

NIC[®]

NIC ONLINE HELP USER'S GUIDE

Network Information Computer

Portable Testing Platform for
Next-Generation Communication Networks



Please direct all questions to your local VeEX Sales Office, Representative, Distributor, or contact VeEX Customer Technical Support at www.veexinc.com.

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Table of Contents

Introduction	9
Welcome!.....	9
Version Information.....	9
Product Overview	10
NIC PLUS Connector Panel	12
Differences between Multi-Rate Circuit Packs.....	14
Getting Started	17
Getting Started	17
General Information	17
Remote Applications.....	26
Common Row Function Buttons	32
Common Tasks.....	40
Understanding Test Units	57
Virtual Network Computing (VNC) Connection	62
SYSTEM Tab	67
System Tab	67
Misc Screen.....	67
I/O Settings Screen.....	83
File Services Screen.....	91
Security Screen	99
User Preference Screen	105
Displaying All Test Status.....	113

All Ether Ports.....	116
Service Disruption.....	117
Monitoring SCPI Commands	118
Chatting	119
Faults.....	120
ATM Tab	123
Asynchronous Transfer Mode (ATM) Overview	123
Screen Functions and Descriptions	123
ATM Specific Tasks	202
CSA MLD Tab	215
CSA-MLD Overview.....	215
Screens and Function Descriptions	215
MLD Specific Tasks	247
CSA OTN Tab.....	251
CSA-OTN Overview.....	251
Screens and Function Descriptions	251
Specific Tasks	299
CSA PACKET Tab.....	305
CSA-Packet Overview	305
Screens and Function Descriptions	305
CSA Packet Specific Tasks	347
CSA SDH Tab.....	381
CSA-SDH Overview.....	381

Screens and Function Descriptions	382
Specific Tasks	447
CSA SONET Tab.....	459
CSA-SONET Overview.....	459
Screens and Function Descriptions	460
Specific Tasks	522
DS1 Tab.....	533
DS1 Overview.....	533
Screen Functions and Descriptions	533
DS1 Specific Tasks.....	571
DS3 Tab.....	579
DS3 Overview.....	579
Screen Functions and Descriptions	579
DS3 Specific Tasks.....	605
Dual Enet Tab	611
Dual Ethernet (Dual Enet) Overview.....	611
Ethernet - Screen Functions and Description	611
Ethernet - Specific Tasks.....	674
Fibre Channel - Screen Functions and Description	717
Fibre Channel - Specific Tasks.....	752
E1 Tab	761
E1 Overview	761
Screen Functions and Descriptions	761

E1 Specific Tasks	791
E3 Tab	801
E3 Overview	801
Screen Functions and Descriptions	801
E3 Specific Tasks	824
E4 Tab	831
E4 Overview	831
Screen Functions and Descriptions	831
E4 Specific Tasks	853
Jitter PDH/T-Carrier	857
PDH/T-Carrier Jitter System Overview	857
Screen Function and Definitions	857
Automated Compliance Testing	878
Jitter Specific Tasks	898
Jitter Optical Tab	907
NIC Jitter System Overview	907
Screen Function and Definitions	907
Automated Compliance Testing	928
Jitter Specific Tasks	948
NIC BP (Battery Power)	957
NIC BP™ “Battery Power” - AC Power Supply	957
NIC BP™ “Battery Power” - Faceplate	958
NIC BP™ “Battery Power” - Battery Status Display	960

NIC BP™ “Battery Power” - How To.....	961
NIC BP - General Precautions.....	965
NIC Technical Specifications	967
OSA Tab	971
OSA Overview	971
Screen and Functions Descriptions	971
C Band L Band Channel Tables	983
Specific Tasks	993
OSA Connector Panels.....	1001
OSA Technical Specifications.....	1001
OTN Tab	1005
OTN Overview	1005
Screen and Function Descriptions	1006
Specific Tasks	1060
Packet Tab	1071
Packet Tab Overview.....	1071
LAN/WAN - Screen and Function Description	1071
LAN/WAN - Specific Tasks	1122
Fibre Channel - Screen Functions and Description	1155
Fibre Channel - Specific Tasks	1189
GFP - Screen and Function Description	1197
GFP - Specific Tasks	1240
SDH Tab	1259

SDH Overview	1259
Screen Functions and Descriptions	1259
Specific Tasks	1364
Serial Tab	1419
RS-232 / EIA-530 Serial Overview.....	1419
Screen Functions and Descriptions	1419
Serial Specific Tasks	1442
SONET Tab	1455
SONET Overview	1455
Screen Functions and Descriptions	1455
Specific Tasks	1558
Switch Matrix Tab.....	1609
Switch Matrix	1609
Using the Switch Matrix	1610
Technical Specifications	1613
NIC Technical Specifications	1613
ATM Technical Specifications.....	1615
E3/E4 Technical Specifications	1617
OSA Technical Specifications.....	1618
Troubleshooting	1621
Term Definitions	1625

Introduction

NIC[®] ONLINE HELP USER'S GUIDE NETWORK INFORMATION COMPUTER[®]

PORTABLE TESTING PLATFORM FOR:

SONET, SDH, OTN, T-CARRIER, PDH and ATM NETWORKS
JITTER, WANDER, RS-530, OSA, GFP, VCAT, LCAS, FIBRE CHANNEL
10/100/1000 BASE-T, 10G WAN, 1G/10G/40G/100G LAN ETHERNET



Welcome!

VeEX Florida (dba Digital Lightwave) is pleased to present the Network Information Computer (NIC) Online Help User's Guide.

To view help topics, use your finger or a smooth blunt object, such as a PDA stylus, to expand the folder icons and view the topics.

Have questions regarding your NIC unit? Contact our [Technical Support](#) personnel.

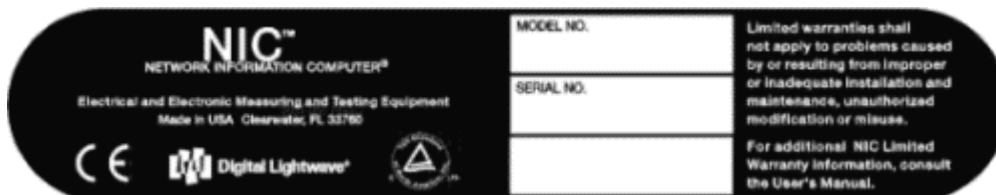
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Version Information

NIC Online Help Document Number: CO 004678O - Version 7.7

For the unit's hardware serial numbers, license keys and software release information, see [About This Product](#).

In addition, unit configuration information is also available on the unit's rear label.



Product Overview

The NIC Platform provides a flexible solution for verifying and qualifying the performance of today's global communications networks. The unit's flexible software/firmware-based architecture combines several traditional hardware based test sets into a single platform.

The NIC family is comprised of three chassis configurations, a 2-slot and 5-slot portable and a 5-slot rack-mount.

Modules are available to enable the following test capabilities:

- SONET: OC-768(40G), OC-192(10G), OC-48(2.5G), OC-12(622M), OC-3(155M), OC-1(51M), EC-3(155M), EC-1(51M)
- SDH: STM-256(40G), STM-64(10G), STM-16(2.5G), STM-4(622M), STM-1(155M), STM-0(51M), STM-1e(155M), STM-0e(51M)
- Next Generation (NXG): VCAT, LCAS, GFP
- OTN: OTU4(112G), OTU3(43G), OTU2(10.7G), OTU1(2.66G)
- SONET/SDH/OTN Jitter and Wander Testing: 51M, 155M, 622M, 2.5G, 2.66G, 10G, 10.7G
- Ethernet: 100GigE(103.125G), OTU-3e2(44.583G), OTU-3e1(44.571G), 40GigE(41.25G), 10GigE FEC OTU2e(11.095G), 10GigE FEC OTU1e(11.049G), 10GigE LAN(10.3G), 10GigE WAN(9.953G), 1GigE, 10M/100M/1000M Base-T
- Fibre Channel: OTU2f(11.317G), OTU1f(11.270G), 10.52G, 8.50G, 4G, 2G, 1G
- T-Carrier: DS3(45M), DS1(1.5M)
- PDH: E4(139M), E3(34M), E1(2M) Bantam, E1(2M) BNC
- PDH: DS1/DS3 and E1/E3 drop and insert from SONET/SDH, built in M13/E13
- T-Carrier/PDH Jitter and Wander Testing: DS3(45M), DS1(1.5M) Bantam, DS1(1.5M) BNC
- Serial Port Testing: RS-232, RS-530 Synchronous and Asynchronous, DTE and DCE Emulation
- Asynchronous Transfer Mode (ATM) testing features, including support for AAL0, AAL1, AAL5, traffic shaping, OAM, QoS measurements, and HEC generation
- Optical Spectrum Analyzer (OSA): C-Band, L-Band
- For new capabilities added since the publishing date of this manual, see www.lightwave.com/service.YOU

The NIC Platform offers the following features:

- Windows 7 Embedded OS, with removable industrial-grade compact flash module
- Internal Stratum 3 clock reference, BITS/SETS/2.048MHz clock in & clock out, Bantam & BNC
- Easy-to-use Graphical User Interface (GUI) with large color touch-screen
- Multi-user [Remote GUI](#) control software via 10/100/1000 Base-T or [USB WiFi adaptors](#)
- Remote [GUI control via VNC](#) for tablet/mobile and non-Windows OS devices is also supported
- External VGA display port (DE-15)
- Simultaneous and independent testing of Ethernet, Fibre Channel, SONET/SDH, T-Carrier, PDH, and ATM.
- Combines Telecom and Datacom testing into one box
- Modular, upgradeable design provides investment protection
- Through-mode with overhead manipulation
- Pluggable SFP/XFP/CFP optics (on specific modules)
- Auto configuration to pattern level
- Three (3) USB 2.0 ports and one (1) SDHC Flash port available for USB or SD Flash memory storage, USB mouse control, USB Printer, USB to WiFi adapters, and USB to GPIB adapters
- Trigger In/Out (SMA connectors)
- Free 24-hour [technical support](#)

Chassis Configurations

The NIC Chassis: A two-slot, lightweight, and compact configuration for field testing of SONET, SDH, OTN, ATM, OSA, Ethernet and DWDM networks.

The NIC Plus Chassis: With five-slots available, the NIC Plus provides Telecom and Datacom testing in one chassis, capable of unmatched multi-port configurations as well as Jitter and Wander testing.

The NIC EP Chassis: Rack-mount five-slot chassis “Embedded Platform” with remote management software to enable remote circuit turn up, monitoring, troubleshooting and is also optimized for lab and manufacturing applications.

When is a NIC an NXG?

A NIC is designated “NXG” if it contains at least one Next Generation Multi-Rate Module (NGMR), or Multi-Service Analyzer (MSA). The NGMR and MSA cards are revolutionary modules supporting SONET, SDH, OTN, Ethernet and Next Generation capabilities (VCAT, LCAS, GFP) that can be configured by licensing to suit exactly the users needs. These modules can be ordered initially with a minimum feature set, then upgraded in minutes by license key (no hardware upgrade required) to provide additional capabilities as needed.

What is a NIC BP?

A [NIC BP](#) is a modified NIC chassis that supports Battery Power to keep the test set operational in the event of a power failure.

NIC PLUS Connector Panel

The NIC Plus connector panel contains a variety of auxiliary interfaces as described below. NIC unit can be configured with a variety of Circuit pack configurations. The image below shows one example of a NIC configuration, and describes the NIC Plus chassis and **System Controller 3** interface connections.



	Connector	Description
1	Power Cord Connector	AC input connector. Accepts a 3-prong, grounded Type 13 connector.
2	Power Switch	Turns unit on or off (0=off, 1=on).
3	Power Fuse Compartment	The Power Fuse protects the NIC from voltage spikes.
4	Trigger In and Out	SMA connectors used for trigger operation.
5	Power/Boot Status LEDs	The top LED is lit anytime the unit is Powered On The three other LEDs are lit while the unit is booting, and turn off after the unit has booted and is ready for use.
6	System Drive	The System Drive uses Compact Flash technology and contains the NIC unit's Operating System and User Interface software. This card is required for normal operation. Do not remove this card unless instructed to do so by Customer Service to resolve a software issue, or in accordance with DLI's Certificate of Volatility.
7	SD Card	The SD Card slot can be used to insert an SD memory card for transferring reports and other saved files from the NIC to a laptop or PC.
8	USB ports	The System Controller III module offers three 2.0 USB ports for multiple uses. The USB ports can be used for transferring reports and other saved files to a USB memory drive, printing reports to a USB printer, USB to GPIB adaptors, USB WiFi adaptors, and USB Keyboard/Mouse.
9	VGA port	The VGA Port allows the local GUI (Graphical User Interface) to be displayed on an external VGA monitor. Note: This is not a hot-swap connection, and the monitor must be connected to the NIC when it is turned on.
10	Ethernet port	10/100 BaseT, 8-pin RJ-45 modular jack, for Ethernet connections. An Ethernet connection is needed for Remote GUI and remote SCPI command scripting.

11	BITS/SETS In and Out (Bantam)	100 ohm Bantam jacks for external timing equipment. BITS clocking supports 1.544 Mbps. SETS clocking supports 2.048 Mbps. And 2.048 MHz analog clock is also supported.
12	BITS/SETS In and Out (BNC)	50 ohm BNC jacks for external timing equipment. BITS clocking supports 1.544 Mbps. SETS clocking supports 2.048 Mbps. And 2.048 MHz analog clock is also supported.

Differences between Multi-Rate Circuit Packs

NIC test sets can be equipped with a variety of Multi-Rate Circuit Packs, each are capable of testing SONET, SDH, OTN, as well as Datacom interface rates.

►The legacy **OMR (Optical Multi-Rate)** circuit pack was the first Digital Lightwave module to offer SONET/SDH Interface testing from OC-1/STM-0 up to OC-192/STM-64, as well as OTU-1 and OTU-2 OTN testing.

❗The OMR circuit pack is not supported in Features Sets starting with **7.0** or higher.

►The legacy **NGMR (Next Generation Multi-Rate)** circuit pack, which succeeded the OMR circuit pack, can also offer the same SONET, SDH, and OTN interface rates offered on the OMR Circuit Pack. However, the NGMR circuit pack can also be licensed for some additional features not available on the OMR circuit pack such as VCAT, LCAS, GFP, 1G and 10G LAN, 10G LAN or G.709 (OTN), ODTU-12 Add/Drop multiplexing, as well as hot-swappable SFP and XFP lasers.

❗The NGMR circuit pack is not supported in Features Sets starting with **7.4** or higher.

►The **MSA (Multi-Service Analyzer)** circuit pack, which succeeded the NGMR circuit pack, can also offer the same interfaces rates and test options as the legacy OMR and the legacy NGMR circuit packs. However, the MSA circuit pack also supports Dual RJ-45 ports for 10/100/1000 Mbps Electrical Ethernet testing, as well as Dual hot-swappable Optical SFP ports dedicated for Gigabit Ethernet and Fibre Channel testing. The Dual SFP ports can be licensed for 1G and 100M optical Ethernet testing including support for MPLS and IPv6, as well as 1G, 2G and 4G Fibre Channel rates. 10G LAN/WAN, 8G/10G Fibre Channel, SONET/SDH up to 10G, OTN, VCAT, LCAS and GFP testing can all be performed independently from the Dual Enet/FC testing options. OTN supports ODU-Flex mappings for 8G and 10G Fibre Channel over OTU-2, 10G LAN over OTU-2, as well as ODTU-12, ODTU-01, ODTU-02, and ODTU-012 Add/Drop multiplexing, where the ODU-n Add/Drop mappings can then be further configured for SONET/SDH, or GFP mappings.

►The **40G/100G Service Analyzer (CSA)** circuit pack supports interface rates of 40G and 100G, for testing SONET/SDH, OTN, and Ethernet protocols at those rates. The CSA circuit pack supports hot swappable CFP modules, and can test MLD (Multi-Lane Distribution) channels used by the CFP modules. The CSA circuit pack also works in conjunction with an MSA circuit pack for Add/Drop mappings down to 10G rates and below.

There are two straight-forward ways for you to know which Multi-Rate Circuit Pack your NIC unit is equipped with; looking up the Card Type, or looking at the [connector panel](#).

- **Card Type:** Select the **System tab**, then select the [About this product](#) from the **Misc** screen. Look for the Card Type labels.

Optical Multirate (OMR) Card Type and Kit Number

Card Type: Multirate	Version: 6.4
Kit Number: 400060	S/N: JF06050085
License: 12345678901234567890123456789012	
Fpga 0 Version 3.4.6	Fpga 1 Version 3.0.8
Fpga 2 Version 1.0.80	Fpga 3 Version 3.3.33

Next Generation (NGMR) Card Type and Kit Number

Card Type: NGMR	Version: 7.3
Kit Number: 400548	S/N: MC11070140
License: 12345678901234567890123456789012	
Fpga 0 Version 2.0.13	Fpga 1 Version 2.0.45
Fpga 2 Version 3.0.164	Fpga 3 Version 2.2.52

Multi-Service Analyzer (MSA) Card Type and Kit Number

Card Type: MSA	Version: 7.3
Kit Number: 401850	S/N: MC11250019
License: 12345678901234567890123456789012	
Fpga 1 Version 1.0.31	Fpga 2 Version 1.0.84
Fpga 3 Version 1.0.38	Fpga 4 Version 0.0.34

40G/100G Service Analyzer (CSA) Card Type and Kit Number

Card Type: CSA	Version: 7.3
Kit Number: 401955	S/N: MC11430009
License: 12345678901234567890123456789012	
Fpga 1 Version 0.0.37	Fpga 2 Version 1.0.6
Fpga 3 Version 1.0.62	Fpga 4 Version 1.0.7

Getting Started

Getting Started

This section includes information to help you to use your system. It is broken into the following topics:

- [General Information](#): Contains a broad range of information about Digital Lightwave and our NIC product
- [Remote Applications](#): Contains information on how to control the NIC unit via Remote GUI software and VNC
- [Common Row Function Buttons](#): Contains detailed information about the common function buttons located at the bottom of GUI
- [Common Tasks](#): Contains general instructions for performing common tasks, as well as common screen components, and other useful information on how to use the NIC product
- [Understanding Test Units](#): Contains information about what a Test Unit is, and how to Lock and Unlock Test Units
- [VNC Connection](#): Contains information on how to establish a remote GUI desktop connection via a VNC viewer
- [Troubleshooting](#): Includes resolutions to common user interface problems

Please click on the hyperlinks above or use the Online Help **Contents** tab to select and open topics.

General Information

General Information Overview

This section contains a broad range of information about Digital Lightwave and our NIC product. For tasks that are protocol processor specific, refer to the appropriate protocol processor section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view the information in this section.

- [Safety Guidelines for Portable Products](#)
- [Agency Approvals](#)
- [Copyright and Patent Information](#)

- [Customer Technical Support](#)
- [Warranties and Return Policies](#)
- [RMA Shipping Instruction](#)

Safety Guidelines for Portable Products

The following safety precautions are provided to avoid injury and prevent damage to this product or any products connected to it during normal operation. Only qualified maintenance personnel should perform service procedures.

- **Use Proper Power Cord:** To avoid fire hazard, only use the power cord specified for this instrument. For use in North America, use a power cord (maximum 6-foot length) with a type SJT, 18 AWG, two conductor with ground, IEC 320 connector on one end and a NEMA 5-15 connector on the other end.

For use **outside of North America**, use an HO5VV-F power cord with a 1-mm², two conductor plus ground, IEC 320 C-14 connector on one end, and a wall-socket plug on the other end that is certified for use in the country of installation.



The entire cord set must be certified for use in the country of installation.

- **Avoid electric overload.** This unit is designed to be powered from 100–120 and 200–240 VAC, 50–60 Hz. To avoid electric shock, fire hazard, or damage to the instrument, do not apply a higher voltage.
- **Ground the instrument.** The unit is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the instrument, ensure that the product is properly grounded.
- **Do Not Operate in Hazardous Conditions.** To avoid injury or fire hazard, do not operate this instrument in wet, damp, or other hazardous condition. Do not operate this instrument in an explosive atmosphere. This instrument is not intended for outdoor use.
- **Eye Protection.** Users should never stare into unterminated connectors or broken fibers. In addition, fiber cables and interfaces should always be handled as if they were emitting laser light. Always leave protective covers on optical connectors to prevent damage and prevent laser emissions.

- **Field Service:** This equipment is not intended to be serviced in the field. All service is intended to be completed by VeEX.
- **Environmental Statement:** This product may contain lead-based solder materials and a lithium battery for computer support. Please return all VeEX products to the factory for proper disposal. Operation of this product is not hazardous to the environment.



This is a Class A product per EN55022. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. Cables used should be less than 3-meters long for compliance with EMC directive.

- **Laser Safety:** The unit contains Class 1 laser devices (21 CFR 1040.10 and 1040.11 Compliant; EN60825-1:1993+A11+A2). Never look into an unterminated fiber. Always place dust caps on the optical ports when fiber is not attached to the optical ports.



Class 1 Laser Product

NOTICE

Unterminated optical connectors may emit laser radiation. Do not view with optical instruments.

Use of controls or adjustments or procedures other than those specified herein may result in hazardous radiation exposure.

CDRH Accession Numbers

NIC10G/NIC 2.5G: 0021615

Agency Approvals



TUV Rheinland of North America is the test laboratory used.

For NIC, NIC 2.5G and NIC 10G:

TUV Safety File No. E2073411.01/E2073412.01/E2073414.01/.02

EMC Report File (NIC 10G) P2071068.01

EMC Report File (NIC 2.5G) P2071251.01/.02

CU License No. CU2071103.01

CDRH Accession No. 0021615

For NIC Plus:

TUV Safety File No. E2173656.01/E2173655.01

EMC Report File No. P2171264.01

CE Report File No. E2173659.01

CB Report File No. E2173657.01

CU License No. CU2173522.01

Standards products were tested to:

EMC Standards

- EN 55024
- EN 55022
- EN 61326-1
- EN 55011
- EN 300386-2 (NAA IV only)

Safety Standards

- EN 60950
- IEC950/UL1950/IEC60950
- CSA 22.2 No. 950

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Patent Information

NIC ® (Network Information Computer) , as described in this publication, may be protected by one or more patents on file with the United States Patent Office.

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Customer Technical Support

Our Customer Technical Support representatives are available 24-hours a day to help you.

Standard business hours are from 8:30 am to 5:30 pm Eastern Time, Monday through Friday.

+1-877-929-4357 (Toll-Free in USA and Canada)

+1-727-475-1206 (International, and local area)

+1-727-536-3541 (FAX)

ServiceAndSupport@veexinc.com (Emails will be replied to during the standard business hours.)

Extended Service Hours

Note: *Extended support service is available to all premier accounts free of charge. Ask your sales account manager for details.*

A representative from Tech Support is available 24 hours a day, 7 days a week.

Please call **+1-727-448-1809** anytime after normal business hours (including weekends), and our 24-hour answering service will direct your call to a tech support representative.

Company Address

VeEX Florida Inc.

2100 Tall Pines Drive

Largo, Florida 33771, USA

+1-800-548-9283 (Main Receptionist)

Warranties and Return Policies

Limited Warranty for Equipment

Seller warrants to the First Purchaser of a VeEX Inc. product that all components of the product, excluding optical modules (pluggable optics or transponders) and batteries, will function in accordance with Seller's published specifications under normal conditions of use for a period of one (1) years from the date of shipment for Seller's products and one (1) year from the date of shipment for new third party products sold by Seller. All pluggable optics and all optical transponders are warranted for a period of nine (9) months from the date of shipment. Batteries are warranted for a period of one (1) year from the date of shipment.

Recertified products excluding optical modules and batteries are warranted for a period of ninety (90) days from the date of shipment. During the warranty period, Seller's liability is expressly

limited, at Seller's election, to repairing or replacing the product or component not complying with this Limited Warranty as determined by Seller's inspection, or to the repayment of, or crediting the First Purchaser with an amount equal to the purchase price of the product, whether the First Purchaser's claims are for breach of warranty or negligence. The foregoing remedy as provided herein shall be the sole and exclusive remedy of the First Purchaser.

Limited Warranty for Software and Firmware

Seller warrants to the First Purchaser of a VeEX Inc. product that each item of Software and Firmware included in the Product, in its unaltered form, will conform substantially to the then-current functional specifications for ninety (90) days from its installation date, provided such Software or Firmware is used in a manner consistent with Seller's applicable minimum equipment and software or firmware configuration specifications. Seller will make reasonable efforts to correct any errors reflecting significant deviations from the functional specifications as are reported by First Purchaser to Seller during such warranty period. Because not all errors in Software or Firmware can or need be corrected, Seller does not warrant that all Software or Firmware defects will be corrected. Similarly, Seller does not warrant that the Software or Firmware will meet First Purchaser's requirements or that the Software or Firmware will operate in combinations selected for use by First Purchaser.

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Limitations of all Warranties

All Equipment, Software and Firmware Limited Warranties apply only to the First Purchaser of a VeEX Inc.. product and are not transferable without the express written permission of Seller. Any claim under any of these Limited Warranties shall be deemed waived unless submitted to Seller in writing within sixty (60) days from the date the First Purchaser discovered, or should have discovered, the facts giving rise to the claim. The foregoing Limited Warranties shall not apply to problems caused by or resulting from improper or inadequate maintenance, acts or omissions of First Purchaser, First Purchaser-supplied software or interfacing, unauthorized modification or misuse, breaking the seals or otherwise attempting to open the plastic and/or metal housing, operation outside of the environment specifications for the products, improper site preparation or maintenance. Seller is not responsible for any damages caused by any person or entity through misuse, neglect or accident. For warranty service or repair, Seller products must be returned in accordance with the Seller's Return Policies to a service facility designated by Seller. The First Purchaser shall prepay shipping charges to VeEX Inc., and if Seller discovers a breach of the Limited Warranty, Seller shall pay shipping charges to return the product to First Purchaser. However, First Purchaser shall pay all shipping charges, duties and taxes for products returned by Seller to First Purchaser outside the United States.

Return Policies

Approval must be obtained from Seller, prior to return of any merchandise. All material returned without a Seller [Return Material Authorization](#) (RMA) number may be refused automatically. The first purchaser must return the product in original package and in good condition, without its serial numbers or any part thereof altered, defaced or removed and accompanied by a specification in writing or previously provided to Customer Support of the defects involved. The first purchaser shall notify Seller in each instance when first purchaser intends to return goods which first purchaser believes are not in accordance with this Limited Warranty and Seller shall be entitled, at Seller's option, to examine such goods at first purchaser's facilities prior to return.

EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH IN WRITING IN THIS LIMITED WARRANTY AND IN SELLER'S TERMS AND CONDITIONS OF SALE, SELLER MAKES NO OTHER WARRANTY, WHETHER WRITTEN, ORAL OR IMPLIED. ANY IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, NON-INFRINGEMENT OR FITNESS FOR A PARTICULAR PURPOSE IS HEREBY DISCLAIMED BY SELLER AND EXCLUDED FROM ANY AGREEMENT BETWEEN BUYER AND SELLER.

SELLER SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL LOSSES, DAMAGES OR EXPENSES, DIRECTLY OR INDIRECTLY ARISING FROM THE SALE, HANDLING OR USE OF THE PRODUCTS, OR FROM ANY OTHER CAUSE WITH RESPECT TO THE PRODUCTS OR THIS LIMITED WARRANTY WHETHER SUCH CLAIM IS BASED UPON BREACH OF CONTRACT, BREACH OF WARRANTY, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHER LEGAL THEORY. THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES MAY NOT APPLY IN SOME STATES.

Return Shipping Instructions

If it is necessary to return the unit, obtain a **Return Material Authorization (RMA)** number and return shipping address by contacting [Customer Service](#) between 8:30 A.M. and 5:30 P.M. eastern time, Monday through Friday.

Please be prepared to provide the following information:

- Unit Serial Number
- Brief description as to why the unit needs to be returned
- Customer contact name, telephone number and email address
- Return shipping address

Note: If the unit is not under Warranty then an RMA Quotation will be provided, if needed to obtain a Purchase Order.

Shipping with the Original Container

If you have the original shipping container (box):

1. Place the unit (and letter that describes the reason for the return) into the canvas carry bag, and pack it into the original Digital Lightwave, Inc. shipping container. Do **not** include personal items such as jumper cords or connectors. Digital Lightwave, Inc. will not be responsible for these items. Use the original foam inserts to protect all six sides of the unit.
2. Securely seal the shipping container and mark **FRAGILE** on the container to ensure careful handling.
3. Include the RMA number on the outside of the shipping container.
4. Contact [Technical Support](#) for the Repair Department's return shipping address.

Shipping Without the Original Container

If you do not have the original shipping container:

- You may purchase a shipping container, custom designed for the size and shape of your test unit, or

- You can use the following general instructions to repack the unit using commercially available materials:
 1. Use a strong shipping container, similar to the original unit shipping box. Verify that the substitute container is rated at 350 lbs. per square inch pressure durable.
 2. Pack the unit (and letter describing the reason for return) into the canvas carry bag and make sure that the unit is satisfactorily protected by using a layer of ESD-protected short absorbing foam material. The foam padding must be three to four inches in thickness (70 to 100 mm) and applied to all six sides of the unit to provide adequate protection. Make sure that the unit cannot move or shift within the container.
 3. Securely seal the shipping container and mark **FRAGILE** on the container to ensure careful handling.
 4. Include the RMA number on the outside of the shipping container.
 5. Contact [Technical Support](#) for the repair department's return shipping address.

Shipping Charges

The customer is responsible for paying all shipping charges (including insurance, duties, taxes, customs fees, and/or other charges) for RMA units being shipped **to** VeEX, from any location within or outside of the United States.

When the service is complete, your unit will be returned to the customer postage paid (excluding Calibration RMA's) if the shipment is within the United States.

Remote Applications

DLI Remote Client Application

The DLI Remote Client is a remote GUI (Graphical User Interface) application that allows you to remotely connect to and control NIC products from a Windows based PC.

Before using the DLI Remote Client :

- Verify the minimum [software and hardware requirements](#).
- Verify that the [Ethernet parameters](#) have been entered into your test set.
- Verify that you have security access to the unit.

- Verify that [FTP service](#) is enabled on the unit.
- Install the [DLI Remote Client](#) on to your PC.

To start the Remote Control Application:



If using **Windows Vista** or **Windows 7**, you may need configure Windows to run the Remote GUI with Administrator permissions, even if you are already logged in as an Administrator.

To do this **Right-click** on the **Remote NIC** icon and select **Properties**. Then from the **Compatibility** tab, enable the “**Run this program as Administrator**” option, and click **OK**.

1. Double-click the **DLI Remote Client** shortcut icon that appears on your PC's desktop.
2. Enter the remote unit's **IP address**, and your **User ID** and **Password**.



The default User ID is **Admin** (case sensitive), and the default Password is **Admin1** (case sensitive)

3. Select **OK**.
4. Once the connection is made, the remote unit's GUI appears. The title bar contains the product name and connection method. Use your mouse to select functions.

To automate the log on process, select [Automating the Remote Control Icon](#) for more information.



Important: Files that are created when using the Remote Control Application are saved on your PC in the Remote Control's compatibility directory.

If you want to keep these files, copy and save the following to a backup directory on your PC that is not in the compatibility directory's path:

- Any file with the .pdf, .set, .stat, .health, .evt, .aps, .perf, .rep, or .bmp extension.

DLI Remote Client Requirements

Software

The minimum software requirements are:

- Windows XP, Vista, 7, 8 or newer Windows operating systems.
- Microsoft Internet Explorer 5.0 or greater.
- TCP/IP Network Protocol
- Host domain and IP address information for LAN access.
Make sure that this information is entered into your unit. Refer to [Ethernet Port Configuration](#) for more information.

Hardware

The minimum hardware requirements are:

- A personal computer with a 500-MHz Pentium processor or faster.
- 128 MB RAM (256 MB RAM recommended for optimum performance)
- 60 MB of free disk space
- An SVGA monitor with a minimum screen resolution of 800 by 600 pixels and 256 colors (1025 by 768 recommended for optimum viewing).
- A CD-ROM drive (if installing from a CD-ROM) or web browser (if installing from the DLI web site) for software installation.
- A standard 10/100/1000BaseT Ethernet cable for connectivity between the unit and the network.



If you connect the unit directly to your PC, you will need the following:

- An Ethernet network interface card installed in your PC.
- Either a straight-through or a crossover Ethernet cable for connectivity between the NIC and the PC's network interface card.

Ethernet Port Configuration

To configure the unit's Ethernet port:



If Ethernet port parameters are changed, the unit must be rebooted for the changes to take affect.

1. Select **System**.
2. Select **I/O Settings**.
3. Enter the unit's **IP Address**, **Subnet Address**, and **Router Address** from the Ethernet Configuration functions.



IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A system conflict can occur if these IP addresses are entered.

DLI Remote Client Installation

The DLI Remote Client is supplied on the Software and Remote CD. Install the application from the CD upon first use of the application or when there is a major Feature Set change. For example from Feature Set 6.0 to 7.0.

To install from a CD:

1. Close any applications running on your PC before installing the software.
2. Insert the CD into the CD-ROM drive.
3. The Auto-Run feature starts and displays the Welcome screen.



If the Auto-Run feature is disabled on your system, open **Windows Explorer** and select the **CD-ROM** drive, to display the contents of the CD. Select the **DLIInstall.exe** file to launch the Welcome screen.

4. From the **Software** tab, select **Remote Control Application** and click **Install**.
5. Select **Next** and follow the on-screen instructions to install the software into a directory and create a program folder. The default directory is **C:\Program Files\DLI\RemoteClient**.
6. When prompted for "**How do you want to maintain the Remote GUI files on your PC?**", the default option is **(A) Create Multiple Directories**.
 - a. Use the default option for the fastest execution when repeatedly connecting to the same test set, or to other test sets with the same Feature Set version.
 - b. Select option **(B) Create one GUI directory** only if space is limited on your PC's hard disk drive, as this will require the Remote GUI files to

transfer from the test set to your PC every time you remotely connect to the test set.

7. Select **Finish** to complete installation.
8. After the installation is complete, a DLI Remote Client shortcut icon appears on the desktop. Open the application by clicking the **DLI Remote Client** icon.
9. This completes the installation.

DLI Remote Client Removal

 **Important:** Reports that were saved to the Compatibility folders, located in the Remote Client application directory (for example, C:\Program Files\DLI\RemoteClient\Compat700060032) will be deleted during the uninstall process.

To save historical reports, copy and save data files with the following file extensions to a folder located outside of the Remote Client application directory before proceeding with the uninstall process.

- Any file with the .pdf, .set, .stat, .health, .evt, .aps, .perf, .rep, or .bmp extension.

To remove the Remote Control Application

1. Close the DLI Remote Client application.
2. Click the **Windows Start** button and choose **Settings**.
3. Select **Control Panel** and choose **Programs and Features**.
4. Select **DLI Remote Client** and click the **Uninstall/Change** button.
5. Follow the on-screen instructions.
6. Open Windows Explorer and locate the Remote Client application directory. For example, **C:\Program Files\DLI\RemoteClient**.
7. Delete the **RemoteClient** folder.
8. [Install](#) the new DLI Remote Client application, if upgrading to a newer remote version.

Automating the DLI Remote Client Icon

The DLI Remote Client software is a graphical user interface (GUI) that allows you to remotely control portable and rackmount products from a PC. An icon for the DLI Remote Client software is created and placed on your desktop when the software is installed.

Once installed, you can add a specific IP address, User ID, and Password parameters to the icon to automate the login process.

1. From the desktop, **right-click** on the **DLI Remote Client** application icon.
2. Select **Properties** and choose the **Shortcut** tab.
3. Place the cursor at the end of the **Target** text box.
4. Press the **space bar** and then type:

ip=x.x.x.x, uid=y, pw=z

- **x.x.x.x** is the NIC unit's IP address
- **y** is the user ID (case sensitive)
 The default user ID is **Admin**
- **z** is the password (case sensitive)
 The default password is **Admin1**
- do not include any spaces between fields

Example: "C:\Program Files\DLI\RemoteClient\Galaxy.exe"
ip=10.1.8.21, uid=Admin, pw=Admin1

5. Click **OK**.
6. Now when you double click the **DLI Remote Client** application's icon, a connection is automatically made, and the remote system's GUI appears.

 If an invalid parameter is entered, the automatic login will fail, and you must enter the appropriate data.

 Multiple DLI Remote Client applications can be running on the same PC at the same time, each connected to the either same or different test sets.

Multiple DLI Remote Client icons can be copied to your desktop, each with a dedicated IP Address for connecting to multiple test sets.

1. Create a copy of the DLI Remote Client shortcut icon to your desktop.
2. **Right-click** on the copied **DLI Remote Client** application icon and select **Rename**.
3. **Rename** the icon to the dedicated IP Address for the test set that this icon will be configured to connect to, using the above procedure.
4. Follow the steps in the above procedure to configure this copy of the DLI Remote Client icon to automatically connect to the test set's designated IP Address.
5. Repeat this process for as many test sets as needed.

Common Row Function Buttons

Common Function Buttons

The bottom of the touch screen contains task-oriented buttons. These buttons do not appear when using the System or Help tabs. Additionally, buttons that do not pertain to a protocol will not appear when that protocol tab is selected.



The Common Function Buttons include:

- [Error Insert](#)
- [Stop](#)
- [Restart](#)
- Report
- [Presets](#)
- [Auto Config](#)
- [Test Setup](#)

- [Clear History](#)
- [Lock Screen](#)
- [Shut Down](#)

Error Insert

The Error Insert [common function button](#) is used to injects single errors into the transmitted protocol processor signal:

If no error types are specified for the **Error to Insert** setting in the Transmit > Error / Alarm screen, then a **Select Error to Insert** menu will appear when the Error Insert button is first pressed, allowing the user to specify which error type to insert.

The **Error Insert** button then causes single error insertions of the selected Error Type each time the button is pressed.

Stopping a Test

The Stop [common function button](#) stops the reporting of received data and takes a snapshot of error, alarm, and event activity.

When the Stop button is selected, the following occurs:

- All statistics logged and reported by the Performance Monitoring function stop.
- All alarm, error, and event statistics logged and reported by the Results function stop.
- All elapsed time and duration counters stop.



The LEDs will continue to update and indicate current activity.

To stop a test:

- Select the **Stop** common function button located at the bottom of the touch screen.

To restart test activity and statistic reporting, select the **Restart** button.

Restarting a Test

The Restart [common function button](#) is used to initiate the following test activities:

- **Clears and resets** error, alarm, and event activity counters, statistics, and LEDs for the current protocol processor.
- **Restarts** monitoring for error, alarm, or event activity that was stopped using the Stop button.
- **Elapsed Time** counter resets to 000 Days, 00 Hours, 00 Minutes, and 00 Seconds, and then begins to increment after the Restart finishes.

To restart a test or reset statistics:

- Select the **Restart** common function button located at the bottom of the touch screen. Configured testing on the current protocol processor is restarted.

Presets Function

The Presets function provides a quick and convenient way to set up the system for operation. Using Presets involves selecting a starting protocol and its interface, and then making an internal connection to another protocol. See [Adding/Dropping SDH/PDH Signals](#) for more information.

To set up a connection using the Presets function:

1. Select **Presets** from the Common Function Buttons row.
2. Select **Interface**. All line interfaces available for your unit appear.
3. Select an interface as a starting point.
4. Select **Configuration**. The protocols available for the selected interface appear.
5. Select a protocol to connect to the interface. If required, select the **Configuration** button again to create additional connections.



If you make a mistake while creating connections, simply select **Interface** and reenter the interface value. This action erases any previously entered interface or configuration values.

6. Select **Apply**. The unit takes a few moments to apply the new protocol connections. Use the [Switch Matrix](#) to view the new connections.

To disengage the configured protocol connections:

- Select **All to Tx/Rx**. This globally disconnects any internal connections between multiple protocol processors. A protocol processor will now expect to receive a signal using its line interface.

Auto Config

The Auto Config function allows you to quickly configure and PDH/DSn interface to match the parameters of an incoming signal. This function sets up the same mapping, framing, line coding, and pattern characteristics as the incoming signal without having to manually configure the unit.

To automatically configure the unit:

1. Select a [Protocol Processor mode](#) that corresponds to the network and the incoming signal (E1/E3, or DS1/DS3).
2. Select the protocol processor tab (located at the top of the screen) that corresponds to the signal that you want to configure.
3. Make sure that the signal being received by the unit is from a valid source (loop back is not supported).
4. Select **Auto Configure** button from the protocol processor Receive settings screen.



If the Auto Conf button is disabled or is not present, then the selected Protocol Processor does not support this feature.



You must have the protocol processor locked.

5. If the Select Type of Auto Configuration dialog box appears, then select the type of auto configuration to perform. See the table below for a description of the options.
6. The unit starts detecting parameters about the incoming signal, such as signal rate, mapping, and payload pattern, and configures the unit accordingly. This process may take a few minutes to complete.

Auto Config Type	Description

Master Configuration	The unit detects the mapping, framing, and pattern of the incoming signal and configures the protocol processor to match these parameters. If successful, the unit then attempts to drop a signal to tributary protocol processors. This process continues until the lowest tributary is configured. If the auto configuration process is unsuccessful, the process terminates.
E4 Only	Detects the parameters of the incoming E4 signal, and configures the E4 protocol processor to these parameters.
E3 Only	Detects the parameters of the incoming E3 signal, and configures the E3 protocol processor to these parameters.
DS3 Only	Detects the parameters of the incoming DS3 signal, and configures the DS3 protocol processor to these parameters.

Test Setup Button

This menu provides the options to either **Save** the current Test Set configuration and settings, or to **Restore** either a previously saved settings file, or Restore the Test Set to **Factory Defaults** for a specific Protocol Mode, or just change the current **Protocol Mode**.

- **Save This Test Set to File:** Saves the current Test Set configuration and settings.
- **Change the Protocol Mode:** Changes the unit's Protocol settings. If this option is selected, the processor's protocol mode is changed (for example, from SONET to SDH).
- **Restore Settings to Factory Defaults:** Restores the Test Set to Factory Defaults for a specific Protocol Mode
- **Restore Settings from Saved File:** Restores the Test Set's settings from a previously saved settings configuration file.

Clearing LED History and Resetting Results

The unit uses the following functions to log event, alarm, and error activity monitored on the incoming signal:

- LEDs as displayed in the **Quick Status LEDs** area and the **Large LEDs** tab
- Every LED has a text label (Status Indicator) which will turn Red when the specific occurs, and remain Red after the event clears
- The many **Results** windows display the number of events counted and/or the total time the events occurred for

To only clear LEDs and Status Indicator history:

- Select the **Clear History** [common function button](#) that appears at the bottom of the touch screen
- The LEDs' recorded history clears (Status Indicator)
- Refer to [Using LEDs](#) for LED color descriptions



The Clear History button does not reset error counts, alarm counts, or data that appear in graphs. To clear this data, use the [Restart](#) button.

To restart a test or reset statistics:

- Select the **Restart** [common function button](#) that appears at the bottom of the touch screen.
- Resets errors, alarms, and event activity counters, statistics back to 0 for the current protocol processor.
- Restarts errors, alarms, and event activity that may be stopped from using the [Stop](#) button.
- The LEDs' recorded history clears (Status Indicator)
- The Elapsed Time reset to zero seconds, and begins counting over again.

Locking/Unlocking Screen Access

The test set screen can be disabled to prevent user access by others. This function requires a user ID and password to lock and unlock the screen. When unlocking the screen, the unit will only accept the last user ID and password entered, or the unit's original user ID and password.

To lock the screen:

1. Select **Lock Screen** from the [common function buttons](#). The Off/Lock dialog box appears.

2. Enter your **User ID**.

On a portable unit, press  to open a keyboard to enter the User ID.

3. Enter your **Password**.

On a portable unit, press  to open a keyboard to enter the Password.

The Password is masked with Asterisks, so it will not be displayed on the screen.

4. Select **OK**. The Locked Unit dialog box appears. This dialog box remains on the screen until the screen is unlocked.



If the unit is locked because critical testing is in progress, select the **Unlock** button and enter the **User ID** and **Password** again. Select **OK**.

The unit will only accept the last User ID and Password entered or the unit's original User ID and Password. An error message appears if an invalid ID or Password is entered.

To unlock the screen:

1. Select the **Unlock** button from the **Locked Unit** dialog box. The Unlock Login dialog box appears.

2. Enter your **User ID**.

On a portable unit, press  to open a keyboard to enter the user ID.

3. Enter your **Password**.

On a portable unit, press  to open a keyboard to enter the password.

The Password is masked with Asterisks, so it will not be displayed on the screen.

4. Select **OK**.



The unit will only accept the last User ID and Password entered or the unit's original User ID and Password. An error message appears if an invalid ID or Password is entered.

Turning the Test Set Off

The procedure described below allows the system to write unsaved data to the disk before you shutdown the test set. This task is performed by selecting the Shut Down [common function button](#) on any Protocol Processor tab.



Important: It is important to use the procedure described below when Shutting down or Rebooting the test set. Failure to do so may result in lost data or corrupt system files which may prevent the unit to reboot successfully.

To shut down the test set from a Protocol Processor tab:

1. Select the **Shut Down** from the common function button row.
2. Select one of the two options
 - **Shutdown**
 - **Reboot**

Shut Down

1. When **Shutdown** is selected, a Shutdown window appears giving you the option to select OK or Cancel.
2. Selecting **OK** will begin the shutdown process, which may take up to 30 seconds or so.
3. After the GUI and the background applications close and the Windows OS turns off, the screen will turn black. At this point it is acceptable to toggle the **power switch** on the top of the test set to the off position to complete the shut down process.

Reboot

1. When **Reboot** is selected, a Reboot the Unit window appears giving you the option to select OK or Cancel.
2. Selecting **OK** will begin the Reboot process, which may take several minutes to complete..

3. After the GUI and the background applications close and the Windows OS turns off, the screen will turn black. At this point the unit should begin to boot back up again, as if it were just turn on.



NIC units with the original System Controller normally stay at the black screen that appears after Windows turns off. When this occurs the Power Switch will need to be toggle the **power switch** on the top of the test set to Off and back On again to complete the reboot process.



NIC units with the new System Controller card are full able to perform a Reboot command with having to toggle the power switch.

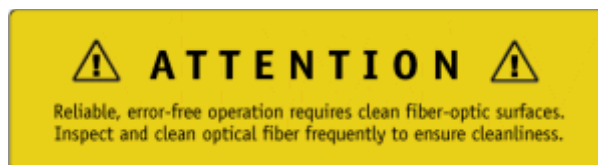
Common Tasks

Common Tasks Overview

This section lists common tasks that are performed the same for each protocol processor mode. For tasks that are protocol processor specific, refer to the appropriate protocol processor section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view the information in this section.

Fiber-Optic Cleaning Procedure



With fiber optics, the tolerance to dirt is near zero. Oils, greases, airborne particles of dust, lint, and other debris are all very harmful to fiber-optic cables. They can scratch and damage fiber-optic connectors if not removed. Not only can scratches and debris harm the connectors, but they also can jeopardize the integrity and accuracy of the optical signal.

The ferrule end faces of fiber optic patch cords and receptacle connectors are some of the most critical components for fiber optical networks. *Prior to inserting any patch cord into the test equipment's receptacle connector, clean and examine the patch cord's and the receptacle's connectors to verify the quality of each.*

Inspect the Ferrule End Face of a Patch Cord Connector

 **WARNING: Never look into the end of a fiber, through a microscope or your bare eye, if the other end is connected to an operating piece of network or test equipment!**

1. Prior to inserting any patch cord into the microscope, verify that the other end is not connected to an operating piece of network equipment.
2. Visually examine the end face of the connector using a fiber-optic microscope.
3. If the end face of the connector is unacceptable, properly clean the connector prior to use.
4. If the end faces are acceptable, then use the fiber-optical patch cord as intended. If the end faces are not acceptable, then clean the connectors and reexamine them again.

To Clean a Patch Cord Connector Using Lint-Free Tissue and Alcohol

1. Using the pressurized canned air, blow away any dust particles that may be on the exterior surface of the connector, particularly the sides and end face of the ferrule. Hold the can approximately two inches from the surface to be cleaned and apply three to five short blasts of air.
2. Next, using an Optic Prep (or any lens-grade lint-free tissue moistened with isopropyl alcohol), gently and slowly slide the tissue across the tip of the ferrule end face in one sweeping move.
3. Repeat the last step again using a clean section of the tissue.

 **WARNING: Only isopropyl alcohol should be used because some solvents might attack epoxy.**

Performing Periodic Maintenance on the Patch Cord Connector Using a CLETOP style cleaner

CLETOP cleaners provide a thorough and easy method of cleaning optical connectors. It uses a reel-type cassette of dry, woven polyester, alcohol-free, cloth film. It is a fast and reliable remover of dirt, lint, and debris from the ferrule end face of the optical connector. This cleaner should be used on the patch cord periodically if the patch cord is frequently inserted and removed from the test equipment.

1. To clean the ferrule end face of the connector, advance a clean portion of the reel by depressing the side lever with your thumb.

2. Gently stroke the tip of the connector along the exposed film in the manner according to the directions on the label.
3. While sliding the connector along the blue film, slightly twist the connector between your thumb and finger to assure a thorough cleaning.



If the end-face of the patch cord is damaged or scratched beyond cleaning or repair, replace the patch cord with a new one whose end faces are acceptable.

4. Inspect the connector receptacle of the network test equipment.



WARNING: Always turn the test equipment's laser OFF before inserting the video micro-scope into the receptacle, or looking directly into the receptacle of the test equipment!

5. Prior to inserting the video microscope, verify that either the unit or its laser is turned OFF.
6. Using the pressurized canned air, blow away any dust particles that may be on the interior surface of the receptacle. If dirt is present inside the receptacle, it can scratch the lens of the video microscope, or the end-face of the connector.
7. Insert the video microscope into the receptacle. Using the monitor, visually examine the receptacle's end face of the connector.
8. If the receptacle's end face has a build up of dust, dirt, or any debris, clean the receptacle according to the next procedure.

To Clean a Connector Receptacle (also referred to as a bulkhead or adapter)

1. Using the pressurized canned air, blow away any dust particles that may be on the interior surface of the receptacle, particularly the inside walls of the alignment sleeve. Hold the can approximately two inches from the receptacle to be cleaned and apply three to five short blasts of air.
2. Moisten the end of a 2.5-mm foam swab with isopropyl alcohol, and insert it into one side of the receptacle. Move the swab in and out two or three times and then remove it.
3. Moisten the end of a NEW swab with alcohol, and insert it into the open side of the receptacle. Rotate the swab back and forth 90-degrees twice and then remove it.
4. Dry the inside of the receptacle by holding the pressurized canned air approximately two inches from the end of the receptacle and applying three to five short blasts of air.



Only use foam swabs; cotton swabs leave particles and threads behind.

Upgrade Software

The I/O Settings function allows you to configure your unit with the ability to upgrade your software using Digital Lightwave's Software Upgrade System, which is provided to you on a separate installation CD-ROM or via the DLI Software Upgrade web site.



The unit's [FTP service](#) must be enabled to successfully perform an upgrade.

To set up your unit to perform software upgrades using the Software Upgrade System:

1. Select **System**.
2. Select **I/O Settings**.
3. Select the **IP Address** button. A keypad appears.
4. Using the keypad, enter the IP address of your unit, and select **Enter** when you are done.



IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A serious system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

5. Select the **Subnet Address** button. A keypad appears.
6. Using the keypad, enter the Subnet address, and select **Enter** when you are done.
7. Select the **Router** button. A keypad appears.
8. Using the keypad, enter the router address, and select **Enter** when you are done.
9. **Power** the unit **off** and then **on** again so that these changes take affect.
10. The unit is now set up to perform software upgrades using the Software Upgrade System.
11. If upgrading a NIC BP unit, then ensure the external AC power supply is connected to unit prior to starting the upgrade.



Information on Digital Lightwave's Software Upgrade System is available through the Help button located on the Software Upgrade System. The application is

available via CD-ROM or the DLI Software Upgrade web site (www.lightwave.com/service.YOU).

Upgrading Test Set Software from CD

The instructions outlined below provide a quick set of steps for upgrading your NIC/NAA test set and troubleshooting a cancelled upgrade. For more in-depth information, see the NIC/NAA Software Upgrade Online Help.

 **Warning:** You must have the **Java® Runtime Environment (JRE)** installed on your PC before proceeding with the upgrade.

To upgrade the test set software from the CD:

1. Turn the NIC test set **On**.
2. From the **System** tab, select **I/O Settings**.

 If the NIC test set is not on the network, use a cross-over cable to connect it to the PC.

3. Insert the **Software and Remote CD**, which you received with your NIC test set, into your computer's CD-ROM drive. The CD should automatically open the Remote NIC Software window.
4. From the **Software** tab, select **Upgrade NIC Software**.
5. Select **Install**. A DOS prompt window displays and then the Digital Lightwave's Software Upgrade dialog box appears. No action is required for the DOS prompt window.
6. From the Software Upgrade dialog box, select **Device Logon**. The Device Logon dialog box appears.
7. In the **New IP Address** box, type the IP Address for the NIC test set that is being upgraded. You can find the IP Address on the NIC test set's I/O screen.
8. Select **Add IP to List**. The address appears in the IP Address List box.

 Up to 32 device IP Addresses can be stored in the IP Address List box.

9. Select the **IP Address** and click the > button. The IP Address moves to the IP Addresses Selected box.

 **Warning:** Do not attempt to upgrade more than one test unit (device) at a time. Devices moved into the IP Addresses Selected box are scheduled for upgrade. Therefore, select only one device from the IP Address List box before proceeding to the next step.

10. Select **OK**. The upgrade software connects to the NIC test set and then the Scheduled Upgrades Notice dialog box appears.
11. Select **OK**. The notice box closes and you are returned to the Software Upgrade dialog box.
12. Select **Upgrade**. The Upgrade Activity Status dialog box appears and then the Upgrade Alert! dialog box.

 This automatically upgrades all circuit packs in the NIC test set. The upgrade process may take several minutes.

13. Select **OK**.
14. Toggle the test set's On/Off switch to **Off**.

 **Warning:** Leave the test set off for a minimum of 10 seconds before rebooting it.

15. Turn the test set **On**.
16. From the NIC Common Function buttons, select **Restore**. The Select Type of Restore dialog box appears.
17. Select **Factory Defaults**.
18. This completes the software upgrade.

Changing the Protocol Mode

The unit can be configured to operate in SONET, SDH, PDH, or DS3/DS1 networks.

 The options that appear on this screen are determined by your hardware configuration.

 Changing the Protocol Mode from the System > Misc screen will globally apply the Protocol mode change to all [Test Units](#) in the NIC unit.

 You must have all SONET/SDH and PDH/DSn processors [locked](#).

1. Select the **System** tab and choose **Misc**.
2. Select the **Change Protocol Mode** button.
3. The following menu options appear:

Change Protocol Mode SONET Change Protocol Mode SDH	These options appear if your unit contains one or more SONET/SDH board, but no PDH board
Change Protocol Mode DS1/DS3 Change Protocol Mode E1/DS3 Change Protocol Mode E1/E3	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Change Protocol Mode SDH/E1/E3 Change Protocol Mode SDH/E1/DS3 Change Protocol Mode SDH/DS1/DS3 Change Protocol Mode SONET/DS1/DS3 Change Protocol Mode SONET/E1/DS3	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

4. Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode.

Restoring Factory Defaults

This function will reconfigure all of the protocol processor's settings back to the original Factory Defaults, for the selected Protocol Mode.



The options that appear on this screen are determined by your hardware configuration.



Restoring the Factory Defaults from the System > Misc screen will globally apply to all protocol processors in the NIC unit.



You must have all protocol processors [locked](#).

1. Select the **System** tab and choose **Misc**.
2. Select the **Restore To Factory Defaults** button.

3. The following menu options appear:

Restore To Factory Default SONET Restore To Factory Default SDH	These options appear if your unit contains one or more SONET/SDH board, but no PDH board
Restore To Factory Default DS1/DS3 Restore To Factory Default E1/DS3 Restore To Factory Default E1/E3	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Restore To Factory Default SDH/E1/E3 Restore To Factory Default SDH/E1/DS3 Restore To Factory Default SDH/DS1/DS3 Restore To Factory Default SONET/DS1/DS3 Restore To Factory Default SONET/E1/DS3 Restore To Factory Default SONET/E1/E3	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

4. Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode, and all of the protocol settings will revert back to their factory assigned default values.

Starting a Test

The Duration and Action After Duration functions determine how long a test runs and what activities occur at the end of the test.

To start a test:

1. Select the protocol processor that is running the test.
2. Select **Test**. The Duration and Action After Duration functions appear under [SET 1](#).

3. Select [Duration](#). The Select Duration of a Test dialog box appears.
4. Select how long you want the test to run.
5. Select [Action After Duration](#). The Select Action After Test dialog box appears.
6. Choose the desired action that will occur at the end of the test. When you select **Repeat Actions**, the Select Repeat Action after Test dialog box appears. When you select **Realtime Actions**, the Select Realtime Actions after Test dialog box appears.

 Real-time test reporting is only available locally (from the touch screen) on portable test sets.

To stop a test before the test duration expires:

- Select the [Stop](#) common function button. All statistics and events logged and reported by the Performance Monitoring and Results functions stop. In addition, the Elapsed Time and Duration counts stop.

To restart a test:

- Select the [Restart](#) common function button. The test and statistics clear and the Elapsed Time counter restarts at zero.

To pause a test:

- Select [Pause Test](#). When Pause is selected, the system will stop collecting data, but the elapsed time counter will continue.

To resume a paused test:

- Select [Resume Test](#).

Inserting Multiple Errors

Various errors can be transmitted by the system. One reason for transmitting errors is to determine if the receiving equipment can detect an error in the incoming signal. Inserting multiple errors at a specified error rate allows you to monitor the network and receiving equipment for any undesirable behavior as the error rate is increased.

To insert multiple errors:

1. Select a protocol processor mode.
2. Select **Transmit** and choose **Error Alarm**.

3. Select **Error to Insert**. The Select Error to Insert window appears.
4. Select an error.
5. Select **Error Insert Rate**. The Select Error Insert Rate window appears.
6. Select an error rate. The system starts transmitting errors.



Selecting **None** will stop the error transmission.

Inserting Alarms

The system can transmit alarms to simulate various alarm conditions. One reason for transmitting alarms is to determine if the receiving equipment can detect an alarm in the incoming signal.

To insert alarms:

1. Select a protocol processor.
2. Select **Transmit** and choose **Error Alarm**.
3. Select **Alarm Generated**. The Select Alarm to Insert window appears.
4. Select an alarm. The system starts transmitting alarms.

To stop alarm transmission:

1. Select the protocol processor mode.
2. Select **Transmit** and choose **Error Alarm**.
3. Select **Alarm Generated**. The Select Alarm to Insert window appears.
4. Select **Off**. Alarm transmission stops.

Printer Port Configuration

The unit supports both parallel and serial printers.

For Parallel Printing:

- Attach a parallel printer cable (with a 25-pin male connector on one end) to the unit's **Parallel Port** connector. This is a DB-25 female connector.

For Serial Printing:

 Important: The following steps must be performed from the NIC unit touch screen. "Printer" is not an available Serial port assignment from the Remote Control Application.

1. Attach a serial printer cable (with a 9-pin female connector on one end) to the unit's **RS-232** port connector. This is a DB-9 male connector.
2. From the **System** tab, select **I/O Settings**.
3. Select the **Serial** button.
4. Select the **Port Assignment** button and choose **Printer**.

Printing or Viewing Saved Files

While running tests, you have the option to save the information to a file. The instructions below tell you where and how to print or view a saved file.

 Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

To print or view a saved file:

1. From the **System** tab, select **File Services**.
2. Select a file from the **Disk** directory box. The desired report may display in the main Disk directory, or it may be stored in one of the folders in the directory. Folder names are enclosed in brackets **[foldername]**. To return to the main Disk directory after opening a folder, select **[. .]** or the **Disk** button.

 Important: Real-time reports generated from the NIC unit touch-screen, using the [Action after Duration](#) function, are automatically stored in the [APP] folder. Select the folder to display those reports.

The following is a list of file extension used for files generated from the Print Report, [Graph](#), or [Action after Duration](#) functions:

- **.aps** - APS Report
- **.rep** - Graph Report, BERT Analysis, RFC Thru Put Analysis
- **.evt** - Event Report
- **.set** - Settings Report
- **.perf** - Performance Report
- **.stat** - Results Report
- **.real** - Real-time Test Report (Stored in [APP] folder on NIC unit.)
- **.statE** - Event Report
- **.grp** - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results**, pointing to **Graph** and choosing the **Replay Graphs** button.)

3. Choose one of the following

To **Print** the file:

- a. Select **Print**. A standard Print dialog box appears.



If you want to print a report directly from the NIC unit, make sure that a printer is [attached to the unit's parallel or serial port](#).

- b. Select the printer **Name** and choose **OK**.

To **View** the file:

- a. Select **View**. The View File window appears.
b. Select **Exit** to close the window.

Print a Graph Report

1. Select the protocol processor running the test for which you want to print the graph.
2. From the **Results** tab, select **Graph**.
3. Select the Graph screen's **Print Report** command button. The Report Setup menu appears.
4. Choose one of the following:

- From Destination Printer, select **Graphs** to print reports to a printer.



If printing a report from the NIC unit, make sure that a [printer is attached](#) to the unit's parallel or serial port.

- From Destination File, select **Graphs to File** to print reports to a file. The File Browser dialog box appears.
 - ▶ Enter a filename and select **OK**. The file extension for a graph is .rep.



Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

5. Select **OK**.

For information on retrieving a graph saved to file, see [Print or View Saved Files](#).

Recording in the Event Log

The Event Log is a table that displays events recorded by the unit. A scroll bar is available, allowing you to scroll up and down to view an extended history.

To use the Event Log:

1. Select a protocol processor tab.
2. Select the **Results** button.
3. Select **Event**. As events occur (such as alarms, errors, or Pointer activity) they appear and continuously scroll in the table.

Events display in a ascending order from the most recent event to the oldest event. The Descending button indicates that events appear in descending order. (This button switches between descending event order appearance and ascending event order appearance. The current label of the button indicates the event order.)

4. To begin a new test, select the [Restart](#) function button located at the bottom of the touch screen. This will clear all history of previous events, and resets the **Start Test** Date and Time stamp to current time. You now have a reference point as to when new events occur, in comparison to when the test began.

5. Select **Pause**, to stop the scrolling action and then use the scroll bar to view events. Select **Resume** to restart the event log.
5. To display events in an ascending order, select **Descending**. The button changes to Ascending and the events appear from the oldest event to the most recent event.
6. Select **Resume**, to continue Event Log reporting.
7. If the test has completed a Timed Test, or if the [Stop](#) function button located at the bottom of the touch screen was pressed, then the **End Test** Date and Time will also be logged.
8. Select the Report function button located at the bottom of the touch screen to **Print** or **Save** (.evt extension) the Event Log report.

File Services

This function provides file management of saved reports. It allows you to:

- [Printing Saved Files](#)
- [Viewing Save Files](#)
- [Uploading Files](#)
- [Downloading Files](#)
- [Renaming Files](#)
- [Deleting Files](#)
- [Deleting Directories](#)
- [Create a new directory for file storage](#)
- [FTP files](#)

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.



The events occurring while in pause mode will be recorded in the Event Log.

LED Quick Status Area

The left side of the screen provides an at-a-glance view of the current protocol processor's LEDs and Laser ON/Off button. The LEDs report incoming error and alarm activity, current status, and event history.

This portion of the screen allows you to quickly scan and target potential problem areas. It is broken down into the following areas:

- **Laser On/Off button:** Enables you to turn the laser on and off. (only for optical interfaces)
- **TX:** Displays the transmit interface configuration, such as rate, wavelength, framing, and/or duplex depending on the specific protocol processor
- **RX:** Displays the receive interface configuration, such as optical power level or framing depending on the specific protocol processor
- **E/A:** Displays any Errors or Alarms configured to be inserted into the transmitted signal
- **Test Paused:** This LED will turn Red if the [Pause Test](#) button has been selected. Any errors or alarms received while the test is paused will not be recorded in any of the Results statistics.
- **All Tests:** Provides a shortcut to the [All Test Status](#) screen (located under the System tab) which shows a general status summary of all circuit packs installed in the unit.
- **LEDs:** The LEDs that appear are dependent on which protocol processor is selected.

These visual cues help to narrow the focus if problems are detected on the incoming protocol processors' signals and provide a starting point when trying to diagnose problems.

There are two ways to view LEDs from the screen: the **Quick Status LEDs**, which are located on the left side of the screen, and the **Large LEDS** side tab under Results.

The following tables describe what is indicated by the LED color.



For LED descriptions for a specific protocol processor, go to the appropriate protocol processor section of the online help and navigate to **Screen Functions and Definitions > LEDs**.

Quick Status LEDs Color Description

If the LED is ...	Then this indicates ...
Green with white text	Normal operation. The LED is used as a status indicator.
White with white text	Normal operation, no errors or alarms. The LED is used as an error and alarm indicator.
Red with red text	An error or alarm event is in progress. The LED is used as an error and alarm indicator.
White with red text	An error or alarm event was detected, but is now cleared. The text serves as a history indicator.

Large LED Tab Color Description

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with red text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart .
White with black text	No activity from this specific function.



Some LEDs such as TCM or TC Summary, or [VCAT](#) or [VCAT/LCAS](#) are summary LEDs, which represent a larger group of LEDs that display in a pop-up window when their summary LED is selected.

Timed Licenses

License-based features on NIC products are normally enabled/disabled by permanent licenses based on a series of license keys, one for each installed module. However, in specific instances, features can be enabled for a limited time period using Timed Licenses.

Timed Licenses contain a start date and end date, and be for as little as one day or last as long as one year.

To determine whether a unit has an active Timed License, see "[About this product](#)" under System Tab > Misc. You will see the units permanent "base" licenses and, if applicable, any Timed Licenses.



```
Card Type: NGMR                      Version: 5.4
Kit Number: 400548                  S/N: MC11070140
Base License: 12345678901234567890123456789012
Timed License Start: 12/22/2007 Stop: 12/21/2008 State: InUse
Fpga 0 Version 2.0.13              Fpga 1 Version 2.0.51
Fpga 2 Version 3.0.164             Fpga 3 Version 2.2.52
```

To enable a Timed License, [Customer Technical Support](#) will provide a license key along with instructions on how to enter it. See the [Update License Key](#) section of this help file for instructions on entering the Timed License key. Once the unit is rebooted, one of two things will occur:



If the Timed Licensed start-date is in the past, the new licensed features will be enabled and the license State will be listed as **"InUse"**.

-- or --



If the Timed Licensed options are scheduled to begin at a future date, the license State will be listed as **"InFuture"**. A message displays when the unit boots up to reminding the user about the future Timed Licenses. On the date that the Timed License becomes active, the applicable features will become enabled, and the license State will be listed as **"InUse"**.

 When a NIC unit is rebooted within seven (7) days of Timed Licenses [expiration](#) date, a notice will appear on the user interface to inform the user of this fact.

Once the Timed License period is over, the Timed License key will become invalid and the unit will restore the permanent "Base License" key and operate according to the options defined by that key.

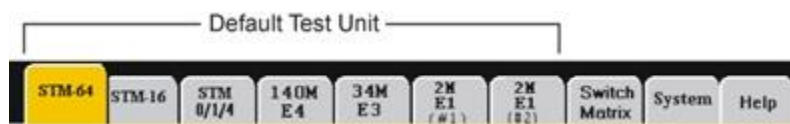
A Timed License expires at midnight on the expiration date. At that moment, the circuit pack will revert to its previous base license. If a test is running on the unit prior to midnight, the test will continue to run and results can be viewed, printed, etc. No settings changes can be made. The test can be stopped, but cannot be restarted.

When a unit is rebooted after Timed License expiration, the Timed License information is no longer displayed in the About information.

Understanding Test Units

Understanding Test-Units

A test-unit (also known as test-set), is a series of adjacent circuit packs that are installed in one NIC chassis. The test-unit is based on a circuit pack's internal addressing and provides Add/Drop functionality between higher speed and lower speed processors.



For example, a NIC chassis may contain multiple circuit packs ranging from 10G down to PDH. When this type of configuration occurs, the test unit begins at higher speed circuit pack, and each lower speed circuit packs immediately to the right of the 10G card are included in the test unit.

The Add/Drop testing can then be setup between these circuit packs using the [Preset](#) menu.



However, when a second instance of a higher speed circuit pack is encountered, it is considered the beginning of a second test-unit. The image displayed above shows a NIC that has 10 protocol tabs, representing 3 individual test units.



Some circuit packs however, such as High Density Ethernet, may contain up to 13 individual Ports under the one protocol tab. In this case, each individual port is considered its own test-unit, since each port is operated independently of each other and there are no Add/Drop opportunities with any other circuit packs.



Also, when one protocol processor within a test-unit is [Locked or Unlocked](#), then all of the protocol processors within that test-unit are automatically locked and unlocked as well.



Important: When the NIC has multiple test units, you must first select a protocol tab from desired test unit before selecting the [Preset](#) button. The configuration options available through the Preset Selection screen are dependent on the test unit that is selected.

Locking and Unlocking a Test Unit

To prevent users from interfering with each other, an individual user can "lock" and take control of a [test unit](#). This is done using the [Lock icon](#) that appears on the GUI. Permission levels determine the user's ability to lock and unlock a test set. When you lock the test set, you can configure protocol processors, start tests, and perform general product functions without the worry of contending for resources with another user.



When a test set is locked by someone else, the  icon is displayed.

To unlock a test set locked by someone else:

1. Select the Lock icon. The Lock/Unlock dialog box appears.
2. Select **Force Unlock**. The command buttons change to "Lock and Exit" and "Lock."



You must have **Admin** privileges to be able to force the unlock.

3. Selecting one of the following causes the command buttons to change to "Unlock and Exit" and "Unlock", and the information boxes become available.
 - **Lock and Exit** - Locks the unit and automatically closes the dialog box. To enter notes after the dialog box closes, select the locked icon to reopen the dialog box.
 - **Lock** - Allows you to enter note information in the Circuit Info: and Contact Info: boxes before closing the dialog box. The notes carry over to all protocol processors in the test set. When a different test set is locked the user can enter notes pertinent to it.
4. To enter note information, select **Circuit Info:** and/or **Contact Info:**. The Enter User String keyboard opens.
5. Type notes and select **Enter**. The notes appear in their associated information box.
6. Select **Exit** to close the Lock/Unlock dialog box.



When you have the test set locked, the  icon is displayed.

To unlock a test set that you have locked:

1. Select the icon. The Lock/Unlock dialog box appears.
2. Selecting one of the following causes the command buttons to change to "Lock and Exit" and "Lock":
 - **Unlock and Exit** - Unlocks the unit and automatically closes the dialog box.
 - **Unlock** - Unlocks the unit without closing the dialog box. Select **Exit** to close the Lock/Unlock dialog box.



When the test set is unlocked, the  icon is displayed.

To lock a test set:

1. Select the icon. The Lock/Unlock dialog box appears.
2. Selecting one of the following causes the command buttons to change to "Unlock and Exit" and "Unlock", and the information boxes become available.
 - **Lock and Exit** - Locks the unit and automatically closes the dialog box.
 - **Lock** - Allows you to enter note information in the **Circuit Info:** and **Contact Info:** boxes before closing the dialog box. The notes carry over to all protocol processors in the test set. When a different test set is locked the user can enter notes pertinent to it. Select **Exit** to close the dialog box.

Lock Icon

Overview

The unit's multi-user functionality allows up to twenty (20) simultaneous users to be connected to a portable unit. This includes one (1) local GUI (Graphical User Interface) via the unit's touch screen, and nineteen (19) can be shared by external remote GUI connections, or [SCPI](#) command sessions.

To prevent users from interfering with each other, an individual user can "lock" and take control of a [Test Set](#). This is done using the Lock icon that appears on the GUI. Permission levels determine the user's ability to lock and unlock a test set. When you lock the test set, you can configure protocol processors, start tests, and perform general product functions without the worry of contending for resources with another user.

Using the Lock Icon

The following guidelines describe how to lock and unlock a test set using the Lock icon. See [Locking and Unlocking a Test Set](#) for more information. For setting the default lock state, see [Configuring the Lock on Startup](#).)

If I see this icon on my GUI,	It means
	The test set is unlocked and available. No individual user has control of it. I can lock the test set by selecting this icon and

	choosing Lock or Lock and Exit from the Lock/Unlock dialog box.
	I have the test set locked. I currently control the test set and can configure protocol processors. I can unlock the test set by selecting the icon. Other users will see  on their GUI.
	The test set is locked by another user. I can only view protocol processor screens. If I have Admin privileges – I can select this icon and force an unlock. If I do not have the proper user privilege – A message appears stating that the protocol processor is locked by the current owner. For example, "Protocol Processor locked by User X."
	The circuit pack (and its associated protocol processors) is out of service. A counter appears indicating how long the circuit pack has been out of service. A fault is also logged.

Configuring the Lock on Startup

To control the Lock's default state when the unit is started:

1. From the **System** tab, select **User Preference**.
2. Select **Startup Locking State**.
 - Select **Lock** to automatically lock the unit when it is started.
 - Select **Unlock** to make the unit available to anyone when it is started.

Adding Notes to a Test Unit

When you [lock](#) a test unit, you can add notes to the Add/Lock dialog box that are pertinent to the test set. Different test units can carry their own specific notes.

To add notes to the Lock/Unlock dialog box for a test unit:

1. Choose the desired protocol processor and select the **Lock** icon. The Lock/Unlock dialog box appears.

 If the test unit is locked by someone else, select [Force Unlock](#) and choose [Lock and Exit](#) or [Lock](#).

2. Select **Circuit Info:** and/or **Contact Info:**. The Enter User String keyboard opens.
3. Type notes and select **Enter**. The notes appear in their associated information box.
4. Select **Exit** to close the Lock/Unlock dialog box.

To edit notes on the Lock/Unlock dialog box for a test unit:

 To edit the notes, the test unit must be placed in locked mode by the immediate user.

1. Choose the desired protocol processor and select the **Lock** icon. The Lock/Unlock dialog box appears.
2. Select **Circuit Info:** and/or **Contact Info:** and make appropriate changes using the Enter User String keyboard. Select **Enter**.
3. Select **Exit**.

Virtual Network Computing (VNC) Connection

All NIC units with Feature Set version 7.0.40 (or later) are configured to support VNC desktop sharing.

This section describes how to establish a remote GUI desktop connection via a VNC viewer.

VNC works on a Server/Viewer model. The VNC server runs on the NIC unit and a VNC viewer connects to the VNC server via Ethernet to share the NIC's desktop, as another method of remotely controlling the NIC's Graphical User Interface (GUI).

 One major benefit of using a VNC viewer to control the NIC's GUI is that VNC viewers are available for most portable products such as Laptops, Netbooks,

Tablets, and even Smartphones, and are supported on multiple OS platforms including Windows, Mac OS X, iOS, Android, Linux, etc.

Before using VNC:

- Verify that the NIC's **IP Address** has been configured from the System tab's I/O Settings > [Ethernet screen](#), and verify that you can ping the NIC's IP Address.
- Enable the NIC's **VNC** server from the System tab's Security screen, by checking the VNC checkbox.

 The default setting for VNC is unchecked (disabled).

- The default VNC Authentication Password is **Admin1**. If the VNC password has since been changed and lost, you can modify the VNC Authentication Password from the VNC Server Properties window.

 VNC viewers only require a login Password. A Username is not required.

VNC Server Properties:

By default you do not need to change the VNC Server properties to securely use the VNC feature, other than enabling it by selecting the VNC checkbox.

If needed however, you can reconfigure the VNC Server Properties by selecting **VNC Config** from the System tab's Security screen.

 The following are some of the **default** VNC Server Properties:

 If **No Authentication** is selected, then anyone on the same network as the NIC will be able to connect to the NIC via VNC, without being required to enter a password.

- Prompt local users to accept connections: **Unchecked**
- Accept connections on port: **5900 (Checked)**  *DO NOT CHANGE PORT#*
- Disconnect idle clients after (seconds): **3600**
- Serve Java viewer HTTP on port: **5800 (Checked)**  *DO NOT CHANGE PORT#*
- Only accept connections from the local machine: **Unchecked**

VNC viewer application:

VNC viewer applications such as Real VNC, Tight VNC, or whichever VNC viewer application is supported by your device, can typically be downloaded from the Internet for free.



The default TCP port for any VNC viewer application is **5900**.

VNC web browser applet:

The NIC's VNC server also supports HTTP connections via TCP port **5800** (default). **Java-enabled** web browsers can quickly establish a VNC connection, without having to first install a VNC viewer program.

If your web browser's **Java add-on** is **enabled**, you can simply enter the **http://<IP Address>:5800** URL (ex. <http://74.11.181.134:5800>) and press **Enter** to launch an embedded VNC viewer as a Java applet.



You will need to enter the VNC Authentication **Password**, but the **Username** field should be left blank.

VNC connection to NIC:

When the NIC is connected to the same network as your VNC equipped PC or wireless portable device, you can log into the NIC using either the VNC viewer or a web browser, and remotely control the NIC's GUI.

NIC units equipped with the System Controller 3 (SC3) module (the one with 3 USB ports) and OS version 7.3.3 or later fully support Cisco/Linksys AE1000, AE1200 and AE2500 model Wireless-N USB Adapters (sold separately). You can use one of these USB-WiFi adapters to connect the NIC to your portable smartphone/tablet or your company's wireless router, for greater mobility. See App Note 00199 for details.

With the use of a hotspot enabled smartphone/tablet, equipped with a VNC viewer, you can configure the NIC's WiFi adapter's settings to obtain an IP Address directly from your handheld device, essentially putting both devices on the same network. This allows you to remotely control the NIC's GUI directly from the palm of your hand, without the need for a wireless router or an external network.

Troubleshooting:

Issue:	Resolution:
Unable to connect to VNC Server	• Verify the NIC's IP Address is valid, and that there are no IP Address conflicts on the network. • Verify that the VNC checkbox is enabled in the Security settings screen. • Verify the following VNC Configuration Properties: • "Accept connections on port" is Checked, and configured for port # 5900 • "Only accept connections from the local machine" is Unchecked • "Prompt local users to accept connections" is Unchecked
Unable to connect via HTTP web browser	• Verify the latest version of Java is installed on your PC. • Verify that your web browser's Java permissions are enabled. • Verify the NIC's VNC Configuration Property setting: • "Serve Java viewer HTTP on port" is Checked, and configured for port # 5800 • Try connecting with a different web browser.
Password Authentication Failed	• The default VNC Authentication Password is: Admin1 • If the default password has been changed and since forgotten or lost, you can enter a new VNC Authentication Password from the VNC Configuration window in the Security settings screen.
Low Color Resolution	• From the VNC viewer's options screen, change the Color settings to the highest setting available (or Full Color resolution).

SYSTEM Tab

The System tab contains functions used to establish unit preferences, set up tests, and configure input and output port configuration settings in order to perform software upgrades, file transfers, and many other functions.

The System tab contains the following function screens:

- [Misc](#)
- [I/O Setting](#)
- [File Service](#)
- [Security](#)
- [User Preference](#)
- [All Test Status](#)
- [All Ether Ports](#)
- [Service Disruption](#)
- [Monitor](#)
- [Chat](#)
- [Faults](#)

Misc Screen

Miscellaneous System Settings

The following functions are available under the System Miscellaneous screen:

- [Recalibrate Touch Screen](#) *(Does not apply to Remote GUI connections)*
- Optics Inspection
- [Update License Keys](#)
- [Start Screen Saver](#) *(Does not apply to Remote GUI connections)*
- [Backlight Intensity](#) *(Does not apply to Remote GUI connections)*
- [Speaker Volume](#) *(Does not apply to Remote GUI connections)*
- [Boot Sound Enabled](#) *(Does not apply to Remote GUI connections)*

- [Unit Time, Date, and Time Zone \(and synchronized network time\)](#)
- [Oscillator Value](#)
- [About this product](#)
- Check for Upgrade
- [User Login Required](#) *(Does not apply to Remote GUI connections)*
- [Enable Calibration](#)

The following Global Settings apply to all Test Sets

- [Change Protocol Mode](#)
- [Restore To Factory Defaults](#)
- [Save Settings To File](#)
- [Restore Settings From File](#)
- [External Clock](#)
- External Clock In Status
- [Recalibrate Touch Screen](#) *(Does not apply to Remote GUI connections)*

Calibrating the Touch Screen

 The touch screen can only be calibrated from the NIC's local GUI, and does not apply to Remote GUI connections.

Touch screen calibration is performed on all portable units prior to shipping from the factory. However, if your unit's touch screen requires recalibration, perform the procedure described below.

Although touch screen calibration can be performed using your finger, a pointing device such as a stylus is recommended for greater accuracy.

Below are two sets of instructions, which are based on two different touch screen utilities.

- NIC units which are equipped with **System Controller 3** will display the [Microchip,TSHARC-12](#) calibration utility

- NIC units which are equipped with **System Controller 2** will display the [Hampshire](#) calibration utility



See the Differences between System Controller modules section in this help file for more details.

Follow the set of instructions below that apply to the System Controller in your unit.

To calibrate the System Controller 3's touch screen:

1. From the **System** tab, select **Misc**.
2. Select **Recalibrate Touch Screen**. The touch screen calibration window appears.
3. Starting in the upper left corner, press down and hold your pointing device as close to the target area (the red dot in the center of a blue cross) as possible.
4. The blue cross icon  changes to a green check icon  when the calibration for that specific point is complete.
5. The next blue cross calibration target appears. Repeat steps 3 and 4 for the remaining 24 targets.



If the screen is not touched for a 15-second period or longer, the current calibration process is canceled. The calibration must be restarted using the first touch screen target.

6. When touch screen calibration is complete, move your pointing device around the touch screen and verify the touch screen is calibrated to your satisfaction.
7. Select **Confirm** to apply the calibration settings.

To calibrate the System Controller 2's touch screen:

1. From the **System** tab, select **Misc**.
2. Select **Recalibrate Touch Screen**. The touch screen calibration window appears.

3. Starting in the upper left corner, press down and hold your pointing device as close to the target area indicated by animated red arrows as possible.



In all 20 touch screen targets (calibration points) will appear on the screen.

4. The message **Release** appears when calibration for that specific point is complete.
5. The animated red arrows then move to the next target. Repeat steps 3 and 4 for the remaining targets.



If the screen is not touched for a 15-second period or longer, the current calibration process is canceled. The calibration must be restarted using the first touch screen target.

6. When touch screen calibration is complete, move your pointing device around the touch screen and verify the touch screen is calibrated to your satisfaction.
7. Select **Accept** to apply the calibration settings.

Update License Keys

The Update License Key function allows you to enable functionality that you may not have initially purchased.

If you wish to enable functionality currently disabled, contact your Digital Lightwave sales manager or Digital Lightwave [Customer/Technical Service](#).

The current License Keys can be viewed from the [About This Product](#) window.

If new features are purchased, you will be provided a License Key that will activate the requested features.

[Timed License Keys](#) can also be obtained, which will unlock requested features for a specific length of time. After the timed license key expires, the requested feature will automatically become unavailable, and the unit will revert to its previous permanent license key.

To enter a new license key:

1. From the **System tab**, choose **Misc**.
2. Select **Update License Key**.

3. Select the **Circuit Pack** for which the new license key has been created. The **Enter User String** keyboard appears.
4. Enter the new license key. When entering the license key, only Capitalized letters are acceptable (**do not enter lower case letters**).
 - If using the GUI's touchscreen keyboard, you will need to toggle the “**Shift**” button between number and letter entries.
 - If using a USB keyboard, utilize the Caps Lock feature.
 - If you have established a Remote GUI connection from your PC to the NIC unit, then the new license key can easily be copied from your PC and pasted into the keyboard entry field.
5. Select **Enter** when done.
6. [Reboot](#) the unit for the new functions to take effect.

Configuring the Screen Saver

 The Screen Saver can only be configured from the NIC touch screen, and does not apply to Remote GUI connections.

The screen saver can be turned off or configured to activate after a set period of time. When the screen saver is operating, you can clear it by touching anywhere on the touch screen.

To enable the screen saver:

1. From the **System** tab, select **Misc**.
2. Select **Start Screen Saver**. The Select Screen Saver Delay dialog box appears.
3. Select the desired delay period.

To disable the screen saver:

1. From the **System** tab, select **Misc**.
2. Select **Start Screen Saver** and choose **Off**.

Adjusting Touch Screen Brightness

 The touch screen's brightness level can only be adjusted from the NIC touch screen, and does not apply to Remote GUI connections.

To adjust a portable unit's touch screen brightness:

1. From the **System** tab, choose **Misc**.
2. Select **Backlight Intensity**. A keypad appears.
3. Enter the desired intensity setting. Valid values range from **0** (brightest setting) to **255** (dimmiest setting).
4. Select **OK**.

Increasing or Decreasing Speaker Volume

 The unit's speaker volume can only be adjusted from the NIC touch screen, and does not apply to Remote GUI connections.

This function allows you to increase or decrease the speaker volume in order to hear the touch screen beep, the [boot sound](#), as well as other features that emit sounds from the unit's speaker.

To increase or decrease speaker volume:

1. From the **System** tab, choose **Misc**.
2. From **Speaker Volume**, select the **Low** arrow to decrease the volume, or **High** arrow to increase the volume.

Enabling Boot Sound

 The Boot Sound setting can only be changed from the NIC touch screen, and does not apply to Remote GUI connections.

Enabling the Boot Sound option allows a .wav sound file to play that acknowledges when the NIC unit is fully booted and available.

To enable the boot sound:

1. From the **System** tab, select **Misc**.
2. Select the **Boot Sound Enabled** check box.



To disable the Boot Sound, simply clear the Boot Sound Enabled check box.

Set the Unit's Date, Time, Time Zone, and Daylight Saving Time option

The current time and date settings are displayed to the right of this setting. The Time's format is displayed in 24-hour (military time format) as **HH/MM/SS**. The Date's format is displayed as **MM/DD/YYYY**.

To manually set the Time:

1. From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.
 - The Date/Time and Zone menu displays the following three items: Manually Adjust Date/Time, Automatically Adjust Date/Time and Adjust Time Zone
 - After manually setting the current time or date, the word (Enabled) will appear to the right of Manually Adjust Date/Time. Likewise, the word (Disabled) will appear to the right of Automatically Adjust Date/Time
2. Select **Manually Adjust Date/Time**. The Set the Date/Time window appear.
3. Press the **Time** button, and change any of the following options.
 - Press **Hour** to adjust the hour setting using 2-digit, 24-hour, military time format
 - Press **Minute** to adjust the minutes setting using a 2-digit format
 - Press **Second** to adjust the seconds setting using a 2-digit format
4. Select **Set**. The time change appears next to the Unit Time, Date, Zone setting

To manually set the Date:

1. From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.
 - The Date/Time and Zone menu displays the following three items: Manually Adjust Date/Time, Automatically Adjust Date/Time and Adjust Time Zone

- After manually setting the current time or date, the word (Enabled) will appear to the right of Manually Adjust Date/Time. Likewise, the word (Disabled) will appear to the right of Automatically Adjust Date/Time
2. Select **Manually Adjust Date/Time**. The Set the Date/Time window appear.
 3. Press the **Date** button, and change any of the following options.
 - Press **Month** to adjust the month setting using a 2-digit format
 - Press **Day** to adjust the day setting using a 2-digit format
 - Press **Year** to adjust the year setting using a 4-digit format
 3. Select **Set**. The date change appears next to the Unit Time, Date, Zone setting.

To set your current Time Zone:

1. From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.
2. Select **Adjust Time Zone**. The Time Zone Properties window appear.
3. Select the desired Time Zone (and geographic location) from the drop-down menu.
4. Select **OK**. The system time will automatically update for the change in time zones.

To adjust clock automatically for Daylight Saving Time change:

To configure your unit's clock so it will adjust automatically when daylight saving time changes, make sure the Automatically adjust clock for daylight saving changes check box is selected.

This option is only available in Time Zones that support Daylight Saving Time changes.

1. From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.
2. Select **Adjust Time Zone**. The Time Zone Properties window appear.
3. **Enable** the Automatically adjust clock for daylight saving changes.
4. Select **OK**. The system time will automatically update for daylight saving time changes.

To Automatically set the Time and Date:

The NIC's clock can be synchronized with a network time server or an Internet time server (when you connect to a Network via Ethernet).

1. From the **System** tab, select **Unit Time, Date, Zone**. The Date/Time and Zone menu appears.
 - The Date/Time and Zone menu displays the following three items: Manually Adjust Date/Time, Automatically Adjust Date/Time and Adjust Time Zone
 - After configuring the unit to automatically adjust the Date and Time, the word (Enabled) will appear to the right of Automatically Adjust Date/Time. Likewise, the word (Disabled) will appear to the right of Manually Adjust Date/Time
2. Select **Automatically Adjust Date/Time**. The Enter User String keyboard appears.
3. Enter the Name or IP Address of the desired network/Internet time server, and select **Enter** when done.
 - By default the network time server is programmed as **time.nist.gov**
4. [Reboot](#) the unit for the network settings change to take effect.

Setting Oscillator Value

This setting is used for Calibrating the System internal Stratum III Clock Frequency

 **Important:** The following procedure is for use by qualified Digital Lightwave personnel. It is assumed that you have already measured the frequency offset that must be entered into the unit.

To enter and adjust the frequency of the Stratum III clock:

1. From the **System** tab, select **Misc**.
2. Select **Oscillator Value**. A keypad appears. The unit's internal clock frequency can be adjusted in 255 steps, where **0** is the lowest frequency, **128** is the center frequency, and **255** is the highest frequency.
3. Using the keypad, enter a value, and select **OK** when you are done. The new Oscillator Value is set.

About This Product

This window displays the following information:

- Feature Set (this is the overall software version of the NIC unit.)
- Phone, website and email contact information for Digital Lightwave Technical Support
- Product Name (Digital Lightwave – NIC Plus, NIC 2.5G, NIC GigE, etc.)
- Product Serial Number (11 Digits)
- Usage Time (This is the total number of hours that the NIC unit has been operating.)
- Card Type, Software Version, Licensing and additional information for each installed module



If a circuit pack has a [Timed License](#), then the Timed Licensed information will also be listed.

- Copyright and Patent Information

Saving Information

NOTE: The above information may be needed when calling for [Technical Support](#).

The information contained in the window can be saved to a text file by pressing the **SAVE** button in the lower left corner of the window; so that it can easily be copied from the unit, and attached to an email.

The About file is saved to the location specified.

- If this is done on the touch screen of the NIC unit, the text file will be stored on the unit's hard drive. The file can then be copied to USB drive or PCMCIA-Flash Ram card, or sent by [FTP](#).
- If done with remote control software, the file will be saved to the specified location on the PC's hard drive.

To close the About This Product window, select **OK**.

Establishing a Required User Login

 The User Login Required setting can only be changed from the NIC touch screen, and does not apply to Remote GUI connections.

This function allows an administrator to establish a required login, which results in the user having to enter a user ID and password each time they use the unit.

Administrators can create or change User-names, Passwords and Permissions from the System > [Security](#) screen.

To establish a required login:

1. From the **System** tab, choose **Misc**.
2. From **Local Setting**, select the **User Login Required** check box. When this box is checked, a required login has been established.
 - To disable the required login, clear the **User Login Required** check box.
3. [Reboot](#) the unit for this setting to take effect.

 When the unit reboots, a valid User name and Password will be required in order for the local GUI to appear on the NIC touch screen.

Calibrating SDH/SONET Electrical Interface Power Meters

 The following calibration procedures do not apply to optical interfaces that utilize hot-swappable SFP/XFP/CFP lasers.

Calibrating the Electrical Interface power measurements should be done carefully. To keep unauthorized users from changing calibration settings, the Update Signal Calibration button on the protocol processor's Receive > SIG screen is unavailable by default. To change the setting, a user with Admin or Calibrate privileges must enable the calibration mode. Once calibration has been enabled, each protocol processor has its own calibration procedure.

To enable protocol processor calibration:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, select **Enable Calibration**.



The user must have Admin or Calibrate privileges to enable the calibration mode.

The **Update Signal Calibration** button is now available on the protocol processor's **Receive SIG** screen.

Calibrating Electrical Interfaces

For calibrating 155 Mbps electrical interfaces see the SONET or SDH calibration procedures for EC-3 or STM-1e. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.

For calibrating 52 Mbps electrical interfaces see the SONET or SDH calibration procedures for EC-1 or STM-0e. Use the Contents tab on the left side of the online help window to locate and open the appropriate topic. Calibration procedures are located under Specific Tasks.



For local touch screen calibration procedures, select [Calibrating the Touch Screen](#).

Changing the Protocol Mode

The unit can be configured to operate in SONET, SDH, PDH, or DS3/DS1 networks.



The options that appear on this screen are determined by your hardware configuration.



Changing the Protocol Mode from the System > Misc screen will globally apply the Protocol mode change to all [Test Units](#) in the NIC unit.



You must have all SONET/SDH and PDH/DSn processors [locked](#).

1. Select the **System** tab and choose **Misc**.

2. Select the **Change Protocol Mode** button.
3. The following menu options appear:

Change Protocol Mode SONET Change Protocol Mode SDH	These options appear if your unit contains one or more SONET/SDH board, but no PDH board
Change Protocol Mode DS1/DS3 Change Protocol Mode E1/DS3 Change Protocol Mode E1/E3	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Change Protocol Mode SDH/E1/E3 Change Protocol Mode SDH/E1/DS3 Change Protocol Mode SDH/DS1/DS3 Change Protocol Mode SONET/DS1/DS3 Change Protocol Mode SONET/E1/DS3	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

4. Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode.

Restoring Factory Defaults

This function will reconfigure all of the protocol processor's settings back to the original Factory Defaults, for the selected Protocol Mode.

-  The options that appear on this screen are determined by your hardware configuration.
-  Restoring the Factory Defaults from the System > Misc screen will globally apply to all protocol processors in the NIC unit.
-  You must have all protocol processors [locked](#).

1. Select the **System** tab and choose **Misc**.
2. Select the **Restore To Factory Defaults** button.
3. The following menu options appear:

Restore To Factory Default SONET Restore To Factory Default SDH	These options appear if your unit contains one or more SONET/SDH board, but no PDH board
Restore To Factory Default DS1/DS3 Restore To Factory Default E1/DS3 Restore To Factory Default E1/E3	These options appear if your unit contains one or more PDH board, but no SONET/SDH board
Restore To Factory Default SDH/E1/E3 Restore To Factory Default SDH/E1/DS3 Restore To Factory Default SDH/DS1/DS3 Restore To Factory Default SONET/DS1/DS3 Restore To Factory Default SONET/E1/DS3 Restore To Factory Default SONET/E1/E3	These options appear if your unit contains one or more SONET/SDH board, and one or more PDH board

4. Select the desired protocol mode. The protocol tabs and settings will updated to reflect the selected mode, and all of the protocol settings will revert back to their factory assigned default values.

Saving and Restoring Global Settings Configurations

This function allows you to perform the following actions:

- [Save](#) all protocol processor Transmit and Receive settings and configurations to file.
- [Restore](#) all protocol processor Transmit and Receive settings and configurations by recalling a previously saved settings file.

To Save the current settings configuration:

1. Select **System** and choose **Misc**.
2. Select the **Save Settings To File** button. The File Browser window appears.
3. Press **File Name**. The Enter User String keyboard appears.
4. Enter a settings file name, and select **Enter** when done.
 - Do not include the Space character in any file name

- Do not type a file extension; the .SET file extension will automatically be added to the filename.
5. Select **Drive**, if you wish to save the file to a different Drive letter.
 6. Double click on an existing directory, or click New Dir and create a new directory, if you do not wish to save the file in the default directory.
 7. Select **OK** to save the settings file.

To Restore a settings configuration:

1. Select **System** and choose **Misc**.
2. Select the **Restore Settings From File** button. The File Browser window appears.
3. Type or select the name of the settings configuration file to be restored from the list of filenames.
 - Settings files will have a .SET file extension
4. If the desired settings file resides in a different drive or directory, then select the settings file for the appropriate location.
5. Click **OK** to recall the previously saved settings.

Setting the External Clock

This function allows you to set the external clock to BITS, SETS, 1.544 MHz Clock, or 2.048 MHz Clock.

To set the external clock:

1. Select **System** and choose **Misc**.
2. Select **External Clock**. The External Clock dialog box appears.
3. Select **BITS (1.544 Mbps)**, **SETS (2.048 Mbps)**, **1.544 MHz Clock**, or **2.048 MHz Clock**.

Option	Description
BITS (1.544 Mbps)	Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. The CLK:BITS displays in the Quick LED Status area, when the Transmit Clock Reference is configured for BITS/SETS.  If this option is selected, but BITS clocking is not available, then this function defaults to Internal.
SETS (2.048 Mbps)	Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. The CLK:SETS displays in the Quick LED Status area, when the Transmit Clock Reference is configured for BITS/SETS.  If this option is selected, but SETS clocking is not available, then this function defaults to Internal.
1.544 MHz Clock	This synchronizes the transmitted signal to a 1.544 MHz sine-wave clock input. The CLK:BITS displays in the Quick LED Status area, when the Transmit Clock Reference is configured for BITS/SETS.  If this option is selected, but BITS clocking is not available, then this function defaults to Internal.  This is only available on new System Controller cards.
2.048 MHz Clock	This synchronizes the transmitted signal to a 2.048 MHz sine-wave clock input. The CLK:SETS displays in the Quick LED Status area, when the Transmit Clock Reference is configured for BITS/SETS.  If this option is selected, but SETS clocking is not available, then this function defaults to Internal.  This is only available on new System Controller cards.

I/O Settings Screen

I/O Settings

The unit can be remotely controller by wired Ethernet port or wireless Ethernet (via USB Wi/Fi card), as well as a GPIB port (via USB GPIB card) that can be used for sending SCPI commands to the NIC unit.

- The I/O Settings tab allows you to configure and control the unit's communications port parameters.
- The I/O Settings tab also provides a way to [Reboot](#) the test set.

The following port settings and configuration options are available on the I/O Settings screens:

- [Ethernet Port Settings](#)
 - [Configuring the Ethernet Port](#)
 - [Configuring Wireless Ethernet](#)
- [GPIB Port Settings](#)
 - [Configuring the GPIB Port](#)

Ethernet Port Settings

Ethernet Port Settings



If Ethernet port parameters are changed, the test set must be [rebooted](#) for the changes to take affect.

These settings are used to configure the Ethernet port's parameters:

- **[Obtain an IP address from a DHCP server](#):** The unit will uses the network's Dynamic Host Connection Protocol (DHCP) server to dynamically assign it an IP address. ***When selected, the IP Address, Subnet Address, Router, Host Name, and Domain Name functions are disabled, but will be populated by the DHCP server.***

- **Specify an IP address**: Allows a static IP Address to be entered using the IP Address, Subnet Address, Router, Host Name, and Domain Name functions.
- **IP Address**: Enter the unit's IP Address using dotted decimal notation. For example, **nnn.nnn.nnn.nnn**, where **nnn** is a value from 0 to 255.

 IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A serious system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

- **Subnet Address**: Enter the Subnet Mask Address using dotted decimal notation.
- **Router**: Enter the Router/Gateway Address using dotted decimal notation.
- **Host Name**: Enter the unit's host name (for example, the NIC's Serial Number). This is an optional parameter, and is used to identify the NIC unit on your network, in the same way that each computer may have a unique name on the network.
- **Domain Name**: Enter the unit's domain name (for example, lightwave.com). This is an optional parameter.
- **Port Assignment**: Displays what has been assigned, by way of default or license. SCPI is automatically listed. If the unit is licensed for TL1, then TL1 is also displayed on the assignment line.

 The **Host Name** and **Domain Name** parameters defined for Ethernet Configuration screen also apply to the Wireless Configuration screen. Any changes made to these parameters on one screen will also be made on the other screen.

Configuring the Ethernet Port

The unit can be controlled using SCPI commands, Remote GUI operation, as well as File Transferring through the unit's Ethernet port. The unit supports static IP addressing and dynamic IP addressing, using Dynamic Host Connection Protocol (DHCP).

 If Ethernet port parameters are changed, the test set must be [rebooted](#) for the changes to take affect.

To configure the Ethernet port for a static IP address:

1. From the **System** tab, select **I/O Settings**.

2. Select **Ethernet**.
3. Select **Specify an IP address** from the [Ethernet Configuration](#) functions.
4. Enter the unit's **IP Address**, **Subnet Address**, and **Router Address**.

 IP addresses **192.168.138.0 through 192.168.138.255** are reserved and should not be used. A serious system conflict can occur if these IP addresses are entered.

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

5. Reboot the unit using the [Reboot](#) button for changes to take affect.

To configure the Ethernet port for a dynamic IP address using DHCP:

1. Plug an Ethernet cable into the unit's RJ-45 port, that is connected to a **DHCP network server**.
2. From the **System** tab, select **I/O Settings**.
3. Select **Ethernet**.
4. From **Ethernet Configuration**, select **Obtain an IP address from a DHCP server**.
5. Reboot the unit using the [Reboot](#) button for changes to take affect.
6. Upon rebooting, the unit will use the network's DHCP server to dynamically assign it an IP Address, Subnet Mask Address and Router Address.

Configuring Wireless Ethernet

You can use an external WiFi adapter to connect the NIC to your company's wireless router or access point, or even to your portable smartphone/tablet for greater mobility.

 NIC units equipped with the System Controller 3 (SC3) module (three USB 2.0 ports) fully support Cisco/Linksys AE1000, AE1200 and AE2500 Wireless-N USB adapters (requires OS version 7.3.3 or later), sold separately.

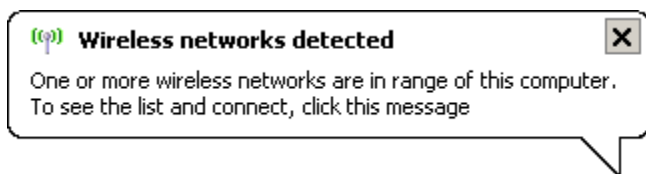
 Legacy NIC units equipped with the System Controller 2 (SC2) module (one USB 1.0 port, and status LEDs next to the dual-slot PCMCIA slots) supports 11-Mbps Wireless LAN PCMCIA CardBus Adapters (sold separately). This card is inserted into the unit's PCMCIA slot.

The unit supports static IP addressing and dynamic IP addressing, using Dynamic Host Connection Protocol (DHCP).

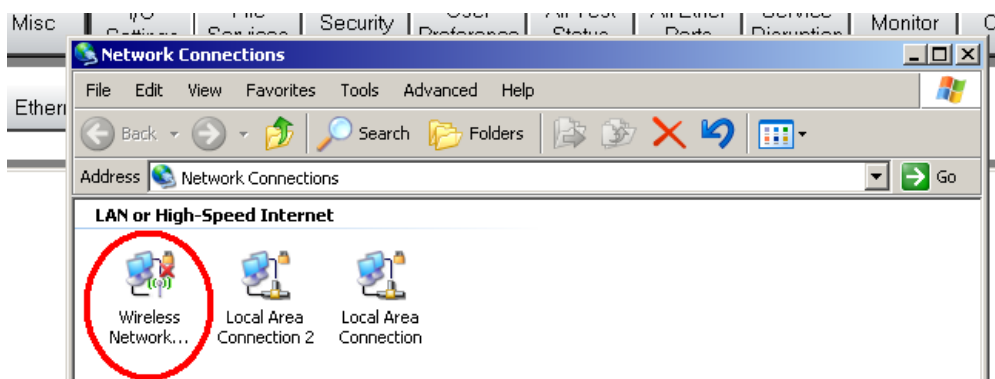
- ① If the Wireless Ethernet port parameters are changed, the test set must be **rebooted** for the changes to take affect.
- ① The **Wireless** settings are only displayed when configuring from the NIC touch screen.

Initial wireless configuration:

1. With the NIC unit turned off, insert a supported Wireless adapter and turn the unit on, then wait for the unit to boot.
2. While booting the following message should display, but do not click on it. Wait for the GUI to appear.



3. From the **System tab** go to **I/O Settings**, select **Wireless**, and press the **Configure Wireless** button to open the **Network Connections** window.



4. If the NIC has not been connected to the wireless network previously, then the Wireless Network icon will show a red **X**, indicating that it is not connected.



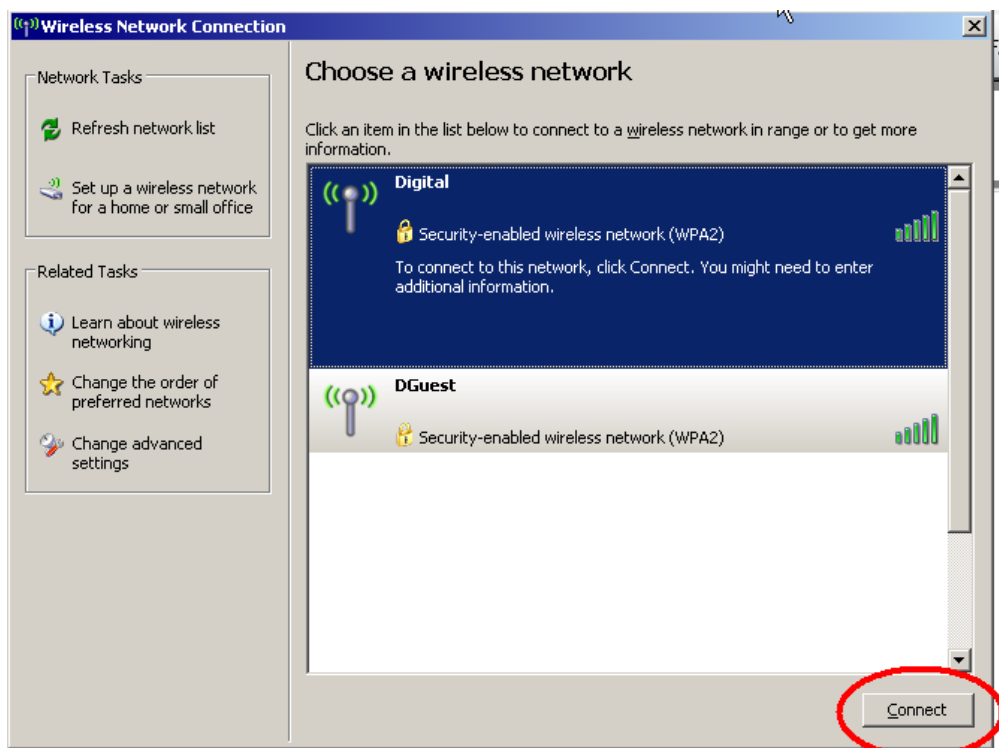
5. Double-click Wireless Network Connection icon to choose a Wireless Network.

6. If the wireless network is configured to automatically assign an IP Address by DHCP, then skip the following step.
7. If your network requires a static IP Address to be entered, then select Change Advanced Settings.
 - a. From the General tab, scroll down and double-click on Internet Protocol (TCP/IP)
 - b. Select Use the following IP Address, and enter the static IP Address provided by your network administrator.
 - c. Click OK twice, and then double-click Wireless Network Connection icon again, and continue to the next step.

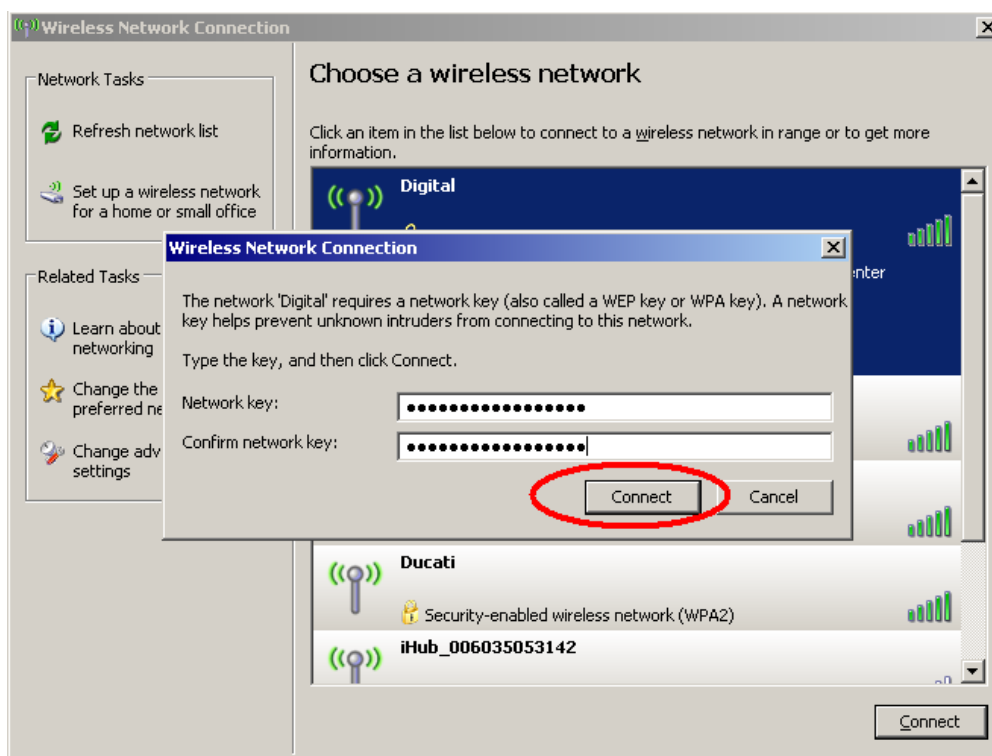
 **Warning: IP addresses **192.168.138.0** through **192.168.138.255** are reserved and cannot be used. A system conflict can occur if these IP addresses are entered.**

If you must use an IP address in the range of **192.168.x.y** (where x is not equal to 138), then you **must** set the Subnet Address to **255.255.255.0**.

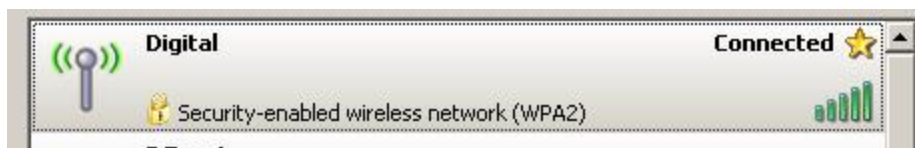
8. From the list of available networks select the Wireless Network you would like to connect to and click the **Connect** button.



9. If the selected network is password protected then enter the required Network key using a USB keyboard. You will need to re-enter the key to confirm it was entered correctly and then click Connect.



10. If the connection is successful, then the word Connected will appear with a gold star, on the selected network.

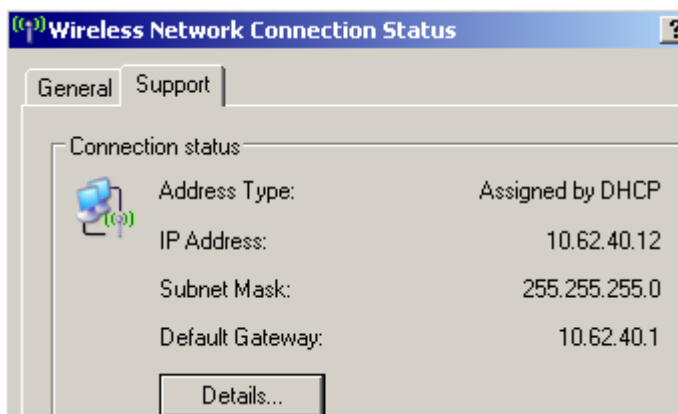


11. Once the desired connection has been established close the Wireless Network Connection window, then close the Network Connections window.
12. Click on the **Ethernet** screen from I/O settings, select **Reboot** and click Ok to reboot.
13. Do not click on any Wireless status messages while the NIC is booting, and wait for the GUI to appear.
14. To identify the assigned wireless IP Address go to the System tab, I/O Settings, Wireless, and press the Configure Wireless button to open the Network Configuration window.

15. If the NIC has connected to the wireless network successfully, then the Wireless Network Connection icon will appear without the red **X**, indicating that the connection is enabled.



16. For DHCP networks, double-click the Wireless Network Connection icon to open the Wireless Network Connection Status window. Click the Support tab to see the IP Address assigned by DHCP.



17. The assigned IP Address can now be used to remotely connect to the NIC unit via the [Remote GUI](#), [FTP](#), SCPI, [software upgrade](#) or [VNC](#).

GPIO Port Settings

GPIO Port Settings



If GPIO port parameters are changed, the test set must be [rebooted](#) for the changes to take affect.

The following configures the GPIB port's parameters.

- **GPIB Port:** Sets the GPIB port address from 0 to 30. The primary address must match the GPIB host or communications cannot be established.
- **Port Assignment:** The unit can be controlled using SCPI commands through the unit's GPIB port. The Port Assignment line of the GPIB screen automatically displays SCPI as its assignment.

Configuring the GPIB Port



If GPIB port parameters are changed, the test set must be [rebooted](#) for the changes to take affect.

The unit can be controlled using SCPI commands through the unit's GPIB port. The Port Assignment line on the GPIB screen automatically displays SCPI as its assignment.

To configure the GPIB port address:

1. From the **System** tab, select **I/O Settings**.
2. Select **GPIB**.
3. Select **GPIB Port** and enter the primary address for the GPIB interface. Address values are from 0 to 30. The primary address must match the GPIB host or communications cannot be established.
4. Select **OK**.
5. Reboot the unit using the [Reboot](#) setting for changes to take affect.



NIC units that have the new System Controller 2 running Windows XP embedded must use GPIB PCMCIA data-bus cards manufactured by INES.



NIC units that have the original System Controller running Windows NT embedded must use GPIB PCMCIA cards manufactured by National Instruments.

Rebooting the Test Set

This function allows the system to write unsaved data to the disk before you reboot the unit. You can perform this task from the System I/O window or by selecting the Off/Lock button on a protocol processor tab.

 **Important:** Rebooting the test set must be done from the NIC touch screen.

To reboot the unit from the System, I/O Settings window:

1. Select the **System** tab and choose **I/O Settings**.
2. Select **Ethernet** and choose **Reboot**. The Reboot dialog box appears.
3. Select **OK** to continue with the reboot process, or **Cancel** to keep the unit on. The Shutdown in Progress message box appears.
4. After all unsaved data is written to the disk, the unit restarts.

 **Important:** If the unit does not successfully reboot turn it off manually by toggling the On/Off switch to **Off**. It is recommended that you wait about 10 seconds before turning the unit back on.

File Services Screen

File Services

This function provides file management of saved reports. It allows you to:

- [Printing Saved Files](#)
- [Viewing Save Files](#)
- [Uploading Files](#)
- [Downloading Files](#)
- [Renaming Files](#)
- [Deleting Files](#)
- [Deleting Directories](#)
- [Create a new directory for file storage](#)
- [FTP files](#)

Printing Saved Files

While running tests, you have the option to save the information to a file. The instructions below tell you where and how to print a saved file.

 **Important:** The NIC unit saves the files to its default D:\DLI\FTP\APPL\ directory on the test unit.

However, files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC.

- Open the Remote NIC (**GalaxyNIC**) directory. For example, the default directory is C:\Program Files\GalaxyNIC\.
- Locate the **Compat** folder from which the Remote NIC is running. The folder name represents the Feature Set operating on the NIC unit. For example, the Compat folder for Feature Set 5.3.53 appears in the GalaxyNIC directory as **Compat500030053**.

To print a saved file:

1. From the **System** tab, select **File Services**.
2. Select a file from the **Disk** directory box. The desired report may display in the main Disk directory, or it may be stored in one of the folders in the directory. Folder names are enclosed in brackets [**foldername**]. To return to the main Disk directory after opening a folder, select [**. .**] or the **Disk** button.

 **Important:** Real-time reports generated from the NIC unit touch-screen, using the Action after Duration function, are automatically stored in the [APP] folder. Select the folder to display those reports.

The following is a list of file extension used for files generated from the Print Report, Graph, or Action after Duration functions:

• .aps - APS Report	• .rep - Graph Report, BERT Analysis, RFC Thru Put Analysis
• .evt - Event Report	• .set - Settings Report
• .perf - Performance Report	• .stat - Results Report

- **.real** - Real-time Test Report (Stored in [APP] folder on NIC unit.)
 - **.statE** - Event Report
 - **.grp** - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results**, pointing to **Graph** and choosing the **Replay Graphs** button.)
3. Select a file from the File List box.
 4. Select **Print**. A standard Print dialog box appears.

 If you want to print a report directly from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

 Printing to a USB printer is not supported at this time.

5. Select the printer **Name** and choose **OK**.

Viewing Saved Report Files

While running tests, you have the option to save the information to a file. The instructions below tell you where and how to view a saved file.

 Important: Image files such as saved Screen Captures that have a **.BMP** file extension can not be viewed by the NIC's GUI.

 Important: Save reports with a **.PDF** file extension can not be viewed by the NIC's GUI.

- For these file types, you will need to transfer them to a PC to be opened and viewed.

 The NIC unit saves the files to its default **C:\DLI\FTPI\APPL** directory on the test unit.

However, files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC.

- Open the Remote NIC (**GalaxyNIC**) directory. For example, the default directory is **C:\Program Files\GalaxyNIC**.

- Locate the **Compat** folder from which the Remote NIC is running. The folder name represents the Feature Set operating on the NIC unit. For example, the Compat folder for Feature Set 7.3.39 appears in the GalaxyNIC directory as **Compat700030039**.

To view a saved file:

1. From the **System** tab, select **File Services**.
2. Select a file from the **Disk** directory box. The desired report may display in the main Disk directory, or it may be stored in one of the folders in the directory. Folder names are enclosed in brackets [**foldername**]. To return to the main Disk directory after opening a folder, select [**. .**] or the **Disk** button.

 **Important:** Real-time reports generated from the NIC unit touch-screen, using the Action after Duration function, are automatically stored in the [APPL] folder. Select the folder to display those reports.

The following is a list of file extension used for files generated from the Print Report, Graph, or Action after Duration functions:

- **.aps** - APS Report
- **.evt** - Event Report
- **.perf** - Performance Report
- **.real** - Real-time Test Report (Stored in [APPL] folder on NIC unit.)
- **.grp** - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results**, pointing to **Graph** and choosing the **Replay Graphs** button.)
- **.rep** - Graph Report, BERT Analysis, RFC Thru Put Analysis
- **.set** - Settings Report
- **.stat** - Results Report
- **.statE** - Event Report

3. Select a file from the File List box.



The following file details display below the File List box.

- File name
- File size and date
- File attributes

4. Select **View**. The View File window appears.

5. Use the **Display Hex / Display ASCII** toggle button to display the file in Hex or ASCII format.



By default the text may be highlighted. Select anywhere in the View File window to un-highlight the text.

6. Select **Exit** to close the View File window.

Uploading Files



A file can be transferred from the unit to a remote device (e.g., a PC), or to external memory devices such as a PCMCIA/Compact Flash memory card, USB memory, and SD memory cards.

(Note that the System Controller 2 module supports USB memory, and the System Controller 3 module supports USB and SD memory.)

If using external memory, make sure that the external storage device is plugged into the NIC unit before selecting the File Services button. When the external storage device is inserted, an audible tone indicates the device is ready for use.

If using the FTP function, make sure you have the IP address of the receiving device.

See also [Download Files](#)

1. From the System tab, select **File Services**.
2. From the right File List box, select the upload method by clicking on the Drive — FTP button.

If using [FTP](#), click on that button, then enter the IP Address of the device that will receive the file (unless you are using the Remote Control Software; then enter the test set address). If this device is secured with a User ID and Password, then enter this information. Enter an FTP session on the connecting device.

If using an external memory device, plug the card or device into the appropriate slot. After a few seconds the system will recognize the device and update the drive selection window. New drive letters will appear in the File List box. Note that it is possible to have multiple external devices connected to the NIC at the same time. From one of the drives in the File

List box, select a target directory to receive the file. Note that it is usually best to plug in the storage media before clicking the File Services button.

From the left File List box, select the current directory location of the file you want to transfer.

Select the desired file to be transferred.

Select the upload button.  The file will be transferred from the NIC unit.

 **Warning:** When the unit is powered off, the root FTP directory is automatically purged. However, files contained in sub-directories of the FTP directory (such as APPL) will not be deleted.

Downloading Files

 A file can be transferred to the unit to a remote device (e.g., a PC), or from a external memory devices such as a PCMCIA/Compact Flash memory card, USB memory, and SD memory cards.

(Note that the System Controller 2 module supports USB memory, and the System Controller 3 module supports USB and SD memory.)

If using external memory, make sure that the external storage device is plugged into the NIC unit before selecting the File Services button. When the external storage device is inserted, an audible tone indicates the device is ready for use.

If using the FTP function, make sure you have the IP address of the receiving device.

See also [Uploading Files](#)

1. From the System tab, select **File Services**.
2. From the right File List box, select the download method by clicking on the Drive — FTP button.
 - If using [FTP](#), click on that button, then enter the IP Address of the device that will send the file to the NIC unit (unless you are using the Remote Control Software; then enter the test set address). If this device is secured with a User

ID and Password, then enter this information. Enter an FTP session on the connecting device.

- If using an external memory device, plug the card or device into the appropriate slot. After a few seconds the system will recognize the device and update the drive selection window. New drive letters will appear in the File List box. Note that it is possible to have multiple external devices connected to the NIC at the same time. From one of the drives in the File List box, select the directory containing the file to transfer. Note that it is usually best to plug in the storage media before clicking the File Services button.
3. From the left File List box, select the destination directory.
 4. From the right File List box, select the desired file to be transferred.
 5. Select the download button.  The file will be transferred to the NIC unit.

 **Warning:** When the unit is powered off, the root FTP directory is automatically purged. However, files contained in sub-directories of the FTP directory (such as APPL) will not be deleted.

Renaming Files

1. From the **System** tab, select **Files Services**.
2. Select a file from the File List box.
3. Select **Rename**. A keyboard appears. Enter the new file name with extension.

 *Do not use spaces in file names*

• .aps - APS Report	• .rep - Graph Report, BERT Analysis, RFC Thru Put Analysis
• .evt - Event Report	• .set - Settings Report
• .perf - Performance Report	• .stat - Results Report
• .real - Real-time Test Report (Stored in [APP] folder on NIC unit.)	• .bmp - Print Screen image

- **.grp** - Graph (This is not a text file. It can only be viewed as a graph by selecting **Results**, pointing to **Graph** and choosing the **Replay Graphs** button.)

4. Select **Enter** from the keyboard. The file is renamed.



The extensions above are default file extensions. You are able change these to .txt (text) files using the **Rename** function.

Deleting Files

1. From the **System** tab, select **File Services**.
2. Select a file or multiple files from the File List box.



Note: Selecting multiple files does not cause previous files to be unselected. To un-select a previously selected file, you must click it a second time.

3. Select **Delete**. A confirmation message appears.
4. Select **Yes**. The file is deleted.



If you do not have authorization to delete files, the **Access Denied** message appears.

Deleting Directories



The APPL directories can not and should not be deleted.

1. From the **System** tab, select **File Services**.
2. Select a directories from the File List box. Directory names are shown between left and right brackets
3. Double-click the directory and delete all of the directory's contents.



A directory can not be deleted if it is not empty

4. Select **Delete**. A confirmation message appears.
5. Select **Yes**. The file is deleted.

 If you do not have authorization to delete directories , the **Access Denied** message appears.

 Double-clicking on directories whose name are shown as just two dots [. .] will move you up one level in the directory tree structure.

Creating a New Directory

1. From the System tab, select **File Services**.
2. Select **New Dir**. A keypad appears.
3. Enter a directory name and select **Enter**. The new directory appears at the bottom of the File List box.

 *Do not use spaces in directory names*

FTP Files

File Transfer Protocol can be used to copy files to and from the unit.

- If using the Remote Control Application or DLI Software Upgrade program, make sure that [FTP service](#) is enabled.
- To upload files using FTP, select [Upload Files](#)
- To download files using FTP, select [Download Files](#).

Security Screen

Security Settings Screen

Security is an administrative function and only appears if you are logged on as an Administrator. This screen is divided into the following main sections: User Security Information, System Services, NT/FTP Administrator, and Reset System.

 **Important:** The Security option is not available unless you have Admin privileges.

User Security Information

This function allows you to view the following security information on system users:

- **User Name**
- **Permissions:** [Admin](#), [Calibrate](#), [Read/Write](#), or [Read Only](#)
- **Active:** Displays “Yes” for user’s currently logged in to the test set.
- **Current:** Displays permissions of active users.
- **[Default User](#):** This column only appears on the local GUI and is linked directly to the “User Login Required” setting on the System Misc screen. When User Login Required is not selected the default user appears in the Login dialog box.



Default User only appears on the NIC touch screen.

The Security function also enables a user with administrator privileges to perform the following tasks:

- [Add a User](#)
- [Delete a User](#)
- [Update a User Profile](#)
- [Enable/Disable Security System Lock](#)
- [Establish a Default Login](#)
- [Establish a Required Login](#)



Selecting the [Security System Lock](#) check box prevents other users from logging onto the test set with the Remote GUI or SCPI.

System Services

[System Services](#) allows an administrator to disable specific network services to meet their network’s security policies. To enable a system service, select its check box. To disable a system service, clear the check box.

NT/FTP Administrator

NT/FTP Administrator assigns a user ID and password so that a user can log in to a remote computer and transfer files using the file transfer protocol service.

Reset System

[Reset System](#) restores default Security settings.

Adding a New User



If the System Lock function is enabled, only one user with Read and Write permissions (this includes Calibration and Admin users) can be logged in at a time. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read permissions only.

1. From the **System** tab, select **Security**.
2. From the **User Name** column, select **NEW USER**.
3. From **Account Information**, select , next to the **User Name** field. A keypad appears.
4. Enter the **user name**.  **Important: User name must between 5 and 18 characters long, and can not contain and spaces.**
5. Select , next to the **Password** field. A keypad appears.
6. Enter a **password**.  **Important: Password must between 4 and 8 characters long, and can not contain and spaces.**
7. Select , next to the **Permission** field. The Select User Permissions window appears.
8. Select one of the following user permissions:
 - **Admin:** Allows the user to perform network administrator tasks such as calibrating, adding, deleting, and updating user profiles.
 - **Calibrate:** Allows the user read and write privileges and the ability to perform calibration procedures on the unit.
 - **Read/Write:** Allows the user to read and update information.
 - **Read:** Allows the user read-only privileges.
9. Select **Update**. The new user profile is added and appears on the User List.

Deleting a User



If the System Lock function is enabled, only one user with Read and Write permissions (this includes Calibration and Admin users) can be logged in at a time. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read permissions only.

1. From the **System** tab, select **Security**.
2. From the User List, select the **User Name** to be deleted.

3. With the user name highlighted, select **Delete**. The user is removed from the User List.

Updating a User Profile



If the System Lock function is enabled, only one user with Read and Write permissions (this includes Calibration and Admin users) can be logged in at a time. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read permissions only.

1. From the **System** tab, select **Security**.
2. From the User Name list box, select the user profile to be updated. The user name, password, and permission appears in the Account Information box.
3. Select , next to the field to be updated.
 - If *Password* was selected, a keypad appears, allowing you to modify the current information. Press **Enter** when you are done.
 - If *Permissions* was selected, the Select User Permissions window appears. Select the updated permissions that you wish to apply.
4. When you are done updating the user's profile, select **Update**. The updated information appears on the User List.

Enabling/Disabling Security System Lock

This function allows an administrator to enable a Security System Lock that only allows one user with Read and Write permissions (this includes Calibration and Admin users) to be logged in at a time. If a user with Read and Write permissions is already logged in, a window will appear giving you the option of logging in with Read Only permissions only. When the user logs on with Read Only permissions, all functionality will be disabled with the exception of the online help and the [About this product](#) function.

To enable Security System Lock:

1. From the **System** tab, select **Security**.
2. From **Default Entry**, select the **Security System Lock** check box. A checked box indicates that the Security System Lock function is enabled.

To disable Security System Lock:

1. From the **System** tab, select **Security**.
2. From **Default Entry**, clear the **Security System Lock** check box. A cleared check box indicates that the Security System Lock function is disabled.

Establishing a Default User Login

This function allows an administrator to establish a default login, which results in users not having to enter a user ID and password each time they use the unit.

 **Important:** The default login function is only applicable for the NIC unit. When connecting to a NIC via the Remote NIC application, a user ID and password are required. Establishing a default login user can only be done from the NIC touch screen.

To establish a default login user:

1. From the **System** tab, select **Security**.
2. From the User Name list box, select the **User Name** that you wish to make the default upon login.
3. Select **Set as Default**. Under the Default User column, a "Yes" appears, indicating that the user has been established as default user.



The Set as Default button is only available from the NIC touch screen.

To disable a default login:

1. From the **System** tab, select **Misc**.
2. From **Local Settings**, clear the **User Login Required** check box. A cleared check box, indicates that User Login Required is disabled.



The User Login Required check box is only available from the NIC touch screen.

3. [Reboot](#) the unit for changes to take affect. When the unit restarts, a login box appears.

If you do not wish to reset a Default Login user, there is no need to continue to the next step.

4. If you wish to set another default user, log in as an Admin user and repeat the steps above under, *To establish a default login*.

Establishing User Login Parameters

This function allows an administrator to establish the user login parameters. The login parameters allow for the following:

- A [default login](#), which means when the test set is booted up a default user name already appears in the User Name of the login dialog box. However, the user must enter a password.
- A [required login](#), which means when the test set is booted up the user is required to enter a user name and password.

 Important: The login function is only applicable for the NIC unit. When connecting to a NIC via the Remote NIC application, the NIC IP Address, User ID, and Password are required.

System Services

The following system services can be enabled or disabled by an Administrator.



A unit [reboot](#) is required if any changes are made to system services.

To enable or disable a system service:

1. From the **System** tab, select **Security**.
2. From **System Services**, enable the following services by selecting the check box, or disable the service by clearing the check box.
 - **Telnet.** The Telnet service allows a user to log in to a remote system. Disabling this function can prevent unauthorized users from using the unit to access a customer's network.
 - **File Transfer Protocol.** The FTP service allows a user to remotely log in to the unit and transfer files. Disabling this function can prevent unauthorized access to ports 20 and 21.



FTP service must be enabled if you use the Remote GUI Application or the DLI Software Upgrade software. You can not connect to the unit using these applications if FTP service is disabled.

- **SCPI.** The SCPI (Standard Commands for Programmable Instruments) service uses port **8090** to send and receive SCPI commands to the unit. Disabling this function will prevent access to the port.
- **VNC.** Enables or Disables the [VNC Server](#) from allowing remote desktop connections. (unchecked by default)

- **VNC Config.** Allows the user to configure the VNC Server Properties.

2.

Resetting the System

This Administrator function clears and restores default settings to the following:

- [User Accounts](#) - Deletes all user accounts and restores the default Admin account.
- [FTP Administrator](#) - Deletes the FTP account and restores the default FTP user ID and password.
- [System Services](#) - Restores all default system service settings.



User files, such as the protocol processor's transmit and receive settings, report statistics, graphs, and test results, are not deleted. These files are managed using [File Services](#).

To reset the system:

1. From the **System** tab, select **Security**.
2. Select **Reset System**.
3. A message asking to confirm that you want to reset the system appears. Select **Yes**.
4. A message stating that the system must be restarted for changes to take affect appears. Select **OK**.
5. [Reboot](#) the system.

User Preference Screen

User Preference

Allows you to customize various preferences, such as how to label function tabs, how often to refresh status rates, and how to assign sounds to alarm events. The following functions appear on the User Preference screen:

- **PP Label Information:** You can assign a specific name (up to 20 characters in length) to each protocol processor function tab. When a protocol processor tab

is selected, the name appears in the PP Name/Go To area of the screen. For example:



Refer to [Changing a Tab Name for the Go To Label](#) for more information.

- **Current Printer:** When printing a report or a saved file to a network printer, you can disable or enable the Windows Print dialog.
 - If **No Prompt Use** is selected, then you will be initially prompted to configure a default printer so future printed reports are sent to your default printer without any further user intervention.
 - If **Prompt Each Time** is selected, you can choose a printer for each report printed, using the Print dialog.
 - The following list of **USB Printer Drivers** are pre-installed on NIC unit with the **System Controller 3** modules (3 USB ports).
- **Startup Locking State:** Determines if a test set is automatically locked (see Lock Icon) when the unit is started.
- **[Alarm Beeper Status](#):** Associates a WAV file sound with an alarm event. When using the unit's touch screen, a total of 10 sounds are available. When using the remote GUI, up to a total of 16 sounds can be used. This includes [customized WAV files](#) that you provide by copying your own WAV files into the Remote NIC directory.
- **[Email Alert Notification](#):** Allows the NIC to be configured for sending automatic Email Alerts based on user specified Error/Alarm occurrences.

Changing the Tab Name for Protocol Processors

1. From the **System** tab, select **User Preference**.
2. Under **Label Preferences**, select **Local** or **Global**.
 - **Local** – Only changes the tab label for your session. Other users will not see the tab name that you enter.
 - **Global** – Changes the tab label on the unit so that all users see the same tab name that you enter.
3. Select a tab name from the **Assigned Name** column of the list box.

4. Under **PP Label Information**, enter a name in the **Assigned Name** text field. (When using the touch screen, select  to open a keypad.)
5. Select **Update List Entry**, to add the name to the User Defined Name column of the list box.
6. Repeat steps 3 through 5 to continue adding user-defined names, as desired.
7. Select **Save All List Entries**.
 - User defined names instantly replaces the default tab names
 - User defined names also appear in the PP Name/Go To area of the screen, when the tab is selected
 - User defined names also appear in the Go To menu, located in the top-left corner of the touch screen
 - User defined names also appear in the Subject line of all [Email Alerts](#) pertaining to the specific protocol processor



To restore the default tab names, select [Restoring Default Tab Names](#)

Restoring Default Tab Names for the Go To Label

1. From the **System** tab, select **User Preferences**.
2. Under Label Preferences, select **Default**.
3. Select **Save All List Entries**. The default tab names are restored.

To change tab names, select [Changing a Tab Name for the Go To Label](#).

Setting the Alarm Beeper Status

This function associates a WAV file sound with an alarm event. When using the unit's touch screen, a total of 10 sounds are available. When using the remote GUI, up to a total of 16 sounds can be used. This includes customized WAV files that can be added by copying the new file to the Remote Control's installation directory on your PC.

To assign an audible notification to an alarm:

1. From the **System** tab, select **User Preference**.
2. Select **Alarm Beeper Status**.

3. Select **On** or **Maintenance**. The Alarm Beep Definition dialog box appears.
4. Select an alarm type to display the Select Alarms Sound dialog box.
5. Select a sound. The sound selection uses the WAV file's name. For example, chord.wav appears as CHORD.
6. If desired, select **Test** to hear the sound.
7. Select **Apply**.

To turn off all alarm sounds:

1. Select **Alarm Beeper Status**.
2. Select **Off**.

To add new WAV files to the Remote NIC on your PC:

1. Make sure that your Remote NIC application is closed.
2. Place a copy of the WAV file into the Compat folder that you are running the Remote NIC from.

To locate the Compat folder:

- a. Open the Remote NIC (**GalaxyNIC**) directory. For example, the default directory is C:\Program Files\GalaxyNIC.
- b. Locate the **Compat** folder from which the Remote NIC is running. The folder name represents the Feature Set operating on the NIC unit. For example, the Compat folder for Feature Set 5.3.53 appears in the GalaxyNIC directory as **lCompat500030053**.



There can be more than one Compat folder in the GalaxyNIC directory. To determine the correct folder, check the Feature Set version operating on the NIC test set that you want to add the WAV file to by selecting its **System** tab, choosing **Misc**, and pointing to **About this product**. The **Feature Set** version is located near the top of the **About NIC** dialog box.

3. After the WAV file has been added to the appropriate Compat folder, open the Remote NIC application.
4. From the **System** tab, select **User Preference**.
5. Select **Alarm Beeper Status**.
6. Select **On** or **Maintenance**. The Alarm Beep Definition dialog box appears.

7. Select an alarm type to display the Select All Alarms Sound dialog box. The new WAV files appear in the dialog box. Only the first 16 sounds will appear in the selection window. The sound files that appear use the WAV file's name.
8. Select the new WAV file and choose **Apply**.

Sending Email Alerts

Before using the email alert feature, check with your Network Administrator to verify that your email account is set up to accept and forward SMTP mail.

 **Important:** After the Email Alerts settings are completed, email notifications will only be sent if the GUI is actively viewing either the All Tests Status window or the protocol processor tab for which the Mail Notify setting has been configured. Email alert messages will not be generated if these conditions are not met.

To set up email alerts:

1. Ensure the NIC unit is connected via an **Ethernet cable to your network**; and it is properly configured with a valid IP Address, Subnet Mask, and Router if necessary.
2. From the **System** tab, select **User Preference**, and configure the following **Mail Notification** settings.
3. Select the **Mail From**, and enter the "From" name as it should appear in the email, and press **Enter**.
 - The default setting is the last four digits of the unit's serial number
 - Important: Some email servers may require the "**@yourdomainname.com**" extension to be added to this setting, in order for the email to be sent
4. Select the **Mail Server**, and enter the email server address and press **Enter**.
 - For example, ms1 or mail.yourdomainname.com, etc. (Your I/T administrator should be able to provide this information)
5. Select the **Mail To**, and enter the recipient's email address, and press **Enter**.

- Multiple recipient email addresses can be entered by separating each of them with just a comma (do not use a semi-colon)
 - This entry is limited to a total of 65 characters. However, multiple Remote GUI's can be connected to one unit, and each used to send emails to different recipients. Also, you can set up group emails with your email system where one address delivers the message to several recipients
6. Select the **Mail Interval**, and pick a desired time setting from the **Duration of Test** window.
- This option determines the minimum amount of time required to elapse between email notifications
 - The first email notification will be generated the instant that any of the selected errors/alarms occur, regardless of what the Mail Interval setting is set to. The **Mail Interval** setting then determines how long the system waits until it re-checks that processor's errors/alarms again
 - If the processor is still receiving the selected error/alarm (or any other errors/alarms if ALL is specified) after the Mail Interval time has elapsed, then the system will generate a follow-up email, and continue to repeat in this manner for as long as the error/alarm condition(s) are being received
 - If the processor is no longer receiving the selected error/alarm after the Mail Interval time elapses, then the system will not generate another email, but rather wait until the next error/alarm occurrence. As before, the system will then wait for the Mail Interval time to elapse before re-checking the processor again
 - If more than one processor receives their specified errors/alarms at different times, then they will each independently generate an email when their respective event occurs, and they will each independently wait for the specified Mail Interval time to elapse before checking their errors/alarms again
 - If at any time the processor being monitored is **restarted**, causing the Elapsed Time to revert back to 000:00:00:00, then an email notification will be generated at the next onset of the specified error/alarm type, at which point the processor once again begins to wait for the specified Time Interval to elapse before it re-checks for errors/alarms again
7. **Conditional:** Select **Mail User**, and enter a valid network User ID. Select **Mail Password** enter the Password for the specified network User ID.

- The **Mail User** and **Mail Password** settings may or may not be required, depending on the network's configuration and security settings
 - Only enter this information if Email Alerts are not being sent without it
 - **Note:** The **Mail Password** is not saved, displayed, shared, transmitted to anyone, or accessible by anyone in any way
 - **Important:** The **Mail Password** setting DOES NOT persist after the unit has been rebooted
8. From the **Processor / Mail Notify** list box, select the protocol processor for which you want to set up Email Alerts. The **Select Error/Alarm Mail Notification** window appears. Select the desired **error/alarm** type to monitor, or select **All** to monitor all of the errors and alarms listed for that processor.
- When **None** is selected, then Email Alerts will not be generated from that processor, regardless to the error/alarm condition of the processor
 - Some processors have more selections than the window can display at one time. In this case, the last option will be **More**. Select **More** to see the next sheet of error/alarm types to choose from
 - You can configure additional protocol processors for Email Alerts by selecting another processor, after choosing the desired error/alarm type for this processor
 - When monitoring multiple processors, each processor can be configured for its own error/alarm type, or select **All** to monitor all errors and alarms listed for each
 - **Important:** The **Processor / Mail Notify settings** DO NOT persist after the unit has been rebooted
9. After you have finished configuring the Email Alerts, the GUI must actively be monitoring the specified protocol processor(s) for which the Email Alerts have been configured, at all times.
- **Important:** If the GUI is not monitoring the selected processor(s) at the time a specified event occurs, an email will not be generated
 - For reliable email generation when multiple processors have been configured to be monitored, you must select the **All Tests Status** window located under the System tab. The All Test Status window is capable of monitoring all processors at the same time, allowing emails to be

generated for any configured processor if a specified error or alarm event occurs

- If you have configured to monitor a single processor, then you may select either the **All Tests Status** window, or any window under that processor's tab
- **Note:** A Remote GUI connection could be used for the sole purpose of Email Alerts, to free up the local GUI (or other remote GUI's) for other protocol testing purposes

 **Important:** To activate the email notification function for multiple protocols you must select the **All Tests Status** screen after the configurations are completed.

To terminate email alerts:

1. From the **System** tab, select **User Preference**. The User Preference screen appears.
2. Select the **Mail Interval** button. The **Select Duration of Test** dialog box appears.
3. Select **OFF**.
4. In the **Processor/Mail Notify** list box, select the protocol processor for which you want to terminate the Email Alerts for and choose **None** from the **Select Error/Alarm Mail Notification** window.

Testing/Troubleshooting Email Alerts (optional):

It is strongly suggested to test Email Alerts configurations prior to leaving the unit unattended of an important long-term test.

1. From the User Preference window, configure all of the Email Alert settings as describe in the sections above, customized for your specific test needs with two exceptions.
 - i. Choose either **ALL** or **LOS** from the **Select Error/Alarm Mail Notification** window for the specified processor

- ii. Enter 1 minute for the Mail Interval Time. This way, after the test email is sent, the processor only has to wait one minute before it is ready to send the next email
2. Select the configured Protocol Processor tab, and momentarily unplug the receive Fiber Optic or Electrical Interface cable, causing a brief LOS situation to occur.
3. Check the designated email inbox, and verify that the email notification was received.
 3.
 - If the email alert does not appear in the Inbox, then be sure to check any anti-spam mail folders before adjusting the Email Alerts settings
 - If a spam filter did not perceive the Email Alert to be junk-mail, then some adjustments to the Email Alerts' settings may need to be made
 - If the Mail Interval, Mail To and Mail Server settings all look correct, then add the "**@yourdomainname.com**" extension to the **Mail From** setting, or enter a valid **Mail User ID** and **Mail Password**, and try the test again
 4. If the test mail is received, then this completes the Email Alerts notification test.
 - Reconfigure the **Processor / Mail Notify** setting for the desired error/alarm type
 - Reconfigure the **Mail Interval** to the desired duration for the actual test
 - Remember to leave the GUI parked on the configured Protocol Processor tab, or the All Test Status screen

Displaying All Test Status

The NIC can operate multiple tests simultaneously. Each Protocol Processor has a panel of Error, Alarm and Status LED Indicators to display the status and history of the current test. The All Test Status screen allows the user to observe, at a glance, the status of all simultaneous tests.

To view All Test Status, select the  button from any protocol processor or select  under the System Tab.

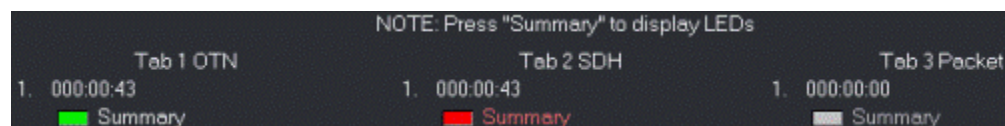
 When in this All Test Status mode, each circuit pack is polled. You may notice a slight delay in status reporting based on your unit's configuration.

The All Test Status screen is a general summary screen for up a maximum of 12 protocol processor tabs at one time. If the unit contains more than 12 circuit packs (protocol processor tabs), the protocol processor tabs appear in groups of 12. Select the All Test button (**All Test (1 to 12)**) to scroll through the various groups.

The following information appears for each protocol processor or individual port number:

1. Protocol Processor tab name
2. Elapsed time (in minutes)
3. Summary LED (See [Conditional LED](#) options below)
 - A **Red** Summary LED indicates that at least one "Conditional" LED is currently Red in the LED Status Indicator section of the Protocol Processor
 - A **Green** Summary LED indicates that at least one "Conditional" LED is currently Green, and none of the "conditional" LEDs are currently Red, in the LED Status Indicator section of the Protocol Processor
 - A **White** Summary LED indicates either none of the "Conditional" LEDs are currently Green or Red in the LED Status Indicator section, or status LEDs are selected (checked) to be "Conditional"
 - A **Gray** Summary LED indicates that the Protocol Processor tab is currently disabled
 - The color of the word "**Summary**" indicates history. White text indicates that no alarm or error has been detected during the current test. Red text indicates that at least one "conditional" LED is or was Red during the test in progress

Below is an example of the All Test Status screen:



Expanded Alarm and Status Indicators

In order to display all Error, Alarm and Status Indicator LEDs for any one Protocol Processors, select “Summary” to expand the list of Status Indicator LEDs for the Protocol Processor. You will then see a pop-up window containing all Status LEDs for that Protocol Processor or Port number. Press “OK” to close the window.

Tab 2 SDH - Leds

☒ ■ RS	☒ ■ PAT SYNC
☐ LOS	☒ ■ BIT ERR
☐ OOF	☒ ■ SS MisMatch
☐ LOF	☐ Test Paused
☐ B1	
☒ ■ MS	☐ MS-REI
☒ ■ MS-AIS	☐ APS
☐ MS-RDI	☐ ■ B2
☒ ■ HP	
☐ AU-AIS	☐ HP-RDI
☐ AU-LOP	☐ HP-REI
☐ AU-PTR	☐ ■ B3
☐ HP-UNEQ	

OK

Conditional LED Option

In the expanded Status Indicator LED pop-up window, there are a series of check boxes. When selected (checked), the specified LEDs are considered "Conditional", and will be used to trigger the Summary LED as either Green or Red depending on the current status of the Conditional LEDs. Regardless of number Conditional LEDs that are currently Green, if any of the Conditional LEDs turn Red, then the Summary LED and the word Summary will turn Red.

By default, all of the Status LEDs are selected, and considered to be Conditional. However, this feature allows the user to only monitor specific Errors or Alarms or specific sections of Errors and Alarms for each Protocol Processor in the All Test Status window by un-selecting certain LEDs. If a check box is unselected (unchecked), those Errors and Alarms will be ignored when displaying the Summary LED on All Test Status screen. Thus causing the Summary LED to not turn Red when any non-selected Status LEDs in the LED Status Indicator section do turn Red.

Multi-Page Display

NIC unit configured to Packet testing on more than one port or tab can operate multiple Ethernet tests simultaneously. The All Ether (Ethernet) Ports screen allows the user to observe, at a glance, results and statistics of all simultaneous tests.

To view the All Ether Ports screen, select  under the System Tab.

The All Ether Ports display operates similar to a spreadsheet. The user can re-size and re-order the rows and columns easily. There are over 30 columns of information so not

all can be shown simultaneously. Use the scroll bar at the bottom to scroll to the additional rows.

Re-Order Rows

Click on any row in the left-most column, "Port". A pop-up window will allow the user to supply a new position for that row.

Reset Rows to Default

Click on  to restore the sequence of rows to default.

Order Columns

Select  to re-order columns. A pop-up window will appear. Select the column or columns to move to the front (left).

Global Stop (All Tests)

Selecting the **Stop** button will stop all tests on all of the listed ports, that are locked by the GUI. Essentially, this is the equivalent of selecting the "Stop" button on each of the ports at the same time.

Global Restart (All Tests)

Selecting the **Restart** button will reset the counters and restart all of the listed ports, that are locked by the GUI. Essentially, this is the equivalent of selecting the "Restart " button on each of the ports at the same time.

 **IMPORTANT:** The **Stop** and **Restart** buttons only control those ports that the user has locked on all Ethernet processors. If a port is unlocked or was locked by someone else, it will not be affected.

Service Disruption

This functionality allows the NIC unit to measure service disruption intervals in your network.

The unit can be configured to monitor for a specific event that will cause a service disruption. When the service disruption event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

This function also allows you to set a specific event as a trigger for service disruption activity.

The SDH/SONET/OTN service disruption measurement has an accuracy of 1 μ s (microsecond). GigE service disruption tests show an accuracy of 0.1 ms (millisecond).

Monitoring SCPI Commands

The Monitor screen is a command window that allows you to view SCPI commands issued to the unit, command responses (for valid commands entered), and the error code (if an invalid command is entered).

To use the Monitor feature, the communications port must be configured. [Ethernet](#) and [GPIB](#) ports are always enabled for SCPI commands.

To open the monitor:

1. From the **System** tab, select **Monitor**.
2. Choose **Reverse** if you wish reverse the order in which commands appear.
 - By default, commands are listed such that the latest command will always be display at the top of the window, whereas the previous commands are pushed down. Thus you do not have to scroll down to see the commands as they occur.
3. Choose **Pause** if you wish to freeze the Monitor and prevent new commands from being displayed as they arrive, to give you time to review the commands that already appear in the list.
 - This does not pause the SCPI server from excepting new commands as they arrive, nor does it pause the processors from carrying out the commands
 - Choose **Resume** to continue to display new commands as they arrive
4. Choose **Clear** to delete the list of SCPI commands currently displayed.
5. The **Select Command Processor** currently only supports **SCPI** commands.

To issue SCPI commands to the unit:

- Refer to the *SCPI Command Reference Guide* for procedures. The guide can be found in the Technical Documentation Library at www.lightwave.com/service.YOU.

Chatting

Use the Chat function to send brief messages to other networked units.

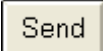
To send a message:

1. From the **System** tab, select **Chat**.
2. Enter your message in the **Input Message** box.
 - Select  if using the touch screen on a portable unit. A keypad appears allowing you to enter the message. Select **Enter** when done. The message appears in the Input Message window.
 - Remote GUI users can place their mouse cursor in the Input Message box and type the message using their computer's keyboard.

 If **Multi Lines** is unchecked, then pressing the **Enter** key will send the chat message.

 If **Multi Lines** is checked, then pressing the **Enter** key does not send the chat message. Instead, the Enter key implements a Carriage Return and moves the cursor to the beginning of the next line, to allow for longer messages.

 If **Multi Lines** is checked, the **Send** button must be clicked to send multi-line chat messages.

3. The  button will send the chat message to the NIC's local GUI as well as all remote GUI's connected to same NIC unit.
4. The  button located next to the Input Message box will remove all lines of text that have been typed but not sent yet.
5. There are three **Message Types** to choose from that will assign the chat message's priority level:
 1. **High Priority** - The chat message will appear in a High Priority Message pop-up window in front of the other GUI connections, regardless of which tab the other GUI's are currently viewing. The other GUI users will need to click an OK button to close the message.

2. **Reply Required** - The chat message will appear in a Chat Reply pop-up window in front of the other GUI connections, regardless of which tab the other GUI's are currently viewing. This requires the other GUI users to send a Reply Message in response to the chat message received. The response is sent as a Low Priority chat message.
3. **Low Priority** - A Low Priority (default) chat message is sent when neither the **High Priority** nor the **Reply Required** options are selected. When a Low Priority chat message is received by the other GUI's, a "User Chat Message has been received" message will be displayed for a short period of time in the lower left corner of the GUI. The other GUI users can then go to the Chat function on their System tabs to read or reply to the chat message received, when convenient to do so.
5. The **Clear After Send** option clears the Input Message box after the chat message is sent. Otherwise the text entered will remain in the Input Message box, even after the chat message is sent.
6. The **Received Messages** box shows all chat messages sent to and received by other GUI connections. The sender's [user name] will appear to the left of the sent/received chat messages.

 If all users are logged in to their respective GUI applications with the same user name (such as Admin), then all chat messages sent and received will show the same [user name].

8. The **Clear** button located next Received Messages box will permanently remove all sent and received chat messages from the current GUI's Chat window. This does not effect other GUI users. Chat messages in the Received Messages box are also permanently remove when the current GUI application is closed.

Faults

The unit maintains a fault log of critical hardware problems reported by circuit packs.



If a circuit pack is out of service, the  icon appears.

To view system faults:

1. Select **System**.
2. Select **Faults**. If a fault has been logged, the following appears in the Fault Messages window:
 - Date and time that the fault occurred.

- Fault description
- Card – The circuit pack that is reporting the problem.

To clear the system fault log:

- Select **Clear**.

ATM Tab

Asynchronous Transfer Mode (ATM) Overview

ATM is a multiplexing/switching technique in which information is organized into fixed-length cells with each cell consisting of an identification header field and an information field. The transfer mode is asynchronous in the sense that the use of the cells depends on the required or instantaneous bit rate.

This ATM section is divided into three areas:

- [ATM Screen Functions and Descriptions](#)
- [ATM Specific Tasks](#)
- [ATM Technical Specifications](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Functions and Descriptions

ATM Screen Functions and Descriptions Overview

The following function screens are available through the ATM protocol processor tab:

- [Config](#)
- [VCC Table](#)
- [Functions](#)
- [Results](#)
- [LEDs](#)

Config

Configuration (Config) Screens and Functions

The Config function provides access to functions that configure the system. The following options are available:

- [SET](#)

The options below only appear when [ATM Interface](#) is not set to NNI:

- [SVC](#)
- [TMR](#)

The options below only appear when [ATM Interface](#) is not set to NNI, [ATM Mapping](#) is configured, and [Signalling](#) is enabled:

- [SIG FTRS](#)
- [LOAD TEST](#)

Config - Settings (SET)

The SET button allows you to configure the system for a specific type of ATM interface (UNI or NNI). You can also set the unit of measure for the ATM interface (which defaults to a percentage of bandwidth), define how you numerically enter values for the VPI and VCI (these values default to Hex representation), and enable signalling.

The following options are available:

Option	Description
ATM Interface	Configures the system for User-to-Network Interface (UNI) or Network Node Interface (NNI) mode. Set this command based on the type of connection used by your ATM equipment. The following options are available for this command. • User-UNI3.0: User Network Interface version 3.0. If UNI is selected, then the Header Field uses a 4-bit GFC and an 8-bit VPI. • User-UNI3.1: User Network Interface version 3.1. If UNI is selected, then the Header Field uses a 4-bit GFC and an 8-bit VPI. • User-UNI4.0: User Network Interface version 4.0. If UNI is selected, then the Header Field uses a 4-bit GFC and an 8-bit VPI. • NNI: Network Node Interface. If NNI is selected, then the Header Field uses a 12-bit VPI and no GFC.

ATM Mapping	Physically maps ATM to one of the following interfaces (some mappings will only appear if you are currently running in that protocol processor mode): For SDH: None, STM-0 C11 ATM, STM-0 C12 ATM, STM-0 C2 ATM, STM-0 C3 ATM, STM-1 C11 ATM, STM-1 C12 ATM, STM-1 C2 ATM, STM-1 C3 ATM, STM-1 C4 ATM, STM-0e C11 ATM, STM-0e C12 ATM, STM-0e C2 ATM, STM-0e C3 ATM, STM-1e C11 ATM, STM-1e C2 ATM, STM-1e C3 ATM, STM-1e C4 ATM, STM-1e C11 ATM, STM-4 C11 ATM, STM-4 C12 ATM, STM-4 C2 ATM, STM-4 C3 ATM, STM-4 C4 ATM, STM-4 C4-4c ATM For SONET: OC-1 VT1.5 ATM, OC-1 VT2 ATM, OC-1 VT6 ATM, OC-1 Full SPE ATM, OC-3 VT1.5 ATM, OC-3 VT2 ATM, OC-3 VT6 ATM, OC-3 Full SPE ATM, OC-3 STS-3c ATM, STS-1 VT1.5 ATM, STS-1 VT2 ATM, STS-1 VT6 ATM, STS-1 Full SPE ATM, STS-3 VT2 ATM, STS-3 VT6 ATM, STS-3 Full SPE ATM, STS-3 STS-3c ATM, OC-12 VT1.5 ATM, OC-12 VT2 ATM, OC-12 VT6 ATM, OC-12 Full SPE ATM, OC-12 STS-3c ATM, OC-12 STS-12c ATM For PDH: None, E1 #1 ATM Direct, E1 # 1 ATM PLCP, E1 #2 ATM Direct, E1 #2 ATM PLCP, E3 ATM Direct (G.751), E3 ATM PLCP For DS1/DS3: DS1 #1 ATM Direct, DS1 #1 ATM PLCP, DS1 #2 ATM Direct, DS1 #2 ATM PLCP, DS3 ATM Direct, DS3 ATM PLCP, ATM STSX-1, ATM STS-3c, ATM STS-3c in STS-12, ATM STS-12c  DS1 ATM Direct: Uses HEC-based cell delineation. By using less overhead, the maximum ATM Cell throughput is 1.536 Mbps.  DS1 ATM PLCP: Physical Layer Convergence Protocol is used. ATM cells are enclosed in a frame defined by PLCP, which adds more overhead. Because of the extra overhead, the maximum ATM Cell throughput is 1.413 Mbps.

Unit of Measure	Determines how the bandwidth of the ATM interface is represented in units of measure. The following options are available for this command. % Bandwidth: The bandwidth of the ATM Interface is entered and displayed as bandwidth percentage. Mbps: The bandwidth of the ATM Interface is entered and displayed as Mbps. Kbps: The bandwidth of the ATM Interface is entered and displayed as Kbps. Cells/Second: The bandwidth of the ATM Interface is entered and displayed as cells-per-second.
VPI/VCI Numeric Representation	Determines whether the VPI (Virtual Path Identifier) and VCI (Virtual Circuit Identifier) are represented as Hexadecimal or Decimal values. This affects how the VPI and VCI values are displayed on screen and how these values are entered using the Header Field keypad. The following options are available for this command. Hex: Uses hexadecimal values for the VPI and VCI. Decimal: Uses decimal values for the VPI and VCI.
Cell Scrambling	Enables or disables ATM cell payload scrambling. The default setting is Disable. When on, ATM cell payloads are scrambled when transmitted and descrambled when received.
Loopback Response	Enabling this function allows the system to generate a loopback test to ATM equipment on the network. Note: This function is only workable if connected to another test unit.
ADTF	Allowed Cell Rate Decrease Time Factor. Sets the ACR Decrease Time Factor for ABR traffic. This is entered using a keypad, and the range is from 0.01 to 10.23 seconds.
TRM	This function allows you to set the value for upper bound on the time between forward RM (Resource Management) cells. This is entered using a keypad. The TRM value can take 100×2^n, where n can range from -7 to 0.

O.191 Cell Scrambling	Enables or disables O.191 cell scrambling. The default setting is Enable. When enabled, O.191 cells are scrambled when transmitted and descrambled when received.
Signalling	Note: For Signalling options to be active, the ATM Interface must NOT be set to NNI and ATM Mapping must be configured. Configures the system to enable or disable signalling. The following options are available for this command: Enable: Enables signalling Disable: Disables Signalling.
Signalling PCR	Note: For Signalling options to be active, the ATM Interface must NOT be set to NNI and ATM Mapping must be configured. Sets the Peak Cell Rate for the Signalling channel.
Address Plan	Note: For this option to be active, the ATM Interface must NOT be set to NNI. Sets the address of the system. Two addressing format options are available for this command: NSAP-AESA: The Network Service - Access Point ATM End System Address is set by this command. Three fields can be edited: N/W Prefix, ESI, and Selector. E.164 Native: The End system address is set by this command. N/W Prefix field can be edited

SVC

Config - SVC

The SVC function allows you to set the default SVC setup parameters QoS class, traffic parameters and called party address. The SVC screen is only available when [ATM Interface](#) is not set to NNI.

The following options are available:

- [QoS Class](#)
- [AAL Type](#)
- [CPCS SDU Size](#)
- [Traffic Type](#)
- [Peak Cell Rate](#) (PCR for CLP0, PCR for CLP0 + 1)
- [Sustained Cell Rate](#) (SCR for CLP0, SCR for CLP0 + 1)
- [Max Burst Size](#) (MBS for CLP0, MBS for CLP0 + 1)
- [Traffic Combination](#)
- [Tagging](#)
- [ABR Parameters](#)
- [Default Called Party Address](#)

Config SVC -QoS Class

Sets the QoS class. The options available for this command are 0, 1, 2, 3 and 4.

Config SVC - AAL Type

Sets the ATM Adaptation Layer (AAL) protocol for both Transmit and Receive. The AAL accomplishes a conversion from a higher level protocol into the ATM layer that is segmentation of the original and larger set of data into the size and format of an ATM cell (5 octet header and 48 octets of data or payload).

The following options are available for this command:

Option	Description
0	ATM Adaptation Layer 0 is used. AAL0 denotes an absence of any AAL function, meaning that AAL0 is not really an AAL type in the true sense of the term. AAL0 simply is the transfer of individual cells with no protocol processing of the cell payloads.
1	ATM Adaptation Layer 1 protocol is used. The ATM Cell consists of a 47-byte payload, a 1-byte sequence number, sequence number protection field and convergence ID field, and a 5 byte header.
5	ATM Adaptation Layer 5 protocol is used. AAL 5 supports variable length data packets or PDUs (1 to 65,535 octets). AAL5 utilizes a minimum of overhead for each PDU it sends. The entire payload is used for data except for the last cell in the PDU. Functionally, this larger type supports variable bit rate, delay tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support.
CPCS SDU Size	This command sets the size in bytes of a Service Data Unit of the Common Part Convergence Sublayer. SDU Size is entered using a keypad. Values can

	range from 2,048 bytes to 65,512 bytes in length. The default value is 4,800 bytes.

Config SVC - CPCS SDU Size

This command sets the size in bytes of a Service Data Unit of the Common Part Convergence Sublayer. SDU Size is entered using a keypad. Values can range from 2048 bytes to 65,512 bytes in length. The default value is 4800 bytes.

Config SVC - Traffic Type

This function selects the type of data algorithm used to buffer cells before transmitting data to the network. The following options are available for this command.

Option	Description
Rt-VBR	Real-time Variable Bit Rate. Uses a real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
Nrt-VBR	Non-Real-Time Variable Bit Rate. Uses a non-real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
CBR	Constant Bit Rate. Supports CBR traffic as a subclass of VBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during the connection life time.
UBR	Unspecified Bit Rate. Specifically, UBR does not include the notation of a per-connection negotiated bandwidth. UBR channels will attempt to equally share, but not guarantee any remaining bandwidth after all CBR or VBR channels are allocated.
ABR	Available Bit Rate. Performs dynamic traffic shaping based on feedback received from the network.

CBR with CLR	Constant Bit Rate. Supports CBR traffic as a subclass of VBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during the connection lifetime. The maximum cell loss ratio can be specified. This can be set only if the ATM Interface is User-UNI4.0
RtVBR with CLR	Real-Time Variable Bit Rate. Uses a real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). The maximum cell loss ratio can be specified. This can be set only if the ATM Interface is User-UNI4.0
NrtVBR with CLR	Non-Real-Time Variable Bit Rate. Uses a non-real-time single leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). The maximum cell loss ratio can be specified. This can be set only if the ATM Interface is User-UNI4.0

Config SVC - Max Burst Size (MBS)

This function sets the maximum number of cells that can transmit at the peak rate and still be in conformance with the Traffic Shaping algorithm. It is only available for VBR Traffic Shaping.

If the maximum burst size (MBS) is changed from a value of two, then the [Peak Cell Rate](#) defaults to 100 percent.

For VBR traffic shaping, MBS and [SCR](#) are related by the following equation:

$$SCR = MBS / (MBS + 1), \text{ where } MBS > 2$$

MBS for CLP0 sets the Max Burst Size for all cells with CLP field in the Header equal to 0.

MBS for CLP0+1 sets the Max Burst Size for all cells with CLP field in the Header equal to 0 or 1.

Config SVC - Sustained Cell Rate

This function sets the Sustained Cell Rate (SCR) for VBR traffic, and is only available only for VBR Traffic Shaping. For VBR traffic shaping, the SCR is closely related to the [Maximum Burst Size](#) (MBS).

The SCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second

These units are defined by the Units of Measure command located in the Config Set function.

SCR for CLP0 sets the Sustained Cell Rate for all cells with CLP field in the Header equal to 0.

SCR for CLP0+1 sets the Sustained Cell Rate for all cells with CLP field in the Header equal to 0 or 1.

TBE

This function allows you to set the Transient Buffer Exposure (TBE). TBE is the negotiated number of cells that the network would like to limit the source to sending during startup periods, before the first Resource Management (RM) cell returns.

TBE is set using a keypad and the range is from 0 to 16,777,215 cells.

Config SVC - Traffic Combination

This function sets the traffic combination for SVC setup. The following options are available.

Option	Description
1	PCR CLP0 and PCR CLP0+1
2	PCR CLP0, PCR CLP0+1 and Tagging = Tagging Requested

3	PCR CLP0+1, SCR CLP0 and MBS CLP0
4	PCR CLP0+1, SCR CLP0, MBS CLP0 and Tagging = Tagging Requested
5	PCR CLP0+1
6	PCR CLP0+1, SCR CLP0+1 and MBS CLP0+1

Config SVC - Tagging

The following options are available for the Tagging function:

- **Yes:** Tagging Requested
- **No:** Tagging not requested

Config SVC - ABR Parameters

This function allows you to set the default ABR parameters for SVCs. The following options are available:

- [ICR](#)
- [RIF](#)
- [RDF](#)
- [MCR](#)

ICR

This function sets the Initial Cell Rate (ICR) for ABR traffic, and is available only for ABR Traffic Shaping.

The ICR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps

- Kbps
- Cells per Second

These units are defined by the Units of Measure command located in the [Config Set](#) screen.

RIF

This function allows you to set the Rate Increase Factor and controls the amount by which the cell transmission rate may increase upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from $\frac{1}{2}^{15}$ to 1.

RIF is entered using a keypad, which allows you to enter the value of n, and the RIF is calculated as $\frac{1}{2}^n$.

RDF

This function allows you to set the Rate Decrease Factor and controls the amount by which the cell transmission rate may decrease upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from $\frac{1}{2}^{15}$ to 1.

RDF is entered using a keypad which allows you to enter the value of n and the RDF is calculated as $\frac{1}{2}^n$

MCR

This function sets the Minimum Cell Rate (MCR) for ABR traffic, and is available only for ABR Traffic Shaping.

The MCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second.

These units are defined by the Units of Measure command located in the Config Set screen

Config SVC - Default Called Party Address

Set the address of the called party. Two addressing format options are available for this command

- **NSAP-AESA:** Network Service Access Point ATM End System Address is set by this command. Three fields can be edited. N/W Prefix, ESI and Selector.
- **E.164 Native:** End system address is set by this command. N/W Prefix field can be edited.

Config - TMR

This function allows you to set the timer values. All timer values are set using keypad and the range is from 1 second to 65535 seconds. The TMR screen is only available when [ATM Interface](#) is not set to NNI.

The following timer values can be set:

Timer	Description
T301	Timer for Alert
T303	Timer for Setup
T308	Timer for Release
T309	Timer for Link Connection
T310	Timer for Call Proceeding Received
T313	Timer for Connect
T316	Timer for Restart
T317	Timer for Restart Received
T322	Timer for Status
Timer for polling Message	Timer for polling Message
Timer for Keep Alive Message	Timer for Keep Alive Message
Timer for No Response	Timer for No Response
Timer for CC	Timer for Connection Control
Timer for idle	Timer for the Idle phase

Config - Signalling Filters (SIG FTRS)

This function allows filtering of Signalling messages. The SIG FTRS screen is only available when [ATM Interface](#) is not set to NNI, [ATM Mapping](#) is configured, and [Signalling](#) is enabled.

The following options are available:

Option	Description
Signalling Filter	This function enables or disables the filtering of signalling messages. The following options are available: • Enable: Enables Signalling filter. • Disable: Disables Signalling filter.
Filter Type	This function specifies what the filtering should be based on. The following options are available: • Message Filter • Call Reference Value • Call Reference Flag • Call Reference Value and Flag • Message and Call Reference Flag • Message and Call Reference Value
Call Reference Value	This function specifies the Call Reference Value based on which filtering is to be done.
Call Reference Flag	This function specifies the Call Reference Flag value based on which filtering is to be done. The value can be either 0 or 1.

Filtering Messages	This function specifies the message to be filtered based on the filter type. One or more messages can be filtered. The following options are available: • Call Proceeding • Connect • Connect Acknowledge • Setup • Release • Release Complete • Signalling Status • Signalling Status Enquiry • Connection Restart • Restart Acknowledge • Alert
Add	Adds the message to the list of messages to be filtered.
Delete	Deletes the message from the list of messages to be filtered.

Config - Load Test

This function allows you to perform load tests. The Load Test screen is only available when [ATM Interface](#) is not set to NNI, [ATM Mapping](#) is configured, and [Signalling](#) is enabled.

The following options are available:

Option	Description

Type of Test	This function allows you to set the type of Load Test to be performed. The following options are available. Call Setup: This function allows you to setup SVC at the rate of the number of calls per second specified for the duration mentioned. After the duration expires, the SVC are cleared. Cyclic Load: This function allows you to establish and release SVC connection at the rate of the number of calls per second specified for the duration mentioned. Call Burst: This function allows you to initiate setup calls at the rate of the number of calls per second specified for the duration mentioned with calls being initiated during the Burst Period specified and no calls being initiated during the Skip Period.
Calls Per Second	This function allows you to set the maximum number of calls per second. This is set using a keypad and the range is from 1 to 20. The Calls per Second can be set only if Type of Test is one of the options above.
Burst Period	This function allows you to set the Burst period. Burst period Defines the number of contiguous seconds during which SVC establishment takes place. The following options are available. • User Defined: Entered using a keypad and the range is from 1 to 4000. • Random Burst: A random number generated.

Skip Period	This function allows you to set the Skip period. Skip period Defines the number of contiguous seconds during which no SVC are established. The following option is available: User Defined: Entered using a keypad and the range is from 1 to 256.
Duration	This function allows you to set the duration of the load test. The load test starts once the duration is set. The following options are available • Off: To stop the load test. • 1 Sec: Set the duration to 1 seconds. • 10 Sec: Set the duration to 10 seconds. • User Defined: Entered using a keypad and the range is from 1 to 65535. • Random: A random number generated.

VCC Table

VCC Table Screens and Functions

The VCC Table function provides access to functions that control the creation of VCC tables. This function allows you to view the existing VCCs. Different colours indicate different types of VCCs.

Red indicates PVC.

Blue indicates SVC set up by the analyzer.

Pink indicates SVC set up by the peer.

Through this function, you are able to access the following options:

- [VCC CNTRL](#)
- [EDIT TBL](#)
- [BKGND](#)
- [SUM](#)
- [VCC RES](#)
- [QoS RES](#)
- [O.191 RES](#)
- [QoS ANAL](#)

VCC Cntrl

VCC Table - VCC CNTRL

The VCC Control function controls the transmission and monitoring of data traffic activity for an individual virtual channel or for multiple virtual channels. When selected, this function displays the virtual channels configured in the VCC Table.

The transmit (TX) and monitor (RX) states for each virtual channel appear in the TX and RX columns of the VCC Table screen display. A maximum of 20 virtual channels can appear on this screen. Use the **Page Up** and **Page Down** buttons (double arrows) to display the previous or next 20 entries in the VCC Table, or use the **Scroll Down** and **Scroll Up** buttons (single arrows) to scroll through the VCC Table one virtual channel at a time.

The following buttons are located at the bottom of the VCC Cntrl table:

- [TX On/Off](#)
- [RX On/Off](#)
- [All TX Mode](#)
- [All RX Mode](#)
- [VCC TX Mode](#)
- [VCC RX Mode](#)

VCC Table VCC CNTRL - TX On/Off

This button starts or stops the transmission of ATM cells on all enabled virtual channels listed in the VCC Table. The transmission status for each virtual channel appears in the TX column of the VCC Table, and displays the following values.

Option	Description
<on>	Indicates that the virtual channel is idle (enabled, but not transmitting data). When this value displays, the ATM TX Alarm and Status Indicator displays OFF.
ON	Indicates that the channel is enabled and transmitting ATM cells. The ATM TX Alarm and Status indicator displays ON.
(No Value Appears)	If the TX column is blank, then the channel is disabled. Refer to the All TX Mode and VCC TX Mode button descriptions for more information.



Note: When turned ON, all Enabled channels generate traffic. When Off (<on>), these channels are idle. If you do not want a specific virtual channel to transmit data, then you must Disable that channel before generating traffic flow.

VCC Table VCC CNTRL - RX On/Off

This button starts or stops data traffic reception and monitoring on all enabled virtual channels listed in the VCC Table.

The monitor and detection status for each virtual channel appears in the RX column of the VCC Table and displays the following values.

Option	Description
<mon>	Indicates that the virtual channel is idle (enabled, but not receiving ATM Cells). When this value displays, the ATM RX Alarm and Status Indicator displays OFF.
MON	Indicates that the circuit is enabled and is receiving ATM Cells. The ATM RX Alarm and Status Indicator displays ON.
<det>	Indicates that the virtual channel is idle, and configured for Detailed Detection mode. This means that the virtual channel is monitoring for Bit, pattern sync, CRC, padding, length, SN/SNP, lost cells, mis-inserted cells errors (depending on the AAL type). A maximum of 34 channels can be detailed for AAL0, AAL1, or AAL5 (30 non-Full PDU and 4 Full PDU).
DET	Indicates that the channels are actively detecting for Bit, pattern sync, CRC, padding, length, SN/SNP, lost cells, mis-inserted cells errors (depending on the AAL type). A maximum of 34 channels can be detailed for AAL0, AAL1, or AAL5 (30 non-Full PDU and 4 Full PDU).
(No Value Appears)	If the RX column is blank, then that virtual channel is disabled. Refer to the All RX Mode button and VCC RX Mode button descriptions for more information.

VCC Table VCC CNTRL - All TX Mode

This button enables data transmission for up to 16 Transmit connections, starting from the current selection in VCC table. This button is only active when data transmission is Off (as displayed by the Tx OFF indicator in the ATM LED Alarm and Status Indicators area).

If some channels are already disabled, and you press this button, then all channels are disabled. Selecting this button again enables all channels including any previously

disabled channels. This button toggles all virtual channels between an enabled and disabled state.

The transmission status appears in the TX column and displays the following values.

Option	Description
<on>	Indicates that the virtual channel is idle (enabled, but not transmitting ATM cells). When this value displays, the ATM TX Alarm and Status Indicator displays OFF.
(No Value Appears)	If the TX column is blank, then the virtual channel is disabled.

VCC Table VCC CNTRL - All RX Mode

This button globally enables or disables data monitoring for all virtual channels listed in the VCC Table. This button is only active when data monitoring is Off (as displayed by the Rx OFF indicator in the ATM LED Alarm and Status Indicators area).

If some channels are already disabled, and you press this button, then all channels are disabled. Selecting this button again enables all channels including any previously disabled channels. This button toggles all virtual channels between an enabled and disabled state.

Option	Description
<mon>	Indicates that the virtual channel is idle (enabled, but not receiving ATM cells). When this value displays, the ATM RX Alarm and Status Indicator displays OFF.
(No Value Displays)	If the RX column is blank, then the channel is disabled.

VCC Table VCC CNTRL - VCC TX Mode

This button enables or disables ATM Cell transmission for individual virtual channels in the VCC Table. This button is only active when data transmission is Off (Tx - OFF) as

indicated in the ATM LED area. The typical button action sequence is to toggle between enable (<on>) and disable.

Option	Description
<on>	Indicates that the virtual channel is idle (enabled, but not transmitting ATM Cells). When this value displays, the ATM TX Alarm and Status Indicator displays OFF.
(No Value Displays)	If the TX column is blank, then the channel is disabled.

VCC Table VCC CNTRL - VCC RX Mode

This button enables or disables ATM Cell monitoring for individual virtual channels in the VCC Table. This button is only active when data monitoring is Off (Rx - OFF) as indicated in the ATM LED area. The typical button action sequence is to toggle between enabled (<mon> or <det>) and disabled.

Option	Description
<mon>	Indicates that the virtual channel is idle (enabled, but not receiving ATM Cells). When this value displays, the ATM RX Alarm and Status Indicator displays OFF.
<det>	Indicates that the virtual channel is idle, and configured for Detailed Detection mode. This means that the virtual channel is monitoring for Bit, pattern sync, CRC, padding, length, SN/SNP, lost cells, mis-inserted cells errors (depending on the AAL type). A maximum of 34 channels can be detailed for AAL0, AAL1, or AAL5 (30 non-Full PDU and 4 Full PDU).
(No Value Appears)	If the RX column is blank, then the channel is disabled.

Edit Tbl

VCC Table - Edit Table (EDIT TBL)

The Edit Table function allows you to modify the parameters of an existing virtual channel listed in the VCC table.

The Edit Tbl function includes the following commands:

- [Edit VCC](#)
- [Add VCC](#)
- [Turbo Add](#)
- [Delete](#)
- [Save Table](#)
- [Recall Table](#)

Edit a VCC Table

The Edit VCC button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then the button is disabled. The button changes to 'View VCC' when transmission or reception is on, which allows you to view the parameters of the VCC but not edit them.

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Choose the table to be edited from the VCC Table grid and select the **Edit VCC** button. The Edit VCC <#> dialog box appears.



You can also scroll to the table to be edited by selecting the Prev or Next buttons on the Edit VCC window.

4. When the appropriate parameters are modified, select **Save**.

Add and Edit VCC

VCC Table EDIT TBL - Edit and Add VCC Options

The **Edit VCC** button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then this button is disabled. This button changes to 'View VCC' when transmission or reception is on, which allows you to view the parameters of the VCC but not edit them.

The **Add VCC** function allows you to create or edit a new virtual channel in the VCC Table.

When [Signalling](#) is not enabled, the Add or Edit VCC function adds a PVC. When [Signalling](#) is enabled the Add or Edit function opens the Select VCC Type list box from which you can select one of the following:

- [PVC](#): This function allows you to add or edit a Permanent Virtual Channel.
- [SVC](#): This function allows you to add or edit a Switched Virtual Channel.

Add or Edit a PVC (Permanent Virtual Circuit)

The following options are available on the Add or Edit VCC screen when Signalling is disabled, or when Signalling is enabled and Add VCC - PVC is selected.

Option	Description
Header Field	The Header Field is responsible for describing the type and destination of the ATM cell. For the Edit VCC button, the Header Field command displays the header components for the current virtual channel. If you press the Header Field button, then the Header Field Entry keypad appears. After entering a Header Field, select Save to confirm your entries. GFC: Generic Flow Control. Sets the first four bits of the ATM cell header for a UNI interface. The GFC field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1. VPI: Virtual Path Identifier. This is a routing field for the network. If the connection is set for UNI, then is field is an 8 bit value. If the ATM connection is set for NNI, then this field is a 12 bit value (there is no GFC). VCI: Virtual Channel Identifier. This field, used together with the VPI, is the routing field for a cell. It is a 16 bit value. VCI values of 3, 4, 6, and 7 are reserved for F4 and Resource Management OAM cells and cannot be entered

	using the keypad. In addition, a VCI of 0 with a VPI of 0 is an idle cell and is not allowed. PTI: Payload Type Indicator. Only the last two bits, which are used for congestion indication, can be set. If the PTI is set to 0 then the value is User Data and No Congestion. If the PTI is set to 1, then the value is User Data with Congestion. The PTI field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1. CLP: Cell Loss Priority. Sets bit 32 of the cell header. CLP can be set to either 0 or 1 (binary). A 0 indicates a high-priority cell and a 1 indicates a low-priority cell. The CLP field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.
Transmit Pattern	Selects the payload pattern sent in the transmit ATM stream for an individual virtual channel. 2¹⁵-1 PRBS - Payload pattern transmitted is a random test pattern at 2¹⁵-1 length. 2¹⁵ PRBS (INV) - Payload pattern transmitted is an inverted PRBS pattern of 2¹⁵-1 length. All Zeros - Payload pattern transmitted is a continuous all-zeros pattern (000000. . .). All Ones - Payload pattern transmitted is a continuous all ones pattern (111111. . .). 1010 - Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .). Full PDU Programmable - Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length. User Defined - Define any 32 bit (four byte) pattern that is repeated 48 times to make up the ATM Cell Payload. O.191 REV-0 - O.191 Revision-0 Cell format O.191 REV-1 - O.191 Revision-1 Cell format

Receive Pattern	This function defines the payload pattern that is checked for bit errors if detailed monitoring is enabled. 2¹⁵-1 PRBS - Payload pattern received is a random test pattern at 2¹⁵-1 length. 2¹⁵ PRBS (INV) - Payload pattern received is an inverted PRBS pattern of 2¹⁵-1 length. All Zeros - Payload pattern received is a continuous all-zeros pattern (000000. . .). All Ones - Payload pattern received is a continuous all ones pattern (111111. . .). 1010 - Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .). Full PDU Programmable - Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length. The number of full PDU connections allowed is four each on the Transmit and Receive sides. User Defined - Define any four byte pattern that is repeated 12 times to make up the ATM Cell Payload. O.191 REV-0 - O.191 Revision-0 Cell format O.191 REV-1 - O.191 Revision-1 Cell format
AAL	Sets the ATM Adaptation Layer (AAL) protocol for both transmit and receive. The AAL accomplishes a conversion from a higher level protocol into the ATM layer, that is, segmentation of the original and larger set of data into the size and format of an ATM cell (5 octet header and 48 octets of data or payload). 0 - ATM Adaptation Layer 0 is used. AAL0 denotes an absence of any AAL function, meaning that AAL0 is not really an AAL type in the true sense of the term. AAL0 simply is the transfer of individual cells with no protocol processing of the cell payloads.

	1 - ATM Adaptation Layer 1 protocol is used. The ATM Cell consists of a 47 byte payload, a 1 byte sequence number, sequence number protection field and convergence ID field, and a 5 byte header. 5 - ATM Adaptation Layer 5 protocol is used. AAL 5 supports variable length data packets or PDUs (1 to 65512 octets). AAL5 utilizes a minimum of overhead for each PDU it sends. The entire payload is used for data except for the last cell in the PDU. Functionally, this larger type supports variable bit rate, delay tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support.
AAL1 CSI Byte Does not appear if AAL1 IS NOT selected.	Sets the AAL1 protocol's Convergence Sublayer Indication (CSI) bit 0 or 1. Use the buttons on the keypad to toggle between 0 and 1. Up to eight bits can be entered (value is equivalent to 255 in decimal). The default value is 0 bit.  This command is available only when using AAL1 protocol.
AAL5 PDU Length Does not appear if AAL5 IS NOT selected.	Sets the length of the AAL5 Protocol Data Unit (PDU). A PDU length is entered using a keypad. Values can range from 2048 to 65,512 bytes in length. The default value is 4800 bytes. There are PDU length limitations for CRC, LEN, and Padding errors.  This command is available only when using AAL5 protocol.
AAL5 COCS UU Octet Does not appear if AAL5 IS NOT selected.	This parameter sets the ATM Adaptation Layer 5 (AAL5) Common Part Convergence Sublayer (CPCS) User-to-User (UU) information octet. A CPCS UU length can be up to eight bits and is entered using a keypad.  This command is available only when using AAL5 protocol.

Traffic Shaping	This function selects the type of data algorithm used to buffer cells before transmitting data to the network. Rt-VBR - Real-time Variable Bit Rate. Uses a real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). Nrt-VBR - Non-real-time Variable Bit Rate. Uses a non-real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR). CBR - Constant Bit Rate. Supports CBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during the connection lifetime. The amount of bandwidth is characterized by Peak Cell Rate (PCR). UBR - Unspecified Bit Rate. If this option is selected then the Peak Cell Rate (PCR), Sustained Cell Rate (SCR), and Max Burst Size (MBS) commands are disabled. Specifically, UBR does not include the notation of a per-connection negotiated bandwidth. UBR channels will attempt to equally share, but not guarantee, any remaining bandwidth after all CBR or VBR channels are allocated.
Peak Cell Rate Does not appear if UBR Traffic Shaping IS NOT selected.	For more information see Peak Cell Rate.
Sustained Cell Rate Does not appear if UBR or CBR Traffic Shaping IS NOT selected.	This function sets the Sustained Cell Rate (SCR) for VBR traffic, and is only available only for VBR Traffic Shaping. The SCR is entered using a keypad and can be represented in the following units of measure: • Bandwidth Percentage • Mbps • Kbps • Cells per Second

	These units are defined by the Units of Measure command located in the Config Set function.
Max Burst Size Does not appear if UBR or CBR Traffic Shaping IS selected.	This function sets the maximum number of cells that can transmit at the peak rate and still be in conformance with the Traffic Shaping algorithm. It is only available for VBR Traffic Shaping. If the maximum burst size (MBS) is changed from a value of 2, then the Peak Cell Rate defaults to 100 percent.
CDVT Does not appear if UBR or CBR Traffic Shaping IS selected.	Cell Delay Variation Tolerance. Set CDVT to maximum of 1047552.
Edit ABR Parameters Appears only if Traffic Shaping is ABR.	This function allows you to set the default ABR parameters for SVCs. ICR - This function sets the Initial Cell Rate (ICR) for ABR traffic, and is available only for ABR Traffic Shaping. The ICR is entered using a keypad and can be represented in the following units of measure: • Bandwidth Percentage • Mbps • Kbps • Cells per Second These units are defined by the Units of Measure command located in the Config Set screen. RIF - This function allows you to set the Rate Increase Factor and controls the amount by which the cell transmission rate may increase upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from $\frac{1}{2}^{15}$ to 1. RIF is entered using a keypad, which allows you to enter the value of n, and the RIF is calculated as $\frac{1}{2}^n$.

	RDF - This function allows you to set the Rate Decrease Factor and controls the amount by which the cell transmission rate may decrease upon receipt of a Resource Management (RM) cell. RIF is a power of two, ranging from 2^{15} to 1. RDF is entered using a keypad which allows you to enter the value of n and the RDF is calculated as 2^n. MCR - This function sets the Minimum Cell Rate (MCR) for ABR traffic, and is available only for ABR Traffic Shaping. The MCR is entered using a keypad and can be represented in the following units of measure: • Bandwidth Percentage • Mbps • Kbps • Cells per Second These units are defined by the Units of Measure command located in the Config Set screen.
O.191 Block Size	Appears only if Receive Pattern is O.191 REV-0 or O.191 REV-1. Refer to the Cell Block Size Table, per ITU-T Rec. 0.191.
O.191 CLP Flow	Appears only if Receive Pattern is O.191 REV-0 or O.191 REV-1.

Add or Edit an SVC (Switched Virtual Channel)

This function allows you to add or edit a switched virtual channel.

The Edit VCC button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then this button is disabled. Also this button is changed to View VCC when transmission or reception is on. View VCC allows you to view the parameters of the VCC without being able to edit them.

The following options are available on the Add SVC screen:

[Header](#)

Call Reference Value: Displays the call reference value.

Default Parameters

[Transmit Pattern](#)

[Receive Pattern](#)

[Traffic Type](#)

Fwd QoS Class: Allows you to select a value from 1 to 4 to specify forward Quality of Service class.

Bwd QoS Class: Allows you to select a value from 1 to 4 to specify backward Quality of Service class.

AAL Parameters

- [AAL](#)
- [AAL1 CSI Byte](#) (Does not appear if AAL1 is not selected.)
- [AAL5 SDU Length](#) (Does not appear is AAL5 is not selected.)
- [AAL5 CPCS UU Octet](#) (Does not appear is AAL5 is not selected.)

Forward Traffic Descriptors

- [Combination](#)
- [PCR for CLP0](#)
- [PCR for CLP0+1](#)
- [Sustained Cell Rate: \(CLP0 and CLP0+1\)](#)
- [Max Burst Size \(CLP0 and CLP0+1\)](#)

Backward Traffic Descriptors

- [Combination](#)
- [PCR for CLP0](#)
- [PCR for CLP0+1](#)

Called Party Number

- [Address Plan](#)
- Address

Function Buttons

- [Optional](#) (This function appears when the ATM Interface parameter is set to UNI4.0.)
- Save
- Exit

Header Field

The Header Field is responsible for describing the type and destination of the ATM cell. For the Edit VCC button, the Header Field command displays the header components for the current virtual channel.

If you press the Header Field button, then the Header Field Entry keypad appears. You can enter values for the following items:

- **GFC:** Generic Flow Control. Sets the first four bits of the ATM cell header for a UNI interface. The GFC field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.
- **VPI:** Virtual Path Identifier. This is a routing field for the network. If the connection is set for UNI, then this field is an 8 bit value. If the ATM connection is set for NNI, then this field is a 12 bit value (there is no GFC).
- **VCI:** Virtual Channel Identifier. This field, used together with the VPI, is the routing field for a cell. It is a 16 bit value. VCI values of 3, 4, 6, and 7 are reserved for F4 and Resource Management OAM cells and cannot be entered using the keypad. In addition, a VCI of 0 with a VPI of 0 is an idle cell and is not allowed.
- **PTI:** Payload Type Indicator. Only the last two bits, which is used for congestion indication, can be set. If the PTI is set to 0 then the value is User Data and No Congestion. If the PTI is set to 1, then the value is User Data with Congestion. The PTI field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.
- **CLP:** Cell Loss Priority. Sets bit 32 of the cell header. CLP can be set to either 0 or 1 (binary). A 0 indicates a high-priority cell and a 1 indicates a low-priority cell. The CLP field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.

After entering a Header Field, select **Save** to confirm your entries.

Transmit Pattern

Selects the payload pattern sent in the transmit ATM stream for an individual virtual channel.

The following options are available for this command.

Option	Description
2 ¹⁵ -1 PRBS	Payload pattern transmitted is a random test pattern at 2 ¹⁵ -1 length.
2 ¹⁵ PRBS (INV)	Payload pattern transmitted is an inverted PRBS pattern of 2 ¹⁵ -1 length.
All Zeros	Payload pattern transmitted is a continuous all-zeros pattern (000000. . .).
All Ones	Payload pattern transmitted is a continuous all ones pattern (111111. . .).
1010	Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .).
Full PDU Programmable	Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length.
User Defined	Define any 32 bit (four byte) pattern that is repeated 48 times to make up the ATM Cell Payload.
O.191 REV-0	O.191 Revision-0 Cell format
O.191 REV-1	O.191 Revision-1 Cell format

Receive Pattern

This function defines the payload pattern that is checked for bit errors if detailed monitoring is enabled.

The following options are available for this command.

Option	Description
2 ¹⁵ -1 PRBS	Payload pattern received is a random test pattern at 2 ¹⁵ -1 length.
2 ¹⁵ PRBS (INV)	Payload pattern received is an inverted PRBS pattern of 2 ¹⁵ -1 length.
All Zeros	Payload pattern received is a continuous all-zeros pattern (000000. . .).
All Ones	Payload pattern received is a continuous all ones pattern (111111. . .).
1010	Payload pattern is a repeating pattern of alternating ones and zeros (101010. . .).
Full PDU Programmable	Full Protocol Data Unit (PDU) Programmable. A PDU length is entered using a keypad. Values can range up to 100 bytes in length. The number of full PDU connections allowed is four each on the Transmit and Receive sides.
User Defined	Define any four byte pattern that is repeated 12 times to make up the ATM Cell Payload.
O.191 REV-0	O.191 Revision-0 Cell format
O.191 REV-1	O.191 Revision-1 Cell format

AAL

AAL

Sets the ATM Adaptation Layer (AAL) protocol for both transmit and receive. The AAL accomplishes a conversion from a higher level protocol into the ATM layer, that is, segmentation of the original and larger set of data into the size and format of an ATM cell (5 octet header and 48 octets of data or payload).

The following options are available for this command.

Option	Description

AAL 0	ATM Adaptation Layer 0 is used. AAL0 denotes an absence of any AAL function, meaning that AAL0 is not really an AAL type in the true sense of the term. AAL0 simply is the transfer of individual cells with no protocol processing of the cell payloads.
AAL 1	ATM Adaptation Layer 1 protocol is used. The ATM Cell consists of a 47 byte payload, a 1 byte sequence number, sequence number protection field and convergence ID field, and a 5 byte header.
AAL 5	ATM Adaptation Layer 5 protocol is used. AAL 5 supports variable length data packets or PDUs (1 to 65512 octets). AAL5 utilizes a minimum of overhead for each PDU it sends. The entire payload is used for data except for the last cell in the PDU. Functionally, this larger type supports variable bit rate, delay tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support.

AAL1 CSI Octet

Sets the AAL1 protocol's Convergence Sublayer Indication (CSI) bit 0 or 1. Use the buttons on the keypad to toggle between 0 and 1. Up to eight bits can be entered (value is equivalent to 255 in decimal). The default value is 0 bit.



This command is available only when using AAL1 protocol.

AAL5 CPCS UU Octet

This parameter sets the ATM Adaptation Layer 5 (AAL5) Common Part Convergence Sublayer (CPCS) User-to-User (UU) information octet. A CPCS UU length can be up to eight bits and is entered using a keypad.



This command is available only when using AAL5 protocol.

AAL5 PDU Length

Sets the length of the AAL5 Protocol Data Unit (PDU). A PDU length is entered using a keypad. Values can range from 2048 to 65,512 bytes in length. The default value is 4800 bytes.

There are PDU length limitations for CRC, LEN, and Padding errors.



This command is available only when using AAL5 protocol.

Traffic Shaping

This function selects the type of data algorithm used to buffer cells before transmitting data to the network. The following options are available for this command.

Option	Description
Rt-VBR	Real-time Variable Bit Rate. Uses a real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
Nrt-VBR	Non-real-time Variable Bit Rate. Uses a non-real-time dual leaky bucket algorithm (GCRA) and characterized by Sustained Cell Rate (SCR) and Peak Cell Rate (PCR).
CBR	Constant Bit Rate. Supports CBR traffic. CBR is used by connections that request a static amount of bandwidth that is continuously available during the connection lifetime. The amount of bandwidth is characterized by Peak Cell Rate (PCR).
UBR	Unspecified Bit Rate. If this option is selected then the Peak Cell Rate (PCR),

	Sustained Cell Rate (SCR), and Max Burst Size (MBS) commands are disabled. Specifically, UBR does not include the notation of a per-connection negotiated bandwidth. UBR channels will attempt to equally share, but not guarantee, any remaining bandwidth after all CBR or VBR channels are allocated.

Config SVC - Peak Cell Rate

This function sets the Peak Cell Rate (PCR) for VBR and CBR traffic and is available only for VBR and CBR Traffic Shaping.

If the PCR is not at 100 percent of line rate for non-OC-12 (or 25 percent for OC-12), then the Max Burst Size defaults to two. If the PCR is changed for a single CBR virtual channel, then all CBR channels are changed to the new PCR value.

The PCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second

These units are defined by the Units of Measure command located in the [Config Set](#) screen.

PCR for CLP0 sets the Peak Cell Rate for all cells with CLP field in the Header equal to 0.

PCR for CLP0+1 sets the Peak Cell Rate for all cells with CLP field in the Header equal to 0 or 1.

Sustained Cell Rate (SCR)

This function sets the Sustained Cell Rate (SCR) for VBR traffic, and is only available only for VBR Traffic Shaping.

The SCR is entered using a keypad and can be represented in the following units of measure:

- Bandwidth Percentage
- Mbps
- Kbps
- Cells per Second

These units are defined by the [Units of Measure](#) command located in the [Config Set](#) function.

Optional SVC

The Optional button appears when ATM Interface is set to UNI4.0. The Optional button allows you to set UNI4.0 parameters to valid or invalid states. When the optional parameters are validated, you are able to edit

- Alternate Traffic Descriptor
- Min Acceptable Traffic Descriptor
- Extended QoS Parameters
- ABR Setup Parameters
- End to end Transmit Delay Parameters

Max Burst Size

This function sets the maximum number of cells that can transmit at the peak rate and still be in conformance with the Traffic Shaping algorithm. It is only available for VBR Traffic Shapings.

If the maximum burst size (MBS) is changed from a value of 2, then the Peak Cell Rate defaults to 100 percent.

CDVT

Cell Delay Variation Tolerance. Set CDVT to maximum of 1047552.

Button Row

Button	Description
Save	Saves any changes made to the parameters for the virtual channel.
Exit	Closes the Edit VCC screen and returns to the Table Edit screen.
Previous	Displays the parameter settings for the previous virtual channel in the VCC Table.
Next	Displays the parameter settings for the next virtual channel in the VCC Table. Available only for the Edit VCC Table dialog.
Delete	Removes the virtual channel from the VCC Table. A Confirmation message appears stating that the virtual channel will be deleted.

VCC Table EDIT TBL - Turbo Add

The Turbo Add button allows you to add several virtual channels to a VCC Table at once instead of having to enter ATM cell parameters for each individual virtual channel.

A total of up to 256 PVCs or 20 SVCs (if Signalling is Enabled) can be added at once.

Channels added using this feature increment the VCI value based on the VCI starting point for the first virtual channel. Likewise, the parameter values entered are replicated for all virtual channels added using this feature. This includes all receive and transmit parameters, AAL settings, and traffic shaping. Once these channels are entered into the VCC Table, their parameters can be changed later, if necessary, using the Edit VCC button.

Only valid user VCIs above 32 decimal (20 Hex)VPI/ VCIs can be entered using Turbo Add. The following are invalid values for VPI/ VCI.

- VPI=0 and VCI=0
- VCI=3
- VCI=4
- VCI=6

- VCI=7

The Turbo Add button operates similar to the [Add VCC](#) button. The major difference is that you must identify the number of virtual channels to add. This is performed using the Number of VCCs to Add keypad. The Turbo Add button accepts values ranging from 1 to 256 (for PVCs) or from 1 to 20 (for SVCs).

Defining the Number of Virtual Channels to Add Using Turbo Add

After defining the number of virtual channels, the Add VCC Main Menu displays. This allows you to modify parameters for this group of virtual channels. For more information on these parameters, refer to [Add VCC](#) and Edit VCC.

VCC Table EDIT TBL - Delete Table

Use this button to delete the current VCC Table. When selected, you are able to delete:

- **Single Entry:** Deletes the currently selected item.
- **Table:** Deletes the entire table.
- **Exit:** Cancels this function.



Once the active table is deleted using this button, it cannot be recalled unless it was previously saved using the [Save Table](#) command.

VCC Table EDIT TBL - Save Table

Selecting the Save Table button opens a File Browser dialog box where you can enter a filename for the saved VCC Table. This button also allows access to the RAM drive (if using locally) or to your PC's hard drive (if using remotely).

VCC Table EDIT TBL - Recall Table

When the Recall Table button is selected the File Browser dialog box appears displaying a list of files on the Flash drive or RAM drive. Saved VCC tables are included in this list. Choose the desired VCC table and select the **OK** button to load the table. VCC tables are designated by a .vcc extension.

VCC Table - Background (BKGND)

This function allows you to configure a background pattern.

The following options are available from the BKGND function:

- Add Sequence
 - [Header](#)
 - Payload - Allows you to specify an eight bit payload pattern.
 - Burst - Allows you to specify burst count from 1 to 255.
 - Skip - Allows you to specify skip size from 1 - 255
 - Delete - Allows you to delete a background sequence.
 - Save - After background settings are completed select the **Save** button to add the new sequence to the Background Sequence Setting table. Once saved, the following options activated:
 - Enabled/Disable (EN/Dis) - Allows you to disable or enable the selected sequence.
 - View/Edit - Allows you to view or edit the current settings for the selected sequence.
 - Cancel - Allows you to cancel any changes or additions you are in the process of making to a sequence.
- Start Traffic - Starts background traffic activity. Button changes to Stop Traffic.

VCC Table - Summary (SUM)

The Summary button displays a summary report of current cell activity, bandwidth percentage used, virtual channel status, and virtual channel totals for the current VCC Table.

All count values can be reset to zero using the [Restart](#) button in the [Common Function Buttons](#).

The following information appears for a Summary Counts report:

- **Total Monitor Cells:** Displays the cell count and bandwidth of all virtual channels in the VCC Table that are currently configured with an active monitor (MON or DET) status.
- **Idle Cells:** Reports Cell Count and Bandwidth Percentage.
- **Discarded Cells:** Reports the total number of user cells (non-zero VCI and VPI cells) that are not part of the monitored traffic. The cell count and bandwidth percentage display.
- **Valid OAM Cells:** Reports the total number and bandwidth of valid Operation and Maintenance cells.

- **Errored OAM Cells:** Reports the total number and bandwidth of errored Operation and Maintenance cells.
- **Transmit VCCs:** Reports the total number of virtual channels that are configured to transmit data. These channels are identified with the <on> status value in the VCC Table's TX column.
- **FNC Enabled VCCs:** Reports the total number of virtual channels that are error enabled.
- **Monitor VCCs:** Reports the total number of virtual channels that are configured to receive and monitor data traffic. These channels are identified with the <mon> status value in the VCC Table's RX column.
- **Detailed VCCs:** Reports the total number of detailed virtual channels.
- **VCC Table Entries:** Reports the total number of virtual channels (regardless of their TX and RX values) entered in the selected VCC Table.

VCC Res

VCC Table - VCC Results (VCC RES)

The VCC RES option displays a current status report for individual virtual channels defined in the VCC Table.

Use the **Previous** and **Next** buttons to scroll through and display other virtual channels in the VCC Table.

VCC Header Information

This line of information displays which virtual channel is currently selected (represented by #) and the associated values for GFC, VPI, VCI, PTI, and CLP.

As you display different virtual channels using the Previous and Next buttons, the status line is updated to reflect the selected virtual channel and its header settings.

VCC Error Counts and Rates Table

The following information can be reported on the Error Counts and Rates Table, depending on configuration settings.

- Cells Received
- AAL5 PDUs
- Bit Errors
- Lost Cells

- Mis Inserted
- SN + SNP
- [AAL0](#)
- [AAL1](#)
- [AAL5](#)

Alarm Seconds

- VPI (F4) AIS
- VPI (F4) RDI
- VCI (F5) AIS
- VCI (F5) RDI
- Pat Sync
- STA

AAL0 Config

If a VCC is configured for AAL0, then the following information appears in the VCC Counts screen:

- VCC Header information
- Error type, count, and rate
- Alarm type and how many seconds it occurred

Option	Description
Cells Received	Displays the cell count and bandwidth percentage for the selected virtual channel.
Bit Errors	Displays the Bit error count and rate for a virtual channel that has Detailed Detection mode enabled.
VPI (F4) AIS Seconds	Displays the total number of seconds an F4 AIS (Alarm Indication Signal) is detected when monitoring for OAM (Operation, Administration, and Maintenance) cells in the virtual path.

VPI (F4) RDI Seconds	Displays the total number of seconds an F4 RDI (Remote Defect Indicator) is detected when monitoring for OAM cells in the virtual path.
VCI (F5) AIS Seconds	Displays the total number of seconds an F5 AIS is detected when monitoring for OAM cells in the virtual channel.
VCI (F5) RDI Seconds	Displays the number of seconds an F5 RDI is detected when monitoring for OAM cells in the virtual channel.
Pattern Sync	Displays the duration of Pattern Sync Errors detected for a virtual channel that has Detailed Detection mode enabled.

AAL1 Config

If a VCC is configured for AAL1, then the following information appears in the VCC Res screen:

- VCC Header information
- Error type, count, and rate
- Alarm type and how many seconds it occurred

Option	Description
Cells Received	Displays the cell count and bandwidth percentage for the selected virtual channel.
Bit Errors	Displays the Bit error count and rate for a virtual channel that has Detailed Detection mode enabled.
Lost Cells	Indicates the difference between the expected and the received Sequence Number.(Appears only if the virtual channel has Detailed Detection mode enabled.)

Mis-sequenced Cells	Indicates that a cell, with a valid sequence number, is received out of order. (Appears only if the virtual channel has Detailed Detection mode enabled.)
SNP Errors	Displays the error count of Sequence Number Protection.
VPI (F4) AIS Seconds	Displays the total number of seconds an F4 AIS (Alarm Indication Signal) is detected when monitoring for OAM (Operation, Administration, and Maintenance) cells in the virtual path.
VPI (F4) RDI Seconds	Displays the total number of seconds an F4 RDI (Remote Defect Indicator) is detected when monitoring for OAM cells in the virtual path.
VCI (F5) AIS Seconds	Displays the total number of seconds an F5 AIS is detected when monitoring for OAM cells in the virtual channel.
VCI (F5) RDI Seconds	Displays the number of seconds an F5 RDI is detected when monitoring for OAM cells in the virtual channel.
Pattern Sync	Displays the duration of Pattern Sync Errors detected for a virtual channel that has Detailed Detection mode enabled.

AAL5 Config

If a VCC is configured for AAL5, then the following information appears in the VCC Counts screen:

- VCC Header information
- Error type, count, and rate
- Alarm type and how many seconds it occurred

Option	Description

Cells Received	Displays the cell count and bandwidth percentage for the selected virtual channel.
AAL5 PDUs	Displays the number of received AAL5 Protocol Data Units (PDU) for the selected virtual channel and the PDU per second rate.
Bit Errors	Displays the Bit error count and rate for a virtual channel that has Detailed Detection mode enabled.
PDU Len Errors	Displays the count and error rate for any PDU length errors detected during data reception.
Padding Errors	Displays the count and error rate for any padding errors detected during data reception.
CRC Errors	Displays the error count and error rate for any CRC (Cyclic Redundancy Check) errors detected during data reception.
VPI (F4) AIS Seconds	Displays the total number of seconds an F4 AIS (Alarm Indication Signal) is detected when monitoring for OAM (Operation, Administration, and Maintenance) cells in the virtual path.
VPI (F4) RDI Seconds	Displays the total number of seconds an F4 RDI (Remote Defect Indicator) is detected when monitoring for OAM cells in the virtual path.
VCI (F5) AIS Seconds	Displays the total number of seconds an F5 AIS is detected when monitoring for OAM cells in the virtual channel.
VCI (F5) RDI Seconds	Displays the total number of seconds an F5 RDI is detected when monitoring for OAM cells in the virtual channel.
Pattern Sync	Displays the total number of seconds a Pattern Sync error was detected for a

	virtual channel that has Detailed Detection mode enabled.

VCC Table - QoS Results (QoS RES)

The Quality of Service (QoS) Results (Res) button displays a summary report of current ratio, rate, and count of cell transfer delay and cell delay variation activity.



In order to receive QOS results, the [PM OAM](#) function must be enabled.

The following options are available:

Option	Description
Errored Cells	Displays the ratio of errored cells during the test.
Aggregate Cell Loss	Displays the ratio of cells lost during the test.
CLR for CLP=0	Displays the Cell Loss Ratio (CLR) for cells with Cell Loss Priority (CLP) bit 0 in ATM header.
CLR for CLP=1	Displays the CLR for CLP signaling bit in ATM header cell (1=low priority).
Misinserted Cells	Display the ratio of misinserted cells received.
SECB	Displays the ratio of Severely Errored Cell Blocks (SECB) received.
Non-Compliant to GCRA1	Displays the number of cells non-compliant to Generic Cell Rate Algorithm1.
Non-Compliant to GCRA2	Displays the number of cells non-compliant to Generic Cell Rate Algorithm 2 (valid for VBR channels).
CLP1 Cells	Displays the number of CLP cells in ATM header cell 1.

At the top of the screen, the VCC Header appears. This line of information displays which virtual channel is currently selected (represented by #) and the associated values for GFC, VPI, VCI, PTI, and CLP.

VCC Table - O.191 Results (O.191 RES)

The ITU defined O.191 test cell provides the most accurate method to calculate ATM-layer performance parameters for QoS tests.

The O.191 RES button displays a summary report of the ATM layer statistics for measuring ATM QoS.

VCC Header Information

At the top of the screen, the VCC Header appears. This line of information displays which virtual channel is currently selected (represented by #) and the associated values for GFC, VPI, VCI, PTI, and CLP.

Use the **Previous** and **Next** buttons to scroll through and display other virtual channels in the VCC Table. As you display different virtual channels using the Previous and Next buttons, the status line is updated to reflect the selected virtual channel and its header settings.

Summary Report Table

O.191 testing returns the following information:

Data Type	Description
Minimum Cell Transfer Delay (CTD)	Minimum round-trip time for transmitted (foreground) test cells.
Maximum CTD	Maximum round-trip time for transmitted (foreground) test cells.
Mean CTD	Average round-trip time for transmitted (foreground) test cells.
Lost Count	The number of cells not received.
Errored Count	The number of cells received with payload bit errors.

Mis-insertion Count	The number of cells detected on one virtual channel (VC) having payload information belonging to another VC.
SECB Count	The number of severely errored cell blocks (SECBs) received.
Loss Ratio	A measurement of the difference between the number of foreground test cells transmitted and the number of test cells received.
Error Ratio	The number of foreground test cells received with payload bit errors divided by the total number of transmitted test cells.
Mis-insertion Rate	The rate of cells detected on one VC having payload information belonging to another VC.
SECB Ratio	The number of SECBs received divided by the total number of transmitted test cells.
Unavailable Seconds	The number of seconds for which switch equipment was unavailable to transmit test cells.
Availability Ratio	The number of unavailable switch equipment seconds divided by the total number of available seconds.
MTBO	Mean time between outages (MTBO) represents the average time between equipment failures or significant outages that essentially render transmission useless.

VCC Table - QoS ANAL

This function configures the protocol to receive and analyze ATM cell streams to ensure they conform to certain QoS parameters.

The **QoS Analysis Settings** box provides the following configuration options:

Option	Description
Type of Analysis	Allows analysis of One Point Cell Delay Variation (CDV) or Inter Arrival Time.
Header	Provides access to the following configuration settings: Generic Flow Control (GFC) - The first four bits of the ATM cell header for a UNI interface. Virtual path identifier (VPI) - The virtual path address over which the transmitted data will flow from the transmitting device to the target device. Virtual Channel Identifier (VCI) - The address or label of a Virtual Channel (VC). Payload Type Indicator (PTI) - The payload type field value distinguishing the various management and user cells. Cell Loss Priority (CLP) - A signaling bit in the ATM header cell (0=high priority, 1=low priority).
Expected Cell Rate	Keypad entry allows setting the minimum and maximum cell rate value.
Start (Stop)	Starts and stops the QoS analysis test. Test results display in the QoS Analysis Results table.

The QoS Analysis Results table provides the following output data:

Result Parameter	Description
Max CDV	Maximum cell delay variation (CDV) experienced because of buffering and cell scheduling.
Min CDV	Minimum CDV experienced because of buffering and cell scheduling.

Functions

Function (Functns) Screens and Functions

This function allows you to perform the following activities:

- Define the type of errors, alarms, and loopback cells to transmit across the ATM
- Transmit a Burst Count
- Configure ATM cells for [network impairment](#) and [QOS](#) testing
- Selectively scan for specific ATM cell parameters, gather that information, and then add it to a VCC Table

The following functions are available for the Functions tab.

- [VCC BURST](#)
- [ERR GEN](#)
- [ALRM GEN](#)
- [NET IMP](#)
- [LOOP BACK](#)
- [VCC SCAN](#)
- [PM OAM](#)
- [CAPT](#)

Functns - VCC Burst

This function transmits a controlled amount of traffic using either AAL0 cells, AAL1 PDUs, or AAL5 PDUs. The type of traffic transmitted is determined by the configured parameters of the active channel (the virtual channel currently highlighted in the VCC Table).

- **Burst Count:** This value represents the number of cells or PDUs sent per burst. This is the value entered using the Burst Count button.
- **AAL0 Cells Sent, AAL1 PDUs Sent, or AAL5 PDUs Sent:** If the virtual channel is configured for AAL0, then the total number of cells sent is displayed. If the virtual channel is configured for AAL1 or AAL5, then the total number of PDUs sent displays.
- **Start:** Select **Start** to transmit the VCC Burst.

Funcntns - Error Generation (ERR GEN)

Use this function to define how the system generates and transmits errors for testing purposes. The following commands are associated with the ERR GEN button.

Select the **Edit** button to display the following options:

Option	Description
Type of Error Added	Select one of the following errors: • None: No errors are selected for transmission. • HEC - Correctable: Header Error Control. One bit in the Header is errored. Errors are inserted on all channels. • HEC - Uncorrectable: Header Error Control. Two or more bits in the Header are errored. Errors are inserted on all channels. • Bit Error: Bit errors are inserted only on the currently active channel as selected from the VCC Table. Bit errors are only inserted on AAL 0 or AAL 1 virtual channels. • SN Error: Inserts a Sequence Number error.

	• SNP Error: Inserts a Sequence Number Protection error. • CRC Error: Inserts a Cyclic Redundancy Check error. • Padding Error: Inserts a Padding error. • PDU Length Error: Inserts a Protocol Data Unit length error.
Error Insertion Rate	Sets the insertion rate for errors in the transmission stream. The following options are available for this command. • Off: No errors are inserted for transmission. • Continuous (1): Generates continuous errors into the transmission stream. If the system is configured to generate Bit errors, then this option does not display. • 1e-X: Selects an error rate. Error rates range from 1e-1 through 1e-9. (For Bit errors, the error rates range from 1e-2 through 1e-9.) • User Defined: Allows you to enter a desired error insertion rate. Values are entered using a keypad display.
Error Burst Count	Defines the number of contiguous cells that contain an error. Selects burst count X, where X ranges from 1 to 10.

Duration of Error Insertion	Determines how long errors are inserted into the data transmission stream. Error insertion begins once you have selected a duration value. The following options are available: • Off: Turns Off any error that is in progress by setting the timer to 0 seconds. • 1 second • 10 seconds • 60 seconds • User Defined: Allows you to enter the duration of the error burst. Values are entered using a keypad display and range from 1 second to 32,765 seconds. • Continuous: Errors are constantly inserted at the selected error insertion rate.

Funcntns - Alarm Generation (ALARM GEN)

The Alarm Gen function allows you to define the type and duration of alarms transmitted by the system. This allows you to solicit a response from a specific network element and verify if that element is correct.

Option	Description

ATM Alarm Generated	Selects the type of alarm generated by the system. The following options are available for this command: • None • LOCS • F4 AIS (Segment) • F4 RDI (Segment) • F4 AIS (End-to-End) • F4 RDI (End-to-End) • F5 RDI (Segment) • F5 AIS (End-to-End) • F5 RDI (End-to-End) • Patten Sync
Duration of Alarm Generation	Determines how long an alarm is generated. This alarm timer counts down to 0. • Off: Turns Off any alarm that is in progress by setting the timer to 0 seconds. • 1 second • 10 seconds • 60 seconds • Continuous: Alarms are constantly reported at an interval of one per second for AIS and RDI alarms. • User Defined: Allows you to enter the duration of the alarm.

	Values are entered using a keypad display and range from 1 second to 32,765 seconds.
Defect Type	Select the type of alarm defect to transmit up to eight bits. Note: This function is only applicable for OAM alarms.

Net Imp

Funcnns - Network Impairment (NET IMP)

This function allows you to insert impairment types into an ATM cell stream to emulate real-world network impairments. You are able to insert the following impairment types:

- [Cell Error Generation](#)
- [Cell Loss](#)
- [Cell Mis-insertion](#)
- [Cell Delay Variation](#)
- [Cell Reordering](#)
- [CLP Tagging](#)
- [CI Setting](#)
- [VPI/VCI Remapping](#)

Funcnns NET IMP - Cell Error Generation

Cell errors are a result of bit errors caused by line noise. When **Cell Error Generation** is selected from the **Type** button on the **Funcnns | NET IMP** screen, the following parameters can be configured.

Option	Description
Error Mask	Select up to eight bits of an octet for corruption.
Octet Select	Select 1 through 53 octets.
Header Select	Specify the VCC Header (to include GFC, VPI, VCI, and CLP) to be compared with these bits.
Burst Size	Select the number of consecutive cells (1-10) to be corrupted.
Burst Rate	Select the number of unerrored cells that should occur between cell errors. • Off: No cells are inserted for transmission. • Continuous (1): Generates cell generation into the transmission stream. • 1e-X: Selects a cell generation rate. Error rates range from 1e-1 through 1e-9. • User Defined: Allows you to enter a desired cell generation rate. Values are entered using a keypad display.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Funcnns NET IMP - Cell Loss

Cell loss results from network problems as buffer overflow, switch malfunction, traffic policing and uncorrectable header errors. When **Cell Loss** is selected from the **Type** button on the **Functns | NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the VCC Header (to include GFC, VPI, VCI, and CLP) to be compared with these bits.
Burst Size	Select the number of consecutive cells (1-10) to be corrupted.
Burst Rate	Select the number of unerrored cells that should occur between cell errors. • Off: No cells are inserted for transmission. • Continuous (1): Generates continuous cell insertion into the transmission stream. • 1e-X: Selects a cell insertion rate. Error rates range from 1e-1 through 1e-9. • User Defined: Allows you to enter a desired cell insertion rate. Values are entered using a keypad display.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Functns NET IMP - Cell Misinsertion

Cell misinsertion is caused by transmission errors and situations in which an undetected header error matches an existing VPI/VCI. The misinserted cell is introduced in lieu of an idle cell. The header of the misinserted cell can be fully specified by the user. When **Cell Mis-insertion** is selected from the **Type** button on the **Functns | NET IMP** screen, the following parameters can be configured.

Option	Description
Mis-inserted Header	Specify the header (to include GFC, VPI, VCI, PTI, and CLP) of the misinserted cell.
Payload Octet	Select up to eight bits for the payload octet that the misinserted cells will have.
Burst Size	Specify the number of consecutive cells to be misinserted (select 1 through 10).
Burst Rate	Specify the number of cells between misinserted cells. The following options are available: • Off: No cells are inserted for transmission. • Continuous (1): Generates continuous cell insertion into the transmission stream. • 1e-X: Selects a cell insertion rate. Error rates range from 1e-1 through 1e-9. • User Defined: Allows you to enter a desired cell insertion rate. Values are entered using a keypad display.
Duration	Specify the duration of the impairment. The options are: Off, 1 second, 10 seconds, 60 seconds, Continuous, and User Defined.

Functns NET IMP - Cell Delay Variation

Cell Delay Variation results from variation in the delay inserted because of problems as congestion, cell blocking, multiplexing cells from two or more connections, OAM cell insertion and physical layer overhead insertion. When **Cell Delay Variation** is selected from the **Type** button on the **Functns | NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Burst Size	Select the number of consecutive cells (1-15) to be delayed.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Funcn's NET IMP - Cell Reordering

Cell Reordering results from transmission errors. When **Cell Reordering** is selected from the **Type** button on the **Funcn's | NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Do Cell Reordering	Performs cell reordering once on two consecutive cells with the header specified.

CLP Tagging

CLP Tagging results from network problems due to buffer overflow and traffic policing. When **CLP Tagging** is selected from the **Type** button on the **Funcn's | NET IMP** screen, the following parameters can be configured.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Funcnns NET IMP - CI Setting

CI settings result from congestion in the network. When the CI Setting impairment type is selected, the following parameters can be specified.

Option	Description
Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Funcnns NET IMP - VPI/VCI Remapping

This function simulates behaviour of a switch. When **VPI/VCI Remapping** is selected from the **Type** button on the **Funcnns | NET IMP** screen, the following parameters can be configured.

Option	Description

Header Select	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC on which impairment should occur.
New Header	Specify the Header (to include GFC, VPI, VCI, and CLP) of the VCC to which the received cells are to be sent.
Duration	Select how long the impairment will occur. The options are: Off, 1 second, 10 seconds, 60 seconds, continuous, and user defined.

Funcntns - LOOP BACK

This function allows the system to generate a loopback test to ATM equipment on the network. The commands associated with this function define the parameters for the loopback test.

Select the **Edit** button to display the following options are available.

Option	Description
Connection Type	Determines whether the loopback cells are looped at a virtual channel segment or throughout the network to an endpoint. The following options are available for this command. • Segment: Sends loopback cells though a portion of the ATM network. For this type of connection, the PTI defaults to 100. • End-to-End: Sends loopback cells to the endpoint of the ATM network. For this type of connection, the PTI defaults to 101.

Duration of Insertion	Sets the period of the loopback test. The test consists of the number of cells per second sent for the length of time defined by this command. Loopback cell results are displays in the Loopback Cell Received status box. The following options are available for this command. • Off: Stops any loopback test that is in progress. • Seconds: Sets the loopback cell test to last for 1, 10, or 60 seconds. • User Defined: Allows you to specify the duration of the test. Values are entered using a keypad and range from 1 second to 32765 seconds. • Continuous: Loopbacks are constantly inserted at the selected loopback insertion rate.
Single Loopback	Generates one loopback cell. This provides the ability to quickly send a loopback cell without having to configure the Loopback Insertion Rate or Duration of Loopback Insertion commands.
Clear Count	Sets the Cells Received counter to zero.

Functns - VCC SCAN

The VCC Scan function is a filter that allows you to identify active virtual channels containing specific cell addressing. This feature allows you to enter specific ATM Cell Header addressing parameters and then capture only those ATM cells. This information can then be easily transferred into a VCC Table for additional analysis.

The following commands are available.

Option	Description

Scan Header (Hex)	Displays a keypad. From here, you can enter specific ATM Cell Header address that will be scanned. Wild card characters can be entered to represent any value.
Start Scan	Initiates a scan. The Scan Status box displays the message "Active."
Stop Scan	Stops the scan in progress. The Scan Status box displays the message "Inactive."
Add to VCC Tbl	Selects the highlighted virtual channel and adds it to the VCC Table.
Add All	Selects all virtual channels identified (displayed in the scroll box) and adds them to the VCC Table.
Clear	Removes any identified virtual channels from the scroll box.

Functns - PM OAM

This function allows you to view and edit performance management settings for Operation, Administration, and Maintenance cells. When [Forward Monitoring](#) and [Backward Reporting](#) are enabled for a connection, you are able to view the OAM-related information for a specified cell block.

The results of this function are viewable through the [QOS Res](#) function when the system is set up in [Loopback](#) mode.

The following options are available from this screen:

Option	Description
VPI/VC	Displays which Virtual Path Indicator/Virtual Channel Indicator are currently being monitored.
Forward Monitoring	Displays whether Forward Monitoring mode is enabled or disabled on the transmitting unit.

Backward Reporting	Displays whether Backward Reporting mode is enabled or disabled on the receiving unit.
Block Size	Displays the interval in which the PM OAM cell sets (or blocks) will be sent. For example, if 256 is selected for Block Size, the cells will be sent after every 256 cells. The options include: • 128 • 256 • 512 • 1024 • 2048 • 4096 • 8192 • 16384 • 32768
Edit	The Edit button includes the following functions: • VPI/VCI: Displays the VPI/VCI currently being managed. • Forward Monitoring: A toggleable button that enables or disables Forward Monitoring. • Backward Reporting: A toggleable button that enables or disables Backward Reporting. • Block Size: Allows you to select the cell set (block) interval in which the PM OAM cells will be sent. • Save: Saves your changes.

	• Exit: Exits the function. If Save is not selected before exiting, no changes are made.

Funcntns - Capture Settings (CAPT)

This function allows you to specify a VPI/VCI channel, and the number of payload bytes to be captured. This function is only enabled when the VCC table contains one or more VPI/VCI channels whose Receive Pattern is set to Capture Capable.

Capture Settings

Setting	Description
VPI/VCI	This function allows you to set the VPI/VCI. Cells on this VPI/VCI will be captured.
Bytes	This function specifies the number of bytes to be captured. This is entered using a keypad and the range is from 1 to 4096.
Start	This function starts the capture of cells.

Start/Stop	This function starts or stops the capture of cells.

Send Options

This function allows you to specify the VPI/VCI channel on which the captured (and modified) cells are to be sent. This function is only enabled when the VCC table contains one or more VPI/VCI channels whose Transmit Pattern is set to Full Cell/PDU Programmable, and the VCC table's TX ON/OFF mode is set to OFF.

Setting	Description
VPI/VCI	This function allows you to set the VPI/VCI on which the captured cells will be transmitted.
Send	This function sends the captured cells on the specified VPI/VCI.

Captured Data

After settings are configured and Capture is initialized, the capture data is displayed under the Captured Data portion of the screen. Use the Arrow Keys on the righthand side of the screen to scroll through the data view.

Additionally, you may select the **Edit** button to modify the captured data bytes to be transmitted in the Sent VPI/VCI channel, when the Send button is selected.

Results

Results - Screens and Functions

Test activity and event history can be viewed using the various functions of the Results screen.

The following buttons make up the Results functions:

- [SCAN](#)
- [ERR](#)
- [ALARM](#)
- [EVENT](#)
- [LARGE LED](#)

- [GRAPH](#)
- [CALL RESULTS](#)

Results - SCAN

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No Trouble."

Results - ERR

This function reports percentage and error count values. It displays the number of errors detected, and the average error rate (using an N.NNe-N format) and current error rate (using an N.NNe-N format for current seconds only). The errors detected are generated either by the ATM network or intentionally by the system.

The following ATM errors are reported:

- HEC - Correctable
- HEC - Uncorrectable
- BIT Error
- Lost Cells
- Mis-Inserted Cells
- SN + SNP Error
- CRC Error
- PDU Length Error
- Padding Error

The type of errors that appear vary depending on the type of Preset/Mapping selected.

Results - ALARM

This function displays how long (in seconds) alarms were received by the system.

The following ATM alarms can appear:

- LOCS Seconds
- SCNR Seconds
- CLP Seconds
- STA Seconds
- LOPS Seconds
- VPI (F4) AIS Seconds
- VPI (F4) RDI Seconds
- VCI (F5) AIS Seconds
- VCI (F5) RDI Seconds

The type of alarms that appear vary depending on the type of [Preset](#) and [Mapping](#) selected.

Results - EVENTS

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - LARGE LED

The system uses LEDs to report alarm, error, and event activity. These visual cues help to narrow the focus if problems are detected on the incoming protocol processors' signals and provide a starting point when trying to diagnose problems.

There are two ways to view LEDs from the touch screen: the [ATM Quick Status LEDs](#), which are located on the left side of the touch screen, and the **Large LEDS** tab. The following tables describe what is indicated by the LED color.

Quick Status LEDs Color Description

If the LED is ...	Then this indicates ...
Green with white text	Normal operation. The LED is used as a status indicator.
White with white text	Normal operation, no errors or alarms. The LED is used as an error and alarm indicator.
Red with red text	An error or alarm event is in progress. The LED is used as an error and alarm indicator.
White with red text	An error or alarm event was detected, but is now cleared. The text serves as a history indicator.

Large LED Tab Color Description

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

Use the **Graph** button to view error and alarm results for the selected protocol processor. Graphs show the test history for either the current test or a previously saved test.

To use the graphs function:

1. Select a protocol processor that has been configured for Error Alarm testing.

2. From **Results**, select **Graph**. The Graph screen appears. It contains two graphs which allow you to display incoming alarms and errors.
3. Use the following buttons to control graphing parameters:
 - **Sample Rate** - Sets the timing for graph results at increments of 1 Second, 1 Minute, or 15 Minutes.
 - **Change Scale** - Compresses or expands the displayed time scale for the graphed errors and alarms at time intervals of 30 minutes, 90 minutes, 3 hours, 6 hours, 12 hours, 24 hours, or 72 hours.
 - **Change Upper** - Sets the type of errors or alarms that appear in the upper graph.
 - **Change Lower** - Sets the type of errors or alarms that appear in the lower graph.
 - **Shift Left and Shift Right** - Adjusts the graph's time scale to an earlier or later time.
 - **Print Report** - Prints a graph report to printer or file.
 - **Save Graphs** - Saves a graph to file as a .grp file that can be replayed at a later time.

 **Important:** This is not a text file; when replayed, it appears as the original graph plot. Choose *Print a Graph to Report* if you desire graph information that can be printed out.)

- **Replay Graphs/Stop Replay** - replays or stops saved graphs (.grp).

Call Results

This function reports Signalling results and is visible only when Signalling is enabled. This gives the values for the number of calls attempted, connected, rejected and cleared, setup time and teardown time. This also gives the SSCOP error statistics.

The following Call Results statistics appear

- TX Calls Attempted
- TX Calls Connected
- TX Calls Rejected
- TX Calls Cleared

- RX Calls Attempted
- RX Calls Connected
- RX Calls Rejected
- RX Calls Cleared
- Avg. Setup Time
- Min Setup Time
- Max Setup Time
- Avg. Teardown Time
- Min Teardown Time
- Max Teardown Time

The following SSCOP error statistics appear:

- Protocol Discriminator: Indicates error in Protocol Discriminator field.
- IE missing: Indicates that information element is missing.
- IE Content: Indicates that the content of the information element is errored.
- Unrecognized IE: Indicates that the information element is unrecognizable.
- Message Type: Indicates that the message type field is errored.
- Message Length: Indicates that the message length field is errored.
- SSCOP PDU Length: Indicates that the PDU length is errored.
- SSCOP Unknown PDU: Indicates that the PDU is not known.
- SSCOP PDU Align: Indicates error in PDU alignment.
- Call Reference Format: Indicates error in call reference format.
- Call Reference Value: Indicates error in Call reference value.

Test

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration**: This function configures how long a timed test runs for.
- **Action After Duration**: This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test**: This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description

None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.

Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

ATM LED Quick Status Area

When the ATM protocol processor is selected, the following LEDs and status indicators are displayed in the LED Quick Status Area of the touch screen. They are also located under Results [Large LEDs](#).

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.

- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Displays transmit status of virtual channels. On indicates selected virtual channels are active and transmitting. Off indicates all virtual channels are not transmitting.
RX	Displays monitor status of virtual channels. On indicates selected virtual channels are active and monitoring. Off indicates all virtual channels are not receiving.
Mapping	Displays the current mapping settings. If none are selected, "None" appears.
LOCS	Loss of Cell Synchronization. Indicates a loss of Cell Sync, which occurs when seven consecutive bad HECs are received. Cell Sync returns when six consecutive good HECs are received.
HEC	Header Error Control. Indicates if a correctable or uncorrectable Header Error Control occurred.
SCNR	Selected Cells Not Received. Monitor or Detail Channels are not receiving cells.
Bit Err	Indicates a Bit error has been received on the active detail channel.
Pat Sync	Loss of Pattern Synchronization. Indicates and displays the status of loss of Pattern Sync on any active details channel.
STA	Status. Indicates that a VCC has received cells with the CLP = 1.
CLP	Cell Loss Priority. Indicates that a VCC has received cells with the CLP = 1.
AAL	ATM Adaption Layer. Indicates that an AAL 1 SN or SNP error or lost or misinserted cell occurred, or a PDU length, padding, or CRC error occurred.
AIS	Alarm Indication Signal. Indicates if an AIS is received on an F4 or F5 OAM flow of an active VCC. This is an alarm LED.

RDI	Remote Defect Indicator. Indicates if a Remote Defect Indicator signal is received on an F4 or F5 OAM flow of an active VCC.
O.191 OVFL	Displays O.191 overflow status. On indicates that the block size set for the current rate is low and there is an overflow. Off indicates that there is no overflow.
SSCOP Link	Displays Service Specific Connection Oriented Protocol (SSCOP) link status. On indicates that the SSCOP link is up. Off indicates that the SSCOP link is down.
PLCP	Physical Layer Convergence Protocol. Indicates if a PLCP signal is received on the active detail channel.

ATM Specific Tasks

ATM Specific Tasks Overview

This section includes tasks that are specific to the ATM protocol processor. For a list of general settings, refer to the [Screen Functions and Descriptions](#) section.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

- [Activate or Disable VCC Table Data Transmission and Monitoring](#)
- [Add an SVC](#)
- [Cell Block Size Table](#)
- [Delete a VCC Entry or Table](#)
- [Edit an SVC](#)
- [Enable Signalling](#)
- [Filter Signalling Messages](#)
- [How to add or edit a VCC](#)
- [Initiate a Loopback Test](#)
- [Insert ATM Alarms](#)
- [Insert ATM Errors](#)
- [Monitor ATM Activity](#)

- [Perform Load Tests](#)
- [Print a Report](#)
- [Recall a VCC Table](#)
- [Save a VCC Table](#)
- [Start and Stop VCC Scan](#)
- [Transmit a Burst Count](#)
- [Use Turbo Add to Add Multiple VCCs](#)
- [ATM Technical Specifications](#)

Activate or Disable VCC Table Data Transmission and Monitoring

1. Select **VCC Table**.
2. Select **VCC CTRL**.
3. Select a VCC.
4. Set the following parameters:
 - Select [All TX Mode](#) to enable data transmission for up to 255 Transmit connections, starting from the current selection in the VCC Table.
 - Select [All RX Mode](#) to enable data monitoring for all virtual channels listed in the VCC Table.
 - Select [VCC TX Mode](#) to enable ATM Cell transmission for individual virtual channels in the VCC Table.
 - Select [VCC RX Mode](#) to enable ATM Cell monitoring for individual virtual channels in the VCC Table.
5. Select [TX On/Off](#) to start or stop the transmission of ATM cells on all enabled virtual channels listed in the VCC Table.
6. Select [RX On/Off](#) to start or stop data traffic reception and monitoring on all enabled virtual channels listed in the VCC Table.

Add an SVC Table

1. Select **Config**.
2. Select **Set**.

3. Select **Signalling** and enable.



Signalling is not supported when the ATM Interface is set to NNI.

4. Select **SVC**. If a change is required, specify the default SVC parameters.
5. Select **VCC Table**.
6. Select **Edit Tbl**.
7. Select **Add VCC** and select **SVC**.
8. To specify the VCC header information in the case of UNI4.0, select **Header**.
9. To change the Default parameters, select **Edit** under the Default Parameter portion of the screen.
 - To specify the VCC's Transmit pattern, select [Transmit Pattern](#).
 - To specify the VCC's Receive pattern, select [Receive Pattern](#).
 - To specify the traffic capability, select **Traffic Type**.
 - To specify the forward QoS class, select **Fwd QoS Class**.
 - To specify the backward QoS class, select **Bwd QoS Class**.
10. To change the AAL protocol mode, select **Edit** under the Aal Parameters portion of the screen.
11. Select [AAL](#) and select AAL0, AAL1, or AAL5.
 - If AAL0 was selected, go to step 12.
 - If AAL1 was selected, select **AAL1 CS1 Octet**.
 - If AAL5 was selected, select **AAL5 CPCS SDU Length** and **AAL5 CPCS UU Octet**.
12. To change the forward traffic descriptors, select **Edit** in Forward Traffic Descriptor screen.
 - Select [Combination](#) and select a combination.
 - To specify the descriptors:
 - If the combination is 1, select PCR CLP0 and PCR CLP0+1.
 - If the combination is 2, select PCR CLP0, PCR CLP0+1 and Tagging = Tagging Requested.
 - If the combination is 3, select PCR CLP0+1, SCR CLP0 and MBS CLP0.

- If the combination is 4, select 4 PCR CLP0+1, SCR CLP0, MBS CLP0 and Tagging = Tagging Requested.
- If the combination is 5, select PCR CLP0+1.
- If the combination is 6, select PCR CLP0+1, SCR CLP0+1 and MBS CLP0+1.

13. To change the backward traffic descriptors, select **Edit** in the Backward Traffic Descriptor portion of the screen.

- Select [Combination](#) and select a combination.
- To specify the descriptors:
 - If the combination is 1, select PCR CLP0 and PCR CLP0+1.
 - If the combination is 2, select PCR CLP0, PCR CLP0+1 and Tagging = Tagging Requested.
 - If the combination is 3, select PCR CLP0+1, SCR CLP0 and MBS CLP0.
 - If the combination is 4, select 4 PCR CLP0+1, SCR CLP0, MBS CLP0 and Tagging = Tagging Requested.
 - If the combination is 5, select PCR CLP0+1.
 - If the combination is 6, select PCR CLP0+1, SCR CLP0+1 and MBS CLP0+1.

14. Select **Edit** under the Called Party Address portion of the screen and set the address.

15. If the ATM Interface is UNI4.0, select **Optional** and set the optional parameters.

16. Select **Save**.

Cell Block Sizes and SECB Thresholds (Per ITU-T Rec. 0.191)			
PCR (cells/second)	(User information rate in Mbit/s)	N (block size)	M (threshold)
$0 \text{ ___} < x \leq 3200$	$(0 \text{ ___} < y \leq 1.23)$	128	4
$3200 \text{ ___} < x \leq 6400$	$(1.23 \text{ ___} < y \leq 2.46)$	256	8
$6400 \text{ ___} < x \leq 12\ 800$	$(2.46 \text{ ___} < y \leq 4.92)$	512	16
$12\ 800 \text{ ___} < x \leq 25\ 600$	$(4.92 \text{ ___} < y \leq 9.83)$	1 024	32
$25\ 600 \text{ ___} < x \leq 51\ 200$	$(9.83 \text{ ___} < y \leq 19.66)$	2 048	64
$51\ 200 \text{ ___} < x \leq 102\ 400$	$(19.66 \text{ ___} < y \leq 39.32)$	4 096	128

102 400 ____ < x ≤ 204 800	(39.32 ____ < y ≤ 78.64)	8 192	256
204 800 ____ < x ≤ 409 600	(78.64 ____ < y ≤ 157.29)	16 384	512
409 600 ____ < x ≤ 819 200	(157.29 ____ < y ≤ 314.57)	32 768	1024
NOTE – This table applies to the peak cell rate of the aggregate cell flow, CLP = 0 + 1.			

Delete a VCC Entry or Table

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. You can delete a single entry or entire table.

- *To delete a single entry*

Select the VCC that you wish to delete, and select the **Delete** button at the bottom of the table. From the Delete window, select **Single Entry**. The item is deleted.

- *To delete an entire table*

Select the **Delete** button located at the bottom of the table. From the Delete window, select **Table**. The Confirm Delete window appears, confirming that you wish to delete the current table. Select **Yes**. The entry or table is removed.

Edit an SVC

This function allows you to edit an SVC.

The Edit VCC button modifies parameters of an existing virtual channel listed in the VCC Table. If there are no virtual channels listed in the VCC Table, then this button is disabled. Also this button is changed to View VCC when transmission or reception is on. View VCC allows you to view the parameters of the VCC without being able to edit them.

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Choose the SVC table to be edited from the VCC Table grid and select the **Edit VCC** button. The Edit VCC <#> Type: SVC dialog box appears.



You can also scroll to the table to be edited by selecting the Prev or Next buttons on the Edit VCC window.

4. See the section [Add an SVC](#) for descriptions of the options on the Edit screen. After the appropriate parameters are modified, select **Save**.

Enable Signalling

1. Select **Config.** and **SET**.
2. Select **ATM Mapping** and set the mapping.
3. To specify the ATM interface, select **ATM Interface** and select **User-UNI3.0**, **User-UNI3.1**, or **User-UNI4.0**.
4. To specify the signalling PCR, select **Signalling PCR** and set the value.
5. To specify the Timer values, select **TMR**.
6. Select **Signalling** and select **Enable**.

Filter Signalling Messages

1. Select **Config**.
2. Enable **Signalling**.
3. Select **SIG FTRS**.
4. Select **Signalling Filter** and select **Enable**.
5. Select **Filter Type** and select a type of filter.
 - a. If the filter type selected is Message Filter/ Message and Call Reference Flag/ Message and Call Reference Value, press **Add** and select the message to be filtered.
 - b. If the filter type selected is Call Reference Flag/ Message and Call Reference Flag/ Call Reference Value and Flag, select **Call Reference Flag** and set it to **1** or **0**.
 - c. If the filter type selected is Call Reference Value/ Message and Call Reference Value/ Call Reference Value and Flag, select **Call Reference Value** and set the value.
6. For selecting multiple messages, repeat step a.

Add a VCC Table

The Add VCC function allows you to create or edit a new virtual channel in the VCC Table.

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Select **Add VCC**. The Select VCC Type window appears.
 - When Signaling is not enabled, the Add VCC function adds a PVC. When Signaling is enabled the Add function opens the Select VCC Type list box from which you can select PVC or SVC.
4. Select **PVC** or **SVC**.
 - The PVC function allows you to add a Permanent Virtual Channel. When selected, the Add VCC screen appears. Modify the appropriate PVC parameters. See the [Add or Edit a PVC](#) section for additional information.
 - The SVC function allows you to add a Switched Virtual Channel (SVC). When selected, the Add SVC screen appears. Modify the appropriate SVC parameters. See the [Add an SVC](#) section for additional information on adding SVCs.
5. When the appropriate parameters are modified, select **Save**.

Initiate a Loopback Test

1. Connect to the test unit to which you want to send a loopback.
2. Select [Config](#).
3. Select [SET](#).
4. Select [Loopback Response](#).
5. Select **Enable**.
6. Select [Functions](#).
7. Select [Loopback](#).
8. Select the table item you wish to send and select **Edit**.
9. Select [Connection Type](#) and select a parameter.
10. Select [Duration of Insertion](#) and select a parameter.
11. Select [Single Loopback](#) and select a parameter.
12. Select [Clear Count](#) and select a parameter.

Insert ATM Alarms

1. Select **Functions**.

2. Select **Alarm Gen.**
3. Select a VCC in the table.
4. Select the **Edit** button located in the bottom right corner of the table. The Edit Alarm Settings window appears.
5. Select [ATM Alarm Generated](#) and select an alarm type.
6. Select [Duration of Alarm Generation](#) and select the duration.
7. If applicable, select [Defect Type](#).
8. Select **Save**.

To stop alarm transmission:

1. Select **Functns.**
2. Select **Alarm Gen.**
3. Select an item in the table.
4. Select the **Edit** button located in the bottom right corner of the table. The Edit Alarm Settings window appears.
5. Select [Duration of Alarm Generation](#).
6. Select **Off**.

Insert ATM Errors

1. Select **Functns.**
2. Select **Error Gen.**
3. Select a VCC entry from the table.
4. Select the **Edit** button located in the right bottom corner of the table. The Edit Error Settings window appears.
5. Select [Type of Error Added](#) and select an error type.
6. Select [Error Insertion Rate](#) and select the rate of the error insert.
7. Select [Error Burst Count](#) and use the key pad to enter the number of error bursts to occur.
8. Select [Duration of Error Insertion](#) and select the duration of the error.
9. Select **Save**.

To stop error transmission:

1. Select **Functions**.
2. Select **Error Gen**.
3. Select a VCC entry from the table.
4. Select the **Edit** button located in the right bottom corner of the table. The Edit Error Settings window appears.
5. Select [Error Insertion Rate](#) or [Duration of Error Insertion](#).
6. Select **Off**.

Monitor ATM Activity

Various ATM test and event activity can be viewed by select the ATM Results button. The Results screen offers the following options:

- [Scan](#)
- [ERR](#)
- [Alarm](#)
- [Event](#)
- [Large LED](#)
- [Graph](#)
- [Call RSLTS](#)

You can also display a summary report of current cell activity, bandwidth percentage used, virtual channel status, and virtual channel totals for a VCC table by using the [SUM](#).

To access the SUM function:

1. From the ATM protocol processor, select **VCC Table**.
2. Select **SUM**.

Perform Load Tests

1. Select **Config**.
2. Select **Signalling** and select **Enable**.
3. Select **Load Test**.

4. Select **Type of Test** and select one of the types.
5. Select **Calls per Second** and enter a value.
 - If the type of test selected is Call Burst, select **Burst Period** and select a value.
 - If the type of test selected is Call Burst, select **Skip Period** and select a value.
6. Select **Duration** and select a value.

Print a Report

You are able to print the following types of ATM reports:

- **Summary Results Report:** Prints a summarized listing of ATM test results.
- **Summary Counts Report:** Prints a summarized count of idle cells, total monitored cells, discarded cells, valid OAM cells, errored OAM, transmitting VCCs, Receiving VCCs, and total VCCs.
- **VCC Counts Report:** Prints a listing of individual VCC counts or all VCC counts.
- **QOS Counts Report:** Prints a listing of individual QOS counts or all QOS counts.
- **Connection Details:** Prints a listing of individual connections details or all connections details.
- **Current Settings:** Prints the all current configuration settings for the ATM protocol processor.

To print a report:

1. Select **Print Report**. (This button is part of the [Common Function Buttons](#) that appear at the bottom of the touch screen.) The Report Setup menu appears.
2. Use the **Destination Printer** functions to print reports to a printer.
3. Use the **Destination File** functions to print reports to a file.
4. Select a report.
5. Select **OK**.

If printing to a file, the File Browser appears. Enter a filename and select **OK**.

Recall a VCC Table

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Select **Recall Table** from the bottom of the screen. The File Browser window appears.
4. Select the table that you wish to restore. All table names have a .VCC extension.
5. Select **OK**. A warning message appears confirming that you wish to restore the selected table.
6. Select **Yes**. The table information appears in the Edit Tbl screen.

Save a VCC Table

1. Add the VCCs that you wish to save to a table. For more information, see the [Add a VCC](#) section.
2. With the table open, from the Edit Tbl screen, select **Save Table** (located at the bottom of the screen). The File Browser window appears.
3. Select **File Name**. A keypad appears.
4. Enter the name of the table to be saved, and select **Enter**. The table's file name appears next to the Filename field with a .VCC extension.
5. Select **OK**. The table is saved to the directory you specified.

Start and Stop a VCC Scan

The VCC Scan function is a filter that allows you to identify active virtual channels containing specific cell addressing. This feature allows you to filter specific ATM Cell Header addressing parameters and then capture only those ATM cells. This information can then be easily transferred into a VCC Table for additional analysis.

To start a VCC Scan:

1. Select **Functions**.
2. Select **VCC Scan**.
3. Select the [Scan Header](#) button. The Enter VCC Header keypad appears.
4. Enter the header information and press **Enter** when done.

5. Select the **Start Scan** button to start scanning. The Scan Status (in the top right corner of the table) displays "Active."

Additionally in this screen, you may:

- Use the **Add VCC to VCC Tbl** button to add a scan header to the VCC table.
- Use the **Add All** button to add all scan headers to the VCC table.
- Use the **Clear** button to clear all table entries.

To stop the VCC Scan:

- Select **Stop Scan**. The Scan Status (in the top right corner of the table) displays "Inactive."

Transmit a Burst Count

This function transmits a controlled amount of traffic using either AAL0 cells, AAL1 PDUs, or AAL5 PDUs. This type of traffic is determined by the parameters of the active channel (the virtual channel currently highlighted in the VCC table).



In order to send a Burst Count, [TX On/Off](#) must be turned off.

To transmit a single burst:

1. Select [Functns](#).
2. Select [VCC Burst](#).
3. Select a virtual channel on the VCC Burst table.
4. Select the **Burst Count** button. The Burst Count keypad appears.
5. Enter a value from 1 to 1000, and press **Enter** on the keypad.
6. Select the **Start** button. The burst is transmitted and increments on the Funtcns screen.

Use Turbo Add to Add Multiple VCCs

1. Select **VCC Table**.
2. Select **Edit Tbl**.
3. Select the [Turbo Add](#) button. The No. of VCCs to be Added keypad appears.
4. Enter the number of VCCs to be added to the table (1 through 250).

5. Select **OK**. The Turbo Add window appears.
6. Select **PVC** or **SVC**.
 - If PVC is selected, the Add or Edit VCC screen appears. Modify the appropriate [PVC](#) parameters.
 - If SVC is selected, the Add SVC screen appears. Modify the appropriate [SVC](#) parameters.



Depending on which parameters are selected for AAL and Traffic Shaping, [additional options](#) may appear on the Turbo Add screen.

7. When the appropriate parameters are modified, select **Save**.

CSA MLD Tab

CSA-MLD Overview

From the CSA 4100 (40G/100G Service Analyzer) circuit pack's MLD (**Multi-Lane Distribution**) protocol processor tab:

- All CSA module test interface rates and framed/unframed mapping options can be selected.
- The PCS or Logical, unframed BERT, and PCS BERT virtual lane based settings can be modified.
- The PCS or Logical, unframed BERT, and PCS BERT virtual lane based results can be monitored.
- All Physical lane settings and results can be tested and monitored from this tab.
- All Optical lane settings and results can be tested and monitored from this tab.

The CSA-MLD Online Help is divided into the following sections:

- [CSA-MLD Screen and Functions Overview](#)
- [MLD Specific Tasks](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screens and Function Descriptions

CSA-MLD Screen and Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control CSA's MLD (Multi-Lane Distribution) configuration and operation.

The following screens and functions are discussed:

- [Transmit](#)
- [Receive](#)
- [Results](#)

- [Test](#)
- [LEDs](#)

Transmit

CSA-MLD Transmit Screens and Functions

The transmit section allows you to configure the transmit signal parameters used in Multi-Lane Distribution (MLD) operations.

The following transmit functionalities are available through the CSA-MLD Transmit screen:

- [SET](#)
- [Multi Lanes](#)
- [ERROR ALARM](#)

CSA-MLD Transmit - Set

The CSA-MLD Transmit Settings screen configures the MLD transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.

Interface	Selects the transmit interface rate.  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it. The following interface rates may be available: • OTU-4 (111.809G) OTL-4.10 • Unframed BERT (111.809G) • 100G Ethernet (103.125G) • Unframed BERT (103.125G) • OTU-3e2 (44.583G) OTL-3.4 • Unframed BERT (44.583G) • OTU-3e1 (44.571G) OTL-3.4 • Unframed BERT (44.571G) • OTU-3 (43.018G) OTL-3.4 • Unframed BERT (43.018G) • 40G Ethernet (41.25G) • Unframed BERT (41.25G) • STM-256/OC-768 (39.813G) STL-256.4 • Unframed BERT (39.813G)  This setting is disabled when a CFP module is not inserted.

	 Unframed BERT Interfaces are only valid when the number of Physical Lanes equal the number of Optical Lanes. Refer to the CSA-MLD Receive - SIG screen.
Clock Reference	Allows the user to select the timing source for the transmit signal. Select one of the following: Internal, Recovered, Bits/Sets.  The BITS/SETS external clock is configured from the System tab > MISC.
Line Frequency Offset	Adjusts the offset of the signal frequency of the transmitted signal. The frequency can be adjusted in parts per million (ppm). Use the keypad to enter the offset frequency. The frequency offset ranges from -120.0 to 120.0 in increments of 0.1 A 0 (zero) value equals Off.

Initial Laser Setting	Controls whether the CFP laser is On or Off when the unit is turned on. The following options are available: • Off - The CFP laser will be Off when the unit is turned on. • On - The CFP laser will be On when the unit is turned on. • Restore Previous State - When the unit is turned on, the CFP laser will be On or Off based on its previous setting before the unit was turned off.
TX Clock Loss Threshold	When the transmit Clock Reference setting is set to an external timing source such as Recovered or BITS/SETS, a TX Clock Loss alarm can be used to indicate when the Measured TX Line Frequency Offset exceeds this configured Threshold. The threshold range is from 0 to 120 ppm, in increments of 0.1. (0 ppm is disabled.)  When Clock Reference setting is set to Internal this setting and the TX Clock Loss alarm are disabled.
Measured TX Line Frequency	The current Transmit Line Frequency measurement for the configured interface (based on the selected reference clock) is displayed. When the transmit Clock Reference setting is set to an external timing source such as Recovered or BITS/SETS, this measurement is derived from the external reference clock
Measured TX Line Frequency Offset	When the transmit Clock Reference setting is set to an external timing source such as Recovered or BITS/SETS, this measurement indicates the deviation between the system's internal clock and the Measured TX Line Frequency. The measured offset value is displayed in Hz and ppm.

CSA-MLD Transmit - Multi Lanes

The Transmit Multi Lanes screen is used for generating & testing Logical and PCS virtual lanes, and for mapping Logical/PCS lanes into Physical lanes (sometimes referred to as electrical lanes).

- 100G Interface types have 10x10G Physical lanes, and 40G Interface types have 4x10G Physical lanes
- Depending on the selected Interface rate and type, if the number of Logical/PCS virtual lanes double the number of 10G Physical lanes then two virtual lanes will be mapped into each Physical lane.
- For framed Ethernet Interface types, the virtual lanes are referred to as "PCS lanes".
- For SONET, SDH and OTN Interface types, the virtual lanes are referred to as "Logical lanes".
- Unframed BERT Interface types use Physical lanes, but do not use virtual lanes.

The screenshot displays the 'Transmit Multi Lanes' configuration window. At the top, there's a navigation bar with tabs for different interface types: MLD, OTN, SDH, Packet, E4, E3, E1 #1, and E1 #2. Below this is a sub-navigation bar with buttons for 'Transmit', 'Receive', 'Results', and 'Test'. The main area shows a table of lane configurations. The table has columns for 'Alarm', 'Bit Delay', 'Ps Delay', 'Logical Lane', and 'Phy Lane'. The 'Logical Lane' column shows pairs of numbers in parentheses, representing logical and PCS lanes. The 'Phy Lane' column shows the corresponding physical lane numbers. The table is populated with 20 rows of data, showing a mapping from logical/PCS lanes to physical lanes. On the left side, there's a sidebar with various controls, including 'Laser is On', 'Tx/Rx power', 'E/A', and a 'Lane Summary' section. At the bottom, there's a bar with buttons for 'Error Insert', 'Stop', 'Restart', 'Report', 'Presets', 'Test Setup', 'Clear History', 'Lock Screen', and 'Shut Down'.

Alarm	Bit Delay	Ps Delay	Logical Lane	Phy Lane
None	0	0	0 (0)	0
None	0	0	10 (1)	0
None	0	0	1 (2)	1
None	0	0	11 (3)	1
None	0	0	2 (4)	2
None	0	0	12 (5)	2
None	0	0	3 (6)	3
None	0	0	13 (7)	3
None	0	0	4 (8)	4
None	0	0	14 (9)	4
None	0	0	5 (10)	5
None	0	0	15 (11)	5
None	0	0	6 (12)	6
None	0	0	16 (13)	6
None	0	0	7 (14)	7
None	0	0	17 (15)	7
None	0	0	8 (16)	8
None	0	0	18 (17)	8
None	0	0	9 (18)	9
None	0	0	19 (19)	9



In the Multi Lane table the following columns may or may not be displayed, depending on the errors/alarms supported by the configure Interface:

Global Buttons

- **Payload** - The selected Payload pattern will be applied to all of the lanes. The Payload pattern selection only applies to Unframed BERT interfaces.
- **Error**- The selected Error type will be inserted on all of the lanes, at the specified Error rate. Selecting "None" will turn off any Errors that are currently being inserted on any of the lanes.
- **Alarm** - The selected Alarm type will be generated on all of the lanes. Selecting "None" will turn off any Alarms that are currently being inserted on any of the lanes.
- **Clear Delays** - Will disable any Bit Delays currently being generated on any of the lanes.
- **Lane Map** - This menu allows you to choose **Rotate** or **Restor to Defaults**
 - When **Rotate** is selected, you choose the virtual lane number to be assigned to position 0, and the remaining virtual lanes rotate so that they sequentially align with the remaining positions.
 - When **Restor to Defaults** is selected, all of the virtual lanes are re-assigned to their default lane positions.

Individual Lane Buttons

- **Error**- The selected Error type will be inserted on the specified lane, at the specified Error rate. Selecting "None" will turn off the Errors that are currently being inserted on the specified lane.
 - BIT**- Inserts BIT errors into the lane's Payload Pattern.
 - Sync Hdr** - Inserts invalid Synchronization Headers.
 - Al Mark** - Inserts Alignment Mark errors.
 - BIP-8** - Inserts Bit Interleaved Parity 8 errors
- **Alarm** - Generates the selected Alarm type on the specified lane. Selecting "None" will turn off the Alarm currently being inserted on that lane. The following Alarm Types may or may not be available, depending on the configured Interface type.

- **LOF** - Loss Of Frame. The equipment cannot lock onto the framing bytes for that protocol.
 - **OOF** - Out Of Frame. Indicates that the virtual lane's deframer has not found a consistent Start Of Frame for 5 consecutive frames.
 - **LOR** - Loss Of Recovery. Indicates that the virtual lane's assignment value has been in the Out Of Recovery state for more than 3ms.
 - **OOR**- Out Of Recovery. Indicates that the virtual lane's assignment value has not been consistent for 5 consecutive frames.
 - **AIS** - Alarm Indication Signal. Alert the receiving end of the circuit that a segment of the end-to-end link has failed at a logical or physical level.
- **Bit Delay**- Adds a known value of time delay to the selected specified virtual lane. This delay is entered as bits and displayed as bits and pico seconds.
 - **Logical/PCS Lane** -This is the virtual lane number that will be identified by the alignment marker logic for assignment to a particular physical lane. Selecting the virtual lane will bring up a menu that allows swapping lane assignment to any other virtual lane. Depending on the selected Interface type, if the number of virtual lanes double the number of physical lanes then two Logical or PCS virtual lanes will be mapped into each physical lane. The number in (parentheses) is the virtual lane's fixed position.
 - **Physical Lane** - This is the fixed tag/label for the transmitting physical lane.

CSA-MLD Transmit - Error Alarm

The test unit can transmit errors and alarms to simulate various defects and anomalies to determine if the receiving equipment can detect an error or alarm in the incoming signal.



Virtual Lane Errors and Alarms can be inserted on individual Lanes from the Multi-Lanes screen

This screen allows you to generate LOS alarms on the Optical Lanes.

►An LOS alarm can be generated on each Optical Lane separately, by selecting the check box next to the **LOS (Optical Lane #) OFF**.



When the Lane's LOS alarm is enabled (checked), the word OFF changes to ON.

- ▶The **ALL LOS ON** button can be used to generate LOS on all Optical Lanes simultaneously.
- ▶The **ALL LOS OFF** button can be used to turn off the LOS alarm on any Optical Lanes currently generating an LOS alarm.

Receive

CSA-MLD Receive Screens and Functions

The receive section allows you to configure the receive settings for the parameters used in Multi-Lane Distribution (MLD) operations.

The following receive functionalities are available through the MLD protocol processor tab on the CSA board.

- [SET](#)
- [Multi Lanes](#)
- [SIG](#)

CSA-MLD Receive - Set

The CSA-MLD Receive Settings screen configures the MLD transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, settings established on the Receive screen will only affect Receive mode.

Interface	Selects the receive interface rate.  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  Only select the available interface rate that is supported by the currently inserted CFP module. The following interface rates may be available: • OTU-4 (111.809G) OTL-4.10 • Unframed BERT (111.809G) • 100G Ethernet (103.125G) • Unframed BERT (103.125G) • OTU-3e2 (44.583G) OTL-3.4 • Unframed BERT (44.583G) • OTU-3e1 (44.571G) OTL-3.4 • Unframed BERT (44.571G) • OTU-3 (43.018G) OTL-3.4 • Unframed BERT (43.018G) • 40G Ethernet (41.25G) • Unframed BERT (41.25G) • STM-256/OC-768 (39.813G) STL-256.4 • Unframed BERT (39.813G)  Unframed BERT Interfaces are only valid when the number of Physical Lanes equal the number of Optical Lanes. Refer to the CSA-MLD Receive - SIG screen.

Power Low Threshold	Sets the received optical power level (in dBm) threshold. If the power drops below the threshold, the Power Low alarm is triggered. This applies to all optical channels supported by the CFP. The threshold range is from 0 to -100 dBm ppm, in increments of 0.1. (-100 dBm is disabled.)
Out of Frequency Threshold	Sets the frequency threshold (in ppm) for the Line Frequency Offset. When the threshold is reached, the Frequency Wide alarm is triggered. This applies to all physical channels supported by the CFP. The threshold range is from 0 to 120 ppm, in increments of 0.1. (0 ppm is disabled.)
Excessive Skew Threshold	Sets the Skew alarm (Bit Delay) threshold (in bits) for all virtual (Logic/PCS) lanes. When a virtual lane's measured Skew (Bit delay) exceeds the configured threshold, the Skew alarm for that virtual lane is triggered. The threshold range is from 0 to the maximum Bit delay (in bits), in increments of 1. (0 bits is disabled.)

CSA-MLD Receive - Multi Lanes

The Receive Multi Lanes screen shows received Skew delay measurements for each of the Physical lanes and Logical/PCS virtual lanes.

 In the Multi Lane table the following columns are shown:

Physical Lane	Displays the Physical Lane number.
Logical/PCS Lane (w/ lane position)	Displays the virtual Logical/PCS Lane number(s) assigned to each Physical Lane.
Skew (bit)	Shows the measured Skew delay in Bits.

Skew (ps)	Shows the measured Skew delay in picoseconds.

CSA-MLD Receive - SIG (Signal Status)

Displays the following signal measurements of the incoming Physical and Optical Lanes, supported by the inserted CFP module:

- Frequency in Hz, for each Physical Lane
- Line Frequency Offset Received in Hz and ppm, for each Physical Lane
- Optical power in dBm, for each Optical Lane

Results

CSA-MLD Results Screens and Functions

All monitored activity that the MLD (Multi-Lane Distribution) protocol processor receives is reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The Results screen provides different ways of viewing received statistics. From the left side of the Result screen, select one of the following tabs:

- [Error & Alarm](#)
- [Multi Lanes](#)
- [Event Log](#)
- [Large LED](#)
- [Graph](#)

CSA-MLD Results - Error / Alarm

The Results Error / Alarm screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms on all MLD optical, physical and virtual lanes. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms.

For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

- **Scan All** - Select Scan All to access a quick summary of incoming errors and alarms on all MLD optical and virtual lanes, as well as any client errors and alarms on any of the associated CSA tabs (ie, CSA OTN, CSA SONET/SDH, CSA Packet).

For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

- **Alarms** - The system can monitor and report alarms and their duration on all of the MLD optical and physical lanes. The alarms are shown in duration of the alarm in seconds.

The following Alarms will be monitored:

- ▶ CP Power Loss
- ▶ LOA (Loss of Alignment)
- ▶ Frequency Wide (*for all Physical Lanes*)
- ▶ Power Low (*for all Optical Lanes*)
- ▶ Paused (# of seconds the test was paused for)
- ▶ LOS (Loss of Signal) (*for all Optical Lanes*)
- ▶ Power Hot (*for all Optical Lanes*)
- ▶ Power Warm (*for all Optical Lanes*)



Errors and Alarms received on any Logical/PCS virtual lanes will be displayed in the Multi Lanes screen.

CSA-MLD Results - Multi Lanes

The Results Multi Lanes screen is used for monitoring the individual Physical lanes and Logical/PCS virtual lanes for Errors, Alarms and Skew delays.

The top section will show the selected Error/Alarm statistics for the selected virtual lane.

► When monitoring Error statistics, the following information is display:

- Lane # selected
- Name of Error type selected
- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

► When monitoring Alarm statistics, the following information is display:

- Lane # selected
- Name of Alarm type selected
- Duration of the Alarm in seconds



In the Multi Lane table the following columns may or may not be displayed, depending on the errors/alarms supported by the configure Interface:

Physical Lane	Displays the Physical Lane number.
Logical/PCS Lane (w/ lane position)	Displays the virtual Logical/PCS Lane number(s) assigned to each Physical Lane.
Skew (bit)	Shows the measured Skew delay in Bits.
Skew (ps)	Shows the measured Skew delay in picoseconds.

AIS	Indicates if any Alarm Indication Signal alarms for that lane have been received. (see <i>button description below</i>)
LOF	Indicates if any Loss of Frame alarms for that lane have been received. (see <i>button description below</i>)
LOR	Indicates if any Loss Of Recovery alarms for that lane have been received. (see <i>button description below</i>)
BLKLOC/SyncHdr	Indicates if any Block Lock Loss alarms or Synchronization Header errors for that lane have been received. (see <i>button description below</i>)
AlignMark	Indicates if any Alignment Mark errors for that lane have been received. (see <i>button description below</i>)
BIP8	Indicates if any BIP 8 errors for that lane have been received. (see <i>button description below</i>)
Pattern	Indicates if any Pattern Synchronization alarms for that lane have been received. (see <i>button description below</i>)

Button description:

- The lane's Error/Alarm button will appear Grey with no text if that lane has not received any of the specified Error or Alarm since the beginning of the current test.
- The lane's Error/Alarm button will appear Red with Black text if that lane is currently receiving the specified Error or Alarm.

- The lane's Error/Alarm button will appear Grey with Red text if that lane previously received the specified Error or Alarm, but is not currently receiving them.
- Selecting the lane's Error/Alarm button will show you the number of accumulated Errors/Alarms that lane has currently received.

CSA-MLD Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

CSA-MLD Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.

White with black text	No activity from this specific function.

For a list of available LEDs in the SONET protocol processor, see [CSA-MLD LEDs](#).

Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

Use the **Graph** button to view error and alarm results for the selected protocol processor. Graphs show the test history for either the current test or a previously saved test.

To use the graphs function:

1. Select a protocol processor that has been configured for Error Alarm testing.
2. From **Results**, select **Graph**. The Graph screen appears. It contains two graphs which allow you to display incoming alarms and errors.
3. Use the following buttons to control graphing parameters:
 - **Sample Rate** - Sets the timing for graph results at increments of 1 Second, 1 Minute, or 15 Minutes.
 - **Change Scale** - Compresses or expands the displayed time scale for the graphed errors and alarms at time intervals of 30 minutes, 90 minutes, 3 hours, 6 hours, 12 hours, 24 hours, or 72 hours.
 - **Change Upper** - Sets the type of errors or alarms that appear in the upper graph.
 - **Change Lower** - Sets the type of errors or alarms that appear in the lower graph.
 - **Shift Left and Shift Right** - Adjusts the graph's time scale to an earlier or later time.
 - **Print Report** - Prints a graph report to printer or file.
 - **Save Graphs** - Saves a graph to file as a .grp file that can be replayed at a later time.

 Important: This is not a text file; when replayed, it appears as the original graph plot. Choose *Print a Graph to Report* if you desire graph information that can be printed out.)

- **Replay Graphs/Stop Replay** - replays or stops saved graphs (.grp).

Test

Test Screens and Functions

(Specifically for CSA-MLD testing)

The Test screen configures test parameters associated with a CSA-MLD protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Signal Cond](#)
- [CFP Info](#)
- [Module Check](#)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

 To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed

	in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function

	Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

CSA-MLD Test - Signal Condition

The Signal Condition screen allows you to adjust the host board's CAUI and XLAUI properties for the 10.3125 GBaud electrical interface lanes (referred to as the Physical Lanes) .

 The following controls do not adjust any settings on the actual CFP module, just the Physical Lanes that communicate with the CFP.

Swing	Sets the transmit differential voltage Swing value in mV, for the Physical Lanes. Select "ALL" to adjust the Swing values for all of the lanes, or adjust each physical lane individually. Valid mV settings are: 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, 1000, 1050, 1100, 1150, 1200, or DEFAULT
PreEmph	Sets the pre-cursor transmit emphasis (Pre-Emphasis) value in dB, for the Physical Lanes.

	Select "ALL" to adjust the Pre-Emphasis values for all of the lanes, or adjust each physical lane individually. Valid dB settings are: 0.0, 0.75, 1.5, 2.5, or DEFAULT  Some values may not be allowed depending on the lane's Swing value. If the lane's Swing value is changed and if the current Pre-Emphasis value exceeds the highest setting allowed, the Pre-Emphasis value will default to the highest dB value available.
PostEmph	Sets the post-cursor transmit emphasis (Post-Emphasis) value in dB, for the Physical Lanes. Select "ALL" to adjust the Post-Emphasis values for all of the lanes, or adjust each physical lane individually. Valid dB settings are: 0.0, 1.0, 2.0, 3.5, 4.5, 6.0, or DEFAULT  Some values may not be allowed depending on the lane's Swing value. If the lane's Swing value is changed and if the current Post-Emphasis value exceeds the highest setting allowed, the Post-Emphasis value will default to the highest dB value available.
Equalize	Sets the receive Equalize value in dB, for the Physical lanes. Select "ALL" to adjust the Equalize values for all of the lanes, or adjust each physical lane individually. Valid Equalize value settings are: 0.15, 0.36, 0.74, 0.96, 1.98, 2.19, 2.71, 2.88, 4.15, 4.32, 4.64, 4.79, 5.20, 5.34, 5.54, 5.67, or DEFAULT
Gain	Sets the receive Gain value, for the Physical lanes. Select "ALL" to adjust the Gain values for all of the lanes, or adjust each physical lane individually. Valid Gain value range is from: 0 to 31, or DEFAULT

CSA-MLD Test - CFP Info

The CFP Info screen displays common MDIO register values, as programmed by the CFP's manufacturer, for the inserted CFP module.

The CFP Info screen can also be used to write to the CFP's MDIO register addresses as per the CFP MSA Management Interface Specification.



If the inserted CFP support Digital Diagnostics, then the following module information is displayed on the this screen and is also included in saved Module Check/Module Info report.



The following MDIO Reference Addresses are compliant with **CFP MSA Management Interface Specification** (100/40 Gigabit Transceiver Package Multi-Source Agreement), from the NVR 1 Table (basic ID registers) .

MDIO register	Description	CFP4 MSA Reference:
Module ID	Displays the CFP module's form-factor Identifier code. Example: CFP	CFP NVR 1, Hex Addr: 8000
Power Class:	Displays the CFP module's Power Class. Responses include: 1 (<= 8W max) 2 (<= 16W max) 3 (<= 24W max) 4 (<= 32W)	CFP NVR 1, Hex Addr: 8001
WDM Type:	Displays the CFP module's WDM Type. Responses include: Non-WDM CWDM LANWDM DWDM on 200G-grid DWDM on 100G-grid DWDM on 50G-grid DWDM on 25G-grid Other WDM Note: This field shall identify any optical grid spacing which is in use by the CFP module.	CFP NVR 1, Hex Addr: 8001

Connector Type:	Displays the CFP module's Connector Type. Responses include: Undefined, SC, LC, MT-RJ or MPO	CFP NVR 1, Hex Addr: 8002
Ethernet Code:	Displays what (if any) Ethernet application is supported by the CFP module. Responses include: 100GE SMF 10km, 100GE-LR4 100GE SMF 40km, 100GE-ER4 100GE MMF 100m OM3, 100GE-SR10 For future use 40GE SMF 10km, 40GE-LR4 40GE MMF 100m OM3, 40GE-SR4 40GE-CR4 Copper 100GE-CR10 Copper 40G BASE-FR Undefined	CFP NVR 1, Hex Addr: 8003
Fibre Chan Code:	Displays what (if any) Fibre Channel application is supported by the CFP module.	CFP NVR 1, Hex Addr: 8004
SONET/SDH Code:	Displays what (if any) SONET/SDH application is supported by the CFP module. Responses include: VSR2000-3R2 VSR2000-3R3 VSR2000-3R5 Undefined	CFP NVR 1, Hex Addr: 8006
OTN Code:	Displays what (if any) OTN application is supported by the CFP module. Responses include: VSR2000-3R2F VSR2000-3R3F VSR2000-3R5F VSR2000-3L2F VSR2000-3L3F VSR2000-3L5F OTL3.4 OTL4.4	CFP NVR 1, Hex Addr: 8007

	Undefined	
Media Type:	Displays the CFP module's transmission Media Type. Responses include: SMF, MMF (OM3) or Copper.	CFP NVR 1, Hex Addr: 800A
Signal Modulation:	Displays the CFP module's Signal Modulation.	CFP NVR 1, Hex Addr: 801A
Signal Coding:	Displays the CFP module's Signal Coding.	CFP NVR 1, Hex Addr: 801A
Additional Rates:	Displays all of the CFP module's supported Interface rates. Responses include: 39.8G, 43G, 41.25G, 103.125G and/or 111.8G	CFP NVR 1, Hex Addr: 8008
Vendor Name:	Displays the CFP module's Vendor (manufacturer) Name.	CFP NVR 1, Hex Addr: 8021-8030
Vendor OUI:	Displays the CFP module's Vendor OUI (Organizationally Unique Identifier).	CFP NVR 1, Hex Addr: 8031-8033
Part Number:	Displays the CFP module's Part Number (model number).	CFP NVR 1, Hex Addr: 8034-8043
Serial Number:	Displays the CFP module's Serial Number.	CFP NVR 1, Hex Addr: 8044-8053
Max Output Power:	Displays the CFP module's Maximum Optical Output Power level, per Optical Lane. The value in both mW and dBm are displayed. Example: 11.2 mW (10.5 dBm)	CFP NVR 1, Hex Addr: 801B
Max Input Power:	Displays the CFP module's Maximum Optical Input Power level, per Optical Lane. The value in both mW and dBm are displayed. Example: 2.8 mW (4.5 dBm)	CFP NVR 1, Hex Addr: 801C
Host Signal Spec:	Displays the CFP module's Host (Physical) Lane Signal Spec. Responses include: Unspecified, CAUI, XLAUI or SFI5.2	CFP NVR 1, Hex Addr: 8074
Network Lanes:	Displays the number of Network (Optical) Lanes supported by the CFP module.	CFP NVR 1, Hex Addr: 8009

	- The values of 1 through 15 represent the actual number of network lanes supported. - The value of 0 represents 16 network lanes supported.	
Host Lanes:	Displays the number of Host (Physical) Lanes supported by the CFP module. - The value of 0 represents 16 host lanes supported. - The values of 1 through 15 represent the actual number of host lanes supported.	CFP NVR 1, Hex Addr: 8009
Date Code:	Displays the CFP module's vendor (manufacturer) date, in the format YYYYMMDD. e.g., 20150310 = March 10, 2015	CFP NVR 1, Hex Addr: 8054-805B
Lot Code:	Displays the CFP module's Lot Code. Note: Nothing is returned if the Lot Code is unspecified.	CFP NVR 1, Hex Addr: 805C-805D
CLEI Code:	Displays the CFP module's CLEI (Common Language Equipment Identifier) code. Note: "Not present" is returned if the CLEI Code is unspecified.	CFP NVR 1, Hex Addr: 805E-8067
MSA HW Rev:	Displays the CFP module's MSA Hardware Specification Revision number. Example: 1.4	CFP NVR 1, Hex Addr: 8068
MSA MIS Rev:	Displays the CFP module's MSA Management Interface Specification Revision number. Example: 1.4	CFP NVR 1, Hex Addr: 8069
Hardware Version:	Displays the CFP module's Hardware Version number. Note: A value of 0.0 indicates that the vendor's Hardware Version number is unspecified.	CFP NVR 1, Hex Addr: 806A-806B

Firmware Version:	Displays the CFP module's Firmware Version number. Note: A value of 0.0 indicates that the vendor's Firmware Version number is unspecified.	CFP NVR 1, Hex Addr: 806C-806D

MDIO Access

This section allow users to **Read** and/or **Write** to specific **MDIO reference addresses**.

►Select the **Address** button to open a keypad that can used to enter the hexadecimal reference address.

►Select the **+** or **-** buttons to increment or decrement the hexadecimal reference address.

►Select the **Read** button to read the selected reference address current value, which displays as a four-digit hexadecimal number next to the **Data** button.

►Select the **Data** button to open a keypad that can used to enter a user-defined hexadecimal value to be written to the reference address.

►Select the **Write** button to send the user-defined Data value to the specified reference address.



The user-defined hexadecimal numbers can range from 0 to FFFF (leading 0's do not need to be entered).

CSA-MLD Test - Module Check

The Module Check screen provides the ability to quickly qualify the integrity of the installed CFP module before deployment with a simple Pass/Fail result.

- Verifies conformance of optical power level thresholds, line frequency offset, skew, and BERT tolerances.
- Supports transmit line frequency and skew offset generation options to further stress the modules
- Every parameter tested can be optionally enabled or disabled
- Each parameter is constantly monitored throughout the entire test duration
- Result reporting option includes test settings, test results, and the CFP MDIO information of the tested module

- User definable test parameters include:
 - All 40/100G Interface line rates and framed/unframed mappings
 - Pre-defined and user-defined test durations
 - Optical power high threshold (-20dBm/lane to +100dBm/lane)
 - Optical power low threshold (+30dBm/lane to -100dBm/lane)
 - Frequency wide threshold (+/- 0ppm to 120ppm)
 - TX frequency offset (-120ppm to +120ppm)
 - Excessive skew threshold (0 bits to 4158 bits)
 - TX skew offset (0 bits to 4158 bits)
 - Bit error threshold (fail on Any Error or above a user specified error-rate)
 - Pre-defined PRBS payload patterns

CSA-MLD LED Quick Status Area

When the CSA-MLD protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) Results screen.



Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.



Some of the LED's in the list below may or may not be visible on the GUI, depending on if the selected Interface supports that statistic or not.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Indicates current transmit interface setting and rate.
RX	Displays the received optical power in dBm. This status indicator will flash when one or more received Optical Lanes' power level exceeds the CFP's Power Warm or Power Hot thresholds.  This is an aggregate broadband power value, based on the combined power levels from all of the CFP's received Optical Lanes. See the CSA-MLD Receive - SIG screen for individual Optical Lane power levels.  If the CFP module has been removed, "Missing CFP" will be displayed.
E/A	Indicates the current Error / Alarm configured for transmission.
Test Paused	If red, indicates that the current test has been paused .
CLK	Indicates the value of the Transmit Clock Reference function. This is a status indicator.
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
<u>LOS</u>	Loss of Signal. A Red LED indicates an LOS alarm condition exists on one or more Optical Lanes. If no signal or an all-zeros pattern exists for 100 milliseconds or longer on an incoming Optical Lane, then an LOS alarm is reported for that Lane, and the LOS status LED turns Red.
LOA	Loss of Alignment. Indicates that the MLD has a loss of lane alignment and cannot de-skew the lanes relative to one another.

<u>Lane Details</u>	Lane Status LED. Indicates if any of the errors or alarms supported by the virtual Logic/PCS lanes are being received.
<u>LOF</u>	Loss of Frame. Indicates that one or more virtual lanes has received an OOF condition for at least 3ms.
<u>OOE</u>	Out Of Frame. Indicates that one or more virtual lanes has not found a consistent start of frame for 5 or more consecutive frames.
<u>AIS</u>	Alarm indication signal. Indicates that one or more virtual lanes is receiving an AIS alarm.
<u>SKEW</u>	Skew Bit Delay. Indicates the measured Skew delay in one or more virtual lanes is exceeding the RX Excessive Threshold setting.
<u>LOR</u>	Loss of Recovery. Indicates that one or more virtual lanes has received an OOR condition for at least 3ms.
<u>OOO</u>	Out Of Recovery. Indicates that one or more virtual lane assignment values has not been consistent for 5 or more consecutive frames.
<u>BLKLOC</u>	Block Lock Loss. Indicates that one or more virtual lanes is receiving a Loss of Block Lock alarm.
<u>ALMARK</u>	Alignment Mark. Indicates that one or more virtual lanes is receiving any Alignment Mark errors.
<u>SYNCHDR</u>	Synchronization Header. Indicates that one or more virtual lanes is receiving any Synchronization Header errors.
<u>BIP8</u>	Bit Interleaved Parity 8. Indicates that one or more virtual lanes is receiving any BIP 8 errors.

Lane Summary	<u>Lane Numbers/Positions</u>. Shows the status of each Logical or PCS virtual lane number, and the position number (in parentheses) that the received virtual lane number was assigned to. Unframed BERT interfaces will just show the received physical lane numbers. A Green LED indicates error-free operation, whereas a Red LED indicates a problem. Click on any Lane number to view that lane's error/alarm summary statistics.

MLD Specific Tasks

CSA-MLD Specific Tasks

This section covers procedures and information that are specific to the operation of the CSA-MLD protocol processor.

[CSA-MLD Miscellaneous Information](#)

[CFP Performance Verification](#)

CSA-MLD Miscellaneous Information

Block Lock

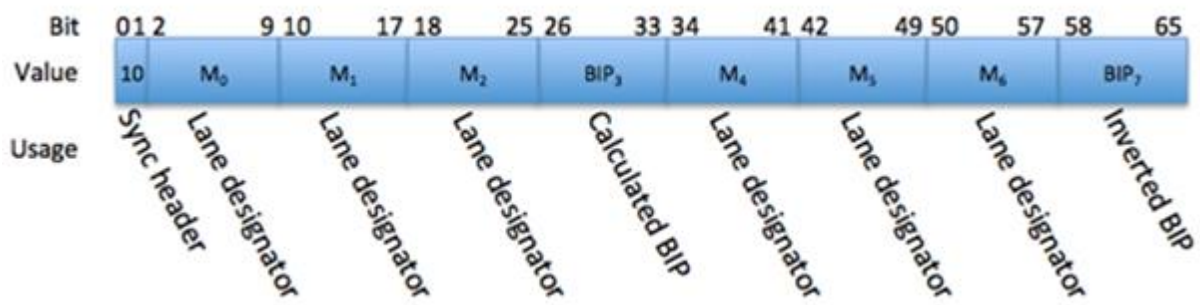
- Each block lock process looks for 64 valid sync headers in a row to declare lock. A valid sync header is either a 01 or a 10.
- Once in lock, the lock process looks for 65 invalid sync headers within a 1024 sync window to declare out of lock. An invalid sync header is either a 11 or a 00.
- Once block lock is achieved on a lane, then the alignment marker process starts.

Sync Header

- Blocks consist of 66 bits. The first two bits of a block are the synchronization header (sync header)
- Blocks are either data blocks or control blocks. The sync header is 01 for data blocks and 10 for control blocks. Thus, there is always a transition between the first two bits of a block
- The remainder of the block contains the payload. The payload is scrambled and the sync header bypasses the scrambler. Therefore, the sync header is the only position in the block that is always guaranteed to contain a transition
- This feature is used to obtain block synchronization

Alignment Marker

- Composed of a specially defined 66-bit block with a control block sync header
- Not scrambled in order for the receiver to find alignment marker, deskew the PCS lanes, and reassemble the aggregate stream before descramble
- Added after encoding and removed before decoding
- Inserted after every 16383 66-bit blocks on each PCS lane
- Room for the alignment markers is created by periodically deleting IPG
- Contains BIP field
- After all PCS lanes are aligned and deskewed, the PCS lanes are multiplexed together in the proper order to reconstruct the original stream of blocks and the alignment markers are deleted from the data stream. As part of the alignment marker removal process, the BIP3 field is compared to the calculated BIP value for each PCS lane
- Once in lock, a lane will go out of alignment marker lock if four markers are received in a row that do not match the alignment marker that the lane is currently locked to



Skew

- Skew (or relative delay) can be introduced between lanes by both active and passive elements of a link
- Skew is defined as the difference between the times of the earliest PCS lane and latest PCS lane for the one to zero transition of the alignment marker sync bits
- Note that the sync headers and alignment markers are added to the stream so that the receive PCS can align and deskew the PCS lanes

CSA-MLD Test - Module Check

The Module Check screen provides the ability to quickly qualify the integrity of the installed CFP module before deployment with a simple Pass/Fail result.

- Verifies conformance of optical power level thresholds, line frequency offset, skew, and BERT tolerances.
- Supports transmit line frequency and skew offset generation options to further stress the modules
- Every parameter tested can be optionally enabled or disabled
- Each parameter is constantly monitored throughout the entire test duration
- Result reporting option includes test settings, test results, and the CFP MDIO information of the tested module
- User definable test parameters include:
 - All 40/100G Interface line rates and framed/unframed mappings
 - Pre-defined and user-defined test durations
 - Optical power high threshold (-20dBm/lane to +100dBm/lane)
 - Optical power low threshold (+30dBm/lane to -100dBm/lane)
 - Frequency wide threshold (+/- 0ppm to 120ppm)
 - TX frequency offset (-120ppm to +120ppm)
 - Excessive skew threshold (0 bits to 4158 bits)
 - TX skew offset (0 bits to 4158 bits)
 - Bit error threshold (fail on Any Error or above a user specified error-rate)
 - Pre-defined PRBS payload patterns

CSA OTN Tab

CSA-OTN Overview

The CSA 4100 (40G/100G Service Analyzer) circuit pack's OTN (Optical Transport Network) protocol processor is the first Digital Lightwave module to offer the following OTN Interface rates on one circuit pack: OTU-3 (43.018G), OTU-3e1 (44.571G), OTU-3e2 (44.583G) and OTU-4 (111.809G); including PRBS, Null Client, SONET/SDH, GFP and Ethernet protocol mappings.



Available interface rates and mappings are dependent on the licensed-based test options currently enabled.



All currently licensed interface rates are displayed in the Interface menu, regardless of the rates supported by the currently inserted CFP module.



Verify that the inserted CFP module supports the desired Interface rate prior to selecting it.

The CSA-OTN Online Help is divided into the following sections:

- [CSA-OTN Screen and Functions Overview](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screens and Function Descriptions

CSA-OTN Screens and Functions Overview

This section of the online help system describes the various functions, buttons, and tabs that control CSA's OTN configuration and operation.

The following screens and functions are discussed:

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)

- [LEDs](#)

Transmit

CSA-OTN Transmit Screens and Functions

The transmit section allows you to configure the transmit signal parameters used in OTN operations.

The following transmit functionalities are available through the OTN Transmit screen:

- [Set 1](#)
- [Set 2](#)
- [OTN OH](#)
- [A/D OH](#)
- [ERROR & ALARM](#)

CSA-OTN Transmit - Set / Set 1

Use the Set 1 screen to configure CSA-OTN Transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.  Some settings such as Interface are always coupled, regardless of the Settings Control mode.
Passthru Mode	Activates or deactivates passthru mode, allowing an incoming OTN signal to pass through the unit without altering the data in the signal. The following options are available: On and Off .
Interface	Sets the OTN transmit interface rate. The following interface rates <u>may</u> be available:

	• OTU-4 (111.809G) OTL-4.10 • OTU-3e2 (44.583G) OTL-3.4 • OTU-3e1 (44.571G) OTL-3.4 • OTU-3 (43.018G) OTL-3.4  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it.  This setting is disabled when a CFP module is not inserted.  Not Assigned is displayed if a Non-OTN Interface is currently configured by another CSA tab.
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. <u>BITS/SETS.</u> • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to

	Internal. The <i>CLK:BITS 1.5MHz</i> displays when configured for BITS clocking. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The <i>CLK:SETS 2MHz</i> displays when configured for SETS clocking.
Mapping Note: The Mapping function is not available when the Interface shows Not Assigned	Selects the type of signals that are combined and inserted into the OTN transmit signal. For OTU-3, the following Mappings is supported: • SDH Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. • SDH Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. • SONET Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. • SONET Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. • PRBS: Inserts a PRBS payload pattern into the OTN frame • Null Client: Inserts an All Zeros payload pattern into the OTN frame • 41G LAN: 41G Ethernet mapped into OTU-3 • ODTU-03 (PT=21): Configures OTU-3 to be filled with 32 ODU-0's • ODTU-13 (PT=20): Configures OTU-3 to be filled with 16 ODU-1's • ODTU-13 (PT=21): Configures OTU-3 to be filled with 16 ODU-1's, each filled with 2 ODU-0's

	• ODTU-23 (PT=20): Configures OTU-3 to be filled with 4 ODU-2's, each filled with 4 ODU-1's • ODTU-23 (PT=21): Configures OTU-3 to be filled with 4 ODU-2's, each filled with 8 ODU-0's • ODTU-2e3 (PT=21): Configures OTU-3 to be filled with 3 ODU-2e's, each filled with 9 ODU-0's For OTU-4, the following Mappings is supported: • PRBS: Inserts a PRBS payload pattern into the OTN frame • Null Client: Inserts an All Zeros payload pattern into the OTN frame • 103G LAN: 103G Ethernet mapped into an OTU-4 • ODTU-04 (PT=21) - Configures OTU-4 to be filled with 80 ODU-0's • ODTU-14 (PT=21) - Configures OTU-4 to be filled with 40 ODU-1's, each filled with 2 ODU-0's • ODTU-24 (PT=21) - Configures OTU-4 to be filled with 10 ODU-2's, each filled with 8 ODU-0's • ODTU-2e4 (PT=21) - Configures OTU-4 to be filled with 10 ODU-2e's, each filled with 8 ODU-0's • ODTU-34 (PT=21) - Configures OTU-4 to be filled with 2 ODU-3's, each filled with 31 ODU-1's For OTU3e1 and OTU3e2, the following Mappings is supported: • PRBS: Inserts a PRBS payload pattern into the OTN frame • Null Client: Inserts an All Zeros payload pattern into the OTN frame  The available mapping options are dependent on the Interface rate selected, and the licensed-based test options currently enabled.  The Mapping function is not available when the Interface shows Not Assigned
Payload Pattern	Selects a test pattern to insert into the payload of an OTN signal, when the Mapping or ODU-0 Mapping is set to PRBS. Select one of the following:

	PRBS 9; PRBS 9 Inverted; PRBS 11; PRBS 11 Inverted; PRBS 15, PRBS 15 Inverted; PRBS 20; PRBS 20 Inverted; PRBS 23; PRBS 23 Inverted; PRBS 31; PRBS 31 Inverted; or a User Defined pattern (32-bit value)
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. - The frequency offset ranges from -120.0 to 120.0, in increments of 0.1 - The default value of 0 (zero) equals Off.  The Line Frequency Offset setting is only available when the Clock Reference is set to Internal timing.  This setting is coupled to the TX Line Frequency Offset setting on the CSA-MLD tab.
OPU Frequency Offset	Sets the Optical Channel Payload Unit (OPU) frequency offset in ppm.  The OPU Frequency Offset setting is only available for ODTU-03 or SONET/SDH Asynchronous mappings.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. Off. The unit's laser will be off when the unit is turned on. On. The unit's laser will be on when the unit is turned on. Restore Previous State. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Use the Set 2 screen to configure CSA-SONET Transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Trigger In	Determines how the protocol processor responds when an external +5v "pulse" is detected on the external Trigger In SMA connector. The following options are available: • None: The protocol processor will do nothing when an external pulse is received. (default setting) • Restart: The current test will restart when an external pulse is received. • Error Insert: The protocol processor will insert an error when an external pulse is received. For this to work, you must first select an Error Type to be inserted.
Scramble	Enables/disables the transmit Scramble option, as defined by G.709. The default value is Enable.
Forward Error Correction	Enables/disables the transmit Forward Error Correction (FEC), as defined by G.709. The default value is Enable.
TX Clock Loss Threshold	 This setting is not currently supported on the CSA module.

OTN Overhead

CSA-OTN Transmit - Overhead (OTN OH)

The OTN OH screen allows you to configure the following overhead signals:

[OTU](#)

[ODU-A](#)

[ODU-B](#)

[TCM](#)

[OPU](#)

[OH INTRUDE](#)

CSA-OTN Transmit - OTN OH / OTU

The following overhead options are available from the OTU screen.

Option	Description
OA1	Edits the first three bytes of the Frame Alignment Signal (FAS) OH. The default byte value is 1111 0110 (0xF6).
OA2	Edits the second three bytes of the FAS OH. The default byte value is 0010 1000 (0x28).
MFAS	Edits the Multiframe Alignment Signal OH byte. This byte is located in row1, column 7 of the OTU OH.
TTI	Trail Trace Identifier. The TTI OH byte defines the 64-byte TTI string. The TTI is part of the OTU Section Monitoring (SM) OH.  See SAPI, DAPI and Specific trace settings below.
BIP-8	Edits the OTU SM error detection code signal. It is a single byte that uses a Bit Interleaved Parity-8 code.
BEI/BDI/IAE/RES	The Backward Error Indication (BEI) and Backward Incoming Alignment Error (BIAE) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI.

	The Incoming Alignment Error (IAE) subfield is a single bit used to indicate a frame alignment error. This bit is set to 1 to indicate an IAE. Two bytes of the Section Monitoring overhead are reserved (RES) for future use.
GCC0-1 and GCC0-2	General Communication Channel 0, Byte 1 and Byte 2.
RES-1 and RES-2	Two bytes of the OTU overhead are reserved for future use.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

CSA-OTN Transmit - OTN OH / ODU-A

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-A, [ODU-B](#), and [TCM](#).

Use screen A of the Optical Channel Data Unit (ODU) Overhead to edit the Path Monitoring overhead and the Fault Type and Fault Location (FTFL) overhead bytes and messages. The FTFL is a 256-byte message that is divided into two parts: the Forward FTFL and the Backward FTFL.

Forward FTFL

The Forward FTFL consists of bytes 0 to 127 of the FTFL message.

Option	Description

Fault	Byte 0 is the Fault Identification field. It provides a fault status and uses the following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 1 through 9 are used for the Operator Identifier field.
OS	Bytes 10 through 127 are used for the Operator Specific field.

Backward FTFL

The Backward FTFL consists of bytes 128 to 255 of the FTFL message.

Option	Description
Fault	Byte 128 is the Fault Identification field. It provides a fault status and uses the following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 129 through 137 are used for the Operator Identifier field.
OS	Bytes 138 through 255 are used for the Operator Specific field.

ODU Path Monitoring Overhead

Option	Description
TTI	The ODU Trail Trace Identifier (TTI) is a single byte used for Path Monitoring to identify the 64-byte TTI signal message.
BIP-8	A single byte used to define the Error Detection Code signal, which is a Bit Interleaved Parity-8 (BIP-8) code.
BEI/BDI/STAT	The Backward Error Indication (BEI) and Backward Incoming Alignment Error (BIAE) subfield is a four-bit signal sent in the

	upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

Option	Description
TTI	The ODU Trail Trace Identifier (TTI) is a single byte used for Path Monitoring to identify the 64-byte TTI signal message.
BIP-8	A single byte used to define the Error Detection Code signal, which is a Bit Interleaved Parity-8 (BIP-8) code.
BEI/BDI/STAT	The Backward Error Indication (BEI) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.

DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

CSA-OTN Transmit - OTN OH / ODU-B

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: [ODU-A](#), ODU-B, and [TCM](#).

Use screen B of the ODU overhead to edit the following bytes.

Option	Description
RES-1 through RES-9	Nine bytes of the ODU overhead are reserved for future use. These bytes are set to all zeros.
EXP-1 and EXP-2	Two bytes of the ODU overhead are reserved for experimental use.
GCC1-1 and GCC1-2	General Communications Channel 1, Byte 1 and Byte 2.
GCC2-1 and GCC2-2	General Communications Channel 2, Byte 1 and Byte 2.
APS/PCC-1 through APS/PCC-4	Automatic Protection Switching and Protection Communication Channel, Byte 1, Byte 2, Byte 3, and Byte 4.

CSA-OTN Transmit - OTN OH / TCM

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: [ODU-A](#), [ODU-B](#), and TCM.

The ODU overhead contains six Tandem Connection Monitoring (TCM) fields. The following overhead bytes can be edited for each TCM field.

Option	Description

TCM Selection	Selects a specific TCM field (TCM1 through TCM6).
BIP-8	One byte of the ODU TCM overhead is used to identify an Error Detection Code signal, which is a BIP-8 signal.
BEI/BDI/STAT	The Backward Error Indication (BEI) and Backward Incoming Alignment Error (BIAE) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

CSA-OTN Transmit - OTN OH / OPU

Use this screen to edit the Optical Channel Payload Unit (OPU) bytes.

Option	Description
RES-1 through RES-3 and RES-5 through RES-8	Seven bytes of the OPU overhead are reserved for future use. These bytes are set to all zeros.
PT (PSI-0)	Payload Type. This byte identifies the type of signal mapped into an OPU.
Positive Adjust	Positive Justification Opportunity byte.

Negative Adjust	Negative Justification Opportunity byte.

 The OPU Positive and Negative Adjust buttons are only available for Asynchronous mappings.

CSA-OTN Transmit - OTN OH / INTRUDE

When the unit is in Passthru Mode, the Intrude option allows you intrude on selected byte data in a return signal.

To intrude upon a byte:

1. Select the **CSA-OTN** tab.
2. Select **Transmit** and **Set 1**.
3. Verify the **Passthru Mode** setting is set to **On**.
4. Select **OTN OH**.
5. Select the **Intrude** button. The Intrude screen appears displaying byte buttons.
6. Select the button that represents the byte you want to intrude upon. The button turns red while intruding on the byte.

 The Passthru mode feature cannot be tested with the unit looped back to itself.

CSA-OTN Transmit - A/D OH

The A/D OH settings apply to the additional layer of overhead bytes for lower ODU rate payloads that are multiplexed up to a higher OTU Interface rate.

The Transmit A/D OH screens become enabled when OTU-3 is configured for an ODTU-03 Add/Drop mapping.

 See the [CSA-OTN Transmit - OTN OH](#) section for a description of each of the transmit overhead bytes.

CSA-OTN Transmit - Error Alarm

Use this screen to configure and transmit OTN errors and alarms.

For information on inserting errors and alarms see the online help topics, [Inserting Errors](#) and [Inserting Alarms](#) in the Common Tasks section.

The following options are available on the OTN Errors and Alarms screen.

Option	Description
Error to Insert	Allows the user to select an error that is transmitted by the OTN signal. Selecting the Error to Insert button opens the Select Error Insert list. Available errors include: - FEC:UNCOR, FEC:COR, FRAME, MFAS, OTU:BIP8, OTU:BEI, ODU:BIP8, ODU:BEI, BIT, TCM1:BIP8 – TCM6:BIP8, and TCM1:BEI – TCM6:BEI (Note that FEC Correctable & Uncorrectable errors are inserted after the FEC wrapper is created.) Selecting More opens second page of Errors to Insert. - When testing ODTU-03 Add/Drop mapping, then the following Add/Drop error types are available: - FRAME, MFAS, ODU:BIP8, ODU:BEI, TCM1:BIP8 – TCM6:BIP8, and TCM1:BEI – TCM6:BEI - Selecting More again (or the first time when not testing ODTU-03), lists the Alarms to Burst list. Select an Alarm to burst (like error insertion), and then configure the Burst settings below. - OTU:IAE, OTU:BIAE, OTU:BDI, ODU:BDI, TCM1:BDI - TCM6:BDI, TCM1:BIAE - TCM6:BIAE
Error Insert Rate	Sets the insertion rate for the selected error type. This setting is not available if Error to Insert is set to None. The following options are available for this command. Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button.

	• 1e-X, where X is a value from 3 through 10. • User Defined: Allows you to enter and save a customized error insertion rate.  When an Alarm to Burst is selected, then "Periodic Burst" is displayed.
Error Burst Size	Sets the duration, either in Frames or MilliSec, for the alarm selected from the Alarms to Burst list to be inserted.  This option is not available unless an Alarm to Burst has been selected from the Error to Insert function.
Error Burst Period	Sets the elapsed time (in MilliSec) or Frame count between alarm insertion bursts. This is a repeating action.  This option is not available unless an Alarm to Burst has been selected from the Error to Insert function.
Alarm Generated	Generates a specific alarm that is transmitted by the OTN signal. The following alarms are available: • LOS, LOF, OOF, LOM, OOM, OTU:IAE, OTU:BIAE, OTU:BDI, ODU:AIS, ODU:LCK, ODU:OCI, ODU:BDI, TCM1:BDI – TCM6:BDI, TCM1:BIAE – TCM6:BIAE, and None.

Receive

CSA-OTN Receive Screens and Functions

The receive section allows you to configure the receive settings for the parameters used in OTN operations.

The following receive functionalities are available through the OTN Receive screen:

- [Set 1](#)
- [Set 2](#)

- [Set 3](#)
- [OTN OH](#)
- [A/D OH](#)
- [Capture](#)
- [SIG](#)

CSA-OTN Receive - Set / Set 1

Use the Set 1 screen to configure CSA-OTN Receive parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, settings established on the Receive screen will only affect Receive mode.  Some settings such as Interface are always coupled, regardless of the Settings Control mode.
Interface	Sets the OTN receive interface rate. The following interface rates <u>may</u> be available: • OTU-4 (111.809G) OTL-4.10 • OTU-3e2 (44.583G) OTL-3.4 • OTU-3e1 (44.571G) OTL-3.4 • OTU-3 (43.018G) OTL-3.4  The available interface rates are dependent on the licensed-based test options currently enabled.

	 All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it.  This setting is disabled when a CFP module is not inserted.  Not Assigned is displayed if a Non-OTN Interface is currently configured by another CSA tab.
Mapping	Selects the type of signals that are dropped out of the OTN receive signal. For OTU-3, the following Mappings is supported: • SDH Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. • SDH Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. • SONET Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. • SONET Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. • PRBS: Inserts a PRBS payload pattern into the OTN frame • Null Client: Inserts an All Zeros payload pattern into the OTN frame • 41G LAN: 41G Ethernet mapped into OTU-3 • ODTU-03 (PT=21): Configures OTU-3 to be filled with 32 ODU-0's • ODTU-13 (PT=20): Configures OTU-3 to be filled with 16 ODU-1's

- **ODTU-13 (PT=21):** Configures OTU-3 to be filled with 16 ODU-1's, each filled with 2 ODU-0's
- **ODTU-23 (PT=20):** Configures OTU-3 to be filled with 4 ODU-2's, each filled with 4 ODU-1's
- **ODTU-23 (PT=21):** Configures OTU-3 to be filled with 4 ODU-2's, each filled with 8 ODU-0's
- **ODTU-2e3 (PT=21):** Configures OTU-3 to be filled with 3 ODU-2e's, each filled with 9 ODU-0's

For **OTU-4**, the following Mappings is supported:

- **PRBS:** Inserts a PRBS payload pattern into the OTN frame
- **Null Client:** Inserts an All Zeros payload pattern into the OTN frame
- **103G LAN:** 103G Ethernet mapped into an OTU-4
- **ODTU-04 (PT=21)** - Configures OTU-4 to be filled with 80 ODU-0's
- **ODTU-14 (PT=21)** - Configures OTU-4 to be filled with 40 ODU-1's, each filled with 2 ODU-0's
- **ODTU-24 (PT=21)** - Configures OTU-4 to be filled with 10 ODU-2's, each filled with 8 ODU-0's
- **ODTU-2e4 (PT=21)** - Configures OTU-4 to be filled with 10 ODU-2e's, each filled with 8 ODU-0's
- **ODTU-34 (PT=21)** - Configures OTU-4 to be filled with 2 ODU-3's, each filled with 31 ODU-1's

For **OTU3e1** and **OTU3e2**, the following Mappings is supported:

- **PRBS:** Inserts a PRBS payload pattern into the OTN frame
- **Null Client:** Inserts an All Zeros payload pattern into the OTN frame



The available mapping options are dependent on the Interface rate selected, and the licensed-based test options currently enabled.



The Mapping function is not available when the Interface shows Not Assigned

Payload Pattern	Selects an expected test pattern in the payload of an OTN signal, when the Mapping (or ODU-0 Mapping) is set to PRBS. Select one of the following patterns: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
Power Low Threshold	This setting is not supported on the CSA-OTN tab.  Use the Power Low Threshold setting on the CSA-MLD tab.
Out of Frequency Threshold	Sets the threshold for which the Frequency Wide alarm occurs. When the received Line Frequency Offset (in ppm) exceeds the set threshold setting, the Frequency Wide alarm will occur. The threshold value is entered using an on-screen keypad, and can range from 0 ppm to 120.0 ppm in increments of 0.1 ppm. The default value is 0 ppm (Disabled).
Scramble	Enables/disables the received Scramble option, as defined by G.709. The default value is Enable.
Forward Error Correction	Enables/disables the received Forward Error Correction (FEC), as defined by G.709. The default value is Enable.
Trigger Out	Selects a specific receive event that will cause the protocol processor to generate a +5v "pulse" on the external Trigger Out SMA connector.

ODU-0 Mapping Note: The ODU-0 Mapping function is only available when the OTU-3 Mapping is configured for ODTU-03	Selects the type of signal expected in the foreground ODU-0 Mapping of the ODTU-03 receive signal. SDH Synchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-0 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. <i>(Requires an Add/Drop to an MSA circuit pack)</i> SDH Asynchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-0 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. <i>(Requires an Add/Drop to an MSA circuit pack)</i> SONET Synchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-0 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. <i>(Requires an Add/Drop to an MSA circuit pack)</i> SONET Asynchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-0 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. <i>(Requires an Add/Drop to an MSA circuit pack)</i> PRBS: The expected foreground ODU-0 Mapping is configured with a PRBS pattern. Null Client: The expected foreground ODU-0 Mapping is an All Zeros payload pattern. Transcoded 1000Base-X: The expected foreground ODU-0 Mapping is configured with a Transcoded 1000Base-X Payload. <i>(Requires OTN_GFP license)</i>
ODU-0 Dropped Note: The ODU-0 Mapping function is only available when the OTU-3 Mapping	Selects which or the 32 ODU-0 channels will be the demultiplexed (dropped) channel.

is configured for ODTU-03	

CSA-OTN Receive - Set / Set 2

Use the Set 2 screen to Enable and Disable the following CSA-OTN alarm reporting parameters:

- OTU SM TIM Alarm Reporting (OTU SAPI and DAPI - Trace Identifier Mismatch).
- ODU PM TIM Alarm Reporting (ODU SAPI and DAPI - Trace Identifier Mismatch).
- TCM #1 (Tandem Connection Monitoring #1) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #2 (Tandem Connection Monitoring #2) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #3 (Tandem Connection Monitoring #3) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #4 (Tandem Connection Monitoring #4) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #5 (Tandem Connection Monitoring #5) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #6 (Tandem Connection Monitoring #6) Alarm Reporting (with or without TIM Alarm Reporting)
- OPU PLM (Payload Label Mismatch) Alarm Reporting
- OPU Out of Frequency Threshold - Sets the threshold (in ppm) for which the OPU:Frequency Wide alarm occurs, based on the measured OPU Justify Frequency Offset. The default value is 0.0 (Disabled).

CSA-OTN Receive - Set / Set 3

Use the Set 3 screen to Enable and Disable the following ODTU-03 A/D alarm reporting parameters:

- A/D ODU PM TIM Alarm Reporting (A/D ODU SAPI and DAPI - Trace Identifier Mismatch).

- A/D TCM #1 (Tandem Connection Monitoring #1) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #2 (Tandem Connection Monitoring #2) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #3 (Tandem Connection Monitoring #3) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #4 (Tandem Connection Monitoring #4) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #5 (Tandem Connection Monitoring #5) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #6 (Tandem Connection Monitoring #6) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D OPU PLM (Payload Label Mismatch) Alarm Reporting
- A/D OPU Out of Frequency Threshold - Sets the threshold (in ppm) for which the Add/Drop OPU:Frequency Wide alarm occurs, based on the measured A/D OPU Justify Frequency Offset. The default value is 0.0 (Disabled).

 These settings are only available when the OTN Interface is configured for an ODTU Add/Drop mapping.

CSA-OTN Receive - OTN OH

The OTN Receive Overhead screen contains the following read-only functions.

Function	Options
OTU Overhead	Displays the Optical Channel Transport Unit (OTU) overhead bytes on the incoming signal. This is a read-only function. Use the SAPI and DAPI Expected buttons to configure expected OTU SAPI and DAPI trace values.  A Trace Identifier Mismatch (TIM) alarm will be trigger if the expected and received OTU SAPI and/or DAPI traces don't match, and if the OTU SM TIM Alarm Reporting setting is set to "Enabled".

ODU-A Overhead	Displays the first screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function. Use the SAPI and DAPI Expected buttons to configure expected ODU SAPI and DAPI trace values.  A Trace Identifier Mismatch (TIM) alarm will be trigger if the expected and received ODU SAPI and/or DAPI traces don't match, and if the ODU PM TIM Alarm Reporting setting is set to "Enabled".
ODU-B Overhead	Displays the second screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function.
TCM Overhead	Displays the Tandem Connection Monitoring (TCM) Overhead on the incoming signal. This is a read-only function. Use the TCM Selection button to select which of the 6 TCM channels to view. Use the SAPI and DAPI Expected buttons to configure expected SAPI and DAPI traces, for each TCM channel.  A Trace Identifier Mismatch (TIM) alarm will be trigger if the expected and received TCM SAPI and/or DAPI traces don't match, and if the specified channel's TCM Alarm Reporting setting is set to "Enabled with TIM".
OPU Overhead	Displays the Optical Channel Payload Unit (OPU) Overhead bytes and MSI bytes on the incoming signal. This is a read-only function. Use the PT (PSI-0) Expected button to configure expected OPU Payload Structure Identifier value.  An OPU:PLM (Path Label Mismatch) alarm will be trigger if the expected and received OPU PT (PSI-0) values don't match, and if the OPU PLM Alarm Reporting setting is set to "Enabled".
Received SAPI Trace	Displays the Source Access Point Identifier (SAPI) trace received on the incoming signal for OTU, ODU, and TCM1-TCM6 OH bytes.

Expected SAPI Trace	The Expected SAPI Trace is a User Defined setting that can be compared to the received SAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's SAPI alarm will increment if the received SAPI Trace is different than the Expected SAPI Trace setting.
Received DAPI Trace	Displays the Destination Access Point Identifier (DAPI) trace received on the incoming signal for OTU, ODU, and TCM1-TCM6 OH bytes.
Expected DAPI Trace	The Expected DAPI Trace is a User Defined setting that can be compared to the received DAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's DAPI alarm will increment if the received DAPI Trace is different than the Expected DAPI Trace setting.

CSA-OTN Receive - A/D OH

The A/D OH settings apply to the additional layer of overhead bytes for lower ODU rate payloads that are multiplexed up to a higher OTU Interface rate.

The Receive A/D OH screens become enabled when OTU-3 is configured for an ODTU-03 Add/Drop mapping.



See the [CSA-OTN Receive - OTN OH](#) section for a description of each of the received overhead bytes.

CSA-OTN Receive - Capture

Use the Capture screen to capture 256 bytes of received overhead bytes, before/after a triggered event occurs.

Function	Description			
Byte Select	Select the overhead byte to be captured. <table><tr><td>OTU:FAS OA1 1</td><td>ODU:TCM3 BIP</td><td>ODU:PM BIP</td></tr></table>	OTU:FAS OA1 1	ODU:TCM3 BIP	ODU:PM BIP
OTU:FAS OA1 1	ODU:TCM3 BIP	ODU:PM BIP		

	OTU:FAS OA1 2	ODU:TCM4 BIP	ODU:PM BEI
	OTU:FAS OA1 3	ODU:TCM5 BIP	ODU:EXP 1
	OTU:FAS OA2 1	ODU:TCM6 BIP	ODU:EXP 2
	OTU:FAS OA2 2	ODU:TCM1 BEI	ODU:GCC1 1
	OTU:FAS OA2 3	ODU:TCM2 BEI	ODU:GCC2 1
	OTU:MFAS	ODU:TCM3 BEI	ODU:GCC1 2
	OTU:SM TTI	ODU:TCM4 BEI	ODU:GCC2 2
	OTU:SM BIP	ODU:TCM5 BEI	ODU:APS PCC 1
	OTU:SM BEI	ODU:TCM6 BEI	ODU:APS PCC 2
	OTU:GCC0 1	ODU:RES 1	ODU:APS PCC 3
	OTU:GCC0 2	ODU:RES 2	ODU:APS PCC 4
	OTU:RES 1	ODU:RES 3	OPU:JC-1
	OTU:RES 2	ODU:RES 4	OPU:JC-2
	ODU:TCM1 TTI	ODU:RES 5	OPU:JC-3
	ODU:TCM2 TTI	ODU:RES 6	OPU:NJO
	ODU:TCM3 TTI	ODU:RES 7	OPU:PSI
	ODU:TCM4 TTI	ODU:RES 8	OPU:RES 1
	ODU:TCM5 TTI	ODU:RES 9	OPU:RES 2
	ODU:TCM6 TTI	ODU:TCM ACT	OPU:RES 3
	ODU:TCM1 BIP	ODU:FTFL	
	ODU:TCM2 BIP	ODU:PM TTI	
Capture Trigger	Select the Capture Trigger event.		
	FRAME ERROR	OOM ALARM	
	BIT ERROR	OTU:AIS ALARM	
	FEC:CORR ERROR	OTU:IAE ALARM	
	FEC:UNCORR ERROR	OTU:BDI ALARM	
	MFAS ERROR	POS JUSTIFY	
	OTU:BIP8 ERROR	NEG JUSTIFY	
	OTU:BEI ERROR	BYTE EQUAL	
	ODU:BIP8 ERROR	BYTE NOT EQUAL	
	ODU:BEI ERROR	MANUAL	
	LOM ALARM		

Match Value	This setting only appears when the Capture Trigger is set to "BYTE EQUAL" or "BYTE NOT EQUAL". Use the keypad to enter the byte value (in Hex) that the selected byte's received value will either need to "equal" or "not equal" in order to trigger the capture event.
Bytes After Trigger	When a Capture event has been triggered, 256 overhead byte values will be captured (from 0 to 255). This setting is used to specify how many of those 256 bytes should be captured immediately following the trigger, and in turn how many of those 256 bytes should be captured immediately preceding the trigger.  If 255 is entered (default), then the triggered byte value, and the following 255 byte values after the trigger event will be captured.  If 254 is entered (default), then the one byte immediately preceding the trigger, the triggered byte value, and the following 254 byte values will be captured.  If 100 is entered, then the 155 bytes immediately preceding the trigger, as well as the triggered byte value, and the following 100 byte values will be captured.  If 0 is entered, then the 255 bytes immediately preceding the trigger, as well as the triggered byte value will be captured, but 0 bytes after the trigger will be captured.
Action buttons	► Capture - Activates the capture feature, and changes the State to "Waiting for Trigger".  If the Capture Trigger setting is set to MANUAL, then the capture will immediately be triggered, otherwise the processor will wait until the selected Capture Trigger event occurs. ► Stop - Deactivates the capture feature, and changes the State from "Waiting for Trigger" to "Start", and re-enables the Capture button.

	► Reset - Clears the previously captured byte values
State	Displays the current state of the capture feature. Possible States include: ► Start ► Waiting for Trigger ► Done
OH CAPTURE RESULTS	When a capture event is triggered, the 256 captured bytes are displayed in both Hexadecimal and ASCII. The Frame column displays the frame number for each of the captures bytes. Frame numbers can range from -255 to 255, depending on the Bytes After Trigger setting. The Hex column displays each captured frame's byte value in Hexadecimal format. The ASCII column displays each captured frame's byte value in ASCII format. (A hex value o 0, will be displayed as blank)

CSA-OTN Receive - SIG (Signal Status)

Displays the following measurements of the incoming OTN signal:

- Line Frequency in Hz
- Line Frequency Offset Received in Hz and PPM
- Optical Power source in dBm (this is an aggregate power level when the CFP has multiple Optical lanes)



The per-lane optical power levels are displayed on the [CSA-MLD Receive - SIG](#) screen.

- OPU Justify Frequency Offset in PPM

 The OPU Justify Frequency measurement is only made when the OPU is configured for an Asynchronous Add/Drop mapping.

- A/D OPU Justify Frequency Offset in PPM

 The A/D OPU Justify Frequency measurement is only made when the A/D OPU is configured for an Asynchronous Add/Drop mapping.

Results

CSA-OTN Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The Results screen provides different ways of viewing received statistics. From the left side of the Result screen, select one of the following tabs:

- [Error / Alarm](#)
- [Event Log](#)
- [Large LED](#)
- [Graphs](#)

Error / Alarm

CSA-OTN Results - Error & Alarm

The Err screens provides the following options:

- [Scan](#)
- [Errors](#)
- [Add/Drop Errors](#)
- [Alarms](#)
- [Add/Drop Alarms](#)
- [Counts](#)

CSA-OTN Results - Error & Alarm - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

- For [Alarms](#), the duration is reported as a count in seconds.
- For [Errors](#), an error count is reported.
- The message **No Errors or Alarms** appears if no events are received by the unit.

CSA-OTN Results - Error & Alarm - Errors

The system can monitor and report errors on the incoming OTN signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the OTN network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **FRAME**
- **MFAS**
- **FEC:Uncorrected**
- **FEC:Corrected**
- **OTU:BIP8**
- **OTU:BEI**
- **ODU:BIP8**
- **ODU:BEI**
- **BIT**
- **TCM1:BIP8 – TCM6:BIP8**
- **TCM1:BEI – TCM6:BEI**

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

CSA-OTN Results - Error & Alarm - Add/Drop Errors

When OTU-3 is configured for ODTU-03 Add/Drop mapping, the system can monitor and report errors on the incoming Add/Drop ODU Mapping. The **Add/Drop Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the OTN network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **Add/Drop Frame**
- **Add/Drop MFAS**
- **Add/Drop ODU:BIP8**
- **Add/Drop ODU:BEI**
- **Add/Drop BIT**
- **Add/Drop TCM1:BIP8 – Add/Drop TCM6:BIP8**
- **Add/Drop TCM1:BEI – Add/Drop TCM6:BEI**

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

CSA-OTN Results - Error & Alarm - Alarms

The system can monitor and report alarms and their duration on the incoming OTN signal. The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- LOS
- Power Hot
- Power Warm
- Power Low
- Frequency Wide
- LOF
- OOF
- LOM
- OOM
- OTU:AIS
- OTU:IAE
- OTU:BIAE
- OTU:BDI
- OTU:SAPI
- OTU:DAPI
- ODU:AIS
- ODU:LCK
- ODU:OCI
- ODU:BDI
- ODU:SAPI
- ODU:DAPI
- TCM1:BDI – TCM6:BDI
- TCM1:BIAE – TCM6:BIAE
- TCM1:SAPI – TCM6:SAPI
- TCM1:DAPI – TCM6:DAPI
- OPU:C8 Sync
- OPU:PLM

- Paused
- Pat Sync

CSA-OTN Results - Error & Alarm - Add/Drop Alarms

When OTU-3 is configured for ODTU-03 Add/Drop mapping, the system can monitor and report alarms on the incoming Add/Drop ODU Mapping. The **Add/Drop Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- Add/Drop Pat Sync
- Add/Drop LOF
- Add/Drop OOF
- Add/Drop LOM
- Add/Drop OOM
- Add/Drop ODU:AIS
- Add/Drop ODU:LCK
- Add/Drop ODU:OCI
- Add/Drop ODU:BDI
- Add/Drop TCM1:BIAE – A/D TCM6:BIAE
- Add/Drop ODU:SAPI
- Add/Drop ODU:DAPI
- Add/Drop TCM1:BDI – A/D TCM6:BDI
- Add/Drop TCM1:SAPI – A/D TCM6:SAPI
- Add/Drop TCM1:DAPI – A/D TCM6:DAPI
- Add/Drop OPU:PLM

CSA-OTN Results - Error & Alarm - Counts

The Count screen displays the following statistics:

Count	Description
Positive Justification	Reports the total number of Positive OPU Justification counts.
Negative Justification	Reports the total number of Negative OPU Justification counts.
Justification Seconds	Reports the total duration of OPU Justifications in seconds.
Add/Drop Positive Justification	Reports the total number of Positive Add/Drop OPU Justification counts.
Add/Drop Negative Justification	Reports the total number of Negative Add/Drop OPU Justification counts.
Add/Drop Justification Seconds	Reports the total duration of Add/Drop OPU Justifications in seconds.

CSA-OTN Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

CSA-OTN Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the OTN protocol processor, see [CSA-OTN LEDs](#).

CSA-OTN Results - Graph

The Graph function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Test

Test Screens and Functions

(Specifically for CSA-OTN testing)

The Test screen configures test parameters associated with a CSA-OTN protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [RTD](#)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration**: This function configures how long a timed test runs for.
- **Action After Duration**: This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test**: This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.

1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is

 This option appears when Repeat Actions is selected.	stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the

 This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for CSA-OTN testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For OTU-4 one frame duration is roughly 0.001 ms (1.168 μ s)
- ▶ For OTU-3 one frame duration is roughly 0.003 ms (3.035 μ s)
- ▶ For OTU-3e1 one frame duration is roughly 0.003 ms (2.929 μ s)
- ▶ For OTU-3e2 one frame duration is roughly 0.003 ms (2.928 μ s)
- ▶ For all SONET and SDH rates one frame is roughly .125 ms (125 μ s)

Test Service Disruption functions include:

- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.



For all **OTN** processors the Protection Switch Criteria include: **OOF**, **OTU-AIS**, **OTU-BIP8**, **ODU-AIS**, **ODU-BIP8**, and **BIT** (Bit Errors and Loss of Pattern Sync).

- **Good Time** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ The range for OTU-4 is 0.001 to 19.130 ms, and is entered using a keypad.
 - ▶ The range for OTU-3 is 0.003 to 49.722 ms, and is entered using a keypad.
 - ▶ The range for OTU-3e1 is 0.003 to 47.990 ms, and is entered using a keypad.
 - ▶ The range for OTU-3e2 is 0.003 to 47.977 ms, and is entered using a keypad.
- **Good Frames** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range is 1 to 16383 frames, and is entered using a keypad.
- **Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Switch Frames** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5).
- **History Recent Frames**: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
OTU 4	0.001 ms (1.168 μ s)	16383 frames (19.130 ms)
OTU 3	0.003 ms (3.035 μ s)	16383 frames (49.722 ms)
OTU 3e1	0.003 ms (2.929 μ s)	16383 frames (47.990 ms)
OTU 3e2	0.003 ms (2.928 μ s)	16383 frames (47.977 ms)
SONET / SDH	0.125 ms (125 μ s)	16383 frames (2047.875 ms)

Test - RTD (Round-Trip Delay)

(Specifically for CSA-OTN testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State):** Starts and stops round-trip delay mode.
 - **Single Round-Trip Delay** - If selected, an ODU-BIP8 alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the ODU-BIP8 frame is received by the unit. Milliseconds indicates how long it took for the ODU-BIP8 frame to travel out and return to the unit.
 - **Continuous Round-Trip Delay** - If selected, an ODU-BIP8 alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The

fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

▶ **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.

- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames detected after each errored frame is transmitted and return back to the unit.

▶ The **Current** column displays the most recent round trip measurement.

▶ The **Minimum** column displays the fastest round trip measurement.

▶ The **Maximum** column displays the slowest round trip measurement

- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before round-trip measurements stop accumulating.

▶ The range for OTU-4 is 0.001 to 19.130 ms, and is entered using a keypad.

▶ The range for OTU-3 is 0.003 to 49.722 ms, and is entered using a keypad.

▶ The range for OTU-3e1 is 0.003 to 47.990 ms, and is entered using a keypad.

▶ The range for OTU-3e2 is 0.003 to 47.977 ms, and is entered using a keypad.

- **Consecutive Good Frames Required:** This function allows you to enter the number of consecutive error-free frames to occur before round-trip measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

CSA-OTN LED Quick Status Area

When the CSA-OTN protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) Results screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Indicates current OTN transmit interface setting and rate.  If a non-OTN interface is selected from one of the other CSA tabs, then "Not Assigned" will be displayed.  If the CFP module has been removed after an OTN interface was selected, "No Laser" will be displayed.
RX	Displays the received optical power in dBm. This status indicator will flash when one or more received Optical Lanes' power level exceeds the CFP's Power Warm or Power Hot thresholds.  This is an aggregate broadband power value, based on the combined power levels from all of the CFP's received Optical Lanes. See the CSA-MLD Receive - SIG screen for individual Optical Lane power levels.  If the CFP module has been removed, "Missing CFP" will be displayed.
E/A	Indicates the current Error / Alarm configured for transmission in the OTN signal. This is a status indicator.

Test Paused	If red, indicates that the current test has been paused .
CLK	Indicates the value of the Transmit Clock Reference function. This is a status indicator.
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
OTU	Optical channel Transport Unit. Indicates current error, alarm, and event activity for the OTU Section Monitoring. This is a status LED.
AIS	Alarm Indication Signal (OTU). This is an alarm LED.
LOS	Loss of Signal. Indicates that a valid OTN signal is not being received. This is an alarm LED.
BDI	Backward Defect Indication (OTU). This is an alarm LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming signal has been detected. This is an alarm LED.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
UNCOR	Forward Error Correction:Uncorrectable. This is an error LED.
COR	Forward Error Correction:Correctable. This is an error LED.

LOM	Loss of Multiframe. This is an alarm LED.
OOM	Out of Multiframe. This is an alarm LED.
BIP8	Bit Interleaved Parity 8 (OTU). This is an error LED.
BEI	Backward Error Indication (OTU). This is an error LED.
IAE	Incoming Alignment Error (OTU). This is an alarm LED.
BIAE	Backward Incoming Alignment Error (OTU). This is an alarm LED.
ODU	Optical channel Data Unit. Indicates current error, alarm, and event activity for the ODU Path Monitoring. This is a status LED.
BIP8	Bit Interleaved Parity 8 (ODU). This is an error LED.
BEI	Backward Error Indication (ODU). This is an error LED.
AIS	Alarm Indication Signal (ODU). This is an alarm LED.
LCK	Lock Indication (ODU). This is an alarm LED.
OCI	Open Connection Indication (ODU). This is an alarm LED.

BDI	Backward Defect Indication (ODU). This is an alarm LED.
<u>TCM Summary</u>	Tandem Connection Monitoring (ODU). This is a Summary LED that indicates if a TCM error or alarm has been detected on any TCM channel. See OTN TCM Summary LEDs for specific TCM error and alarm types.  If this LED is red, click the LED text (<u>TCM Summary</u>) to display a detailed LED window with all of the ODU TCM errors and alarms for TCM:1 to TCM:6.
C8 SYNC	C8 Synchronization (OPU). This is an alarm LED.
C8 CRC8	C8 Cyclic Redundancy Check-8 (OPU). This is an error LED.
Add/Drop OTU	Add/Drop Optical channel Transport Unit. Indicates if the Add/Drop mapping is detecting any OTU Section Monitoring alarms such as LOF, OOF, LOM, or OOM. This is a Summary LED.
Add/Drop ODU	Add/Drop Optical channel Data Unit. Indicates current error, alarm, and event activity for the Add/Drop ODU Path Monitoring. This is a status LED.
BIP8	Bit Interleaved Parity 8 (A/D ODU). This is an error LED.
BEI	Backward Error Indication (A/D ODU). This is an error LED.
AIS	Alarm Indication Signal (A/D ODU). This is an alarm LED.
LCK	ODU Lock Indication (A/D ODU). This is an alarm LED.

OCI	Open Connection Indication (A/D ODU). This is an alarm LED.
BDI	Backward Defect Indication (A/D ODU). This is an alarm LED.
<u>TCM Summary</u>	Tandem Connection Monitoring (A/D ODU). This is a Summary LED that indicates if a TCM error or alarm has been detected on any Add/Drop TCM channel. See OTN TCM Summary LEDs for specific TCM error and alarm types.  If this LED is red, click the LED text (<u>TCM Summary</u>) to display a detailed LED window with all of the A/D ODU TCM errors and alarms for TCM:1 to TCM:6.
PAT SYNC	Loss of Pattern Synchronization. Displays the status of loss of Pattern Synchronization on any active details channel.  This LED is <u>not</u> displayed if the Mapping is set to SONET or SDH or GFP, or if the Receive Payload Pattern is set to Live.
BIT ERR	Payload Bit error. This is an error LED, that indicates a Bit error in the received foreground payload pattern was detected..  This LED is <u>not</u> displayed if the Mapping is set to SONET or SDH or GFP, or if the Receive Payload Pattern is set to Live.

Specific Tasks

CSA-OTN Specific Tasks

This section includes tasks that are specific to the CSA-OTN protocol processor (G.709 compliant).

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

This section of the online help system discusses the following topics:

- [ODTU-jk Add/Drop Mappings](#)
- [OTN TX Wavelengths and RX OPM](#)
- [Enabling/Disabling OTN FEC Mode](#)
- [Enabling/Disabling OTN Scramble Mode](#)
- [Monitoring OTN SAPI and DAPI Traces](#)

ODTU-jk Add/Drop Mappings (CSA-OTN)

For CSA-OTN, the Optical channel Data Tributary Unit j into k (ODUj into OTUk) Add/Drop Mapping allows multiple lower ODU/OPU mappings to be multiplexed up to, and demultiplexed out of a higher OTU Interface rate.

For **OTU-3**, the following **ODTU-jk** mappings are supported:

- **ODTU-03 (PT=21)** - Allows OTU-3 to be filled with 32 ODU-0's
- **ODTU-13 (PT=20)** - Allows OTU-3 to be filled with 16 ODU-1's
- **ODTU-13 (PT=21)** - Allows OTU-3 to be filled with 16 ODU-1's, each filled with 2 ODU-0's
- **ODTU-23 (PT=20)** - Allows OTU-3 to be filled with 4 ODU-2's, each filled with 4 ODU-1's
- **ODTU-23 (PT=21)** - Allows OTU-3 to be filled with 4 ODU-2's, each filled with 8 ODU-0's
- **ODTU-2e3 (PT=21)** - Allows OTU-3 to be filled with 3 ODU-2e's, each filled with 9 ODU-0's

For **OTU-4**, the following **ODTU-jk** mappings are supported:

- **ODTU-04 (PT=21)** - Allows OTU-4 to be filled with 80 ODU-0's
- **ODTU-14 (PT=21)** - Allows OTU-4 to be filled with 40 ODU-1's, each filled with 2 ODU-0's
- **ODTU-24 (PT=21)** - Allows OTU-4 to be filled with 10 ODU-2's, each filled with 8 ODU-0's
- **ODTU-2e4 (PT=21)** - Allows OTU-4 to be filled with 10 ODU-2e's, each filled with 8 ODU-0's
- **ODTU-34 (PT=21)** - Allows OTU-4 to be filled with 2 ODU-3's, each filled with 31 ODU-1's

 These are licensable options. Please contact [Tech Support](#), or your VeEX sales representative, to enable this option on your NIC unit.

OTN TX Wavelengths and RX Optical Power Measurements

The OTN protocol processor utilizes hot-swappable **SFP** (for OTU-1), **XFP** (for OTU-2) and **CFP** (for OTU-3 and OTU-4) laser technology, which are equipped with their own internal digital diagnostics tools. The internal diagnostics of these modules provide the transmit laser wavelength, and are capable of measuring the received optical power levels.

TX: Indicates current OTN transmit interface wavelength.

- Wavelengths are laser specific. To change the wavelength, simply hot-swap the laser module.

 **WARNING:** Always turn the TX Laser off before hot-swapping SFP or XFP modules.

- When the laser module has been removed after an OTN interface was selected, "No Laser" will be displayed.
- When the laser module is hot-swapped, the laser's transmit wavelength will automatically update for the new laser module.

 If a non-OTN interface is selected from one of the other tabs, then "Not Assigned" will be displayed.

RX: Displays the received optical power in dBm.

- This status indicator will flash when the received optical power level exceeds the SFP's/XFP's **Power Warm** or **Power Hot** thresholds. See Power Hot, Power Warm and Power Low Alarms for details.

This information is then fed to the user interface, and is displayed on the [LED Quick Status Area](#) just below the Laser button.

Enabling/Disabling OTN Scramble Mode

1. Select the **OTN** tab.
2. Select **Transmit** and **Set**.
3. Select the **SET 2** button from the Transmit/Set window.
4. Select **Scramble** and then **Enable** or **Disable**.



If the Transmit and Receive Settings Control is set to Couple, Scramble is automatically changed under the Receive settings. If Settings Control is set to **Independent**, then Scramble mode can be changed for the receive signal by selecting **Receive**, **SET 1**, and changing the **Scramble** setting.



Disabling both **Forward Error Correction** and **Scrambling** at the same time may cause a Loss of Frame condition due to a lack of sufficient zero to one transitions for valid data/clock recovery.

Enabling/Disabling OTN FEC Mode

1. Select the **OTN** tab.
2. Select **Transmit** and **Set**.
3. Select the **SET 2** button from the Transmit/Set window.
4. Select **Forward Error Correction** and then **Enable** or **Disable**.



If the Transmit and Receive Settings Control is set to Couple, FEC is automatically changed under the Receive settings. If Settings Control is set to **Independent**, then FEC mode can be changed for the receive signal by selecting **Receive**, **SET 1**, and changing the **Forward Error Correction** setting.



Disabling both **Forward Error Correction** and **Scrambling** at the same time may cause a Loss of Frame condition due to a lack of sufficient zero to one transitions for valid data/clock recovery.

Monitoring OTN SAPI and DAPI Traces

1. Select the **Receive** button from the **OTN** tab.
2. Select the **OTN OH** tab along the left side of the screen.
3. Select one of the following OTN sections:

OTU, ODU-A, or TCM,

4. The incoming SAPI, DAPI, and Operator Specific traces are decoded from the OTN Overhead, and appear in ASCII format at the bottom of the screen.
5. Expected SAPI or DAPI trace values can also be defined, and the NIC can be setup to display **Trace Identifier Mismatch** (TIM) alarms if the incoming SAPI or DAPI traces do not match what is expected.
6. OTU, ODU, and TCM TIM alarms can be individually enabled from the [SET 2](#) window.



SAPI and DAPI TIM alarms occur when the incoming trace does not match the expected trace, and the TIM Alarm Reporting has been enabled for that trace. There are no LEDS associated with TIM alarms; however TIM alarm durations appear on the Results Scan and Alarm screens .

CSA PACKET Tab

CSA-Packet Overview

The CSA 4100 (40G/100G Service Analyzer) circuit pack is the first Digital Lightwave module to offer 41Gbps and 103Gbps Optical Ethernet Interfaces, with support for pluggable CFP modules.



Available interface rates and mappings are dependent on the licensed-based test options currently enabled.



All currently licensed interface rates are displayed in the Interface menu, regardless of the rates supported by the currently inserted CFP module.



Verify that the inserted CFP module supports the desired Interface rate prior to selecting it.

From the CSA-Packet protocol processor tab, users can perform high-speed packet-level testing on up to 32 Ethernet streams (complying with IEEE 802.3ba) for traffic generation and analysis, including RFC-2544 (throughput, frame loss, latency, and Back to Back Burst) testing, ITU-T Y.1564 Ethernet service testing, and Service Disruption testing.

The CSA-Packet Online Help is divided into the following sections:

- [CSA-Packet Screens Functions and Descriptions](#)
- [CSA-Packet Specific Tasks](#)

Screens and Function Descriptions

CSA Packet Tab - Screen Functions and Descriptions Overview

(Specifically for LAN/WAN Ethernet testing)

This section of the online help system describes the various functions, buttons, and tabs that control CSA's Packet configuration and operation (41Gbps and 103Gbps optical LAN Interfaces).

The following screens and functions are discussed:

- [Config](#)
- [Standard Tests](#) (RFC-2544 and Y.1564)

- [Results](#)
- [Test](#)
- [LEDs](#)

Config

CSA-Packet - Config Screens and Functions

The Config screen contains the following functions:

- [Set](#)
- [Strms Pg 1 & Strms Pg 2](#)
- [Traffic Stream Profile](#)
- [Error Alarm](#)

Config - Set screen

(Specifically for Ethernet testing on the CSA-Packet tab)

The **Config > Set** (Settings Configuration) screen allows you to define the CSA-Packet tab's Ethernet parameters that will be used to generate a traffic flow into the network. Up to 32 different streams can be generated simultaneous.

The following functions appear on the Settings Configuration screen:

Function	Description

Mode	Selects which Ethernet interface rate to test. • 103 Gbps optical LAN • 41 Gbps optical LAN  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it.  This setting is disabled when a CFP module is not inserted.  Not Assigned is displayed if a Non-Packet Interface is currently configured by another CSA tab.				
Status	Displays the configured Mode setting.				
Reflect	Allows the user to start IP Packet Reflection Mode. Valid options are: <table border="1"> <tr> <td>Digital Lightwave Packets Only</td><td> This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source. </td></tr> <tr> <td>All Non-Routing Packets</td><td>This will reflect back all data packets, not just from Digital Lightwave test</td></tr> </table>	Digital Lightwave Packets Only	This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source.	All Non-Routing Packets	This will reflect back all data packets, not just from Digital Lightwave test
Digital Lightwave Packets Only	This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source.				
All Non-Routing Packets	This will reflect back all data packets, not just from Digital Lightwave test				

		units, but it will not reflect Routing packets such as ARP and negotiation.
	Thru Mode	This will pass through every data packet that is received.
	Off	Turns Reflection mode Off
Flow Control	Enables or Disables Flow Control.  Important: Flow Control must be enabled in order to count Pause Packets.	
Pause	Allows the user to generate Pause frames for a specific Pause Quanta value. Valid values are: 1 to 65535  Important: Flow Control must be enabled in order to count Pause Packets.  Important: Pause is not available when IP Reflection is enabled.  For more information, see the Inserting a Pause (Flow Control) into a Stream specific task.	

VLAN RX TPID	Filters the Stream Results RX packet count by the Streams VLAN TPID values. Each DLI test Stream can contain up to (4) stacked VLAN tags, (1) S-VLAN (service provider) tag and up to (3) C-VLAN (customer) tags, each with a unique TPID (Tag Protocol Identifier) value. The VLAN RX TPID section allows the processor to only count those packets whose VLAN TPID are specified by the TPID filter options. Four filters are available, "A" through "D". Filter "A" is mandatory and always enabled, "B" through "D" are optional.  Each filter has a menu that allows the user to select a predefined TPID value (0x8100, 0x88A8, 0x9100 and 0x9200), or enter a user defined value.
Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Packets - Displays the total number of packets sent and received since the test was started • Pkts/sec - Displays the current rate of packets sent and received in packets per second • Bytes - Displays the total number of bytes sent and received since the test was started • Mbit/sec - Displays the current rate of packets sent and received in Megabits per second • %BW - Displays the current percentage of bandwidth of packets sent and received

Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • Off - The unit's laser will be off when the unit is turned on. • On - The unit's laser will be on when the unit is turned on. • Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Config - Strms Pg 1 and Strms Pg 2

(Specifically for LAN/WAN Ethernet testing)

The **Config > Strms Pg 1 and Strms Pg 2** (Streams Page 1 and Page 2) screens allow up total of 32 test streams to be simultaneously generated and tested, per port.



The **Strms Pg 1** side tab is used to control Streams 1 through 16, and **Strms Pg 2** controls Streams 17 through 32.

On/Off Checkboxes (1-32)	Enables packet generation for the specified Stream Id.  When enabled (on) the selected stream will begin transmitting packet at the Rate specified in the Traffic Stream Profile dialog box. By default, each stream is configured for 1.00% BW.  If the total configured bandwidth for all streams enabled exceeds 100%, the processor will evenly scale back the actual rates generated to achieve a maximum bandwidth of exactly 100%.
All	Selecting All with Enable/Disable all 32 test streams simultaneously.  If one or more streams are currently enabled, then All disables all enabled streams. If no streams are currently enabled, then All enables all test streams on both Pg1 and Pg2.

	💡 If the total configured bandwidth for all streams enabled exceeds 100%, the processor will evenly scale back the actual rates generated to achieve a maximum bandwidth of exactly 100%.

The parameters for each test stream are displayed in the Stream Profile Table as individual rows, with a horizontal scroll bar at the bottom that can be used to see all of the columns in the table.

Selecting a Stream (row) from the profile table opens the [Traffic Stream Profile](#) dialog box from which the stream parameters are configured.

These are the columns displayed in the **Stream Profile Table**, in order by the default arrangement:

Column	Description
TX Status	Indicates whether streams 1-32 are being transmitted (On) or not being transmitted (Off)
Traffic	Displays the configured transmit Rates (in %BW) for each stream.
MAC Dest	Destination MAC address
Length	Frame Length
IP Mode	IPv4 or IPv6 💡 The CSA board currently only supports IPv4
Payload	Payload Pattern selected
VLAN Levels	The number of stacked VLAN tags enables (1 through 4, or N/A for none)
MPLS Levels	The number of stacked MPLS tags enables (1 through 4, or N/A for none) 💡 The CSA board currently only supports VLAN tagging
IP Dest	Destination IP address
UDP Dest	UDP Destination Port
MAC Src	Source MAC address

IP Src	Source IP address
UDP Src	UDP Source Port
IP TOS	IPv4 - IP Type of Service
IP TTL	IPv4 - IP Time to Live
IP FRAG	IPv4 - Select whether to allow or disallow IP fragments
IP TC	IPv6 - Traffic Class (hexadecimal number)
IP HOP	IPv6 - Hop Limit
IP FLOW	IPv6 - Flow Label

Send Burst	The Send Burst button will generate a single burst of packets on the selected stream id, for the number of packets specified by the Burst Size setting, when the selected stream is turned off.  The default Burst size is 1 frame, however you can edit the stream's Burst Size setting from the stream's Profile window. Burst sizes can range from 1 to the maximum number of packets per second.

COL button	The COL button allows the user to rearrange the Stream Profile Table's columns display. To use the Rearrange Columns feature: 1. Select the Col button, to display the Rearrange Columns dialog box. 2. In the Rearrange Columns dialog box, select the Columns button to display the Select Next Column dialog box.

3. In the **Select Next Column** dialog box, select the button for the associated description to appear as the first column (from left to right) in table. The **Select Next Column** dialog box disappears and your selection appears in the top row of **Column** dialog box display window.
4. Again, in the **Rearrange Columns** dialog box, select the **Columns** button to re-display the **Select Next Column** dialog box.
5. In the **Select Next Column** dialog box, select another button for the associated description to appear as the next column (from left to right) in the table. The **Select Next Column** dialog box disappears again and this selection now appears above the previous selection in the **Column** dialog box display window. .
6. Repeat Steps 4 and 5 to select the chosen however many of the remaining entries in the **Select Next Column** dialog box you wish to re-order.
7. There are two choices for submitting the selected column display order: (1) Selecting the **Apply** button retains the column display order settings until the next time the unit's power is cycled; (2) Selecting the **Save** button retains the column display order settings indefinitely.



The **Columns** settings entered locally on the touch screen panel and those entered via a remote connection are completely independent of each other. The remote settings are saved on the remotely connected PC, while the local settings are saved in the unit. The **Clear** button can be used to clear the entries in the **Rearrange Columns** dialog box display window, should you want to rearrange the existing order in the display window. The **Cancel** button can be used to cancel out of the operation without changing the existing column display order. Clicking on the **Apply** button when no items are listed in the display window will set up the default columns display order.

Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Packets - Displays the total number of packets sent and received since the test was started • Pkts/sec - Displays the current rate of packets sent and received in packets per second • Bytes - Displays the total number of bytes sent and received since the test was started • Mbit/sec - Displays the current rate of packets sent and received in Megabits per second • %BW - Displays the current percentage of bandwidth of packets sent and received

Traffic Stream Profile Configuration

(Specifically for LAN/WAN Ethernet testing)

A packet stream's profile defines the type, size, content, destination address, and source addresses for the frame.



The stream protocol supported is UDP/IP.

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select any of the streams in the Stream Profile Table.

Parameter	Description
Stream ID #	Displays the Stream ID # that the settings are being modified for.  The title bar of this Traffic Stream Profile window also shows which Stream ID # is currently selected.

Dest Port	Sets the Destination Port. The default is “same”. This setting is mainly useful for RFC2544 testing where the test involves sending packets and evaluating received packets for lost packages, latency and other factors. These test can be done using only one port or sending on one port and receiving on another.  This setting is only available on protocol processors that support more than on Port, such as Dual Enet and HDEnet.
Auto Setup Peer	Check “auto setup peer”, and when “Save All” is selected Stream on the Destination Port will automatically be configured to mirror the source port's IP and MAC addresses, swapping the Source and Destination values. This function will also configure the affected Stream with the same values for all of the other stream settings such as; Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc., when the “Save All” button is selected.  This setting is only available on protocol processors that support more than on Port, such as Dual Enet and HDEnet, and is only applicable if Destination Port is set to anything except “Same”.
ARP Request	Each stream can either have the ARP Request setting enabled or disabled. When ARP Request is enabled, the stream's IP Src and MAC Src settings become disabled, and the Port Source IP Address and MAC settings located on the Config > Set screen will be used by the stream.  The stream's Destination MAC Address also becomes disabled, and when the stream's transmission is turned On, an ARP request is performed on the Port. The connected device's source MAC address obtained from the ARP request's reply is then automatically configured as the stream's MAC Dest address setting.  The CSA board does not support this feature.

Multi Stream Config	Automatically increments the Source and Destination IP and MAC address values on up to all 32 Streams, and applies other global changes to each selected Stream, all in one step. See Ethernet Multi-Stream Configuration for details.
MAC Src address	Sets a Source MAC (origination) address for generated traffic. The address is a 12-digit (6-octets) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
MAC Dest address	Sets a Destination MAC address for generated traffic. The address is a 12-digit (6-octets) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on values entered, except that all a value must be entered into all fields.  For "Unicast Packets" the 1st octet for the Destination MAC addresses should be set to an even number such as "00".  For "Multicast Packets" the 1st octet for the Destination MAC addresses should be set to an odd number such as "01".  For "Broadcast Packets" all 6 octets of the Destination MAC addresses should be set to "FF".
IP Src address	Sets the IP address of the source (origination). For IPv4, the address is entered in decimal notation using a keypad. There are no restrictions on values entered but the format must be correct, i.e: (0-255.0-255.0-255.0-255). If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually. For IPv6, the address is entered in hexadecimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: (0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF). If four digits are entered in a field, a colon will be automatically added. If only less than four digits are entered, you must enter a colon manually.

	 The CSA board currently only supports IPv4
IP Dest address	Sets the IP address of the destination. For IPv4, the address is entered in decimal notation using a keypad. There are no restrictions on values entered but the format must be correct, i.e: (0-255.0-255.0-255.0-255). If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually. For IPv6, the address is entered in hexadecimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: (0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF). If four digits are entered in a field, a colon will be automatically added. If only less than four digits are entered, you must enter a colon manually.  The CSA board currently only supports IPv4
IP Mode	Sets the IP version (IPv4 or IPv6) used for the Stream's configuration.
Ether Type	A two-octet field in an Ethernet frame, used to indicate which protocol is encapsulated in the payload. The following menu items are available: • Internet Protocol, Version 4 (IPv4) 0x0800 • Internet Protocol, Version 6 (IPv6) 0x086DD • MPLS 0x8847 • User defined (0x0 to FFFF)

UDP Src port	Selects a User Data Protocol source port number (0 to 65535).
UDP Dest port	Selects a User Data Protocol destination port number (0 to 65535)  Port 0 is an officially reserved port in TCP/IP networking, and should not be used.
Frame Size	Sets the frame length in bytes. The frame size is entered as a decimal value, entered using a keypad, ranging from 64 to 16000. The default value is 128 bytes.  Note that when in 1Gbps Half-Duplex (HDX) mode, the default frame size is 512 bytes.
Payload	Allows the user to select a test pattern to be transmitted in the stream's payload. Select one of the following: PRBS 9, PRBS 9 Inverted, PRBS 11, PRBS 11 Inverted, PRBS 15, PRBS 15 Inverted, PRBS 20, PRBS 20 Inverted, PRBS 23, PRBS 23 Inverted, PRBS 31, PRBS 31 Inverted or a User Defined pattern (32-bit value).
IP TOS (IPv4) / Traffic Class (IPv6)	Sets the Type Of Service/Traffic Class as defined in RFC 791. This can be entered as a 2-character HEX value, or the dialog box lets you configure the TOS based on the individual bit fields. • bits 0-2 sets the Precedence • bit 3 sets the Delay (0 = Normal, 1 = Low) • bit 4 sets the Throughput (0 = Normal, 1 = High) • bit 5 sets the Reliability (0 = Normal, 1 = High) • bit 6 sets the Cost (0 or 1) • bit 7 is reserved for future use (0 or 1)  RFC2474 redefined the TOS fields, where bits 0-5 set the Differentiated Services Code Point (DSCP).

IP TTLs (<i>IPv4</i>) / Hop Limits (<i>IPv6</i>)	Sets the IP Time To Live/Hop Limits. This is a decimal value from 0 to 255.  This is an IP header field designed to keep packets from running in loops, essentially forever, through a network (this can happen when there is a route change, and the routers involved don't all know the same information as new information is being replicated and updated).  The default value is 255, and is reduced by 1 every time it passes through a server (hop). If the this value should ever reach 0, the packet has expired. The router that it is passing through will then send it back to the source.
IP Fragment Flag (<i>IPv4</i>)	Select to either Allow (0) or Disallow (1) IP fragments.
Flow Label (<i>IPv6</i>)	Sets IPv6's IP Flow Label. This is a decimal value from 0 to 1048575.
Rate	Sets the traffic generation rate for the selected Stream. Rates can be configured as: • Constant %Bandwidth (0.01 to 100%) • Constant Mbit/sec (0.1 to max Mb/s, for the selected Interface) • Constant IPG-Bytes • Constant IPG-MS • Ramp %Bandwidth • Ramp Mbit/sec  See How to use the Ramp Mode for Ethernet Traffic Generation for information on Ramp mode testing.

Burst Size	Configures the number of packets to be inserted in each Burst. This setting applies to both the traffic generation rates, and the Send Burst button. The Send Burst button will generate a single burst of packets, for the specified amount of packets.  The default Burst size is 1 frame, and should be set to 1 frame when not intentionally generating bursty traffic, to allow the inner-packet gaps (IPG's) to be evenly distributed. Any value greater than 1 will result in the packets being generated as bursts of packet, with minimal IPG's between the packets within the burst, and longer than normal IPG's between the bursts.  See How to use the Burst Mode for Ethernet Traffic Generation for information on Burst mode testing.
Ramp Mode Settings	The following settings become enabled when a Ramp rate is selected: • Ramp Step: This is the size of the % Bandwidth or Mbps rate that each step (up and down) should change by. • Ramp Floor: This is the minimum % Bandwidth or Mbps rate that the stream will step down to. • Ramp Duration: This is the number of Seconds (1 to 999) that each step (up and down) will transmit for.  See How to use the Ramp Mode for Ethernet Traffic Generation for information on Ramp mode testing.
Select MPLS/VLAN Tagging	Enables either VLAN, MPLS, or No Tagging.  When testing VLAN or MPLS, up to 4 stacked tags can be enabled by selecting the checkbox for the next tag. Each tag adds 4 bytes to the Packet's header fields.

	 MPLS is a licensable feature and is only available if the enabled in the license key. The VLAN tagging option however is included on all NIC units that support packet streams.  The CSA board currently only supports VLAN, and does not support MPLS.
VLAN TPID	Configures the VLAN Tag Protocol Identifier. The default value is 0x8100, but the menu lets you select 0x88A8, 0x9100, 0x9200 or enter a 2-byte User Defined HEX value.  VLAN Tagging must be enabled to use this parameter
VLAN PCP/QOS	Configures the VLAN Priority Code Point/Quality Of Service. This is the frame's priority level and is a 3-bit field ranging from the default value of 0 (best effort) to 7 (highest priority).  VLAN Tagging must be enabled to use this parameter.
VLAN CFI	Configures the VLAN Canonical Format Indicator. This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.  VLAN Tagging must be enabled to use this parameter.
VLAN DEI	Configures the VLAN Drop Eligible Indicator. This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.  VLAN Tagging must be enabled to use this parameter.
VLAN VID	Assigns a VLAN ID to the VLAN tag. This identifies to which VLAN the frame belongs. IDs are entered as a decimal identifier ranging from 0 to 4095.  VLAN Tagging must be enabled to use this parameter.

Prev	Moves to the stream with the next lower number.  If currently looking at stream #1, selecting "Prev" will bring up stream #32. Note that changes made will not be saved until "Save All" is selected.
Next	Moves to the stream with the next higher number.  If currently looking at stream #32, selecting "Next" will bring up stream #1. Note that changes made will not be saved until "Save All" is selected.
Save All	Saves all changes made and closes the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Errors and Alarms

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.



Note that error insertion is disabled when in IP Reflection Mode.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the "Send Error" button is pressed or when a rate is selected.

	The following types are available: • Code - Generates line code errors • FCS - Generates an invalid Frame Check Sequence • IP Checksum - Generates an invalid IP header checksum • Runt - Generates an undersized frame (user definable between 12 and 64 bytes), with a bad CRC • Bit Error (Stream #n) - Generates bit errors in the payload for the specified stream number. • Sequence Error (Stream #n) - Generates Sequence errors in the payload for the specified stream number.  The CSA Packet tab currently does not support Line Code or Runt errors.
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • 1E-<x> - X is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1×10^{-x} (The smaller the exponential the higher the error rate.) • User Defined – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1×10^{-x} but more exact choices are available such as 2.6×10^{-4} or 7.1×10^{-3}
Runt Size	Specify the frame size of the Runt errors to be inserted, between 12 to 63 bytes.  This setting is only available when the Runt error type is selected.
Reply to Local Fault	When enabled, the test interface will respond to Local Fault alarms by generating Remote Faults

	 This setting is only available for 103 Gbps LAN, 41 Gbps LAN and 10 Gbps Optical LAN/WAN.

Results

Results Screens and Functions

(Specifically for LAN/WAN Ethernet testing)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Packet and VLAN count statistics.
- [Strm Rslt](#) - Displays Stream ID specific statistics.
- [Event](#) - Displays a summary of error alarm activity.
- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

Results - Scan Screen

(Specifically for LAN/WAN Ethernet testing)

This function displays a list of received errors and alarms.

For [Alarms](#), the duration is reported as a count in seconds.

For [Errors](#), an error count is reported.

The message **No Errors or Alarms** appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors) Screen**(Specifically for LAN/WAN Ethernet testing)**

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

Error Type	Description
Code	A Code error or Symbol error is detected in the line encoding
Undersized	A frame whose length is < 64 bytes, with good FCS/CRC checksum
Invalid FCS	An error in the Frame Check Sequence (CRC checksum), and whose Frame length is ≥ 64 bytes

Invalid IP	An error in the frame's IP Checksum
Invalid UDP	An error in the frame's UDP Checksum
Runts	A frame whose length is < 64 byte with an FCS error

Results - Alarm Screen

(Specifically for LAN/WAN Ethernet testing)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

Error Type	Description
CP Power Loss	The Circuit Pack module experience a power loss fault during test
Paused	The test was manually paused by selecting the Pause button or by a SCPI script command

Power Hot	The received optical power level exceeded the laser's maximum input limit
Power Warm	The received optical power level is within 3 dBm of laser's maximum input limit
LOS	A Loss Of Signal alarm has occurred
Link Down	A Loss of Link State alarm occurred
Local Fault	A Local Fault alarm has occurred
Remote Fault	A Remote Fault alarm has occurred
Jabber Condition	A Jabber alarm has occurred, which could be caused by a device that is handling the electrical signals improperly.  10/100/1000BaseT ports only

Results - Strm Rslt (Stream Results) Screen

(Specifically for LAN/WAN Ethernet testing)

The Stream Results screen displays statistics for a specified incoming packet stream. The screen allows you to scroll through the different packet streams and view their individual results.

The following statistics appear:

Statistic	Description
Selected Stream Entry	Displays the selected Stream ID number and the stream's MAC Source and MAC Destination addresses, to which the displayed statistics data belongs.

Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW, for the selected Stream ID. Transmit Statistics (per stream): • TX PORT # - Show the selected transmit Port #, for Protocol Processors that support more that 1 interface port. • Packets - Total number of Packets transmitted. • Bytes - Total number of Bytes transmitted. • BW - Percent of bandwidth currently being transmitted. Receive Statistics (per stream): • RX PORT # - Show the receive statistics for the stream's configured Destination Port #, for Protocol Processors that support more that 1 interface port. • Packets - Total number of Packets received. • Bytes - Total number of Bytes received. • BW - Percent of bandwidth currently being received. • Loss - Current Packet Loss rate.  For loop backs with large latency, the Loss rate may show greater than 0 while the test stream generation is active, even if no packets are actually being lost (dropped). This is due to the real-time RX packet count being lower than the TX packet count, because of the latency. If no packets were lost during the test, then this value will drop to 0 when the test stream generation is turned off.
Pass/Fail Test	Provides User-Defined Acceptance Criteria:  Refer to Timed Test Using Acceptance Criteria • Accept Seq Errors - A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test.

	• Accept Bit Errors - A user-specified threshold value for determining the acceptable bit error rate for a timed test. • Accept Loss Rate - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. • Pass/Fail - Test results are displayed as "Running" when the test is active (Elapsed Time is incrementing); and displayed as "PASS" or "FAIL" when the test ends, depending on whether or not specified failure criteria was attained.
Errors	Displays Error statistic as Counts, Errored Seconds, Average error rate and Current error rate, for the following Error Types: • Sequence Errors - Each sent packet is marked with a sequence number. This count is incremented when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet. This can be the result of packets being received out of sequence, or due to packets being dropped. • Bit Errors Received
Latency	Displays Minimum, Average, and Maximum latency (delay) measurements, in microseconds (μs). A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated (real-time) as new latency measurements are logged.  If the TX and RX are looped on itself with a short patch cable, the latency may appear as 0 μs.
Alarms	Displays Alarm statistics as total number of Seconds the alarm was active during the test, for the following Alarm type: • Pattern Sync

First, Prev, Next, Last	Allows the user to scroll through all of the packet streams and view their individual results. Selecting First immediately moves the stream statistics to Stream 1; selecting Last immediately moves the last stream's statistics; selecting Prev or Next moves the stream statistics to/from one stream immediately before or after the currently selected stream.

Results - Event Screen

(Specifically for LAN/WAN Ethernet testing)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Count Screen

(Specifically for LAN/WAN Ethernet testing)

The Count screen displays [Utilization](#), [Packets](#), [VLAN](#), [MPLS](#) and [Packet Size](#) statistics by type and count.

To view total transmit and receive utilization statistics, select the **Utilization** button. The following statistics appear:

Desc column	Current / Min / Max / Avg columns
Total - TX BW	Displays the Current, Min, Max and Avg. Total %BW Transmitted

Total - TX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate transmitted
Total - TX PPS	Displays the Current, Min, Max and Avg. Total Packet Per Second rate transmitted
Total - RX BW	Displays the Current, Min, Max and Avg. Total %BW received
Total - RX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate received
Total - RX PPS	Displays the Current, Min, Max and Avg. Total Packet Per Second rate received
TX IPv4 BW	Displays the Current, Min, Max and Avg. IPv4 %BW Transmitted
TX IPv4 Mbps	Displays the Current, Min, Max and Avg. IPv4 Mbps rate transmitted
TX IPv4 PPS	Displays the Current, Min, Max and Avg. IPv4 Packet Per Second rate transmitted
RX IPv4 BW	Displays the Current, Min, Max and Avg. IPv4 %BW received
RX IPv4 Mbps	Displays the Current, Min, Max and Avg. IPv4 Mbps rate received
RX IPv4 PPS	Displays the Current, Min, Max and Avg. IPv4 Packet Per Second rate received
TX IPv6 BW	Displays the Current, Min, Max and Avg. IPv6 %BW Transmitted

TX IPv6 Mbps	Displays the Current, Min, Max and Avg. IPv6 Mbps rate transmitted
TX IPv6 PPS	Displays the Current, Min, Max and Avg. IPv6 Packet Per Second rate transmitted
RX IPv6 BW	Displays the Current, Min, Max and Avg. IPv6 %BW received
RX IPv6 Mbps	Displays the Current, Min, Max and Avg. IPv6 Mbps rate received
RX IPv6 PPS	Displays the Current, Min, Max and Avg. IPv6 Packet Per Second rate received
TX VLAN BW	Displays the Current, Min, Max and Avg. VLAN %BW Transmitted
TX VLAN Mbps	Displays the Current, Min, Max and Avg. VLAN Mbps rate transmitted
TX VLAN PPS	Displays the Current, Min, Max and Avg. VLAN Packet Per Second rate transmitted
RX VLAN BW	Displays the Current, Min, Max and Avg. VLAN %BW received
RX VLAN Mbps	Displays the Current, Min, Max and Avg. VLAN Mbps rate received
RX VLAN PPS	Displays the Current, Min, Max and Avg. VLAN Packet Per Second rate received
TX MPLS BW	Displays the Current, Min, Max and Avg. MPLS %BW Transmitted

TX MPLS Mbps	Displays the Current, Min, Max and Avg. MPLS Mbps rate transmitted
TX MPLS PPS	Displays the Current, Min, Max and Avg. MPLS Packet Per Second rate transmitted
RX MPLS BW	Displays the Current, Min, Max and Avg. MPLS %BW received
RX MPLS Mbps	Displays the Current, Min, Max and Avg. MPLS Mbps rate received
RX MPLS PPS	Displays the Current, Min, Max and Avg. MPLS Packet Per Second rate received

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Packets	Reports the total number of packets sent.
Received Packets	Reports the total number of packets received.
Received Jumbo Packets	Reports the total number of jumbo packets received. Jumbo packets are those from 1519 – 9000 bytes in size.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
Pause Packets Received	Reports the total number of Pause frames received.  Important: Flow Control must be enabled in order to count Pause Packets.

Pause Quantas Taken	Reports the total number of quantas received. A quanta is a 512-bit timing increment used by a Pause frame. The number of quantas (N x 512-bits) indicate the duration of the pause.  Important: Flow Control must be enabled in order to count Pause Packets.
Pause End Packets	Reports the number of times that a Pause condition ended allowing data transmission to resume. The pause condition ends when the Pause frame's time parameter is set to 0.  Important: Flow Control must be enabled in order to count Pause Packets.
IP Packets	Internet Protocol. Reports the total number of IP packets received.
ICMP Packets	Internet Control Message Protocol. Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.
UDP Packets	User Data Protocol. Reports the total number of UDP packets received.
IGMP Packets	Internet Group Management Protocol. Reports the total number of IGMP packets received.
Broadcast Packets	Reports the total number of Broadcast packets received.
Multicast Packets	Reports the total number of Multicast packets received.
Unicast Packets	Reports the total number of Unicast packets received.

To view VLAN results, select the **VLAN** button. The following statistics appear:

VLAN	Description
VLAN Tagged Frames (per level)	Reports the total number of frames received that are identified as VLAN frames, per tag level. For each tag level enabled (1-4), a 4-byte VLAN tag is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.
Quality of Service Entry	For each stacked VLAN tag level (1-4), separate data rows for QOS Entries 0-7 are displayed. These reports the number of frames received for each user priority level value. A total of 8 different counters appear for each Stacked VLAN level.

To view MPLS results, select the **MPLS** button. The following statistics appear:

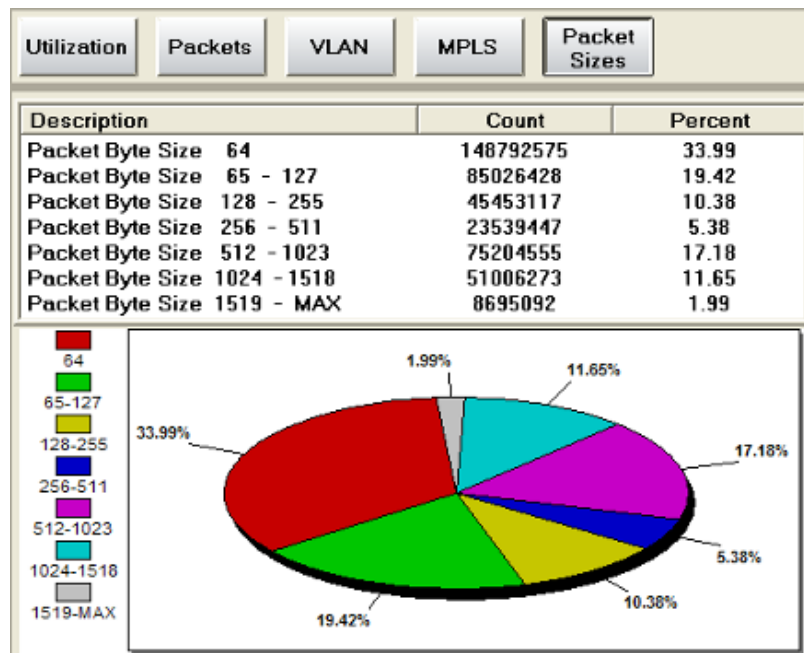
MPLS	Description
MPLS Tagged Frames (per level)	Reports the total number of frames received that are identified as MPLS frames, per tag level. For each tag level enabled (1-4), a 4-byte MPLS label is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.
Traffic Class Entry	For each stacked MPLS label level (1-4), separate data rows for TC Entries 0-7 are displayed. These reports the number of frames received for each user priority level value. A total of 8 different counters appear for each Stacked MPLS level.

To view Packet Size results, select the **Packet Sizes** button. The following statistics appear:

Packet Sizes	Description
Packet Size Table	Reports the received packet count and percentage of total received packets for each packet byte size range found: 64; 65-127; 128-255; 256-511; 512-1023; 1024-1518; 1519-Max (Jumbo Packets).

Packet Size Graph

The measured percentage for each Packet Byte Size range is displayed in a pie chart, where each range has a uniquely colored slice, when that range percentage is greater than 0.00.



Results - Large LEDs Screen

(Specifically for LAN/WAN Ethernet testing)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.

White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs for LAN/WAN, see [LAN/WAN LEDs](#).

Test

Test Screens and Functions

(Specifically for LAN/WAN Ethernet testing)

The Test screen configures test parameters associated with a LAN/WAN protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [PING](#)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

 To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.

Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function

	Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.

Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for LAN/WAN Ethernet testing)

The unit can measure Service Disruption switching intervals in your network. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

When enabled, the trigger event to begin service disruption measurements occurs when it stops detecting incoming packets.

 The MSA module's Packet processor tab and Dual Enet processor tab also triggers on incoming packets with CRC/FCS errors.

The duration for every Ethernet service disruption event is measured in milliseconds, with granular accuracy of .1 ms (100 μ s).

When the Action state is configured for Continuous APS, the 10 most recent measurements are displayed in the History window. Also the Minimum and Maximum measurement times are logged, as well as an Average duration based on all measurements taken since the test began.

Test Service Disruption functions include:

- **Resolution:** When testing Service Disruption measurements on lower rate Ethernet bandwidths ($\leq$ 1Gbps), this setting is used to ensure that at least one Ethernet packet is received within the configured period of time (measurement window). The following options are available:
 - ▶High (.1 ms)
 - ▶Medium (1 ms)
 - ▶Low (10 ms)



When receiving fewer packets per second (lower bandwidths), a lower resolution setting (larger window of time) is required.



Important: This setting is only displayed on ports that support Ethernet rates $\leq$ 1Gbps.

- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **Consecutive Bad Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate. The range is 0.1 to 1638.3 milliseconds and is entered using a keypad.
- **Action (State):** Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- ▶ **Single APS:** Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- ▶ **Continuous APS:** Constantly monitors for service disruption events, and updates the seconds and frames reported.
- ▶ **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch Time (MilliSecs):** Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **History Recent Milliseconds:** The 10 most recent measurements are displayed from left to right (5 on the top line and 5.



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For more information about monitoring service disruption activity, select [Measuring Service Disruption Activity](#) in the Specific Tasks section of the online help.

Test - PING

(Specifically for LAN/WAN Ethernet testing)

This section provides a brief overview of the PING functions that are available on the Test screen.

See the [PING Functionality](#) page for detailed descriptions on using the PING feature.

Function	Description
IP Source	This is the Port's IP Source address that is used for the PING operation.  This also configures the Port IP Source address setting located on the Config > Set screen.

IP Destination	This is the target Destination IP Address that is used for the PING operation.
Num. of PINGs	This is the number of PING attempts.
Timeout	This is the amount of time (in seconds) that the unit will wait for a PING reply. Valid values are 1-5 (secs.) in one-second intervals.  The default value is 1.
MAC Source	This is the Port's MAC Source address that is used for the PING operation.  This also configures the Port MAC Source address setting located on the Config > Set screen.
Packet Size	This is the size of the PING packet used for the PING operation. Valid values are 64-16000 (bytes).  The default value is 64.
Time To Live	Sets the IP Time To Live. This is a decimal value from 1 to 255.  This is an IP header field designed to keep packets from running in loops, essentially forever, through a network (this can happen when there is a route change, and the routers involved don't all know the same information as new information is being replicated and updated).  The default value is 128, and is reduced by 1 every time it passes through a server (hops). If the this value should ever reach 0, the packet has expired. The router that it is passing through will then send it back to the source.

Start Ping	This begins the Ping Operation. When “Start Ping” button is selected, the unit will send an ARP request to the target Destination IP address to determine what the MAC address is. When the ARP reply packet is received, the target MAC address will be displayed in the “MAC Dest Address” field, in the Ping statistics section. The specified number of PING requests will be sent, with the last 4 responses displayed in the Ping Response Window.  Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.
Stop Ping	This will stop an active Ping operation.
Ping Response Window	Lists the following information obtained from the Ping reply packets: ▶Response: Displays "Successful", "No Response" or "Timeout" ▶IP Reply: Displays the IP Address obtained from the Ping's reply packets ▶Bytes: Displays the size of the Ping packet in Bytes ▶ICMP Seq: Displays the Ping's reply ICMP Sequence ID number ▶Time: Displays the number of milliseconds between when the ARP Request was sent and when the ARP Reply was received. This is also referred to as the Ping packet's Round Trip Delay (RTD). ▶TTL: Displays the Ping packet's Time To Live value
Ping statistics section	Shows the following information obtained from the Ping transmit and reply packets: ▶Tx Packets: The number of Ping packets transmitted

	►Rx Packets: The number of Ping replies received ►% Loss: The percentage of lost packets ►MAC Dest. Address: The target's MAC Address obtained from the replies. ►Round Trip Delay - Average: The average Time measurement, based on all Ping replies received ►Round Trip Delay - Minimum: The minimum Time measurement, based on all Ping replies received ►Round Trip Delay - Maximum: The maximum Time measurement, based on all Ping replies received

CSA Packet Specific Tasks

Specific Tasks Overview

(Specifically for Ethernet testing on the CSA-Packet tab)

This section includes tasks that are specific to the CSA-Packet tab for 41Gbps and 103Gbps Ethernet Interfaces

For a list of general tasks, see [Common Tasks](#) located in the Getting Started section.

For a description of specific screens and their functionality, refer to [CSA-Packet - Screen Functions and Descriptions Overview](#).

The following Specific Tasks for this protocol processor are discussed:

- [Configuring Packet Streams](#)
- [Initiating Auto Negotiation](#)
- [Multi-Stream Configuration](#)
- [Ramp Mode Traffic Generation](#)
- [Burst Mode Traffic Generation](#)
- [Enabling Stacked VLAN Tagging](#)
- [Enabling MPLS Label Stacking](#)
- [Transmitting Packet Streams](#)
- [Inserting a Pause \(Flow Control\) into a Stream](#)

- [Inserting Errors and Alarms](#)
- [Viewing Error and Alarm Results](#)
- [Configuring an RFC-2544 Test](#)
- [RFC-2544 - Throughput Testing](#)
- [RFC-2544 - Frame Loss Testing](#)
- [RFC-2544 - B2B Burst Testing](#)
- [Timed Test Using Acceptance Criteria](#)
- [Measuring Service Disruption](#)
- [PING Functionality](#)
- Saving and Printing Statistics and Settings Reports

Configuring Packet Streams

(Specifically for LAN/WAN Ethernet testing)

The [Config > Strms Pg1](#) and [Strms Pg2](#) screens provides the tools required to configure or edit any or all of the available packet streams.

To configure a packet stream:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Select **Config** and choose **SET**.
3. If the current **Interface** rate (or **Mode**) needs to be changed, then configure the setting for the desired rate.
4. Choose a **Strms Pg #** side tab. (Where # is either 1 or 2 depending on which stream(s) you want to set.
5. Select a desired stream to test in the Stream Profile table. The **Traffic Stream Profile** dialog box appears.
6. From the [Traffic Stream Profile](#) dialog box, set the parameters for the packet stream.



If routing the packets through a network switch, the stream's Source and Destination [MAC Addresses](#) should be configured.

 If routing the packets through a network router, the stream's Source and Destination MAC and [IP Addresses](#) should be configured.

6. Select **Save**. The stream configuration parameters display in the Stream Profile table.

Use the horizontal scroll bar at the bottom of the Stream Profile table to view additional columns.

 You can also rearrange the [column order](#) so information that is most important to you can be displayed without needing to use the scroll bar.

7. With all of the test streams turned Off, press the **Restart** button at the bottom of the screen to set the transmitted and received packet counts to 0.
8. **Enable** the desired stream(s) to begin generating traffic on the configured test stream(s).
9. After the desired test time has elapsed, then **Disable** the stream(s) currently generating traffic.

 This is preferred over pressing the Stop button, because this allows any packets in transit to be returned and counted, whereas Stop might stop all packet counters before any packets in transit have been returned.

Initiating Auto Negotiation

Negotiation is an Ethernet handshaking mechanism that looks at the incoming signal and determines the link speed and duplex mode (full-duplex or half-duplex). The Negotiate button enables or disables negotiation mode.

When auto negotiation is first enabled, it attempts to negotiate the link with a remote device. After successful negotiation, negotiation will not be performed again unless the remote device initiates an auto negotiation sequence.

By disabling auto negotiation, the test set can simulate older Ethernet equipment that does not support auto negotiation logic.



Negotiate is not available for Ethernet rates of 10G or higher.

To enable auto negotiation:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Select **Config** and choose **SET**.
3. If the current **Interface** rate (or **Mode**) needs to be changed, then configure the setting for the desired rate.
4. Select **Negotiate** and choose **Enabled**.
 - When first enabled, the Status displays "Enabled" and "Pending link".
 - Upon successful negotiation with a remote device, the Status displays the negotiated Interface Rate and Duplex mode.

To disable auto negotiation:

1. Select **Negotiate** and choose **Disable**.
 - When disabled, the Status displays "Disabled".

Ethernet Multi-Stream Configuration

The Digital Lightwave NIC's Ethernet testing capabilities include simultaneous testing of up to 32 independent Streams. The Multi-Stream Configuration feature allows the user to easily set up the Source and Destination IP and MAC address values on up to all 32 Streams in one step.

Important: This function will also configure each of the affected Streams with the same values for all of the other stream settings such as; **Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc.**, when the "Save All" button is selected.

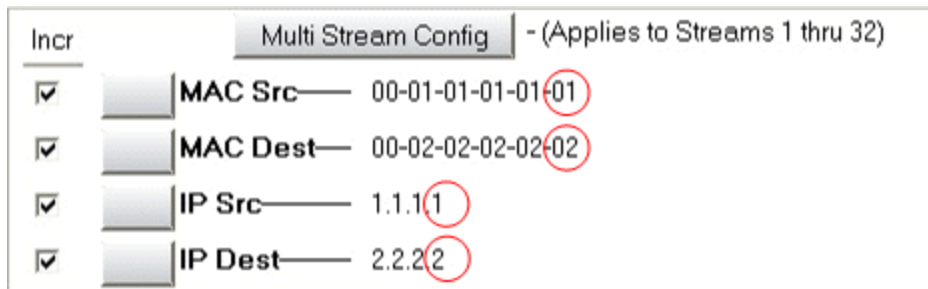
Procedure:

1. With NIC configured for any Ethernet rate, select Config, then Strms Pg 1 or Strms Pg 2. From the [Stream Profile Table](#), select any Stream by touching any Stream (1-16) or (17-32) in the white area. The [traffic Stream profile](#) for the

selected screen will appear. Multi-Stream Configuration will begin from the selected Stream.

2. Select **Multi Stream Config** located above the MAC Src.
3. When this button is selected, the user will be prompted to select the number of additional Streams to edit (from the current Stream id up to #32), keeping in mind that the Multi-Stream Configuration will begin from the selected Stream.

 The increment feature can be applied from the selected Stream up to Stream 32. For example, if Stream 30 is selected, Streams 30, 31, & 32 can be incremented.



Incr	Field	Value
☒	MAC Src	00-01-01-01-01
☒	MAC Dest	00-02-02-02-02
☒	IP Src	1.1.1.1
☒	IP Dest	2.2.2.2

After the number of additional Streams is entered, a new Profile window is displayed.

4. This new Stream Profile window displays the affected Streams id's beside the Multi Stream Config button and also displays the Increment (Incr) checkboxes beside the applicable address buttons. These checkboxes are initially unchecked when the window is opened. Select the appropriate checkboxes and enter the initial Address required for each of the selected addresses.

 If an address Incr checkbox is not selected then the specified address will be applied to all of the affected Streams

5. For each address with its Incr checkbox selected, the last part of the address (circled in red above) will be incremented by 1 for each subsequent Stream when the "Save All" button is selected.

 The MAC addresses and IPv6 IP addresses will increment by hex values

6. The example shown in the Stream Profile window above will result in the following values for each Stream (in this case Streams 1-32).

on, off	MAC Src	MAC Dest	IP Src	IP Dest
1 ☐	00-01-01-01-01-01	00-02-02-02-02-02	1.1.1.1	2.2.2.2
2 ☐	00-01-01-01-01-02	00-02-02-02-02-03	1.1.1.2	2.2.2.3
3 ☐	00-01-01-01-01-03	00-02-02-02-02-04	1.1.1.3	2.2.2.4
4 ☐	00-01-01-01-01-04	00-02-02-02-02-05	1.1.1.4	2.2.2.5
5 ☐	00-01-01-01-01-05	00-02-02-02-02-06	1.1.1.5	2.2.2.6
6 ☐	00-01-01-01-01-06	00-02-02-02-02-07	1.1.1.6	2.2.2.7
7 ☐	00-01-01-01-01-07	00-02-02-02-02-08	1.1.1.7	2.2.2.8
8 ☐	00-01-01-01-01-08	00-02-02-02-02-09	1.1.1.8	2.2.2.9
9 ☐	00-01-01-01-01-09	00-02-02-02-02-0a	1.1.1.9	2.2.2.10
10 ☐	00-01-01-01-01-0a	00-02-02-02-02-0b	1.1.1.10	2.2.2.11
11 ☐	00-01-01-01-01-0b	00-02-02-02-02-0c	1.1.1.11	2.2.2.12
12 ☐	00-01-01-01-01-0c	00-02-02-02-02-0d	1.1.1.12	2.2.2.13
13 ☐	00-01-01-01-01-0d	00-02-02-02-02-0e	1.1.1.13	2.2.2.14
14 ☐	00-01-01-01-01-0e	00-02-02-02-02-0f	1.1.1.14	2.2.2.15
15 ☐	00-01-01-01-01-0f	00-02-02-02-02-10	1.1.1.15	2.2.2.16
16 ☐	00-01-01-01-01-10	00-02-02-02-02-11	1.1.1.16	2.2.2.17
All				

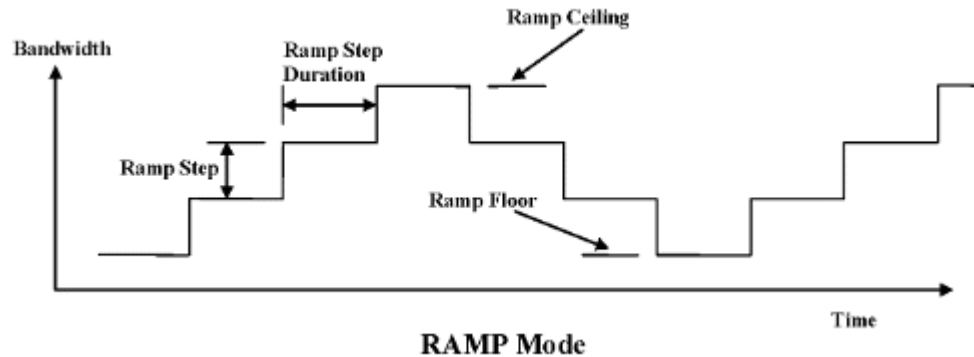
7. The Multi-Stream Configuration feature can also be used to will also configure each of the affected Streams with the same values for all of the other stream settings such as; **Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc.**, when the “Save All” button is selected.

How to use the Ramp Mode for Ethernet Traffic Generation

What is Ramp Mode?

Ramp Mode is an Ethernet Traffic Generation method that continuously steps up and down the transmit bandwidth, or Mbps rate.

Ramp mode is a feature that is commonly used to simulate a dynamic increasing and decreasing traffic load on a network device. This is normally performed to monitor a network device's performance, under these varying loads. This mode can also be used as a stress test, when the traffic increase is set to a very steep rate change.



Configuration Settings (from the [Traffic Stream Profile](#) window)

- **Rate:** From this menu select either **Ramp %Bandwidth** or **Ramp Mbit/sec**. Next, enter either the maximum % Bandwidth or Mbps rate that you want the stream traffic to step up to. 💡 This is the **Ramp Ceiling** value.
- **Ramp Step:** This is the size of the % Bandwidth or Mbps rate that each step (up and down) should change by.
- **Ramp Floor:** This is the minimum % Bandwidth or Mbps rate that the stream will step down to.
- **Ramp Duration:** This is the number of Seconds (1 to 999) that each step (up and down) will transmit for.

Setup:

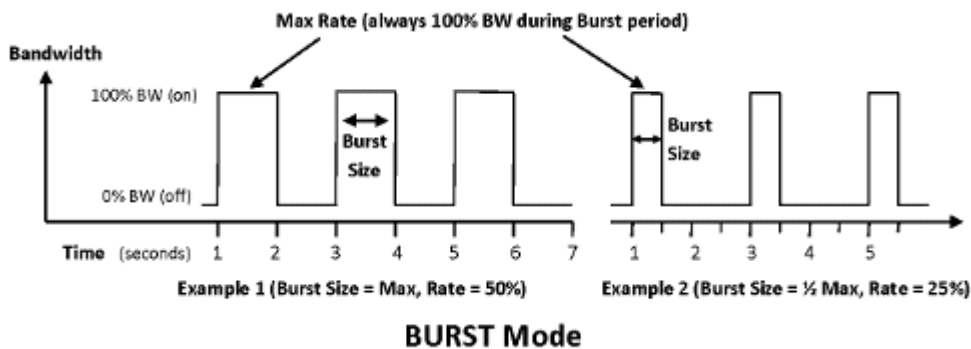
1. Turn **OFF** the test streams, and press the **Restart** button to clear any packet count history.
2. Next turn **ON** the test Stream(s) that are configured for Ramp Mode.
3. Monitor the network device under test (DUT) for anomalies, as the traffic being generated repeatedly steps up and steps back down again, increasing and decreasing its RX traffic load.
4. Turn **OFF** the test Stream(s), and verify that the DUT's RX Packet count and the NIC's TX Packet count match.

How to use the Burst Mode for Ethernet Traffic Generation

What is Burst Mode?

Burst mode is a feature that is commonly used to simulate "bursty" traffic loads on a network device.

This mode is used as a more realistic method of testing network loads than a constant bandwidth, because Ethernet traffic is typically "bursty" by nature.



Configuration Settings (from the [Traffic Stream Profile](#) window)

- **Rate:** From this menu select either **Constant %Bandwidth** or **Constant Mbit/sec**.
 - 💡 For Burst mode, burst of **100% BW** are inserted, but the overall rate is **averaged** over time.
- **Burst Size:** The number of packets within the generated burst, with the Minimum Inter-Packet Gap (IPG) allowed, between each packet.
 - 💡 This is sometimes referred to as the **Burst Width**.

Configuration Notes:

- The maximum Burst Size allowed is equivalent to the maximum Frame Rate, in Packet Per Second (PPS).
- Before adjusting the Burst Size the user should change the test stream's Frame Size and press Save.
- The maximum Burst Size allowed dynamically changes based on the last Frame Size setting to be saved.

Example:

- A 1GigE stream configured for a Frame Size of **128** bytes has a maximum Burst Size of **844594** PPS.
- When the Burst Size is set to 844594, this generates a burst of exactly 844594 packets, at 100% bandwidth for a full 1 second, with the minimum Inter-Packet Gap between each packet, regardless of the Rate setting.
- The Burst Size can be thought of as the amount of time that the burst of 100% BW is "On", up to 1 second for the maximum allowed burst size.
- A Burst Size of 1/2 the max (422297 for 1Gbps) would generate 100% bandwidth for 1/2 a second, then the amount of "Off" time would depend on the Rate setting.
- The Rate is the "ratio of time" that packets are "On" for (100% BW), versus "Off" for (0% BW).
- If the Rate is set to 50%, then the burst of 100% BW would last for the same amount of time as the 0% BW.
- The greater the Rate, the shorter the "Off" time. The lower the Rate, the greater the "Off" time.

Constant Burst Setup:

1. Turn **OFF** the test Stream(s) and press the **Restart** button to clear any packet count history.
2. Next turn **ON** the test Stream(s) that are configured for Burst Mode, as described above.
3. Monitor the network device under test (DUT) for anomalies, as the bursts of generated packets are received.
4. Turn **OFF** the test Stream(s) and verify that the DUT's RX Packet count and the NIC's TX Packet count match.

Single Burst Setup:

1. The user also has the ability to transmit a **Single Burst** using the [Send Burst](#) button to the right of the **Stream Profile Table**.
2. This will generate the exact one burst of the number of packets that the selected stream's **Burst Size** setting is configured for.
3. See the section called [To transmit a single Burst of packets](#) on one stream for more information.

Enabling Stacked VLAN Tagging

Stacked VLAN tags (often referred to as **Q-in-Q** Virtual LANs) allows multiple VLAN tags to be added sequentially to a single Ethernet Stream, as defined in IEEE 802.1Q standard.

The [Traffic Stream Profile](#) dialog box allows up to 4 Stacked VLAN tags to be configured per Ethernet Stream.

To enable Stacked VLAN tagging:

1. Select the Stream you want to enable VLAN tagging on by clicking the desired stream in the **Stream Profile table**. The Traffic Stream Profile dialog box appears.
2. From the Traffic Stream Profile dialog box, select the button next to **No MPLS/VLAN tag** and choose **VLAN Tagging** from the Select Tagging menu.
3. Once VLAN Tagging has been enabled, **VLAN Tag 1** becomes enabled and allows you to modify that tag's settings:
 - Tag 1 is referred to as the **S-Tag** (Service Provider VLAN tag).
4. To enable a second VLAN tag, click the checkbox next to **VLAN Tag 2**. This enables 2 VLAN tags
5. To enable a third VLAN tag, click the checkbox next to **VLAN Tag 3**. And to enable all four VLAN tags click the checkbox next to **VLAN Tag 4**.
 - Tags 2 through 4 are known referred to as the **C-Tags** (Customer VLAN tags).
6. After enabling the desired VLAN tags, the user can modify each tag's **TPID**, **PCP/QOS**, **CFI** or **DEI**, and **VID** settings.
7. Select **Prev** or **Next** to modify the Stacked VLAN tagging for other Ethernet Streams.
8. Select **Save All** to apply the setting and close the Traffic Stream Profile dialog box.

Each VLAN tag adds an addition 4-bytes to the Ethernet Stream, consisting of the following settings:

- **TPID** (Tag Protocol Identifier): The default value is 0x8100, but the menu lets you select 0x88A8, 0x9100, 0x9200 or enter a 2-byte User Defined HEX value.
- **PCP/QOS** (Priority Code Point/Quality Of Service): This indicates the frame priority level and is a 3-bit field ranging from the default value of 0 (best effort) to 7 (highest priority).
- **CFI** (Canonical Format Indicator) / **DEI** (Drop Eligible Indicator): This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.
- **VID** (VLAN ID): This is a 12-bit decimal identifier ranging from 0 to 4095, used for the switching operation.

Enabling MPLS Label Stacking

MPLS (**M**ulti-**P**rotocol **L**abel **S**witching) is a set of procedures for augmenting IPv4 and IPv6 packets with "label stacks", thereby turning them into "labeled packets". These labels act as a shorthand representation of the IP packet's header. Routers which support MPLS are known as "Label Switching Routers", or "LSRs".

The [Traffic Stream Profile](#) dialog box allows up to 4 Stacked MPLS labels to be configured per Ethernet Stream.

To enable Stacked MPLS labeling:

1. Select the Stream you want to enable MPLS tagging on by clicking the desired stream in the **Stream Profile table**. The Traffic Stream Profile dialog box appears.
2. From the Traffic Stream Profile dialog box, select the button next to **No MPLS/VLAN tag** and choose **MPLS Tagging** from the Select Tagging menu.
3. Once MPLS has been enabled, **MPLS Level 1** becomes enabled and allows you to modify that label's settings:
4. To enable a second MPLS label, click the checkbox next to **MPLS Level 2**.
5. To enable a third MPLS label, click the checkbox next to **MPLS Level 3**. And to enable all four MPLS labels click the checkbox next to **MPLS Level 4**.
6. After enabling the desired MPLS labels, the user can modify each label's **Label** value, **TC**, **S(Bottom)**, and **TTL** settings.
7. Select **Prev** or **Next** to modify the MPLS labels for other Ethernet Streams.

8. Select **Save All** to apply the setting and close the Traffic Stream Profile dialog box.

Each MPLS label adds an additional 4-bytes to the Ethernet Stream, consisting of the following settings:

- **Label** (value): The default value is 0x1234, but this can be changed to any 20-bit User Defined HEX value from 0x0 to 0xFFFFF.
- **TC** (Traffic Class): This indicates the packet's QoS (quality of Service) priority ranging from 0 (best effort) to 7 (highest).
- **S(Bottom)** (Bottom of Stack): This is a 1-bit bottom of stack flag. This bit is automatically set to 1 for the last MPLS label to be enabled (i.e., the bottom of the stack), and automatically set to 0 for all higher level labels in the stack.
- **TTL** (Time to Live): This is an 8-bit field used to encode a Time-To-Live value ranging from 0 to 255 (default).

Transmitting Packet Streams

(Specifically for LAN/WAN Ethernet testing)

The [Config > Strms Pg1 and Strms Pg2](#) screens provides the tools required to configure or edit any or all of the available packet streams.

To start transmission on specific packet streams:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Configure the [Mode and desired Packet Stream](#) settings.
3. When configuring more than one stream, if the total configured bandwidth exceeds 100% the processor will automatically and proportionately adjust each enabled stream so the total bandwidth being transmitted is exactly 100%.
4. Choose a **Strms Pg #** side tab. (Where # is either 1 or 2 depending on which stream(s) you want to set.
5. **Enable** the desired stream(s) to begin generating traffic on the configured test stream(s).

 **Important:** Streams cannot be enabled when IP Reflection is enabled.

6. Packets begin transmitting as soon as the On/Off checkbox is enabled.

 To begin transmitting packets on multiple streams starting at the exact same time, then first select the **Stop** button from bottom of the screen, then Enable the desired packet streams, then press the **Restart** button from the bottom of the screen. The selected packets will begin simultaneously transmitting.

7. The stream transmission status displays in the TX State column of the [Stream Profile table](#).

8. The total TX and RX packet count statistics for all packet streams are displayed in the Count Statistics table below Stream Profile table.

To start transmission on All packet streams:

1. Repeat steps 1 through 4 above.
2. Select the All button beneath the last stream's On/Off check box.

 If no packet streams are currently enabled, then this will simultaneously enable all 32 packet streams.

 If one or more packet streams are currently enabled, then this will disable all enabled packet streams.

To transmit a single Burst of packets on one stream:

1. Configure the packet stream's setting from the [Traffic Stream Profile](#) window.
2. Select the **Burst Size** setting, and enter the desired number of packets to be transmitted in the burst
3. Press Save All to save the configuration and exit the Traffic Stream Profile window.
4. Press the stream's Number Button under in [Send Burst](#) column to inject a single burst of packets, for the configured burst size.

 When done inserting bursts configuring the stream for transmitting at a Constant %BW rate, set the Burst Size back to 1 to avoid "bursty" transmissions.

Inserting a Pause (Flow Control) into a Stream

Pausing frames is a means of flow control that specifies how long the transmitting device should remain quite. The flow control gives limited ability to regulate a (high bandwidth) source by sending pause frames to the source. Inserting a pause into a stream causes the source to stop sending frames for a specified amount of time (Quanta), allowing the (low bandwidth) receiver to catch up and process queued frames.

 Important: **Flow Control** must be enabled in order to count received Pause Packets.

 Important: Pause is not available when **IP Reflection** is enabled.

To start insert a Pause frame in a packet stream:

1. Select **Config** and choose **Set**.
2. Select **Pause**. *The Enter Pause Quanta keypad appears.*
3. Enter a Pause Quanta value and select **OK**.

 A quanta is the unit of time required for transmitting 512-bits at the speed of the port.

 The number of quanta (N x 512-bits) indicate the duration of the pause.

 Valid pause quanta values are 0-65535.

 A pause frame with a pause quanta of 0 indicates a resume frame to restart the paused traffic.

Inserting Errors and Alarms

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific errors and alarms into an Ethernet stream.



Note: Error insertion is disabled when IP Reflection Mode is enabled.

To insert multiple errors:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Configure the [Mode and desired Packet Stream](#) settings.
3. Enable traffic generation from the packet stream to be errored.



Important: Most error types require traffic generation to be enabled on at least one packet stream.

4. Select [Error / Alarm](#) from the tabs along the left side of the Config Screen.
5. Select [Error Type](#) and choose an error type from the Select Error Type dialog box.
6. Select [Error Rate](#) and choose an error rate from the Select Error Rate to Insert dialog box.
7. Errors immediately start injecting into the packet stream when the error rate is selected.
8. View various result statistics by selecting the [Results](#) function.
9. To stop error transmission select **Error Rate** and choose **Off**.

To insert a single error:

1. Repeat steps 1 through 5 above.
2. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
3. Select the **Error Insert** common function button at the bottom of the screen.
4. A single error will be inserted every time the **Error Insert** button is pressed.

 Note: If no Error Type has been previously selected, then the Select Error Type menu will appear the first time the Error Insert button is selected.

5. View various result statistics by selecting the [Results](#) function.

To insert an Alarm:

1. Select the **Packet CSA** tab.
2. Configure the [Mode and desired Packet Stream](#).
3. Enable traffic generation from the packet stream to be errored.
4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. Select [Error / Alarm](#) from the tabs along the left side of the Config Screen.
6. Select **Alarm Generated** and choose an alarm type from the Select Alarm dialog box.

 Important: Once an alarm is selected, then alarm will continuously insert until turned off.

7. View various result statistics by selecting the [Results](#) function.
8. To stop the alarm generation select **Alarm Generated** and choose **None**.

Viewing Error and Alarm Results

After [inserting error and alarms](#) into a packet stream the receiving equipment detects the event and reports it. The Results screen provides different result reports.

To view error or alarm results:

1. From the protocol processor tab (**Packet, CSA Packet, Dual Enet, Etc.**), select [Results](#).
2. The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Packet and VLAN count statistics.
- [Strm Rslt](#) - Displays Stream ID specific statistics.
- [Event](#) - Displays a summary of error alarm activity.
- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

What are RFC 2544 Tests?

RFC 2544 tests are used as a benchmark test for network devices. They were developed to test throughput, latency, frame loss and burstability across a range of packet sizes and bandwidths. RFC 2544 has become the de facto standard for benchmarking Ethernet networks.

- Throughput Testing determines the maximum data rate which can be transported at each of a series of packet sizes, defined by the standard, i.e. 64, 128, 256, 512, 1024, 1280, 1518 bytes. NOTE: The NIC offers the ability to send non-standard packet sizes.
- Latency Testing measures the time interval required to transport a packet through the device or network under test and back. Low and consistent latency is vital for protocols such VoIP and video applications.
- Frame Loss Testing determines what percentage of frames can be sent across the device or network under test at the series of packet sizes as listed above in Throughput Testing.
- Back-to-Back Burst Testing determines the number of frames that can be sent in a burst with minimum inter-packet gap through the device or network under test without losing any frames.

The RFC 2544 methodology can be used to assess the parameters of service-level agreements (SLAs). A carrier can then determine whether an Ethernet circuit complies with the agreement, based on the test results.

Physical Connections

NOTE: RFC 2544 tests must be performed on a loopback basis, and all testing is typically performed on the NIC at the near end.

NIC – Network without Routers – Loopback

- In networks that do not have routers, it may be possible to use a simple loopback on the equipment.

NIC – Network with Routers – NIC in IP Reflection mode

- In networks with routers, a second NIC in IP Reflection mode can be used as a loopback device.
- Configure the far-end NIC unit's Reflect setting for Digital Lightwave Packets Only.
- In IP Reflection mode, the NIC reverses MAC and IP addresses and loops back the RFC test packets.

How to Configure and perform RFC2544 Testing



Note: The RFC tests are performed over the selected test Stream. The RFC tests will over-ride the test Stream's bandwidth rate, frame size and burst size parameters. However other parameters such as MAC addresses, IP addresses, UDP addresses and VLAN/MPLS settings are not over-written, and should be configured prior to beginning the RFC test.

To configure the test Stream:

1. Press **Config**, then **Strms Pg 1** or **Strms Pg 2**.
2. Select one of the streams by pressing the stream's row in the white area (See figure).

TX	Traffic	MAC Dest	Len...	IP MO...	Payload	send burst	
1 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	1
2 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	2
3 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	3
4 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	4
5 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	5
6 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	6
7 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	7
8 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	8
9 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	9
10 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	10
11 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	11
12 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	12
13 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	13
14 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	14
15 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	15
16 ☐	Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	16

	Packets	Pkts/sec	Bytes	Mbit/sec	%BW
TX	0	0	0	0.000	0.00
RX	0	0	0	0.000	0.00

3. Stream settings are made in the [Traffic Stream Profile](#) pop-up window.
 4. Make any applicable Stream settings such as Source and Destination MAC and IP Addresses, UDP port configuration and/or VLAN/MPLS configuration before continuing.
- 💡 It is not necessary to set **Frame Length**, **Rate** or **Burst Size**. These will be set by the RFC 2544 function.
5. NOTE: Adding VLAN or MPLS tags will change the minimum frame length that can be used. For example, if a single VLAN tag is selected, the minimum frame length will be changed from 64 to 68 and the first rate tested in the RFC 2544 test will be 68 bytes long.
 6. Select the On/Off checkbox for the Stream that has just been configured to being generating packets.
 7. Confirm that packets are being sent and received successfully.
- 💡 While the Stream is in On, the TX and RX packet count may not always be equal. This is normal. It is only necessary to determine that packets are being successfully received without any errors to confirm basic connectivity before beginning lengthy RFC 2544 tests.
8. Uncheck the On/Off checkbox to turn the Stream off.

 Note that if the Flow Control box is checked (Rx Enabled), it will automatically default to unchecked when an RFC test is activated. This is to ensure test validity and accuracy.

To configure the an RFC test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) that was configured above for the RFC tests.
3. Select **Trial Duration** and set the duration of the test (in seconds).

 RFC-2544 recommends a trial duration of at least 60 seconds for Through Put and Frame Loss testing.

4. Select **Dest Port** and choose the port that will receive the test signal.

 Note, if a port is in IP Reflection Mode, or if it is already in an active RFC test, this setting will be unavailable.

5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.

 **IMPORTANT:** The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

 **IMPORTANT:** The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
- b. Enter a new value and select **OK**. Value ranges are 64 - 16000.

- c. By default, packet sizes 64 - 1518 are already selected, but packet size 9000 is not selected. You can enable 9000 if your test needs to include Jumbo packets.
 - d. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select the type of RFC test that you wish to run by choosing its tab from along the left side of the RFC Tests screen. Complete any necessary configurations these tabs.
- To run a **Thru Put** test see [Throughput Testing](#)
 - To run a **Frame Loss** test see [Frame Loss Testing](#)
 - To run a **B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC-2544 - Thru Put Testing

Throughput testing is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

For example, the Throughput test starts by transmitting a stream at 100% using a packet size of 64 bytes. If it fails (i.e., an unacceptable number of packets are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing packets. The test then tries to zero in on the best throughput rate based on the Resolution Rate. The final rate appears as the Passing Rate.

Once this is completed, the packet size is increased to 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using default packet sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

When performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- [Accept Lost Rate](#) – Defines the percentage of frames that can be lost without being considered a failure.
- [Resolution Rate](#) – Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.



A Throughput test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Throughput test:

configure the Frame Loss test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.



IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.



IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **Thru Put** from the tabs along the left side of the RFC Tests screen.

9. Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.
10. Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

To start the Throughput test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream using the configured parameters, starting with the smallest packet size. The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first packet size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first packet size transmitted is 64-bytes followed by 128-bytes and so on.)

If packet loss is detected in a byte transmission, the stream is re-transmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

3. View Throughput test results on the [statistics table](#) at the bottom of the screen.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - Frame Loss Testing

Frame Loss testing is an RFC 2544 benchmark test. Its purpose is to determine the number of packets lost, by looping a stream through the network at varying transmit packet rates. The Frame Loss screen allows you to select a specific packet size to use in the Ethernet stream.



A Frame Loss test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Frame Loss test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
- b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
- c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

8. Select **Frame Loss** from the tabs along the left side of the RFC Tests screen.

To start the Frame Loss test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.

2. The unit immediately starts transmitting a test stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, Processing size 64 Rate 10.00. When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

3. View Frame Loss test results on the [statistics table](#) at the bottom of the screen. The table displays the frame loss test results for a specified packet size. The results represent the nine rates determined by the BW Ceiling and BW Floor settings.

To change the packet size and view its results:

- Choose the **Packet Size** button (for example, 256). The Frame Loss table displays the transmit and receive statistics for the selected packet size.

OR

- Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

 **Important:** The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - B2B Burst Testing

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.



A Back-to-Back Burst test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the B2B Burst test:

1. Select **RFC Tests** and choose [Conf.](#)



The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.



This value determines how long each trial runs. Valid values range from 2 to 10 seconds.

4. Select **Dest Port** and choose the port that will receive the test signal.
6. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **B2B Burst** from the tabs along the left side of the RFC Tests screen.
 9. Select **Resolution (in frames)**. A keypad appears.
 10. Enter a precision level for the test. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.
 11. Select **# Of Repetitions**. A keypad appears.
 12. Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50.

To start the Back-to-Back test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts sending a burst of frames with the minimum inter-frame gap between them. If all frames are received, the burst size is increased and the test repeated. If all frames are not received, the burst size is lowered and the test repeated until the longest burst the DUT can handle (without loss of frames) is determined.
3. View B2B Burst test results on the [statistics table](#) at the bottom of the screen.
 - Frame Size (bytes) – Indicates the tested frame size.
 - Max Possible Number of Frames – Indicates the number of frames transmitted without errors.
 - Avg Observed B2B Frames – Indicates the data stream's average frame count.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

Timed Test - Using Acceptance Criteria

The NIC unit has the capability to run a timed test (a test with Ethernet streams enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

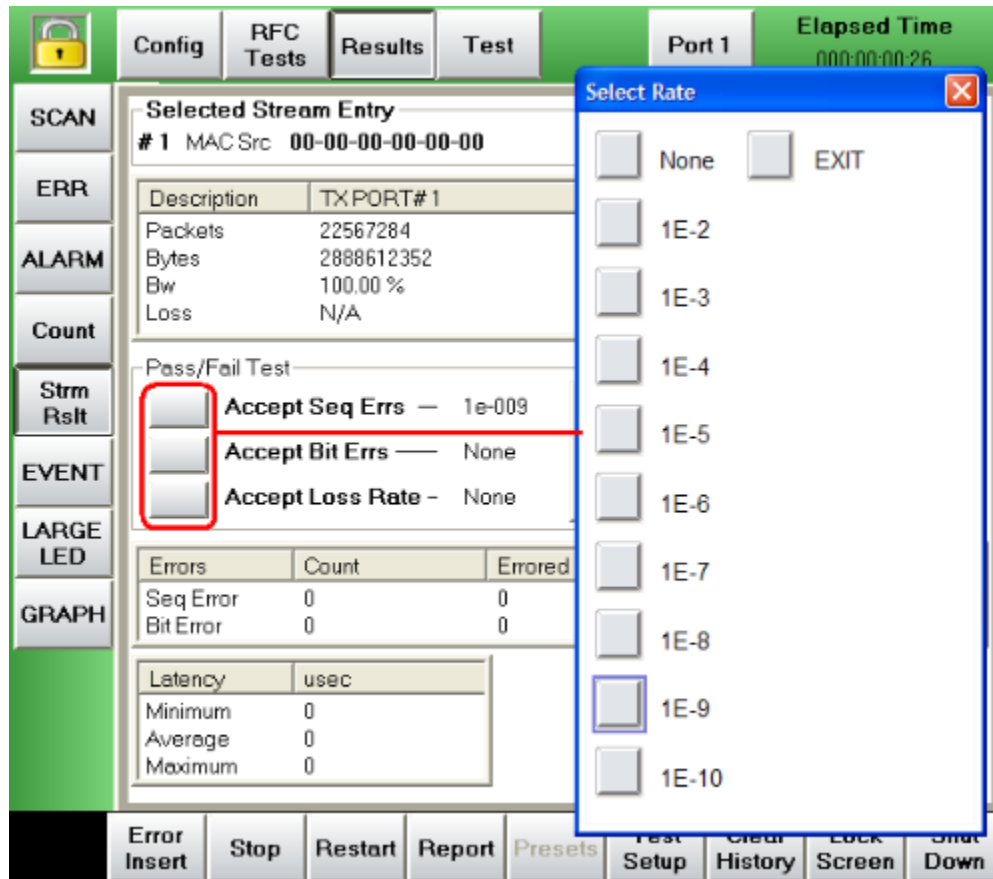
To Set Up the Test

1. Set up the port on which the test will be initiated. This includes the ports Interface, stream parameters, etc.. A test can be performed on a single port or port-to-port basis.
2. Enable the stream(s) to be used for the test.
3. Under the **Results > Strm Rslt** tab, configure the [Pass/Fail Test](#) acceptance criteria options. These include **Acceptable Sequence Error** rate, **Acceptable Bit Error** rate, and **Acceptable Loss Rate**. These values are set up on a per-stream basis.
4. Under the **Test** tab, select the desired **Duration** for the test.



If the "**Continuous**" duration is used, the test will continue to operate until the **Stop** button is pressed.

5. **Restart** the port that will be used for the timed test using the **Restart** button at the bottom of the screen.
6. When the time duration of the test is reached, the streams will automatically stop counting received packets and the Pass/Fail acceptance results are displayed under the **Results > Strm Rslt** tab.



User-Defined Acceptance Criteria:

- **Accept Seq Errors** - A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test.
- **Accept Bit Errors** - A user-specified threshold value for determining the acceptable bit error rate for a timed test.
- **Accept Loss Rate** - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test.

Measuring Service Disruption

(Specifically for LAN/WAN Ethernet testing)

The unit can measure Service Disruption switching intervals in your network. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

When enabled, the trigger event to begin service disruption measurements occurs when it stops detecting incoming packets.



The MSA module's Packet processor tab and Dual Enet processor tab also triggers on incoming packets with CRC/FCS errors.

The duration for every Ethernet service disruption event is measured in milliseconds, with granular accuracy of .1 ms (100 μ s).

When the Action state is configured for Continuous APS, the 10 most recent measurements are displayed in the History window. Also the Minimum and Maximum measurement times are logged, as well as an Average duration based on all measurements taken since the test began.

To measure Ethernet service disruption activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. When testing low speed Ethernet bandwidths ($\leq$ 1Gbps), you may need to configure the **Resolution** setting in conjunction with the **Consecutive Bad Time Required** setting, to ensure that at least one Ethernet packet is received within the configured period of time (measurement window). The following options are available: **High (.1 ms)**, **Medium (1 ms)** and **Low (10 ms)**.



When receiving fewer packets per second (lower bandwidths), a lower resolution setting (larger window of time) is required.



Invert the number of packets per second being received to determine the time between each received packet, and select the Resolution setting that best allows for at least packet to be received within the selected measurement window.



Important: The Resolution setting is only displayed on ports that support Ethernet rates $\leq$ 1Gbps.

3. Select **Consecutive Good Time Required** and enter a time interval ranging from 10 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
4. Select **Consecutive Bad Time Required** and enter a time interval ranging from 0.1 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames (or no frames) to elapse before Protection Switch measurements begin to accumulate.

5. From the **Action** box, select **State**. The Select APS Action dialog box appears.
6. Select [Single APS](#) or [Continuous APS](#) to begin measuring. The test set will begin monitoring the incoming signal for the event. If it occurs, the protection switch state and time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for consecutive good and bad time parameters.
7. In the **Protection Switch Time (MilliSecs)** table, view the duration, in milliseconds, that it took for the service disruption to occur.
8. In the **History Recent MilliSeconds table**, view a history of the 10 most recent measurements.
9. The complete summary of service disruption events for all processors within the NIC unit can be viewed simultaneously by selecting the **System** tab and choosing **Service Disruption**.

To Stop monitoring Service Disruption measurement activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. From the **Action** box, select **State** and choose **Stop APS**.

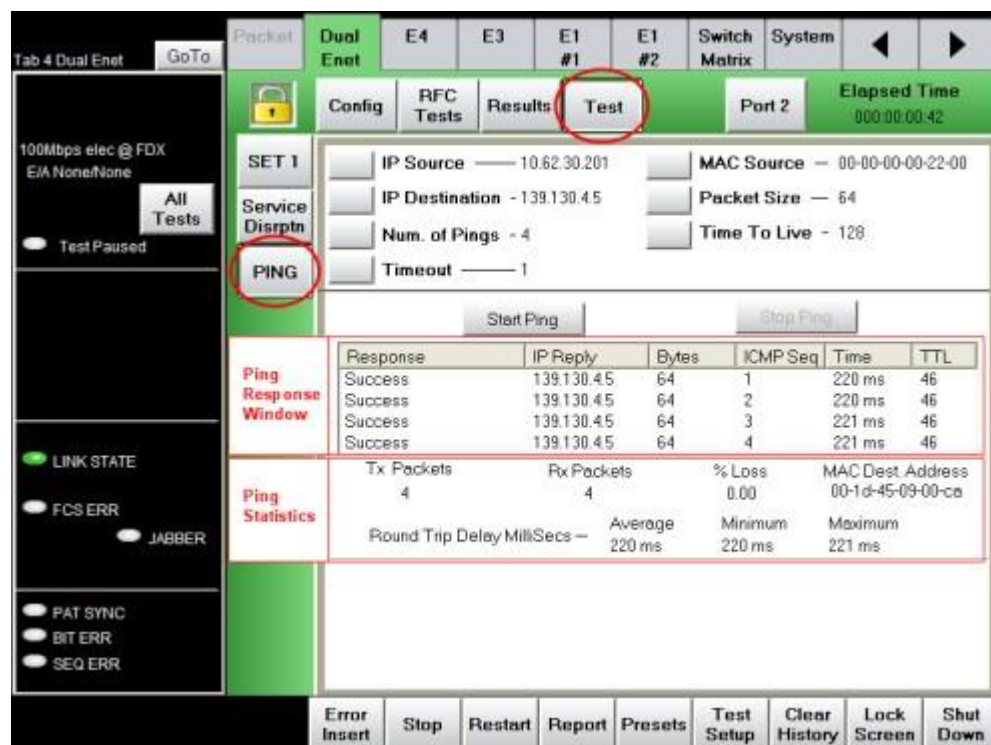
PING Functionality

PING is a utility used to determine whether a specific IP address is accessible. It works by sending a packet to the specified address and waits for a reply. PING is used primarily to troubleshoot Internet connections.

A PING packet is an IP packet requesting that a copy of the contents be echoed back to the sender. This packet type is called an ICMP Echo Request. When a site is “pinged”, an echo request is sent, and the destination site that receives it responds back. The response packet is called an ICMP Echo Reply.

The Ping utility is essentially a system administrator's tool that is used to see if a computer is operating and also to see if network connections are intact. Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.

The [PING screen selection](#) is implemented under the Test Tab.



Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).

- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:
 - From Destination Printer:
 - ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.
 - From Destination File:
 - ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.

 The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

- ▶ Enter a file name and select **OK**.

 **Important:** Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

- ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.

4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.

5. Select **OK**.

CSA SDH Tab

CSA-SDH Overview

The CSA 4100 (40G/100G Service Analyzer) circuit pack's SDH (Synchronous Digital Hierarchy) protocol processor module offers 40G (STM-256), with support for pluggable CFP modules.



Available interface rates and mappings are dependent on the licensed-based test options currently enabled.



All currently licensed interface rates are displayed in the Interface menu, regardless of the rates supported by the currently inserted CFP module.



Verify that the inserted CFP module supports the desired Interface rate prior to selecting it.

- Supports AU-4-256c Bulk Fill, AU-4-64c Bulk Fill, AU-4-16c Bulk Fill, AU-4-4c Bulk Fill, AU-4 C-4 Bulk Fill and AU-3 C-3 Bulk Fill mappings
- Supports Byte Capture, with up to a 256 byte memory
- Supports Low-Order mappings plus PDH and T-Carrier Add/drop, when mated with the MSA and PDH modules
- Supports Next Generation (VCAT/LCAS/GFP) and ATM testing capabilities, when mated with the MSA module
- Supports the "All Channel" Insert Option for AU-4-256c Bulk Fill, AU-4-64c Bulk Fill, AU-4-16c Bulk Fill, AU-4-4c Bulk Fill, AU-4 C-4 Bulk Fill and AU-3 C-3 Bulk Fill mappings
- Supports the ability to replicate the transmitted foreground test channel over all available structured channels
- Enhanced Thru Mode Testing - Supports the ability to manually intrude on Higher Order Path and Lower Order overhead bytes and traces, while Thru Mode is enabled.
- Enhanced Thru Mode Testing - Supports the ability to manually inject Higher Order Path and Lower Order Errors and Alarms, while Thru Mode is enabled
- The ability to set the transmit J0 and J1 traces as 16 byte ASCII, 64 byte ASCII, and unformatted hex values
- The Service Disruption measurement feature now supports measurements on Loss of Signal (LOS) events, with an measurement accuracy of +/-1ms

The CSA-OTN Online Help is divided into the following sections:

- [CSA-SDH Screen and Functions Overview](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screens and Function Descriptions

CSA-SDH Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control CSA's SDH configuration and operation.

The following screens and functions are discussed:

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [Perf Monitor](#)
- [LEDs](#)

Transmit

CSA-SDH Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SDH transmitting operations.

The following parameter setting options are available from the Transmit screen:

- [Set > Set 1](#)
- [Set > Set 2](#)
- [SOH](#)

- POH
- [PTR](#)
- [APS](#)
- [Error Alarm](#)

CSA-SDH Transmit - Set / Set 1

Use the Set 1 screen to configure CSA-SDH Transmit parameters. The following describes the functions that appear on this screen.

Function	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: On and Off .
Interface	Selects the SDH interface. The only option available is: • STM-256 (39.813) MLD  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it.  This setting is disabled when a CFP module is not inserted.

	 Not Assigned is displayed if a Non-SDH Interface is currently configured by another CSA tab.
Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-64c's can be mapped into an STM-256 signal. Mapping options are dependent on the selected Interface. The following options may be available: • AU-4-256c Bulk Fill • AU-4-64c Bulk Fill • AU-4-16c Bulk Fill • AU-4-4c Bulk Fill • AU-4 C-4 Bulk Fill • AU-3 C-3 Bulk Fill  The Mapping function is not available when the Interface shows Not Assigned
AU-<#> Added	Selects foreground AU# of the mapped signal. When available, select the AU-<#> Added button to enter the number of the specific AU channel to set as the <i>foreground</i> (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.

Background AU- <#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining <i>background</i> channels for the SDH signal. Select one of the following: PRBS 9, PRBS 9 Inverted, PRBS 11, PRBS 11 Inverted, PRBS 15, PRBS 15 Inverted, PRBS 20, PRBS 20 Inverted, PRBS 23, PRBS 23 Inverted, PRBS 31, PRBS 31 Inverted or a User Defined pattern (32-bit value).
Payload Pattern	Allows the user to select a test pattern to transmit over the SDH signal. This command is automatically coupled to its equivalent Receive command. Select one of the following: PRBS 9, PRBS 9 Inverted, PRBS 11, PRBS 11 Inverted, PRBS 15, PRBS 15 Inverted, PRBS 20, PRBS 20 Inverted, PRBS 23, PRBS 23 Inverted, PRBS 31, PRBS 31 Inverted or a User Defined pattern (32-bit value).
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. <u>BITS/SETS.</u> • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. The <i>CLK:BITS 1.5MHz</i> displays when configured for BITS clocking.

	• SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The <i>CLK:SETS 2MHz</i> displays when configured for SETS clocking.

CSA-SDH Transmit - Set / Set 2

Use the Set 2 screen to configure CSA-SDH Transmit parameters. The following describes the functions that appear on this screen.

Function	Description
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. • The frequency offset ranges from -120.0 to 120.0, in increments of 0.1 • The default value of 0 (zero) equals Off.  The Line Frequency Offset setting is only available when the Clock Reference is set to Internal timing.  This setting is coupled to the TX Line Frequency Offset setting on the CSA-MLD tab.

Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • Off - The unit's laser will be off when the unit is turned on. • On - The unit's laser will be on when the unit is turned on. • Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH.  Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)

Path Signal Label	The Path Signal Label is part of the POH and identifies the type of traffic contained in the SPE. The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: • 00 (Unequipped) • 01 (Equipped) • 02 (VT Structured STS) • 03 (Lock VT Mode) • 04 (Async DS3 Mapping) • 12 (Async DS4NA Mapping) • 13 (ATM Mapping) • 14 (DQDB Mapping) • 15 (Async FDDI Mapping) • 16 (HDLC Over SONET) • 1A (10G WAN IEEE802.3ae) • 1B (GFP Mapping) • User Defined (any eight bit pattern 0 to FF).  This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: • 00 (Sync Trace Unknown-STU) • 01 (Stratum 1 Trace-PRS) • 04 (Transit Node Clock-TNC) • 07 (Stratum 2 Trace-ST2) • 0A (Stratum 3 Trace-ST3) • 0C (SONET Minimum Clk-SMC) • 0D (Stratum 3E Trace-ST3E) • 0F (Do Not Use for Sync-DUS) • User Defined (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external +5v "pulse" is detected on the external Trigger In SMA connector. The following options are available: • None: The protocol processor will do nothing when an external pulse is received. (default setting) • Restart: The current test will restart when an external pulse is received. • Error Insert: The protocol processor will insert an error when an external pulse is received. For this to work, you must first select an Error Type to be inserted.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • Enable: For SONET, the unit uses its TCM circuitry and the Z5 byte to generate errors and alarms between TCM equipment. For SDH, the unit uses the N1 byte.

	• Disable: TCM mode is disabled, and the Z5 (or N1) byte follows normal operation.
TX Clock Loss Threshold	 This setting is not currently supported on the CSA module.

CSA-SDH Transmit - SOH

The Transmit SOH screen contains the following options:

Function	Description
Showing	Select Showing to choose an Overhead slot within the SDH signal. The overhead bytes that appear on the SOH screen are associated with this slot.
RS and MS Overhead bytes	Allows the user to select an Overhead byte to edit its value.
J0 Trace	The J0 byte is part of the Regenerator Section (RS) Overhead and is known as the RS Trace or J0 Trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern. The following options are available: • Default (64 byte) - Selects the 64-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • User Defined (64 byte) - Selects a 64-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF).

	• All Ones - Selects an All Ones pattern as the J0 trace pattern. • All Zeros - Selects an All Zeros pattern as the J0 trace pattern. • Default (16 byte) - Selects the 16-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte) - Selects a 16-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

CSA-SDH Transmit - PTR

The Transmit PTR screen contains the following Pointer options:

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: Yes (On): Generates an NDF when a new Pointer is transmitted. No (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which Administrative Unit (AU) Pointer adjustments are needed in the Synchronous Payload Envelope (SPE). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.

Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Single options - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. Increment/Decrement option -Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Continuous options - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 5.5 - 35000.
INC Pointer / DEC Pointer (action buttons)	When a Single pointer action is selected, these will performs a single pointer Increment or Decrement. When a Continuous pointer action is selected, these will begin the pointer Increment or Decrement Sequence.
Stop Sequence (action button)	This button becomes available when a Continuous pointer sequence is running, this button will stop the pointer action sequence.

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the [Apply Maintenance to Entry](#) window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- [K1 Full Byte \(Linear Mode\)](#)
- [K1 Bits 1-4 \(Linear Mode\)](#)
- [K1 Bits 5-8 \(Linear Mode\)](#)
- [K2 Full Byte \(Linear Mode\)](#)
- [K2 Bit 5 \(Provisioned\) \(Linear Mode\)](#)
- [K2 Bits 1-4 \(Linear Mode\)](#)
- [K2 Bits 6-8 \(Linear Mode\)](#)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- [K1 Full Byte \(Ring Mode\)](#)
- [K1 Bits 1-4 \(Ring Mode\)](#)
- [K1 Bits 5-8 \(Ring Mode\)](#)
- [K2 Full Byte \(Ring Mode\)](#)
- [K2 Bit 5 \(Provisioned\) \(Ring Mode\)](#)
- [K2 Bits 1-4 \(Ring Mode\)](#)

- [K2 Bits 6-8 \(Ring Mode\)](#)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)

(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.

(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100

#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011

#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101

#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description

#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101

#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description

Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

CSA-SDH Transmit - Error Alarm

Use this screen to configure and transmit SDH errors and alarms.

For information on inserting errors and alarms see the online help topics, [Inserting Errors](#) and [Inserting Alarms](#) in the Common Tasks section.

The following options are available on the SDH Errors and Alarms screen.

Option	Description
Error to Insert	Allows the user to select an error that is transmitted by the SDH signal. Selecting the Error to Insert button opens the Select Error Insert list. Available errors include: - Frame, B1 Error, B2 Error, MS-REI, B3 Error, HP-REI, BIT Error and None Note: When TCM is enabled, the following error are also available. - HP-TC-IEC, HP-TC-REI and HP-TC-OEI
Error Insert Rate	Sets the insertion rate for the selected error type. This setting is not available if Error to Insert is set to None. The following options are available for this command. Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button. 1e-X, where X is a value from 3 through 10. User Defined: Allows you to enter and save a customized error insertion rate.
Alarm Generated	Generates a specific alarm that is transmitted by the SDH signal. The following alarms are available: LOS, LOF, MS-AIS, MS-RDI, AU-LOP, AU-AIS, HP-RDI, HP-UNEQ and None.

	Note: When TCM is enabled, the following alarms are also available. • HP-TC-RDI, HP-TC-ODI, HP-TC-AIS, HP-TC-UNEQ and HP-TC-LOF

Receive

CSA-SDH Receive Screens and Functions

The Receive function allows you to define the parameters used in SDH receiving operations.

The following parameter setting options are available from the Receive screen:

- [Set > Set 1](#)
- [Set > Set 2](#)
- [SOH](#)
- [POH](#)
- [Capture](#)
- [SIG](#)

CSA-SDH Receive - Set / Set 1

Use the Set 1 screen to configure CSA-SDH Receive parameters. The following describes the functions that appear on this screen.

Function	Description
Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well.

	If Independent is selected, settings established on the Receive screen will only affect Receive mode.
Interface	Selects the SDH interface. The only option available is: • STM-256 (39.813) MLD  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it.  This setting is disabled when a CFP module is not inserted.  Not Assigned is displayed if a Non-SDH Interface is currently configured by another CSA tab.

Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-64c's can be mapped into an STM-256 signal. Mapping options are dependent on the selected Interface. The following options may be available: • AU-4-256c Bulk Fill • AU-4-64c Bulk Fill • AU-4-16c Bulk Fill • AU-4-4c Bulk Fill • AU-4 C-4 Bulk Fill • AU-3 C-3 Bulk Fill  The Mapping function is not available when the Interface shows Not Assigned
AU-<#> Dropped	Selects a specific AU# signal to monitor in the SDH signal. The test set receives the SDH signal that is demuxed into dropped signals and then processed.  The options that appear will depend on your current configuration. The default setting is 1.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SDH signal. Select one of the following patterns: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.

Power Low Threshold	This setting is not supported on the CSA-SDH tab.  Use the Power Low Threshold setting on the CSA-MLD tab.
Out of Frequency Threshold	Sets the threshold for which the Frequency Wide alarm occurs. When the received Line Frequency Offset (in ppm) exceeds the set threshold setting, the Frequency Wide alarm will occur. The threshold value is entered using an on-screen keypad, and can range from 0 ppm to 120.0 ppm in increments of 0.1 ppm. The default value is 0 ppm (Disabled).
Trigger Out	Selects a specific receive event that will cause the protocol processor to generate a +5v "pulse" on the external Trigger Out SMA connector.

CSA-SDH Receive - Set / Set 2

Use the Set 2 screen to configure CSA-SDH Receive parameters. The following describes the functions that appear on this screen.

Function	Description
PLM Alarm Reporting	Enables or Disables Payload Label Mismatch alarm reporting.
Expected HP Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: • 00 (Unequipped) • 01 (Equipped) • 02 (TUG Structured) • 03 (Lock TU Mode) • 04 (Async 34M/45M Mapping)

	• 12 (Async 140M Mapping) • 13 (ATM Mapping) • 14 (DQDB Mapping) • 15 (Async FDDI Mapping) • 16 (HDLC Over SONET) • 1A (10G WAN IEEE802.3ae) • 1B (GFP Mapping) • FE (O.181 Test Signal) • FF (VC-AIS) • User Defined (any eight bit pattern 0 to FF)  This option is not coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.
TIM Alarm Reporting	A Regenerator Section Trace Identifier Mismatch (RS-TIM) alarm occurs when the incoming J0 trace does not match the Expected J0 trace setting. An Higher-order Path Trace Identifier Mismatch (HP-TIM) alarm occurs when the incoming J1 trace does not match the Expected J1 trace setting. A TCM Trace Identifier Mismatch (HP-TC-TIM) alarm occurs when the incoming TC trace does not match the Expected TC Trace setting, and when TC Error/Alarm Processing is enabled. The following options are available: • Enabled - TIM alarms are monitored and reported. • Disabled - TIM alarms are ignored.
Expected J0	Defines the expected J0 trace received on the incoming SDH signal.

	When TIM Alarm Reporting is Enabled, an RS-TIM alarm occurs if the incoming J0 trace does not match the Expected J0 trace setting.  The J0 byte is part of the Regenerator Section OH and is known as the RS trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • User Defined (64 byte) - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte): Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. • All 01's - Selects a repeating "All Ones" (0x01 hex) pattern as the expected J0 trace pattern. • All 00's - Selects a repeating "All Zeros" (0x00 hex) pattern as the expected J0 trace pattern. • User Defined (1 byte): Selects a repeating user-defined hexadecimal byte value as the expected J0 trace pattern. The byte value is entered using a touch screen keypad.
Expected J1	Defines the expected J1 trace received on the incoming SDH signal.

	When TIM Alarm Reporting is Enabled, an HP-TIM alarm occurs if the incoming J1 trace does not match the Expected J1 trace setting.  The J1 byte is part of the Higher-order Path OH and is known as the HP trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • User Defined (64 byte) - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte): Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. • All 01's - Selects a repeating "All Ones" (0x01 hex) pattern as the expected J1 trace pattern. • All 00's - Selects a repeating "All Zeros" (0x00 hex) pattern as the expected J1 trace pattern. • User Defined (1 byte): Selects a repeating user-defined hexadecimal byte value as the expected J1 trace pattern. The byte value is entered using a touch screen keypad.
SS Bits Alarm Reporting	Enables or Disables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the alarm's duration in seconds will appear under the Results Scan function.

Expected SS Bits	Selects one of the following as the expected SS Bits (bits 5 and 6 of the H1 Pointer byte) value: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)
TC Error/Alarm Processing	Enables or Disables Tandem Connection Monitoring (TCM) alarm reporting mode. • Enable - Turns on N1 (Z5 for SONET) byte for TCM error and alarm reporting mode. • Disable - Turns off TCM error and alarm reporting mode.  The TCM Summary LED turns red if a TCM error or alarm is reported. Select the TCM Summary text for more details.  Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.
Expected TC Trace	Defines the Expected TCM Trace value on the incoming signal. For SDH this is in the N1 byte, for SONET this is in the Z5 byte. The following options are available: • Default (16 byte): Selects the Digital Lightwave ASCII message as the expected TCM trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte): Selects a user-defined ASCII message as the expected TCM trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. • All 01's - Selects a repeating "All Ones" (0x01 hex) pattern as the expected TCM trace pattern.

	• All 00's - Selects a repeating "All Zeros" (0x00 hex) pattern as the expected TCM trace pattern. • User Defined (1 byte): Selects a repeating user-defined hexadecimal byte value as the expected TCM trace pattern. The byte value is entered using a touch screen keypad.  This function is used in conjunction with both the TC Error/Alarm Processing function, and the TIM Alarm Reporting function.

CSA-SDH Receive - SOH

The Receive SOH (Multiplex Section Overhead) screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SDH signal. The following bytes appear for the selected SOH slot: • Section Overhead bytes (A1, A2, J0/Z0, B1, E1, F1, D1, D2, and D3) • Pointer bytes (H1, H2, and H3) • Path Overhead bytes (B2, K1, K2, D4-D12, S1/Z1, Z2, and E2)  The S1 byte (in Slot 1 only) can be selected to show the decoded value of the received Synchronization Status.
J0 Trace	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

CSA-SDH Receive - POH

The Receive POH (Higher-order Path Overhead) screen contains the following options:

Option	Description

AU-<#> Dropped	Allows the user to enter the number of the specific AU channel to monitor. The default setting is 1.
HP Overhead	Displays the Overhead bytes for a specific Higher-order Path OH slot on the incoming SDH signal. This is a read-only function. The following bytes appear for the selected POH STS channel: Path Overhead bytes (B3, C2, G1, F2, H4, F3, K3, and N1)  The C2 byte can be selected to show the decoded value of the received HP Signal Label.
J1 Trace	Displays the J1 trace received on the incoming SDH signal. This is a read-only function.
TC Trace	Displays the TCM trace received on the incoming SDH signal. This is a read-only function.

CSA-SDH Receive - Capture

Use the Capture screen to capture 256 bytes of received overhead bytes, before/after a triggered event occurs.

Function	Description

Byte Select

Select the **Multiplex Section (MS) Overhead** byte to be captured.

A1	A2	J0/Z0
B1	E1	F1
D1	D2	D3
H1	H2	H3
B2	K1	K2
D4	D5	D6
D7	D8	D9
D10	D11	D12
S1/Z1	Z2/M1	E2
MORE...		

When MORE... is selected, then the following **Higher-order Path (HP) Overhead** bytes can be selected.

J1
B3
C2
G1
F2
H4
F3/Z3
K3/Z4
N1/Z5

Capture Trigger	Select the Capture Trigger event. <table border="1"> <tr> <td>FRAME ERROR</td><td>HP-RDI ALARM</td></tr> <tr> <td>B1 ERROR</td><td>AU-LOP ALARM</td></tr> <tr> <td>B2 ERROR</td><td>PTR INCREMENT</td></tr> <tr> <td>B3 ERROR</td><td>PTR DECREMENT</td></tr> <tr> <td>MS-REI ERROR</td><td>NO NDF ALARM</td></tr> <tr> <td>HP-REI ERROR</td><td>NDF</td></tr> <tr> <td>BIT ERROR</td><td>BYTE EQUAL</td></tr> <tr> <td>MS-AIS ALARM</td><td>BYTE NOT EQUAL</td></tr> <tr> <td>MS-RDI ALARM</td><td>MANUAL</td></tr> <tr> <td>AU-AIS ALARM</td><td></td></tr> </table>	FRAME ERROR	HP-RDI ALARM	B1 ERROR	AU-LOP ALARM	B2 ERROR	PTR INCREMENT	B3 ERROR	PTR DECREMENT	MS-REI ERROR	NO NDF ALARM	HP-REI ERROR	NDF	BIT ERROR	BYTE EQUAL	MS-AIS ALARM	BYTE NOT EQUAL	MS-RDI ALARM	MANUAL	AU-AIS ALARM	
FRAME ERROR	HP-RDI ALARM																				
B1 ERROR	AU-LOP ALARM																				
B2 ERROR	PTR INCREMENT																				
B3 ERROR	PTR DECREMENT																				
MS-REI ERROR	NO NDF ALARM																				
HP-REI ERROR	NDF																				
BIT ERROR	BYTE EQUAL																				
MS-AIS ALARM	BYTE NOT EQUAL																				
MS-RDI ALARM	MANUAL																				
AU-AIS ALARM																					
Match Value	This setting only appears when the Capture Trigger is set to "BYTE EQUAL" or "BYTE NOT EQUAL". Use the keypad to enter the byte value (in Hex) that the selected byte's received value will either need to "equal" or "not equal" in order to trigger the capture event.																				
Bytes After Trigger	When a Capture event has been triggered, 256 overhead byte values will be captured (from 0 to 255). This setting is used to specify how many of those 256 bytes should be captured immediately following the trigger, and in turn how many of those 256 bytes should be captured immediately preceding the trigger.  If 255 is entered (default), then the triggered byte value, and the following 255 byte values after the trigger event will be captured.  If 254 is entered (default), then the one byte immediately preceding the trigger, the triggered byte value, and the following 254 byte values will be captured.  If 100 is entered, then the 155 bytes immediately preceding the trigger, as well as the triggered byte value, and the following 100 byte values will be captured.																				

	 If 0 is entered, then the 255 bytes immediately preceding the trigger, as well as the triggered byte value will be captured, but 0 bytes after the trigger will be captured.
Action buttons	► Capture - Activates the capture feature, and changes the State to "Waiting for Trigger".  If the Capture Trigger setting is set to MANUAL, then the capture will immediately be triggered, otherwise the processor will wait until the selected Capture Trigger event occurs. ► Stop - Deactivates the capture feature, and changes the State from "Waiting for Trigger" to "Start", and re-enables the Capture button. ► Reset - Clears the previously captured byte values
State	Displays the current state of the capture feature. Possible States include: ► Start ► Waiting for Trigger ► Done

OH CAPTURE RESULTS	When a capture event is triggered, the 256 captured bytes are displayed in both Hexadecimal and ASCII. The Frame column displays the frame number for each of the captures bytes. Frame numbers can range from -255 to 255, depending on the Bytes After Trigger setting. The Hex column displays each captured frame's byte value in Hexadecimal format. The ASCII column displays each captured frame's byte value in ASCII format. (A hex value o 0, will be displayed as blank)

CSA-SDH Receive - SIG

Displays the following measurements of the incoming SDH signal:

- Frequency in Hz
- Line Frequency Offset Received in Hz and ppm
- Optical Power source in dBm (this is an aggregate power level when the CFP has multiple Optical lanes)



The per-lane optical power levels are displayed on the [CSA-MLD Receive - SIG](#) screen.

- AU Pointer Frequency Offset in ppm

Results

CSA-SDH Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The Results screen provides different ways of viewing received statistics. From the left side of the Result screen, select one of the following tabs:

- [Error / Alarm](#)

- [PTR](#)
- Event Log
- [APS](#)
- [Large LED](#)
- [Graphs](#)
- VCAT - This is currently not supported on the CSA circuit pack
- LCAS - This is currently not supported on the CSA circuit pack
- All Path - This is currently not supported on the CSA circuit pack

Error / Alarm

CSA-SDH Results - Error & Alarm

The Err screens provides the following options:

- [Scan](#)
- [Errors](#)
- [Alarms](#)

CSA-SDH Results - Error & Alarm - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

- For [Alarms](#), the duration is reported as a count in seconds.
- For [Errors](#), an error count is reported.
- The message **No Errors or Alarms** appears if no events are received by the unit.

CSA-SDH Results - Error & Alarm - Errors

The system can monitor and report errors on the incoming SDH signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the SDH network, or

- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **FRAME (Section A1/A2 Framing Bytes)**
- **B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)**
- **B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)**
- **MS-REI (Multiplex Section - Remote Error Indication - Line)**
- **B3 (Path BIP-8, also known as a Path Coding Violation - CV-P)**
- **HP-TC-IEC (Higher-order Path - TCM-Incoming Error Count)**
- **HP-TC-REI (Higher-order Path - TCM-Remote Error Indicator)**
- **HP-TC-OEI (Higher-order Path - TCM-Outgoing Error Indicator)**
- **BIT (BIT errors reported in the payload)**
- **AU-NDF (Administrative Unit - New Data Flag)**



The TCM-Path Errors only appears when [TC Error/Alarm Processing](#) has to be Enabled in the Receive settings.

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

CSA-SDH Results - Error & Alarm - Alarms

The system can monitor and report alarms and their duration on the incoming SDH signal.

The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- **LOS (Loss of Signal)**

- Power Hot
- Power Warm
- Power Low
- Frequency Wide
- OPU Generic AIS
- LOF (Loss of Frame)
- MS-AIS (Multiplex Section - Alarm Indication Signal)
- MS-APS (Multiplex Section - Automatic Protection Switching)
- OOF (Out Of Frame)
- MS-RDI (Multiplex Section - Remote Defect Indicator)
- RS-TIM (Regenerator Section - Trace Identifier Mismatch)
- Pat Sync (Pattern Synchronization)
- HP-PLM (Higher-order Path - Payload Label Mismatch)
- Concat (Concatenated)
- AU-AIS (Administrative Unit - Alarm Indication Signal)
- AU-LOP (Administrative Unit - Loss of Pointer)
- HP-UNEQ (Higher-order Path - Unequipped)
- HP-RDI (Higher-order Path - Remote Defect Indicator)
- HP-TIM (Higher-order Path - Trace Identifier Mismatch)
- SS MISMATCH (Signal Status Mismatch)
- HP-TC-RDI (Higher-order Path - Remote Defect Indicator)
- HP-TC-ODI (Higher-order Path - Outgoing Defect Indicator)
- HP-TC-AIS (Higher-order Path - Alarm Indication Signal)
- HP-TC-UNEQ (Higher-order Path - Unequipped)
- HP-TC-LOF (Higher-order Path - Loss of Frame)
- HP-TC-TIM (Higher-order Path - Trace Identifier Mismatch)



The HP-TCM Alarms only appears when [TC Error/Alarm Processing](#) has to be Enabled in the Receive settings.

CSA-SDH Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

The following AU Pointer results appear:

- **Pointer Justification** - Indicates the Positive Pointer Justification count.
- **Negative Justification** - Indicates the Negative Pointer Justification count.
- **Positive Justification Seconds** - Indicates the duration of a Pointer adjustment.
- **NDF Count** - Indicates the New Data Flag count.
- **Rx Pointer Bytes (HEX)** and **Rx Pointer Value** (in decimal) - Valid Pointers range from 0 to 782.

CSA-SDH Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description
APS Summary	When selected, the following information appears in the results table last 15 K1 and K2 byte sequences received: • The HEX value of the K1 byte. • The HEX value of the K2 byte. • The number of frames received that contain the K1 and K2 bytes. • The elapsed time of the frames that contain the K1 and K2 bytes.  To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.

APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either Linear Protection Switching Mode or Ring APS Signaling Mode.



Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

CSA-SDH Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.

White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the SDH protocol processor, see [CSA-SDH LEDs](#).

CSA-SDH Results - Graph

The Graph function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Test

Test Screens and Functions

(Specifically for SDH testing)

The Test screen configures test parameters associated with an SDH protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.

- **Action After Duration:** This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test:** This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

 To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description

None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.

Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for SDH testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For all **SDH** rates one frame is roughly .125 ms (125 μ s)

Test Service Disruption functions include:

- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

 For all **SDH** processors the Protection Switch Criteria include: **B1**, **OOF**, **MS-AIS**, **AU-AIS**, **TU-AIS**, and **PRBS** (Bit Errors and Loss of Pattern Sync).
- **Good Time** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ For all **SDH** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.
- **Good Frames** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range is 1 to 16383 frames, and is entered using a keypad.

- **Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Switch Frames** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5).
- **History Recent Frames**: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

Test - RTD (Round-Trip Delay)

(Specifically for SONET and SDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State)**: Starts and stops round-trip delay mode.
 - ▶ **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the errored frame is received by the unit. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.
 - ▶ **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the

slowest round trip appears in the **Maximum** column.

► **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.

- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames detected after each errored frame is transmitted and return back to the unit.

► The **Current** column displays the most recent round trip measurement.

► The **Minimum** column displays the fastest round trip measurement.

► The **Maximum** column displays the slowest round trip measurement

- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement.

► For all **SONET** and **SDH** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.

- **Consecutive Good Frames Required:** This function allows you to enter the number of consecutive error-free frames to occur before round-trip measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

Perf Monitor

Performance Monitor Screens and Functions

Specifically for SDH testing

Performance Monitoring provides greater detail about incoming Regenerator Section (RS), Multiplex Section (MS), Higher-Order Path (HP), Lower-Order Path (LP), BIT errors, and M.2120 / M.2110 compliant Performance Monitoring.

The following options are available:

- [RS](#)

- [MS](#)
- [HP](#)
- [LP](#) (*only available when in a LP mapping*)
- [BIT](#)
- [M.2120 / M.2110](#)

Perf Monitor - RS

Specifically for SDH testing

This provides a detailed breakdown for Regenerator Section errors detected and logged by the SDH protocol processor.

G.826 Near B1 Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Perf Monitor - MS

Specifically for SDH testing

The MS screen provides a detailed breakdown for Multiplexor section errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.829** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.829 results.

This section is broken down into the following areas:

 **Important:** Select the G.826/G.829 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.829 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

G.826 and G.829 Near B2 Errors and Far MS REI Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure
- G.826/G.829: Select the command button to toggle between G.826 and G.829 error statistics.

M.2101.1 Near B2 Errors and Far MS REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Perf Monitor - HP

Specifically for SDH testing

The HP screen provides a detailed breakdown for Higher-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

G.826 and G.828 Near B3 Errors and Far HP REI Errors

 **IMPORTANT:** Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B3 Errors output also toggles the Far HP REI Errors output.

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure
- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near B3 Errors and Far HP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Perf Monitor - LP

Specifically for SDH testing

The LP screen provides a detailed breakdown for Lower-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the G.826/G.828 toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

 **IMPORTANT:** Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

This section is broken down into the following areas:

G.826 and G.828 Near LP BIP Errors and Far LP REI Errors

- Errored Block (EB) count.
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure.

- G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near LP BIP Errors and Far LP REI Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Perf Monitor - BIT

Specifically for SDH testing

The BIT screen provides a detailed breakdown for BIT errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set allocation percentages and durations by selecting their respective buttons.

This section is broken down into the following areas:

G.821 BIT Errors

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826 BIT Errors

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error Free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2101.1 BIT Errors

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2101.1 Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Perf Monitor - M.2120 / M.2110

Specifically for SDH testing

The M.2120 / M.2110 screen provides a detailed breakdown for errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period.

[Error thresholds can be set directly from the M.2120 / M.2110 screen.](#)

The following statistics appear on the M.2120 / M.2110

Statistic	Description
Event	Lists the error type and error.
TR15	Threshold Report 15-minute evaluation period. A TR is an error performance report with respect to a 15-minute

	evaluation period. There are one TR15 and one Reset TR15 (RTR15) for each performance event. The start and end time for the 15-minute evaluation window must occur on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. The TR15 evaluation period occurs as soon as the 15-minute threshold is reached or exceeded. If the number of errors for an event cross the threshold during the 15-minute period the test records "fail"; if the errors do not exceed the threshold the test records "pass." The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result records in the Prev15 column and the performance evaluation continues and records the new result in the Cur15 column.
RTR15	Reset Threshold Report 15-minute evaluation period. There are one RTR15 and one TR15 for each performance event. The start and end time for the 15-minute evaluation window must occur on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. An RTR15 occurs at the end of a 15-minute period in which the count is less than or equal to the reset threshold and there has not been any unavailable time during that period. An RTR15 can only occur subsequent to a 15-minute period containing a TR15.
TR24	Threshold Report 24-hour evaluation period. There is one TR24 for each performance event. The start and end time for the 24-hour evaluation window must occur on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded.
Cur15	Displays the pass or fail state for the current 15-minute evaluation period. After the evaluation period ends the registers reset to zero and the pass/fail state records in the Prev15 column and the performance evaluation continues.
Prev15	Displays the pass or fail state for the previous 15-minute evaluation period. The history periods are used as a stack, i.e. the values held in each register are pushed down the stack

	one place at the end of each 15-minute period, and the oldest value at the bottom of the stack is discarded.
Cur24	Displays the pass or fail state for the current 24-hour evaluation period.
Prev24	Displays the pass or fail state for the previous 24-hour evaluation period.

CSA-SDH LED Quick Status Area

When the CSA-SDH protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) Results screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Indicates current SDH transmit interface setting and rate.  If a non-SDH interface is selected from one of the other CSA tabs, then "Not Assigned" will be displayed.  If the CFP module has been removed after an SDH interface was selected, "No Laser" will be displayed.
RX	Displays the received optical power in dBm. This status indicator will flash when one or more received Optical Lanes'

	power level exceeds the CFP's Power Warm or Power Hot thresholds.  This is an aggregate broadband power value, based on the combined power levels from all of the CFP's received Optical Lanes. See the CSA-MLD Receive - SIG screen for individual Optical Lane power levels.  If the CFP module has been removed, "Missing CFP" will be displayed.
E/A	Indicates the current Error / Alarm configured for transmission in the SDH signal. This is a status indicator.
Test Paused	If red, indicates that the current test has been paused .
CLK	Indicates the value of the Transmit Clock Reference function. This is a status indicator.
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
RS	Regenerator Section Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
LOS	Loss of Signal. Indicates that a valid SDH signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SDH signal, then an LOS is reported.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming SDH signal has been detected. An LOF is reported if an OOF defect continues for 3 milliseconds or longer. This is alarm LED.
OOF	Out Of Frame. Declared when four or more consecutive errored frames are detected on the incoming SDH signal. This is an alarm LED.

B1	Section Overhead BIP-8 Code Violation. Indicates an error in the SDH frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is an RS error that applies not only to the RS OH, but the entire frame. Any error in the frame will result in B1 error. This is an error LED.
MS	Multiplex Section Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
MS-REI	Multiplex Section - Remote Error Indicator. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the SDH MS Overhead are used for this indicator. This is an error LED.
MS-AIS	Multiplex Section - Alarm Indication Signal. Indicates if an alarm is being received from upstream line terminating equipment. This is an alarm LED.
APS	Automatic Protection Switching. Indicates that the K1 and K2 bytes on the incoming SDH signal have changed.
MS-RDI	Multiplex Section - Remote Defect Indicator. Indicates that a downstream defect has occurred along the Line layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
B2	Line Overhead BIP-8 Code Violation. Indicates that parity errors were detected at the Line layer of the incoming SDH signal. This is calculated over the MS OH, HP OH, and payload of each STM-1. This is an error LED
HP	Higher-order Path Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AU-AIS	Administrative Unit - Alarm Indication Signal. Indicates if an alarm is being received from upstream path terminating equipment. This is an alarm LED.

HP-RDI	Higher-order Path - Remote Defect Indicator. Indicates that a remote alarm is being received from downstream Path terminating equipment. The G1 byte of the HP Overhead is used for this indicator. This is an alarm LED.
AU-LOP	Administrative Unit - Loss of Pointer. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SDH signal. This is an alarm LED.
HP-REI	Higher-order Path - Remote Error Indicator. Indicates that an error count is being received from downstream Path terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
AU-PTR	Administrative Unit - Pointer Adjustments. Indicates Pointer offsets or adjustments between the AU payload and the STM-N frame are occurring. This is a status LED.
B3	Higher-order Path Overhead BIP-8 Code Violations. Indicates that parity errors were detected at the HP layer of the incoming SDH signal. This is calculated over the HP OH and payload of each STS-1. This is an error LED.
HP-UNEQ	Higher-order Path - Unequipped Payload. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from path terminating equipment. This is an alarm LED.
PAT SYNC	Pattern Sync Mismatch. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	BIT Error. Indicates a Bit error was detected in the payload. This is an error LED.
TCM  This LED only appears when TC Error/Alarm Processing has to be Enabled in the Receive settings.	Tandem Connection Status LED. Indicates if a TCM error or alarm has been detected.  If this LED is red, select the "TCM" text to display the TCM Summary LEDs.

SSM	Signal Status Mismatch - Displays when the expected SS bits setting in the H1 byte do not match what is received. This is an alarm LED.  SS Bits Alarm Reporting must be enabled for this alarm to occur..

Specific Tasks

CSA-SDH Specific Tasks Overview

This section includes tasks that are specific to the CSA-SDH protocol processor. For general tasks, refer to the [Common Tasks](#) section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- [Make Pointer Adjustments](#)
- [Configuring APS \(K1 and K2\) Commands](#)
- [Decoding APS \(K1 and K2\) Values](#)
- [Using M.2120 / M.2110 PM](#)
- [SDH TCM LEDs](#)

Using Pointers

Making Pointer Adjustments

The beginning of a SONET or SDH payload is identified by a **Pointer**. It consists of the H1 and H2 Pointer bytes. You can stress a network by manually adjusting the Pointer using the Increment and Decrement Pointer buttons. By performing this task, you can stress your SONET or SDH equipment to verify if it can tolerate Pointer adjustments, and how your equipment will react and report these adjustments.

There are several Pointer parameters that must be configured before making a positive or negative Pointer adjustment.

To make Pointer adjustments:

1. Select a protocol processor mode.
2. Select **Transmit** and choose **PTR**.
3. Configure the Pointer Adjustment parameters. For example,
 - Select [NDF Flag](#) to allow a New Data Flag to be set when a new Pointer value has been transmitted.
 - Select [Pointer Value](#) to change the Pointer value from 0 to 782.
 - Select [Frequency Offset](#) to increase or decrease the speed of the Pointer adjustments.
 - Select [Pointer Action](#) to select the type of Pointer activity that occurs when the Increment Pointer or Decrement Pointer buttons are selected.
 - Use [Burst Count](#) to set the number of Pointer location movements (ranging from 1 to 8) to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.
4. Select **INC Pointer** to make a positive pointer adjustment, or select **DEC Pointer** to make a negative pointer adjustment.

These buttons generate and control Pointer movements within the transmitted signal. You can stress test a network by changing pointers or introducing an offset that continuously adjusts the STS or AU Pointer.

NDF on New Pointer

The first four bits of the H1 byte are called the New Data Flag (NDF). These bits are used to indicate if a new Pointer is present. If a new Pointer value is present, then the NDF bits are toggled.

The **NDF on New Pointer** function allows you to accept or ignore changes to the NDF bits.

The following options are available:

Options	Description
Yes (On)	Generates an NDF when a new Pointer is transmitted.
No (Off)	Disables NDF functionality.

Pointer Value

The Pointer Value function provides another method for stressing an SDH or SONET network to verify if the receiving SDH or SONET equipment can detect Pointer Value changes.

The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container (VC) or Synchronous Payload Envelope (SPE) . The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from **0 to 782**.

After entering the new value, the Pointer automatically moves to the new position.

Pointer Actions

This function determines the type of Pointer activity that occurs when the **Inc Pointer** and **Dec Pointer** buttons are selected.

The following options are available:

Options	Description
Single	Inserts a single Pointer movement with each selection of the Inc Pointer or Dec Pointer button. The Pointer value changes by one.
Bursts	Inserts a burst of Pointer movements with each selection of the Inc Pointer or Dec Pointer button. Each Pointer burst consists of a series of one-location Pointer movements spaced four frames apart (maximum legal rate). The burst count is determined by the Burst Count function.
Incr - Decr	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.
Decr - Incr	Alternates the Pointer insertion from decrement to increment with a 200-msec delay in between.

Burst Count

This function allows you to determine the number of Pointer location movements to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.

The Pointer burst count ranges from 1 to 8.

Pointer Frequency Offset

The **Pointer Frequency Offset** function adjusts the rate at which Pointer adjustments are needed in the payload.

By slowing the rate, the SDH or SONET network is forced to increment the H1 and H2 Pointer bytes. This is known as **positive frequency justification**. By increasing the rate, the network is forced to decrement the H1 and H2 Pointer bytes. This is known as **negative frequency justification**.

This type of adjustment simulates network clocks that either run fast or slow. By adjusting the rate, this forces the SDH equipment to compensate by decrementing or incrementing the H1 and H2 Pointer bytes.

The **Pointer Frequency Offset** function uses a keypad to enter a frequency offset ranging from -100.0 ppm to +100.0 ppm.

This function is disabled by entering 0 for the frequency offset.

Configuring APS (K1 and K2) Commands



The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select a protocol processor mode.
2. Select the **Transmit** button.

3. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
4. Select a byte sequence button (for example, ).

The [Apply Maintenance to Entry](#) screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

5. Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.
6. Edit the K1 byte.

The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

- Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.
- Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
- Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. Edit the K2 byte.

The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

- Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
- Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
- Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
- Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears.
4. Select **Stop**.

Related Topic:

[Decoding APS \(K1 and K2\) Values](#)

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

1. Select the **Results** button.
2. Select **APS** from the tabs along the left side of the Results screen.
3. Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring Mode**.
4. From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

- Select **APS Summary**.

The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

- a. Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.
- b. You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:**► Select APS Decode.**

The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Setting Thresholds for M.2120 Performance Events

The [M.2120](#) screen provides a detailed breakdown for errors meeting the ITU-T M.2120 standard. The results table displays errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period. Error thresholds can be set directly from the M.2120 screen.

Threshold Report 15-Minute (TR15) and Reset Threshold Report 15-Minute (RTR15)

When evaluating TR15, performance events are counted separately, second by second, over each 15-minute fixed window period. A threshold can be crossed at any second within the 15-minute period. As soon as a threshold is crossed a 'fail' message is displayed in the Cur15 column. The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result moves to the Prev15 column and the performance evaluation continues and records the new result in the Cur15 column.

If the event is in the fail state, the value of the counter is compared to the reset threshold (RTR15) at the end of each period. If the count is less than or equal to the reset threshold, and there has been no unavailable time during that period, a RTR15 is generated and the state changes back to acceptable. If there has been unavailable time during the period or the count crosses the RTR15 threshold then the event remains in the fail state.

Threshold Report 24-Hour (TR24)

The TR24 filter is a 24-hour fixed window. The start and end time for the 24-hour window must occur on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded. The resultant pass or fail state displays the Cur24 column and records to the Prev24 column as the next evaluation period begins. There is no RTR24 for the 24-hour evaluation period.

To set an evaluation threshold:

1. From the **SDH** tab, select **Perf Monitor**.
2. Select **M.2120** from the tabs along the left side of the Perf Monitor screen.
3. Select the desired performance event for an error type (for example, from the B2 error type, select the SES row). The Select Threshold dialog box appears.
4. Select **TR15**. A keypad appears.
5. Set the error threshold for the 15-minute evaluation period and choose **OK**.
6. Reselect the event row to display the Select Threshold dialog box and choose **RTR15**.



Setting a RTR15 is optional.

7. Set the error reset error threshold and choose **OK**.
8. Reselect the event row to display the Select Threshold dialog box and choose **TR24**.
9. Set the error threshold for the 24-hour evaluation period and choose **OK**.

SDH TCM Summary LEDs

The **TCM Summary** or **TCM** LED indicates if a TCM error or alarm has been detected.

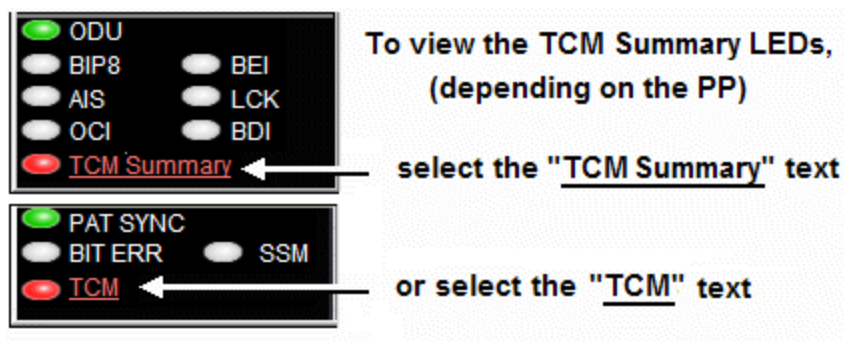


TCM (Tandem Connection Monitoring) is disabled by default, and must be enabled in order to test for TCM errors and alarms. For SDH processors, the **TC Overhead Processing** setting can be Enabled from the **Transmit > SET > SET 2** screen. If the SDH processor is configured for a LP Mapping, then the **TC Overhead Processing** menu will allow you to choose between **HP Enable** or **LP Enable**.



Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

- If the LED is red, select the "**TCM Summary**" or "**TCM**" text to display the TCM LEDs



- The SDH TC LEDs window appears in the center of the screen.

 The following describes the TCM LEDs that appear when the **TC Overhead Processing** is configured for either "**Enable**" or "**HP Enable**".

LED	Description
HP-TC-IEC	Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the N1 byte are used for this indicator. This is an error LED.
HP-TC-REI	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N1 byte is used for this indicator. This is an error LED.
HP-TC-OEI	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N1 byte is used for this indicator. This is an error LED.
HP-TC-RDI	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N1 byte is used for this indicator. This is an alarm LED.
HP-TC-ODI	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N1 byte is used for this indicator. This is an alarm LED.
HP-TC-AIS	Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are being received from upstream TCM equipment.

	(Bits 1-4 of the N1 byte are the IEC bits.) This is an alarm LED.
HP-TC-UNEQ	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the N1 byte of a Tandem Connection. This is an alarm LED.
HP-TC-LOF	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe frame alignment signal (FAS) pattern from upstream TCM equipment. This is an alarm LED.

 The following describes the TCM LEDs that appear when the **TC Overhead Processing** is configured for "**LP Enable**".

LED	Description
LP-TC-BIP	Tandem Connection-Bit Interleaved Parity error. Indicates a BIP error count is being received from downstream TCM equipment. Bits 1-2 of the N2 byte are used for this indicator. This is an error LED.
LP-TC-REI	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N2 byte is used for this indicator. This is an error LED.
LP-TC-OEI	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N2 byte is used for this indicator. This is an error LED.
LP-TC-RDI	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N2 byte is used for this indicator. This is an alarm LED.
LP-TC-ODI	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N2 byte is used for this indicator. This is an alarm LED.
LP-TC-AIS	Indicates that the unit is sending an AIS alarm to upstream TCM equipment. Bit 4 of the N2 byte is used for this indicator. This is an alarm LED.

LP-TC-UNEQ	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the N2 byte of a Tandem Connection. This is an alarm LED.
LP-TC-LOF	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe frame alignment signal (FAS) pattern from upstream TCM equipment. This is an alarm LED.

CSA SONET Tab

CSA-SONET Overview

The CSA 4100 (40G/100G Service Analyzer) circuit pack's SONET (Synchronous Optical Networking) protocol processor module offers 40G (OC-768), with support for pluggable CFP modules.



Available interface rates and mappings are dependent on the licensed-based test options currently enabled.



All currently licensed interface rates are displayed in the Interface menu, regardless of the rates supported by the currently inserted CFP module.



Verify that the inserted CFP module supports the desired Interface rate prior to selecting it.

- Supports STS-768c Bulk Fill, STS-192c Bulk Fill, STS-48c Bulk Fill, STS-12c Bulk Fill, STS-3c Bulk Fill, and STS-1 Bulk Fill mappings
- Supports Byte Capture, with up to a 256 byte memory
- Supports Low-Order mappings plus PDH and T-Carrier Add/drop, when mated with the MSA and PDH modules
- Supports Next Generation (VCAT/LCAS/GFP) and ATM testing capabilities, when mated with the MSA module
- Supports the "All Channel" Insert Option for STS-192c Bulk Fill, STS-48c Bulk Fill, STS-12c Bulk Fill, STS-3c Bulk Fill, and STS-1 Bulk Fill mappings
- Supports the ability to replicate the transmitted foreground test channel over all available structured channels
- Enhanced Thru Mode Testing - Supports the ability to manually intrude on Higher Order Path and Lower Order overhead bytes and traces, while Thru Mode is enabled.
- Enhanced Thru Mode Testing - Supports the ability to manually inject Higher Order Path and Lower Order Errors and Alarms, while Thru Mode is enabled
- The ability to set the transmit J0 and J1 traces as 16 byte ASCII, 64 byte ASCII, and unformatted hex values
- The Service Disruption measurement feature now supports measurements on Loss of Signal (LOS) events, with an measurement accuracy of +/-1ms

The CSA-OTN Online Help is divided into the following sections:

- CSA-SONET Screen and Functions Overview

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screens and Function Descriptions

Transmit

CSA-SONET Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SONET transmitting operations.

The following parameter setting options are available from the Transmit screen:

- [Set > Set 1](#)
- [Set > Set 2](#)
- [SOH](#)
- [POH](#)
- [PTR](#)
- [APS](#)
- [Error Alarm](#)

CSA-SONET Transmit - Set / Set 1

Use the Set 1 screen to configure CSA-SONET Transmit parameters. The following describes the functions that appear on this screen.

Function	Description

Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STS signal to pass through the unit without altering the data in the signal. The following options are available: On and Off.
Interface	Selects the SONET interface. The only option available is: • OC-768 (39.813) MLD  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it.  This setting is disabled when a CFP module is not inserted.  Not Assigned is displayed if a Non-SONET Interface is currently configured by another CSA tab.

Mapping	Defines the type of signals that are combined to create an SONET signal. For example, four STS-192c's can be mapped into an OC-768 signal. Mapping options are dependent on the selected Interface. The following options may be available: • STS-768c Bulk Fill • STS-192c Bulk Fill • STS-48c Bulk Fill • STS-12c Bulk Fill • STS-3c Bulk Fill • STS-1 Bulk Fill  The Mapping function is not available when the Interface shows Not Assigned
STS-<#> Added	Selects foreground STS# of the mapped signal. When available, select the STS-<#> Added button to enter the number of the specific STS channel to set as the <i>foreground</i> (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.
Background STS-<#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining <i>background</i> channels for the SONET signal. Select one of the following: PRBS 9, PRBS 9 Inverted, PRBS 11, PRBS 11 Inverted, PRBS 15, PRBS 15 Inverted, PRBS 20, PRBS 20 Inverted, PRBS 23, PRBS 23 Inverted, PRBS 31, PRBS 31 Inverted or a User Defined pattern (32-bit value).

Payload Pattern	Allows the user to select a test pattern to transmit over the SONET signal. This command is automatically coupled to its equivalent Receive command. Select one of the following: PRBS 9, PRBS 9 Inverted, PRBS 11, PRBS 11 Inverted, PRBS 15, PRBS 15 Inverted, PRBS 20, PRBS 20 Inverted, PRBS 23, PRBS 23 Inverted, PRBS 31, PRBS 31 Inverted or a User Defined pattern (32-bit value).
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. <u>BITS/SETS.</u> • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. The <i>CLK:BITS 1.5MHz</i> displays when configured for BITS clocking. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The <i>CLK:SETS 2MHz</i> displays when configured for SETS clocking.

Use the Set 2 screen to configure CSA-SONET Transmit parameters. The following describes the functions that appear on this screen.

Function	Description
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. - The frequency offset ranges from -120.0 to 120.0, in increments of 0.1 - The default value of 0 (zero) equals Off.  The Line Frequency Offset setting is only available when the Clock Reference is set to Internal timing.  This setting is coupled to the TX Line Frequency Offset setting on the CSA-MLD tab.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: Off - The unit's laser will be off when the unit is turned on. On - The unit's laser will be on when the unit is turned on. Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH.  Changes to the Transport OH are another way to stress a SONET network by simulating errors, alarms, and other stress conditions.

	The following options are available: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)
Path Signal Label	The Path Signal Label is part of the POH and identifies the type of traffic contained in the SPE. The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: • 00 (Unequipped) • 01 (Equipped) • 02 (VT Structured STS) • 03 (Lock VT Mode) • 04 (Async DS3 Mapping) • 12 (Async DS4NA Mapping) • 13 (ATM Mapping) • 14 (DQDB Mapping) • 15 (Async FDDI Mapping) • 16 (HDLC Over SONET) • 1A (10G WAN IEEE802.3ae) • 1B (GFP Mapping) • User Defined (any eight bit pattern 0 to FF).  This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: • 00 (Sync Trace Unknown-STU) • 01 (Stratum 1 Trace-PRS) • 04 (Transit Node Clock-TNC) • 07 (Stratum 2 Trace-ST2) • 0A (Stratum 3 Trace-ST3) • 0C (SONET Minimum Clk-SMC) • 0D (Stratum 3E Trace-ST3E) • 0F (Do Not Use for Sync-DUS) • User Defined (any eight bit pattern 0 to FF)
Trigger In	Determines how the protocol processor responds when an external +5v "pulse" is detected on the external Trigger In SMA connector. The following options are available: • None: The protocol processor will do nothing when an external pulse is received. (default setting) • Restart: The current test will restart when an external pulse is received. • Error Insert: The protocol processor will insert an error when an external pulse is received. For this to work, you must first select an Error Type to be inserted.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. • Enable: For SONET, the unit uses its TCM circuitry and the Z5 byte to generate errors and alarms between TCM equipment. For SDH, the unit uses the N1 byte.

	• Disable: TCM mode is disabled, and the Z5 (or N1) byte follows normal operation.
TX Clock Loss Threshold	 This setting is not currently supported on the CSA module.

CSA-SONET Transmit - SOH

The Transmit SOH screen contains the following options:

Function	Description
Showing	Select Showing to choose an Overhead slot within the SONET signal. The overhead bytes that appear on the SOH screen are associated with this slot.
Section and Line Overhead bytes	Allows the user to select an Overhead byte to edit its value.
J0 Trace	The J0 byte is part of the Section Overhead and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern. The following options are available: • Default (64 byte) - Selects the 64-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • User Defined (64 byte) - Selects a 64-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF).

	• All Ones - Selects an All Ones pattern as the J0 trace pattern. • All Zeros - Selects an All Zeros pattern as the J0 trace pattern. • Default (16 byte) - Selects the 16-byte Digital Lightwave ASCII message as the J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte) - Selects a 16-byte user-defined ASCII message as the J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

CSA-SONET Transmit - POH

The Transmit POH screen contains the following options:

Function	Description
STS-<#> Added	Allows the user to enter the number of the specific STS channel to set as the <i>foreground</i> (source) channel. The default setting is 1.
Path Overhead Bytes	Path Overhead Bytes include: J1, B3, C2, G1, F2, H4, Z3, Z4, and Z5.  The J1 bytes is controller by the J1 Trace function, and the B3 byte can be overwritten from the Error to Insert function. Note: This option will be disabled if Passthru mode is enabled.
J1 Trace	Selects a default or customized pattern to be used as the J1 trace. Select one of the following patterns: • Default (64 byte): Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • User Defined (64 byte): Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The

	message can be up to 64 characters in length (62 characters plus CR and LF). • All Ones: Selects an All Ones pattern as the J1 trace pattern. • All Zeros: Selects an All Zeros pattern as the J1 trace pattern. • Default (16 byte): Selects the Digital Lightwave ASCII message as the J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte): Selects a user-defined ASCII message as the J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.
TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern.  Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: • Default: Selects the 16-byte Digital Lightwave ASCII message as the TC trace pattern. • All Ones - Selects an All Ones pattern as the TC Trace pattern. • All Zeros - Selects an All Zeros pattern as the TC Trace pattern. • User Defined: Selects a 16-byte user-defined ASCII message as the TC trace pattern. The message is entered and saved using a touch screen keyboard.

The Transmit PTR screen contains the following options:

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: Yes (On): Generates an NDF when a new Pointer is transmitted. No (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which STS Pointer adjustments are needed in the Synchronous Payload Envelope (SPE). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Single options - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. Increment/Decrement option -Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Continuous options - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.

Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 5.5 - 35000.
INC Pointer / DEC Pointer (action buttons)	When a Single pointer action is selected, these will performs a single pointer Increment or Decrement. When a Continuous pointer action is selected, these will begin the pointer Increment or Decrement Sequence.
Stop Sequence (action button)	This button becomes available when a Continuous pointer sequence is running, this button will stop the pointer action sequence.

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

- **New Item** - Opens the [Apply Maintenance to Entry](#) window, from which you configure K1 and K2 bytes.
- **Start** - Begins transmission of the K1 and K2 byte configuration.
- **Clear** - Clears the table.

The following **Apply Maintenance to Entry** window **APS Transmit** functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

- [K1 Full Byte \(Linear Mode\)](#)

- [K1 Bits 1-4 \(Linear Mode\)](#)
- [K1 Bits 5-8 \(Linear Mode\)](#)
- [K2 Full Byte \(Linear Mode\)](#)
- [K2 Bit 5 \(Provisioned\) \(Linear Mode\)](#)
- [K2 Bits 1-4 \(Linear Mode\)](#)
- [K2 Bits 6-8 \(Linear Mode\)](#)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

- [K1 Full Byte \(Ring Mode\)](#)
- [K1 Bits 1-4 \(Ring Mode\)](#)
- [K1 Bits 5-8 \(Ring Mode\)](#)
- [K2 Full Byte \(Ring Mode\)](#)
- [K2 Bit 5 \(Provisioned\) \(Ring Mode\)](#)
- [K2 Bits 1-4 \(Ring Mode\)](#)
- [K2 Bits 6-8 \(Ring Mode\)](#)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000

(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description

(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011

#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011

#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

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The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011

#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100

#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10

(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

CSA-SONET Transmit - Error Alarm

Use this screen to configure and transmit SNET errors and alarms.

For information on inserting errors and alarms see the online help topics, [Inserting Errors](#) and [Inserting Alarms](#) in the Common Tasks section.

The following options are available on the SNET Errors and Alarms screen.

Option	Description
Error to Insert	Allows the user to select an error that is transmitted by the SNET signal. Selecting the Error to Insert button opens the Select Error Insert list. Available errors include:

	• Frame, B1 Error, B2 Error, REI-L, B3 Error, REI-P, BIT Error and None Note: When TCM is enabled, the following error are also available. • TC-IEC-P, TC-REI-P and TC-OEI-P
Error Insert Rate	Sets the insertion rate for the selected error type. This setting is not available if Error to Insert is set to None. The following options are available for this command. • Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • 1e-X, where X is a value from 3 through 10. • User Defined: Allows you to enter and save a customized error insertion rate.
Alarm Generated	Generates a specific alarm that is transmitted by the SONET signal. The following alarms are available: • LOS, LOF, OOF, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P and None. Note: When TCM is enabled, the following alarms are also available. • TC-RDI-P, TC-ODI-P, TC-AIS-P, TC-UNEQ-P and TC-LOF-P

Receive

CSA-SONET Receive Screens and Functions

The Receive function allows you to define the parameters used in SONET receiving operations.

The following parameter setting options are available from the Receive screen:

- [Set > Set 1](#)
- [Set > Set 2](#)
- [SOH](#)
- [POH](#)
- [Capture](#)
- [SIG](#)

CSA-SONET Receive - Set / Set 1

Use the Set 1 screen to configure CSA-SONET Receive parameters. The following describes the functions that appear on this screen.

Function	Description
Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, settings established on the Receive screen will only affect Receive mode.

Interface	Selects the SONET interface. The only option available is: • OC-768 (39.813) MLD  Available interface rates are dependent on the licensed-based test options currently enabled.  All currently licensed interface rates are displayed in the Interface menu, regardless if the rates are actually supported by the currently inserted CFP module or not.  You should verify that the inserted CFP module supports the desired Interface rate prior to selecting it.  This setting is disabled when a CFP module is not inserted.  Not Assigned is displayed if a Non-SONET Interface is currently configured by another CSA tab.
Mapping	Defines the type of signals that are combined to create a SONET signal. For example, four STS-192c's can be mapped into an OC-768 signal. Mapping options are dependent on the selected Interface. The following options may be available: • STS-768c Bulk Fill • STS-192c Bulk Fill • STS-48c Bulk Fill • STS-12c Bulk Fill • STS-3c Bulk Fill • STS-1 Bulk Fill  The Mapping function is not available when the Interface shows Not Assigned

STS-<#> Dropped	Selects a specific signal to monitor in the SONET signal. The test set receives the SONET signal that is demuxed into dropped signals and then processed.  The options that appear will depend on your current configuration. The default setting is 1.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SONET signal. Select one of the following patterns: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
Power Low Threshold	This setting is not supported on the CSA-SONET tab.  Use the Power Low Threshold setting on the CSA-MLD tab.
Out of Frequency Threshold	Sets the threshold for which the Frequency Wide alarm occurs. When the received Line Frequency Offset (in ppm) exceeds the set threshold setting, the Frequency Wide alarm will occur. The threshold value is entered using an on-screen keypad, and can range from 0 ppm to 120.0 ppm in increments of 0.1 ppm. The default value is 0 ppm (Disabled).
Trigger Out	Selects a specific receive event that will cause the protocol processor to generate a +5v "pulse" on the external Trigger Out SMA connector.

CSA-SONET Receive - Set / Set 2

Use the Set 2 screen to configure CSA-SONET Receive parameters. The following describes the functions that appear on this screen.

Function	Description
PLM Alarm Reporting	Enables or Disables Payload Label Mismatch alarm reporting.
Expected Path Signal Label	Enter any eight bits for the Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: • 00 (Unequipped) • 01 (Equipped) • 02 (VT Structured STS) • 03 (Lock VT Mode) • 04 (Async DS3 Mapping) • 12 (Async DS4NA Mapping) • 13 (ATM Mapping) • 14 (DQDB Mapping) • 15 (Async FDDI Mapping) • 16 (HDLC Over SONET) • 1A(10G WAN IEEE802.3ae) • 1B(GFP Mapping) • User Defined (any eight bit pattern 0 to FF)  This option is not coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.
TIM Alarm Reporting	A Section Trace Identifier Mismatch (TIM-S) alarm occurs when the incoming J0 trace does not match the Expected J0 trace setting.

	An STS Path Trace Identifier Mismatch (TIM-P) alarm occurs when the incoming J1 trace does not match the Expected J1 trace setting. A TCM Trace Identifier Mismatch (TC-TIM-P) alarm occurs when the incoming TC trace does not match the Expected TC Trace setting, and when TC Error/Alarm Processing is enabled. The following options are available: • Enabled - TIM alarms are monitored and reported. • Disabled - TIM alarms are ignored.
Expected J0	Defines the expected J0 trace received on the incoming SONET signal. When TIM Alarm Reporting is Enabled, a TIM-S alarm occurs if the incoming J0 trace does not match the expected J0 trace.  The J0 byte is part of the Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. • User Defined (64 byte) - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte): Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen

	keyboard. The message can be up to 15 characters, appended with a CRC-7. • All 01's - Selects a repeating "All Ones" (0x01 hex) pattern as the expected J0 trace pattern. • All 00's - Selects a repeating "All Zeros" (0x00 hex) pattern as the expected J0 trace pattern. • User Defined (1 byte): Selects a repeating user-defined hexadecimal byte value as the expected J0 trace pattern. The byte value is entered using a touch screen keypad.
Expected J1	Defines the expected J1 trace received on the incoming SONET signal. When TIM Alarm Reporting is Enabled, a TIM-P alarm occurs if the incoming J1 trace does not match the expected J1 trace.  The J1 byte is part of the Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. • Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. • User Defined (64 byte) - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). • Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte): Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7.

	• All 01's - Selects a repeating "All Ones" (0x01 hex) pattern as the expected J1 trace pattern. • All 00's - Selects a repeating "All Zeros" (0x00 hex) pattern as the expected J1 trace pattern. • User Defined (1 byte): Selects a repeating user-defined hexadecimal byte value as the expected J1 trace pattern. The byte value is entered using a touch screen keypad.
SS Bits Alarm Reporting	Enables or Disables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the alarm's duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits (bits 5 and 6 of the H1 Pointer byte) value: • 00 (SONET) • 01 (Undefined) • 10 (SDH) • 11 (Undefined)
TC Error/Alarm Processing	Enables or Disables Tandem Connection Monitoring (TCM) alarm reporting mode. • Enable - Turns on Z5 (N1 for SDH) byte for TCM error and alarm reporting mode. • Disable - Turns off TCM error and alarm reporting mode.  The TCM Summary LED turns red if a TCM error or alarm is reported. Select the TCM Summary text for more details.  Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.
Expected TC Trace	Defines the Expected TCM Trace value on the incoming signal.

	For SONET this is in the Z5 byte, for SDH this is in the N1 byte. The following options are available: • Default (16 byte): Selects the Digital Lightwave ASCII message as the expected TCM trace pattern. The message consists of 15 characters, appended with a CRC-7. • User Defined (16 byte): Selects a user-defined ASCII message as the expected TCM trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. • All 01's - Selects a repeating "All Ones" (0x01 hex) pattern as the expected TCM trace pattern. • All 00's - Selects a repeating "All Zeros" (0x00 hex) pattern as the expected TCM trace pattern. • User Defined (1 byte): Selects a repeating user-defined hexadecimal byte value as the expected TCM trace pattern. The byte value is entered using a touch screen keypad.  This function is used in conjunction with both the TC Error/Alarm Processing function, and the TIM Alarm Reporting function.

CSA-SONET Receive - SOH

The Receive SOH (Section Overhead) screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SONET signal. The following bytes appear for the selected SOH slot: • Section Overhead bytes (A1, A2, J0/Z0, B1, E1, F1, D1, D2, and D3) • Pointer bytes (H1, H2, and H3)

	Path Overhead bytes (B2, K1, K2, D4-D12, S1/Z1, Z2, and E2)  The S1 byte (in Slot 1 only) can be selected to show the decoded value of the received Synchronization Status.
J0 Trace	Displays the J0 trace received on the incoming SONET signal. This is a read-only function.

CSA-SONET Receive - POH

The Receive POH (Path Overhead) screen contains the following options:

Option	Description
STS-<#> Dropped	Allows the user to enter the number of the specific STS channel to monitor. The default setting is 1.
Path Overhead	Displays the Overhead bytes for a specific Path OH slot on the incoming SONET signal. This is a read-only function. The following bytes appear for the selected POH STS channel: Path Overhead bytes (B3, C2, G1, F2, H4, Z3, Z4, and Z5)  The C2 byte can be selected to show the decoded value of the received Path Signal Label.
J1 Trace	Displays the J1 trace received on the incoming SONET signal. This is a read-only function.
TC Trace	Displays the TCM trace received on the incoming SONET signal. This is a read-only function.

CSA-SONET Receive - Capture

Use the Capture screen to capture 256 bytes of received overhead bytes, before/after a triggered event occurs.

Function	Description																														
Byte Select	Select the Section Overhead byte to be captured.																														
	<table><tr><td>A1</td><td>A2</td><td>J0/Z0</td></tr><tr><td>B1</td><td>E1</td><td>F1</td></tr><tr><td>D1</td><td>D2</td><td>D3</td></tr><tr><td>H1</td><td>H2</td><td>H3</td></tr><tr><td>B2</td><td>K1</td><td>K2</td></tr><tr><td>D4</td><td>D5</td><td>D6</td></tr><tr><td>D7</td><td>D8</td><td>D9</td></tr><tr><td>D10</td><td>D11</td><td>D12</td></tr><tr><td>S1/Z1</td><td>Z2/M1</td><td>E2</td></tr><tr><td>MORE...</td><td></td><td></td></tr></table>	A1	A2	J0/Z0	B1	E1	F1	D1	D2	D3	H1	H2	H3	B2	K1	K2	D4	D5	D6	D7	D8	D9	D10	D11	D12	S1/Z1	Z2/M1	E2	MORE...		
	A1	A2	J0/Z0																												
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	D7	D8	D9																												
	D10	D11	D12																												
S1/Z1	Z2/M1	E2																													
MORE...																															
When MORE... is selected, then the following Path Overhead bytes can be selected.																															
<table><tr><td>J1</td></tr><tr><td>B3</td></tr><tr><td>C2</td></tr><tr><td>G1</td></tr><tr><td>F2</td></tr><tr><td>H4</td></tr><tr><td>F3/Z3</td></tr><tr><td>K3/Z4</td></tr><tr><td>N1/Z5</td></tr></table>	J1	B3	C2	G1	F2	H4	F3/Z3	K3/Z4	N1/Z5																						
J1																															
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F2																															
H4																															
F3/Z3																															
K3/Z4																															
N1/Z5																															

Capture Trigger	Select the Capture Trigger event. <table border="1"> <tr> <td>FRAME ERROR</td><td>RDI-P ALARM</td></tr> <tr> <td>B1 ERROR</td><td>LOP-P ALARM</td></tr> <tr> <td>B2 ERROR</td><td>PTR INCREMENT</td></tr> <tr> <td>B3 ERROR</td><td>PTR DECREMENT</td></tr> <tr> <td>REI-L ERROR</td><td>NO NDF ALARM</td></tr> <tr> <td>REI-P ERROR</td><td>NDF</td></tr> <tr> <td>BIT ERROR</td><td>BYTE EQUAL</td></tr> <tr> <td>AIS-L ALARM</td><td>BYTE NOT EQUAL</td></tr> <tr> <td>RDI-L ALARM</td><td>MANUAL</td></tr> <tr> <td>AIS-P ALARM</td><td></td></tr> </table>	FRAME ERROR	RDI-P ALARM	B1 ERROR	LOP-P ALARM	B2 ERROR	PTR INCREMENT	B3 ERROR	PTR DECREMENT	REI-L ERROR	NO NDF ALARM	REI-P ERROR	NDF	BIT ERROR	BYTE EQUAL	AIS-L ALARM	BYTE NOT EQUAL	RDI-L ALARM	MANUAL	AIS-P ALARM	
FRAME ERROR	RDI-P ALARM																				
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REI-P ERROR	NDF																				
BIT ERROR	BYTE EQUAL																				
AIS-L ALARM	BYTE NOT EQUAL																				
RDI-L ALARM	MANUAL																				
AIS-P ALARM																					
Match Value	This setting only appears when the Capture Trigger is set to "BYTE EQUAL" or "BYTE NOT EQUAL". Use the keypad to enter the byte value (in Hex) that the selected byte's received value will either need to "equal" or "not equal" in order to trigger the capture event.																				
Bytes After Trigger	When a Capture event has been triggered, 256 overhead byte values will be captured (from 0 to 255). This setting is used to specify how many of those 256 bytes should be captured immediately following the trigger, and in turn how many of those 256 bytes should be captured immediately preceding the trigger.  If 255 is entered (default), then the triggered byte value, and the following 255 byte values after the trigger event will be captured.  If 254 is entered (default), then the one byte immediately preceding the trigger, the triggered byte value, and the following 254 byte values will be captured.  If 100 is entered, then the 155 bytes immediately preceding the trigger, as well as the triggered byte value, and the following 100 byte values will be captured.																				

	 If 0 is entered, then the 255 bytes immediately preceding the trigger, as well as the triggered byte value will be captured, but 0 bytes after the trigger will be captured.
Action buttons	► Capture - Activates the capture feature, and changes the State to "Waiting for Trigger".  If the Capture Trigger setting is set to MANUAL, then the capture will immediately be triggered, otherwise the processor will wait until the selected Capture Trigger event occurs. ► Stop - Deactivates the capture feature, and changes the State from "Waiting for Trigger" to "Start", and re-enables the Capture button. ► Reset - Clears the previously captured byte values
State	Displays the current state of the capture feature. Possible States include: ► Start ► Waiting for Trigger ► Done

OH CAPTURE RESULTS	When a capture event is triggered, the 256 captured bytes are displayed in both Hexadecimal and ASCII. The Frame column displays the frame number for each of the captures bytes. Frame numbers can range from -255 to 255, depending on the Bytes After Trigger setting. The Hex column displays each captured frame's byte value in Hexadecimal format. The ASCII column displays each captured frame's byte value in ASCII format. (A hex value o 0, will be displayed as blank)

CSA-SONET Receive - SIG

Displays the following measurements of the incoming SONET signal:

- Frequency in Hz
- Line Frequency Offset Received in Hz and ppm
- Optical Power source in dBm (this is an aggregate power level when the CFP has multiple Optical lanes)



The per-lane optical power levels are displayed on the [CSA-MLD Receive - SIG](#) screen.

- STS Pointer Frequency Offset in ppm

Results

CSA-SONET Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The Results screen provides different ways of viewing received statistics. From the left side of the Result screen, select one of the following tabs:

- [Error / Alarm](#)

- [PTR](#)
- [Event Log](#)
- [APS](#)
- [Large LED](#)
- [Graphs](#)

Error / Alarm

CSA-SONET Results - Error & Alarm

The Err screens provides the following options:

- Scan
- [Errors](#)
- [Alarms](#)

CSA-SDH Results - Error & Alarm - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

- For [Alarms](#), the duration is reported as a count in seconds.
- For [Errors](#), an error count is reported.
- The message **No Errors or Alarms** appears if no events are received by the unit.

CSA-SONET Results - Error & Alarm - Errors

The system can monitor and report errors on the incoming SONET signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the SONET network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **FRAME (Section A1/A2 Framing Bytes)**
- **B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)**
- **B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)**
- **REI-L (Remote Error Indication - Line)**
- **B3 (Path BIP-8, also known as a Path Coding Violation - CV-P)**
- **TC-IEC-P (Incoming Error Count - TCM-Path)**
- **TC-REI-P (Remote Error Indicator - TCM-Path)**
- **TC-OEI-P (Outgoing Error Indicator - TCM-Path)**
- **BIT (BIT errors reported in the payload)**
- **NDF-P (New Data Flag - Path)**



The TCM-Path Errors only appears when [TC Error/Alarm Processing](#) has to be Enabled in the Receive settings.

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

CSA-SONET Results - Error & Alarm - Alarms

The system can monitor and report alarms and their duration on the incoming SONET signal.

The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- **LOS (Loss of Signal)**
- **Power Hot**
- **Power Warm**
- **Power Low**

- Frequency Wide
- OPU Generic AIS
- LOF (Loss of Frame)
- AIS-L (Alarm Indication Signal - Line)
- APS-L (Automatic Protection Switching-Line)
- SEF (Severely Errored Frame)
- RDI-L (Remote Defect Indicator - Line)
- TIM-S (Trace Identifier Mismatch - Section)
- Pat Sync (Pattern Synchronization)
- PLM-P (Payload Label Mismatch - Path)
- Concat (Concatenated)
- AIS-P (Alarm Indication Signal - Path)
- LOP-P (Loss of Pointer - Path)
- UNEQ-P (Unequipped - Path)
- RDI-P (Remote Defect Indicator - Path)
- TIM-P (Trace Identifier Mismatch - Path)
- SS MISMATCH (Signal Status Mismatch)
- TC-RDI-P (Remote Defect Indicator - TCM-Path)
- TC-ODI-P (Outgoing Defect Indicator - TCM-Path)
- TC-AIS-P (Alarm Indication Signal - TCM-Path)
- TC-UNEQ-P (Unequipped - TCM-Path)
- TC-LOF-P (Loss of Frame - TCM-Path)
- TC-TIM-P (Trace Identifier Mismatch - TCM-Path)



The TCM-Path Alarms only appears when [TC Error/Alarm Processing](#) has to be Enabled in the Receive settings.

CSA-SONET Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

The following STS Pointer results appear:

- **Pointer Justification** - Indicates the Positive Pointer Justification count.
- **Negative Justification** - Indicates the Negative Pointer Justification count.
- **Positive Justification Seconds** - Indicates the duration of a Pointer adjustment.
- **NDF Count** - Indicates the New Data Flag count.
- **Rx Pointer Bytes (HEX) and Rx Pointer Value (in decimal)** - Valid Pointers range from 0 to 782.

CSA-SONET Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

CSA-SONET Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description

APS Summary	When selected, the following information appears in the results table last 15 K1 and K2 byte sequences received: • The HEX value of the K1 byte. • The HEX value of the K2 byte. • The number of frames received that contain the K1 and K2 bytes. • The elapsed time of the frames that contain the K1 and K2 bytes.  To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.
APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either Linear Protection Switching Mode or Ring APS Signaling Mode.

 Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

CSA-SONET Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the SONET protocol processor, see [CSA-SONET LEDs](#).

CSA-SONET Results - Graph

The Graph function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Test

Test Screens and Functions

(Specifically for SONET testing)

The Test screen configures test parameters associated with a SONET protocol processor.

The Test screen contains the following functions:

- [SET 1](#)

- [Service Disruption](#)
- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.

2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.

- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.

Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for SONET testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For all **SONET** rates one frame is roughly .125 ms (125 μ s)

Test Service Disruption functions include:

- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.



For all **SONET** processors the Protection Switch Criteria include: **B1**, **SEF**, **AIS-L**, **AIS-P**, **AIS-V**, and **PRBS** (Bit Errors and Loss of Pattern Sync).

- **Good Time** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ For all **SONET** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.
- **Good Frames** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.
- **Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Switch Frames** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5.
- **History Recent Frames**: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5.



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

Test - RTD (Round-Trip Delay)

(Specifically for SONET and SDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State)**: Starts and stops round-trip delay mode.

► **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the errored frame is received by the unit. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.

► **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

► **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.

- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames detected after each errored frame is transmitted and return back to the unit.

► The **Current** column displays the most recent round trip measurement.

► The **Minimum** column displays the fastest round trip measurement.

► The **Maximum** column displays the slowest round trip measurement

- **Consecutive Good Time Required:** This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement.

► For all **SONET** and **SDH** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.

- **Consecutive Good Frames Required:** This function allows you to enter the number of consecutive error-free frames to occur before round-trip measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

Performance Monitor Screens and Functions

Specifically for SONET testing

Performance Monitoring provides greater detail about incoming Section, Line, Path, VT and BIT errors.

The following options are available:

- [Sect](#)
- [Line](#)
- [Path](#)
- [VT Path](#) *(only available when in a VT mapping)*
- [BIT](#)

Perf Monitor - Sect

Specifically for SONET testing

This Section screen provides a detailed breakdown for Section errors detected and logged by the SONET protocol processor.

Section Near End B1 Errors

- **CV** - Coding Violations. Error count of incoming B1 errors.
- **ES** - Errored Seconds. Reports the duration of the incoming B1 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.
- **EFS** - Error Free Seconds. Reports the duration of the incoming B1 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 8554 or more B1 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, or Loss of Signal (LOS) alarm occurs.

Perf Monitor - Line

Specifically for SONET testing

The Line screen displays a detailed breakdown of incoming B2 (Line BIP-8, also known as Coding Violations) and Line Remote Error Indicator (REI-L) errors.

The following statistics are reported:

Line - Near End B2 Errors

- **CV** - Coding Violations. Reports an error count of incoming B2 errors.
- **ES** - Errored Seconds. Reports the duration of the incoming B2 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.
- **EFS** - Error Free Seconds. Reports the duration of the incoming B2 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration of SES on the incoming SONET signal. An SES is reported when 9835 or more B2 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, Loss of Signal (LOS) alarm, or Line Alarm Indication Signal (AIS-L) alarm occurs.
- **UAS** - Unavailable Seconds. Reports the number of seconds that the Line layer was considered unavailable. A Line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.

Line - Far End REI Errors

- **CV** - Coding Violations. Reports an error count of the number of B2 errors detected by the far-end Line Terminating Equipment (LTE). These errors are reported back to the unit using the M1 byte of the Line overhead. The M1 byte is also known as the Line Remote Error Indicator - REI-L. (A CV-LFE was formerly known as a Line FEBE.)
- **ES** - Errored Seconds. This counter reports the number of seconds that an REI-L alarm is reported
- **EFS** - Error Free Seconds. Reports the duration of the incoming REI-L error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. Reports the duration when 9835 or more REI-L errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-L) alarm is present.

- **UAS** - Reports a count of the number of seconds that an SES-LFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-LFE errors must be present before a UAS-LFE is declared.

Perf Monitor - Path

Specifically for SONET testing

The Path screen displays a detailed breakdown of incoming B3 (Path BIP-8, also known as Path Coding Violations) and STS Path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Path - Near End B3 Errors

- **CV** - Code Violations. This is an error count of incoming B3 errors.
- **ES** - Errored Seconds. This reports the duration of the incoming B3 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.
- **EFS** - Error Free Seconds. This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 2400 or more B3 errors occur in one second, or when an AIS-P alarm, UNEQ-P alarm, LOS alarm, LOF alarm, AIS-L alarm, or LOP-P alarm occurs.
- **UAS** - Unavailable Seconds. This reports the number of seconds that the STS Path layer was considered unavailable. A Path is unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.

Path Far End REI Errors

- **CV** - Code Violations. This is an error count of the number of B3 errors detected by the far-end STS Path Terminating Equipment (PTE). These errors are reported back to the unit using the G1 byte of the STS Path overhead. The G1 byte is also known as the STS Path Remote Error Indicator - REI-P. (A CV-PFE was formerly known as an STS Path FEBE.)
- **ES** - Errored Seconds. This is a counter that indicates the number of seconds that an REI-P alarm is reported.

- **EFS** - Error Free Seconds. Reports the duration of the incoming REI-P error free seconds and the percentage of error free seconds compared to the duration of errored seconds.
- **SES** - Severely Errored Seconds. This reports the duration when 2400 or more REI-P errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-P) alarm is present.
- **UAS** - Unavailable Seconds. This is a counter that indicates the number of seconds that an SES-PFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

Perf Monitor - VT Path

Specifically for SONET testing

The VT Path screen displays a detailed breakdown of incoming Virtual Tributary path BIP (Section BIP-8, also known as Coding Violations) errors and Virtual Tributary path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Payload - BIT Errors

- **CV** - Code Violations. Reports the code violations by count.
- **ES** - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.
- **EFS** - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **SES** - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **UAS** - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

Perf Monitor - BIT

Specifically for SONET testing

Bit analysis provides a detailed breakdown for detected Payload Bit errors.

The following statistics are reported:

Payload - BIT Errors

- **CV** - Code Violations. Reports the code violations by count.
- **ES** - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.
- **EFS** - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **SES** - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.
- **UAS** - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

CSA-SONET LED Quick Status Area

When the CSA-SONET protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED Results](#) screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Indicates current SONET transmit interface setting and rate.

	 If a non-SONET interface is selected from one of the other CSA tabs, then "Not Assigned" will be displayed.  If the CFP module has been removed after an SONET interface was selected, "No Laser" will be displayed.
RX	Displays the received optical power in dBm. This status indicator will flash when one or more received Optical Lanes' power level exceeds the CFP's Power Warm or Power Hot thresholds.  This is an aggregate broadband power value, based on the combined power levels from all of the CFP's received Optical Lanes. See the CSA-MLD Receive - SIG screen for individual Optical Lane power levels.  If the CFP module has been removed, "Missing CFP" will be displayed.
E/A	Indicates the current Error / Alarm configured for transmission in the SONET signal. This is a status indicator.
Test Paused	If red, indicates that the current test has been paused .
CLK	Indicates the value of the Transmit Clock Reference function. This is a status indicator.
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
Section	Section Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
LOS	Loss of Signal. Indicates that a valid SONET signal is not being received. If an all-zeros pattern exists for 100

	milliseconds or longer on the incoming SONET signal, then an LOS is reported.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming SONET signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for 3 milliseconds or longer. This is alarm LED.
SEF	Severely Errored Frame. Declared when four or more consecutive errored frames are detected on the incoming SONET signal. This is an alarm LED.
B1	Section Overhead BIP-8 Code Violation. Indicates an error in the SONET frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is a Section error that applies not only to the Section OH, but the entire frame. Any error in the frame will result in B1 error. This is an error LED.
Line	Line Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
REI-L	Line Remote Error Indicator. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the SONET Line Overhead are used for this indicator. This is an error LED.
AIS-L	Line Alarm Indication Signal. Indicates if an alarm is being received from upstream Line terminating equipment. This is an alarm LED.
APS	Automatic Protection Switching. Indicates that the K1 and K2 bytes on the incoming SONET signal have changed.
RDI-L	Line Remote Defect Indicator. Indicates that a downstream defect has occurred along the Line layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
B2	Line Overhead BIP-8 Code Violation. Indicates that parity errors were detected at the Line layer of the incoming SONET

	signal. This is calculated over the Line OH, Path OH, and payload of each STS-1. This is an error LED
Path	STS Path Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AIS-P	STS Path Alarm Indication Signal. Indicates if an alarm is being received from upstream Path terminating equipment. This is an alarm LED.
RDI-P	STS Path Remote Defect Indicator. Indicates that a remote alarm is being received from downstream Path terminating equipment. The G1 byte of the SONET Path Overhead is used for this indicator. This is an alarm LED.
LOP-P	STS Path Loss of Pointer. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
REI-P	STS Path Remote Error Indicator. Indicates that an error count is being received from downstream Path terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
PTR-P	STS Path Pointer Adjustments. Indicates Pointer offsets or adjustments between the STS payload and the OC-N frame are occurring. This is a status LED.
B3	STS Path Overhead BIP-8 Code Violations. Indicates that parity errors were detected at the Path layer of the incoming SONET signal. This is calculated over the Path OH and payload of each STS-1. This is an error LED.
UNEQ-P	STS Path Unequipped Payload. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from Path terminating equipment. This is an alarm LED.
PAT SYNC	Pattern Sync Mismatch. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	BIT Error. Indicates a Bit error was detected in the payload. This is an error LED.

TCM  This LED only appears when TC Error/Alarm Processing has to be Enabled in the Receive settings.	Tandem Connection Status LED. Indicates if a TCM error or alarm has been detected.  If this LED is red, select the "TCM" text to display the TCM Summary LEDs.
SSM	Signal Status Mismatch - Displays when the expected SS bits setting in the H1 byte do not match what is received. This is an alarm LED.  SS Bits Alarm Reporting must be enabled for this alarm to occur..

Specific Tasks

CSA-SONET Specific Tasks Overview

This section includes tasks that are specific to the CSA-SONET protocol processor. For general tasks, refer to the [Common Tasks](#) section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- [Make Pointer Adjustments](#)
- [Configuring APS \(K1 and K2\) Commands](#)
- [Decoding APS \(K1 and K2\) Values](#)
- [SONET TCM LEDs](#)

Using Pointers

Making Pointer Adjustments

The beginning of a SONET or SDH payload is identified by a **Pointer**. It consists of the H1 and H2 Pointer bytes. You can stress a network by manually adjusting the Pointer using the Increment and Decrement Pointer buttons. By performing this task, you can stress your SONET or SDH equipment to verify if it can tolerate Pointer adjustments, and how your equipment will react and report these adjustments.

There are several Pointer parameters that must be configured before making a positive or negative Pointer adjustment.

To make Pointer adjustments:

1. Select a protocol processor mode.
2. Select **Transmit** and choose **PTR**.
3. Configure the Pointer Adjustment parameters. For example,
 - Select [NDF Flag](#) to allow a New Data Flag to be set when a new Pointer value has been transmitted.
 - Select [Pointer Value](#) to change the Pointer value from 0 to 782.
 - Select [Frequency Offset](#) to increase or decrease the speed of the Pointer adjustments.
 - Select [Pointer Action](#) to select the type of Pointer activity that occurs when the Increment Pointer or Decrement Pointer buttons are selected.
 - Use [Burst Count](#) to set the number of Pointer location movements (ranging from 1 to 8) to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.
4. Select **INC Pointer** to make a positive pointer adjustment, or select **DEC Pointer** to make a negative pointer adjustment.

These buttons generate and control Pointer movements within the transmitted signal. You can stress test a network by changing pointers or introducing an offset that continuously adjusts the STS or AU Pointer.

NDF on New Pointer

The first four bits of the H1 byte are called the New Data Flag (NDF). These bits are used to indicate if a new Pointer is present. If a new Pointer value is present, then the NDF bits are toggled.

The **NDF on New Pointer** function allows you to accept or ignore changes to the NDF bits.

The following options are available:

Options	Description
Yes (On)	Generates an NDF when a new Pointer is transmitted.
No (Off)	Disables NDF functionality.

Pointer Value

The Pointer Value function provides another method for stressing an SDH or SONET network to verify if the receiving SDH or SONET equipment can detect Pointer Value changes.

The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container (VC) or Synchronous Payload Envelope (SPE) . The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from **0 to 782**.

After entering the new value, the Pointer automatically moves to the new position.

Pointer Actions

This function determines the type of Pointer activity that occurs when the **Inc Pointer** and **Dec Pointer** buttons are selected.

The following options are available:

Options	Description
Single	Inserts a single Pointer movement with each selection of the Inc Pointer or Dec Pointer button. The Pointer value changes by one.
Bursts	Inserts a burst of Pointer movements with each selection of the Inc Pointer or Dec Pointer button. Each Pointer burst consists of a series of one-location Pointer movements spaced four frames apart

	(maximum legal rate). The burst count is determined by the Burst Count function.
Incr - Decr	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.
Decr - Incr	Alternates the Pointer insertion from decrement to increment with a 200-msec delay in between.

Burst Count

This function allows you to determine the number of Pointer location movements to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.

The Pointer burst count ranges from 1 to 8.

Pointer Frequency Offset

The **Pointer Frequency Offset** function adjusts the rate at which Pointer adjustments are needed in the payload.

By slowing the rate, the SDH or SONET network is forced to increment the H1 and H2 Pointer bytes. This is known as **positive frequency justification**. By increasing the rate, the network is forced to decrement the H1 and H2 Pointer bytes. This is known as **negative frequency justification**.

This type of adjustment simulates network clocks that either run fast or slow. By adjusting the rate, this forces the SDH equipment to compensate by decrementing or incrementing the H1 and H2 Pointer bytes.

The **Pointer Frequency Offset** function uses a keypad to enter a frequency offset ranging from -100.0 ppm to +100.0 ppm.

This function is disabled by entering 0 for the frequency offset.

Configuring APS (K1 and K2) Commands



The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.
4. Select a byte sequence button (for example, ).

The [Apply Maintenance to Entry](#) screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

5. Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.
6. Edit the K1 byte.

The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

- Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.
- Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.
- Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

7. Edit the K2 byte.

The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

- Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.
- Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.
- Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.
- Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

8. Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.
9. Select **Update**. The initial APS screen appears on the touch screen.
10. To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

1. Make sure that K1 and K2 byte sequences are configured as described above.
2. Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

1. Select a protocol processor mode.
2. Select the **Transmit** button.
3. Select the **APS** button. The initial APS screen appears.
4. Select **Stop**.

Related Topic:

[Decoding APS \(K1 and K2\) Values](#)

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

1. Select the **Results** button.
2. Select **APS** from the tabs along the left side of the Results screen.
3. Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring Mode**.
4. From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

► Select **APS Summary**.

The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

- a. Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.
- b. You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

► Select **APS Decode**.

The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

SONET TCM Summary LEDs

The **TCM Summary** or **TCM** LED indicates if a TCM error or alarm has been detected.

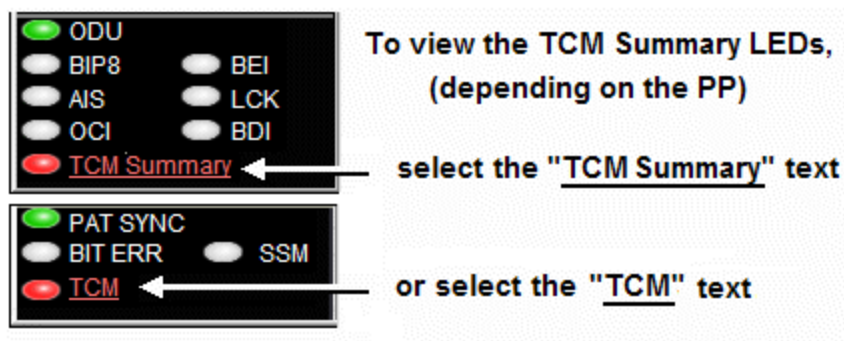


TCM (Tandem Connection Monitoring) is disabled by default, and must be enabled in order to test for TCM errors and alarms. For SONET processors, the **TC Overhead Processing** setting can be Enabled from the **Transmit > SET > SET 2** screen. If the SONET processor is configured for a VT Mapping, then the **TC Overhead Processing** menu will allow you to choose between **Path Enable** or **VT Enable**.



Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

- If the LED is red, select the "**TCM Summary**" or "**TCM**" text to display the TCM LEDs



- The SONET TC LEDs window appears in the center of the screen.

 The following describes the TCM LEDs that appear when the **TC Overhead Processing** is configured for either **"Enable"** or **"Path Enable"**.

LED	Description
TC-IEC-P	Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the Z5 byte are used for this indicator. This is an error LED.
TC-REI-P	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the Z5 byte is used for this indicator. This is an error LED.
TC-OEI-P	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the Z5 byte is used for this indicator. This is an error LED.
TC-RDI-P	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the Z5 byte is used for this indicator. This is an alarm LED.
TC-ODI-P	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the Z5 byte is used for this indicator. This is an alarm LED.
TC-AIS-P	Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are being received from upstream TCM equipment.

	(Bits 1-4 of the Z5 byte are the IEC bits.) This is an alarm LED.
TC-UNEQ-P	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the Z5 byte of a Tandem Connection. This is an alarm LED.
TC-LOF-P	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe frame alignment signal (FAS) pattern from upstream TCM equipment. This is an alarm LED.

 The following describes the TCM LEDs that appear when the **TC Overhead Processing** is configured for "VT Enable".

LED	Description
TC-BIP-V	Tandem Connection-Bit Interleaved Parity error. Indicates a BIP error count is being received from downstream TCM equipment. Bits 1-2 of the Z6 byte are used for this indicator. This is an error LED.
TC-REI-V	Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the Z6 byte is used for this indicator. This is an error LED.
TC-OEI-V	Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the Z6 byte is used for this indicator. This is an error LED.
TC-RDI-V	Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the Z6 byte is used for this indicator. This is an alarm LED.
TC-ODI-V	Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the Z6 byte is used for this indicator. This is an alarm LED.
TC-AIS-V	Indicates that the unit is sending an AIS alarm to upstream TCM equipment. Bit 4 of the Z6 byte is used for this indicator. This is an alarm LED.

TC-UNEQ-V	Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the Z6 byte of a Tandem Connection. This is an alarm LED.
TC-LOF-V	Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe frame alignment signal (FAS) pattern from upstream TCM equipment. This is an alarm LED.

DS1 Tab

DS1 Overview

When the NIC's PDH protocol processor is configured for DS1 mode, the PDH circuit pack supports 2 independent DS1 ports.

- ▶The DS1 #1 tab is used to test the DS1 #1 port (75 ohm Unbalanced - BNC)
- ▶The DS1 #2 tab is used to test the DS1 #2 port (100/120 ohm Balanced - Bantam)

The DS1 online help is divided into the following sections:

- [DS1 Screen Functions and Descriptions](#)
- [DS1 Specific Tasks](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Functions and Descriptions

DS1 Screen Functions and Descriptions Overview

The following function screens are available through the DS1 protocol processor tab.

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [Performance Monitoring](#)
- [LEDs](#)

Transmit

Transmit Screens and Functions

The Transmit functions provide a means for defining the signal parameters used in DS1 transmit operations.

The following functions are available through the DS1 Transmit screen.

- [SET 1](#)
- [Loop Code](#)
- [ERROR ALARM](#)

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the DS1 line interface (T1 line) and the DS1 protocol processor to match the DS1 signal used in your test environment.

The DS1 Transmit Settings screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Termination	Configures the transmit port connector's cable impedance. • DS1 #1 (BNC connector) only supports Unbalanced 75 ohms. • DS1#2 (Bantam connector) supports Balanced 100 ohms or Balanced 120 ohms.

Signal Level	Sets the strength of the DS1 transmit signal. The signal level values are relative to a normal DSX-1 signal level. The following options are available: • DSX-1 and 0 dB Cable Loss: Signal level is at the DSX-1 signal level. • DSX-1 and -7.5 dB Cable Loss: Signal level is -7.5 dB below the normal DSX-1 signal level. • DSX-1 and -15 dB Cable Loss: Signal level is -15 dB below the normal DSX-1 signal level.
Line Code	Selects the type of signal coding transmitted by the DS1 protocol processor. The following options are available. • AMI: Alternate Mark Inversion coding (Default). • B8ZS: Binary 8 Zero Substitution coding.
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. • The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 • The default value of 0 (zero) equals Off.

Clock Reference	Determines the timing source for the DS1 transmit signal. The following options are available: • Internal: Derives the transmit data's timing source from the system's internal clock.  To drop an DS1 from M13 and out the DS3 Line In, then the clock must be set to Internal. • Recovered DS1 #1: Derives the transmit data's timing source from the DS1 #1's RX recover clock. • Recovered DS1 #1: Derives the transmit data's timing source from the DS1 #2's RX recover clock. • BITS/SETS: Derives the transmit's data timing source from the BITS/SETS input ports. • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but a BITS clocking is not available then this function defaults to Internal. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but a SETS clocking is not available then this function defaults to Internal.
Framing	Configures the framing format used for the DS1 transmit signal. Note: Any changes made to this command are replicated to the DS1 receive signal. The following options are available: • Unframed: Configures the system to transmit a DS1 signal using an unframed format. • D4/SF: Configures the system to transmit a DS1 signal using D4 super frame format. • ESF: Configures the system to transmit a DS1 signal using Extended Super Frame format.

	• SLC-96: Configures the system to transmit a DS1 signal using SLC-96 format (Subscriber Loop Carrier).
Mapping	Mapping options include: Bulk Filled, 56K Fractional T1 and 64K Fractional T1.  ATM will appear as the selected Mapping, when ATM is configured for DS1.

Payload Pattern	Selects the type of DS1 payload pattern that is transmitted by the system. The following options are available: • <u>QRSS</u> • <u>PRBS 9</u> • <u>PRBS 9 Inv</u> • <u>PRBS 11</u> • <u>PRBS 11 Inv</u> • <u>PRBS 15</u> • <u>PRBS 20</u> • <u>PRBS 23</u> • <u>All Ones</u> • <u>All Zeros</u> • 3 in 24 (3:21): Transmits a fixed test pattern of F0100 0100 0000 0000 0000 0100. The pattern is aligned with the F-bits as indicated. 3 in 24 provides the minimum ones density and the maximum excess zeros requirements to stress T1 circuits. When the pattern is framed, it violates the minimum ones density requirements. • 1 in 8 (1:7): Transmits a fixed pattern of F01000000. This pattern stresses the minimum ones density requirement for B8ZS encoded T1 circuits if sent unframed. • 1010 Pattern: A fixed test pattern of alternating marks (1) and spaces (0). This pattern is generally used to perform a minimum level stress test on clock recovery circuits. • 55DLY: Transmits a 55 octet Daly pattern. • T1-2: Transmits a 96 octet pattern. • T1-3: Transmits a 54 octet pattern.

	• T1-4: Transmits a 120 octet pattern. • T1-5: Transmits a 53 octet pattern. • 55-OCTET: Transmits a 55 octet pattern. • Bridge Tap: Transmits 21 different patterns to detect bridge taps on a DS1. The following patterns are performed in 30-second increments: All Ones, 1-in-2, 1-in-4, 1-in-6, 1-in-7, 1-in-8, 2-in-9, 2-in-10, 2-in-11, 2-in-12, 2-in-13, 2-in-14, 2-in-15, 3-in-18, 3-in-19, 3-in-20, 3-in-21, 3-in-22, 3-in-23, 3-in-24, and QRSS. • Multi-Pattern: Transmits five different patterns to stress a DS1. The following patterns are performed in five-minute increments: All Ones, 1-in-8, 2-in-8, 3-in-24, and QRSS. • User Defined: Allows you to enter up to a 32-bit pattern.

Fractional T1 (1-24)	Configures the system for Fractional T1 testing.
Background DS0 Pattern	Enter any 8-bit pattern.

Transmit - Loop Code

The Loop Codes function allows you to isolate the connection between the system and the DS1 switch for loopback testing. With this segment isolated, you can configure the system to generate loopbacks in either direction. This allows the system to simulate a DS1 switch so that it can generate or receive loopback codes or place other DS1 facilities into or release from loopback.



Some option selections may be dependent on other settings.

The following options are available from Transmit Loop Code screen.

Option	Description
Loopback Type	Determines if the Loop Codes are sent as in-band signal or out-of-band signals. The following options are available: • In-Band: Available for all framing formats (Unframed, D4, ESF, and SLC-96). • Out-of-Band: Available only for ESF framing. • DDS-Latching: Typically used for 64K channels. Send a specific loopback signal for a set number of bytes. This option is available only if the unit is configured for Fractional T1 mode. • DDS-Non-Latching: Also known as Alternating Loopback. Used for 56K channels only. The Non-Latching loopback sends the selected loopback signal as every other byte in the loopback pattern. This option is available only if the unit is configured for Fractional T1 mode.

Loopback Code	Selects the type of loopback code transmitted. The options available vary based on the whether Loopback Type is configured for in-band or out-of-band signaling. The following options are available: • OCU Loopback: Test is looped at the Office Channel Unit. This option is only available if the unit is configured for Fractional T1 mode. • CSU Loopback: Test is looped at the Channel Service Unit. This option is available only if the unit is configured for Fractional T1 mode. • DSU Loopback: Test is looped at the Data Service Unit. This option is available only if the unit is configured for Fractional T1 mode. • 4-Bit Smartjack (Facility 1): A loop-up code "1100", with the framing bits (D4, SF) over writing the pattern, is transmitted indicating to a compatible facility interface to establish a loop back. A loop-down code "1110" is transmitted to terminate the loop back. This option is only available when the Loopback Type command is configured for In-Band. • 5-Bit Smartjack (Facility 2): A loop-up code "11000", with the framing bits (D4, SF) over writing the pattern, is transmitted indicating to a compatible facility interface to establish a loop back. A loop-down code "11100" is transmitted to terminate the loop back. This option is only available when the Loopback Type command is configured for In-Band. • Line Loopback (CSU): F or In-Band signaling, the Line Loopback should only be responded to by CSU or CI. A loop-up code "10000", with the framing bits (D4, SF) over writing the pattern, is transmitted indicating to a compatible CSU or CI interface to establish a loop back. A loop-down code "100" is transmitted to terminate the loop back. The pattern should last for at least 5 seconds. The entire signal is looped back at the other end, no change in framing or BPV. • For Out-of-Band signaling, the Line Loopback codes are: Loop-up code 0000 1110 1111 1111 and the Loop-down code is 0011 1000 1111 1111. The bits are sent in the order from right to

	left. These codes are sent in the data link bit in the ESF. The entire signal is looped back at the other end, no change in framing or BPV. • User Up Code: Allows you to create an 8-bit loopback pattern for the Loop Up Code. This option is only available for In-Band signaling. • User Down Code: Allows you to create an 8-bit loopback pattern for the Loop Down Code. This option is only available for In-Band signaling.
Auto Response	Determines how the DS1 protocol processor responds to Loop Up and Loop Down codes. The following options are available: • On: The DS1 protocol processor automatically responds to Loop Up and Loop Down codes. The system responds only to the type of loopback code that is selected by the Loopback Code command. • Off: The DS1 protocol processor does not automatically respond to Loop Up and Loop Down codes.
Tester Line Looped	Controls whether or not the system loops back the entire signal it receives from a DS1 switch. (The entire signal consists of the payload and framing bits.) The following options are available: • Down: This is the normal operating mode for this command. • Up: This allows a received loop code to be immediately looped at the DS1 Line Interface. The entire signal (payload and framing bits) is looped. • None: The test line is not looped back.
Tester Payload Looped	Determines whether or not the system loops back just the payload of a signal received from a DS1 switch. This command allows the signal to enter the system. The signal's framing bits are stripped, new framing bits are added, and

	then the signal is returned to the DS1 switch. The following options are available: • Down: This is normal operating mode for this command. • Up: The received signal is stripped of its original framing bits, but the payload remains intact. The system inserts new framing bits and returns the signal to the DS1 switch. • None: The test payload is not looped back.
Loopback	Displays the selected Loopback type.
Loopup Code	Displays the selected Loopup code.
Loopdown Code	Displays the selected Loop down code.
Send Loop Up	Initiates the Loop Up test.
Send Loop DN	Initiated the Loop Down test.

Transmit - ERROR ALARM

The Transmit Error Alarm function allows you to select the type of errors and alarms transmitted by the DS1 protocol processor.

Determines the type of error that is transmitted by the DS1 protocol processor. Often, these errors are used by the receiving equipment to determine if a transmission error has occurred.



Use the Error Insert button to inject single errors into the DS1 transmit signal. When this occurs, the appropriate error LED flashes red, and the error is recorded by various functions in the Results function.

The following options are available:

Option	Description
Error to Insert	Select the error to insert. The following options are available: • None: Turns off DS1 error insertion.

	• BPV: Transmits Bipolar Violation errors, which result in a line code violation event for an AMI-coded signal, the occurrence of received excessive zeros or a bipolar violation that is not part of a zero substitution code. • Bit Error: Transmits a bit error which results in a frame-synchronization-bit error event. This also inserts a frame-bit error in the received frame-bit pattern. • Frame: Results in a severely errored framing event; the occurrence of two or more framing bit pattern errors within a three-microsecond period. This type of error is not available if the DS1 protocol processor is configured for Unframed framing format. • CRC: Results in a CRC error event; the occurrence of a received CRC code that is not identical to the corresponding locally calculated code. This option is available only when the DS1 protocol processor is configured for ESF framing.
Error Insert Rate	Sets the insertion rate for the selected error type. This setting is not available if Error to Insert is set to None. The following options are available for this command. • Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • 1e-X, where X is a value from 3 through 7. • User Defined: Allows you to enter and save a customized error insertion rate.  CRC errors can be inserted at rates of 1.0e-0 to 1.0e-5
Alarm Generated	Generates a specific type of alarm on the transmit side of the DS1 protocol processor. The following options are available: • None: No alarms generated. (The value displayed for this command is None.) • LOS: Generates a Loss of Signal alarm for the transmit DS2 signal.

	• OOF: Generates an Out of Frame alarm for the transmit DS1 signal. • Yellow: Generates a Yellow alarm for the transmit DS1 signal. • AIS: Generates an AIS (Alarm Indication Signal - also known as a Blue Alarm) signal for the transmit DS1 Signal.

Receive

Receive Screens and Functions

The DS1 Receive function provides settings for the signal parameters used in the DS1 protocol processor receive operations. These commands configure the system for the expected receive signal.

The following functions are available from the Receive screen:

- [SET 1](#)
- [DS0](#)
- [DS0 Circuit Signal](#)
- [SIG](#)

Receive - Settings 1 (SET 1)

This screen allows you to configure your unit's Receive parameters for your DS1 test environment.

The DS1 Receive SET1 screen contains the following parameters:

Parameter	Descriptions
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.

Termination Type	Sets the termination point of the DS1 receive signal. The following options are available: • Monitor: Sets the receive sensitivity of the DS1 Line interface. Use this setting if the DS1 line connects to a monitor jack. • Terminated: Sets the receive sensitivity of the DS1 Line interface. Use this setting if the DS1 line terminates at the system's Line Interface. • Bridged: Allows the DS1 receive signal to be connected to both the DS1 interface and the DS1 protocol processor.
Framing	Configures the framing format used for the DS1 Receive signal. Note: Any changes made to this command are replicated to the DS1 Transmit signal. The following options are available: • Unframed: Configures the system to transmit a DS1 signal using an unframed format. • D4/SF: Configures the system to transmit a DS1 signal using D4 super frame format. • ESF: Configures the system to transmit a DS1 signal using Extended Super Frame format. • SLC-96: Configures the system to transmit a DS1 signal using SLC-96 format (Subscriber Loop Carrier).
Mapping	Displays the expected DS1 Mapping, and allows the user to change the Mapping to Bulk Filled or 56K Fractional T1 or 64K Fractional T1.  ATM Direct and ATM PLCP Mapping options will appear if the ATM hardware is available, and if the ATM's Physical Mapping is set to DS1 ATM Direct or DS1 ATM PLCP.

Payload Expected	Selects the payload pattern expected to be received by the system. The following options are available: • <u>QRSS</u> • <u>PRBS 9</u> • <u>PRBS 9 Inv</u> • <u>PRBS 11</u> • <u>PRBS 11 Inv</u> • <u>PRBS 15</u> • <u>PRBS 20</u> • <u>PRBS 23</u> • <u>All Ones</u> • <u>All Zeros</u> • 3 in 24 (3:21): A fixed test pattern of F0100 0100 0000 0000 0000 0100 is received. The pattern is aligned with the F-bits as indicated. 3 in 24 provides the minimum ones density and the maximum excess zeros requirements to stress T1 circuits. When the pattern is framed, it violates the minimum ones density requirements. • 1 in 8 (1:7): A fixed pattern of F01000000 is received. This pattern stresses the minimum ones density requirement for B8ZS encoded T1 circuits if sent unframed. • 1010 Pattern: A fixed test pattern of alternating marks (1) and spaces (0). This pattern is generally used to perform a minimum level stress test on clock recovery circuits. • 55DLY: A 55 octet Daly pattern is received. • T1-2: A 96 octet pattern is received. • T1-3: A 54 octet pattern is received.

	• T1-4: A 120 octet pattern is received. • T1-5: A 53 octet pattern is received. • 55-Octet: A 55 octet pattern is received. • DDS-1: An octet of 11111111 (repeated 100 times) followed by an octet of 00000000 (repeated 100 times) received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • DDS-2: An octet of 01111110 (repeated 100 times) followed by an octet of 00000000 (repeated 100 times) received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • DDS-3: An octet of 01001100 received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • DDS-4: An octet of 00000010 received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • DDS-5: DDS-1 pattern (repeated 4 times); DDS-2 (repeated 4 times); DDS-3 (once); DDS-4 (once) received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • DDS-6: An octet of 11111110 (repeated 7 times) followed by an octet of 11111111 (once) received continuously. Note: This pattern is unavailable if the Framing command is set to Unframed or SLC-96. • Bridge Tap: 21 different patterns are received to detect bridge taps on a DS1. The following patterns are performed in 30 second increments: All Ones, 1-in-2, 1-in-4, 1-in-6, 1-in-7, 1-in-8, 2-in-9, 2-in-10, 2-in-11, 2-in-12, 2-in-13, 2-in-14, 2-in-15, 3-in-18, 3-in-19, 3-in-20, 3-in-21, 3-in-22, 3-in-23, 3-in-24, and QRSS. • Multi-Pattern: Five different patterns are received to stress a DS1. The following patterns are performed in 5 minute increments: All Ones, 1-in-8, 2-in-8, 3-in-24, and QRSS.

- [User Defined](#): Allows you to enter up to a 32-bit pattern.
- [Live](#): Expects live data traffic; no predictable expected pattern. When selected, Bit errors and Pattern Sync alarms are not monitored and their LEDs becomes non-functional.



When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.

Fractional T1 (1-24)	Configures the system for Fractional T1 testing.
CODEC	Select A-law , Mu-law , or True A-law .
Auto Configure	The Auto Configuration button allows you to quickly configure the unit to match the parameters of an incoming signal. This function configures the processor for the same mapping, framing, line coding, and pattern characteristics as the incoming signal, without having to manually configure the processor.

Receive - DS0

The DS0 feature allows you to test and analyze T-Carrier transmission systems at the DS1 and DS0 levels from the DS1 access point. The DS0 function selects individual DS0 channels allowing data bits for D4 and ESF signaling bits (A, B, C, and D) to be monitored. A speaker provides audible VF outputs for the selected DS0 channel. The DS0 function provides analysis of individual circuits using the Chan Drop button or analysis of all 24 DS0 channels using the Chan Scan button.

The following describes the functions associated with each option.

Option	Description

Circuit Signal	Selects the specific type of signaling bits that are monitored and displayed within the DS0 Function Menu area. The following options are available: • Unknown • Loop-Start • Ground-Start • Loop-Rev Battery • Network-Prov-Rev Battery • E and M • CI-Prov Loop Start  See DS0 Circuit Signal for more details.
Test Site	The network interface and the customer installation use compatible robbed-bit signaling states for each type of circuit signaling (refer to Tables 3-1 and 3-2). The Test Site command allows you to determine whether the Network Interface or the Customer Installation is responsible for generating these signals. The following options are available. • Customer<--Network: The network interface generates signaling states to the customer installation. • Network<--Customer: The customer installation generates signaling states to the network interface. • Unknown: Undefined signaling state. Under normal operation, undefined signaling states should only exist during the transition from one signaling state to another signaling state. The duration of these signaling state transmissions should not exceed 3 milliseconds.

DS0 Channel Dropped	Selects a DS0 channel (Channels 1 through 24) to drop from the DS1 signal. For ESF channel signaling, the four Channel Signaling Bits, labeled A, B, C, and D, indicate the status of the selected DS0 channel. For D4 or SLC-96, the two Channel Signaling Bits, labeled A and B, indicate the status of the selected DS0 channel.
Single Chan	Allows you to select a single channel to scan for errors.
Prev/Next Chan	The Prev Chan and Next Chan buttons allow you to select a DS0 channel (Channels 1-24) that is dropped from the DS1 signal by scrolling backwards or forwards through the 24-DS0 channels.
All Chans	Scans all DS0 channels within a DS1 signal for framing errors. This allows you to view the D4, SLC-96, or ESF signaling bits for all 24 DS0 channels at once.
Speaker On/Off	This button that turns the speaker on and off.
Volume	Controls the speaker volume level. Click High to increase volume. Click Low to decrease volume.

DS0 Circuit Signal

The DS1 application uses robbed-bit signaling to provide DS0 per-channel circuit signaling data. Eight bits are available for the payload in each channel during 5 out of 6 frames. Every 6th frame, however, the least significant bit (8th) of each time slot is used (robbed) to provide per-channel circuit signaling.

In the [D4 format](#), bits are robbed in the 6th and 12th frame to derive the signaling channel. This bit is called the A bit and the bit from the 12th frame is called the B bit.

In the [ESF format](#), bits are robbed in the 6th, 12th, 18th, and 24th frames to derive the signaling channel. These make up the A, B, C, and D bits respectively.

The contents and meaning of the signaling bits depend on the type of signaling selected using the Circuit Signaling command. The robbed-bit signaling states for six types of D4 and ESF circuit signaling are provided in the following tables.

The following table describes D4 and SLC-96 circuit signaling and bit formats.

Circuit Signalling	Circuit	Signalling States	A	B
Loop Start	Network to CI	LCF	0	1
		Ringing	0	0
	CI to Network	LO (On-hook)	0	1
		LC (Off-hook)	1	1
Ground-Start	Network to CI	LCF	0	1
		LCFO	1	1
		Ringing	0	0
	CI to Network	LO (on-hook)	0	1
		LC (off-hook)	1	1
		RG (service request)	0	0
Loop-Reverse Battery	Network to CI	LO (on-hook)	0	0
		LC (off-hook)	1	1
	CI to Network	LO (on-hook)	0	0
		LC (off-hook)	1	1
Network-Provided Reverse Battery	Network to CI	LCF (on-hook)	0	0
		RLCF (off-hook)	1	1
	CI to Network	LO (on-hook)	0	0
		LC (off-hook)	1	1
E and M Signalling	Network to CI	On-hook	0	0
		Off-hook	1	1
	CI to Network	On-hook	0	0

CI-Provided Loop Start	Network to CI	LO (on-hook)	0	1
		LC (off-hook)	1	1
	CI to Network	LCF	0	1
		Ringling	0	0

*LCF = Loop Current Feed; RLCF = Reverse Loop Current Feed; LCFO = Loop Current Feed Open;
LO = Loop Open LC = Loop Closure; RG = Ring Ground; CI = Customer Installation*

The following table describes ESF circuit signaling and bit formats.

Circuit Signalling	Circuit	Signalling States	A	B	C	D
Loop Start	Network to CI	LCF	0	1	0	1
		Ringling	0	0	0	0
	CI to Network	LO (On- hook)	0	1	0	1
		LC (Off- hook)	1	1	1	1
Ground- Start	Network to CI	LCF	0			1
		LCFO	1	1	1	1
		Ringling	0	0	0	0
	CI to Network	LO (on- hook)	0	1	0	1
		LC)off- hook)	1	1	1	1
		RG (service request)	0	0	0	0

Loop-Reverse Battery	Network to CI	LO (on-hook)	0	0	0	0
		LC (off-hook)	1	1	1	1
	CI to Network	LO (on-hook)	0	1	0	1
		LC (off-hook)	1	1	1	1
Network-Provided Reverse Battery	Network to CI	LCF (on-hook)	0	0	0	0
		RLCF (off-hook)	1	1	1	1
	CI to Network	LO (on-hook)	0	0	0	0
		LC (off-hook)	1	1	1	1
E and M Signalling	Network to CI	On-hook	0	0	0	0
		Off-hook	1	1	1	1
	CI to Network	On-hook	0	0	0	0
		Off-hook	1	1	1	1
CI-Provided Loop Start	Network to CI	LO (on-hook)	0	1	0	1
		LC (off-hook)	1	1	1	1
	CI to Network	LCF	0	1	0	1
		Ringling	0	0	0	0
LCF = Loop Current Feed; RLCF = Reverse Loop Current Feed; LCFO = Loop Current Feed Open; LO = Loop Open LC = Loop Closure; RG = Ring Ground; CI = Customer Installation						

Receive - Signal Status (SIG)

This function displays the electrical power, line frequency, and line frequency offset of the incoming DS1 signal, for the selected DS1 port.

The following information is displayed on the DS1 Receive SIG screen.

- Peak Positive Pulse Voltage
- Peak Negative Pulse Voltage
- Power in dBm
- Power in dBdSX
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm
- Bit Slips

Results

Results Screens and Functions

The Results function allows you to view DS1 error and alarm analysis and create a history of these events by graphing the information.

The following options are available through the Results screen:

- [SCAN](#)
- [ERR](#)
- [ALARM](#)
- [EVENT](#)
- [LARGE LED](#)
- [GRAPH](#)
- [Multi Pat](#)

Results - SCAN

The SCAN function provides a list of received errors and alarms for the DS1 protocol processor. The duration or count of each event also appears. This function is effective in identifying a general area to investigate when an error or alarm is detected.

When no problems are detected, "No Errors or Alarms" is displayed.

Results - ERR

This function displays the number of errors detected and the average and current error rate measurement. The errors reported are generated by the DS1 network or intentionally by the system using the Error Insert Action button.

The following DS1 errors are reported.

- BPV
- Frame
- CRC
- Excess 0's
- BIT

Results - ALARM

This function displays how long DS1 alarms were detected by the system. Results for the following alarms display.

- AIS Seconds
- Out of Frame Seconds
- Loss of Signal Seconds
- Pat Sync Seconds
- Yellow Seconds
- Excess 0's Seconds
- Clock Seconds
- Idle Seconds
- FBIT

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - LARGE LED

This screen displays the LEDs and status indicators for in a large, easy to read format that covers the entire screen area. This is especially useful for viewing errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

Results - Graph

The Graph screen allows you to view error and alarm results for the protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of alarms and errors.

To use the Results Graph function, see [Using Graphs](#).

Results - Multi Pat

This function is available when the DS1 Receive Payload Pattern is configured for [Multi-Pattern](#).



Multi-Pattern tests 5 different Payload Patterns (**All Ones**, **1-in-8**, **2-in-8**, **3-in-24**, and **QRSS**) in reoccurring intervals of 5 minutes each.

When the test begins each pattern shows PASS under the **Results** column. If a BIT error is detected at any time while testing any of the Payload Patterns, then that Pattern's Results statistic will change to FAIL.

This screen also displays the total number of received **BIT Errors** for each Payload Pattern and the number of **Errored Seconds** that the BIT errors occurred for.

The total number of **Run Seconds** that each Payload Pattern has accumulated since the test began is also displayed.

The **Totals** row shows the accumulated totals of each of the Payload Patterns statistics.

Test

Test Screens and Functions

(Specifically for PDH testing)

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **[Duration](#)**: This function configures how long a timed test runs for.
- **[Action After Duration](#)**: This function defines what activities occur at the conclusion of a timed test
- **[Pause Test/Resume Test](#)**: This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description

None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.

Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for PDH testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- For E4 one frame duration is roughly 0.021 ms (21 μ s)

- ▶ For E3 one frame duration is roughly 0.045 ms (45 μ s)
- ▶ For E1 one frame duration is roughly 0.125 ms (125 μ s)
- ▶ For DS3 one frame duration is roughly 0.106 ms (106 μ s)
- ▶ For DS1 one frame duration is roughly 0.125 ms (125 μ s)

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.
 - 💡 For all **PDH** processors the Protection Switch Criteria is limited to: **Loss of Pattern Sync** and **Bit Errors**.
- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 0.021 to 5.361 ms, and is entered using a keypad.
 - ▶ The range for E3 is 0.045 to 11.397 ms, and is entered using a keypad.
 - ▶ The range for E1 is 0.125 to 511.875 ms, and is entered using a keypad.
 - ▶ The range for DS3 is 0.106 to 27.133 ms, and is entered using a keypad.
 - ▶ The range for DS1 is 0.125 ms to 511.875 ms, and is entered using a keypad.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E1 is 1 to 4095 frames, and is entered using a keypad.
 - ▶ The range for DS3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for DS1 is 1 to 4095 frames, and is entered using a keypad.
- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The

results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Protection Switch Frame** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5.
- **History Recent Frames**: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5.



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)

E1	0.125 ms (125 μ s)	4095 frames (511.875 ms)
DS3	0.106 ms (106 μ s)	255 frames (27.133 ms)
DS1	0.125 ms (125 μ s)	4095 frames (511.875 ms)

Test - RTD (Round-Trip Delay)

(Specifically for PDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State):** Starts and stops round-trip delay mode.
 - ▶ **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in milliseconds. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.
 - ▶ **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network.
 - ▶ **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
 - ▶ The **Current** column displays the most recent round trip measurement.
 - ▶ The **Minimum** column displays the fastest round trip measurement.
 - ▶ The **Maximum** column displays the slowest round trip measurement

Performance Monitoring

Performance Monitoring Screens and Functions

Performance Monitoring provides greater detail about incoming Frame and Bit errors.

The following options are available:

- [Frame](#)
- [CRC](#)
- [BIT](#)

Performance Monitor - Frame

This provides a detailed breakdown for Frame errors detected and logged by the DS1 protocol processor.

This section is broken down into the following areas:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

Performance Monitor - CRC

This provides a detailed breakdown for CRC errors detected and logged by the DS1 protocol processor.



This screen is only available when DS1 is set to ESF Framing.

This section is broken down into the following areas:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

Performance Monitor - BIT

This provides a detailed breakdown for BIT errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

Statistics	Description
CV	Code violations by count.
ES	Errored seconds by count, rate percentage, and objective percentage.
EFS	Error-free seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable seconds by count, rate percentage, and objective percentage.

DS1 LED Quick Status Area

When either of the DS1 protocol processor tabs are selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LEDs Results](#) screen.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	TX indicates the current transmit DS1 Line Interface Signal Level.
RX	RX indicates the current value of the DS1 Line Interface Input Termination.
E/A BIT	Displays the error and/or alarm currently generated by the unit.
CLK	A status indicator that displays the type of transmit clock specified in the setting. Clock settings include SETS, Internal, or RCVD.
Test Paused	Indicates a test has been paused, when LED is red.
LOS	Loss of Signal: Indicates a Loss of Signal status was detected.
BPV	Bipolar Violation Error: Indicates the presence of a Bipolar Violation error. This happens when two consecutive pulses of the same polarity occur in the same digital bit stream.
LOF	Loss of Frame. An alarm LED indicating an alarm signal was generated due to a frame alignment problem.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns.
FBIT	Frame Bit Error: Indicates a frame bit error in the received frame bit pattern. This applies to both SF and ESF framing.

Idle	Indicates a DS1 Idle alarm was received.
EXZ	Excess Zeros: Indicates that more than the permitted number of consecutive zeros were received. For AMI Line Coding, 16 or more zeros are excessive; for B8ZS Line Coding, 8 or more zeros are excessive.
AIS	Alarm Indication Signal: Indicates, to downstream equipment, that an upstream failure has occurred on the DS1 signal.
Yellow	Yellow Alarm: Also known as a Remote Alarm Indication (RAI) signal. Indicates to the far end that a failure was detected.
CRC	Cyclic Redundancy Check: Indicates that a CRC error has occurred. This applies to ESF framing only.
Pat Sync	Pattern Synchronization: Indicates cell synchronization condition
Bit Err	Indicates that a Bit error was received.

DS1 Specific Tasks

DS1 Specific Tasks Overview

This section covers procedures that are specific to the operation of the DS1 protocol processor. For a list of general tasks, which apply to all protocol processors, see [Common Tasks](#) located in the Getting Started section.

- [Add/Drop a DS1 out of a DS3 Signal](#)
- [DS0 Circuit Signal](#)
- [Configure Fractional T1 Testing](#)

Add/Drop a DS1 out of a DS3 Signal

You are able to add/drop multiplex a DS1 signal in to and out of a DS3 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-28) to drop the signal into.

1. Select [Test Setup](#) from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default DS1/DS3**.

- If the DS1/DS3 options are preceded by SONET and SDH, then choose either **SONET/DS1/DS3** or **SDH/DS1/DS3**, depending on the desired protocol mode.
3. Select [Presets](#) from the [Common Function Buttons](#).
 4. Select the **Interface** button and choose **DS3** from the Select from Interface list.
 5. Select the **Configuration** button and choose either one of the following:
 - **DS1 #1 A/D** or **DS1 #2 A/D**: The DS1 Add/Drop setting multiplexes the DS1 signal generated by the DS1#1 (or DS1#2) processor up to the DS3 processor, and transmits it out the DS3 transmit interface port (along with other background DS1 signals generated by the DS3 processor) in the specified DS1 Channel from the Transmit DS1 #1 (or DS1#2) Channel Inserted setting. The specified DS1 #1 (or DS1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the DS1 #1 (or DS1#2) processor for Error and Alarm analysis. The selected DS1 port's TX/RX interfaces are not used in this configuration.
 - **DS1 #1 A/D LI** or **DS1 #2 A/D LI**: The DS1 Line Interface (LI) Add/Drop setting multiplexes the received DS1#1 (or DS1#2) signal up to the DS3 processor, and transmits it out the DS3 transmit interface port (along with other background DS1 signals generated by the DS3 processor) in the specified DS1 Channel from the Transmit DS1 #1 (or DS1#2) Channel Inserted setting. The specified DS1 #1 (or DS1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the DS1 processor and transmitted out to the selected DS1 Interface port.
 6. Select the **Apply** button.



Both DS1#1 and DS1#2 signals can simultaneously be added to the DS3 interface by pressing Presets and selecting DS3 from the Interface menu again, and then choose the other DS1 processor from the Configuration menu.

The unit is configured to drop a DS1 out of the DS3 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **DS3**.
2. Select **Transmit** and **Set 1**.

3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. If you dropped the DS1 #1 signal, select **DS1 #1 Channel Inserted** and select the channel in which you want to drop the DS1 signal.
5. If you dropped the DS1 #2 signal, select **DS1 #2 Channel Inserted** and select the channel in which you want to drop the DS1 signal.
6. Select **DS1 Background Frame** and select the background frame for the specified channel.
7. Select **DS1 Background Pattern**. Select a pattern to fill the background DS1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast DS1 #1 (and/or Broadcast DS1 #2).
 - Broadcast DS1 #1 and Broadcast DS1 #2 will broadcast the Framing and Payload Pattern from the selected DS1 port, over all of the background DS1 channels.
8. Select the **DS1** tab being dropped.
9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected DS3 channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

1. Select the **Results** screen from the specified DS1 #1 (or DS1#2) processor tab to view the received error and alarm activity.
2. Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.
3. If an LOF alarm is being detected, then the DS3 processor is likely in an errored state.

DS0 Circuit Signal

The DS1 application uses robbed-bit signaling to provide DS0 per-channel circuit signaling data. Eight bits are available for the payload in each channel during 5 out of 6 frames. Every 6th frame, however, the least significant bit (8th) of each time slot is used (robbed) to provide per-channel circuit signaling.

In the [D4 format](#), bits are robbed in the 6th and 12th frame to derive the signaling channel. This bit is called the A bit and the bit from the 12th frame is called the B bit.

In the [ESF format](#), bits are robbed in the 6th, 12th, 18th, and 24th frames to derive the signaling channel. These make up the A, B, C, and D bits respectively.

The contents and meaning of the signaling bits depend on the type of signaling selected using the Circuit Signaling command. The robbed-bit signaling states for six types of D4 and ESF circuit signaling are provided in the following tables.

The following table describes D4 and SLC-96 circuit signaling and bit formats.

Circuit Signalling	Circuit	Signalling States	A	B
Loop Start	Network to CI	LCF	0	1
		Ringing	0	0
	CI to Network	LO (On-hook)	0	1
		LC (Off-hook)	1	1
Ground-Start	Network to CI	LCF	0	1
		LCFO	1	1
		Ringing	0	0
	CI to Network	LO (on-hook)	0	1
		LC)off-hook)	1	1
		RG (service request)	0	0
Loop-Reverse Battery	Network to CI	LO (on-hook)	0	0
		LC (off-hook)	1	1

	CI to Network	LO (on-hook)	0	0
		LC (off-hook)	1	1
Network- Provided Reverse Battery	Network to CI	LCF (on-hook)	0	0
		RLCF (off-hook)	1	1
	CI to Network	LO (on-hook)	0	0
		LC (off-hook)	1	1
E and M Signalling	Network to CI	On-hook	0	0
		Off-hook	1	1
	CI to Network	On-hook	0	0
CI-Provided Loop Start	Network to CI	LO (on-hook)	0	1
		LC (off-hook)	1	1
	CI to Network	LCF	0	1
		Ringling	0	0

LCF = Loop Current Feed; RLCF = Reverse Loop Current Feed; LCFO = Loop Current Feed Open; LO = Loop Open LC = Loop Closure; RG = Ring Ground; CI = Customer Installation

The following table describes ESF circuit signaling and bit formats.

Circuit Signalling	Circuit	Signalling States	A	B	C	D
Loop Start	Network to CI	LCF	0	1	0	1
		Ringling	0	0	0	0
	CI to Network	LO (On-hook)	0	1	0	1
			1	1	1	1

		LC (Off-hook)				
Ground-Start	Network to CI	LCF	0			1
		LCFO	1	1	1	1
		Ringling	0	0	0	0
	CI to Network	LO (on-hook)	0	1	0	1
			1	1	1	1
		LC (off-hook)	0	0	0	0
		RG (service request)				
Loop-Reverse Battery	Network to CI	LO (on-hook)	0	0	0	0
			1	1	1	1
		LC (off-hook)				
	CI to Network	LO (on-hook)	0	1	0	1
			1	1	1	1
Network-Provided Reverse Battery	Network to CI	LCF (on-hook)	0	0	0	0
			1	1	1	1
		RLCF (off-hook)				
	CI to Network	LO (on-hook)	0	0	0	0
			1	1	1	1
E and M Signalling	Network to CI	On-hook	0	0	0	0
		Off-hook	1	1	1	1

	CI to Network	On-hook	0	0	0	0
		Off-hook	1	1	1	1
CI- Provided Loop Start	Network to CI	LO (on- hook)	0	1	0	1
			1	1	1	1
		LC (off- hook)				
	CI to Network	LCF	0	1	0	1
		Ringng	0	0	0	0

*LCF = Loop Current Feed; RLCF = Reverse Loop Current Feed; LCFO = Loop Current Feed Open;
LO = Loop Open LC = Loop Closure; RG = Ring Ground; CI = Customer Installation*

Configure Fractional T1 Testing

Configuring the system for 56K or 64K Fractional T1 testing enables you to bulk fill 0 to 24 DS0's in an T1 Transmit signal with a pattern. Additionally, you can specify an eight-bit pattern in background DS0's.

To configure for Fractional T1 testing:

1. Select **DS1**.
2. Select **Transmit**.
3. Select the **SET 1** side tab.
4. Select [Mapping](#), and choose either **56K Fractional T1** or **64K Fractional T1** from the Mapping menu.
5. Select [Fractional T1](#). A Time Slot Assignment window appears.
6. To enable or disable the available Fractional T1 time slots, use the **Left** and **Right** arrow buttons to select which time slot(s) you want to enable; choose **1** to enable the selected time slot, and **0** to disable the selected time slot. When you are done, select **OK**.

- ▶ Every time slot that is Enabled (1) it will use the configured foreground Payload Pattern. Every time slot that is Disabled (0) it will use the configured Background DS0 Pattern.
 - ▶ When a time slot's 1 or 0 value is selected, the next available time slot (either to the left or right, depending on which way the black arrow is facing) will automatically become selected so you can continue to change from one time slot to the next, without having to use the left/right arrow buttons to advance to the next slot.
 - ▶ To change the direction of the black arrow, simply press either the **Left** and **Right** arrow button.
 - ▶ To disable all of the enabled time slots at one time, press the **Disable All** button.
7. Select **Background DS0 Pattern**. A keypad appears.
 8. Use the keypad buttons to specify the 8-bit user defined background 64K pattern you wish to inject on the DS0 time slots that are disabled. The maximum value is eight bits. When you are done, select **OK**.

DS3 Tab

DS3 Overview

The DS3 online help is divided into the following sections:

- [DS3 Screen Functions and Descriptions](#)
- [DS3 Specific Tasks](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Functions and Descriptions

DS3 Screen Functions and Descriptions Overview

The following function screens are available through the DS3 protocol processor tab.

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [Performance Monitoring](#)
- [LEDs](#)

Transmit

Transmit Screens and Functions

This function allows you to define the parameters used in DS3 Transmit operations.

The following functions are available through the DS3 Transmit screen.

- [SET 1](#)
- [ERROR ALARM](#)
- [FEAC CODES](#)

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the DS3 line interface and the DS3 protocol processor to match the DS3 signal used in your test environment.

The DS3 Transmit Settings screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Signal Level	Sets the signal strength of the DS3 transmit signal. The signal level values simulate high and low impedance experienced by a DS3 signal. The following options are available: • DSX-3: Sets the DS3 signal level to 0.48 Vp. This level is equal to a high signal sent through 450 feet of coaxial cable and is the standard cross-connect level. • DS3 High: Sends the DS3 signal at a higher voltage to simulate a "hot" signal sent over a short cable distance. The DS3 signal level is set to 0.95 Vp. Use this setting when testing from the network element location rather than at the DSX. This signal, sent through 450 feet of coaxial cable, is equal to DSX-3 level. • DS3 Low: Sends the DS3 signal at a lower voltage to simulate transmission over a long cable distance. The DSX-3 signal level is set to 0.35 Vp. This level simulates a standard DSX level sent through 450 feet of coaxial cable.

Clock	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. BITS/SETS: Derives the transmit's data timing source from the BITS/SETS input ports. • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but a BITS clocking is not available then this function defaults to Internal. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but a SETS clocking is not available then this function defaults to Internal.
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. • The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 • The default value of 0 (zero) equals Off.
Framing	Configures the framing format used for the DS3 transmit signal. The following options are available:

	• Unframed: Configures the system to transmit a DS3 signal using an unframed format. Note: This option is only available if Mapping is set to Bulk Filled. • M13: Configures the DS3 protocol processor to transmit a signal in a an M13 framing format. • C-Bit: Configures the DS3 protocol processor to transmit a signal in a C-bit framing format. This type of formatting allows for the use of FEAC codes.
Mapping	Displays the DS3 Add/Drop Mapping, and allows the user to change the Mapping back to DS3 Bulk Filled.  ATM Direct and ATM PLCP Mapping options will appear if the ATM hardware is available, and if the ATM's Physical Mapping is set to DS3 ATM Direct or DS3 ATM PLCP.  DS1 Mapping option will appear if a DS1 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.  E1 Mapping option will appear if a E1 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.
Pass Thru Mode	Select On to enable Passthru mode. Select Off to disable Passthru mode.
Payload Pattern	Selects the type of payload pattern that is transmitted by the system. The following options are available: PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, All Ones, All Zeros, User Defined (32-bit entry). Note: This option is only available if Mapping is set to Bulk Filled.
DS1 #1 Channel Inserted	Selects from Channels 1 through 28. Note: This option is only available if DS3 is configured for DS1 #1 A/D mapping.

DS1 #2 Channel Inserted	Selects from Channels 1 through 28. Note: This option is only available if DS3 is configured for DS1 #2 A/D mapping.
DS1 Background Frame	Select from Unframed, D4/SF, and ESF. Note: This option is only available if DS3 is configured for DS1 #1 and/or DS1 #2 A/D mapping.
DS1 Background Pattern	Select from a variety of available PRBS patterns, as well as a 32-bit User Defined pattern, and Broadcast DS1 #1, and/or Broadcast DS1 #2. Broadcast DS1 #1 and Broadcast DS1 #2 will broadcast the Framing and Payload Pattern from the selected DS1 port, over all of the background DS1 channels. Note: This option is only available if DS3 is configured for DS1 #1 and/or DS1 #2 A/D mapping.
E1 #1 Channel Inserted	Selects from Channels 1 through 21. Note: This option is only available if DS3 is configured for E1 #1 A/D mapping.
E1 #2 Channel Inserted	Selects from Channels 1 through 21. Note: This option is only available if DS3 is configured for E1 #2 A/D mapping.
E1 Background Frame	Select from Unframed, PCM30, PCM30CRC, PCM31 and PCM31CRC. Note: This option is only available if DS3 is configured for E1 #1 and/or E1 #2 A/D mapping.
E1 Background Pattern	Select from a variety of available PRBS patterns, as well as a 32-bit User Defined pattern, and Broadcast E1 #1, and/or Broadcast E1 #2.

	Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels. Note: This option is only available if DS3 is configured for E1 #1 and/or E1 #2 A/D mapping..

Transmit - Errors and Alarms (ERROR ALARM)

This function allow you to enter errors or alarms.

The following options are available for the DS3 ERROR ALARM screen:

Option	Description
Error to Insert	Inserts an error that is transmitted by the DS3 protocol processor. The options available include: None: Turns off DS3 error insertion BPV Error: Transmits Bipolar Violation errors which result in a line code violation event for an AMI-Coded signal, the occurrence of received excessive zeros, or a bipolar violation. Bit: Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. Frame: Results in a severely errored framing event, which occurs when two or more framing bit pattern errors occur within a 3-ms period. Note: This type of error is not available if the DS3 protocol processor is configured for Unframed framing format. P-Parity error: Results in an error in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame. Note: This option is not available if the DS3 protocol processor is configured for Unframed framing format. C-Parity error: Results in an error in the C-bit channel which is used to denote the presence or absence of stuffed bits. Note: This option is only available if the

	DS3 protocol processor is configured for C-Bit framing format. • FEBE error: Results in a error in one of the three C-Bits in the M-subframe designated as the Far End Block Error (FEBE) bit. Note: This option is only available if the DS3 protocol processor is configured for C-Bit framing format.
Error Insert Rate	Sets the insertion rate for DS3 transmit errors. This function is not available if Error to Insert is set to None. The following options are available for this command: • Off: No errors are inserted for transmission. • 1e-X, where X is a value from 3 to 9
Alarm Generated	Generates a specific alarm on the transmit side of the DS3 protocol processor. The following options are available: LOS, OOF, AIS, Yellow, or Idle. Note: OOF, Idle, and Yellow alarms are not available if DS3 Framing is set to unframed.

Transmit - FEAC CODES



FEAC Code functionality only appears on the screen when the DS3 protocol processor is configured for [C-BIT framing](#).

The Far-End Alarm and Control (FEAC) channel allows alarm and status information to be sent from the equipment at the far-end of the signal to the equipment at the far-end of the signal. It also allows the near-end equipment to initiate loopback tests from the far-end equipment.

This function configures the type of alarm or loopback test that is sent from the far end of the DS3 connection. In addition, it allows you to use the unit locally to send a command to the far-end equipment that will then initiate an alarm or loopback to the unit.

The following options are available:

Option	Description

FEAC Type	Determines if the far-end equipment sends an alarm/status code (Alarm/Status), or if the far-end equipment starts a loopback test to the unit (Loopback Activate) or stops a loopback test to the unit (Loopback Deactivate).
Alarm/Status Code	Selects the type of alarm code or status code that the far-end equipment sends to the unit. Note: This option is only available if TX FEAC Type is set to Alarm/Status.
Loopback Line	Selects an individual DS1 signal or the entire DS3 signal to activate and deactivate loopback tests. Note: This option is only available if TX FEAC Type is set to Loopback Activate.
Last RX Code	Displays the last alarm or status detected by the unit and how long ago (in seconds) it was detected.
Last RX Loopback Status	Displays the last loopback started by the far-end equipment and detected by the unit. It also displays how long ago (in seconds) it was activated. Note: This information only appears if the TX FEAC Type option is set to Loopback Activate.
Last RX Loopback Deactivate	Displays the last loopback stopped by the far-end equipment and detected by the unit. It also displays how long ago (in seconds) it was deactivated. Note: This information only appears if the TX FEAC Type option is set to Loopback Deactivate.
Burst	Resets the number of seconds since an alarm to zero.

Receive

Receive Screens and Functions

This function allows you to configure settings for the parameters used in the DS3 Receive operations.

The following functions are available through the DS3 Receive screen.

- [SET 1](#)
- [SIG](#)

- [Chan Scan](#)

Receive - Settings 1 (SET 1)

This screen allows you to configure your unit's Receive parameters for your DS3 test environment. The values selected for the parameters are expected values. This means that an error can occur if the unit does not receive the expected parameter value.

The DS3 Receive SET 1 screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Equalization	Configures the DS3 line input termination equalization value to compensate for high and low impedance values. The following options are available: • DS3 (0dB): Expects the received signal level to be near 0 dB, for error-free operation. • DSX-3 (-6dB): Expects the received signal level to be near -6 dB, for error-free operation. • DSX-3 Low (-12dB): Expects the received signal level to be near -12 dB, for error-free operation. Use this setting if the DS3 line connects to a monitor jack.
Framing	Configures the framing format used for the DS3 Receive signal. An error occurs if the DS3 signal is not in the selected framing format. The following options are available: • Unframed: Configures the system to receive a signal in an unframed format. • M13: Configures the system to receive a signal in an M13 framing format.

	• C-Bit: Configures the system to receive a signal in a C-Bit framing format. This type of formatting allows the use of FEAC codes.
Mapping	Displays the expected DS3 Add/Drop Mapping, and allows the user to change the Mapping back to DS3 Bulk Filled.  ATM Direct and ATM PLCP Mapping options will appear if the ATM hardware is available, and if the ATM's Physical Mapping is set to DS3 ATM Direct or DS3 ATM PLCP.  DS1 Mapping option will appear if a DS1 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.  E1 Mapping option will appear if a E1 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.
Payload Pattern	Selects the payload pattern expected to be received by the system. The following options are available, when the Mapping is set to Bulk Filled.: PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
DS1 #1/E1 #1 Channel Drop	Selects from Channels 1 through 21 (for E1) and 28 (for DS1). Note: This option is unavailable if Mapping is not set to E1/DS1.

DS1 #2/E1 #2 Channel Drop	Selects from Channels 1 through 21 (for E1) and 28 (for DS1). Note: This option is unavailable if Mapping is not set to E1/DS1.
Auto Configure	The Auto Configuration button allows you to quickly configure the unit to match the parameters of an incoming signal. This function configures the processor for the same mapping, framing, line coding, and pattern characteristics as the incoming signal, without having to manually configure the processor.

Receive - Signal Status (SIG)

This function displays the electrical power, line frequency, and line frequency offset of the incoming DS3 signal.

The following information is displayed on the DS3 Receive SIG screen:

- Peak Positive Pulse Voltage (in volts)
- Peak Negative Pulse Voltage (in volts)
- Power in dBm
- Power in dBdsx
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm
- Bit Slips

Receive - Channel Scan (Chan Scan)

This function inspects and then reports the contents of the 28 DS1 channels that are contained within a multiplexed DS3 signal. The information reported consists of Mapping and Pattern values for each DS1 channel.



To use this function, Mapping must be set to DS1, and the system must receive a valid signal.

For more information, see [Start/Stop Channel Scan](#).

Results

Result Screens and Functions

This function allows you to view DS3 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the DS3 Results screen

- [Scan / Error / Alarm](#)
- [EVENT](#)
- [LARGE LED](#)
- [GRAPH](#)

DS3 Results - Scan / Errors / Alarms

The Results ERR screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

- **Errors** - The unit can monitor and report errors on the incoming DS3 signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the DS3 network, or errors that are intentionally generated by the system when it is used in a loopback environment.

The following errors can be monitored:

- [Frame Error](#)
- [BPV Error](#)
- [P-Parity](#)
- [C-Parity](#)
- [FEBE](#)

- [Bit Error](#)

The following parameters are measured for the incoming errors:

- ▶ Error count using an 11-digit format
 - ▶ Average error rate using an N.NNe-N format
 - ▶ Current error rate using an N.NNe-N format
 - ▶ Error-free seconds using an 8-digit format
 - ▶ Errored seconds
 - ▶ Severely Errored seconds
 - ▶ Unavailable errored seconds
- **Alarms** - The system can monitor and report alarms and their duration on the incoming DS3 signal. The alarms are shown in duration of the alarm in seconds.

The following alarms can be monitored:

- [Power Loss](#)
- [Paused](#)
- [Clock](#)
- [LOS](#)
- [LOF](#)
- [AIS](#)
- [RDI](#)
- [Idle](#)
- [Frame Mismatch](#)
- [Pat Sync](#)

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - LARGE LEDs

This button displays the DS3 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

Results - Graph

The Graph screen allows you to view error and alarm results for the protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of alarms and errors.

To use the Results Graph function, see [Using Graphs](#).

Test

Test Screens and Functions

(Specifically for PDH testing)

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.

5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.

- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (.). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.

Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for PDH testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For E4 one frame duration is roughly 0.021 ms (21 μ s)
- ▶ For E3 one frame duration is roughly 0.045 ms (45 μ s)
- ▶ For E1 one frame duration is roughly 0.125 ms (125 μ s)
- ▶ For DS3 one frame duration is roughly 0.106 ms (106 μ s)
- ▶ For DS1 one frame duration is roughly 0.125 ms (125 μ s)

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

 For all **PDH** processors the Protection Switch Criteria is limited to: **Loss of Pattern Sync** and **Bit Errors**.

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 0.021 to 5.361 ms, and is entered using a keypad.

- ▶ The range for E3 is 0.045 to 11.397 ms, and is entered using a keypad.
- ▶ The range for E1 is 0.125 to 511.875 ms, and is entered using a keypad.
- ▶ The range for DS3 is 0.106 to 27.133 ms, and is entered using a keypad.
- ▶ The range for DS1 is 0.125 ms to 511.875 ms, and is entered using a keypad.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E1 is 1 to 4095 frames, and is entered using a keypad.
 - ▶ The range for DS3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for DS1 is 1 to 4095 frames, and is entered using a keypad.
- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Protection Switch Frame** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5.

- **History Recent Frames:** The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
E4	0.021 ms (21 μ s)	255 frames (5.361 ms)
E3	0.045 ms (45 μ s)	255 frames (11.397 ms)
E1	0.125 ms (125 μ s)	4095 frames (511.875 ms)
DS3	0.106 ms (106 μ s)	255 frames (27.133 ms)
DS1	0.125 ms (125 μ s)	4095 frames (511.875 ms)

Test - RTD (Round-Trip Delay)

(Specifically for PDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State):** Starts and stops round-trip delay mode.

► **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in milliseconds. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.

► **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network.

► **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.

- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.

► The **Current** column displays the most recent round trip measurement.

► The **Minimum** column displays the fastest round trip measurement.

► The **Maximum** column displays the slowest round trip measurement

Performance Monitoring

Performance Monitoring Screens and Functions

The DS3 Performance Monitor screen includes the following functions:

- [LINE](#)
- [BIT](#)
- [PATH](#)

Perf Monitor - LINE

Performance Monitoring provides greater detail about incoming Line errors.

The following statistics are reported on the LINE screen:

DS3 Line Statistics	Description
CV	Code Violation. This is an error count of incoming BPV errors.

ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.
EFS	Error Free Seconds. The time, in seconds and percentage, in which there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

Perf Monitor - BIT

Performance Monitoring provides greater detail about incoming Bit errors.

The following statistics are reported on the BIT screen:

DS3 Bit Statistics	Description
CV	Code Violation. This is an error count of incoming BIT errors.
ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.
EFS	Error Free Seconds. The time, in seconds and percentage, in which there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

Perf Monitor - PATH

Performance Monitoring provides greater detail about incoming P-Parity and C-Parity errors.

The following statistics are reported on the PATH screen:

DS3 Path Statistics	Description
CV	Code Violation. This is an error count of incoming P-Parity or C-Parity errors.
ES	Errored Seconds. The number of seconds and percentage in which errors were detected in the monitored signal.
EFS	Error Free Seconds. The time, in seconds and percentage, in which there were no errors detected in the signal being monitored.
SES	Severely Errored Seconds. The number of seconds and percentage in which the signal has an extremely high error rate.
UAS	Unavailable Seconds. The time in seconds and percentage, in which the monitored signal was unavailable.

DS3 LED Quick Status Area

When the DS3 protocol processor is selected, the following LEDs and status indicators are displayed in the LED Quick Status Area of the touch screen. They are also located under Results [Large LEDs](#).

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Displays the DS3 transmit signal level and transmit framing value.
RX	Displays the DS3 receive input termination value and the expected receive framing value.

E/A	Displays the error and/or alarm currently generated by the unit.
CLK	Indicates the timing source for the transmit signal. This value is specified by the Clock Reference function. Clock settings include: INT, BITS, SETS, or RCVD.
Line	Indicates received line code. Values that appear are: B3ZS or "blank" if an LOS exists.
LOS	Loss of Signal. Indicates a Loss of Signal status was detected. This is an alarm LED.
BPV	Bipolar Violation. Indicates two consecutive pulses of the same polarity occurred in the same digital bit stream.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
Frame Err	Indicates if the DS3 protocol processor has received framing errors. This is an error LED.
AIS	Alarm Indication Signal. Indicates an Alarm Indication Signal occurred on the Line layer. This is an alarm LED.
Yellow	Indicates that a yellow alarm was received on the DS3 signal. This is an alarm LED.
P-Parity	Indicates an error in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame on the DS3 signal. This is an error LED.
C-Parity	Indicates an error in the C-bit channel of the DS3 channel, which is used to denote the presence or absence of stuffed bits. This is an error LED.
FEBE	Far End Block Error. Indicates a Bit error occurred on the far end of the DS3 signal. This is an error LED.
Idle	Indicates an idle alarm was received. This is an alarm LED.
Pat Sync	Pattern Synchronization. Indicates a loss of pattern synchronization. This is an alarm LED.
Bit Err	Bit Error. Indicates a bit error was detected in the payload. This is an error LED.

DS3 Specific Tasks

DS3 Specific Tasks Overview

This section covers procedures that are specific to the operation of the DS3 protocol processor. For a list of general tasks, which apply to all protocol processors, see [Common Tasks](#) located in the Getting Started section.

- [Add/Drop a DS1 out of a DS3 Signal](#)
- [Add/Drop an E1 out of a DS3 Signal](#)
- [Enabling FEAC Codes](#)
- [Start/Stop DS3 Channel Scan](#)

Add/Drop a DS1 out of a DS3 Signal

You are able to add/drop multiplex a DS1 signal in to and out of a DS3 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-28) to drop the signal into.

1. Select [Test Setup](#) from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default DS1/DS3**.
 - If the DS1/DS3 options are preceded by SONET and SDH, then choose either **SONET/DS1/DS3** or **SDH/DS1/DS3**, depending on the desired protocol mode.
3. Select [Presets](#) from the [Common Function Buttons](#).
4. Select the **Interface** button and choose **DS3** from the Select from Interface list.
5. Select the **Configuration** button and choose either one of the following:
 - **DS1 #1 A/D** or **DS1 #2 A/D**: The DS1 Add/Drop setting multiplexes the DS1 signal generated by the DS1#1 (or DS1#2) processor up to the DS3 processor, and transmits it out the DS3 transmit interface port (along with other background DS1 signals generated by the DS3 processor) in the specified DS1 Channel from the Transmit DS1 #1 (or DS1#2) Channel Inserted setting. The specified DS1 #1 (or DS1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the DS1 #1 (or DS1#2) processor for Error and Alarm analysis. The selected DS1 port's TX/RX interfaces are not used in this configuration.

- **DS1 #1 A/D LI** or **DS1 #2 A/D LI**: The DS1 Line Interface (LI) Add/Drop setting multiplexes the received DS1#1 (or DS1#2) signal up to the DS3 processor, and transmits it out the DS3 transmit interface port (along with other background DS1 signals generated by the DS3 processor) in the specified DS1 Channel from the Transmit DS1 #1 (or DS1#2) Channel Inserted setting. The specified DS1 #1 (or DS1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the DS1 processor and transmitted out to the selected DS1 Interface port.

6. Select the **Apply** button.



Both DS1#1 and DS1#2 signals can simultaneously be added to the DS3 interface by pressing Presets and selecting DS3 from the Interface menu again, and then choose the other DS1 processor from the Configuration menu.

The unit is configured to drop a DS1 out of the DS3 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **DS3**.
2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. If you dropped the DS1 #1 signal, select **DS1 #1 Channel Inserted** and select the channel in which you want to drop the DS1 signal.
5. If you dropped the DS1 #2 signal, select **DS1 #2 Channel Inserted** and select the channel in which you want to drop the DS1 signal.
6. Select **DS1 Background Frame** and select the background frame for the specified channel.
7. Select **DS1 Background Pattern**. Select a pattern to fill the background DS1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast DS1 #1 (and/or Broadcast DS1 #2).
 - Broadcast DS1 #1 and Broadcast DS1 #2 will broadcast the Framing and Payload Pattern from the selected DS1 port, over all of the background DS1 channels.
8. Select the **DS1** tab being dropped.

9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected DS3 channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

1. Select the **Results** screen from the specified DS1 #1 (or DS1#2) processor tab to view the received error and alarm activity.
2. Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.
3. If an LOF alarm is being detected, then the DS3 processor is likely in an errored state.

Add/Drop an E1 out of an DS3 Signal

You are able to add/drop multiplex an E1 signal in to and out of a DS3 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-21) to drop the signal into.

1. Select [Test Setup](#) from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default E1/DS3**.
 - If the E1/DS3 options are preceded by SONET and SDH, then choose either **SONET/E1/DS3** or **SDH/E1/DS3**, depending on the desired protocol mode.
3. Select [Presets](#) from the [Common Function Buttons](#).
4. Select the **Interface** button and choose **DS3** from the Select from Interface list.
5. Select the **Configuration** button and choose either one of the following:
 - **E1 #1 A/D** or **E1 #2 A/D**: The E1 Add/Drop setting multiplexes the E1 signal generated by the E1#1 (or E1#2) processor up to the DS3

processor, and transmits it out the DS3 transmit interface port (along with other background E1 signals generated by the DS3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the E1 #1 (or E1#2) processor for Error and Alarm analysis. The selected E1 port's TX/RX interfaces are not used in this configuration.

- **E1 #1 A/D LI** or **E1 #2 A/D LI**: The E1 Line Interface (LI) Add/Drop setting multiplexes the received E1#1 (or E1#2) signal up to the DS3 processor, and transmits it out the DS3 transmit interface port (along with other background E1 signals generated by the DS3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the E1 processor and transmitted out to the selected E1 Interface port.

6. Select the **Apply** button.



Both E1#1 and E1#2 signals can simultaneously be added to the DS3 interface by pressing Presets and selecting DS3 from the Interface menu again, and then choose the other E1 processor from the Configuration menu.

The unit is configured to drop an E1 out of the DS3 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **DS3**.
2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. If you dropped the E1 #1 signal, select **E1 #1 Channel Inserted** and select the channel in which you want to drop the E1 signal.
5. If you dropped the E1 #2 signal, select **E1 #2 Channel Inserted** and select the channel in which you want to drop the E1 signal.
6. Select **E1 Background Frame** and select the background frame for the specified channel.

7. Select **E1 Background Pattern**. Select a pattern to fill the background E1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast E1 #1 (and/or Broadcast E1 #2).
 - Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels.
8. Select the **E1** tab being dropped.
9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected DS3 channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

1. Select the **Results** screen from the specified E1 #1 (or E1#2) processor tab to view the received error and alarm activity.
2. Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.
3. If an LOF alarm is being detected, then the DS3 processor is likely in an errored state.

Enabling FEAC Codes

FEAC Codes are only available when the DS3 protocol processor is configured for C-BIT framing.

To enable FEAC Code functionality:

1. From the **DS3** tab, select **Transmit**.
2. Select **SET 1**.
3. Select **Framing**.

4. Select **C-BIT**.
5. The FEAC Codes button appears on the screen. Select **FEAC Codes** to display this functionality.

Start/Stop DS3 Channel Scan

The Chan Scan function inspects and then reports the contents of the 21 E1 channels or 28 DS1 channels that are obtained within a multiplexed DS3 signal. The information reported consists of items such as the framing and pattern activity detected on each E1 or DS1 channel.

The DS3 protocol processor must be receiving a valid signal, otherwise, the DS3 scan aborts. While a scan is in progress, you cannot access other functions.

To start an DS3 channel scan:

1. Select **DS3**.
2. Select **Receive**.
3. Select **Chan Scan**. The Channel Scan screen appears.
4. Select **Start Scan**. Framing and pattern activity for each channel is displayed on the screen.

To stop the DS3 scan:

- Select the **Stop Scan** button.

Dual Enet Tab

Dual Ethernet (Dual Enet) Overview

The Dual Ethernet (Dual Enet) Protocol Processor can be equipped with two hot-swappable SFP optical ports and two RJ-45 electrical ports, for simultaneous and independent testing or for loop-back testing from Port to Port.

The Dual Enet Protocol Processor tab enables users to perform high speed packet-level testing at rates of **10/100/1000 Base-T** (Full and Half Duplex), **1 Gigabit Optical Ethernet**, **1Gbps / 2Gbps / 4Gbps Fibre Channel**, and **100 Mbps Optical Ethernet** (which requires a supported SFP module).

Ethernet tests includes BERT testing with up to 32 independently configured **Test Streams** for packet traffic generation and analysis, including **RFC-2544 (throughput, frame loss, latency**, and **Back to Back Burst)** testing, **ITU-T Y.1564** Ethernet service testing, and **Service Disruption** testing, and **IP Address Pinging** for the following:

The following Dual Enet related topics are discussed in this section of the online help system:

- **Ethernet** - Specific Tasks Overview
- **Ethernet** - Screens Functions and Descriptions
- **Fibre Channel** - Specific Tasks Overview
- **Fibre Channel** - Screen Functions and Descriptions

Ethernet - Screen Functions and Description

Dual Enet Tab - Screen Functions and Descriptions Overview

(Specifically for Ethernet testing)

This section describes the various screens and functions that control the configurations and operations of the 10Mbps up to 1Gbps Ethernet Interfaces:

The following screens and functions are discussed:

- [Config](#)
- [Perf Tests](#) (RFC-2544 and Y.1564)
- [Results](#)
- [Test](#)
- [Ports](#)
- [LEDs](#)

Config

Dual Enet - Config Screens and Functions

(Specifically for Ethernet testing)

The Config screen contains the following functions:

- [Set](#)
- [Strms Pg 1 & Strms Pg 2](#)
- [Traffic Stream Profile](#)
- [Error Alarm](#)
- Prim Seq (*disabled - only used for Fibre Channel*)

Config - Set screen

(Specifically for Ethernet testing on the Dual Enet tab)

The **Config > Set** (Settings Configuration) screen allows you to define the Dual Enet tab's Ethernet parameters that will be used to generate a traffic flow into the network. Up to 32 different streams can be generated simultaneously.

The following functions appear on the Settings Configuration screen:

Function	Description

Interface	Selects the interface rate and type as applicable for the port type selected. For the RJ-45 ports the choices are: • 10 Mbps elec @ FDX (Full Duplex) • 10 Mbps elec @ HDX (Half Duplex) • 100 Mbps elec @ FDX (Full Duplex) • 100 Mbps elec @ HDX (Half Duplex) • 1 Gbps elec @ FDX (Full Duplex) • 1 Gbps elec @ HDX (Half Duplex) • Elec Auto Negotiate For the optical SFP ports, the choices are: • 1Gbps opt @ FDX (Full Duplex) • 100 Mbps opt @ FDX (Full Duplex) (requires 100 Mbps Ethernet SFP, and software license test option) For the <u>Fibre Channel ports</u>, the choices are: • 1Gbps Fibre Channel (requires 1G Fibre Channel software license test option) • 2Gbps Fibre Channel (requires 2G Fibre Channel software license test option) • 4Gbps Fibre Channel (requires 4G Fibre Channel software license test option)  Refer to the Dual Enet - Fibre Channel section for Fibre Channel testing.

Negotiate	Allows the user to enable or disable the Auto Negotiation function. Enabled - Enabling auto negotiation allows the system to look at the incoming signal and automatically determine the link speed and duplex mode of the port's remote device and adjust accordingly. Disabled - Disabling auto negotiation allows the test set to simulate older Ethernet equipment that does not support auto negotiation logic.  This setting is only available for the 1Gbps Optical, 10 Mbps Electrical, and 100 Mbps Electrical Interface rates.
Line Control	Configures link negotiation for 1Gbps Electrical interfaces. Auto - Automatically configures the link for either Master or Slave, depending on the reference signal. Master - Configures the port as the Master Link, and expects the reference signal to be Auto or Slave. Slave - Configures the port as the Slave Link, and expects the reference signal to be Auto or Master.  This setting is only available for the 1Gbps Electrical Interface rate.
Status	Displays the Negotiation and Line Control Status information.

Reflect	Allows the user to start IP Packet Reflection Mode. Valid options are: <table border="1"> <tr> <td>Digital Lightwave Packets Only</td><td> This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source. </td></tr> <tr> <td>All Non-Routing Packets</td><td> This will reflect back all data packets, not just from Digital Lightwave test units, but it will not reflect Routing packets such as ARP and negotiation. </td></tr> <tr> <td>Thru Mode</td><td> This will pass through every data packet that is received. </td></tr> <tr> <td>Off</td><td> Turns Reflection mode Off </td></tr> </table>	Digital Lightwave Packets Only	This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source.	All Non-Routing Packets	This will reflect back all data packets, not just from Digital Lightwave test units, but it will not reflect Routing packets such as ARP and negotiation.	Thru Mode	This will pass through every data packet that is received.	Off	Turns Reflection mode Off
Digital Lightwave Packets Only	This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source.								
All Non-Routing Packets	This will reflect back all data packets, not just from Digital Lightwave test units, but it will not reflect Routing packets such as ARP and negotiation.								
Thru Mode	This will pass through every data packet that is received.								
Off	Turns Reflection mode Off								
Flow Control	Enables or Disables Flow Control.  Important: Flow Control must be enabled in order to count Pause Packets.								
Pause	Allows the user to generate Pause frames for a specific Pause Quanta value. Valid values are: 1 to 65535  Important: Flow Control must be enabled in order to count Pause Packets.								

	 Important: Pause is not available when IP Reflection is enabled.  For more information, see the Inserting a Pause (Flow Control) into a Stream specific task.
Preamble	Allows the user to modify the interface Port's Preamble and the Start Frame Delimiter (SFD)  For 1Gbps optical Ethernet, you can also change the Preamble's first byte (K) byte. The default setting is K27.7 (Start).  The SFD is designed to break this pattern with a default value of #D5, and signals the start of the actual frame.  Important: The Restore Default button in the keypad will set the Port's Preamble and SFD back to their default a values.
Port IP Source	Sets the interface Port's Source IP Address used for PING and ARP Requests and to negotiation connections network elements.  Important: If a packet Stream's ARP Request setting is enabled, then this setting will be used as the stream's Source IP Address.  Important: This setting also configures the IP Source address setting located on the Test > Ping screen.
Port MAC Source	Sets the interface Port's Source MAC Address used for PING and ARP Requests and to negotiation connections network elements.  Important: If a packet Stream's ARP Request setting is enabled, then this setting will be used as the stream's Source MAC Address.

	 Important: This setting also configures the MAC Source address setting located on the Test > Ping screen.
Subnet Address	Sets the interface Port's Source Subnet Mask address used for PING and ARP Requests and to negotiation connections network elements.
Default Gateway	Sets the interface Port's Source Default Gateway address used for PING and ARP Requests and to negotiation connections with network elements.
VLAN RX TPID	Filters the Stream Results RX packet count by the Streams VLAN TPID values. Each DLI test Stream can contain up to (4) stacked VLAN tags, (1) S-VLAN (service provider) tag and up to (3) C-VLAN (customer) tags, each with a unique TPID (Tag Protocol Identifier) value. The VLAN RX TPID section allows the processor to only count those packets whose VLAN TPID are specified by the TPID filter options. Four filters are available, "A" through "D". Filter "A" is mandatory and always enabled, "B" through "D" are optional.  Each filter has a menu that allows the user to select a predefined TPID value (0x8100, 0x88A8, 0x9100 and 0x9200), or enter a user defined value.
Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Packets - Displays the total number of packets sent and received since the test was started • Pkts/sec - Displays the current rate of packets sent and received in packets per second • Bytes - Displays the total number of bytes sent and received since the test was started • Mbit/sec - Displays the current rate of packets sent and received in Megabits per second

	• %BW - Displays the current percentage of bandwidth of packets sent and received
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • Off - The unit's laser will be off when the unit is turned on. • On - The unit's laser will be on when the unit is turned on. • Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Config - Strms Pg 1 and Strms Pg 2

(Specifically for LAN/WAN Ethernet testing)

The **Config > Strms Pg 1 and Strms Pg 2** (Streams Page 1 and Page 2) screens allow up total of 32 test streams to be simultaneously generated and tested, per port.



The **Strms Pg 1** side tab is used to control Streams 1 through 16, and **Strms Pg 2** controls Streams 17 through 32.

On/Off Checkboxes (1-32)	Enables packet generation for the specified Stream Id.  When enabled (on) the selected stream will begin transmitting packet at the Rate specified in the Traffic Stream Profile dialog box. By default, each stream is configured for 1.00% BW.  If the total configured bandwidth for all streams enabled exceeds 100%, the processor will evenly scale back the actual rates generated to achieve a maximum bandwidth of exactly 100%.

All	Selecting All with Enable/Disable all 32 test streams simultaneously.  If one or more streams are currently enabled, then All disables all enabled streams. If no streams are currently enabled, then All enables all test streams on both Pg1 and Pg2.  If the total configured bandwidth for all streams enabled exceeds 100%, the processor will evenly scale back the actual rates generated to achieve a maximum bandwidth of exactly 100%.

The parameters for each test stream are displayed in the Stream Profile Table as individual rows, with a horizontal scroll bar at the bottom that can be used to see all of the columns in the table.

Selecting a Stream (row) from the profile table opens the [Traffic Stream Profile](#) dialog box from which the stream parameters are configured.

These are the columns displayed in the **Stream Profile Table**, in order by the default arrangement:

Column	Description
TX Status	Indicates whether streams 1-32 are being transmitted (On) or not being transmitted (Off)
Traffic	Displays the configured transmit Rates (in %BW) for each stream.
MAC Dest	Destination MAC address
Length	Frame Length
IP Mode	IPv4 or IPv6  The CSA board currently only supports IPv4
Payload	Payload Pattern selected
VLAN Levels	The number of stacked VLAN tags enables (1 through 4, or N/A for none)
MPLS Levels	The number of stacked MPLS tags enables (1 through 4, or N/A for none)  The CSA board currently only supports VLAN tagging

IP Dest	Destination IP address
UDP Dest	UDP Destination Port
MAC Src	Source MAC address
IP Src	Source IP address
UDP Src	UDP Source Port
IP TOS	IPv4 - IP Type of Service
IP TTL	IPv4 - IP Time to Live
IP FRAG	IPv4 - Select whether to allow or disallow IP fragments
IP TC	IPv6 - Traffic Class (hexadecimal number)
IP HOP	IPv6 - Hop Limit
IP FLOW	IPv6 - Flow Label

Send Burst	The Send Burst button will generate a single burst of packets on the selected stream id, for the number of packets specified by the Burst Size setting, when the selected stream is turned off.  The default Burst size is 1 frame, however you can edit the stream's Burst Size setting from the stream's Profile window. Burst sizes can range from 1 to the maximum number of packets per second.

COL button	The COL button allows the user to rearrange the Stream Profile Table's columns display. To use the Rearrange Columns feature:

1. Select the **Col** button, to display the **Rearrange Columns** dialog box.
2. In the **Rearrange Columns** dialog box, select the **Columns** button to display the **Select Next Column** dialog box.
3. In the **Select Next Column** dialog box, select the button for the associated description to appear as the first column (from left to right) in table. The **Select Next Column** dialog box disappears and your selection appears in the top row of **Column** dialog box display window.
4. Again, in the **Rearrange Columns** dialog box, select the **Columns** button to re-display the **Select Next Column** dialog box.
5. In the **Select Next Column** dialog box, select another button for the associated description to appear as the next column (from left to right) in the table. The **Select Next Column** dialog box disappears again and this selection now appears above the previous selection in the **Column** dialog box display window. .
6. Repeat Steps 4 and 5 to select the chosen however many of the remaining entries in the **Select Next Column** dialog box you wish to re-order.
7. There are two choices for submitting the selected column display order: (1) Selecting the **Apply** button retains the column display order settings until the next time the unit's power is cycled; (2) Selecting the **Save** button retains the column display order settings indefinitely.



The **Columns** settings entered locally on the touch screen panel and those entered via a remote connection are completely independent of each other. The remote settings are saved on the remotely connected PC, while the local settings are saved in the unit. The **Clear** button can be used to clear the entries in the **Rearrange Columns** dialog box display window, should you want to rearrange the existing order in the display window. The **Cancel** button can be used to cancel out of the operation without changing the existing column display order. Clicking on the **Apply** button when no

	items are listed in the display window will set up the default columns display order.

Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Packets - Displays the total number of packets sent and received since the test was started • Pkts/sec - Displays the current rate of packets sent and received in packets per second • Bytes - Displays the total number of bytes sent and received since the test was started • Mbit/sec - Displays the current rate of packets sent and received in Megabits per second • %BW - Displays the current percentage of bandwidth of packets sent and received

Traffic Stream Profile Configuration

(Specifically for LAN/WAN Ethernet testing)

A packet stream's profile defines the type, size, content, destination address, and source addresses for the frame.



The stream protocol supported is UDP/IP.

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select any of the streams in the Stream Profile Table.

Parameter	Description

Stream ID #	Displays the Stream ID # that the settings are being modified for.  The title bar of this Traffic Stream Profile window also shows which Stream ID # is currently selected.
Dest Port	Sets the Destination Port. The default is “same”. This setting is mainly useful for RFC2544 testing where the test involves sending packets and evaluating received packets for lost packages, latency and other factors. These test can be done using only one port or sending on one port and receiving on another.  This setting is only available on protocol processors that support more than on Port, such as Dual Enet and HDEnet.
Auto Setup Peer	Check “auto setup peer”, and when “Save All” is selected Stream on the Destination Port will automatically be configured to mirror the source port's IP and MAC addresses, swapping the Source and Destination values. This function will also configure the affected Stream with the same values for all of the other stream settings such as; Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc., when the “Save All” button is selected.  This setting is only available on protocol processors that support more than on Port, such as Dual Enet and HDEnet, and is only applicable if Destination Port is set to anything except “Same”.
ARP Request	Each stream can either have the ARP Request setting enabled or disabled. When ARP Request is enabled, the stream's IP Src and MAC Src settings become disabled, and the Port Source IP Address and MAC settings located on the Config > Set screen will be used by the stream.  The stream's Destination MAC Address also becomes disabled, and when the stream's transmission is turned On, an ARP request is performed on the Port. The connected device's source MAC address obtained from the ARP request's reply is

	then automatically configured as the stream's MAC Dest address setting.  The CSA board does not support this feature.
Multi Stream Config	Automatically increments the Source and Destination IP and MAC address values on up to all 32 Streams, and applies other global changes to each selected Stream, all in one step. See Ethernet Multi-Stream Configuration for details.
MAC Src address	Sets a Source MAC (origination) address for generated traffic. The address is a 12-digit (6-octets) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
MAC Dest address	Sets a Destination MAC address for generated traffic. The address is a 12-digit (6-octets) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on values entered, except that all a value must be entered into all fields.  For "Unicast Packets" the 1st octet for the Destination MAC addresses should be set to an even number such as "00".  For "Multicast Packets" the 1st octet for the Destination MAC addresses should be set to an odd number such as "01".  For "Broadcast Packets" all 6 octets of the Destination MAC addresses should be set to "FF".

IP Src address	Sets the IP address of the source (origination). For IPv4, the address is entered in decimal notation using a keypad. There are no restrictions on values entered but the format must be correct, i.e: (0-255.0-255.0-255.0-255). If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually. For IPv6, the address is entered in hexadecimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: (0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF). If four digits are entered in a field, a colon will be automatically added. If only less than four digits are entered, you must enter a colon manually.  The CSA board currently only supports IPv4
IP Dest address	Sets the IP address of the destination. For IPv4, the address is entered in decimal notation using a keypad. There are no restrictions on values entered but the format must be correct, i.e: (0-255.0-255.0-255.0-255). If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually. For IPv6, the address is entered in hexadecimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: (0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF). If four digits are entered in a field, a colon will be automatically added. If only less than four digits are entered, you must enter a colon manually.  The CSA board currently only supports IPv4
IP Mode	Sets the IP version (IPv4 or IPv6) used for the Stream's configuration.

Ether Type	A two-octet field in an Ethernet frame, used to indicate which protocol is encapsulated in the payload. The following menu items are available: • Internet Protocol, Version 4 (IPv4) 0x0800 • Internet Protocol, Version 6 (IPv6) 0x086DD • MPLS 0x8847 • User defined (0x0 to FFFF)
UDP Src port	Selects a User Data Protocol source port number (0 to 65535).
UDP Dest port	Selects a User Data Protocol destination port number (0 to 65535)  Port 0 is an officially reserved port in TCP/IP networking, and should not be used.
Frame Size	Sets the frame length in bytes. The frame size is entered as a decimal value, entered using a keypad, ranging from 64 to 16000. The default value is 128 bytes.  Note that when in 1Gbps Half-Duplex (HDX) mode, the default frame size is 512 bytes.
Payload	Allows the user to select a test pattern to be transmitted in the stream's payload. Select one of the following: PRBS 9, PRBS 9 Inverted, PRBS 11, PRBS 11 Inverted, PRBS 15, PRBS 15 Inverted, PRBS 20, PRBS 20 Inverted, PRBS 23, PRBS 23 Inverted, PRBS 31, PRBS 31 Inverted or a User Defined pattern (32-bit value).

IP TOS (<i>IPv4</i>) / Traffic Class (<i>IPv6</i>)	Sets the Type Of Service/Traffic Class as defined in RFC 791. This can be entered as a 2-character HEX value, or the dialog box lets you configure the TOS based on the individual bit fields. • bits 0-2 sets the Precedence • bit 3 sets the Delay (0 = Normal, 1 = Low) • bit 4 sets the Throughput (0 = Normal, 1 = High) • bit 5 sets the Reliability (0 = Normal, 1 = High) • bit 6 sets the Cost (0 or 1) • bit 7 is reserved for future use (0 or 1)  RFC2474 redefined the TOS fields, where bits 0-5 set the Differentiated Services Code Point (DSCP).
IP TTLs (<i>IPv4</i>) / Hop Limits (<i>IPv6</i>)	Sets the IP Time To Live/Hop Limits. This is a decimal value from 0 to 255.  This is an IP header field designed to keep packets from running in loops, essentially forever, through a network (this can happen when there is a route change, and the routers involved don't all know the same information as new information is being replicated and updated).  The default value is 255, and is reduced by 1 every time it passes through a server (hop). If the this value should ever reach 0, the packet has expired. The router that it is passing through will then send it back to the source.
IP Fragment Flag (<i>IPv4</i>)	Select to either Allow (0) or Disallow (1) IP fragments.
Flow Label (<i>IPv6</i>)	Sets IPv6's IP Flow Label. This is a decimal value from 0 to 1048575.

Rate	Sets the traffic generation rate for the selected Stream. Rates can be configured as: • Constant %Bandwidth (0.01 to 100%) • Constant Mbit/sec (0.1 to max Mb/s, for the selected Interface) • Constant IPG-Bytes • Constant IPG-MS • Ramp %Bandwidth • Ramp Mbit/sec  See How to use the Ramp Mode for Ethernet Traffic Generation for information on Ramp mode testing.
Burst Size	Configures the number of packets to be inserted in each Burst. This setting applies to both the traffic generation rates, and the Send Burst button. The Send Burst button will generate a single burst of packets, for the specified amount of packets.  The default Burst size is 1 frame, and should be set to 1 frame when not intentionally generating bursty traffic, to allow the inner-packet gaps (IPG's) to be evenly distributed. Any value greater than 1 will result in the packets being generated as bursts of packet, with minimal IPG's between the packets within the burst, and longer than normal IPG's between the bursts.  See How to use the Burst Mode for Ethernet Traffic Generation for information on Burst mode testing.

Ramp Mode Settings	The following settings become enabled when a Ramp rate is selected: • Ramp Step: This is the size of the % Bandwidth or Mbps rate that each step (up and down) should change by. • Ramp Floor: This is the minimum % Bandwidth or Mbps rate that the stream will step down to. • Ramp Duration: This is the number of Seconds (1 to 999) that each step (up and down) will transmit for.  See How to use the Ramp Mode for Ethernet Traffic Generation for information on Ramp mode testing.
Select MPLS/VLAN Tagging	Enables either VLAN, MPLS, or No Tagging.  When testing VLAN or MPLS, up to 4 stacked tags can be enabled by selecting the checkbox for the next tag. Each tag adds 4 bytes to the Packet's header fields.  MPLS is a licensable feature and is only available if the enabled in the license key. The VLAN tagging option however is included on all NIC units that support packet streams.  The CSA board currently only supports VLAN, and does not support MPLS.
VLAN TPID	Configures the VLAN Tag Protocol Identifier. The default value is 0x8100, but the menu lets you select 0x88A8, 0x9100, 0x9200 or enter a 2-byte User Defined HEX value.  VLAN Tagging must be enabled to use this parameter
VLAN PCP/QOS	Configures the VLAN Priority Code Point/Quality Of Service. This is the frame's priority level and is a 3-bit field ranging from the default value of 0 (best effort) to 7 (highest priority).  VLAN Tagging must be enabled to use this parameter.

VLAN CFI	Configures the VLAN Canonical Format Indicator. This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.  VLAN Tagging must be enabled to use this parameter.
VLAN DEI	Configures the VLAN Drop Eligible Indicator. This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.  VLAN Tagging must be enabled to use this parameter.
VLAN VID	Assigns a VLAN ID to the VLAN tag. This identifies to which VLAN the frame belongs. IDs are entered as a decimal identifier ranging from 0 to 4095.  VLAN Tagging must be enabled to use this parameter.
Prev	Moves to the stream with the next lower number.  If currently looking at stream #1, selecting "Prev" will bring up stream #32. Note that changes made will not be saved until "Save All" is selected.
Next	Moves to the stream with the next higher number.  If currently looking at stream #32, selecting "Next" will bring up stream #1. Note that changes made will not be saved until "Save All" is selected.
Save All	Saves all changes made and closes the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Errors and Alarms

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.



Note that error insertion is disabled when in IP Reflection Mode.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the “Send Error” button is pressed or when a rate is selected. The following types are available: • Code - Generates line code errors • FCS - Generates an invalid Frame Check Sequence • IP Checksum - Generates an invalid IP header checksum • Runt - Generates an undersized frame (user definable between 12 and 64 bytes), with a bad CRC • Bit Error (Stream #n) - Generates bit errors in the payload for the specified stream number. • Sequence Error (Stream #n) - Generates Sequence errors in the payload for the specified stream number.  The CSA Packet tab currently does not support Line Code or Runt errors.
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following:

	• 1E-<x> - X is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1×10^{-x} (The smaller the exponential the higher the error rate.) • User Defined – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1×10^{-x} but more exact choices are available such as 2.6×10^{-4} or 7.1×10^{-3}
Runt Size	Specify the frame size of the Runt errors to be inserted, between 12 to 63 bytes.  This setting is only available when the Runt error type is selected.
Reply to Local Fault	When enabled, the test interface will respond to Local Fault alarms by generating Remote Faults  This setting is only available for 103 Gbps LAN, 41 Gbps LAN and 10 Gbps Optical LAN/WAN.

Perf Test

Perf Test - Conf (Test Button)

The Performance Test screen allows you test either RFC-2544 or ITU-T Y.1564.

The **Test** button located on the Conf side tab will toggle between the two testing modes.

- Use this section to test [RFC-2544](#)
- Use this section to test [Y.1564 \(Ethernet service tests\)](#)

RFC 2544

RFC 2544 Tests - Screen Functions and Descriptions Overview

The RFC 2544 Tests screen contains the following functions:

- [Conf](#)
- [Thru Put](#)

- [Frame Loss](#)
- [B2B Burst](#)
- Graph



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description
Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544, it will not appear in the Select Port window.

Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-86400 seconds. The default value is 60 seconds.
Stream ID	Allows the user to select one of the four streams for the RFC test.
Dest MAC Address	Reflects the destination MAC address for the selected Stream.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.  For Fibre Channel rates, this is the WWN Dest Address.
Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.
Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 16000.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

Automated Test Sequence	The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes. • Thruput/Latency checkbox and status field • Frame Loss checkbox and status field • B2B Burst checkbox and status field • Start/Stop Button • Test Status field

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.

Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.

Statistics Table	Reports the test results. The following statistics are displayed: Size - Indicates the transmitted test packet size. Rate - Reports the passing rate (percentage) for the specific packet size. TX Packets - Reports the number of packets transmitted in the stream for the frame. RX Packets - Reports the number of packets received by the test set. Latency Min/Max/Avg - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds.  If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.
Start/Stop Test	Starts and stops the Through Put test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select [Frame Loss Testing](#) for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.

Packet Size buttons	Determines which packet size results appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: Rate % - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. Transmit Frames - Reports the total number of frames transmitted. Receive Frames - Reports the total number of frames received. Loss % - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Back-To-Back Burst Test (B2B Burst)

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.  Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.

Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50, however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: • Max Possible Number of Frames - The frame rate (resolution) used as the throughput rate. • Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 Important: The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

Y.1564 Test

Y.1564 Test - Screen Functions and Descriptions Overview

The [Y.1564](#) Tests screen contains the following functions:

- [Conf](#)
- [Test](#)
- [Results](#)



The following link demonstrates how to configure and test Y.1564.

[Y.1564 Service Configuration and Testing](#)

Y.1564 Test - Configuration (Conf)

Y.1564 is an out of-service test methodology created so that service providers may have a standard way of measuring the performance of Ethernet-based services. The Conf screen provides the preliminary Service configuration settings. After these settings are made the user selects the type of Y.1564 test to initiate by selecting the check boxes under Automated Test Sequence and pressing Start.

The following options appear on the Conf screen:

Option	Description
Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544 test, it will not appear in the Select Port window.
Trial Duration	Determines how long the Configuration Ramp test runs for each selected Ramp/Burst Step.

	① “Trial Duration” refers to Configuration test duration, and “Perf Dur” refers to Performance test duration ① The default value of 60 seconds, is the maximum duration specified in the Y.1564 test standard. "The duration for each step size SHOULD be configurable from at least 1 second up to 60 seconds".																						
Restore to Default	Returns the Ramp/Burst Step settings to their default %CIR rates when user-defined rates have been set, and unselects all selected checkboxes, and resets the Trial and Performance Durations back to their default values. Any user-define Service Names which were edited from the Test side tab are also restored back to their default names.																						
Perf Dur	Determines how long the Performance test runs for each selected Service. ① “Perf Dur” refers to Performance test duration, and “Trial Duration” refers to Configuration test duration ① The Y.1564 test standard calls for test durations of 15 minute, 2 hour, and 24 hour intervals. "For example, an operator MAY test services for 15 minutes if the services are provided over a network already carrying working traffic in a metro application. 2 hour Performance test durations MAY be used for services running over a single operator long-haul network. Finally, a 24 hour Performance test durations MAY be used for services which are being carried internationally over multiple operator networks".																						
Service On/Off	Allows the user to select one of the ten Services that will be used for the Y.1564 test. ① Each of the Service's Configuration Test settings can be edited in the Test side tab. ① Each Service selected to be tested should be configured for an increasing number of Frame Lengths, as shown in Table 1. <table border="1"> <thead> <tr> <th>Service #</th><th>Frame Size (bytes)</th></tr> </thead> <tbody> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </tbody> </table>	Service #	Frame Size (bytes)																				
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Service 01	64
Service 02	128
Service 03	256
Service 04	512
Service 05	1024
Service 06	1280
Service 07	1518
Service 08	MTU
Service 09	User Defined
Service 10	User Defined

Table 1 – Recommended Frame Sizes/Lengths for each Service Number

Ramp/Burst Steps

The Ramp/Burst Steps section is used to do the following:

- Selects which Steps to test during the Ramp and Burst Configuration tests.
- Allows the user to configure Steps 1 through 5 with a user-defined value for each of the %CIR Steps selected to be tested.
- When selected, Step 6 tests 100% of the CIR% setting, as configured on the Test side tab.
- When selected, Step 7 exceeds the CIR, by adding Excess Information Rate (EIR), as configured on the Test side tab.

 Each Step tests a gradually increasing percentage of the maximum Committed Information Rate (CIR%) bandwidth, as configured on the Test side tab screen for the selected Service.

 The Config Ramp test was designed to gradually reach and then exceed the maximum CIR% by testing all 7 Steps (at their default CIR% values), for each selected Service.

💡 For example, with the [CIR](#) and the Step sizes configured for default values, the CIR is configured for 5% bandwidth, Step 1 is configured for 10% of the CIR, and Step 2 is configured 30% of the CIR, etc. Thus, Step 1 will test at 0.50% bandwidth, which is 10% of 5%. Likewise, Step 2 will test at 1.50% bandwidth, which is 30% of 5%, and so on. Step 6 (CIR) will test at the full 5% bandwidth. And Step 7 (CIR+EIR) will test at whatever the CIR+EIR bandwidth is configured for on the Test side tab, where the [EIR](#) is difference between CIR and the CIR+EIR value.

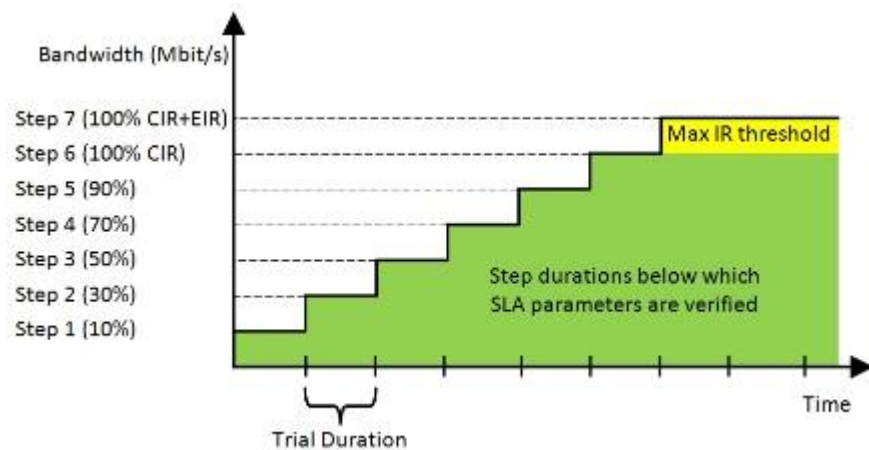


Figure 1 – Step load (Ramp) test used in the service configuration test

💡 Per the Y.1564 test standard, as the performance limits are only used for service acceptance when Ethernet traffic is below or equal to the CIR (green traffic in Figure 1), the performance parameters will not be judged against the limits above the CIR. The next step of the service configuration test is to validate the total information rate of the service (CIR+EIR).

Automated Test Sequence

The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes.

- Config Ramp checkbox and status field
- Config Burst checkbox and status field (***This test is currently unavailable***)
- Perf checkbox and status field

	• Start/Stop Button • Test Status field  Select one or more the test options under the Automated Test Sequence section. At least one test must be selected.  The Config Ramp checkbox selects the Y.1564 Configuration test  The Perf checkbox selects the Y.1564 Performance test  Select the Start button to begin the selected tests. The selected tests will now start and their real-time status will be displayed in the Test Status field next to the Start/Stop button.

Y.1564 - Test

The following options appear on the Test screen:

Option	Description
Service #s 1-10	Allows the user to select the Service to Edit.
Service Name	Allows the user to Edit the Service Name for the selected Service.  The user defined Service Name will also appear on the Conf. screen as well as in the detailed test results and saved/printed test reports.  Selecting the Restore to Default button on the Conf. screen will return all ten Service Names back to their default names.
Edit Flow	This opens the Traffic Stream Profile dialog box from which the selected Service's stream parameters are configured.

	 Each of the Services are linked to the Test Stream with the same ID number.  Per the Y.1564 test standard, each Service selected to be tested should be configured for an increasing number of Frame Lengths, as shown in Table 1. <table border="1"> <thead> <tr> <th>Service #</th><th>Frame Size (bytes)</th></tr> </thead> <tbody> <tr><td>Service 01</td><td>64</td></tr> <tr><td>Service 02</td><td>128</td></tr> <tr><td>Service 03</td><td>256</td></tr> <tr><td>Service 04</td><td>512</td></tr> <tr><td>Service 05</td><td>1024</td></tr> <tr><td>Service 06</td><td>1280</td></tr> <tr><td>Service 07</td><td>1518</td></tr> <tr><td>Service 08</td><td>MTU</td></tr> <tr><td>Service 09</td><td>User Defined (Optional)</td></tr> <tr><td>Service 10</td><td>User Defined (Optional)</td></tr> </tbody> </table> Table 1 – Recommended Frame Sizes/Lengths for each Service Number	Service #	Frame Size (bytes)	Service 01	64	Service 02	128	Service 03	256	Service 04	512	Service 05	1024	Service 06	1280	Service 07	1518	Service 08	MTU	Service 09	User Defined (Optional)	Service 10	User Defined (Optional)
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Max Frame Loss	Allows the user to configure the selected Service's Maximum Frame Loss Pass/Fail threshold rate, for both the Configuration tests and the Performance test.  The Max Frame Loss rate can be set from 0.00% to 99.0%, per Service.  If the measured Frame Loss% exceeds this value while testing the selected Service, then Configuration Test Results Status will show "FAIL" for that Service.																						

Max Jitter	Allows the user to configure the selected Service's Maximum Packet Jitter Pass/Fail threshold, in μsec.  The Max Jitter can be set from 0 to 100000, per Service.  If the measured Jitter exceeds this value while testing the selected Service, then Configuration Test Results Status will show "FAIL" for that Service.
Max Latency	Allows the user to configure the selected Service's Maximum Delay Latency Pass/Fail threshold, in μsec.  The Max Latency can be set from 0 to 100000, per Service.  If the measured Latency exceeds this value while testing the selected Service, then Configuration Test Results Status will show "FAIL" for that Service.
CIR	Allows the user to set the maximum % Committed Information Rate (bandwidth), that the network is committed to transfer while meeting the performance level guaranteed in the service level agreement (SLA).  The CIR bandwidth rate can be set from 0.01% to 100%, per Service.
CIR+EIR	Allows the user to set the additional Excess Information Rate (bandwidth), by which a user can exceed its CIR with some expectation that the excess traffic might be carried though the network.  The CIR+EIR can never be a value less than the CIR.  Setting the CIR+EIR to the same value as the CIR, essentially sets the EIR to 0%.

Y.1564 - Results

Type topic text here.

Results

Results Screens and Functions

(Specifically for LAN/WAN Ethernet testing)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Packet and VLAN count statistics.
- [Strm Rslt](#) - Displays Stream ID specific statistics.
- [Event](#) - Displays a summary of error alarm activity.
- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

Results - Scan Screen

(Specifically for LAN/WAN Ethernet testing)

This function displays a list of received errors and alarms.

For [Alarms](#), the duration is reported as a count in seconds.

For [Errors](#), an error count is reported.

The message **No Errors or Alarms** appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors) Screen

(Specifically for LAN/WAN Ethernet testing)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

Error Type	Description
Code	A Code error or Symbol error is detected in the line encoding
Undersized	A frame whose length is < 64 bytes, with good FCS/CRC checksum
Invalid FCS	An error in the Frame Check Sequence (CRC checksum), and whose Frame length is $\geq$ 64 bytes
Invalid IP	An error in the frame's IP Checksum
Invalid UDP	An error in the frame's UDP Checksum
Runts	A frame whose length is < 64 byte with an FCS error

Results - Alarm Screen

(Specifically for LAN/WAN Ethernet testing)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

Error Type	Description
CP Power Loss	The Circuit Pack module experience a power loss fault during test
Paused	The test was manually paused by selecting the Pause button or by a SCPI script command
Power Hot	The received optical power level exceeded the laser's maximum input limit
Power Warm	The received optical power level is within 3 dBm of laser's maximum input limit
LOS	A Loss Of Signal alarm has occurred

Link Down	A Loss of Link State alarm occurred
Local Fault	A Local Fault alarm has occurred
Remote Fault	A Remote Fault alarm has occurred
Jabber Condition	A Jabber alarm has occurred, which could be caused by a device that is handling the electrical signals improperly.  10/100/1000BaseT ports only

Results - Strm Rslt (Stream Results) Screen

(Specifically for LAN/WAN Ethernet testing)

The Stream Results screen displays statistics for a specified incoming packet stream. The screen allows you to scroll through the different packet streams and view their individual results.

The following statistics appear:

Statistic	Description
Selected Stream Entry	Displays the selected Stream ID number and the stream's MAC Source and MAC Destination addresses, to which the displayed statistics data belongs.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW, for the selected Stream ID. Transmit Statistics (per stream): • TX PORT # - Show the selected transmit Port #, for Protocol Processors that support more than 1 interface port. • Packets - Total number of Packets transmitted.

	• Bytes - Total number of Bytes transmitted. • BW - Percent of bandwidth currently being transmitted. Receive Statistics (per stream): • RX PORT # - Show the receive statistics for the stream's configured Destination Port #, for Protocol Processors that support more than 1 interface port. • Packets - Total number of Packets received. • Bytes - Total number of Bytes received. • BW - Percent of bandwidth currently being received. • Loss - Current Packet Loss rate.  For loop backs with large latency, the Loss rate may show greater than 0 while the test stream generation is active, even if no packets are actually being lost (dropped). This is due to the real-time RX packet count being lower than the TX packet count, because of the latency. If no packets were lost during the test, then this value will drop to 0 when the test stream generation is turned off.
Pass/Fail Test	Provides User-Defined Acceptance Criteria:  Refer to Timed Test Using Acceptance Criteria • Accept Seq Errors - A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test. • Accept Bit Errors - A user-specified threshold value for determining the acceptable bit error rate for a timed test. • Accept Loss Rate - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. • Pass/Fail - Test results are displayed as "Running" when the test is active (Elapsed Time is incrementing); and displayed as "PASS" or "FAIL" when the test ends,

	depending on whether or not specified failure criteria was attained.
Errors	Displays Error statistic as Counts, Errored Seconds, Average error rate and Current error rate, for the following Error Types: • Sequence Errors - Each sent packet is marked with a sequence number. This count is incremented when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet. This can be the result of packets being received out of sequence, or due to packets being dropped. • Bit Errors Received
Latency	Displays Minimum, Average, and Maximum latency (delay) measurements, in microseconds (μs). A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated (real-time) as new latency measurements are logged.  If the TX and RX are looped on itself with a short patch cable, the latency may appear as 0 μs.
Alarms	Displays Alarm statistics as total number of Seconds the alarm was active during the test, for the following Alarm type: • Pattern Sync
First, Prev, Next, Last	Allows the user to scroll through all of the packet streams and view their individual results. Selecting First immediately moves the stream statistics to Stream 1; selecting Last immediately moves the last stream's statistics; selecting Prev or Next moves the stream statistics to/from one stream immediately before or after the currently selected stream.

Results - Event Screen

(Specifically for LAN/WAN Ethernet testing)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Count Screen

(Specifically for LAN/WAN Ethernet testing)

The Count screen displays [Utilization](#), [Packets](#), [VLAN](#), [MPLS](#) and [Packet Size](#) statistics by type and count.

To view total transmit and receive utilization statistics, select the **Utilization** button. The following statistics appear:

Desc column	Current / Min / Max / Avg columns
Total - TX BW	Displays the Current, Min, Max and Avg. Total %BW Transmitted
Total - TX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate transmitted
Total - TX PPS	Displays the Current, Min, Max and Avg. Total Packet Per Second rate transmitted
Total - RX BW	Displays the Current, Min, Max and Avg. Total %BW received
Total - RX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate received

Total - RX PPS	Displays the Current, Min, Max and Avg. Total Packet Per Second rate received
TX IPv4 BW	Displays the Current, Min, Max and Avg. IPv4 %BW Transmitted
TX IPv4 Mbps	Displays the Current, Min, Max and Avg. IPv4 Mbps rate transmitted
TX IPv4 PPS	Displays the Current, Min, Max and Avg. IPv4 Packet Per Second rate transmitted
RX IPv4 BW	Displays the Current, Min, Max and Avg. IPv4 %BW received
RX IPv4 Mbps	Displays the Current, Min, Max and Avg. IPv4 Mbps rate received
RX IPv4 PPS	Displays the Current, Min, Max and Avg. IPv4 Packet Per Second rate received
TX IPv6 BW	Displays the Current, Min, Max and Avg. IPv6 %BW Transmitted
TX IPv6 Mbps	Displays the Current, Min, Max and Avg. IPv6 Mbps rate transmitted
TX IPv6 PPS	Displays the Current, Min, Max and Avg. IPv6 Packet Per Second rate transmitted
RX IPv6 BW	Displays the Current, Min, Max and Avg. IPv6 %BW received
RX IPv6 Mbps	Displays the Current, Min, Max and Avg. IPv6 Mbps rate received

RX IPv6 PPS	Displays the Current, Min, Max and Avg. IPv6 Packet Per Second rate received
TX VLAN BW	Displays the Current, Min, Max and Avg. VLAN %BW Transmitted
TX VLAN Mbps	Displays the Current, Min, Max and Avg. VLAN Mbps rate transmitted
TX VLAN PPS	Displays the Current, Min, Max and Avg. VLAN Packet Per Second rate transmitted
RX VLAN BW	Displays the Current, Min, Max and Avg. VLAN %BW received
RX VLAN Mbps	Displays the Current, Min, Max and Avg. VLAN Mbps rate received
RX VLAN PPS	Displays the Current, Min, Max and Avg. VLAN Packet Per Second rate received
TX MPLS BW	Displays the Current, Min, Max and Avg. MPLS %BW Transmitted
TX MPLS Mbps	Displays the Current, Min, Max and Avg. MPLS Mbps rate transmitted
TX MPLS PPS	Displays the Current, Min, Max and Avg. MPLS Packet Per Second rate transmitted
RX MPLS BW	Displays the Current, Min, Max and Avg. MPLS %BW received
RX MPLS Mbps	Displays the Current, Min, Max and Avg. MPLS Mbps rate received

RX MPLS PPS	Displays the Current, Min, Max and Avg. MPLS Packet Per Second rate received

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Packets	Reports the total number of packets sent.
Received Packets	Reports the total number of packets received.
Received Jumbo Packets	Reports the total number of jumbo packets received. Jumbo packets are those from 1519 – 9000 bytes in size.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
Pause Packets Received	Reports the total number of Pause frames received.  Important: Flow Control must be enabled in order to count Pause Packets.
Pause Quantas Taken	Reports the total number of quantas received. A quanta is a 512-bit timing increment used by a Pause frame. The number of quantas (N x 512-bits) indicate the duration of the pause.  Important: Flow Control must be enabled in order to count Pause Packets.
Pause End Packets	Reports the number of times that a Pause condition ended allowing data transmission to resume.

	The pause condition ends when the Pause frame's time parameter is set to 0.  Important: Flow Control must be enabled in order to count Pause Packets.
IP Packets	Internet Protocol. Reports the total number of IP packets received.
ICMP Packets	Internet Control Message Protocol. Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.
UDP Packets	User Data Protocol. Reports the total number of UDP packets received.
IGMP Packets	Internet Group Management Protocol. Reports the total number of IGMP packets received.
Broadcast Packets	Reports the total number of Broadcast packets received.
Multicast Packets	Reports the total number of Multicast packets received.
Unicast Packets	Reports the total number of Unicast packets received.

To view VLAN results, select the **VLAN** button. The following statistics appear:

VLAN	Description
VLAN Tagged Frames (per level)	Reports the total number of frames received that are identified as VLAN frames, per tag level. For each tag level enabled (1-4), a 4-byte VLAN tag is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.

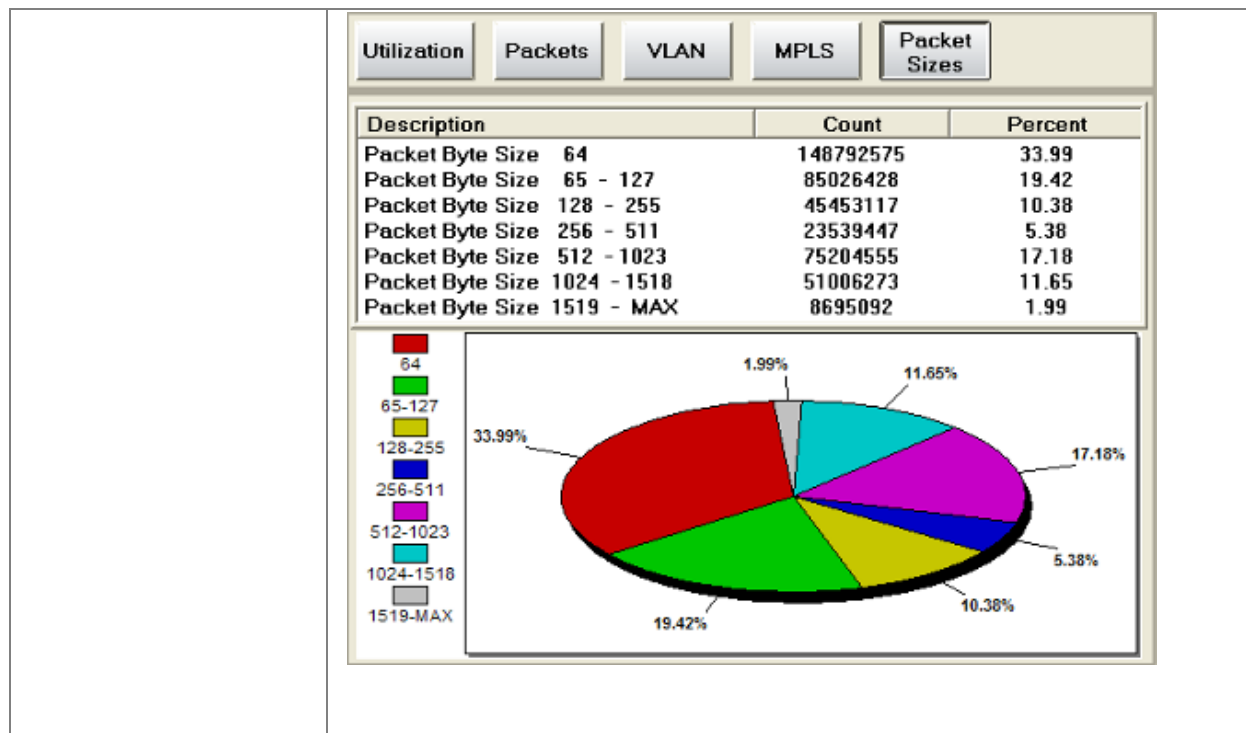
Quality of Service Entry	For each stacked VLAN tag level (1-4), separate data rows for QOS Entries 0-7 are displayed. These reports the number of frames received for each user priority level value. A total of 8 different counters appear for each Stacked VLAN level.

To view MPLS results, select the **MPLS** button. The following statistics appear:

MPLS	Description
MPLS Tagged Frames (per level)	Reports the total number of frames received that are identified as MPLS frames, per tag level. For each tag level enabled (1-4), a 4-byte MPLS label is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.
Traffic Class Entry	For each stacked MPLS label level (1-4), separate data rows for TC Entries 0-7 are displayed. These reports the number of frames received for each user priority level value. A total of 8 different counters appear for each Stacked MPLS level.

To view Packet Size results, select the **Packet Sizes** button. The following statistics appear:

Packet Sizes	Description
Packet Size Table	Reports the received packet count and percentage of total received packets for each packet byte size range found: 64; 65-127; 128-255; 256-511; 512-1023; 1024-1518; 1519-Max (Jumbo Packets).
Packet Size Graph	The measured percentage for each Packet Byte Size range is displayed in a pie chart, where each range has a uniquely colored slice, when that range percentage is greater than 0.00.



Results - Large LEDs Screen

(Specifically for LAN/WAN Ethernet testing)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs for LAN/WAN, see [LAN/WAN LEDs](#).

Test

Test Screens and Functions

(Specifically for LAN/WAN Ethernet testing)

The Test screen configures test parameters associated with a LAN/WAN protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [PING](#)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.

Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

	 Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.

2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for LAN/WAN Ethernet testing)

The unit can measure Service Disruption switching intervals in your network. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

When enabled, the trigger event to begin service disruption measurements occurs when it stops detecting incoming packets.

 The MSA module's Packet processor tab and Dual Enet processor tab also triggers on incoming packets with CRC/FCS errors.

The duration for every Ethernet service disruption event is measured in milliseconds, with granular accuracy of .1 ms (100 μ s).

When the Action state is configured for Continuous APS, the 10 most recent measurements are displayed in the History window. Also the Minimum and Maximum measurement times are logged, as well as an Average duration based on all measurements taken since the test began.

Test Service Disruption functions include:

- **Resolution:** When testing Service Disruption measurements on lower rate Ethernet bandwidths ($\leq$ 1Gbps), this setting is used to ensure that at least one Ethernet packet is received within the configured period of time (measurement window). The following options are available:

- ▶High (.1 ms)
- ▶Medium (1 ms)
- ▶Low (10 ms)



When receiving fewer packets per second (lower bandwidths), a lower resolution setting (larger window of time) is required.



Important: This setting is only displayed on ports that support Ethernet rates ≤ 1 Gbps.

- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **Consecutive Bad Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate. The range is 0.1 to 1638.3 milliseconds and is entered using a keypad.
- **Action (State):** Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS:** Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS:** Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch Time (MilliSecs):** Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **History Recent Milliseconds:** The 10 most recent measurements are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For more information about monitoring service disruption activity, select [Measuring Service Disruption Activity](#) in the Specific Tasks section of the online help.

Test - PING

(Specifically for LAN/WAN Ethernet testing)

This section provides a brief overview of the PING functions that are available on the Test screen.

See the [PING Functionality](#) page for detailed descriptions on using the PING feature.

Function	Description
IP Source	This is the Port's IP Source address that is used for the PING operation.  This also configures the Port IP Source address setting located on the Config > Set screen.
IP Destination	This is the target Destination IP Address that is used for the PING operation.
Num. of PINGs	This is the number of PING attempts.
Timeout	This is the amount of time (in seconds) that the unit will wait for a PING reply. Valid values are 1-5 (secs.) in one-second intervals.  The default value is 1.
MAC Source	This is the Port's MAC Source address that is used for the PING operation.  This also configures the Port MAC Source address setting located on the Config > Set screen.

Packet Size	This is the size of the PING packet used for the PING operation. Valid values are 64-16000 (bytes).  The default value is 64.
Time To Live	Sets the IP Time To Live. This is a decimal value from 1 to 255.  This is an IP header field designed to keep packets from running in loops, essentially forever, through a network (this can happen when there is a route change, and the routers involved don't all know the same information as new information is being replicated and updated).  The default value is 128, and is reduced by 1 every time it passes through a server (hops). If the this value should ever reach 0, the packet has expired. The router that it is passing through will then send it back to the source.
Start Ping	This begins the Ping Operation. When "Start Ping" button is selected, the unit will send an ARP request to the target Destination IP address to determine what the MAC address is. When the ARP reply packet is received, the target MAC address will be displayed in the "MAC Dest Address" field, in the Ping statistics section. The specified number of PING requests will be sent, with the last 4 responses displayed in the Ping Response Window.  Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.
Stop Ping	This will stop an active Ping operation.
Ping Response Window	Lists the following information obtained from the Ping reply packets: ►Response: Displays "Successful", "No Response" or "Timeout" ►IP Reply: Displays the IP Address obtained from the Ping's reply packets

	►Bytes: Displays the size of the Ping packet in Bytes ►ICMP Seq: Displays the Ping's reply ICMP Sequence ID number ►Time: Displays the number of milliseconds between when the ARP Request was sent and when the ARP Reply was received. This is also referred to as the Ping packet's Round Trip Delay (RTD). ►TTL: Displays the Ping packet's Time To Live value
Ping statistics section	Shows the following information obtained from the Ping transmit and reply packets: ►Tx Packets: The number of Ping packets transmitted ►Rx Packets: The number of Ping replies received ►% Loss: The percentage of lost packets ►MAC Dest. Address: The target's MAC Address obtained from the replies. ►Round Trip Delay - Average: The average Time measurement, based on all Ping replies received ►Round Trip Delay - Minimum: The minimum Time measurement, based on all Ping replies received ►Round Trip Delay - Maximum: The maximum Time measurement, based on all Ping replies received

Selecting a Dual Enet Port

The Dual Enet tab allows users to configure and test 2 independent datacom ports, using optical SFP and/or electrical RJ-45 interfaces.

- Two LC full-duplex optical SFP ports are dedicated for use by the two Dual Enet ports for testing 100Mbps and 1Gbps Ethernet, as well as 1Gbps, 2Gbps and 4 Gbps Fibre Channel.

- Two electrical RJ-45 ports are also dedicated for use by the two Dual Enet ports for testing 10/100/1000 Mbps Ethernet.

 Each port provides up to 32 independently configurable traffic generation and analysis Ethernet test streams.

To select a port to configure or monitor:

1. From the **Dual Enet** tab, select the **Port <#>** button.
2. Choose the desired port.

 Any subsequent configurations made will be applied to the selected port. For example, if Port 1 is selected then all configurations, testing, and results pertain to Port 1.

3. From the [Interface menu](#), select the desired Interface rate to test.

 If Port 1 or Port 2 is configured for either 1Gbps or 2Gbps Fibre Channel, the other Port can be also configured to test either 1Gbps or 2Gbps Fibre Channel.

 If Port 1 or Port 2 is configured for 4Gbps Fibre Channel, the other Port will also be configured to test 4Gbps Fibre Channel.

LED Quick Status Area

(Specifically for LAN/WAN Ethernet testing)

When the Packet or CSA-Packet protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the **Large LED Results** screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.
- If an LED is White or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED is White or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.

Indicator, LED or Control	Description
Laser On/Laser Off (button)	Pressing the button will toggle the status of the laser. If no SFP, XFP or CFP module is installed, the button will state "No Laser".
TX:	Indicates current transmit laser wavelength.  This not displayed on CSA modules.
RX:	Displays the received optical power in dBm.  If an SFP, XFP or CFP module has been removed, this will display "Missing SFP", "Missing XFP" or "Missing CFP".  The following rules apply exclusively for CSA modules: ▶ This status indicator will flash when one or more received Optical Lanes' power level exceeds the CFP's Power Warm or Power Hot thresholds. ▶ This is an aggregate broadband power value, based on the combined power levels from all of the CFP's received Optical Lanes. ▶ See the CSA-MLD Receive - SIG screen for individual Optical Lane power levels.
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.

Test Paused	If red, indicates that the current test has been paused .
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
LOS	Loss of Signal alarm status LED. When red, indicates that a valid signal is not being received.  If an all zeros pattern exists for 100 milliseconds or longer on the incoming signal, then an LOS is reported.
Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code	Indicates a Code error or Symbol error is detected in the line encoding.
FCS ERR	Frame Check Sequence error status LED
RF	Remote Fault status LED
LF	Local Fault status LED
PAT SYNC	Pattern Synchronization alarm status LED  Indicates a loss of pattern synchronization in at least one of the 32 Streams.
BIT ERR	Bit error status LED  Indicates a detected BIT error in at least one of the 32 Streams.
SEQ ERR	Sequence error status LED  Indicates a sequence error detected in at least one of the 32 Streams.

Ethernet - Specific Tasks

Specific Tasks Overview

(Specifically for Ethernet testing on the Dual Enet tab)

This section includes tasks that are specific to the Dual Enet tab for 10Mbps up to 1Gbps Ethernet Interfaces

For a list of general tasks, see [Common Tasks](#) located in the Getting Started section.

For a description of specific screens and their functionality, refer to [Dual Enet Tab - Screen Functions and Descriptions Overview](#).

The following Specific Tasks for this protocol processor are discussed:

- [Selecting a Dual Enet Port](#)
- [Configuring Packet Streams](#)
- [Initiating Auto Negotiation](#)
- [Multi-Stream Configuration](#)
- [Ramp Mode Traffic Generation](#)
- [Burst Mode Traffic Generation](#)
- [Enabling Stacked VLAN Tagging](#)
- [Enabling MPLS Label Stacking](#)
- [Transmitting Packet Streams](#)
- [Inserting a Pause \(Flow Control\) into a Stream](#)
- [Inserting Errors and Alarms](#)
- [Viewing Error and Alarm Results](#)
- [Configuring an RFC-2544 Test](#)
- [RFC-2544 - Throughput Testing](#)
- [RFC-2544 - Frame Loss Testing](#)
- [RFC-2544 - B2B Burst Testing](#)
- [Y.1564 Performance Testing Overview](#)
- [Y.1564 Service Configuration and Testing](#)
- [Timed Test Using Acceptance Criteria](#)
- [Measuring Service Disruption](#)
- [PING Functionality](#)
- [Saving and Printing Statistics and Port Settings](#)

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Each port provides up to 32 independently configurable traffic generation and analysis Ethernet test streams.

To select a port to configure or monitor:

1. From the **Dual Enet** tab, select the **Port <#>** button.
2. Choose the desired port.



Any subsequent configurations made will be applied to the selected port. For example, if Port 1 is selected then all configurations, testing, and results pertain to Port 1.

3. From the [Interface menu](#), select the desired Interface rate to test.



If Port 1 or Port 2 is configured for either 1Gbps or 2Gbps Fibre Channel, the other Port can be also configured to test either 1Gbps or 2Gbps Fibre Channel.



If Port 1 or Port 2 is configured for 4Gbps Fibre Channel, the other Port will also be configured to test 4Gbps Fibre Channel.

Configuring Packet Streams

(Specifically for LAN/WAN Ethernet testing)

The [Config > Strms Pg1 and Strms Pg2](#) screens provides the tools required to configure or edit any or all of the available packet streams.

To configure a packet stream:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Select **Config** and choose **SET**.
3. If the current **Interface** rate (or **Mode**) needs to be changed, then configure the setting for the desired rate.
4. Choose a **Strms Pg #** side tab. (Where # is either 1 or 2 depending on which stream(s) you want to set.
5. Select a desired stream to test in the Stream Profile table. The **Traffic Stream Profile** dialog box appears.
6. From the [Traffic Stream Profile](#) dialog box, set the parameters for the packet stream.

 If routing the packets through a network switch, the stream's Source and Destination [MAC Addresses](#) should be configured.

 If routing the packets through a network router, the stream's Source and Destination MAC and [IP Addresses](#) should be configured.

6. Select **Save**. The stream configuration parameters display in the Stream Profile table.

Use the horizontal scroll bar at the bottom of the Stream Profile table to view additional columns.

 You can also rearrange the [column order](#) so information that is most important to you can be displayed without needing to use the scroll bar.

7. With all of the test streams turned Off, press the **Restart** button at the bottom of the screen to set the transmitted and received packet counts to 0.
8. **Enable** the desired stream(s) to begin generating traffic on the configured test stream(s).
9. After the desired test time has elapsed, then **Disable** the stream(s) currently generating traffic.



This is preferred over pressing the Stop button, because this allows any packets in transit to be returned and counted, whereas Stop might stop all packet counters before any packets in transit have been returned.

Initiating Auto Negotiation

Negotiation is an Ethernet handshaking mechanism that looks at the incoming signal and determines the link speed and duplex mode (full-duplex or half-duplex). The Negotiate button enables or disables negotiation mode.

When auto negotiation is first enabled, it attempts to negotiate the link with a remote device. After successful negotiation, negotiation will not be performed again unless the remote device initiates an auto negotiation sequence.

By disabling auto negotiation, the test set can simulate older Ethernet equipment that does not support auto negotiation logic.



Negotiate is not available for Ethernet rates of 10G or higher.

To enable auto negotiation:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Select **Config** and choose **SET**.
3. If the current **Interface** rate (or **Mode**) needs to be changed, then configure the setting for the desired rate.
4. Select **Negotiate** and choose **Enabled**.
 - When first enabled, the Status displays "Enabled" and "Pending link".
 - Upon successful negotiation with a remote device, the Status displays the negotiated Interface Rate and Duplex mode.

To disable auto negotiation:

1. Select **Negotiate** and choose **Disable**.
 - When disabled, the Status displays "Disabled".

Ethernet Multi-Stream Configuration

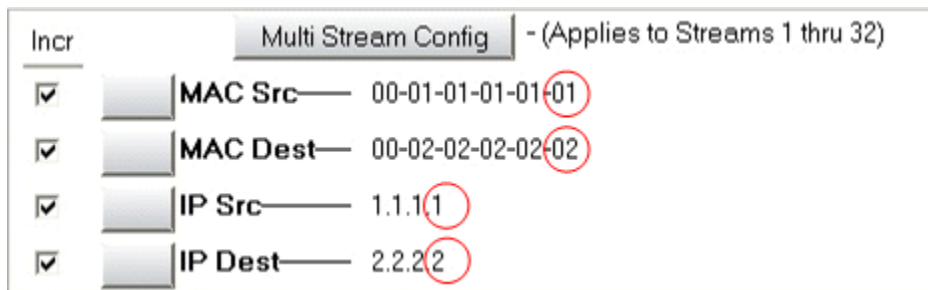
The Digital Lightwave NIC's Ethernet testing capabilities include simultaneous testing of up to 32 independent Streams. The Multi-Stream Configuration feature allows the user to easily set up the Source and Destination IP and MAC address values on up to all 32 Streams in one step.

Important: This function will also configure each of the affected Streams with the same values for all of the other stream settings such as; **Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc.**, when the “Save All” button is selected.

Procedure:

1. With NIC configured for any Ethernet rate, select Config, then Strms Pg 1 or Strms Pg 2. From the [Stream Profile Table](#), select any Stream by touching any Stream (1-16) or (17-32) in the white area. The [traffic Stream profile](#) for the selected screen will appear. Multi-Stream Configuration will begin from the selected Stream.
2. Select **Multi Stream Config** located above the MAC Src.
3. When this button is selected, the user will be prompted to select the number of additional Streams to edit (from the current Stream id up to #32), keeping in mind that the Multi-Stream Configuration will begin from the selected Stream.

 The increment feature can be applied from the selected Stream up to Stream 32. For example, if Stream 30 is selected, Streams 30, 31, & 32 can be incremented.



Incr	Multi Stream Config	Field	Value
☒	Multi Stream Config	MAC Src	00-01-01-01-01-01
☒	Multi Stream Config	MAC Dest	00-02-02-02-02-02
☒	Multi Stream Config	IP Src	1.1.1.1
☒	Multi Stream Config	IP Dest	2.2.2.2

After the number of additional Streams is entered, a new Profile window is displayed.

4. This new Stream Profile window displays the affected Streams id's beside the Multi Stream Config button and also displays the Increment (Incr) checkboxes beside the applicable address buttons. These checkboxes are initially unchecked

when the window is opened. Select the appropriate checkboxes and enter the initial Address required for each of the selected addresses.

 If an address Incr checkbox is not selected then the specified address will be applied to all of the affected Streams

- For each address with its Incr checkbox selected, the last part of the address (circled in red above) will be incremented by 1 for each subsequent Stream when the "Save All" button is selected.

 The MAC addresses and IPv6 IP addresses will increment by hex values

- The example shown in the Stream Profile window above will result in the following values for each Stream (in this case Streams 1-32).

on, off	MAC Src	MAC Dest	IP Src	IP Dest
☐	00-01-01-01-01-01	00-02-02-02-02-02	1.1.1.1	2.2.2.2
☐	00-01-01-01-01-02	00-02-02-02-02-03	1.1.1.2	2.2.2.3
☐	00-01-01-01-01-03	00-02-02-02-02-04	1.1.1.3	2.2.2.4
☐	00-01-01-01-01-04	00-02-02-02-02-05	1.1.1.4	2.2.2.5
☐	00-01-01-01-01-05	00-02-02-02-02-06	1.1.1.5	2.2.2.6
☐	00-01-01-01-01-06	00-02-02-02-02-07	1.1.1.6	2.2.2.7
☐	00-01-01-01-01-07	00-02-02-02-02-08	1.1.1.7	2.2.2.8
☐	00-01-01-01-01-08	00-02-02-02-02-09	1.1.1.8	2.2.2.9
☐	00-01-01-01-01-09	00-02-02-02-02-0a	1.1.1.9	2.2.2.10
☐	00-01-01-01-01-0a	00-02-02-02-02-0b	1.1.1.10	2.2.2.11
☐	00-01-01-01-01-0b	00-02-02-02-02-0c	1.1.1.11	2.2.2.12
☐	00-01-01-01-01-0c	00-02-02-02-02-0d	1.1.1.12	2.2.2.13
☐	00-01-01-01-01-0d	00-02-02-02-02-0e	1.1.1.13	2.2.2.14
☐	00-01-01-01-01-0e	00-02-02-02-02-0f	1.1.1.14	2.2.2.15
☐	00-01-01-01-01-0f	00-02-02-02-02-10	1.1.1.15	2.2.2.16
☐	00-01-01-01-01-10	00-02-02-02-02-11	1.1.1.16	2.2.2.17

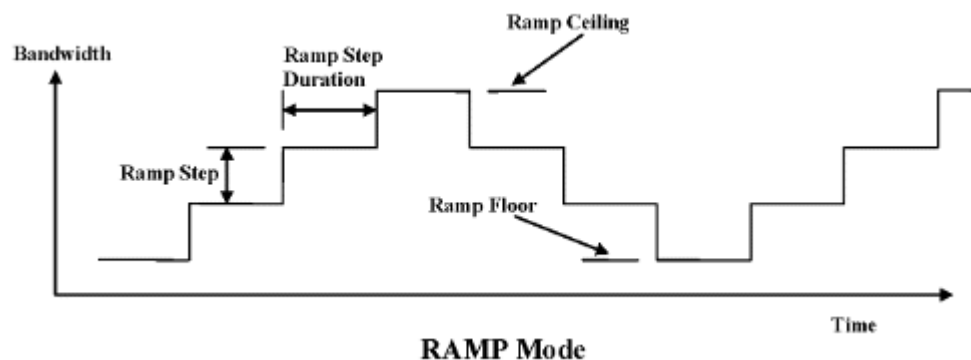
- The Multi-Stream Configuration feature can also be used to will also configure each of the affected Streams with the same values for all of the other stream settings such as; **Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc.**, when the "Save All" button is selected.

How to use the Ramp Mode for Ethernet Traffic Generation

What is Ramp Mode?

Ramp Mode is an Ethernet Traffic Generation method that continuously steps up and down the transmit bandwidth, or Mbps rate.

Ramp mode is a feature that is commonly used to simulate a dynamic increasing and decreasing traffic load on a network device. This is normally performed to monitor a network device's performance, under these varying loads. This mode can also be used as a stress test, when the traffic increase is set to a very steep rate change.



Configuration Settings (from the [Traffic Stream Profile](#) window)

- **Rate:** From this menu select either **Ramp %Bandwidth** or **Ramp Mbit/sec**. Next, enter either the maximum % Bandwidth or Mbps rate that you want the stream traffic to step up to. 💡 This is the **Ramp Ceiling** value.
- **Ramp Step:** This is the size of the % Bandwidth or Mbps rate that each step (up and down) should change by.
- **Ramp Floor:** This is the minimum % Bandwidth or Mbps rate that the stream will step down to.
- **Ramp Duration:** This is the number of Seconds (1 to 999) that each step (up and down) will transmit for.

Setup:

1. Turn **OFF** the test streams, and press the **Restart** button to clear any packet count history.
2. Next turn **ON** the test Stream(s) that are configured for Ramp Mode.
3. Monitor the network device under test (DUT) for anomalies, as the traffic being generated repeatedly steps up and steps back down again, increasing and decreasing its RX traffic load.

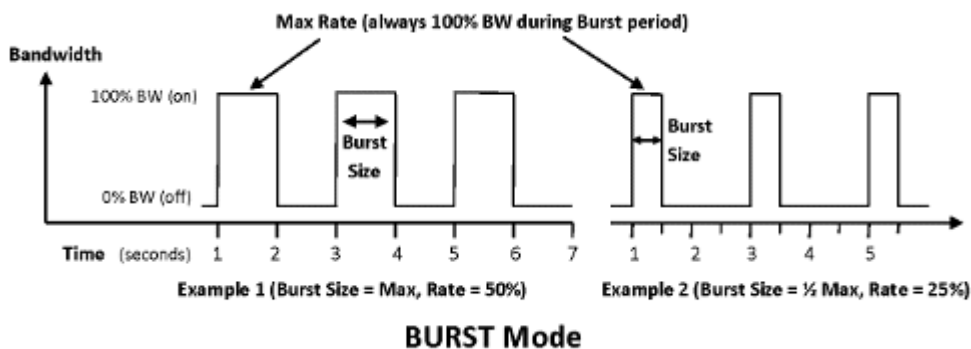
4. Turn **OFF** the test Stream(s), and verify that the DUT's RX Packet count and the NIC's TX Packet count match.

How to use the Burst Mode for Ethernet Traffic Generation

What is Burst Mode?

Burst mode is a feature that is commonly used to simulate "bursty" traffic loads on a network device.

This mode is used as a more realistic method of testing network loads than a constant bandwidth, because Ethernet traffic is typically "bursty" by nature.



Configuration Settings (from the [Traffic Stream Profile](#) window)

- **Rate:** From this menu select either **Constant %Bandwidth** or **Constant Mbit/sec**.
 For Burst mode, burst of **100% BW** are inserted, but the overall rate is **averaged** over time.
- **Burst Size:** The number of packets within the generated burst, with the Minimum Inter-Packet Gap (IPG) allowed, between each packet.
 This is sometimes referred to as the **Burst Width**.

Configuration Notes:

- The maximum Burst Size allowed is equivalent to the maximum Frame Rate, in Packet Per Second (PPS).

- Before adjusting the Burst Size the user should change the test stream's Frame Size and press Save.
- The maximum Burst Size allowed dynamically changes based on the last Frame Size setting to be saved.

Example:

- A 1GigE stream configured for a Frame Size of **128** bytes has a maximum Burst Size of **844594** PPS.
- When the Burst Size is set to 844594, this generates a burst of exactly 844594 packets, at 100% bandwidth for a full 1 second, with the minimum Inter-Packet Gap between each packet, regardless of the Rate setting.
- The Burst Size can be thought of as the amount of time that the burst of 100% BW is "On", up to 1 second for the maximum allowed burst size.
- A Burst Size of 1/2 the max (422297 for 1Gbps) would generate 100% bandwidth for 1/2 a second, then the amount of "Off" time would depend on the Rate setting.
- The Rate is the "ratio of time" that packets are "On" for (100% BW), versus "Off" for (0% BW).
- If the Rate is set to 50%, then the burst of 100% BW would last for the same amount of time as the 0% BW.
- The greater the Rate, the shorter the "Off" time. The lower the Rate, the greater the "Off" time.

Constant Burst Setup:

1. Turn **OFF** the test Stream(s) and press the **Restart** button to clear any packet count history.
2. Next turn **ON** the test Stream(s) that are configured for Burst Mode, as described above.
3. Monitor the network device under test (DUT) for anomalies, as the bursts of generated packets are received.
4. Turn **OFF** the test Stream(s) and verify that the DUT's RX Packet count and the NIC's TX Packet count match.

Single Burst Setup:

1. The user also has the ability to transmit a **Single Burst** using the [Send Burst](#) button to the right of the **Stream Profile Table**.
2. This will generate the exact one burst of the number of packets that the selected stream's **Burst Size** setting is configured for.
3. See the section called [To transmit a single Burst of packets](#) on one stream for more information.

Enabling Stacked VLAN Tagging

Stacked VLAN tags (often referred to as **Q-in-Q** Virtual LANs) allows multiple VLAN tags to be added sequentially to a single Ethernet Stream, as defined in IEEE 802.1Q standard.

The [Traffic Stream Profile](#) dialog box allows up to 4 Stacked VLAN tags to be configured per Ethernet Stream.

To enable Stacked VLAN tagging:

1. Select the Stream you want to enable VLAN tagging on by clicking the desired stream in the **Stream Profile table**. The Traffic Stream Profile dialog box appears.
2. From the Traffic Stream Profile dialog box, select the button next to **No MPLS/VLAN tag** and choose **VLAN Tagging** from the Select Tagging menu.
3. Once VLAN Tagging has been enabled, **VLAN Tag 1** becomes enabled and allows you to modify that tag's settings:
 - Tag 1 is referred to as the **S-Tag** (Service Provider VLAN tag).
4. To enable a second VLAN tag, click the checkbox next to **VLAN Tag 2**. This enables 2 VLAN tags
5. To enable a third VLAN tag, click the checkbox next to **VLAN Tag 3**. And to enable all four VLAN tags click the checkbox next to **VLAN Tag 4**.
 - Tags 2 through 4 are known referred to as the **C-Tags** (Customer VLAN tags).
6. After enabling the desired VLAN tags, the user can modify each tag's **TPID**, **PCP/QOS**, **CFI** or **DEI**, and **VID** settings.
7. Select **Prev** or **Next** to modify the Stacked VLAN tagging for other Ethernet Streams.

8. Select **Save All** to apply the setting and close the Traffic Stream Profile dialog box.

Each VLAN tag adds an addition 4-bytes to the Ethernet Stream, consisting of the following settings:

- **TPID** (Tag Protocol Identifier): The default value is 0x8100, but the menu lets you select 0x88A8, 0x9100, 0x9200 or enter a 2-byte User Defined HEX value.
- **PCP/QOS** (Priority Code Point/Quality Of Service): This indicates the frame priority level and is a 3-bit field ranging from the default value of 0 (best effort) to 7 (highest priority).
- **CFI** (Canonical Format Indicator) / **DEI** (Drop Eligible Indicator): This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.
- **VID** (VLAN ID): This is a 12-bit decimal identifier ranging from 0 to 4095, used for the switching operation.

Enabling MPLS Label Stacking

MPLS (**M**ulti-**P**rotocol **L**abel **S**witching) is a set of procedures for augmenting IPv4 and IPv6 packets with "label stacks", thereby turning them into "labeled packets". These labels act as a shorthand representation of the IP packet's header. Routers which support MPLS are known as "Label Switching Routers", or "LSRs".

The [Traffic Stream Profile](#) dialog box allows up to 4 Stacked MPLS labels to be configured per Ethernet Stream.

To enable Stacked MPLS labeling:

1. Select the Stream you want to enable MPLS tagging on by clicking the desired stream in the **Stream Profile table**. The Traffic Stream Profile dialog box appears.
2. From the Traffic Stream Profile dialog box, select the button next to **No MPLS/VLAN tag** and choose **MPLS Tagging** from the Select Tagging menu.
3. Once MPLS has been enabled, **MPLS Level 1** becomes enabled and allows you to modify that label's settings:
4. To enable a second MPLS label, click the checkbox next to **MPLS Level 2**.

5. To enable a third MPLS label, click the checkbox next to **MPLS Level 3**. And to enable all four MPLS labels click the checkbox next to **MPLS Level 4**.
6. After enabling the desired MPLS labels, the user can modify each label's **Label** value, **TC**, **S(Bottom)**, and **TTL** settings.
7. Select **Prev** or **Next** to modify the MPLS labels for other Ethernet Streams.
8. Select **Save All** to apply the setting and close the Traffic Stream Profile dialog box.

Each MPLS label adds an additional 4-bytes to the Ethernet Stream, consisting of the following settings:

- **Label** (value): The default value is 0x1234, but this can be changed to any 20-bit User Defined HEX value from 0x0 to 0xFFFFF.
- **TC** (Traffic Class): This indicates the packet's QoS (quality of Service) priority ranging from 0 (best effort) to 7 (highest).
- **S(Bottom)** (Bottom of Stack): This is a 1-bit bottom of stack flag. This bit is automatically set to 1 for the last MPLS label to be enabled (i.e., the bottom of the stack), and automatically set to 0 for all higher level labels in the stack.
- **TTL** (Time to Live): This is an 8-bit field used to encode a Time-To-Live value ranging from 0 to 255 (default).

Transmitting Packet Streams

(Specifically for LAN/WAN Ethernet testing)

The [Config > Strms Pg1 and Strms Pg2](#) screens provide the tools required to configure or edit any or all of the available packet streams.

To start transmission on specific packet streams:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Configure the [Mode and desired Packet Stream](#) settings.

3. When configuring more than one stream, if the total configured bandwidth exceeds 100% the processor will automatically and proportionately adjust each enabled stream so the total bandwidth being transmitted is exactly 100%.
4. Choose a **Strms Pg #** side tab. (Where # is either 1 or 2 depending on which stream(s) you want to set).
5. **Enable** the desired stream(s) to begin generating traffic on the configured test stream(s).

 **Important:** Streams cannot be enabled when IP Reflection is enabled.

6. Packets begin transmitting as soon as the On/Off checkbox is enabled.

 To begin transmitting packets on multiple streams starting at the exact same time, then first select the **Stop** button from bottom of the screen, then Enable the desired packet streams, then press the **Restart** button from the bottom of the screen. The selected packets will begin simultaneously transmitting.

7. The stream transmission status displays in the TX State column of the [Stream Profile table](#).
8. The total TX and RX packet count statistics for all packet streams are displayed in the Count Statistics table below Stream Profile table.

To start transmission on All packet streams:

1. Repeat steps 1 through 4 above.
2. Select the All button beneath the last stream's On/Off check box.

 If no packet streams are currently enabled, then this will simultaneously enable all 32 packet streams.

 If one or more packet streams are currently enabled, then this will disable all enabled packet streams.

To transmit a single Burst of packets on one stream:

1. Configure the packet stream's setting from the [Traffic Stream Profile](#) window.

2. Select the **Burst Size** setting, and enter the desired number of packets to be transmitted in the burst
3. Press Save All to save the configuration and exit the Traffic Stream Profile window.
4. Press the stream's Number Button under in [Send Burst](#) column to inject a single burst of packets, for the configured burst size.

 When done inserting bursts configuring the stream for transmitting at a Constant %BW rate, set the Burst Size back to 1 to avoid "bursty" transmissions.

Inserting a Pause (Flow Control) into a Stream

Pausing frames is a means of flow control that specifies how long the transmitting device should remain quite. The flow control gives limited ability to regulate a (high bandwidth) source by sending pause frames to the source. Inserting a pause into a stream causes the source to stop sending frames for a specified amount of time (Quanta), allowing the (low bandwidth) receiver to catch up and process queued frames.

 Important: **Flow Control** must be enabled in order to count received Pause Packets.

 Important: Pause is not available when **IP Reflection** is enabled.

To start insert a Pause frame in a packet stream:

1. Select **Config** and choose **Set**.
2. Select **Pause**. *The Enter Pause Quanta keypad appears.*
3. Enter a Pause Quanta value and select **OK**.

 A quanta is the unit of time required for transmitting 512-bits at the speed of the port.

 The number of quanta ($N \times 512\text{-bits}$) indicate the duration of the pause.

 Valid pause quanta values are 0-65535.

 A pause frame with a pause quanta of 0 indicates a resume frame to restart the paused traffic.

Inserting Errors and Alarms

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific errors and alarms into an Ethernet stream.

 Note: Error insertion is disabled when IP Reflection Mode is enabled.

To insert multiple errors:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Configure the [Mode and desired Packet Stream](#) settings.
3. Enable traffic generation from the packet stream to be errored.

 Important: Most error types require traffic generation to be enabled on at least one packet stream.

4. Select [Error / Alarm](#) from the tabs along the left side of the Config Screen.
5. Select [Error Type](#) and choose an error type from the Select Error Type dialog box.
6. Select [Error Rate](#) and choose an error rate from the Select Error Rate to Insert dialog box.
7. Errors immediately start injecting into the packet stream when the error rate is selected.
8. View various result statistics by selecting the [Results](#) function.
9. To stop error transmission select **Error Rate** and choose **Off**.

To insert a single error:

1. Repeat steps 1 through 5 above.
2. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
3. Select the **Error Insert** common function button at the bottom of the screen.
4. A single error will be inserted every time the **Error Insert** button is pressed.



Note: If no Error Type has been previously selected, then the Select Error Type menu will appear the first time the Error Insert button is selected.

5. View various result statistics by selecting the [Results](#) function.

To insert an Alarm:

1. Select the **Packet CSA** tab.
2. Configure the [Mode and desired Packet Stream](#).
3. Enable traffic generation from the packet stream to be errored.
4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. Select [Error / Alarm](#) from the tabs along the left side of the Config Screen.
6. Select **Alarm Generated** and choose an alarm type from the Select Alarm dialog box.



Important: Once an alarm is selected, then alarm will continuously insert until turned off.

7. View various result statistics by selecting the [Results](#) function.
8. To stop the alarm generation select **Alarm Generated** and choose **None**.

Viewing Error and Alarm Results

After [inserting error and alarms](#) into a packet stream the receiving equipment detects the event and reports it. The Results screen provides different result reports.

To view error or alarm results:

1. From the protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.), select [Results](#).
2. The Results screen contains the following functions:
 - [Scan](#) - Displays a list of errors and alarms along with their count and duration.
 - [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
 - [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
 - [Count](#) - Displays Packet and VLAN count statistics.
 - [Strm Rslt](#) - Displays Stream ID specific statistics.
 - [Event](#) - Displays a summary of error alarm activity.
 - [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

What are RFC 2544 Tests?

RFC 2544 tests are used as a benchmark test for network devices. They were developed to test throughput, latency, frame loss and burstability across a range of packet sizes and bandwidths. RFC 2544 has become the de facto standard for benchmarking Ethernet networks.

- Throughput Testing determines the maximum data rate which can be transported at each of a series of packet sizes, defined by the standard, i.e. 64, 128, 256, 512, 1024, 1280, 1518 bytes. NOTE: The NIC offers the ability to send non-standard packet sizes.
- Latency Testing measures the time interval required to transport a packet through the device or network under test and back. Low and consistent latency is vital for protocols such VoIP and video applications.
- Frame Loss Testing determines what percentage of frames can be sent across the device or network under test at the series of packet sizes as listed above in Throughput Testing.
- Back-to-Back Burst Testing determines the number of frames that can be sent in a burst with minimum inter-packet gap through the device or network under test without losing any frames.

The RFC 2544 methodology can be used to assess the parameters of service-level agreements (SLAs). A carrier can then determine whether an Ethernet circuit complies with the agreement, based on the test results.

Physical Connections

NOTE: RFC 2544 tests must be performed on a loopback basis, and all testing is typically performed on the NIC at the near end.

NIC – Network without Routers – Loopback

- In networks that do not have routers, it may be possible to use a simple loopback on the equipment.

NIC – Network with Routers – NIC in IP Reflection mode

- In networks with routers, a second NIC in IP Reflection mode can be used as a loopback device.
- Configure the far-end NIC unit's Reflect setting for Digital Lightwave Packets Only.
- In IP Reflection mode, the NIC reverses MAC and IP addresses and loops back the RFC test packets.

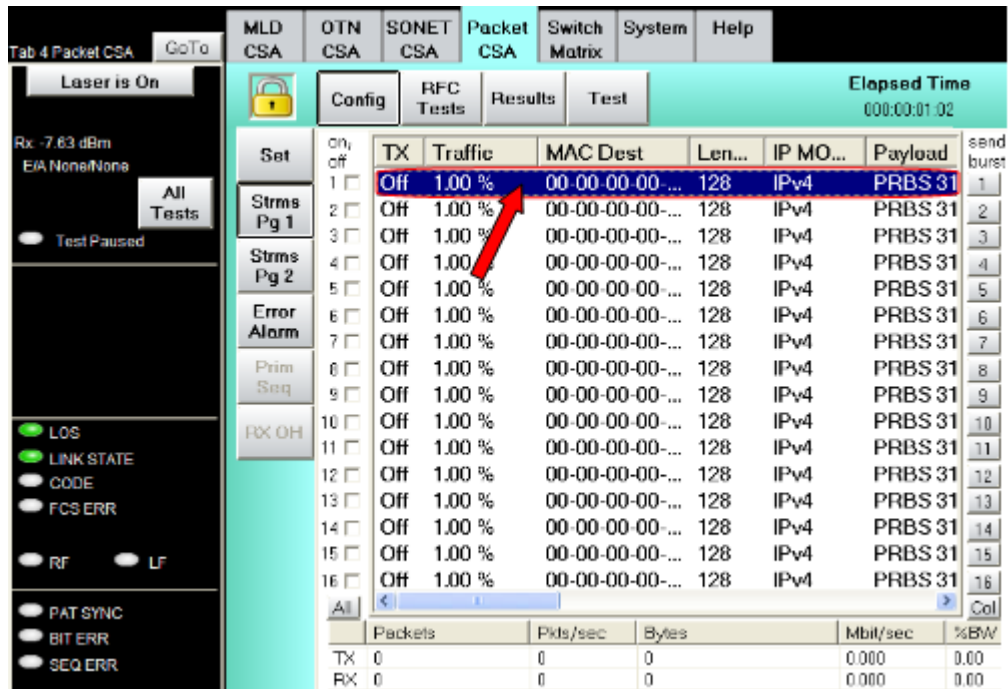
How to Configure and perform RFC2544 Testing



Note: The RFC tests are performed over the selected test Stream. The RFC tests will over-ride the test Stream's bandwidth rate, frame size and burst size parameters. However other parameters such as MAC addresses, IP addresses, UDP addresses and VLAN/MPLS settings are not over-written, and should be configured prior to beginning the RFC test.

To configure the test Stream:

1. Press **Config**, then **Strms Pg 1** or **Strms Pg 2**.
2. Select one of the streams by pressing the stream's row in the white area (See figure).



- Stream settings are made in the [Traffic Stream Profile](#) pop-up window.
- Make any applicable Stream settings such as Source and Destination MAC and IP Addresses, UDP port configuration and/or VLAN/MPLS configuration before continuing.
- It is not necessary to set **Frame Length**, **Rate** or **Burst Size**. These will be set by the RFC 2544 function.
- NOTE: Adding VLAN or MPLS tags will change the minimum frame length that can be used. For example, if a single VLAN tag is selected, the minimum frame length will be changed from 64 to 68 and the first rate tested in the RFC 2544 test will be 68 bytes long.
- Select the On/Off checkbox for the Stream that has just been configured to being generating packets.
- Confirm that packets are being sent and received successfully.
- While the Stream is in On, the TX and RX packet count may not always be equal. This is normal. It is only necessary to determine that packets are being successfully received without any errors to confirm basic connectivity before beginning lengthy RFC 2544 tests.
- Uncheck the On/Off checkbox to turn the Stream off.

 Note that if the Flow Control box is checked (Rx Enabled), it will automatically default to unchecked when an RFC test is activated. This is to ensure test validity and accuracy.

To configure the an RFC test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) that was configured above for the RFC tests.
3. Select **Trial Duration** and set the duration of the test (in seconds).

 RFC-2544 recommends a trial duration of at least 60 seconds for Through Put and Frame Loss testing.

4. Select **Dest Port** and choose the port that will receive the test signal.

 Note, if a port is in IP Reflection Mode, or if it is already in an active RFC test, this setting will be unavailable.

5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.

 **IMPORTANT:** The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

 **IMPORTANT:** The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
- b. Enter a new value and select **OK**. Value ranges are 64 - 16000.

- c. By default, packet sizes 64 - 1518 are already selected, but packet size 9000 is not selected. You can enable 9000 if your test needs to include Jumbo packets.
 - d. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select the type of RFC test that you wish to run by choosing its tab from along the left side of the RFC Tests screen. Complete any necessary configurations these tabs.
- To run a **Thru Put** test see [Throughput Testing](#)
 - To run a **Frame Loss** test see [Frame Loss Testing](#)
 - To run a **B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC-2544 - Thru Put Testing

Throughput testing is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

For example, the Throughput test starts by transmitting a stream at 100% using a packet size of 64 bytes. If it fails (i.e., an unacceptable number of packets are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing packets. The test then tries to zero in on the best throughput rate based on the Resolution Rate. The final rate appears as the Passing Rate.

Once this is completed, the packet size is increased to 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using default packet sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

When performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- [Accept Lost Rate](#) – Defines the percentage of frames that can be lost without being considered a failure.
- [Resolution Rate](#) – Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.



A Throughput test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Throughput test:

configure the Frame Loss test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.



IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.



IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **Thru Put** from the tabs along the left side of the RFC Tests screen.

9. Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.
10. Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

To start the Throughput test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream using the configured parameters, starting with the smallest packet size. The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first packet size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first packet size transmitted is 64-bytes followed by 128-bytes and so on.)

If packet loss is detected in a byte transmission, the stream is re-transmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

3. View Throughput test results on the [statistics table](#) at the bottom of the screen.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - Frame Loss Testing

Frame Loss testing is an RFC 2544 benchmark test. Its purpose is to determine the number of packets lost, by looping a stream through the network at varying transmit packet rates. The Frame Loss screen allows you to select a specific packet size to use in the Ethernet stream.



A Frame Loss test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Frame Loss test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **Frame Loss** from the tabs along the left side of the RFC Tests screen.

To start the Frame Loss test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.

2. The unit immediately starts transmitting a test stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, Processing size 64 Rate 10.00. When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

3. View Frame Loss test results on the [statistics table](#) at the bottom of the screen. The table displays the frame loss test results for a specified packet size. The results represent the nine rates determined by the BW Ceiling and BW Floor settings.

To change the packet size and view its results:

- Choose the **Packet Size** button (for example, 256). The Frame Loss table displays the transmit and receive statistics for the selected packet size.

OR

- Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

 **Important:** The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - B2B Burst Testing

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.



A Back-to-Back Burst test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the B2B Burst test:

1. Select **RFC Tests** and choose [Conf.](#)



The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.



This value determines how long each trial runs. Valid values range from 2 to 10 seconds.

4. Select **Dest Port** and choose the port that will receive the test signal.
6. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **B2B Burst** from the tabs along the left side of the RFC Tests screen.
 9. Select **Resolution (in frames)**. A keypad appears.
 10. Enter a precision level for the test. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.
 11. Select **# Of Repetitions**. A keypad appears.
 12. Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50.

To start the Back-to-Back test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts sending a burst of frames with the minimum inter-frame gap between them. If all frames are received, the burst size is increased and the test repeated. If all frames are not received, the burst size is lowered and the test repeated until the longest burst the DUT can handle (without loss of frames) is determined.
3. View B2B Burst test results on the [statistics table](#) at the bottom of the screen.
 - Frame Size (bytes) – Indicates the tested frame size.
 - Max Possible Number of Frames – Indicates the number of frames transmitted without errors.
 - Avg Observed B2B Frames – Indicates the data stream's average frame count.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

Y.1564 Performance Testing Overview

ITU-T [Y.1564](#) defines a test methodology that may be used in assessing the proper configuration and performance of an Ethernet network to deliver Ethernet-based services. This out of-service test methodology was created so that service providers may have a standard way of measuring the performance of Ethernet-based services.

The Y.1564 Service Configuration & Performance testing supports the following features:

- Bandwidth profile testing with [CIR](#), [EIR](#), and Traffic Policing testing capabilities
- Supports Non-Color Aware modes
- Supports the optional Y.1564 reordered and out-of-order frames analysis per test flow
- Supports Service Performance testing on up to 10 simultaneous services/test stream flows
- Each Service Configuration and Service Performance test can be optionally enabled or disabled for testing
- Independent test duration options for Service Configuration and Performance tests
- Includes both logical & physical IP Reflection loopback modes for redirecting test traffic at the far end which is required for Y.1564 test configurations.
- All user configured test profiles can be saved and restored for user convenience
- Supported MSA module interfaces OTU2e/OTU1e, 10GbE, 1GbE, 100M, 10/100/100BASE-T interfaces
- Supported on all MSA 2020/2030, 2020A/2030A, 2020B/2030B modules with the exception of the dual 1G/100M & 10/100/1000BASE-T ports on the MSA 2020/2030 version module.
- Supported on CSA 4100 module 40G & 100G Ethernet interfaces
- Software license-based Test Option



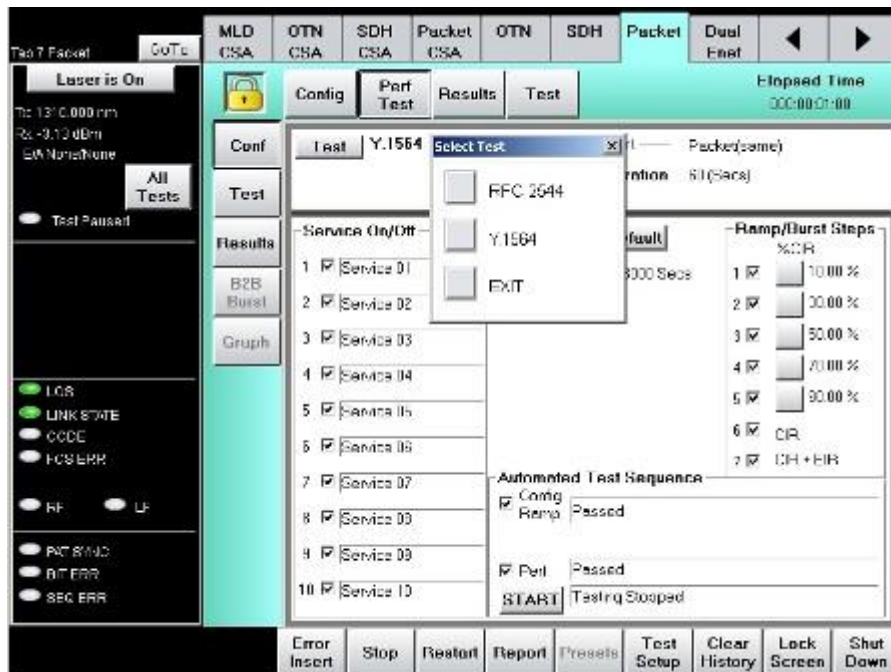
The following link demonstrates how to configure and test Y.1564.

[Y.1564 Service Configuration and Testing](#)

Y.1564 Service Configuration and Testing

How to enable Y.1564 test mode:

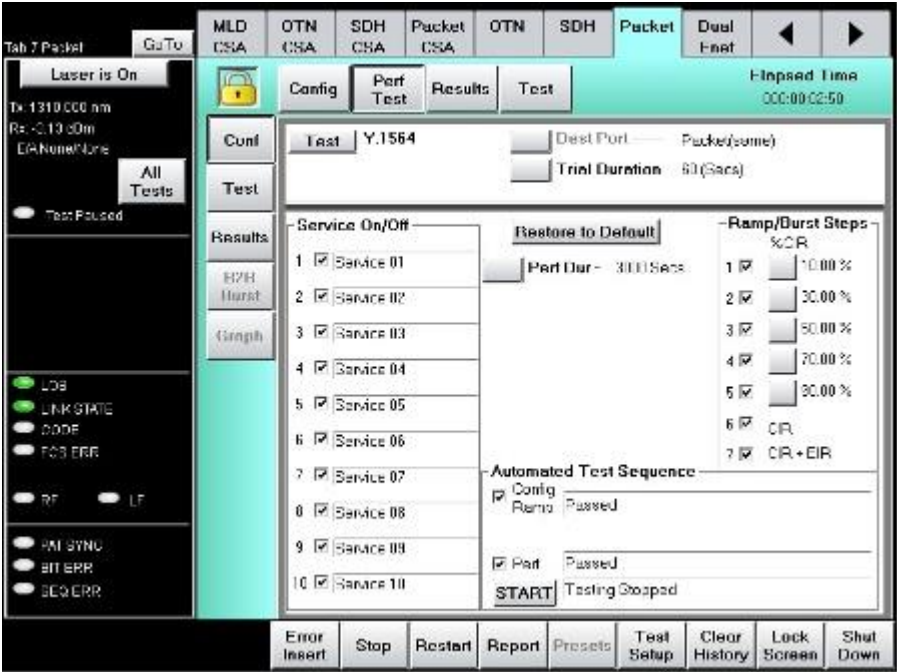
1. Select the desired test interface.
2. Verify appropriate network connections such as power levels, valid link state, etc.
3. Select the **Perf Test > Conf** tab
4. Select the **Test** button and enable the **Y.1564** selection



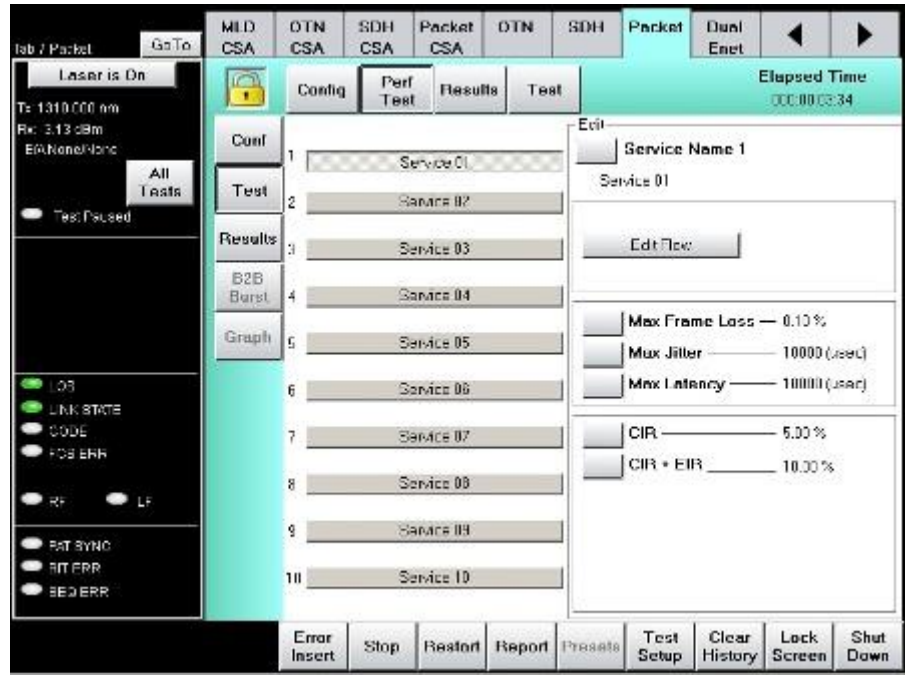
Y.1564 Test Mode Selecti on

How to configure Y.1564 test options:

1. From the Conf side tab, select the desired settings
2. From the Test side tab, select the desired settings



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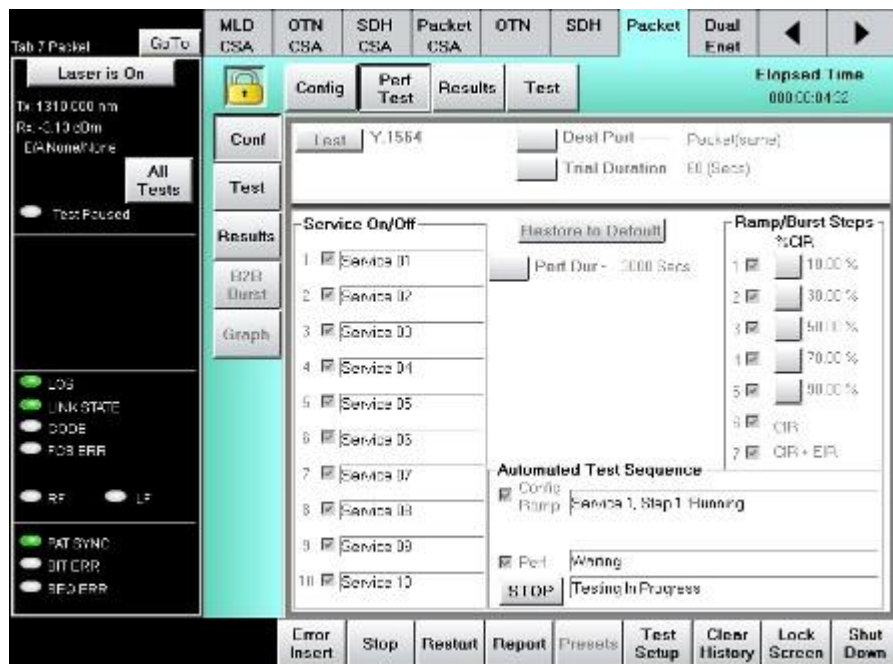


Y.156
4 Test

Tab Config uration n

How to start the Y.1564 test:

1. From the Conf tab, select the test options under the Automated Test Sequence section. At least one test must be selected
2. The Config Ramp and Config Burst selections are Y.1564 Configuration tests
3. The Perf selection enables the Y.1564 Performance test
4. Select the Start button in the Automated Test Sequence section. The selected tests will now start and their real-time status will be displayed next to the Start/Stop button.

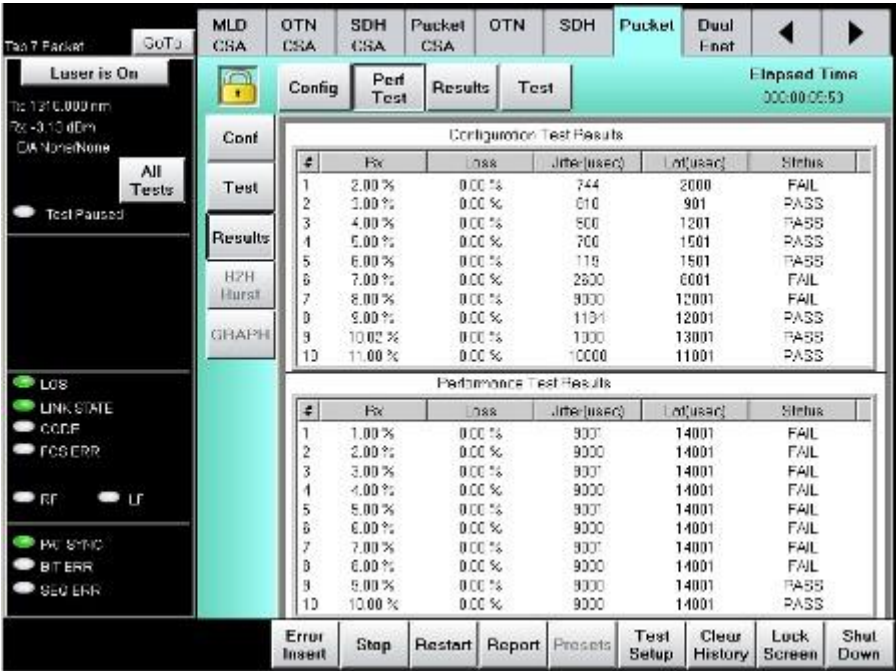


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How to view Y.1564 summary results:

- 1. Select the Perf Test > Results tab
- 2. A summary overview of the Configuration and Performance test results for all services are displayed.



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How to view Y.1564 per service detailed results:

- 1. When a specific service is selected from the Configuration Test Results table a detailed result view is displayed for that service.
- 2. When a specific service is selected from the Performance Test Results table a detailed result view is displayed for that service.

Configuration Test Detailed Results						
Service #1 - Service 01						
Ramp Test	CIR(%)	Rx	Fr Loss	Max Jitter	Max Lat	Status
Step 1	12.25 %	0.12 %	0.00 %	744	2000	FAIL
Step 2	34.26 %	0.34 %	0.00 %	1	1000	PASS
Step 3	56.78 %	0.56 %	0.00 %	1	1000	PASS
Step 4	78.92 %	0.78 %	0.00 %	112	1400	FAIL
Step 5	91.51 %	0.91 %	0.00 %	299	500	PASS
CIR	100.00 %	1.00 %	0.00 %	1	500	PASS
CIR + EIR		2.00 %	0.00 %	1	500	PASS

Detailed Y.1564 Con

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Performance Test Detailed Results						
Service #1 - Service 01						
	Max	Min	Avg	Curr		
RX	1.02 %	0.96 %	1.00 %	1.00 %		
Jitter	9001	0	0	1		
Latency	14001	3999	6768	14000		

Error	Count	Errored Secs	Average	Current	Avail	Unavail Secs
Seq	0	0	0.00e+000	0.00e+000		
Loss	0	0	0.00e+000	0.00e+000	100.00 %	0

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How to save or print Y.1564 test results:

1. Select the Report button at the bottom of the screen.
2. The individual or combined Y.1564 test results can be saved or printed.



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Timed Test - Using Acceptance Criteria

The NIC unit has the capability to run a timed test (a test with Ethernet streams enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

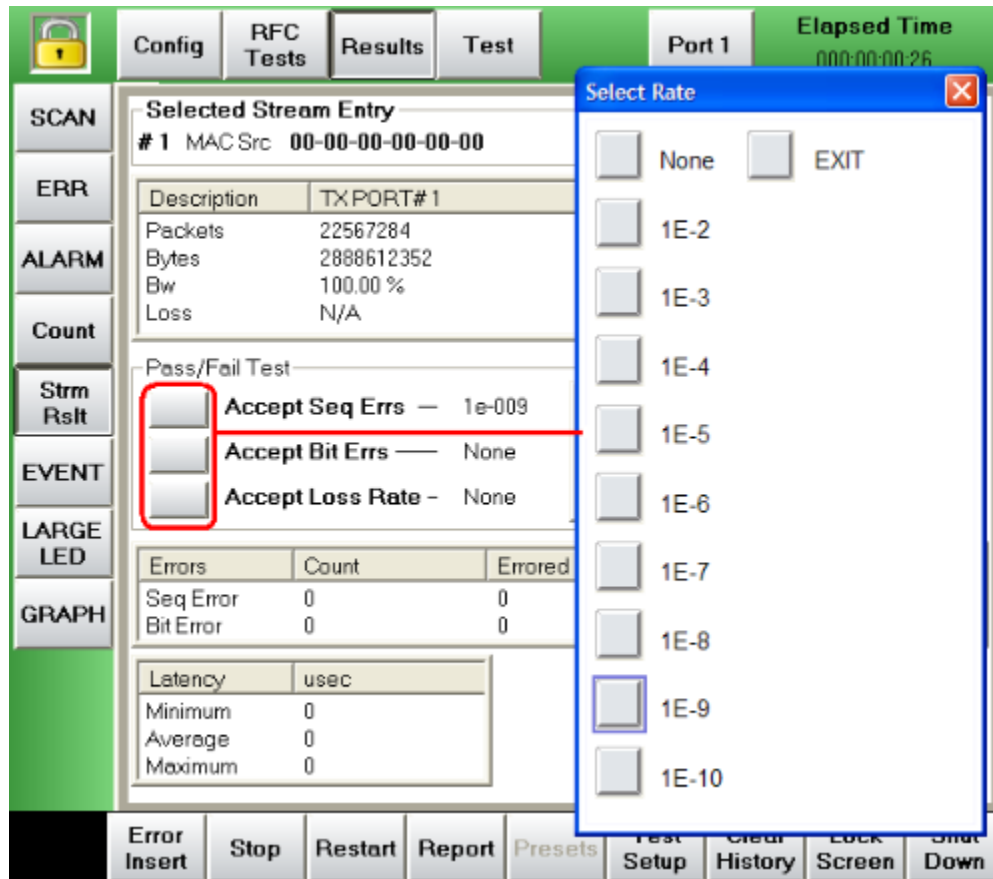
To Set Up the Test

1. Set up the port on which the test will be initiated. This includes the ports Interface, stream parameters, etc.. A test can be performed on a single port or port-to-port basis.
2. Enable the stream(s) to be used for the test.
3. Under the **Results > Strm Rslt** tab, configure the [Pass/Fail Test](#) acceptance criteria options. These include **Acceptable Sequence Error** rate, **Acceptable Bit Error** rate, and **Acceptable Loss Rate**. These values are set up on a per-stream basis.
4. Under the **Test** tab, select the desired **Duration** for the test.



If the "**Continuous**" duration is used, the test will continue to operate until the **Stop** button is pressed.

5. **Restart** the port that will be used for the timed test using the **Restart** button at the bottom of the screen.
6. When the time duration of the test is reached, the streams will automatically stop counting received packets and the Pass/Fail acceptance results are displayed under the **Results > Strm Rslt** tab.



User-Defined Acceptance Criteria:

- **Accept Seq Errors** - A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test.
- **Accept Bit Errors** - A user-specified threshold value for determining the acceptable bit error rate for a timed test.
- **Accept Loss Rate** - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test.

Measuring Service Disruption

(Specifically for LAN/WAN Ethernet testing)

The unit can measure Service Disruption switching intervals in your network. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

When enabled, the trigger event to begin service disruption measurements occurs when it stops detecting incoming packets.



The MSA module's Packet processor tab and Dual Enet processor tab also triggers on incoming packets with CRC/FCS errors.

The duration for every Ethernet service disruption event is measured in milliseconds, with granular accuracy of .1 ms (100 μ s).

When the Action state is configured for Continuous APS, the 10 most recent measurements are displayed in the History window. Also the Minimum and Maximum measurement times are logged, as well as an Average duration based on all measurements taken since the test began.

To measure Ethernet service disruption activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. When testing low speed Ethernet bandwidths ($\leq$ 1Gbps), you may need to configure the **Resolution** setting in conjunction with the **Consecutive Bad Time Required** setting, to ensure that at least one Ethernet packet is received within the configured period of time (measurement window). The following options are available: **High (.1 ms)**, **Medium (1 ms)** and **Low (10 ms)**.



When receiving fewer packets per second (lower bandwidths), a lower resolution setting (larger window of time) is required.



Invert the number of packets per second being received to determine the time between each received packet, and select the Resolution setting that best allows for at least packet to be received within the selected measurement window.



Important: The Resolution setting is only displayed on ports that support Ethernet rates $\leq$ 1Gbps.

3. Select **Consecutive Good Time Required** and enter a time interval ranging from 10 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
4. Select **Consecutive Bad Time Required** and enter a time interval ranging from 0.1 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames (or no frames) to elapse before Protection Switch measurements begin to accumulate.

5. From the **Action** box, select **State**. The Select APS Action dialog box appears.
6. Select [Single APS](#) or [Continuous APS](#) to begin measuring. The test set will begin monitoring the incoming signal for the event. If it occurs, the protection switch state and time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for consecutive good and bad time parameters.
7. In the **Protection Switch Time (MilliSecs)** table, view the duration, in milliseconds, that it took for the service disruption to occur.
8. In the **History Recent MilliSeconds table**, view a history of the 10 most recent measurements.
9. The complete summary of service disruption events for all processors within the NIC unit can be viewed simultaneously by selecting the **System** tab and choosing **Service Disruption**.

To Stop monitoring Service Disruption measurement activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. From the **Action** box, select **State** and choose **Stop APS**.

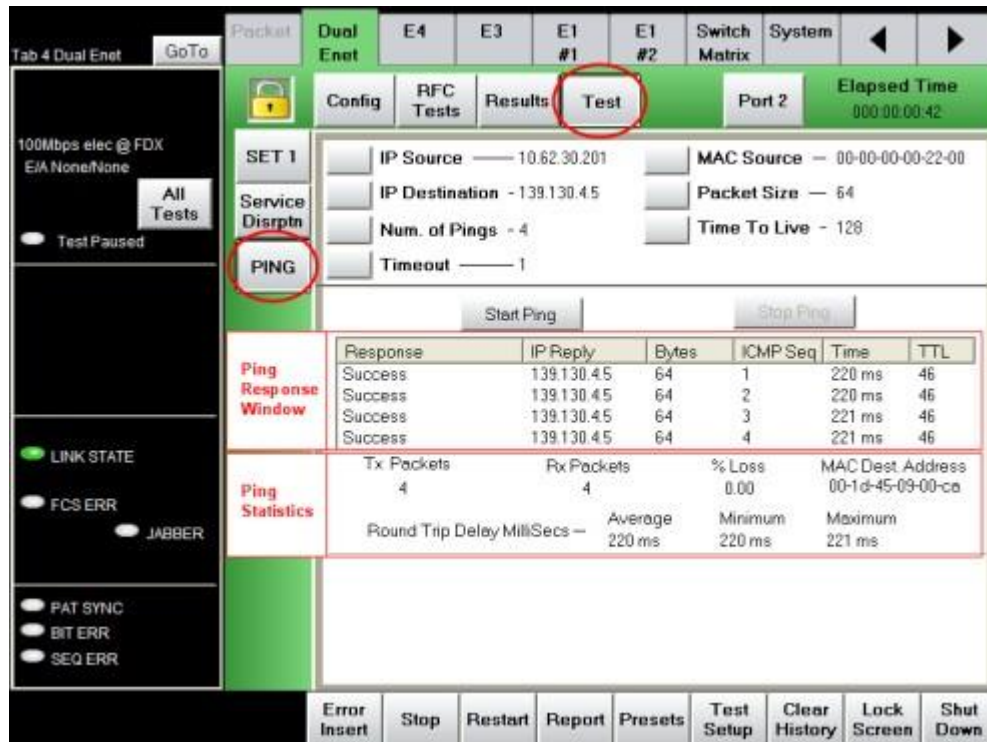
PING Functionality

PING is a utility used to determine whether a specific IP address is accessible. It works by sending a packet to the specified address and waits for a reply. PING is used primarily to troubleshoot Internet connections.

A PING packet is an IP packet requesting that a copy of the contents be echoed back to the sender. This packet type is called an ICMP Echo Request. When a site is "pinged", an echo request is sent, and the destination site that receives it responds back. The response packet is called an ICMP Echo Reply.

The Ping utility is essentially a system administrator's tool that is used to see if a computer is operating and also to see if network connections are intact. Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.

The [PING screen selection](#) is implemented under the Test Tab.



Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).

- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:
 - From Destination Printer:
 - ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.
 - From Destination File:
 - ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.



The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

- ▶ Enter a file name and select **OK**.



Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

- ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.
4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.

5. Select **OK**.

Fibre Channel - Screen Functions and Description

Dual Enet tab - Screen Functions and Descriptions

(Specifically for Fibre Channel SAN testing on the Dual Enet tab)

This section describes the various screens and functions that control **1G**, **2G** and **4G** Fibre Channel rate configuration and operation:

- [Config](#)
- [Standard Tests](#) (RFC-2544 and Y.1564)
- [Results](#)
- [Test](#)
- [Ports](#)
- [LEDs](#)

Config

Dual Enet tab - Config Screens and Functions

(Specifically for Fibre Channel SAN testing on the Dual Enet tab)

The Config screen contains the following functions:

- [Set \(Settings Configuration\)](#)
- [Traffic Stream Profile](#)
- [Error Alarm](#)
- [Prim Seq](#)

Config - Set screen

(Specifically for Fibre Channel SAN testing on the Dual Enet tab)

The **Config > Set** (Settings Configuration) screen allows you to define the Fibre Channel frame parameters that will be used to generate a traffic flow or stream into the network.

 **1G, 2G, and 4G** Fibre Channel rates are supported on the MSA circuit pack's **Dual Enet** tab.

The following functions appear on the Settings Configuration screen:

Function	Description
Interface	Selects the Fibre Channel rate. • 1Gbps Fibre Channel • 2Gbps Fibre Channel • 4Gbps Fibre Channel  If Port 1 or Port 2 is configured for either 1Gbps or 2Gbps Fibre Channel, the other Port can be also configured to test either 1Gbps or 2Gbps Fibre Channel.  If Port 1 or Port 2 is configured for 4Gbps Fibre Channel, the other Port will also be configured to test 4Gbps Fibre Channel.
Fabric Login	Attempts a Fabric Login  This is disabled when the test stream is On.
Name Server Login	Attempts a name server Login  This is disabled when the test stream is On.
Status	Link: – displays the current Link status Fabric: - displays the current Fabric status Name Server: - displays the current status

Col (Columns)	Rearrange order of columns displayed in the Stream Profile Table.  See below for more information on the Stream Profile Table.
R_T_TOV	Sets the R_T_TOV timeout setting. The default value is 100ms, and supports a range of 0.01ms to 655.35ms, specified in units of 10us. This is the timeout value used by the receiver logic to detect loss of synchronization. When the receiver goes into the Loss of Synchronization state for more than the R_T_TOV timeout value, then a link failure is detected.
Stream Profile Table	The Stream Profile Table contains one Fibre Channel stream that can be configured. Selecting the stream from the profile table opens the Traffic Stream Profile dialog box from which the stream parameters are configured. Use the horizontal scroll bar at the bottom of the table to view hidden columns for the stream settings.  See below for more information on the Stream Profile Table.
Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) frames: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Frames - Displays the total number of frames sent or received since the test was started. • Frms/sec - Displays the current rate of frames sent or received in frames per second. • Bytes - Displays the total number of bytes sent or received since the test was started. • Mbit/sec - Displays the current rate of frames sent or received in Megabits per second. • %BW - Displays the total percent of bandwidth used by each active stream.

Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • Off - The unit's laser will be off when the unit is turned on. • On - The unit's laser will be on when the unit is turned on. • Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Information about the configuration of the streams are displayed in the Stream Profile Table.

TX	%BW	WWN Dest	Length	Payload	SEQ_ID
On	100.00 %	00-00-00-00-00-0...	2088	PRBS 31	0

At the left, there is one button to turn on and off the fibre channel stream. The other columns of information can be seen by using the scroll bar at the bottom or by rearranging the columns. These are the columns (note that the sequence may be different, depending upon how the user has arranged the columns):

TX	Indicates whether that stream 1-4 is being transmitted
%BW	Percentage of bandwidth selected on that stream
WWN Dest	Destination World Wide Name address
Payload	Payload Pattern selected
Length	Frame Length
SEQ_ID	Sequence Identifier selected

F_CTL	Frame Control address
D_ID	Destination Identifier address
OX_ID	Originator Exchange ID address
WWN Src	Source World Wide Name address
S_ID	Source Identifier address
RX_ID	Responder Exchange Identifier address
R_CTL	Routing Control address

Config - Traffic Stream Profile

(Specifically for Fibre Channel SAN testing)

A frame stream's profile defines the size, content, and several addresses, and other parameters for the frame.

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select stream #1 in the Stream Profile Table.



The Fibre Channel Class of Service is set to 3 by default.

Parameter	Description
WWN SRC ADDRESS	Sets the World Wide Name Source Address.  Important: This value must be set before a Fabric & Name Server login is attempted

WWN DEST ADDRESS	Sets the World Wide Name Destination Address.  Important: This value must be set before a Fabric & Name Server login is attempted
Class of Service	Supports Class of Service 3
Frame Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad. The default value is 68 bytes.
Rate	Sets the bandwidth percentage used, from 0.01 to 100% BW.
Payload	Sets the type of data used for the stream's payload. The payload can be set to: • PRBS 31 • PRBS 31 INV • User Defined
SOF	Select the Start of Frame Delimiter used. SOF Delimiter Functions are: • SOFc1 – SOF Connect Class 1 • SOFi1 – SOF Initiate Class 1 • SOFn1 – SOF Normal Class 1 • SOFi2 – SOF initiate Class 2 • SOFn2 – SOF Normal Class 2 • SOFi3 – SOF Initiate Class 3 • SOFn3 – SOF Normal Class 3 • SOFc4 – SOF Connect Class 4 • SOFi4 – SOF Initiate Class 4 • SOFn4 – SOF Normal Class 4 • SOFf - SOF Fabric

EOF	Selects the End of Frame Delimiter Used. EOF Delimiter Functions are: • EOFt – EOF Terminate • EOFdt – EOF Disconnect-Terminate • EOFa – EOF Abort • EOFn – EOF Normal • EOFni – EOF Normal-Invalid • EOFdti – EOF Disconnect-Terminate-Invalid • EOFrt – EOF Remove Terminate • EOFrti – EOF Remove Terminate-Invalid
R_CTL	Routing Control – 1 byte, used for categorizing the frame function. The routing portion says if this is a data frame or a link-control frame (either an ACK or a Link Response), and the information portion indicates the type of data.  supports raw edit of field values only
D_ID	Destination Identifier – 3 bytes, address identifier of the FC frame's destination port.  supports raw edit of field values only
CS_CTL	Class Specific Control/Priority - 1 byte, Quality of Service.  supports raw edit of field values only
S_ID	Source Identifier – 3 bytes, address identifier of the FC frame's source port.  supports raw edit of field values only
TYPE	Data Structure Type – 1 byte, categorization of the Frame's data. Indicates the next protocol (what's in the Payload), unless R_CTL indicates a control frame.  supports raw edit of field values only

F_CTL	Frame Control – 3 bytes, contains control information relating to the frames content's various FC options, such as sequencing information.  supports raw edit of field values only
SEQ_ID	Sequence Identifier – 1 byte, unique identifier for the frame's Sequence number, just like the frame sequence for IP.  supports raw edit of field values only
DF_CTL	Data Field Control – 1 byte, specifies the presence of, or absence of, optional headers, and the size, between the frame header and frame payload.  supports raw edit of field values only
SEQ_CNT	Sequence Count – 2 bytes, used to count the number of frames that have been transmitted in a sequence  not editable
OX_ID	Originator Exchange ID – 2 bytes, provides association of frames within specific exchanges originating at a particular port. It is assigned by the initiator, used to group related sequences.  supports raw edit of field values only
RX_ID	Responder Exchange ID – 2 bytes, provides the same function for the exchange responder that the OX_ID provides for the Exchange Originator, but assigned by a target node.  supports raw edit of field values only
PARM	For Link Control frames, indicates the specific type of Link control frame. 4 bytes, used mostly as a "relative offset" in sequences. For ACK frames, used to indicate how many frames are being acknowledged and whether all frames with lower SEQ_CNT values have been acknowledged.  supports raw edit of field values only

Credits	Specifies the initial number of frames that can be sent on the link prior to receiving an R_RDY reply, range of 1 to 65535. default of 16.  Important: This value must be set before a Fabric & Name Server login is attempted
Save All	Saves all changes made to the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Error Alarm

(Specifically for Fibre Channel SAN testing)

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the "Send Error" button is pressed or when a rate is selected. The following types are available: • Code - Generates line code errors • Bit Error - Generates bit errors in the payload • CRC - Generates an invalid CRC error

Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • 1E-<x> - X is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1×10^{-x} (The smaller the exponential the higher the error rate.) • User Defined – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1×10^{-x} but more exact choices are available such as 2.6×10^{-4} or 7.1×10^{-3}
Alarm Generated	Selects an alarm to be transmitted. Once selected the system begins sending the alarm condition. Select one of the following: • LOS - Transmits a loss of signal

Config - Prim Seq

(Specifically for Fibre Channel SAN testing)

Supports the generation of Primitive Sequences including:

- **Send NOS** - Non-operational Ordered Set: K28.5 D21.2 D31.5 D5.2
- **Send LR** - Link Response Ordered Set: K28.5 D9.2 D31.5 D9.2
- **Send LRR** - Link Response Reset Ordered Set: K28.5 D21.1 D31.5 D9.2
- **Send OLS**- Off Line Ordered Set: K28.5 D21.1 D10.4 D21.1

Select the option and then the duration:

- **Selectable Duration:** Supports the generation of **1 to 10** consecutive sequences or **continuous** sequence generation.

 If **Continuous** sequence generation is selected, then select the option again to turn off the selected Primitive Sequence generation

Perf Test

Perf Test - Conf (Test Button)

(Specifically for Fibre Channel SAN testing on the Packet tab)

The Performance Test screen allows you perform RFC-2544 standard based tests.

- Use this section to test [RFC-2544](#).

RFC Tests

RFC 2544 Tests - Screen Functions and Descriptions Overview

The RFC 2544 Tests screen contains the following functions:

- [Conf](#)
- [Thru Put](#)
- [Frame Loss](#)
- [B2B Burst](#)
- Graph

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description
Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544, it will not appear in the Select Port window.
Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-86400 seconds. The default value is 60 seconds.
Stream ID	Allows the user to select one of the four streams for the RFC test.
Dest MAC Address	Reflects the destination MAC address for the selected Stream.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.  For Fibre Channel rates, this is the WWN Dest Address.
Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.

Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 16000.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
Automated Test Sequence	The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes. • Thruput/Latency checkbox and status field • Frame Loss checkbox and status field • B2B Burst checkbox and status field • Start/Stop Button • Test Status field



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)

- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.

Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.
Statistics Table	Reports the test results. The following statistics are displayed: Size - Indicates the transmitted test packet size. Rate - Reports the passing rate (percentage) for the specific packet size. TX Packets - Reports the number of packets transmitted in the stream for the frame. RX Packets - Reports the number of packets received by the test set. Latency Min/Max/Avg - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds.  If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.

Start/Stop Test	Starts and stops the Through Put test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select [Frame Loss Testing](#) for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.

BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.
Packet Size buttons	Determines which packet size results appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: Rate % - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. Transmit Frames - Reports the total number of frames transmitted. Receive Frames - Reports the total number of frames received.

	Loss % - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Back-To-Back Burst Test (B2B Burst)

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description

Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.  Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50, however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: Max Possible Number of Frames - The frame rate (resolution) used as the throughput rate.

	• Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 **Important:** The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

Results

Results - Screens and Functions

(Specifically for Fibre Channel SAN testing)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Frame count statistics.
- [Strm Rslt](#) - Displays the Stream specific statistics.
- [Event](#) - Displays a summary of error alarm activity.

- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.
- [Graph](#) - Displays a graphical representation of the error and alarm history.

Results - Scan

(Specifically for Fibre Channel SAN testing)

This function displays a list of received errors and alarms.

For **alarms**, the duration is reported as a count in seconds.

For **errors**, an error count is reported.

The message *No Errors or Alarms* appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors)

(Specifically for Fibre Channel SAN testing)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

Error Type	Description
Code	A Code error or Symbol error is detected in the line encoding
Oversized	A frame whose length is > 2144 bytes
Undersized	A frame whose length is < 28 bytes, with good FCS/CRC checksum
Invalid FCS	An error in the Frame Check Sequence (CRC checksum), and whose Frame length is $\geq$ 28 bytes
Alignment Error	An error in the frame's word alignment
EOFA	An error in the frame's EOFa (End Of Frame - Abort) primitive
EOF Error	A frame received that is missing an EOF (End Of Frame)
Disparity	An error in the frame's Ordered Set Disparity

Results - Alarm

(Specifically for Fibre Channel SAN testing)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.

Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

Error Type	Description
CP Power Loss	The Circuit Pack module experience a power loss fault during test
Paused	The test was manually paused by selecting the Pause button or by a SCPI script command
Power Hot	The received optical power level exceeded the laser's maximum input limit
Power Warm	The received optical power level is within 3 dBm of laser's maximum input limit
LOS	A Loss Of Signal alarm has occurred
Link Down	A Loss of Link State alarm occurred

Results - Count

(Specifically for Fibre Channel SAN testing)

The Count screen displays [Utilization](#) and [Packets](#) statistics by type and count.

To view total transmit and receive utilization statistics, select the **Utilization** button. The following statistics appear:

Desc column	Current / Min / Max / Avg columns

Total - TX BW	Displays the Current, Min, Max and Avg. Total %BW Transmitted
Total - TX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate transmitted
Total - TX FPS	Displays the Current, Min, Max and Avg. Total Frames Per Second rate transmitted
Total - RX BW	Displays the Current, Min, Max and Avg. Total %BW received
Total - RX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate received
Total - RX FPS	Displays the Current, Min, Max and Avg. Total Frames Per Second rate received

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Frames	Reports the total number of frames sent.
Received Frames	Reports the total number of frames received.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
R_RDYs Transmitted	Indicates the count of R_RDYs (Receiver Ready) transmitted
R_RDYs Received	Indicates the count of R_RDYs received

BB Credit Available	Indicates the amount of Buffer-to-Buffer credit that is currently available for sending frames to the far end device
R_RDY Credit Pending	Indicates the amount of credit (R_RDYs) currently pending for return to the far end device. The R_RDY counter keeps track of how many R_RDY primitives need to be transmitted based on how many frames were received. Credit is returned for frames that have a valid SOF and at least one word of data following the SOF, independent of the validity of the CRC.

Results - Strm Rslt (Stream Results)

(Specifically for Fibre Channel SAN testing)

The Stream Results screen displays the following statistics for the incoming stream:

Statistic	Description
Selected Stream Entry	Displays the stream's WWN source and WWN destination addresses.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW. Transmit Statistics: • Packets - Total number of Packets transmitted. • Bytes - Total number of Bytes transmitted. • BW - Percent of bandwidth currently being transmitted. Receive Statistics: • Packets - Total number of Packets received. • Bytes - Total number of Bytes received. • BW - Percent of bandwidth currently being received. • Loss - Current Packet Loss rate.

	 For loop backs with large latency, the Loss rate may show greater than 0 while the test stream generation is active, even if no packets are actually being lost (dropped). This is due to the real-time RX packet count being lower than the TX packet count, because of the latency. If no packets were lost during the test, then this value will drop to 0 when the test stream generation is turned off.
Pass/Fail Test	Provides User-Defined Acceptance Criteria:  Refer to Timed Test Using Acceptance Criteria • Accept Bit Errors - A user-specified threshold value for determining the acceptable bit error rate for a timed test. • Accept Loss Rate - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. • Pass/Fail - Test results are displayed as "Running" when the test is active (Elapsed Time is incrementing); and displayed as "PASS" or "FAIL" when the test ends, depending on whether or not specified failure criteria was attained.
Errors	Displays Error statistic as Counts, Errored Seconds, Average error rate and Current error rate, for the following Error Types: • Bit Errors Received
Latency	Displays Minimum, Average, and Maximum latency (delay) measurements, in microseconds (µs). A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated (real-time) as new latency measurements are logged.  If the TX and RX are looped on itself with a short patch cable, the latency may appear as 0 µs.

Alarms	Displays Alarm statistics as total number of Seconds the alarm was active during the test, for the following Alarm type: • Pattern Sync

Results - Event

(Specifically for Fibre Channel SAN testing)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Large LEDs

(Specifically for Fibre Channel SAN testing)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.

White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs for Fibre Channel, see [Fibre Channel LEDs](#).

Results - Graph

(Specifically for Fibre Channel SAN testing)

This function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Test

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

 To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed

	in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function

	Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Selecting a Dual Enet Port

The Dual Enet tab allows users to configure and test 2 independent datacom ports, using optical SFP and/or electrical RJ-45 interfaces.

- Two LC full-duplex optical SFP ports are dedicated for use by the two Dual Enet ports for testing 100Mbps and 1Gbps Ethernet, as well as 1Gbps, 2Gbps and 4 Gbps Fibre Channel.
- Two electrical RJ-45 ports are also dedicated for use by the two Dual Enet ports for testing 10/100/1000 Mbps Ethernet.

 Each port provides up to 32 independently configurable traffic generation and analysis Ethernet test streams.

To select a port to configure or monitor:

1. From the **Dual Enet** tab, select the **Port <#>** button.
2. Choose the desired port.



Any subsequent configurations made will be applied to the selected port. For example, if Port 1 is selected then all configurations, testing, and results pertain to Port 1.

3. From the [Interface menu](#), select the desired Interface rate to test.



If Port 1 or Port 2 is configured for either 1Gbps or 2Gbps Fibre Channel, the other Port can be also configured to test either 1Gbps or 2Gbps Fibre Channel.



If Port 1 or Port 2 is configured for 4Gbps Fibre Channel, the other Port will also be configured to test 4Gbps Fibre Channel.

LED Quick Status Area

(Specifically for Fibre Channel SAN testing)

When **Fibre Channel** is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) screen.



Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

Indicator, LED or Control	Description
Laser On/Laser Off Control	Pressing the button will toggle the status of the laser. If no SFP module is installed, the button will state "No Laser".

RX:	Displays the received optical power in dBm.
TX:	Indicates current transmit laser wavelength.
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
Test Paused	If red, indicates that the current test has been paused .
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
LOS	Loss of Signal. When red, indicates that a valid signal is not being received. This is an alarm LED.
Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code	Indicates a line code error was detected on the incoming frame.
CRC	Indicates a CRC error was detected on the incoming frame.
Pat Sync	Indicates a loss of pattern synchronization in at least one of the 4 streams. This is an alarm LED.
BIT ERR	Indicates a detected BIT error in at least one of the 4 streams.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with white text	The specific function is active and OK.
Red with white text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with white text	No activity from this specific function.

Fibre Channel - Specific Tasks

Fibre Channel Specific Tasks Overview

(Specifically for Fibre Channel SAN testing)

This section includes how to setup and use Fibre Channel procedures, for the configured Fibre Channel SAN Interfaces.

 All Fibre Channel interface rates are licensable test options. Please contact [Tech Support](#), or your DLI sales representative, to enable the Fibre Channel test options on your NIC unit.

 **1G, 2G, and 4G** Fibre Channel rates are supported on the MSA circuit pack's [Dual Enet](#) tab.

 **8.5G and 10.52G** Fibre Channel, as well as **OTU1f (11.270G)** and **OTU2f (11.317G) - 10G Fibre Channel over OTU-2** are supported on the MSA circuit pack's [Packet](#) tab.

The following procedure demonstrates how to interconnect the NIC with a Fibre Channel SAN switch, and establish test-stream data connections.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

- Select [Connect \(without Server login\) procedure](#) to establish connection that does not require a Fabric and Name Server login

- Select [Fabric and Name Server login process](#) to establish connection that requires a Fabric and Name Server login
- Select [Analyzing Fibre Channel Test Results](#) to view statistics for any errors or alarms that occurred
- Select [Timed Test Using Acceptance Criteria](#) to configure user-defined acceptance criteria for Pass/Fail results
- [Saving and Printing Statistics and Port Settings](#)

Connect (without Server login) procedure

(Specifically for Fibre Channel SAN testing)

This procedure demonstrates how to interconnect the NIC with a Fibre Channel SAN switch.

This procedure will establish a connection that does not require a Fabric and Name Server login.

1. Verify the optical SFP/XFP module being used supports the selected Fibre Channel data rate, and the wavelength is compatible SAN equipment being tested.
2. Configure the Fibre Channel test interface.

 1G, 2G and 4G Fibre Channel rates are supported by the [Dual Enet tab](#).

 8G, 10G and 10G over OTU-2 Fibre Channel rates are supported by the [Packet tab](#).

3. Turn the TX Laser on and verify both transmit and receive optical power levels are within specification. Then interconnect the transmit and receive NIC test port interfaces with the SAN equipment.
4. The NIC test port and the SAN equipment should quickly establish a valid Link State. The "Active" link state status can be observed under the Status section in the Config > Set screen, and the Link State LED should be green.
5. Select the stream from the stream profile table to open the [Traffic Stream Profile](#) dialog box, from which the stream parameters need to be configured.

Traffic Stream Profile #1

Stream ID #1

☐ WWN SRC ADDRESS ee-ee-ee-ee-ee-ee-ee-ee

☐ WWN DEST ADDRESS ff-ff-ff-ff-ff-ff-ff-ff

Class of Service — 3

☐ Frame Length — 68

☐ Rate — 20.00 %

☐ Payload — PRBS 31

☐ SOF — SOFi3 ☐ EOF — EOFn

Push Button to Edit

R_CTL: 00	D_ID: 00 00 01
CS_CTL: 05	S_ID: 01 00 01
TYPE: 01	F_CTL: 29 00 00
SEQ_ID: 00	DF_CTL: 00
	SEQ_CNT: 00 00
OX_ID: 00 19	RX_ID: FF FF
PARM: 00 00 00 00	

Buffer To Buffer

☐ Credits — 56

7. Configure the desired **Data Rate**, **Frame Length**, and **Payload** test pattern.
8. Select the **Save All** button to save the entered test stream parameters, then select the **Exit** button.
9. The Status menu field will display the following
 - The Fabric Login status will display “Fabric: Not Logged in”
 - The Name Server Login status will display “Named Server: Not Logged in”
10. Select the On/Off button labelled **1** to the left of the stream to turn on stream traffic generation.
11. Fibre Channel verification statistics may now be observed.

Fabric and Name Server login procedure

(Specifically for Fibre Channel SAN testing)

This procedure demonstrates how to interconnect the NIC with a Fibre Channel SAN switch.

This procedure will establish a connection that requires a Fabric and Name Server login.

1. Verify the optical SFP/XFP module being used supports the selected Fibre Channel data rate, and the wavelength is compatible SAN equipment being tested.
2. Configure the Fibre Channel test interface.

 1G, 2G and 4G Fibre Channel rates are supported by the [Dual Enet tab](#).

 8G, 10G and 10G over OTU-2 Fibre Channel rates are supported by the [Packet tab](#).

3. Turn the TX Laser on and verify both transmit and receive optical power levels are within specification. Then interconnect the transmit and receive NIC test port interfaces with the SAN equipment.
4. The NIC test port and the SAN equipment should quickly establish a valid Link State. The "Active" link state status can be observed under the Status section in the Config > Set screen, and the Link State LED should be green.
5. Select the stream from the stream profile table to open the [Traffic Stream Profile](#) dialog box, from which the stream parameters need to be configured.

Traffic Stream Profile #1

Stream ID #1

☐ WWN SRC ADDRESS ee-ee-ee-ee-ee-ee-ee-ee

☐ WWN DEST ADDRESS ff-ff-ff-ff-ff-ff-ff-ff

Class of Service — 3

☐ Frame Length — 68

☐ Rate — 20.00 %

☐ Payload — PRBS 31

☐ SOF — SOFi3 ☐ EOF — EOFn

Push Button to Edit

R_CTL: 00	D_ID: 00 00 01
CS_CTL: 05	S_ID: 01 00 01
TYPE: 01	F_CTL: 29 00 00
SEQ_ID: 00	DF_CTL: 00
	SEQ_CNT: 00 00
OX_ID: 00 19	RX_ID: FF FF
PARM: 00 00 00 00	

Buffer To Buffer

☐ Credits — 56

7. Enter the correct **WWN Source and Destination addresses**, Destination ID (**D_ID**), and Source ID (**S_ID**) addresses. These will be network dependent.
8. Also, configure the correct Buffer to Buffer **Credits**, **Data Rate**, **Frame Length**, and **Payload** test pattern.
9. Select the **Save All** button to save the entered test stream parameters, then select the **Exit** button.
10. Verify the test stream is **TX** is set to **Off** before continuing. The required Fabric and Name Server login options are not available while the test stream is enabled.
11. Select the **Fabric Login** button to perform a Fabric Login.
 - The Fabric Login status will display “Waiting for Response” while it attempts to login to the SAN equipment
 - The Fabric Login status will display “Logged In” when the process completes
12. Select the **Name Server Login** button to perform a Name Server Login.
 - The Name Server Login status will display “Waiting for Response” while it attempts to login to the SAN equipment

- The Name Server Login status will display “Logged In” when the process completes
13. At this point the Fibre Channel test interface will have a valid Fabric and Name Server login with the SAN equipment, and the test stream can be enabled.
 14. Select the On/Off button labelled **1** to the left of the stream to turn on stream traffic generation.
 15. Fibre Channel verification statistics may now be observed.

Analyzing Fibre Channel Test Results

(Specifically for Fibre Channel SAN testing)

Error and Alarm activity and other frame statistics can be viewed using the various screens.

- The **Config > Set** screen has a **Count Statistics Table** that displays a summary view of transmitted and received Frame counts and Byte counts, as well as the transmitted and received bandwidth
- The [Results](#) screens display all error and alarm counts and history, as well as transmitted and received Frame statistics
- The [System > All Ether Ports](#) screen displays a summary view for all of the Ethernet and Fiber Channel test ports in the instrument (depending on the mode of the test port)
- The [System > All Test Status](#) screen displays a summary LED view for all of the protocol processors including all HDEnet ports in the instrument
- The status indicators and LEDs are displayed in the [LED Quick Status Area](#) and in the [Large LED](#) screen.

Timed Test - Using Acceptance Criteria

(Specifically for Fibre Channel SAN testing)

The NIC unit has the capability to run a timed test (a test with Fibre Channel enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

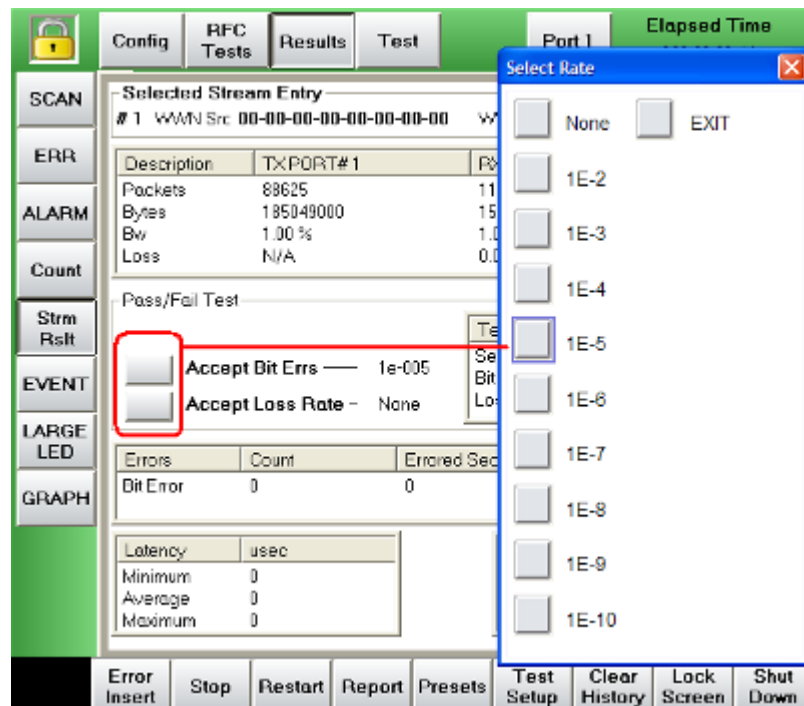
To Set Up the Test

1. Set up the Fibre Channel port on which the test will be initiated. This includes the Interface, stream parameters, etc.
2. Enable the test stream.
3. Under the **Results** > **Strm Rslt** tab, configure the [Pass/Fail Test](#) acceptance criteria options. These include **Acceptable Bit Error** rate, and **Acceptable Loss Rate**.
4. Under the **Test** tab, select the desired **Duration** for the test.



If the "**Continuous**" duration is used, the test will continue to operate until the **Stop** button is pressed.

5. **Restart** the port that will be used for the timed test using the **Restart** button at the bottom of the screen.
6. When the time duration of the test is reached, the streams will automatically stop counting received packets and the **Pass/Fail** acceptance results are displayed under the **Results** > **Strm Rslt** tab.



User-Defined Acceptance Criteria:

- **Accept Bit Errors** - A user-specified threshold value for determining the acceptable bit error rate for a timed test.
- **Accept Loss Rate** - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test.

Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:

- From Destination Printer:
 - ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.
- From Destination File:
 - ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.



The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

- ▶ Enter a file name and select **OK**.



Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

- ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.
4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.
 5. Select **OK**.

E1 Tab

E1 Overview

When the NIC's PDH protocol processor is configured for E1 mode, the PDH circuit pack supports 2 independent E1 ports.

- ▶The E1 #1 tab is used to test the E1 #1 port (75 ohm Unbalanced - BNC)
- ▶The E1 #2 tab is used to test the E1 #2 port (100/120 ohm Balanced - Bantam)

The E1 online help is divided into the following sections:

- [E1 Screen Functions and Descriptions](#)
- [E1 Specific Tasks](#)
- E1 Technical Specifications

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Functions and Descriptions

E1 Screen Functions and Descriptions Overview

The following function screens are available through the E1 protocol processor tab.

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [Performance Monitoring](#)
- [LEDs](#)

Transmit

Transmit Screens and Functions

This function allows you to define the parameters used in E1 Transmit operations.

The following functions are available through the E1 Transmit screen.

- [SET 1](#)
- [OH](#)
- [ERROR / ALARM](#)

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the E1 line interface and the E1 protocol processor to match the E1 signal used in your test environment.

The E1 Transmit Settings screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Termination	Configures the transmit port connector's cable impedance. • E1 #1 (BNC connector) only supports Unbalanced 75 ohms. • E1#2 (Bantam connector) supports Balanced 100 ohms or Balanced 120 ohms.
Signal Level	The transmit strength of the E1 signal level is set to 0 dB Cable Loss.

Line Code	Selects the type of signal coding transmitted by the E1 protocol processor. The following options are available: • AMI: Alternate Mark Inversion coding • HDB3: High Density Bipolar 3 Zero Substitution coding
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. • The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 • The default value of 0 (zero) equals Off.
Clock Reference	Determines the timing source for the E1 transmit signal. The following options are available: • Internal: Derives the transmit data's timing source from the system's internal clock.  To drop an E1 from M13 and out the E3 Line In, then the clock must be set to Internal. • Recovered E1 #1: Derives the transmit data's timing source from the E1 #1's RX recover clock. • Recovered E1 #2: Derives the transmit data's timing source from the E1 #2's RX recover clock. • BITS/SETS: Derives the transmit's data timing source from the BITS/SETS input ports. • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but a BITS clocking is not available then this function defaults to Internal. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is

	selected, but a SETS clocking is not available then this function defaults to Internal.
Loopback	Selects the type of loopback code transmitted. The options include: • None: The loopback function is not active. • Payload: Transmits the received payload in a frame formatted by the transmitter using either the internal or recovered clock. • Line: Transmits the entire received signal using the recovered clock.
Framing	Configures the framing format used for the E1 transmit signal. The following options are available: • Unframed • <u>PCM30</u> • <u>PCM30CRC</u> • <u>PCM31</u>

	• PCM31CRC
Mapping	Mapping options include: Bulk Filled or Fractional E1.  ATM will appear as the selected Mapping, when ATM is configured for E1.
Payload Pattern	Selects the type of payload pattern that is transmitted by the system. The following options are available: PRBS 6, PRBS 6 Inv, PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, All Ones, All Zeros, User Defined (32-bit entry). Note: This option is only available if Mapping is set to Bulk Filled.
Fractional E1	Configures the system for Fractional E1 testing.
Background 64K Pattern	A customized DS0 pattern can be entered in hex, decimal, or bin format.

Transmit - Overhead (OH)

This function displays the CAS Signaling Bits, Spare Bits, E Bits, and X Bits that are transmitted for a selected E1. These bytes can be edited to determine if the E1 facility can detect problems due to any of these types of overhead errors.

When a bit button is selected, a key pad appears enabling you to edit the bytes using a Hex, Decimal, or Bin format.

The following table describes the bits available in each Overhead section.

Overhead Bit Type	Description
CAS Signaling Bits	Allows you to select: • CH1 through 30 • Global CAS Bits: None or user defined.
Spare Bits	Allows you to select: • Global Spare Bits: Allows you to select a specific spare bit (4 through 8) of an eight-bit sequence. Select None to specify no bits. Selecting None will change the Global Spare Bits field to all zeros. • Bit for 8 bit sequence: None or bit 4 through 8. • 8 bit sequence: Allows you to select a user pattern for an E1 spare overhead bit.
E Bits	Allows you to select an E Bit up to two bits (00).
X Bits	Allows you to select an X Bit up to three bits (000).

Transmit - ERROR ALARM

This function allows you to insert errors and alarms.

The following options are available on the E1 ERROR ALARM screen.

Option	Description

Error to Insert	Inserts an error that is transmitted by the E1 protocol processor. The options available include: • None: Turns off E1 error insertion. • BPV Error: Transmits Bipolar Violation errors which result in a line code violation event for an AMI-coded signal, the occurrence of received excessive zeros, or a bipolar violation. • Bit: Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. • Frame: Results in a severely errored framing event, which occurs when two or more framing bit pattern errors within a 3-ms period. This type of error is not available if the E1 protocol processor is configured for Unframed framing format. • CRC: Results in a CRC error event, which occurs when a received CRC code that is not identical to the corresponding locally calculated code. This option is available only when the E1 protocol processor is configured for CRC framing format. • FEBE: Results in a Far End Block Error, which occurs when a bit error has been detected at the Physical layer of the far end of the link. This option is available only when the E1 protocol processor is configured for CRC framing format.
Error Insert Rate	Sets the insertion rate for the selected error type. This setting is not available if Error to Insert is set to None. The following options are available for this command. • Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • 1e-X, where X is a value from 3 through 5.

	• User Defined: Allows you to enter and save a customized error insertion rate.
Alarm Generated	Generates a specific alarm on the transmit side of the E1 protocol process. The following options are available: LOS, LOF, AIS, RAI, RMFAI, CASMFL and None.

Receive

Receive Screens and Functions

This function allows you to configure settings for the parameters used in the E1 Receive operations.

The following functions are available through the E1 Receive screen.

- [SET 1](#)
- [OH](#)
- [SIG](#)

Receive - Settings 1 (SET 1)

This screen allows you to configure your unit's Receive parameters for your E1 test environment.

The E1 Receive SET1 screen contains the following parameters:

Parameter	Descriptions

Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Termination Type	Sets the termination point of the E1 receive signal. The following options are available: • Monitor: Sets the receive sensitivity of the E1 Line interface. Use this setting if the E1 line connects to a monitor jack. • Terminated: Sets the receive sensitivity of the E1 Line interface. Use this setting if the E1 line terminates at the system's Line Interface. • Bridged: Allows the E1 receive signal to be connected to both the E1 interface and the E1 protocol processor.
Framing	Configures the framing format used for the E1 Receive signal. The following options are available: • Unframed: Configures the system to receive an E1 signal using an unframed format. Note: For an E1 unframed, all-zeros user pattern, there is an insufficient ones density to detect a signal unless HDB3 encoding is used. Therefore, if E1 is receiving an unframed, all-zeros pattern in AMI encoding from the line interface, an LOS is reported. If E1 is receiving an unframed all-zeros pattern from an E3 or SDH drop, an LOS is suppressed; however, various Framing LEDs will not function correctly. • PCM30 • PCM30CRC • PCM31 • PCM31CRC

Mapping	Displays the expected E1 Mapping, and allows the user to change the Mapping to Bulk Filled or Fractional E1.  ATM Direct and ATM PLCP Mapping options will appear if the ATM hardware is available, and if the ATM's Physical Mapping is set to E1 ATM Direct or E1 ATM PLCP.
Payload Expected	Selects the payload pattern expected to be received by the system. The following options are available: PRBS 6, PRBS 6 Inv, PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
Fractional E1	Configures the system for Fractional E1 testing.
CODEC	Select A-law, Mu-law, or True A-law.
64K Channel Dropped	Select the DS0 channel to be dropped, 1-31.
Auto Configure	The Auto Configuration button allows you to quickly configure the unit to match the parameters of an incoming signal. This function configures the processor for the same mapping, framing, line coding, and pattern characteristics as the incoming signal, without having to manually configure the processor.
Speaker On/Off	This button that turns the speaker on and off.
Volume	Controls the speaker volume level. Click High to increase volume. Click Low to decrease volume.

Receive - Overhead (OH)

This function displays the overhead bytes for specific Channel Associated Signalling bytes, spare bits, E-Bits, and X-Bits on the incoming E1 signal. This is a read-only function.

The "Channel Data Bits" portion of the screen displays the received data bits on the [Fractional E1](#) channel.

Receive - Signal Status (SIG)

This function displays the electrical power, line frequency, and line frequency offset of the incoming E1 signal, for the selected E1 port.

The following information is displayed on the E1 Receive SIG screen.

- Peak Positive Pulse Voltage
- Peak Negative Pulse Voltage
- Power in dBm
- Power in dBdSX
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm
- Bit Slips

Results

Results Screens and Functions

The Results function allows you to view E1 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the E1 Results screen.

- [SCAN](#)
- [ERR](#)
- [ALARM](#)
- [EVENT](#)
- [LARGE LED](#)

- [GRAPH](#)

Results - SCAN

The SCAN function provides a list of received errors and alarms for the E1 protocol processor. The duration or count of each event also appears. This function is effective in identifying a general area to investigate when an error or alarm is detected.

When no problems are detected, "No Errors or Alarms" is displayed.

Results - Errors (ERR)

This function reports statistical information on errors including the error count, average error rate, and current error rate.

The following errors are displayed on the E1 Results ERR screen:

- BIT
- BPV
- Frame
- CRC
- FEBE

Results - ALARM

This function displays how long E1 alarms were detected by the system. Results for the following alarms display.

- AIS
- LOF
- LOS
- PAT Sync
- RAI

- RMFAI
- CASMFL

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - LARGE LEDs

This button displays the E1 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the E1 protocol processor, see [E1 LEDs](#).

Results - Graph

The Graph screen allows you to view error and alarm results for the protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of alarms and errors.

To use the Results Graph function, see [Using Graphs](#).

Test

Test Screens and Functions

(Specifically for PDH testing)

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.

Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function

	Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.

Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for PDH testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For E4 one frame duration is roughly 0.021 ms (21 μ s)
- ▶ For E3 one frame duration is roughly 0.045 ms (45 μ s)
- ▶ For E1 one frame duration is roughly 0.125 ms (125 μ s)
- ▶ For DS3 one frame duration is roughly 0.106 ms (106 μ s)

- ▶ For DS1 one frame duration is roughly 0.125 ms (125 μ s)

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.



For all **PDH** processors the Protection Switch Criteria is limited to: **Loss of Pattern Sync** and **Bit Errors**.

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 0.021 to 5.361 ms, and is entered using a keypad.
 - ▶ The range for E3 is 0.045 to 11.397 ms, and is entered using a keypad.
 - ▶ The range for E1 is 0.125 to 511.875 ms, and is entered using a keypad.
 - ▶ The range for DS3 is 0.106 to 27.133 ms, and is entered using a keypad.
 - ▶ The range for DS1 is 0.125 ms to 511.875 ms, and is entered using a keypad.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E1 is 1 to 4095 frames, and is entered using a keypad.
 - ▶ The range for DS3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for DS1 is 1 to 4095 frames, and is entered using a keypad.
- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

► **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

► **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.

► **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Protection Switch Frame** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5).
- **History Recent Frames**: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
E4	0.021 ms (21 µs)	255 frames (5.361 ms)
E3	0.045 ms (45 µs)	255 frames (11.397 ms)
E1	0.125 ms (125 µs)	4095 frames (511.875 ms)

DS3	0.106 ms (106 μ s)	255 frames (27.133 ms)
DS1	0.125 ms (125 μ s)	4095 frames (511.875 ms)

Test - RTD (Round-Trip Delay)

(Specifically for PDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State):** Starts and stops round-trip delay mode.
 - ▶ **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in milliseconds. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.
 - ▶ **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network.
 - ▶ **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
 - ▶ The **Current** column displays the most recent round trip measurement.
 - ▶ The **Minimum** column displays the fastest round trip measurement.
 - ▶ The **Maximum** column displays the slowest round trip measurement

Performance Monitoring

Performance Monitoring Screens and Functions

The E1 Performance Monitoring screen includes the following functions:

- [FAS](#)
- [CRC](#)
- [FEBE](#)
- [BIT](#)

Perf Monitor - FAS

This provides a detailed breakdown for Frame Alignment Signal errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2100 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Perf Monitor - CRC

This provides a detailed breakdown for CRC errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.

- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2100 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Perf Monitor - FEBE

This provides a detailed breakdown for FEBE errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.821 Allocation: Select an allocation percentage from 0 to 100.

- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- G.826 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- M.2100 Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

Perf Monitor - BIT

This provides a detailed breakdown for BIT errors detected and logged by the E1 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

G.826

- Errored Block (EB) count
- Background Block Error (BBE) by count, rate percentage, and objective percentage.
- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.

- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass, Uncertain, or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Set monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

E1 LED Quick Status Area

When the E1 protocol processor is selected, the following LEDs and status indicators are displayed in the LED Quick Status Area of the touch screen. They are also located under Results [Large LEDs](#).

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX / RX	Displays the Transmit and Receive frequency.
E/A	Displays the error and/or alarm generated. If both an error and alarm is being generated concurrently, a slash (/) will separate the error and alarm. If neither are generated, "None" will display
CLK:	An alarm LED that displays the type of transmit clock specified in the setting. Clock settings include: SETS, Internal, or RCVD.
LOS	Loss of Signal. An alarm LED indicating a Loss of Signal status was detected.
BPV	Bipolar Violation. An error LED indicating two consecutive pulses of the same polarity occurred in the same digital bit stream. In E1 mode, BPV errors are only generated in the payload.
LOF	Loss of Frame. An alarm LED indicating an alarm signal was generated due to a frame alignment problem.
AIS	Alarm Indication Signal. An alarm LED indicating an Alarm Indication Signal occurred on the line layer.
FRAME ERR	An error LED indicating the E1 protocol processor has received framing errors.
CRC	Cyclic Redundancy Check. An error LED indicating the CRC data at the transmission end did not match the CRC data evaluated at the receiving end.
CASMFL	Channel Associated Signaling Multiframe Loss. Indicates that four zeros at the start of Time Slot 16 in frame 0 cannot be found.
RAI	Remote Alarm Indication. An alarm error indicating to the upstream circuit that a failure condition has been declared downstream.
RMFAI	Remote Multiframe Alarm Indication. This is an alarm LED.
FEBE	Far End Block Error. An error LED indicating a bit error has occurred in the physical layer at the far end of the link.
PAT Sync	An alarm LED indicating a loss of pattern synchronization.

BIT ERR	Bit Error. An error LED indicating a bit error was detected in the payload.

E1 Specific Tasks

E1 Specific Tasks Overview

This section covers procedures that are specific to the operation of the E1 protocol processor. For a list of general tasks, which apply to all protocol processors, see [Common Tasks](#) located in the Getting Started section.

- [Add/Drop an E1 out of an E3 Signal](#)
- [Add/Drop an E1 out of a DS3 Signal](#)
- [Add/Drop an E1 Signal from an SDH Signal](#)
- [Change E1 Transmit Overhead](#)
- [Configure Fractional E1 Testing](#)
- E1 Technical Specifications

Add/Drop an E1 out of an E3 Signal

You are able to add/drop multiplex an E1 signal in to and out of an E3 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-16) to drop the signal into.

1. Select [Test Setup](#) from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default E1/E3**.
 - If the E1/E3 options are preceded by SONET and SDH, then choose either **SONET/E1/E3** or **SDH/E1/E3**, depending on the desired protocol mode.
3. Select [Presets](#) from the [Common Function Buttons](#).
4. Select the **Interface** button and choose **E3** from the Select from Interface list.
5. Select the **Configuration** button and choose either one of the following:
 - **E1 #1 A/D** or **E1 #2 A/D**: The E1 Add/Drop setting multiplexes the E1 signal generated by the E1#1 (or E1#2) processor up to the E3 processor, and transmits it out the E3 transmit interface port (along with other background E1 signals generated by the E3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is

demultiplexed out of the received E3 signal and dropped down to the E1 #1 (or E1#2) processor for Error and Alarm analysis. The selected E1 port's TX/RX interfaces are not used in this configuration.

- **E1 #1 A/D LI** or **E1 #2 A/D LI**: The E1 Line Interface (LI) Add/Drop setting multiplexes the received E1#1 (or E1#2) signal up to the E3 processor, and transmits it out the E3 transmit interface port (along with other background E1 signals generated by the E3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received E3 signal and dropped down to the E1 processor and transmitted out to the selected E1 Interface port.

6. Select the **Apply** button.



Both E1#1 and E1#2 signals can simultaneously be added to the E3 interface by pressing Presets and selecting E3 from the Interface menu again, and then choose the other E1 processor from the Configuration menu.

The unit is configured to drop an E1 out of the E3 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **E3**.
2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. If you dropped the E1 #1 signal, select **E1 #1 Channel Inserted** and select the channel in which you want to drop the E1 signal.
5. If you dropped the E1 #2 signal, select **E1 #2 Channel Inserted** and select the channel in which you want to drop the E1 signal.
6. Select **E1 Background Frame** and select the background frame for the specified channel.
7. Select **E1 Background Pattern**. Select a pattern to fill the background E1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast E1 #1 (and/or Broadcast E1 #2).

- Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels.
8. Select the **E1** tab being dropped.
 9. Select **Transmit** and **Set 1**.
 10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected E3 channel.
 11. Select **Receive** and **Set 1**.
 12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
 13. Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

1. Select the **Results** screen from the specified E1 #1 (or E1#2) processor tab to view the received error and alarm activity.
2. Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.
3. If an LOF alarm is being detected, then the E3 processor is likely in an errored state.

Add/Drop an E1 out of an DS3 Signal

You are able to add/drop multiplex an E1 signal in to and out of a DS3 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-21) to drop the signal into.

1. Select [Test Setup](#) from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default E1/DS3**.
 - If the E1/DS3 options are preceded by SONET and SDH, then choose either **SONET/E1/DS3** or **SDH/E1/DS3**, depending on the desired protocol mode.

3. Select [Presets](#) from the [Common Function Buttons](#).
4. Select the **Interface** button and choose **DS3** from the Select from Interface list.
5. Select the **Configuration** button and choose either one of the following:
 - **E1 #1 A/D** or **E1 #2 A/D**: The E1 Add/Drop setting multiplexes the E1 signal generated by the E1#1 (or E1#2) processor up to the DS3 processor, and transmits it out the DS3 transmit interface port (along with other background E1 signals generated by the DS3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the E1 #1 (or E1#2) processor for Error and Alarm analysis. The selected E1 port's TX/RX interfaces are not used in this configuration.
 - **E1 #1 A/D LI** or **E1 #2 A/D LI**: The E1 Line Interface (LI) Add/Drop setting multiplexes the received E1#1 (or E1#2) signal up to the DS3 processor, and transmits it out the DS3 transmit interface port (along with other background E1 signals generated by the DS3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received DS3 signal and dropped down to the E1 processor and transmitted out to the selected E1 Interface port.
6. Select the **Apply** button.



Both E1#1 and E1#2 signals can simultaneously be added to the DS3 interface by pressing Presets and selecting DS3 from the Interface menu again, and then choose the other E1 processor from the Configuration menu.

The unit is configured to drop an E1 out of the DS3 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **DS3**.
2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.

4. If you dropped the E1 #1 signal, select **E1 #1 Channel Inserted** and select the channel in which you want to drop the E1 signal.
5. If you dropped the E1 #2 signal, select **E1 #2 Channel Inserted** and select the channel in which you want to drop the E1 signal.
6. Select **E1 Background Frame** and select the background frame for the specified channel.
7. Select **E1 Background Pattern**. Select a pattern to fill the background E1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast E1 #1 (and/or Broadcast E1 #2).
 - Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels.
8. Select the **E1** tab being dropped.
9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected DS3 channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

1. Select the **Results** screen from the specified E1 #1 (or E1#2) processor tab to view the received error and alarm activity.
2. Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.
3. If an LOF alarm is being detected, then the DS3 processor is likely in an errored state.

Add/Drop an E1 Signal from an SDH Signal

1. Select **Presets**, from the Common Function buttons.

2. Select **Interface** and choose the desired SDH interface (such as **STM-1**) from the Select Interface list.
3. Select the **Configuration** button and choose either one of the following from the Select To Configuration list:
 - **E1 #1 A/D** or **E1 #2 A/D**: The E1 Add/Drop setting multiplexes the E1 signal generated by the E1#1 (or E1#2) processor up to the SDH processor, and transmits it out the SDH transmit interface port (along with other background E1 signals generated by the SDH processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received SDH signal and dropped down to the E1 #1 (or E1#2) processor for Error and Alarm analysis. The selected E1 port's TX/RX interfaces are not used in this configuration.
 - **E1 #1 A/D LI** or **E1 #2 A/D LI**: The E1 Line Interface (LI) Add/Drop setting multiplexes the received E1#1 (or E1#2) signal up to the SDH processor, and transmits it out the SDH transmit interface port (along with other background E1 signals generated by the SDH processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received SDH signal and dropped down to the E1 processor and transmitted out to the selected E1 Interface port.
4. Select the **Apply** button.

The unit is configured to drop an E1 out of the SDH signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **SDH**.
2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. If you dropped the E1 #1 signal, select **E1 #1 Channel Inserted** and select the channel in which you want to drop the E1 signal.
5. If you dropped the E1 #2 signal, select **E1 #2 Channel Inserted** and select the channel in which you want to drop the E1 signal.

6. Select **E1 Background Frame** and select the background frame for the specified channel.
7. Select **E1 Background Pattern**. Select a pattern to fill the background E1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast E1 #1 (and/or Broadcast E1 #2).
 - Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels.
8. Select the **E1** tab being dropped.
9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected SDH channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

1. Select the **Results** screen from the specified E1 #1 (or E1#2) processor tab to view the received error and alarm activity.
2. Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.
3. If an LOF alarm is being detected, then the SDH processor is likely in an errored state.

Change E1 Transmit Overhead

The Transmit Overhead (OH) function allows you to stress a E1 network by directly editing overhead bits to simulate errors, alarms, and other stress conditions. For the E1 protocol processor, the following overhead bits can be edited:

- **CAS Signaling Bits:** If the framing is set to 30 channels ([PCM30](#) or [PCM30CRC](#)), the CAS byte contains ABCD bits for 30 channels, at four bits per channel.
- **Spare Bits:** Contain odd-numbered bits in bits four to eight in the FAS channel (Timeslot 0). Spare bits can be set to a single five-bit value for all bits. Additionally, one of the five bits can be a separate 4,000 bit per second channel with an eight bit sequence specified the channel.
- **E-Bits:** These are Far-End CRC (block) errors. There are two bits per multiframe, and one per super multiframe. If a FEBC is generated, its value will override the value specified for the E-Bit.
- **X-Bits:** These are bits 5, 7, and 8 of the CAS channel (Timeslot 16) in the first frame of the multiframe. X-Bits are only displayed when framing is set for 30 channels (PCM30 or PCM30CRC) and can only be entered on the Transmit side.

A specific slot can be selected, and its bytes can be changed for transmission out of the system. By altering the OH bytes, this allows other receiving equipment to detect and, if necessary, react to these changes.

To change Overhead bytes:

1. Select **E1**.
2. Select **Transmit**.
3. Select **OH**.
4. Select **CAS**, **Spare Bit**, **E Bits**, or **X Bits**.

A keypad appears allowing the byte's pattern to be edited. The byte appears in binary notation by default. Use the keypad's 1 and 0 buttons to change the bit value. Bit values are changed from the least significant bit to the most significant bit (from right to left).

The byte can also appear in HEX or decimal notation. Select the **HEX** or **DEC** button on the keypad.



The bit value can also be erased from the keypad using the **Clear** button.

5. When editing is complete, select **OK** to save the new value. **Cancel** discards any changes made to the byte and restores the previous value.

Configure Fractional E1 Testing

Configuring the system for Fractional E1 testing enables you to bulk fill 0 to 31 DS0's in an E1 Transmit signal with a pattern. Additionally, you can specify an eight-bit pattern in background DS0's.

To configure for Fractional E1 testing:

1. Select **E1**.
2. Select **Transmit**.
3. Select the **SET 1** side tab.
4. Select [Mapping](#), and choose **Fractional E1** from the Mapping menu.
5. Select [Fractional E1](#). A Time Slot Assignment window appears.
6. To enable or disable the available Fractional E1 time slots, use the **Left** and **Right** arrow buttons to select which time slot(s) you want to enable; choose **1** to enable the selected time slot, and **0** to disable the selected time slot. When you are done, select **OK**.

► Every time slot that is Enabled (1) it will use the configured foreground Payload Pattern. Every time slot that is Disabled (1) it will use the configured Background 64K Pattern.

► When a time slot's 1 or 0 value is selected, the next available time slot (either to the left or right, depending on which way the black arrow is facing) will automatically become selected so you can continue to change from one time slot to the next, without having to use the left/right arrow buttons to advance to the next slot.

► To change the direction of the black arrow, simply press either the **Left** and **Right** arrow button.

► The maximum value is 32 bits (one bit for each time slot). However time slot **0** is reserved for framing, and cannot be enabled.

► When the [Framing](#) is set to **PCM30**, time slot **16** is also not available.

► To disable all of the enabled time slots at one time, press the **Disable All** button.

7. Select **Background 64K Pattern**. A keypad appears.
8. Use the keypad buttons to specify the 8-bit user defined background 64K pattern you wish to inject on the DS0 time slots that are disabled. The maximum value is eight bits. When you are done, select **OK**.

E3 Tab

E3 Overview

The E3 online help is divided into the following sections:

- [E3 Screen Functions and Descriptions](#)
- [E3 Specific Tasks](#)
- [E3/E4 Technical Specifications](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Functions and Descriptions

E3 Screen Functions and Descriptions Overview

The following function screens are available through the E3 protocol processor tab.

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [Performance Monitoring](#)
- [LEDs](#)

Transmit

E3 Transmit

This function allows you to define the parameters used in E3 Transmit operations.

The following functions are available through the E3 Transmit screen.

- [SET 1](#)
- [ERROR / ALARM](#)

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the E3 line interface and the E3 protocol processor to match the E3 signal used in your test environment.

The E3 Transmit Settings screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Clock	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. <u>BITS/SETS</u>: Derives the transmit's data timing source from the <u>BITS/SETS</u> input ports. • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but a BITS clocking is not available then this function defaults to Internal. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but a

	SETS clocking is not available then this function defaults to Internal.
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. • The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 • The default value of 0 (zero) equals Off.
Framing	Configures the framing format used for the E3 transmit signal. The following options are available: • Framed: Configures the system to transmit an E3 signal using a framed format. • Unframed: Configures the system to transmit an E3 signal using an unframed format. Note: This option is only available if Mapping is set to Bulk Filled.
Mapping	Displays the E3 Add/Drop Mapping, and allows the user to change the Mapping back to E3 Bulk Filled.  ATM Direct and ATM PLCP Mapping options will appear if the ATM hardware is available, and if the ATM's Physical Mapping is set to E3 ATM Direct or E3 ATM PLCP.  E1 Mapping option will appear if an E1 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.
Payload Pattern	Selects the type of payload pattern that is transmitted by the system. The following options are available: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, All Ones, All Zeros, User Defined (32-bit entry). Note: This option is only available if Mapping is set to Bulk Filled.

Pass Thru Mode	Select On to enable Pass Thru Mode. Select Off to disable Pass Thru Mode. Note: This option will be unavailable if Mapping is not set to E1.
E1 #1 Channel Inserted	Selects from Channels 1 through 16. Note: This option is only available if E3 is configured for E1 #1 A/D mapping.
E1 #2 Channel Inserted	Selects from Channels 1 through 16. Note: This option is only available if E3 is configured for E1 #2 A/D mapping.
E1 Background Frame	Select from Unframed, PCM30, PCM30CRC, PCM31 and PCM31CRC. Note: This option is only available if E3 is configured for E1 #1 and/or E1 #2 A/D mapping.
E1 Background Pattern	Select from a variety of available PRBS patterns, as well as a 32-bit User Defined pattern, and Broadcast E1 #1, and/or Broadcast E1 #2. Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels. Note: This option is only available if E3 is configured for E1 #1 and/or E1 #2 A/D mapping..

E3 Transmit Errors and Alarms

This function allows you to enter errors and alarms.

The following options are available on the E3 Errors and Alarms screen.

Option	Description
Error to Insert	Inserts an error that is transmitted by the E3 protocol processor. The options available include:

	• None: Turns off E3 error insertion. • BPV Error: Transmits Bipolar Violation errors which result in a line code violation event for an AMI-coded signal, the occurrence of received excessive zeros, or a bipolar violation. • Bit: Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. • Frame: Results in a severely errored framing event, which occurs when two or more framing bit pattern errors within a 3-ms period. This type of error is not available if the E3 protocol processor is configured for Unframed framing format.
Error Insert Rate	Sets the insertion rate for E3 transmit errors. This command is not available if Error to Insert is set to None. The following options are available for this command: • Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • 1e-X, where X is a value from 3 through 10.
Alarm Generated	Generates a specific alarm on the transmit side of the E3 protocol process. The following options are available: LOS, LOF, AIS, or RDI. Note: LOF and RDI alarms are not available if Framing is set to Unframed.

Receive

E3 Receive

This function allows you to configure settings for the parameters used in the E3 Receive operations.

The following functions are available through the E3 Receive screen.

- [SET 1](#)
- [Signal Status](#)

- [Channel Scan](#)

E3 Receive Settings 1

This screen allows you to configure your unit's Receive parameters for your E3 test environment.

The E3 Receive Settings 1 screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Equalization	Configures receive sensitivity of the E3 Line Interface. Select one of the following options: • 0dB: Expects the received signal level to be near 0 dB, for error-free operation. • -6dB: Expects the received signal level to be near -6 dB, for error-free operation. • -12dB: Expects the received signal level to be near -12 dB, for error-free operation. Use this setting if the E3 line connects to a monitor jack.
Framing	Configures the framing format used for the E3 Receive signal. The following options are available: • Unframed: Configures the system to transmit an E3 signal using an unframed format. • Framed: Configures the system to transmit an E3 signal using a framed format.

Mapping	Displays the expected E3 Add/Drop Mapping, and allows the user to change the Mapping back to E3 Bulk Filled.  ATM Direct and ATM PLCP Mapping options will appear if the ATM hardware is available, and if the ATM's Physical Mapping is set to E3 ATM Direct or E3 ATM PLCP.  E1 Mapping option will appear if a E1 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.
Payload Pattern	Selects the payload pattern expected to be received by the system. The following options are available: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
E1 #1 Channel Drop	Select from Channels 1 through 16. Note: This option is only available if E3 is configured for E1 #1 and/or E1 #2 A/D mapping.
E1 #2 Channel Drop	Select from Channels 1 through 16. Note: This option is only available if E3 is configured for E1 #1 and/or E1 #2 A/D mapping.
Auto Configure	The Auto Configuration button allows you to quickly configure the unit to match the parameters of an incoming signal. This function configures the processor for the same mapping, framing, line coding, and pattern characteristics as the incoming signal, without having to manually configure the processor.

E3 Receive Signal Status

This function displays the electrical power, line frequency, and line frequency offset of the incoming E3 signal.

The following information is displayed on the E3 Receive Signal Status screen:

- Peak Positive Pulse Voltage (in volts)
- Peak Negative Pulse Voltage (in volts)
- Power in dBm
- Power in dBdsx
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm
- Bit Slips

Receive - Channel Scan (Chan Scan)

This function inspects and then reports the contents of the 16 E1 channels that are contained within a multiplexed E3 signal. The information reported consists of Mapping and Pattern values for each E1 channel.



To use this function, Mapping must be set to E1, and the system must receive a valid signal.

For more information, see [Start/Stop Channel Scan](#).

Results

E3 Results

This function allows you to view E3 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the E3 Results screen.

- [Scan / Error / Alarm](#)
- [EVENT](#)
- [Large LED](#)
- [GRAPH](#)

E3 Results - Scan / Errors / Alarms

The Results ERR screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

- **Errors** - The unit can monitor and report errors on the incoming E3 signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the E3 network, or errors that are intentionally generated by the system when it is used in a loopback environment.

The following errors can be monitored:

- [Frame Error](#)
- [BPV Error](#)
- [Bit Error](#)

The following parameters are measured for the incoming errors:

- ▶ Error count using an 11-digit format
 - ▶ Average error rate using an N.NNe-N format
 - ▶ Current error rate using an N.NNe-N format
 - ▶ Error-free seconds using an 8-digit format
 - ▶ Errored seconds
 - ▶ Severely Errored seconds
 - ▶ Unavailable errored seconds
- **Alarms** - The system can monitor and report alarms and their duration on the incoming E3 signal. The alarms are shown in duration of the alarm in seconds.

The following alarms can be monitored:

- [Power Loss](#)
- [Paused](#)

- [LOS](#)
- [LOF](#)
- [AIS](#)
- [RDI](#)
- [Pat Sync](#)

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

E3 Results Large LEDs

This button displays the E3 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart .

White with black text	No activity from this specific function.

For a list of available LEDs in the E3 protocol processor, see [E3 LEDs](#).

Results - Graph

The Graph screen allows you to view error and alarm results for the protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of alarms and errors.

To use the Results Graph function, see [Using Graphs](#).

Test

Test Screens and Functions

(Specifically for PDH testing)

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

 To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.

Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function

	Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.

Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for PDH testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For E4 one frame duration is roughly 0.021 ms (21 μ s)
- ▶ For E3 one frame duration is roughly 0.045 ms (45 μ s)
- ▶ For E1 one frame duration is roughly 0.125 ms (125 μ s)
- ▶ For DS3 one frame duration is roughly 0.106 ms (106 μ s)

- ▶ For DS1 one frame duration is roughly 0.125 ms (125 μ s)

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.
 - 💡 For all **PDH** processors the Protection Switch Criteria is limited to: **Loss of Pattern Sync** and **Bit Errors**.
- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 0.021 to 5.361 ms, and is entered using a keypad.
 - ▶ The range for E3 is 0.045 to 11.397 ms, and is entered using a keypad.
 - ▶ The range for E1 is 0.125 to 511.875 ms, and is entered using a keypad.
 - ▶ The range for DS3 is 0.106 to 27.133 ms, and is entered using a keypad.
 - ▶ The range for DS1 is 0.125 ms to 511.875 ms, and is entered using a keypad.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E1 is 1 to 4095 frames, and is entered using a keypad.
 - ▶ The range for DS3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for DS1 is 1 to 4095 frames, and is entered using a keypad.
- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Protection Switch Frame** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5.
- **History Recent Frames**: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5.



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
E4	0.021 ms (21 μ s)	255 frames (5.361 ms)
E3	0.045 ms (45 μ s)	255 frames (11.397 ms)
E1	0.125 ms (125 μ s)	4095 frames (511.875 ms)

DS3	0.106 ms (106 μ s)	255 frames (27.133 ms)
DS1	0.125 ms (125 μ s)	4095 frames (511.875 ms)

Test - RTD (Round-Trip Delay)

(Specifically for PDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State):** Starts and stops round-trip delay mode.
 - ▶ **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in milliseconds. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.
 - ▶ **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network.
 - ▶ **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
 - ▶ The **Current** column displays the most recent round trip measurement.
 - ▶ The **Minimum** column displays the fastest round trip measurement.
 - ▶ The **Maximum** column displays the slowest round trip measurement

Performance Monitoring

E3 Performance Monitoring

The E3 Performance Monitoring screen includes the following functions:

- [FAS](#)
- [BIT](#)

E3 Performance Monitoring FAS

This provides a detailed breakdown for Frame Alignment Signal errors detected and logged by the E3 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

G.826

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.

- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to be 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

E3 Performance Monitoring Bit

This provides a detailed breakdown for BIT errors detected and logged by the E3 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.

- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

G.826

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count, rate percentage, and objective percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.

- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

E3 LED Quick Status Area

When the E3 protocol processor is selected, the following LEDs and status indicators are displayed in the LED Quick Status Area of the touch screen. They are also located under Results [Large LEDs](#).

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX / RX	Displays the transmitted and received electrical power.
CLK:	Displays the type of transmit clock specified in the setting. Clock settings include: SETS, Internal, or RCVD. This is an alarm LED.
LOS	Loss of Signal. Indicates a Loss of Signal status was detected. This is an alarm LED.
BPV	Bipolar Violation. Indicates two consecutive pulses of the same polarity occurred in the same digital bit stream. In E3 mode, BPV errors are only generated in the payload. This is an error LED.
LOF	Loss of Frame. Indicates an alarm signal was generated due to a frame alignment problem. This is an alarm LED.
AIS	Alarm Indication Signal. Indicates an Alarm Indication Signal occurred on the line layer. This is an alarm LED.
FRAME ERR	Indicates if the E3 protocol processor has received framing errors. This is an error LED.

RDI	Remote Defect Indicator. Indicates a signal returned to the transmitting Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
PAT Sync	Pattern Loss. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	Bit Error. Indicates a bit error was detected in the payload. This is an error LED.

E3 Specific Tasks

E3 Specific Tasks Overview

This section covers procedures that are specific to the operation of the E3 protocol processor. For a list of general tasks, which apply to all protocol processors, see [Common Tasks](#) located in the Getting Started section.

- [Add/Drop an E1 out of an E3 Signal](#)
- [Add/Drop an E3 out of an E4 Signal](#)
- [Start/Stop E3 Channel Scan](#)
- [E3/E4 Technical Specifications](#)

Add/Drop an E1 out of an E3 Signal

You are able to add/drop multiplex an E1 signal in to and out of an E3 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-16) to drop the signal into.

1. Select [Test Setup](#) from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default E1/E3**.
 - If the E1/E3 options are preceded by SONET and SDH, then choose either **SONET/E1/E3** or **SDH/E1/E3**, depending on the desired protocol mode.
3. Select [Presets](#) from the [Common Function Buttons](#).
4. Select the **Interface** button and choose **E3** from the Select from Interface list.
5. Select the **Configuration** button and choose either one of the following:

- **E1 #1 A/D** or **E1 #2 A/D**: The E1 Add/Drop setting multiplexes the E1 signal generated by the E1#1 (or E1#2) processor up to the E3 processor, and transmits it out the E3 transmit interface port (along with other background E1 signals generated by the E3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received E3 signal and dropped down to the E1 #1 (or E1#2) processor for Error and Alarm analysis. The selected E1 port's TX/RX interfaces are not used in this configuration.
- **E1 #1 A/D LI** or **E1 #2 A/D LI**: The E1 Line Interface (LI) Add/Drop setting multiplexes the received E1#1 (or E1#2) signal up to the E3 processor, and transmits it out the E3 transmit interface port (along with other background E1 signals generated by the E3 processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received E3 signal and dropped down to the E1 processor and transmitted out to the selected E1 Interface port.

6. Select the **Apply** button.



Both E1#1 and E1#2 signals can simultaneously be added to the E3 interface by pressing Presets and selecting E3 from the Interface menu again, and then choose the other E1 processor from the Configuration menu.

The unit is configured to drop an E1 out of the E3 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **E3**.
2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. If you dropped the E1 #1 signal, select **E1 #1 Channel Inserted** and select the channel in which you want to drop the E1 signal.
5. If you dropped the E1 #2 signal, select **E1 #2 Channel Inserted** and select the channel in which you want to drop the E1 signal.
6. Select **E1 Background Frame** and select the background frame for the specified channel.

7. Select **E1 Background Pattern**. Select a pattern to fill the background E1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast E1 #1 (and/or Broadcast E1 #2).
 - Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels.
8. Select the **E1** tab being dropped.
9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected E3 channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

1. Select the **Results** screen from the specified E1 #1 (or E1#2) processor tab to view the received error and alarm activity.
2. Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.
3. If an LOF alarm is being detected, then the E3 processor is likely in an errored state.

Add/Drop an E3 out of an E4 Signal

You are able to add/drop multiplex an E3 signal in to and out of an E4 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-4) to drop the signal into.

1. Select [Test Setup](#) from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default E1/E3**.

- If the E1/E3 options are preceded by SONET and SDH, then choose either **SONET/E1/E3** or **SDH/E1/E3**, depending on the desired protocol mode.
3. Select [Presets](#) from the [Common Function Buttons](#).
 4. Select the **Interface** button and choose **E4** from the Select from Interface list.
 5. Select the **Configuration** button and choose either one of the following:
 - **E3 A/D:** The E3 Add/Drop setting multiplexes the signal generated by the E3 processor up to the E4 processor, and transmits it out the E4 transmit interface port (along with other background E3 signals generated by the E4 processor) in the specified channel from the Transmit E3 Channel Inserted setting. The specified E3 Channel Dropped from the Receive settings, is demultiplexed out of the received E4 signal and dropped down to the E3 processor for Error and Alarm analysis. The E3 port's TX/RX interfaces are not used in this configuration.
 - **E3 A/D LI:** The E3 Line Interface (LI) Add/Drop setting multiplexes the received E3 signal up to the E4 processor, and transmits it out the E4 transmit interface port (along with other background E3 signals generated by the E4 processor) in the specified channel from the Transmit E3 Channel Inserted setting. The specified E3 Channel Dropped from the Receive settings, is demultiplexed out of the received E4 signal and dropped down to the E3 processor and transmitted out to the E3 Interface TX port.
 6. Select the **Apply** button.



You can further [Add/Drop E1#1 and/or E1#2](#) mappings within the E3 Add/Drop

The unit is now configured to drop an E3 out of the E4 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **E4**.
2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. Select [E3 Channel Inserted](#) and select the channel in which you want to drop the E3 signal.

5. Select [E3 Background Frame](#) and select the background frame for the specified channel.
6. Select [E3 Background Pattern](#) and select a pattern to fill the background E3 channels. This can be a 32-bit User Defined pattern, or an E3 Broadcast setting.
 - The Broadcast setting broadcast the configured Framing and Payload Pattern from the E3 processor port, over all of the background E3 channels.
8. Select the **E3** tab.
9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected E4 channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

Start/Stop E3 Channel Scan

The Chan Scan function inspects and then reports the contents of the 16 E1 channels that are obtained within the multiplexed E3 signal.

The information reported consists of items such as the framing and pattern activity detected on each E1 channel.

The E3 protocol processor must be receiving a valid signal, otherwise, the scan aborts. While a scan is in progress, you cannot access other functions.

To start a channel scan:

1. Select the **E3** protocol processor tab.
2. Select **Receive**.
3. Select **Chan Scan**.
4. Select **Start Scan**. Framing and pattern activity for each channel is displayed on the screen.

To stop the channel scan:

- Select the **Stop Scan** button.

E4 Tab

E4 Overview

The E4 protocol processor section includes:

- [E4 Screen Functions and Descriptions](#)
- [E4 Specific Tasks](#)
- [E3/E4 Technical Specifications](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Functions and Descriptions

E4 Screen Functions and Descriptions Overview

The following function screens are available through the E4 protocol processor tab.

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [Performance Monitoring](#)
- [LEDs](#)

Transmit

Transmit Screens and Functions

This function allows you to define the parameters used in E4 Transmit operations.

The following functions are available through the E4 Transmit screen.

- [SET 1](#)

- [Error Alarm](#)

Transmit - Settings 1 (SET 1)

This screen allows you to configure the transmit signal parameters for the E4 line interface and the E4 protocol processor to match the E4 signal used in your test environment.

The E4 Transmit Settings screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Clock	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. <u>BITS/SETS</u>: Derives the transmit's data timing source from the BITS/SETS input ports. • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but a BITS clocking is not available then this function defaults to Internal.

	• SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but a SETS clocking is not available then this function defaults to Internal.
Line Frequency Offset	The transmitted signal's line frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. • The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 • The default value of 0 (zero) equals Off.
Framing	Configures the framing format used for the E4 transmit signal. The following options are available: • Framed: Configures the system to transmit an E4 signal using a framed format. • Unframed: Configures the system to transmit an E4 signal using an unframed format. Note: This option is only available if Mapping is set to Bulk Filled.
Mapping	Displays the E4 Add/Drop Mapping, and allows the user to change the Mapping back to E4 Bulk Filled.  ATM Direct and ATM PLCP Mapping options will appear if the ATM hardware is available, and if the ATM's Physical Mapping is set to E3 ATM Direct or E3 ATM PLCP.  E3 Mapping option will appear if an E3 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.
Payload Pattern	Selects the type of payload pattern that is transmitted by the system. The following options are available: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20,

	PRBS 20 Inv , PRBS 23 , PRBS 23 Inv , All Ones , All Zeros , User Defined (32-bit entry). Note: This option is only available if Mapping is set to Bulk Filled.
E3 Channel Inserted	Select from Channels 1 through 4, All, or None. Note: This option is only available if E4 is configured for E3 A/D mapping.
E3 Background Frame	Select from Framed or Unframed. Note: This option is only available if E4 is configured for E3 A/D mapping.
E3 Background Pattern	Select a pattern to fill the background E3 channels. This can be a 32-bit User Defined pattern, or an E3 Broadcast setting. The Broadcast setting broadcast the configured Framing and Payload Pattern from the E3 processor port, over all of the background E3 channels. Note: This option is only available if E4 is configured for E3 A/D mapping.

Transmit - Errors and Alarms (Error Alarm)

This function allows you to enter errors and alarms.

The following options are available on the E4 Errors and Alarms screen.

Option	Description
Error to Insert	Inserts an error that is transmitted by the E4 protocol processor. The options available include: None: Turns off E4 error insertion. LCV: Transmits Line Code Violation errors, which result in a line code violation event for an AMI-coded signal.

	• Bit: Transmits a bit error, which results in a frame synchronization bit error event. This also inserts a frame bit error in the received frame bit pattern. • Frame: Results in a severely errored framing event, which occurs when two or more framing bit pattern errors within a 3-ms period. This type of error is not available if the E4 protocol processor is configured for Unframed framing format.
Error Insert Rate	Sets the insertion rate for E4 transmit errors. This command is not available if Error to Insert is set to None. The following options are available for this command. • Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • 1e-X, where X is a value from 3 through 10.
Alarm Generated	Generates a specific alarm on the transmit side of the STM-4 protocol process. The following options are available: None, LOS, LOF, AIS, and RDI.

Receive

Receive Screens and Functions

Functions on the Receive screens allow you to configure settings for the parameters used in E4 Receive operations.

The following functions are available through the E4 Receive screen.

- [SET 1](#)

- [SIG](#)

Receive - Settings 1 (SET 1)

This screen allows you to configure your unit's Receive parameters for your E4 test environment.

The E4 Receive Settings 1 screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Signal Level	Configures the E4 line input termination. Select one of the following options: • Normal (0 dB): Sets the Receive Sensitivity of the E4 Line Interface. Use this setting if the E4 line terminates at the system's Line Interface. • Monitor (-20 dB): Sets the Receive Sensitivity of the E4 Line Interface. Use this setting if the E4 line connects to a monitor jack.
Framing	Configures the framing format used for the E4 Receive signal. The following options are available: • Unframed: Configures the system to transmit an E4 signal using an unframed format. • Framed: Configures the system to transmit an E4 signal using a framed format.

Mapping	Displays the expected E4 Add/Drop Mapping, and allows the user to change the Mapping back to E4 Bulk Filled.  E3 Mapping option will appear if a E3 Add/Drop Mapping was selected from the Preset menu, or from the Switch Matrix.
Payload Expected	Selects the payload pattern expected to be received by the system. The following options are available: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
E3 Channel Dropped	Select a channel to drop, 1-4. Note: This option is only available if E4 is configured for E3 A/D mapping.
Auto Configure	The Auto Configuration button allows you to quickly configure the unit to match the parameters of an incoming signal. This function configures the processor for the same mapping, framing, line coding, and pattern characteristics as the incoming signal, without having to manually configure the processor.

Receive - Signal Status (SIG)

This function displays the electrical power, line frequency, and line frequency offset of the incoming E4 signal.

The following information is displayed on the E4 Receive Signal Status screen.

- Peak Positive Pulse Voltage (in volts)
- Peak Negative Pulse Voltage (in volts)

- Power in dBm
- Power in dBdsx
- Line Frequency in MHz
- Line Frequency Offset Received in Hz and ppm
- Bit Slips

Results

Result Screens and Functions

Result screens allow you to view E4 error and alarm analysis and create a history of these events by graphing the information.

The following functions are available through the E4 Results screen.

- [Scan / Error / Alarm](#)
- [EVENT](#)
- [LARGE LED](#)
- [GRAPH](#)

E4 Results - Scan / Errors / Alarms

The Results ERR screen contains the following options:

- **Scan** - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

- **Errors** - The unit can monitor and report errors on the incoming E4 signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the E4 network, or errors that are intentionally generated by the system when it is used in a loopback environment.

The following errors can be monitored:

- [Frame Error](#)

- [LCV Error](#)
- [Bit Error](#)

The following parameters are measured for the incoming errors:

- ▶ Error count using an 11-digit format
 - ▶ Average error rate using an N.NNe-N format
 - ▶ Current error rate using an N.NNe-N format
 - ▶ Error-free seconds using an 8-digit format
 - ▶ Errored seconds
 - ▶ Severely Errored seconds
 - ▶ Unavailable errored seconds
- **Alarms** - The system can monitor and report alarms and their duration on the incoming E4 signal. The alarms are shown in duration of the alarm in seconds.

The following alarms can be monitored:

- [Power Loss](#)
- [Paused](#)
- [LOS](#)
- [LOF](#)
- [AIS](#)
- [RDI](#)
- [Pat Sync](#)

Results - EVENT

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Large LEDs (LARGE LED)

This button displays the E4 LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart .
White with black text	No activity from this specific function.

For a list of available LEDs in the E4 protocol processor, see [E4 LEDs](#).

Results - Graph

The Graph screen allows you to view error and alarm results for the protocol processor. These graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of alarms and errors.

To use the Results Graph function, see [Using Graphs](#).

Test

Test Screens and Functions

(Specifically for PDH testing)

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)
- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.

15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.

- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (.). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.

Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for PDH testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For E4 one frame duration is roughly 0.021 ms (21 μ s)
- ▶ For E3 one frame duration is roughly 0.045 ms (45 μ s)
- ▶ For E1 one frame duration is roughly 0.125 ms (125 μ s)
- ▶ For DS3 one frame duration is roughly 0.106 ms (106 μ s)
- ▶ For DS1 one frame duration is roughly 0.125 ms (125 μ s)

Test Service Disruption functions include:

- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

 For all **PDH** processors the Protection Switch Criteria is limited to: **Loss of Pattern Sync** and **Bit Errors**.

- **Consecutive Good Time Required** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 0.021 to 5.361 ms, and is entered using a keypad.

- ▶ The range for E3 is 0.045 to 11.397 ms, and is entered using a keypad.
- ▶ The range for E1 is 0.125 to 511.875 ms, and is entered using a keypad.
- ▶ The range for DS3 is 0.106 to 27.133 ms, and is entered using a keypad.
- ▶ The range for DS1 is 0.125 ms to 511.875 ms, and is entered using a keypad.
- **Consecutive Good Frames Required** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range for E4 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for E1 is 1 to 4095 frames, and is entered using a keypad.
 - ▶ The range for DS3 is 1 to 255 frames, and is entered using a keypad.
 - ▶ The range for DS1 is 1 to 4095 frames, and is entered using a keypad.
- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Protection Switch Frame** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.
- **History Recent Milliseconds**: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5.

- **History Recent Frames:** The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
E4	0.021 ms (21 μ s)	255 frames (5.361 ms)
E3	0.045 ms (45 μ s)	255 frames (11.397 ms)
E1	0.125 ms (125 μ s)	4095 frames (511.875 ms)
DS3	0.106 ms (106 μ s)	255 frames (27.133 ms)
DS1	0.125 ms (125 μ s)	4095 frames (511.875 ms)

Test - RTD (Round-Trip Delay)

(Specifically for PDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State):** Starts and stops round-trip delay mode.

- ▶ **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in milliseconds. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.
- ▶ **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network.
- ▶ **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
 - ▶ The **Current** column displays the most recent round trip measurement.
 - ▶ The **Minimum** column displays the fastest round trip measurement.
 - ▶ The **Maximum** column displays the slowest round trip measurement

Performance Monitoring

Performance Monitoring Screens and Functions

The E4 Performance Monitoring screen includes the following functions:

- [FAS](#)
- [BIT](#)

Perf Monitor - FAS

This provides a detailed breakdown for Frame Alignment Signal (FAS) errors detected and logged by the E4 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.

- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

G.826

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

Perf Monitor - BIT

This provides a detailed breakdown for BIT errors detected and logged by the E4 protocol processor.

This section is broken down into the following areas:

G.821

- Errored Seconds (ES) by count, rate percentage, and objective percentage.
- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

G.826

- Errored Seconds (ES) by count, rate percentage, and objective percentage.

- Error-free Seconds (EFS) by count and rate percentage.
- Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.
- Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Status: Pass or failure

M.2100

- Errored Seconds (ES) by count, percentage and S1 and S2 percentage.
- Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.
- Allocation: Select an allocation percentage from 0 to 100.
- Duration: Select the monitoring duration to 2 hours, 1 day, or 7 days.
- Status: Pass, Uncertain, or failure

E4 LED Quick Status Area

When the E4 protocol processor is selected, the following LEDs and status indicators are displayed in the LED Quick Status Area of the touch screen. They are also located under Results [Large LEDs](#).

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX / RX	Displays the transmitted and received electrical power.
CLK:	Displays the type of transmit clock specified in the setting. Clock settings include: SETS, Internal, or RCVD. This is an alarm LED.
LOS	Loss of Signal. Indicates a Loss of Signal status was detected. This is an alarm LED.
LCV	Line Code Violation. Indicates a Line Code Violation was detected. This is an error LED.
AIS	Alarm Indication Signal. Indicates an Alarm Indication Signal occurred on the line layer. This is an alarm LED.
Frame Err	Indicates if the E4 protocol processor has received framing errors. This is an error LED.
RDI	Remote Defect Indicator. Indicates a signal returned to the transmitting Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
PAT Sync	Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	Bit Error. Indicates a bit error was detected in the payload. This is an error LED.

E4 Specific Tasks

E4 Specific Tasks

This section includes tasks that are specific to the E4 protocol processor. For a list of general tasks, see [Common Tasks](#) located in the Getting Started section.

- [Add/Drop an E3 out of an E4 Signal](#)
- [E3/E4 Technical Specifications](#)

Add/Drop an E3 out of an E4 Signal

You are able to add/drop multiplex an E3 signal in to and out of an E4 signal to monitor for error and alarm conditions. Additionally, you are able to specify which channel (1-4) to drop the signal into.

1. Select **Test Setup** from the [Common Function Buttons](#).
2. Select Factory Default, and choose **Factory Default E1/E3**.
 - If the E1/E3 options are preceded by SONET and SDH, then choose either **SONET/E1/E3** or **SDH/E1/E3**, depending on the desired protocol mode.
3. Select **Presets** from the [Common Function Buttons](#).
4. Select the **Interface** button and choose **E4** from the Select from Interface list.
5. Select the **Configuration** button and choose either one of the following:
 - **E3 A/D:** The E3 Add/Drop setting multiplexes the signal generated by the E3 processor up to the E4 processor, and transmits it out the E4 transmit interface port (along with other background E3 signals generated by the E4 processor) in the specified channel from the Transmit E3 Channel Inserted setting. The specified E3 Channel Dropped from the Receive settings, is demultiplexed out of the received E4 signal and dropped down to the E3 processor for Error and Alarm analysis. The E3 port's TX/RX interfaces are not used in this configuration.
 - **E3 A/D LI:** The E3 Line Interface (LI) Add/Drop setting multiplexes the received E3 signal up to the E4 processor, and transmits it out the E4 transmit interface port (along with other background E3 signals generated by the E4 processor) in the specified channel from the Transmit E3 Channel Inserted setting. The specified E3 Channel Dropped from the Receive settings, is demultiplexed out of the received E4 signal and dropped down to the E3 processor and transmitted out to the E3 Interface TX port.
6. Select the **Apply** button.



You can further [Add/Drop E1#1 and/or E1#2](#) mappings within the E3 Add/Drop

The unit is now configured to drop an E3 out of the E4 signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

1. Select **E4**.

2. Select **Transmit** and **Set 1**.
3. If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.
4. Select [E3 Channel Inserted](#) and select the channel in which you want to drop the E3 signal.
5. Select [E3 Background Frame](#) and select the background frame for the specified channel.
6. Select [E3 Background Pattern](#) and select a pattern to fill the background E3 channels. This can be a 32-bit User Defined pattern, or an E3 Broadcast setting.
 - The Broadcast setting broadcast the configured Framing and Payload Pattern from the E3 processor port, over all of the background E3 channels.
8. Select the **E3** tab.
9. Select **Transmit** and **Set 1**.
10. Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected E4 channel.
11. Select **Receive** and **Set 1**.
12. If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.
13. Configure the expected Mapping, Framing, Payload Pattern, etc.

Jitter PDH/T-Carrier

PDH/T-Carrier Jitter System Overview

The NIC Jitter system is used to generate and analyze jitter. Jitter can be generated manually or programmed to execute Automated Compliance Tests.

In manual mode, the user can set up a number of parameters for jitter generation, or measurement and then manually start the process. The process continues until the user stops it.

In automated mode, the user can program the Jitter system to execute **Jitter Output**, **Jitter Tolerance**, or **Jitter Transfer** Automated Compliance Tests (ACT). The compliance tests allow the user to programmatically scan through a number of setup parameters and make measurements in accordance with mask sets. These masks can be standardized sets prescribed by various standards organizations, or custom user-defined mask sets.

Jitter configurations are made from the [Transmit](#), [Receive](#), Output Jitter, [Test](#), and Toler/Transfer screens.

To assist you in performing tasks and understanding protocol functionalities, this Online Help is divided into the following sections:

- [Jitter Screen Functions and Descriptions](#)
- [Automated Compliance Testing](#)
- [Jitter Specific Tasks](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Function and Definitions

PDH/T-Carrier Jitter Screen Functions and Descriptions Overview

This section of the online help describes the function screens, buttons, and tabs that control Jitter configuration and operation.

The following screens are found in the Jitter protocol processor:

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- Output Jitter
- Toler/Transfer
- LEDs

Transmit

PDH/T-Carrier Jitter Transmit Screens and Functions

The PDH/T-Carrier Jitter Transmit function screens allow you to configure and view transmit settings used to generate Jitter over an electrical signal.

The following options are available on the Jitter TX Transmit screen:

- [Set 1](#)

PDH/T-Carrier Jitter Transmit - Settings (SET 1)

The PDH/T-Carrier Jitter Transmit function allows the user to inject jitter onto a selected transmit signal at a chosen sinusoidal frequency that ranges from 10 Hz to the maximum jitter frequency rate for the selected electrical Interface rate. It receives its signal content from the rest of the system. As such, any signal content parameters must be set up by the selected interface's protocol processor.

Use the Set 1 screen to configure Jitter Transmit parameters. The following describes the functions that appear on this screen.

Function	Description
Start Wander GUI (button)	Selecting the Start Wander GUI button launches the Wander Client application.

	 This button only appears on the Remote GUI for NIC test sets licensed for the Wander Client.
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Generation Mode	The user can change the Generation Mode from Wander back to Jitter, if Wander mode was enabled by the Wander Client.
Interface Rate	Configures the PDH/T-Carrier line rate of the jitter transmit signal.  For PDH mode, the following Interface rates are available: E1 #1, E1 #2, E3, E4, and 2.048MHz (Clock). For T-Carrier mode, the following Interface rates are available: DS1 #1, DS1 #2, DS3, and 1.544MHz (Clock).
Transmit Jitter State	Allows the user to manually turn jitter generation On and Off.
Jitter Frequency	Displays a pop-up window that allows the manual setting of the jitter frequency.  The minimum and maximum jitter frequency is dependent on the configured Interface Rate.
Jitter Amplitude	Displays a pop-up window that allows the manual setting of the jitter amplitude.  The minimum and maximum jitter amplitude is dependent on the configured jitter frequency.

Receive

PDH/T-Carrier Jitter Receive Screens and Functions

The PDH/T-Carrier Receive function screens allow you to configure and view receive settings used to measures Jitter on an incoming electrical signal.

The following options are available on the Jitter RX Receive screen:

- [Set 1](#)

PDH/T-Carrier Jitter Receive - Settings (SET 1)

The PDH/T-Carrier Jitter Receive function allows the user to configure and view receive settings used to measures Jitter on an incoming electrical signal.

Use the Set 1 screen to configure Jitter Receive parameters. The following describes the functions that appear on this screen.

Function	Description
Start Wander GUI (button)	Selecting the Start Wander GUI button launches the Wander Client application.  This button only appears on the Remote GUI for NIC test sets licensed for the Wander Client.
Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, settings established on the Receive screen will only affect Receive settings.
Measurement Mode	The user can change the Measurement Mode from Wander back to Jitter, if Wander mode was enabled by the Wander Client.
Interface Rate	Configures the PDH/T-Carrier line rate of the jitter receive signal.  For PDH mode, the following Interface rates are available: E1 #1, E1 #2, E3, E4, and 2.048MHz (Clock). For T-Carrier mode, the following Interface rates are available: DS1 #1, DS1 #2, DS3, and 1.544MHz (Clock).

Clock Reference	Displays the clock reference to be used for the jitter/wander measurement, as specified from the selected interface's protocol processor tab.
Filter	Allows the user to select between High Pass, Low Pass, or Band Pass (High Pass +Low Pass) filters.
Demodulated Data Filter	Sets the receive demodulation data filter setting. The demodulated data filter ranges vary depending on the selected interface rate and the type of filter selected.
Demodulated Output Range	Programs the gain of the demodulated jitter output signal. Values are in Ulpp.
Jitter Hit Threshold	Programs the number of UI that is allowed in a jitter measurement before a jitter hit is registered.
Measurement Window Size	Programs the size of the measurement window in seconds.

Results

PDH/T-Carrier Jitter Results Screens and Functions

The Results screens allows you to view jitter test results and measurements in various formats.

The following functions are available through Jitter Results screen:

- [Meas](#)
- [Detail Meas](#)
- [Alarm](#)
- [Large LED](#)

PDH/T-Carrier Jitter Results - Meas

The Count screen shows status indicators, current measurements, and jitter hits.

The following information is displayed:

Function	Description

Interface Rate and Type	Shows the currently selected line rate.
Filter	Shows the currently selected filter.
Measurement Window Size	Shows the currently programmed window size, in seconds.
Current Measurements Table	The table below the three status indicators described above (Interface Rate and Type, Filter, Measurement Window Size) displays the window status, as well as the current measurements for: • Peak-to-Peak • Positive Peak • Negative Peak • RMS (Available when a filter is selected that includes RMS measurement it is shown as well.) These measurements are for the current window and the windows where the minimum and maximum readings were recorded.
Jitter Hit Threshold	Below the Count Measurements Table is another table showing jitter hits. It shows both the jitter hit seconds, as well as the total number of jitter hits.

Jitter Results - Jitter vs. Time

The Jitter vs. Time screen is used to display a running graphical representation of the jitter results. These results can be displayed in either a UI versus Time format or a Histogram format. The screen contains a number of check boxes and buttons that allow the user to change the details of how the results are displayed.

Function	Description
Peak to Peak	When selected, the Peak to Peak values are displayed in the graph.
Negative Peak	When selected, the Negative Peak values are displayed in the graph.
Positive Peak	When selected, the Positive Peak values are displayed in the graph.

RMS	When selected, the RMS values are displayed in the graph.  If the user has not selected a filter that allows RMS measurement, this item will not be available.
Hit Threshold	Allows the user to program the Jitter Hit Threshold from the Jitter vs Time screen. This has the same effect as the Jitter Hit Threshold button on the Receive Set 1 screen.
Display Threshold	When selected, the Hit Threshold is displayed as a dotted line on the Results graph.
Live Update	When selected, the screen updates each time a new measurement window is evaluated. Clearing the check box freezes the graph until you check the box again.
Histogram	When selected, the graph displays results in histogram form. The Horizontal axis is measured UI and vertical axis is the number of windowed measurements at a particular UI level.  When Histogram is selected the Hit Threshold button is not available.
Undo Zoom	Restores the zoom level of the graph to the default size.
Scale Up	Decreases the resolution of the time axis in the UI versus time display.
Scale Down	Increases the resolution of the time axis in the UI versus time display.
Auto Scale	Automatically sets the resolution of the axis such that the entire results can be seen.



You can zoom in on portions of the graph by simply dragging the cursor across a section of the Histogram.

PDH/T-Carrier Jitter Results - Alarm

The Alarm screen monitors and report alarms various alarms, and the duration of each alarm in seconds, detected by the jitter receiver.

The following alarms can be monitored:

- **RX Fault**
- **Power Loss**

PDH/T-Carrier Jitter Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the Jitter protocol processor, see Quick Status LEDs.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following function:

- [SET 1](#)

Set 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration**: This function configures how long a timed test runs for.
- **Action After Duration**: This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test**: This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.

1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is

 This option appears when Repeat Actions is selected.	stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the

 This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Output Jitter

Output Jitter Test Screen and Functions

The Output Jitter screen is used to configure and display results for an [Output Jitter Compliance Test](#).

 This functionality allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. The combinations of filter settings and levels are organized into test standards. The NIC provides a number of test standards that can be selected from the NIC touch screen.

The following functions are available through Output Jitter screen:

Function	Description
Test Standard	Allows the user to select from a variety of jitter output jitter test standards , based on different filter settings. It also allows the user to create/select a user-defined test standard.
Modify User Settings	If the User-Defined Test Standard is selected under Test Standard then the Modify User Settings button allows the user to choose a set of filters and levels to make up their own mask.
Rate	Displays the transmit interface rate.
Start/Stop Test	Starts/Stops the Output Jitter compliance test.
Percent Complete	T test's progress is displayed in the Percent Complete bar
Summary Test Result table	For each of the test filters, this table displays the acceptable UI limit (per the selected standard), the actual measured UI value, the Pass/Fail/Testing state, and the duration that the filter was tested for in seconds.

Output Jitter Test Screen and Functions

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Rate	Displays the transmit interface rate.
Start/Stop Test	Starts/Stops the Output Jitter compliance test.
Percent Complete	T test's progress is displayed in the Percent Complete bar
Summary Test Result table	For each of the test filters, this table displays the acceptable UI limit (per the selected standard), the actual measured UI value, the Pass/Fail/Testing state, and the duration that the filter was tested for in seconds.

Output Jitter Test Standards

The [Output Jitter Compliance Test](#) allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. These combinations of filter settings and levels are organized into test standards.



In addition to the test standards listed below, a [User-Defined Test Standard](#) can also be set up.

►The following is a list of test standards available when testing **OC-192/STM-64** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- G.825 Network
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-48/STM-16** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- GR-253 Network, Type B
- T1.105.03 Equipment
- T1.105.03 Network, Type A Regen
- T1.105.03 Network, Type B Regen
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment

►The following is a list of test standards available when testing **OC-12/STM-4** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network

- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-3/STM-1** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment
- EN 302 084 Network

►The following test standard is available when testing **OTU-1** or **OTU-2** Jitter:

- G-8251 Network

Toler / Transfer

Jitter Toler/Transfer Settings Screens

The Toler/Transfer, Set screen provides the configuration settings for all of the test parameters. The user can select from a number of standardized stimulus and response masks, or create their own custom masks.

Settings are configured on the following screens:

- [Set 1](#)
- [Set 2](#)
- [Test](#)

Jitter Toler/Transfer - SET Screen Settings 1 (Set 1)

The Tolerance and Transfer Settings 1 screen contains the following options:

Function	Description
Test Type	Provides selection of four types of tolerance tests and two types of transfer tests.
Test Standard	Provides a list of industry standard transfer and tolerance masks, as well as User Defined masks from which to choose.
Auto Distributed Frequency Points	Allows the user to set the number of automatically distributed test points in the mask.  You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.
Error Type	Provides a list of error types used in determining onset of errors or a BER rate in a jitter tolerance test.  The Error Type button does not apply if jitter transfer is selected as a test type.
Edit Mask	Provides access to the Edit Mask screen, where you can view and add measurement points to a standardized mask. If the mask is user-defined it allows you to add or edit vertices points to the mask.
ES Threshold	Allows the user to set the number of errored seconds that are allowed in an onset of errors tolerance test before that point is marked as failed.  This does not apply to transfer measurements or 1db power penalty tolerance measurements.
BER - Threshold	When a Power Penalty Tolerance test is selected, this allows the user to set the BER operating point, around which the 1db power penalty measurements are made.
BER - Recommended Threshold	When a Power Penalty Tolerance test is selected, this displays the current recommended BER threshold for power penalty measurements.

	 Selecting the Set button to the left of Recommended Threshold will set the Threshold to the recommended displayed value.
BER - Current Reading	When a Power Penalty Tolerance test is selected, this displays the current reading at the receiver.  Selecting the Set button to the left of Current Reading will set the Threshold to the current reading value.

Jitter Toler/Transfer - SET Screen Settings 2 (Set 2)

The Transfer and Tolerance Settings 2 screen contains the following options:

Function	Description
Stimulus Level %	Provides ability to set a stimulus level for acceptance tests. By setting this value higher than 100%, the user can build margin into an acceptance test. Setting this to 100% causes the measurements to run exactly at the standardized acceptance point.
Jitter Transfer Start Frequency Override	For Transfer tests, this function provides the ability to change the start frequency of the measurements by checking the Enable checkbox and selecting the Frequency button to enter a starting value different from that of the standardized mask.
DUT Settling Time/Point	For Tolerance tests, this function allows the user to program a delay between the time that the stimulus is applied at a particular frequency and the time the measurement is started.
Measurement Time/Point	For Tolerance tests, this function is used to program the number of seconds for which each frequency point is tested.
Meas. Search Method	For Tolerance measurements, this function allows selection of the search method used in arriving at the pass fail point.
Meas. Resolution (% of Mask)	For Tolerance measurements, this function allows the user to program the accuracy of the measurement. The search will cease when the difference between the pass and fail level is less than the programmed percentage of the total measurement level.

Jitter Toler/Transfer - Test

The Test screen contains a variety of options that provide different views of measurement points, frequency and amplitude annotations, coordinate displays, amplitude capability, and measured jitter tolerance values.

The Toler/Transfer Test screen contains the following options:

Function	Description
Start/Stop Test	Starts and stops the test.
Show	Allows the user to change the appearance of the graph in the right-hand portion of the screen. • Grid shows or hides the frequency and amplitude annotations for the graph axis. • Vertices shows or hides the coordinate display for the mask vertices. • Gen. Limit shows or hides a display of the maximum amplitude capability of the jitter generator. • Connect enables or disables drawing a line between adjacent dots that show measured jitter tolerance values. This function is not applicable to acceptance tests.
Cursor	Selecting the Cursor buttons moves the cursor to various measurement points on the graph. The window immediately below the buttons displays the frequency, mask value, measured value, and pass/fail status of the current point.

Jitter LED Quick Status Area

When the Jitter protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) screen.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

 The Jitter laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

LED	Description
Tx	Displays the status of Transmit interface rate.
Rx	Displays the status of the Receive interface rate.
Opt. Power	Displays the optical signal power, when the Receive Interface Type is set to Optical Data.
Test Paused	Displays a red LED when a test paused.
Tx Clk:	Displays the status of the Transmit Clock Reference.
Rx Clk:	Displays the status of the Receive Clock Reference.
Tx PP Ref.	Confirms that the Jitter Tx Protocol Processor internal clock reference is okay and that the test set is operating normally.
Rx PP Ref.	Confirms that the Jitter Rx Protocol Processor internal clock reference is okay and that the test set is operating normally.
Jitter	Indicates whether or not jitter is activated. (i.e. generating jitter).
Laser Over Temp	Indicates that the temperature control on the laser, for the Jitter TX has failed to keep the laser temperature within the specified guidelines. It may be due to a failure of the jitter TX board's temperature control or general system overheating.  This condition could be injurious to the laser. The system should be immediately powered down and sent in for service.
Laser Under Temp	Indicates that the temperature control on the laser, for the Jitter TX has failed to keep the laser temperature within the specified guidelines.

	This is usually to a failure in the Jitter TX board's temperature control circuit.  If this condition persists the system should be sent in for service.
Input Optical Data	Indicates the presence of an optical signal at the input of the module.
LOS	Loss of Signal. An alarm LED indicating a valid signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported.
Optical Overload	Indicates that the optical power level is exceeds the maximum allowable (0 dBm) level.
Power Loss	Indicates there has been a loss of line power.
Frequency Out of Range	Indicates that the measured line rate of the incoming signal is greater or less than the reference line rate of the measurement system by more than the amount programmed by the Frequency Tolerance button.
Jitter Hits	Indicates that the system had instances of measured jitter exceeding the Jitter Hit Threshold.
STM1-e Code Violations	For an STM-1e input, a red LED indicates CMI Code Violations.

Automated Compliance Testing

Performing Automated Compliance Tests

Automated Compliance Tests (ACT) differ from manual measurements in that the system can be programmed to make multiple test point measurements instead of just one. This allows the multiple test points to be compared against a set of allowable limits to those measurements.

This is done by using the Jitter Stimulus Mask to define the set of points to be measured for the device-under-test that meets a set of standardized or user-defined criteria. This frees the user from the burden of having to manually set up and run a test for each of the data points.

The NIC provides for three types of automated compliance tests: **Jitter Output**, **Jitter Tolerance**, and **Jitter Transfer**.

- **Jitter Output - Automated Compliance Tests** - A number of different filter settings can be used, each with its own jitter output limit.
- [Jitter Tolerance - Automated Compliance Tests](#) - A number of different frequency/level pairs can be used as stimulus for the DUT. The pass/fail criteria can be programmed to either 'Onset' or 'Power Penalty'.
- [Jitter Transfer - Automated Compliance Tests](#) - Both stimulus and response criteria can be programmed. The stimulus can be programmed to vary in both frequency and level. The response mask can also be programmed with frequency and level points.

Jitter Output

Running an Output Jitter Compliance Test

A Jitter Output Test measures the jitter on an incoming optical or electrical signal. That incoming signal may be either a clock or data signal. To prepare for the Output test the module line rate must be programmed.

The system measures jitter as a peak-to-peak or RMS value after selecting and applying a filter. The filters are standardized sets of filters defined by the ITU and Telcordia, and are line rate dependant.

1. From the **Jitter** tab, select [Output Jitter](#).
2. Select **Test Standard** and choose a test standard from the [Select Test Standard](#) dialog box.



If you choose **User Defined** as the Test Standard, select the **Modify User Settings** button on the Output Jitter screen to select the filters and levels that you want as part of your test.

See the section "[Configuring a User-Defined Test Standard](#)" for more information on modifying user settings.

3. Select **Start Test**. Test progress displays in the Percent Complete bar.
4. When the test is complete the results of each filter are shown in the Summary Test Result table, below the Start Test button.

5. For each of the test filters, the results table displays the acceptable UI limit (per the selected standard), the actual measured UI value, the Pass/Fail/Testing state, and the duration that the filter was tested for in seconds.

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See the section "[Configuring a User-Defined Test Standard](#)" for more information on modifying user settings.

3. Select **Start Test**. Test progress displays in the Percent Complete bar.
4. When the test is complete the results of each filter are shown in the Summary Test Result table, below the Start Test button.
5. For each of the test filters, the results table displays the acceptable UI limit (per the selected standard), the actual measured UI value, the Pass/Fail/Testing state, and the duration that the filter was tested for in seconds.

PDH/T-Carrier Output Jitter Test Standards

The [Output Jitter Compliance Test](#) allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. These combinations of filter settings and levels are organized into test standards.



In addition to the test standards listed below, a [User-Defined Test Standard](#) can also be set up.

►The following is a list of test standards available when testing **OC-192/STM-64** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- G.825 Network
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-48/STM-16** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- GR-253 Network, Type B
- T1.105.03 Equipment
- T1.105.03 Network, Type A Regen
- T1.105.03 Network, Type B Regen
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment

►The following is a list of test standards available when testing **OC-12/STM-4** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment

- GR-812 Equipment
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-3/STM-1** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment
- EN 302 084 Network

►The following test standard is available when testing **OTU-1** or **OTU-2** Jitter:

- G-8251 Network

Configuring a User-Defined Test Standard

1. From the **Jitter** tab select **Output Jitter**.
2. Select **Test Standard** choose **User Defined** from the Select Test Standard dialog box.
3. Select **Modify User Settings**. The Configure User Test Standard dialog box appears.
4. Enable the desired filter(s) by selecting its check box.
5. Select the **Modify** button next to the enabled filter(s) and enter an allowable jitter value. Select **OK**.
6. Select **OK** to close the Configure User Test Standard dialog box.

Jitter Tolerance

Jitter Tolerance - Automated Compliance Tests

The jitter tolerance Automated Compliance Test (ACT) applies jitter and measures errors at a series of frequency/amplitude points. This verifies a network element's ability to perform its function in the presence of jitter on its input signal.

The NIC performs both jitter tolerance ‘acceptance’ tests, and jitter tolerance ‘measurements’ tests.

- **Jitter Tolerance Acceptance Test** - An acceptance test applies jitter at a set of particular frequencies and amplitudes, and verifies that the device under test functions under those conditions. Any point for which the device under test cannot tolerate the specified jitter causes the test to fail.
- **Jitter Tolerance Measurement Test** - A measurement test attempts to determine the maximum level of jitter with which a device will function. The NIC applies jitter at the same frequencies as the acceptance test, but at each frequency it varies the jitter amplitude to find the level at which the device under test fails the selected criterion. The highest level at which the device under test passes becomes the measured jitter tolerance for that frequency.

A tolerance test is traditionally measured in one of two ways:

1. **1-dB Optical Power Penalty Method** - This method uses an attenuated input signal that is adjusted to achieve a specified error rate, typically approximately 100 errors per second with no jitter applied. The input power level is increased by 1dB, which reduces the error rate. Jitter of a specified frequency and amplitude is then applied and the error rate measured again. If the error rate with jitter is at or below the error rate initially measured at reduced power, the device under test can tolerate the jitter applied.
2. **Onset-of-errors Method** - This method starts with a signal that is error free when no jitter is applied. Jitter of a specified frequency and amplitude is then applied to the input of the device under test and its output is monitored for errors for a specified time interval. If, during this interval, the number of errored seconds – one-second intervals in which one or more errors occur – is at or below a threshold, the device under test can tolerate the jitter applied.

Before starting a jitter tolerance test or measurement you are required to set up parameters on the Toler/Transfer screen. The parameters are configured from the Set 1 and Set 2 screens. Once configured, you can begin taking jitter tolerance measurement tests and viewing different types of test result data.

- Configuring Tolerance Test - Set 1
- Configuring Tolerance Test - Set 2
- [Editing a User-Defined Tolerance Mask](#)
- [Starting a Tolerance Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Jitter Tolerance - Automated Compliance Tests

The jitter tolerance Automated Compliance Test (ACT) applies jitter and measures errors at a series of frequency/amplitude points. This verifies a network element's ability to perform its function in the presence of jitter on its input signal.

The NIC performs both jitter tolerance 'acceptance' tests, and jitter tolerance 'measurements' tests.

- **Jitter Tolerance Acceptance Test** - An acceptance test applies jitter at a set of particular frequencies and amplitudes, and verifies that the device under test functions under those conditions. Any point for which the device under test cannot tolerate the specified jitter causes the test to fail.
- **Jitter Tolerance Measurement Test** - A measurement test attempts to determine the maximum level of jitter with which a device will function. The NIC applies jitter at the same frequencies as the acceptance test, but at each frequency it varies the jitter amplitude to find the level at which the device under test fails the selected criterion. The highest level at which the device under test passes becomes the measured jitter tolerance for that frequency.

A tolerance test is traditionally measured in one of two ways:

1. **1-dB Optical Power Penalty Method** - This method uses an attenuated input signal that is adjusted to achieve a specified error rate, typically approximately 100 errors per second with no jitter applied. The input power level is increased by 1dB, which reduces the error rate. Jitter of a specified frequency and amplitude is then applied and the error rate measured again. If the error rate with jitter is at or below the error rate initially measured at reduced power, the device under test can tolerate the jitter applied.
2. **Onset-of-errors Method** - This method starts with a signal that is error free when no jitter is applied. Jitter of a specified frequency and amplitude is then applied to the input of the device under test and its output is monitored for errors for a specified time interval. If, during this interval, the number of errored seconds – one-second intervals in which one or more errors occur – is at or below a threshold, the device under test can tolerate the jitter applied.

Before starting a jitter tolerance test or measurement you are required to set up parameters on the Toler/Transfer screen. The parameters are configured from the Set 1 and Set 2 screens. Once configured, you can begin taking jitter tolerance measurement tests and viewing different types of test result data.

- Configuring Tolerance Test - Set 1
- Configuring Tolerance Test - Set 2
- [Editing a User-Defined Tolerance Mask](#)
- [Starting a Tolerance Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Configuring Tolerance Test - Settings 1 (Set 1)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select the **Test Type** button. The Select Test Type dialog box appears. For a Tolerance test, choose one of the following:
 - **Tolerance - Power Penalty (Acceptance)** -An acceptance test using the 1-dB optical power penalty method.
 - **Tolerance - Power Penalty (Measure)** - A jitter tolerance measurement using the 1-dB optical power penalty method.
 - **Tolerance - Onset (Acceptance)** - An acceptance test using the onset-of-errors measurement method.
 - **Tolerance - Onset (Measure)** - A jitter tolerance measurement using the onset-of-errors measurement method.
4. Select **Test Standard**. The Select Test Standard dialog box appears.
5. Choose the tolerance mask applicable for the currently selected line rate. Both standard (fixed) masks and user-defined masks appear in the list.
6. Select **Auto Distributed Freq Points** and enter the number of automatically distributed test points that you want in the mask.



You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.

5. Select **Error Type**. The Select Error Type dialog box appears.
6. Select the type of measurement error that is to be used for determining the largest bit-error ratio (BER) for a given jitter stimulus frequency.
7. Select [Edit Mask](#). The Edit Mask screen appears.

8. Make any necessary changes to the mask and select **OK**. Select **Cancel** if no changes are required.
9. Select **ES Threshold** to enter the errored second threshold. A measured count that exceeds this threshold causes that point to fail. The ES Threshold button is only available when an 'Onset' Test Type is selected.



For tests using the 'Onset' method, the threshold is the maximum number of errored seconds (ES) that are allowed to occur during the measurement time for one point.

10. If available, select **Threshold**. The BER Parameters section is available when a 'Power Penalty' Test Type is selected.
 - a. Enter the BER Threshold. The threshold is the largest BER that is allowed to occur during the measurement time for one point. A measured ratio that exceeds this threshold causes that point to fail.
 - b. Select the **Set** button for either **Recommended Threshold** or **Current Reading**.

The NIC shows a recommended BER threshold (**Recommended Threshold**) and the currently measured BER (**Current Reading**) based on the line rate and monitored bit error type. The recommended BER threshold is set to 100 errors per second for the chosen error type. This is computed as $100/(\text{bit opportunities per second})$, where the number of bit opportunities is affected by which error type you select and the line rate. For example, the B1 byte covers all the bits in a frame. That translates into 311040 bit opportunities per frame for OC48 at 8000 frames per second. This is 2488320000 bit opportunities per second yielding a recommended BER of $4.018\text{E-}8$. B3 errors would cover fewer of the bytes in a frame and yield a slightly higher BER.

11. To complete the Tolerance test configuration, configure Set 2 parameters.

Configuring Tolerance Test - Settings 2 (Set 2)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 2**.
3. Select **Stimulus Level %** to perform a tolerance acceptance test at a multiple of the amplitude specified by the mask. The Stimulus Level % button is only available when an 'Acceptance' Test Type is selected.

4. Enter the desired stimulus level. This allows for verification of a desired operating margin without the need for a user-defined mask. This value is expressed as a percentage of the mask value; therefore, setting it to 100 performs the test 'at' the mask value.



The maximum amplitude capability of the jitter generator may, at some frequencies, limit the jitter applied to less than the specified multiple of the mask value.

5. Select **DUT Settling Time/Point** and set the time, in seconds, between when jitter is applied to the device under test and the start of monitoring its output for bit errors.
6. Select **Meas. Time/Point** and set the allowable time, in seconds, for applying jitter at a single frequency and monitoring the resulting errors. This setting allows trading-off test execution speed for measurement thoroughness. Some industry standards specify a value, typically 30 seconds, for this parameter.
7. Select **Meas. Search Method** to choose the method of searching for a jitter stimulus level that will toggle the error condition. The Meas. Search Method button is available when a tolerance 'Measurement' Test Type is chosen in the Set 1 configurations. The available choices are:
 - Binary, Decrease amplitude from maximum
 - Binary, Increase amplitude from 0
 - Linear, Decrease amplitude from maximum
 - Linear, Increase amplitude from 0
 - Linear, Increase amplitude per 0.171
 - Binary, Decrease amplitude from maximum (fast)
8. Select **Meas. Resolution (% Of Mask)** to enter a numeric percentage of the mask value for each measurement point. The search will continue until the difference between the pass and fail levels is less than this value. The Meas. Resolution (% Of Mask) button is available when a tolerance 'Measurement' Test Type is chosen in the Set 1 configurations.

Editing a Tolerance Mask

Editing a jitter tolerance (stimulus) [mask](#) allows the user to define or modify the currently selected mask and set the number of measurement points.

1. From the **Jitter** tab, select **Toler/Transfer** and choose **Set 1**.

2. Select **Test Type** and choose a tolerance test from the Select Test Type dialog box.
3. Select **Test Standard** and choose the tolerance mask to be edited.
4. Select **Edit Mask**. The Edit Mask screen appears.
5. The following options are available:
 - **Mask name / description** - Displays the mask selected from the Set 1 Test Standard option.
 - ▶ If a *standardized mask*, you can add extra measurement points; however, you cannot change the end points (vertices).
 - ▶ If a *user-defined mask*, you can add extra measurement points and end points, or [create a new user-defined mask](#).
 - **Auto Distributed Freq Points** - Displays the number of points along the mask curve at which measurements will be performed. The system forces at least as many points as the number of mask vertices.
 - ▶ To change this number, select the **Auto Distributed Freq Points** button and enter the new number of points.
 - **Copy Mask** - Allows you to copy data from a standard mask or another user-defined mask. This function is only available for user-defined masks.
 - ▶ To copy the mask, select **Copy Mask** and choose the desired mask.
 - **Mask Segment Definition** - The segment box displays the parameters for the vertices of the mask segments. Examining the segment definitions of a standard mask is an effective way to become familiar with the format in which mask definitions are displayed and entered. These coordinates are only editable for user-defined masks.

To edit user-defined mask segments:

- a. To add a new segment, select **Add** and enter the coordinates.
 - b. To delete a segment, choose the segment and select **Delete**.
 - c. To modify a segment, choose the segment, select **Modify** and enter the new coordinates.
- **Show meas. points** - Displays dots in the mask plot at the selected measurement frequency points.

- ▶ Select the check box to display the dots or clear the check box to remove the dots.
- **Show generator limits** - Displays the mask trace on the mask plot, which represents the maximum jitter amplitude capability of the jitter generator.
 - ▶ Select the check box to display the mask trace or clear the check box to remove mask trace.
- **Cursor** - Allows you to move a vertical cursor across the mask plot from measurement point to measurement point. The value of frequency and level at the current cursor point are shown in the box to the right of the cursor buttons.
 - ▶ Select the left-arrow or right-arrow Cursor button to move the vertical cursor across the plot.
- **Extra measurement points** -Allows you to specify particular frequencies at which you want measurements to be made. These points are independent of automatically assigned frequencies. The frequencies specified must be within the range covered by the mask. This feature may be used to concentrate measurements in a frequency range that is of particular interest. These points are defined by frequency only and do not create vertices.

To edit user-defined mask segments:

- a. To add a new frequency, select **Add** and enter the coordinates.
- b. To delete a frequency, choose the segment and select **Delete**.
- c. To modify a frequency, choose the segment, select **Modify** and enter the new coordinates.

6. Select **OK**.

Starting a Jitter Tolerance Measurement Test

A jitter tolerance measurement displays the value measured rather than the amplitude applied.

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select **Test Type** and choose a tolerance test.
4. Select the **Test** tab along the left-side of the screen and choose **Start Test**.

During the execution of the test the Elapsed Time indicator increments, the Percent Complete progress bar advances, and the graph and results box are updated.

Individual measurements appear as dots on the graph, using a visual coding system, which is described below.

- **Green triangles** - Measurements that pass testing.
- **Red triangles** - Measurements that fail testing.
- **Green or red dot with a black center** - A measurement's whose applied jitter amplitude is limited by the maximum capability of the jitter generator and has reached its source limit. If space permits, the word **LIMIT** appears next to or below it.
- The frequency, mask value, measured value, and pass/fail status for each point are shown in the window below the graph. These values also appear in the Cursor window for the point at which the vertical cursor is located on the graph.

To view measurement data results more precisely use the [optimization](#) features.

Jitter Transfer

Jitter Transfer - Automated Compliance Tests

The jitter transfer Automated Compliance Test (ACT) verifies that a network element generates or re-transmits no more than an allowed fraction of the jitter it receives at its input.

To perform a transfer a test, the NIC applies jitter over a range of frequencies to the device under test. At each frequency, it makes a narrow-band measurement of the jitter

received from the device under test and calculates the ratio, or jitter gain, of the measured [jitter amplitude](#) to the jitter amplitude applied. If, at all frequencies measured, the device's jitter gain is at or below the allowable threshold, the test passes.

It is recommended to first run a Fast transfer test to get a quick set of results. If the Fast test passes, then perform a High Accuracy test to get a better overall measurement.

Before starting a jitter transfer test or measurement you must set up parameters on the Jitter TX, Toler/Transfer screen. The parameters are configured from Set 1 and Set 2 windows. The user can select from a number of standardized stimulus and response masks, or create their own custom masks. Once the test parameters are configured, you can begin taking jitter transfer measurement tests and viewing different types of test result data.

- [Configuring Transfer Test - Set 1](#)
- [Configuring Transfer Test - Set 2](#)
- [Editing a User-Defined Transfer Mask](#)
- [Calibrating a Transfer Measurement](#)
- [Starting a Transfer Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Jitter Transfer - Automated Compliance Tests

The jitter transfer Automated Compliance Test (ACT) verifies that a network element generates or re-transmits no more than an allowed fraction of the jitter it receives at its input.

To perform a transfer test, the NIC applies jitter over a range of frequencies to the device under test. At each frequency, it makes a narrow-band measurement of the jitter received from the device under test and calculates the ratio, or jitter gain, of the measured [jitter amplitude](#) to the jitter amplitude applied. If, at all frequencies measured, the device's jitter gain is at or below the allowable threshold, the test passes.

It is recommended to first run a Fast transfer test to get a quick set of results. If the Fast test passes, then perform a High Accuracy test to get a better overall measurement.

Before starting a jitter transfer test or measurement you must set up parameters on the Jitter TX, Toler/Transfer screen. The parameters are configured from Set 1 and Set 2 windows. The user can select from a number of standardized stimulus and response masks, or create their own custom masks. Once the test parameters are configured, you can begin taking jitter transfer measurement tests and viewing different types of test result data.

- [Configuring Transfer Test - Set 1](#)
- [Configuring Transfer Test - Set 2](#)
- [Editing a User-Defined Transfer Mask](#)
- [Calibrating a Transfer Measurement](#)
- [Starting a Transfer Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Configuring Transfer Test - Settings 1 (Set 1)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select the **Test Type** button. The Select Test Type dialog box appears. For a Transfer test, choose one of the following:
 - **Transfer (Fast)** - Uses an efficient jitter transfer measurement to achieve the shortest test time. For most test situations, this technique yields satisfactory accuracy.
 - **Transfer (High Accuracy)** - Uses an integration technique to minimize the effects of noise and random variation in the jitter measurement at the expense of a longer test time.
5. Select **Test Standard**. The Select Test Standard dialog box appears.
6. Choose the transfer mask applicable to the currently selected line rate. Both standard (fixed) masks and user-defined masks appear in the list.
7. Select **Auto Distributed Freq Points** and enter the number of automatically distributed test points you want in the mask.



You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.

8. Select the **Edit Mask** button. The [Edit Mask](#) window appears.
9. Make any necessary changes to the mask and select **OK**. Select **Cancel** if no changes are required.
10. [Configure Set 2](#) parameters.

Configuring Transfer Test - Settings 2 (Set 2)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 2**.
3. Select **Stimulus Level %** to control the applied jitter level, at which the jitter transfer is measured. The value is expressed as a percentage of the amplitude specified by the stimulus mask.
4. From **Jitter Transfer Start Frequency Override**, select the **Enable** check box.



The Enable check box must be selected for the Frequency option to be available.

5. Select **Frequency** and enter a precise start frequency transfer value. This setting causes the jitter transfer test to perform over only that part of the frequency range specified by the jitter transfer mask.

Editing a Transfer Mask

Editing a jitter transfer [mask](#) allows the user to define or modify the currently selected mask and to select the number of measurement points.



This is the same mask editor used for [editing a tolerance mask](#) but with minor differences in its configuration.

1. From the **Jitter** tab, select **Toler/Transfer** and choose **Set 1**.
2. Select **Test Type** and choose a transfer test from the Select Test Type dialog box.
3. Select **Test Standard** and choose the transfer mask to be edited.
4. Select **Edit Mask**. The Edit Mask screen appears.
5. The following options are available:

- **Mask name / description** - Displays the mask selected from the Set 1 Test Standard option.
 - ▶ If a *standardized mask*, you can add extra measurement points; however, you cannot change the end points (vertices).
 - ▶ If a *user-defined mask*, you can add extra measurement points and end points, or [create a new user-defined mask](#).
- **Associated stimulus mask name/description** - Displays the name of the jitter tolerance mask that defines the stimulus for the jitter transfer mask.
 - ▶ If a *standardized mask*, you can add extra measurement points; however, you cannot change the end points (vertices).
 - ▶ If a *user-defined mask*, you can add extra measurement points and end points, or [create a new user-defined mask](#).
- **Auto Distributed Freq Points** - Displays the number of points along the mask curve at which measurements will be performed. The system forces at least as many points as the number of mask vertices.
 - ▶ To change this number, select the **Auto Distributed Freq Points** button and enter the new number of points.
- **Copy Mask** - Allows you to copy the Response Mask and/or Stimulus Mask from a standard mask or another user-defined mask to the current user-defined mask. This function is only available for user-defined masks.
 - ▶ To copy the mask, select **Copy Mask** and choose the desired mask.
- **Mask Segment Definition** - Displays the coordinates of the end points (vertices) of the mask segments. Examining the segment definitions of a standard mask is an effective way to become familiar with the format in which mask definitions are displayed and entered. For user-defined masks this field is editable and may be used to add, delete, or modify the vertex coordinates.

To edit user-defined mask segments:

- a. To add a new segment, select **Add** and enter the coordinates.
- b. To delete a segment, choose the segment and select **Delete**.
- c. To modify a segment, choose the segment, select **Modify** and enter the new coordinates.

- **Display** - Displays a Response Mask or Stimulus Mask on the mask plot. For user-defined masks, this option selects the mask currently open for editing.
 - ▶ Select the **Stimulus Mask** or **Response Mask** radio button.
- **Show meas. points** - Displays dots in the mask plot at the selected measurement frequency points.
 - ▶ Select the check box to display the dots or clear the check box to remove the dots.



Measurement points are allocated based on the Response Mask, independent of whether the Response Mask or Stimulus Mask is displayed. Extra measurement points are similarly allocated within the range specified by the response mask.

- **Show generator limits** - Displays the mask trace on the mask plot, which represents the maximum jitter amplitude capability of the jitter generator.
 - ▶ Select the check box to display the mask trace or clear the check box to remove mask trace.
- **Cursor** - Allows you to move a vertical cursor across the mask plot from measurement point to measurement point. The value of frequency and level at the current cursor point are shown in the box to the right of the cursor buttons.
 - ▶ Select the left-arrow or right-arrow Cursor button to move the vertical cursor across the plot.
- **Extra measurement points** - Allows you to specify particular frequencies at which you want measurements to be made. These points are independent of automatically assigned frequencies. The frequencies specified must be within the range covered by the mask. This feature may be used to concentrate measurements in a frequency range that is of particular interest. These points are defined by frequency only and do not create vertices.

To edit user-defined mask segments:

- To add a new frequency, select **Add** and enter the coordinates.
- To delete a frequency, choose the segment and select **Delete**.
- To modify a frequency, choose the segment, select **Modify** and enter the new coordinates.

6. Select **OK**.

Calibrating a Transfer Measurement

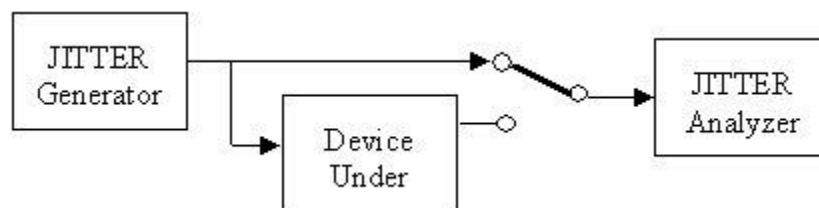
A jitter transfer measurement applies jitter to a device's input and measures the resulting jitter at its output. The jitter amplitude at the output can be small errors or inaccuracies in the jitter measurement. These small problems can be reflected as significant errors in the calculated jitter transfer ratio. There are two opportunities for error in the jitter transfer measurement:

1. Error in generating the applied jitter - This results in the actual amplitude of the applied jitter being different from the intended value.
2. Error in measuring the output jitter - This results in the value measured being different from the actual value.

Because jitter transfer is defined as the ratio of two jitter amplitudes, it is possible to measure not only the jitter at the output of the device under test, but also at its input, and to calculate the jitter transfer ratio from these two measured values. This approach minimizes the effect of both the errors described above for the following reasons:

- Errors in the generated jitter amplitude are irrelevant, because the transfer ratio is calculated from the measured jitter at the input and output of the device under test and not the absolute amplitude to which the jitter generator is set.
- Gain errors in the basic jitter measurement affect measured input and output jitter amplitudes equally and do not enter into the ratio calculation.

Performing a calibration step, in which the NIC's output is connected directly to its input and the jitter amplitude measured at each frequency, can significantly improve the accuracy of jitter transfer measurements. In effect, the measurements are made in a configuration like the one shown below.



 Calibration should be performed after the NIC system has warmed up for 20 minutes or more, and repeated at least once a day.

To start the calibration:

1. From the **Jitter** tab, select **Toler/Transfer**.

 Before continuing, ensure that the system has been set up for a [Jitter Transfer Test](#), looped back to itself for calibration, and that the mask and test settings are configured at the desired values.

2. Select the **Test** tab along the left-side of the screen and choose **Start Calibrate**.

During calibration, the Elapsed Time indicator increments and the Percent Complete progress bar advances. When calibration is complete, the GUI displays "**Calibrated.**"

 Do not change the mask selection or test settings after calibration is completed. Changing these settings erases the calibration data and requires that you repeat of the calibration process.

Starting a Jitter Transfer Measurement Test

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select **Test Type** and choose a transfer test.
4. Select the **Test** tab along the left-side of the screen and choose **Start Test**.

During the execution of the test the Elapsed Time indicator increments, the Percent Complete progress bar advances, and the graph and results box are updated.

Individual measurements appear as dots on the graph, using a visual coding system, which is described below.

- **Green triangles** - Measurements that pass testing.
- **Red triangles** - Measurements that fail testing.
- **Green or red dot with a black center** - A measurement's whose applied jitter amplitude is limited by the maximum capability of the jitter generator and has reached its source limit. If space permits, the word **LIMIT** appears next to or below it.
- The frequency, jitter transfer threshold value, measured jitter transfer value, and pass/fail status for each point are shown in the box below the

graph. These values also appear in the Cursor window for the point at which the vertical cursor is located on the graph.

To view measurement data results more precisely use the [optimization](#) features.

Jitter Specific Tasks

Jitter Specific Tasks

This section includes other tasks that are specific to the Jitter protocol processor.

 For information on performing **Jitter Output**, **Jitter Tolerance**, or **Jitter Transfer** tests, see [Automated Compliance Testing](#).

 For a list of general tasks for a NIC test set, see **Common Tasks**, located in the [Getting Started](#) section of the NIC test set's Online Help.

The following Jitter protocol processor specific tasks is provided:

- [Testing OTN Jitter Interfaces](#)
- [Testing SONET Jitter Interfaces](#)
- [Testing SDH Jitter Interfaces](#)
- [Jitter Stimulus Mask](#)
- [Creating a New User-Defined Mask](#)
- [Optimizing Test Screen Results](#)

Testing OTN Jitter Interfaces

NIC units that contain both a jitter testing module and a OTN circuit pack licensed for OTN jitter Interfaces can be set up to the OTN jitter interfaces from either the Jitter tab or the OTN tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the OTN TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

- Notice that OTU-2 Jitter has its own Jitter TX and RX laser connectors
- OTU-1 Jitter also has its own Jitter TX and RX laser connectors



When testing OTN Jitter, the OTN lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remain ON and active when the optical OTN interface is then changed to a non-jitter Interface rate from the OTN tab, allowing for both the Jitter lasers and OTN lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for an OTN Jitter Interface

1. Select the **OTN** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired **OTN Jitter Interface** for testing.
5. Configure all other necessary OTN parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.



Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for testing optical jitter.

Testing SONET Jitter Interfaces

NIC units that contain both a jitter testing module and a SONET circuit pack licensed for SONET jitter Interfaces can be set up to the SONET jitter interfaces from either the Jitter tab or the SONET tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the SONET TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

- Notice that OC-192 Jitter has it's own Jitter TX and RX laser connectors
- OC-48 Jitter down to OC-3 Jitter also has its own Jitter TX and RX laser connectors
- And EC-3 Jitter has it's own Jitter TX and RX BNC electrical connectors



When testing SONET Jitter, the SONET lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remains ON and active when the optical SONET interface is then changed to a non-jitter Interface rate from the SONET tab, allowing for both the Jitter lasers and SONET lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for a SONET Jitter Interface

1. Select the **SONET** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired **SONET Jitter Interface** for testing.
5. Configure all other necessary SONET parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.



Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for jesting optical jitter.

Testing SDH Jitter Interfaces

NIC units that contain both a jitter testing module and a SDH circuit pack licensed for SDH jitter Interfaces can be set up to the SDH jitter interfaces from either the Jitter tab or the SDH tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the SDH TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

- Notice that STM-64 Jitter has it's own Jitter TX and RX laser connectors
- STM-16 Jitter down to STM-1 Jitter also has its own Jitter TX and RX laser connectors
- And STM-1e Jitter has it's own Jitter TX and RX BNC electrical connectors



When testing SDH Jitter, the SDH lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remains ON and active when the optical SDH interface is then changed to a non-jitter Interface rate from the SDH tab, allowing for both the Jitter lasers and SDH lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for an SDH Jitter Interface

1. Select the **SDH** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired **SDH Jitter Interface** for testing.
5. Configure all other necessary SDH parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.

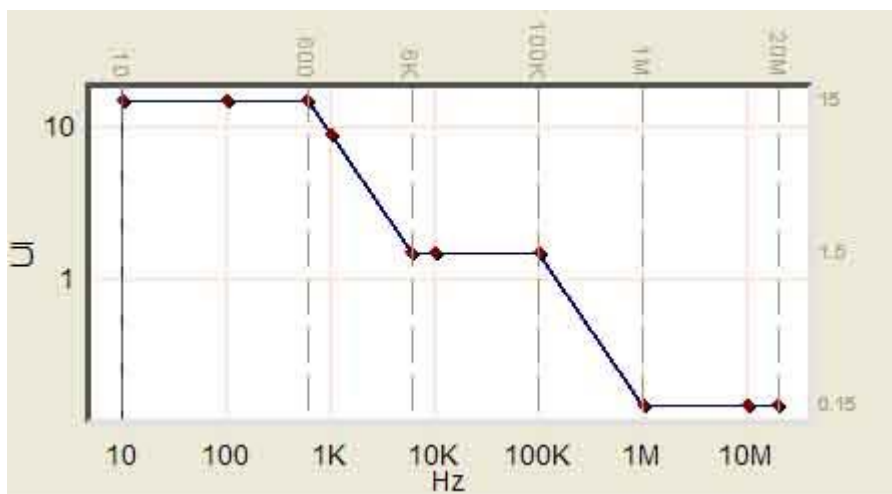
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

⚠ Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for jesting optical jitter.

Jitter Stimulus Mask

The amplitude of jitter that a network element must accept depends on the jitter frequency. It is typically specified by a mask represented in a graph of jitter amplitude, in unit intervals (UI) vs. frequency, called a mask.

The example below, the GR-253 OC-48 Jitter Tolerance Requirement Mask, is a typical jitter mask used for jitter tolerance tests.



In this example:

- The device under test must accept jitter at an amplitude of 15 UI or greater over the frequency range 10 Hz to 1 KHz.
- The required amplitude declines to 1.5 UI at 10 KHz, a slope of one decade of amplitude for one decade of frequency.
- The amplitude value is 1.5 UI to 100 KHz.
- It then declines to 0.15 UI at 1 MHz, again at a slope of one amplitude decade per frequency decade.
- The amplitude remains a constant 0.15 UI up to 20 MHz.

- The frequency range outside of 10 Hz to 20 MHz is not covered by this mask. The standard for which this mask is defined covers only 10 Hz to 20 MHz.

Standard Masks and User-Defined Masks

The telecommunications industry standards define a number of jitter tolerance masks for different line rates and applications. The NIC software includes these [standard masks](#).

In addition to standard masks, there are [user-defined](#) masks whose parameters may be chosen to meet the needs of a particular application. User-defined masks are specified by the frequency and amplitude coordinates of their segment's end points (vertices).

Creating a New User-Defined Mask

When a user-defined mask is selected for the Transfer/Tolerance Test Standard, the Edit Mask screen provides the capability to create a new user-defined mask.

To create a new user-defined mask:

1. Configure a Jitter [Tolerance](#) or [Transfer](#) test. You must select a **User-Defined** mask for the **Test Standard** selection during the configuration.
2. From the **Transmit Set 1** screen, select **Edit Mask**. The Edit Mask screen appears.
3. Select the **Mask name/description** button and enter a new mask name using the keyboard that appears.

 **IMPORTANT:** If you configured the system for a *Transfer* test, then both **Mask name/description** and [Associated stimulus mask name/description](#) options appear. Use the same procedure described below to create a new jitter tolerance mask that will define the stimulus for the jitter transfer mask.

4. Select **Enter**. The new mask name appears in the Mask name/description text field.
5. Select [Auto Distributed Freq Points](#) and enter the number of measurement points to display along the mask curve.
6. From the [Mask Segment definition](#) box, select **Add**. The Modify Jitter Frequency and Amplitude dialog appears.

7. Select **Jitter Frequency** and enter the frequency vertex coordinate using the frequency calculator that appears. Select **OK**.
8. Select **Jitter Amplitude** and enter the amplitude vertex coordinate using the amplitude calculator that appears. Select **OK**.

 **IMPORTANT:** A minimum of two vertices must be defined for the mask segment.

9. From the **Modify Jitter Frequency and Amplitude** dialog box, select **OK** after the segments have been added. Additional segments can be added later and existing segments can be modified by selecting the segment and choosing the appropriate control button. The new segments appear on the mask plot window.
10. You can add extra frequency measurement points to the vertice by selecting **Add** from the [Extra measurement points](#) box.
11. Enter the frequency value using the frequency calculator that appears. Select **OK**. The measurement point appears as a dot on the mask plot.
12. After all coordinates have been configured, select **OK**. The Edit Mask screen closes and the new mask displays as the selected **Test Standard**.

For more information on using the Edit Mask screen, see [Editing a Tolerance Mask](#) and [Editing a Transfer Mask](#).

Optimizing Test Screen Results

The Tolerance/Transfer Test screen contains a variety of options that provide different views of measurement points, frequency and amplitude annotations, coordinate displays, amplitude capability, and measured jitter tolerance values.

To view the test screen results:

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select **Test** from the tabs along the left-side of the Toler/Transfer screen.
3. Use one of the following display controls to view output information:
 - **Graph Display** - Select or clear the check boxes in the Show group to change the way the graph displays data.
 - ▶ **Grid** shows or hides the frequency and amplitude annotations for the graph axis.
 - ▶ **Vertices** shows or hides the coordinate display for the mask vertices.

- ▶ **Gen. Limit** shows or hides a display of the maximum amplitude capability of the jitter generator.
- ▶ **Connect** enables or disables a line between adjacent dots that show measured jitter tolerance values. This function is not applicable to acceptance tests.
- **Cursors** - Select a cursor button to move a vertical cursor to various measurement points on the graph. The window immediately below the buttons displays the frequency and mask values for the cursor point.

Demodulated Data Filter

The following is a list of receive Demodulation Data Filter settings available when testing PDH and T-Carrier Jitter, based on the selected interface rate and the type of receive filter selected:

PDH / T-Carrier Interface	RX Filter	Demod. Filter Range
GR-253 Equipment, Category II		G.783 Type A Regen (2.048 Mbits/S)
GR-253 Network		G.783 Regen. (1.544 Mbits/S)
T1.105.03 Equipment		G.825 Network
T1.105.03 Network		EN 302 084 Network

Jitter Optical Tab

NIC Jitter System Overview

The NIC Jitter system is used to generate and analyze jitter. Jitter can be generated manually or programmed to execute Automated Compliance Tests.

In manual mode, the user can set up a number of parameters for jitter generation, or measurement and then manually start the process. The process continues until the user stops it.

In automated mode, the user can program the Jitter system to execute **Jitter Output**, **Jitter Tolerance**, or **Jitter Transfer** Automated Compliance Tests (ACT). The compliance tests allow the user to programmatically scan through a number of setup parameters and make measurements in accordance with mask sets. These masks can be standardized sets prescribed by various standards organizations, or custom user-defined mask sets.

Jitter configurations are made from the [Transmit](#), [Receive](#), [Output Jitter](#), [Test](#), and [Toler/Transfer](#) screens.

To assist you in performing tasks and understanding protocol functionalities, this Online Help is divided into the following sections:

- [Jitter Screen Functions and Descriptions](#)
- [Automated Compliance Testing](#)
- [Jitter Specific Tasks](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Function and Definitions

Jitter Screen Functions and Descriptions Overview

This section of the online help describes the function screens, buttons, and tabs that control Jitter configuration and operation.

The following screens are found in the Jitter protocol processor:

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [Output Jitter](#)
- [Toler/Transfer](#)
- [LEDs](#)

Transmit

Jitter Transmit Screens and Functions

The Transmit function screens allow you to configure and view transmit settings used to generate Jitter/Wander over an optical or electrical signal.

The following options are available on the Jitter TX Transmit screen:

- [Set 1](#)

Jitter Transmit - Settings (SET 1)

The Jitter Transmit function allows the user to inject jitter onto a selected transmit signal at a chosen sinusoidal frequency that ranges from 10 Hz to the maximum jitter frequency rate for the selected Interface rate. It receives its signal content from the rest of the system. As such, any signal content parameters must be set up by the selected interface's protocol processor.

Use the Set 1 screen to configure Jitter Transmit parameters. The following describes the functions that appear on this screen.

Function	Description
Start Wander GUI (button)	Selecting the Start Wander GUI button launches the Wander Client application.

	 This button only appears on the Remote GUI for NIC test sets licensed for the Wander Client.
Generation Mode	The user can change the Generation Mode from Wander back to Jitter, if Wander mode was enabled by the Wander Client.
Transmit Jitter Mode	Allows the user to manually turn jitter generation on and off.
Jitter Frequency and Amplitude	Displays a pop-up window that allows the manual setting of the jitter frequency and amplitude.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. Off. The unit's laser will be off when the unit is turned on. On. The unit's laser will be on when the unit is turned on. Restore Previous State. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
Interface Rate	Configures the line rate of the jitter transmit signal.  Jitter Interface Rates can also be set using client's OTN or SONET/SDH tab's Interface menu, and from the Presets function.
Clock Reference	Selects the clock reference for the jitter/wander transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. BITS/SETS. • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to

	Internal. The <i>CLK:BITS 1.5MHz</i> displays when configured for BITS clocking. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The <i>CLK:SETS 2MHz</i> displays when configured for SETS clocking.

Receive

Jitter Receive Screens and Functions

The Receive function screens allow you to configure and view receive settings used to measures jitter on an incoming optical or electrical signal.

The following options are available on the Jitter RX Receive screen:

- [Set 1](#)
- [SIG](#)

Jitter Receive - Settings (SET 1)

The Receive SET 1 screen provides the following options and controls:

The following describes the functions that appear on this screen.

Function	Description
Start Wander GUI (button)	Selecting the Start Wander GUI button launches the Wander Client application.  This button only appears on the Remote GUI for NIC test sets licensed for the Wander Client.
Measurement Mode	The user can change the Measurement Mode from Wander back to Jitter, if Wander mode was enabled by the Wander Client.

Interface Type	Allows the user to select from a variety of optical or electrical interfaces as the source for the input signal to be measured for jitter.
STM1e Gain	Allows the user to select between unamplified and amplified signals for measuring jitter over STM-1e. Select one of the following: • Normal (0 dB) • Monitor 9-20 dB)
Threshold Offset	Allows for programming an optical level at which the selection between a low and high level is made. A value of 0mV (default) puts the optical threshold at midpoint between the high and low optical level. Valid range is: -100mv to 100mv
Filter	Allows the user to select from a number of line rate dependant filters to use in the measurement.
Jitter Hit Threshold	Programs the number of UI that is allowed in a jitter measurement before a jitter hit is registered.
Measurement Window Size	Programs the size of the measurement window in seconds.
Frequency Tolerance	Programs the allowable frequency offset in PPM. Valid range is: 0.01 to 100 PPM (20.00 PPM is default)  If the input frequency exceeds this in either direction, a Frequency Out of Range error is registered.
Demodulated Output Range	Programs the gain of the demodulated jitter output signal. Values are in UIpp.
Interface Rate	Configures the line rate of the jitter receive signal.  Jitter Interface Rates can also be set using client's OTN or SONET/SDH tab's Interface menu, and from the Presets function.

Clock Reference	Displays the selected clock reference for the jitter/wander measurement.

Receive - Signal (SIG)

The Receive Signal (SIG) screen shows a number of different measure values concerning the incoming signal. The following describes the functions that appear on this screen.

Function	Description
Frequency	Shows the current measured line frequency of the incoming signal.
Line Frequency Offset Received	Shows the difference, in PPM, between the incoming line frequency and the jitter systems reference frequency.
Optical Power	Shows the current measured optical power of the incoming signal in dBm.

Results

Jitter Results Screens and Functions

The Results screens allows you to view jitter test results and measurements in various formats.

The following functions are available through Jitter Results screen:

- [Count](#)
- [Alarm](#)
- [Large LED](#)
- [Jitter vs. Time](#)

Jitter Results - Count

The Count screen shows status indicators, current measurements, and jitter hits.

The following information is displayed:

Function	Description
Interface Rate and Type	Shows the currently selected line rate.
Filter	Shows the currently selected filter.
Measurement Window Size	Shows the currently programmed window size, in seconds.
Current Measurements Table	The table below the three status indicators described above (Interface Rate and Type, Filter, Measurement Window Size) displays the window status, as well as the current measurements for: • Peak-to-Peak • Positive Peak • Negative Peak • RMS (Available when a filter is selected that includes RMS measurement it is shown as well.) These measurements are for the current window and the windows where the minimum and maximum readings were recorded.
Jitter Hit Threshold	Below the Count Measurements Table is another table showing jitter hits. It shows both the jitter hit seconds, as well as the total number of jitter hits.

Jitter Results - Alarm

The Alarm screen monitors and report alarms various alarms, and the duration of each alarm in seconds, detected by the jitter receiver.

The following alarms can be monitored:

- **LOS (Loss of Signal)**
- **PP Ref. Not Ok**
- **Optical Overload**
- **Power Loss**
- **Frequency Out of Range**

Jitter Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the Jitter protocol processor, see [Quick Status LEDs](#).

Jitter Results - Jitter vs. Time

The Jitter vs. Time screen is used to display a running graphical representation of the jitter results. These results can be displayed in either a UI versus Time format or a Histogram format. The screen contains a number of check boxes and buttons that allow the user to change the details of how the results are displayed.

Function	Description
Peak to Peak	When selected, the Peak to Peak values are displayed in the graph.
Negative Peak	When selected, the Negative Peak values are displayed in the graph.
Positive Peak	When selected, the Positive Peak values are displayed in the graph.
RMS	When selected, the RMS values are displayed in the graph.

	💡 If the user has not selected a filter that allows RMS measurement, this item will not be available.
Hit Threshold	Allows the user to program the Jitter Hit Threshold from the Jitter vs Time screen. This has the same effect as the Jitter Hit Threshold button on the Receive Set 1 screen.
Display Threshold	When selected, the Hit Threshold is displayed as a dotted line on the Results graph.
Live Update	When selected, the screen updates each time a new measurement window is evaluated. Clearing the check box freezes the graph until you check the box again.
Histogram	When selected, the graph displays results in histogram form. The Horizontal axis is measured UI and vertical axis is the number of windowed measurements at a particular UI level. 💡 When Histogram is selected the Hit Threshold button is not available.
Undo Zoom	Restores the zoom level of the graph to the default size.
Scale Up	Decreases the resolution of the time axis in the UI versus time display.
Scale Down	Increases the resolution of the time axis in the UI versus time display.
Auto Scale	Automatically sets the resolution of the axis such that the entire results can be seen.

💡 You can zoom in on portions of the graph by simply dragging the cursor across a section of the Histogram.

Test

Test Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following function:

- [SET 1](#)

Set 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.

1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.

- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (.). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the

	Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test	Enables real-time reporting. Any event that occurs during a real-time test automatically

 This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.



The events occurring while in pause mode will be recorded in the Event Log.

Output Jitter

Output Jitter Test Screen and Functions

The Output Jitter screen is used to configure and display results for an [Output Jitter Compliance Test](#).



This functionality allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. The combinations of filter settings and levels are organized into test standards. The NIC provides a number of test standards that can be selected from the NIC touch screen.

The following functions are available through Output Jitter screen:

Function	Description
Test Standard	Allows the user to select from a variety of jitter output jitter test standards , based on different filter settings. It also allows the user to create/select a user-defined test standard.
Modify User Settings	If the User-Defined Test Standard is selected under Test Standard then the Modify User Settings button allows the user to choose a set of filters and levels to make up their own mask.
Rate	Displays the transmit interface rate.
Start/Stop Test	Starts/Stops the Output Jitter compliance test.
Percent Complete	T test's progress is displayed in the Percent Complete bar
Summary Test Result table	For each of the test filters, this table displays the acceptable UI limit (per the selected standard), the actual measured UI value, the Pass/Fail/Testing state, and the duration that the filter was tested for in seconds.

Output Jitter Test Standards

The [Output Jitter Compliance Test](#) allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. These combinations of filter settings and levels are organized into test standards.



In addition to the test standards listed below, a [User-Defined Test Standard](#) can also be set up.

►The following is a list of test standards available when testing **OC-192/STM-64** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- G.825 Network
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-48/STM-16** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- GR-253 Network, Type B
- T1.105.03 Equipment
- T1.105.03 Network, Type A Regen
- T1.105.03 Network, Type B Regen
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment

►The following is a list of test standards available when testing **OC-12/STM-4** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-3/STM-1** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment
- EN 302 084 Network

►The following test standard is available when testing **OTU-1** or **OTU-2** Jitter:

- G-8251 Network

Toler / Transfer

Jitter Toler/Transfer Settings Screens

The Toler/Transfer, Set screen provides the configuration settings for all of the test parameters. The user can select from a number of standardized stimulus and response masks, or create their own custom masks.

Settings are configured on the following screens:

- [Set 1](#)

- [Set 2](#)
- [Test](#)

Jitter Toler/Transfer - SET Screen Settings 1 (Set 1)

The Tolerance and Transfer Settings 1 screen contains the following options:

Function	Description
Test Type	Provides selection of four types of tolerance tests and two types of transfer tests.
Test Standard	Provides a list of industry standard transfer and tolerance masks, as well as User Defined masks from which to choose.
Auto Distributed Frequency Points	Allows the user to set the number of automatically distributed test points in the mask.  You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.
Error Type	Provides a list of error types used in determining onset of errors or a BER rate in a jitter tolerance test.  The Error Type button does not apply if jitter transfer is selected as a test type.
Edit Mask	Provides access to the Edit Mask screen, where you can view and add measurement points to a standardized mask. If the mask is user-defined it allows you to add or edit vertices points to the mask.
ES Threshold	Allows the user to set the number of errored seconds that are allowed in an onset of errors tolerance test before that point is marked as failed.  This does not apply to transfer measurements or 1db power penalty tolerance measurements.
BER - Threshold	When a Power Penalty Tolerance test is selected, this allows the user to set the BER operating point, around which the 1db power penalty measurements are made.

BER - Recommended Threshold	When a Power Penalty Tolerance test is selected, this displays the current recommended BER threshold for power penalty measurements.  Selecting the Set button to the left of Recommended Threshold will set the Threshold to the recommended displayed value.
BER - Current Reading	When a Power Penalty Tolerance test is selected, this displays the current reading at the receiver.  Selecting the Set button to the left of Current Reading will set the Threshold to the current reading value.

Jitter Toler/Transfer - SET Screen Settings 2 (Set 2)

The Transfer and Tolerance Settings 2 screen contains the following options:

Function	Description
Stimulus Level %	Provides ability to set a stimulus level for acceptance tests. By setting this value higher than 100%, the user can build margin into an acceptance test. Setting this to 100% causes the measurements to run exactly at the standardized acceptance point.
Jitter Transfer Start Frequency Override	For Transfer tests, this function provides the ability to change the start frequency of the measurements by checking the Enable checkbox and selecting the Frequency button to enter a starting value different from that of the standardized mask.
DUT Settling Time/Point	For Tolerance tests, this function allows the user to program a delay between the time that the stimulus is applied at a particular frequency and the time the measurement is started.
Measurement Time/Point	For Tolerance tests, this function is used to program the number of seconds for which each frequency point is tested.
Meas. Search Method	For Tolerance measurements, this function allows selection of the search method used in arriving at the pass fail point.

Meas. Resolution (% of Mask)	For Tolerance measurements, this function allows the user to program the accuracy of the measurement. The search will cease when the difference between the pass and fail level is less than the programmed percentage of the total measurement level.

Jitter Toler/Transfer - Test

The Test screen contains a variety of options that provide different views of measurement points, frequency and amplitude annotations, coordinate displays, amplitude capability, and measured jitter tolerance values.

The Toler/Transfer Test screen contains the following options:

Function	Description
Start/Stop Test	Starts and stops the test.
Show	Allows the user to change the appearance of the graph in the right-hand portion of the screen. • Grid shows or hides the frequency and amplitude annotations for the graph axis. • Vertices shows or hides the coordinate display for the mask vertices. • Gen. Limit shows or hides a display of the maximum amplitude capability of the jitter generator. • Connect enables or disables drawing a line between adjacent dots that show measured jitter tolerance values. This function is not applicable to acceptance tests.
Cursor	Selecting the Cursor buttons moves the cursor to various measurement points on the graph. The window immediately below the buttons displays the frequency, mask value, measured value, and pass/fail status of the current point.

Jitter LED Quick Status Area

When the Jitter protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) screen.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

 The Jitter laser remains ON when the optical interface is changed to a non-jitter SONET/SDH signal, allowing the Jitter laser and Optical Multirate laser to remain on at the same time.

LED	Description
Tx	Displays the status of Transmit interface rate.
Rx	Displays the status of the Receive interface rate.
Opt. Power	Displays the optical signal power, when the Receive Interface Type is set to Optical Data.
Test Paused	Displays a red LED when a test paused.
Tx Clk:	Displays the status of the Transmit Clock Reference.
Rx Clk:	Displays the status of the Receive Clock Reference.
Tx PP Ref.	Confirms that the Jitter Tx Protocol Processor internal clock reference is okay and that the test set is operating normally.
Rx PP Ref.	Confirms that the Jitter Rx Protocol Processor internal clock reference is okay and that the test set is operating normally.
Jitter	Indicates whether or not jitter is activated. (i.e. generating jitter).
Laser Over Temp	Indicates that the temperature control on the laser, for the Jitter TX has failed to keep the laser temperature within the specified guidelines. It

	may be due to a failure of the jitter TX board's temperature control or general system overheating.  This condition could be injurious to the laser. The system should be immediately powered down and sent in for service.
Laser Under Temp	Indicates that the temperature control on the laser, for the Jitter TX has failed to keep the laser temperature within the specified guidelines. This is usually to a failure in the Jitter TX board's temperature control circuit.  If this condition persists the system should be sent in for service.
Input Optical Data	Indicates the presence of an optical signal at the input of the module.
LOS	Loss of Signal. An alarm LED indicating a valid signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported.
Optical Overload	Indicates that the optical power level is exceeds the maximum allowable (0 dBm) level.
Power Loss	Indicates there has been a loss of line power.
Frequency Out of Range	Indicates that the measured line rate of the incoming signal is greater or less than the reference line rate of the measurement system by more than the amount programmed by the Frequency Tolerance button.
Jitter Hits	Indicates that the system had instances of measured jitter exceeding the Jitter Hit Threshold.
STM1-e Code Violations	For an STM-1e input, a red LED indicates CMI Code Violations.

Automated Compliance Testing

Performing Automated Compliance Tests

Automated Compliance Tests (ACT) differ from manual measurements in that the system can be programmed to make multiple test point measurements instead of just one. This allows the multiple test points to be compared against a set of allowable limits to those measurements.

This is done by using the Jitter Stimulus Mask to define the set of points to be measured for the device-under-test that meets a set of standardized or user-defined criteria. This frees the user from the burden of having to manually set up and run a test for each of the data points.

The NIC provides for three types of automated compliance tests: **Jitter Output**, **Jitter Tolerance**, and **Jitter Transfer**.

- [Jitter Output - Automated Compliance Tests](#) - A number of different filter settings can be used, each with its own jitter output limit.
- [Jitter Tolerance - Automated Compliance Tests](#) - A number of different frequency/level pairs can be used as stimulus for the DUT. The pass/fail criteria can be programmed to either 'Onset' or 'Power Penalty'.
- [Jitter Transfer - Automated Compliance Tests](#) - Both stimulus and response criteria can be programmed. The stimulus can be programmed to vary in both frequency and level. The response mask can also be programmed with frequency and level points.

Jitter Output

Running an Output Jitter Compliance Test

A Jitter Output Test measures the jitter on an incoming optical or electrical signal. That incoming signal may be either a clock or data signal. To prepare for the Output test the module line rate must be programmed.

The system measures jitter as a peak-to-peak or RMS value after selecting and applying a filter. The filters are standardized sets of filters defined by the ITU and Telcordia, and are line rate dependant.

1. From the **Jitter** tab, select [Output Jitter](#).
2. Select **Test Standard** and choose a test standard from the [Select Test Standard](#) dialog box.



If you choose **User Defined** as the Test Standard, select the **Modify User Settings** button on the Output Jitter screen to select the filters and levels that you want as part of your test.

See the section "[Configuring a User-Defined Test Standard](#)" for more information on modifying user settings.

3. Select **Start Test**. Test progress displays in the Percent Complete bar.
4. When the test is complete the results of each filter are shown in the Summary Test Result table, below the Start Test button.
5. For each of the test filters, the results table displays the acceptable UI limit (per the selected standard), the actual measured UI value, the Pass/Fail/Testing state, and the duration that the filter was tested for in seconds.

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A Jitter Output Test measures the jitter on an incoming optical or electrical signal. That incoming signal may be either a clock or data signal. To prepare for the Output test the module line rate must be programmed.

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See the section "[Configuring a User-Defined Test Standard](#)" for more information on modifying user settings.

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5. For each of the test filters, the results table displays the acceptable UI limit (per the selected standard), the actual measured UI value, the Pass/Fail/Testing state, and the duration that the filter was tested for in seconds.

Output Jitter Test Standards

The [Output Jitter Compliance Test](#) allows the user to test a device's output jitter against a set of allowable jitter levels at each of a number of different filter settings. These combinations of filter settings and levels are organized into test standards.



In addition to the test standards listed below, a [User-Defined Test Standard](#) can also be set up.

►The following is a list of test standards available when testing **OC-192/STM-64** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- G.825 Network
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-48/STM-16** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- GR-253 Network, Type B
- T1.105.03 Equipment
- T1.105.03 Network, Type A Regen
- T1.105.03 Network, Type B Regen
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment

►The following is a list of test standards available when testing **OC-12/STM-4** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network

- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment
- EN 302 084 Network

►The following is a list of test standards available when testing **OC-3/STM-1** Jitter:

- GR-253 Equipment, Category II
- GR-253 Network
- T1.105.03 Equipment
- T1.105.03 Network
- G.783 Type A Regen (2.048 Mbits/S)
- G.783 Regen. (1.544 Mbits/S)
- GR-812 Equipment
- GR-813 Equipment, Option 1
- GR-813 Equipment, Option 2
- G.825 Network
- EN 300 462-4-1 Equipment
- EN 300 462-5-1 Equipment
- EN 300 462-7-1 Equipment
- EN 302 084 Network

►The following test standard is available when testing **OTU-1** or **OTU-2** Jitter:

- G-8251 Network

Configuring a User-Defined Test Standard

1. From the **Jitter** tab select **Output Jitter**.
2. Select **Test Standard** choose **User Defined** from the Select Test Standard dialog box.
3. Select **Modify User Settings**. The Configure User Test Standard dialog box appears.
4. Enable the desired filter(s) by selecting its check box.
5. Select the **Modify** button next to the enabled filter(s) and enter an allowable jitter value. Select **OK**.
6. Select **OK** to close the Configure User Test Standard dialog box.

Jitter Tolerance

Jitter Tolerance - Automated Compliance Tests

The jitter tolerance Automated Compliance Test (ACT) applies jitter and measures errors at a series of frequency/amplitude points. This verifies a network element's ability to perform its function in the presence of jitter on its input signal.

The NIC performs both jitter tolerance 'acceptance' tests, and jitter tolerance 'measurements' tests.

- **Jitter Tolerance Acceptance Test** - An acceptance test applies jitter at a set of particular frequencies and amplitudes, and verifies that the device under test functions under those conditions. Any point for which the device under test cannot tolerate the specified jitter causes the test to fail.
- **Jitter Tolerance Measurement Test** - A measurement test attempts to determine the maximum level of jitter with which a device will function. The NIC applies jitter at the same frequencies as the acceptance test, but at each frequency it varies the jitter amplitude to find the level at which the device under test fails the selected criterion. The highest level at which the device under test passes becomes the measured jitter tolerance for that frequency.

A tolerance test is traditionally measured in one of two ways:

1. **1-dB Optical Power Penalty Method** - This method uses an attenuated input signal that is adjusted to achieve a specified error rate, typically approximately 100 errors per second with no jitter applied. The input power level is increased by 1dB, which reduces the error rate. Jitter of a specified frequency and amplitude is then applied and the error rate measured again. If the error rate with jitter is at or below the error rate initially measured at reduced power, the device under test can tolerate the jitter applied.
2. **Onset-of-errors Method** - This method starts with a signal that is error free when no jitter is applied. Jitter of a specified frequency and amplitude is then applied to the input of the device under test and its output is monitored for errors for a specified time interval. If, during this interval, the number of errored seconds – one-second intervals in which one or more errors occur – is at or below a threshold, the device under test can tolerate the jitter applied.

Before starting a jitter tolerance test or measurement you are required to set up parameters on the Toler/Transfer screen. The parameters are configured from the Set 1 and Set 2 screens. Once configured, you can begin taking jitter tolerance measurement tests and viewing different types of test result data.

- Configuring Tolerance Test - Set 1

- Configuring Tolerance Test - Set 2
- [Editing a User-Defined Tolerance Mask](#)
- [Starting a Tolerance Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Jitter Tolerance - Automated Compliance Tests

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The NIC performs both jitter tolerance 'acceptance' tests, and jitter tolerance 'measurements' tests.

- **Jitter Tolerance Acceptance Test** - An acceptance test applies jitter at a set of particular frequencies and amplitudes, and verifies that the device under test functions under those conditions. Any point for which the device under test cannot tolerate the specified jitter causes the test to fail.
- **Jitter Tolerance Measurement Test** - A measurement test attempts to determine the maximum level of jitter with which a device will function. The NIC applies jitter at the same frequencies as the acceptance test, but at each frequency it varies the jitter amplitude to find the level at which the device under test fails the selected criterion. The highest level at which the device under test passes becomes the measured jitter tolerance for that frequency.

A tolerance test is traditionally measured in one of two ways:

1. **1-dB Optical Power Penalty Method** - This method uses an attenuated input signal that is adjusted to achieve a specified error rate, typically approximately 100 errors per second with no jitter applied. The input power level is increased by 1dB, which reduces the error rate. Jitter of a specified frequency and amplitude is then applied and the error rate measured again. If the error rate with jitter is at or below the error rate initially measured at reduced power, the device under test can tolerate the jitter applied.
2. **Onset-of-errors Method** - This method starts with a signal that is error free when no jitter is applied. Jitter of a specified frequency and amplitude is then applied to the input of the device under test and its output is monitored for errors for a specified time interval. If, during this interval, the number of errored seconds – one-second intervals in which one or more errors occur – is at or below a threshold, the device under test can tolerate the jitter applied.

Before starting a jitter tolerance test or measurement you are required to set up parameters on the Toler/Transfer screen. The parameters are configured from the Set 1 and Set 2 screens. Once configured, you can begin taking jitter tolerance measurement tests and viewing different types of test result data.

- Configuring Tolerance Test - Set 1
- Configuring Tolerance Test - Set 2
- [Editing a User-Defined Tolerance Mask](#)
- [Starting a Tolerance Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Configuring Tolerance Test - Settings 1 (Set 1)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select the **Test Type** button. The Select Test Type dialog box appears. For a Tolerance test, choose one of the following:
 - **Tolerance - Power Penalty (Acceptance)** -An acceptance test using the 1-dB optical power penalty method.
 - **Tolerance - Power Penalty (Measure)** - A jitter tolerance measurement using the 1-dB optical power penalty method.
 - **Tolerance - Onset (Acceptance)** - An acceptance test using the onset-of-errors measurement method.
 - **Tolerance - Onset (Measure)** - A jitter tolerance measurement using the onset-of-errors measurement method.
4. Select **Test Standard**. The Select Test Standard dialog box appears.
5. Choose the tolerance mask applicable for the currently selected line rate. Both standard (fixed) masks and user-defined masks appear in the list.
6. Select **Auto Distributed Freq Points** and enter the number of automatically distributed test points that you want in the mask.



You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.

5. Select **Error Type**. The Select Error Type dialog box appears.
6. Select the type of measurement error that is to be used for determining the largest bit-error ratio (BER) for a given jitter stimulus frequency.
7. Select **Edit Mask**. The Edit Mask screen appears.
8. Make any necessary changes to the mask and select **OK**. Select **Cancel** if no changes are required.
9. Select **ES Threshold** to enter the errored second threshold. A measured count that exceeds this threshold causes that point to fail. The ES Threshold button is only available when an 'Onset' Test Type is selected.



For tests using the 'Onset' method, the threshold is the maximum number of errored seconds (ES) that are allowed to occur during the measurement time for one point.

10. If available, select **Threshold**. The BER Parameters section is available when a 'Power Penalty' Test Type is selected.
 - a. Enter the BER Threshold. The threshold is the largest BER that is allowed to occur during the measurement time for one point. A measured ratio that exceeds this threshold causes that point to fail.
 - b. Select the **Set** button for either **Recommended Threshold** or **Current Reading**.

The NIC shows a recommended BER threshold (**Recommended Threshold**) and the currently measured BER (**Current Reading**) based on the line rate and monitored bit error type. The recommended BER threshold is set to 100 errors per second for the chosen error type. This is computed as $100/(\text{bit opportunities per second})$, where the number of bit opportunities is affected by which error type you select and the line rate. For example, the B1 byte covers all the bits in a frame. That translates into 311040 bit opportunities per frame for OC48 at 8000 frames per second. This is 2488320000 bit opportunities per second yielding a recommended BER of $4.018\text{E-}8$. B3 errors would cover fewer of the bytes in a frame and yield a slightly higher BER.

11. To complete the Tolerance test configuration, configure Set 2 parameters.

Configuring Tolerance Test - Settings 2 (Set 2)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 2**.
3. Select **Stimulus Level %** to perform a tolerance acceptance test at a multiple of the amplitude specified by the mask. The Stimulus Level % button is only available when an 'Acceptance' Test Type is selected.
4. Enter the desired stimulus level. This allows for verification of a desired operating margin without the need for a user-defined mask. This value is expressed as a percentage of the mask value; therefore, setting it to 100 performs the test 'at' the mask value.



The maximum amplitude capability of the jitter generator may, at some frequencies, limit the jitter applied to less than the specified multiple of the mask value.

5. Select **DUT Settling Time/Point** and set the time, in seconds, between when jitter is applied to the device under test and the start of monitoring its output for bit errors.
6. Select **Meas. Time/Point** and set the allowable time, in seconds, for applying jitter at a single frequency and monitoring the resulting errors. This setting allows trading-off test execution speed for measurement thoroughness. Some industry standards specify a value, typically 30 seconds, for this parameter.
7. Select **Meas. Search Method** to choose the method of searching for a jitter stimulus level that will toggle the error condition. The Meas. Search Method button is available when a tolerance 'Measurement' Test Type is chosen in the Set 1 configurations. The available choices are:
 - Binary, Decrease amplitude from maximum
 - Binary, Increase amplitude from 0
 - Linear, Decrease amplitude from maximum
 - Linear, Increase amplitude from 0
 - Linear, Increase amplitude per 0.171
 - Binary, Decrease amplitude from maximum (fast)
8. Select **Meas. Resolution (% Of Mask)** to enter a numeric percentage of the mask value for each measurement point. The search will continue until the difference between the pass and fail levels is less than this value. The Meas. Resolution (% Of Mask) button is available when a tolerance 'Measurement' Test Type is chosen in the Set 1 configurations.

Editing a Tolerance Mask

Editing a jitter tolerance (stimulus) [mask](#) allows the user to define or modify the currently selected mask and set the number of measurement points.

1. From the **Jitter** tab, select **Toler/Transfer** and choose **Set 1**.
2. Select **Test Type** and choose a tolerance test from the Select Test Type dialog box.
3. Select **Test Standard** and choose the tolerance mask to be edited.
4. Select **Edit Mask**. The Edit Mask screen appears.
5. The following options are available:
 - **Mask name / description** - Displays the mask selected from the Set 1 Test Standard option.
 - ▶ If a *standardized mask*, you can add extra measurement points; however, you cannot change the end points (vertices).
 - ▶ If a *user-defined mask*, you can add extra measurement points and end points, or [create a new user-defined mask](#).
 - **Auto Distributed Freq Points** - Displays the number of points along the mask curve at which measurements will be performed. The system forces at least as many points as the number of mask vertices.
 - ▶ To change this number, select the **Auto Distributed Freq Points** button and enter the new number of points.
 - **Copy Mask** - Allows you to copy data from a standard mask or another user-defined mask. This function is only available for user-defined masks.
 - ▶ To copy the mask, select **Copy Mask** and choose the desired mask.
 - **Mask Segment Definition** - The segment box displays the parameters for the vertices of the mask segments. Examining the segment definitions of a standard mask is an effective way to become familiar with the format in which mask definitions are displayed and entered. These coordinates are only editable for user-defined masks.

To edit user-defined mask segments:

- a. To add a new segment, select **Add** and enter the coordinates.
- b. To delete a segment, choose the segment and select **Delete**.

- c. To modify a segment, choose the segment, select **Modify** and enter the new coordinates.
- **Show meas. points** - Displays dots in the mask plot at the selected measurement frequency points.
 - ▶ Select the check box to display the dots or clear the check box to remove the dots.
- **Show generator limits** - Displays the mask trace on the mask plot, which represents the maximum jitter amplitude capability of the jitter generator.
 - ▶ Select the check box to display the mask trace or clear the check box to remove mask trace.
- **Cursor** - Allows you to move a vertical cursor across the mask plot from measurement point to measurement point. The value of frequency and level at the current cursor point are shown in the box to the right of the cursor buttons.
 - ▶ Select the left-arrow or right-arrow Cursor button to move the vertical cursor across the plot.
- **Extra measurement points** -Allows you to specify particular frequencies at which you want measurements to be made. These points are independent of automatically assigned frequencies. The frequencies specified must be within the range covered by the mask. This feature may be used to concentrate measurements in a frequency range that is of particular interest. These points are defined by frequency only and do not create vertices.

To edit user-defined mask segments:

- a. To add a new frequency, select **Add** and enter the coordinates.
- b. To delete a frequency, choose the segment and select **Delete**.
- c. To modify a frequency, choose the segment, select **Modify** and enter the new coordinates.

6. Select **OK**.

Starting a Jitter Tolerance Measurement Test

A jitter tolerance measurement displays the value measured rather than the amplitude applied.

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select **Test Type** and choose a tolerance test.
4. Select the **Test** tab along the left-side of the screen and choose **Start Test**.

During the execution of the test the Elapsed Time indicator increments, the Percent Complete progress bar advances, and the graph and results box are updated.

Individual measurements appear as dots on the graph, using a visual coding system, which is described below.

- **Green triangles** - Measurements that pass testing.
- **Red triangles** - Measurements that fail testing.
- **Green or red dot with a black center** - A measurement's whose applied jitter amplitude is limited by the maximum capability of the jitter generator and has reached its source limit. If space permits, the word **LIMIT** appears next to or below it.
- The frequency, mask value, measured value, and pass/fail status for each point are shown in the window below the graph. These values also appear in the Cursor window for the point at which the vertical cursor is located on the graph.

To view measurement data results more precisely use the [optimization](#) features.

Jitter Transfer

Jitter Transfer - Automated Compliance Tests

The jitter transfer Automated Compliance Test (ACT) verifies that a network element generates or re-transmits no more than an allowed fraction of the jitter it receives at its input.

To perform a transfer a test, the NIC applies jitter over a range of frequencies to the device under test. At each frequency, it makes a narrow-band measurement of the jitter received from the device under test and calculates the ratio, or jitter gain, of the measured [jitter amplitude](#) to the jitter amplitude applied. If, at all frequencies measured, the device's jitter gain is at or below the allowable threshold, the test passes.

It is recommended to first run a Fast transfer test to get a quick set of results. If the Fast test passes, then perform a High Accuracy test to get a better overall measurement.

Before starting a jitter transfer test or measurement you must set up parameters on the Jitter TX, Toler/Transfer screen. The parameters are configured from Set 1 and Set 2 windows. The user can select from a number of standardized stimulus and response masks, or create their own custom masks. Once the test parameters are configured, you can begin taking jitter transfer measurement tests and viewing different types of test result data.

- [Configuring Transfer Test - Set 1](#)
- [Configuring Transfer Test - Set 2](#)
- [Editing a User-Defined Transfer Mask](#)
- [Calibrating a Transfer Measurement](#)
- [Starting a Transfer Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Jitter Transfer - Automated Compliance Tests

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To perform a transfer a test, the NIC applies jitter over a range of frequencies to the device under test. At each frequency, it makes a narrow-band measurement of the jitter received from the device under test and calculates the ratio, or jitter gain, of the

measured [jitter amplitude](#) to the jitter amplitude applied. If, at all frequencies measured, the device's jitter gain is at or below the allowable threshold, the test passes.

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Before starting a jitter transfer test or measurement you must set up parameters on the Jitter TX, Toler/Transfer screen. The parameters are configured from Set 1 and Set 2 windows. The user can select from a number of standardized stimulus and response masks, or create their own custom masks. Once the test parameters are configured, you can begin taking jitter transfer measurement tests and viewing different types of test result data.

- [Configuring Transfer Test - Set 1](#)
- [Configuring Transfer Test - Set 2](#)
- [Editing a User-Defined Transfer Mask](#)
- [Calibrating a Transfer Measurement](#)
- [Starting a Transfer Measurement Test](#)
- [Optimizing Tolerance/Transfer Test Screen Results](#)

Configuring Transfer Test - Settings 1 (Set 1)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select the **Test Type** button. The Select Test Type dialog box appears. For a Transfer test, choose one of the following:
 - **Transfer (Fast)** - Uses an efficient jitter transfer measurement to achieve the shortest test time. For most test situations, this technique yields satisfactory accuracy.
 - **Transfer (High Accuracy)** - Uses an integration technique to minimize the effects of noise and random variation in the jitter measurement at the expense of a longer test time.
5. Select **Test Standard**. The Select Test Standard dialog box appears.

6. Choose the transfer mask applicable to the currently selected line rate. Both standard (fixed) masks and user-defined masks appear in the list.
7. Select **Auto Distributed Freq Points** and enter the number of automatically distributed test points you want in the mask.



You are not allowed to enter a number that is less than the minimum number of points required to define the set of vertices in the mask.

8. Select the **Edit Mask** button. The [Edit Mask](#) window appears.
9. Make any necessary changes to the mask and select **OK**. Select **Cancel** if no changes are required.
10. [Configure Set 2](#) parameters.

Configuring Transfer Test - Settings 2 (Set 2)

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 2**.
3. Select **Stimulus Level %** to control the applied jitter level, at which the jitter transfer is measured. The value is expressed as a percentage of the amplitude specified by the stimulus mask.
4. From **Jitter Transfer Start Frequency Override**, select the **Enable** check box.



The Enable check box must be selected for the Frequency option to be available.

5. Select **Frequency** and enter a precise start frequency transfer value. This setting causes the jitter transfer test to perform over only that part of the frequency range specified by the jitter transfer mask.

Editing a Transfer Mask

Editing a jitter transfer [mask](#) allows the user to define or modify the currently selected mask and to select the number of measurement points.



This is the same mask editor used for [editing a tolerance mask](#) but with minor differences in its configuration.

1. From the **Jitter** tab, select **Toler/Transfer** and choose **Set 1**.
2. Select **Test Type** and choose a transfer test from the Select Test Type dialog box.
3. Select **Test Standard** and choose the transfer mask to be edited.

4. Select **Edit Mask**. The Edit Mask screen appears.
5. The following options are available:
 - **Mask name / description** - Displays the mask selected from the Set 1 Test Standard option.
 - ▶ If a *standardized mask*, you can add extra measurement points; however, you cannot change the end points (vertices).
 - ▶ If a *user-defined mask*, you can add extra measurement points and end points, or [create a new user-defined mask](#).
 - **Associated stimulus mask name/description** - Displays the name of the jitter tolerance mask that defines the stimulus for the jitter transfer mask.
 - ▶ If a *standardized mask*, you can add extra measurement points; however, you cannot change the end points (vertices).
 - ▶ If a *user-defined mask*, you can add extra measurement points and end points, or [create a new user-defined mask](#).
 - **Auto Distributed Freq Points** - Displays the number of points along the mask curve at which measurements will be performed. The system forces at least as many points as the number of mask vertices.
 - ▶ To change this number, select the **Auto Distributed Freq Points** button and enter the new number of points.
 - **Copy Mask** - Allows you to copy the Response Mask and/or Stimulus Mask from a standard mask or another user-defined mask to the current user-defined mask. This function is only available for user-defined masks.
 - ▶ To copy the mask, select **Copy Mask** and choose the desired mask.
 - **Mask Segment Definition** - Displays the coordinates of the end points (vertices) of the mask segments. Examining the segment definitions of a standard mask is an effective way to become familiar with the format in which mask definitions are displayed and entered. For user-defined masks this field is editable and may be used to add, delete, or modify the vertex coordinates.

To edit user-defined mask segments:

- a. To add a new segment, select **Add** and enter the coordinates.

- b. To delete a segment, choose the segment and select **Delete**.
 - c. To modify a segment, choose the segment, select **Modify** and enter the new coordinates.
- **Display** - Displays a Response Mask or Stimulus Mask on the mask plot. For user-defined masks, this option selects the mask currently open for editing.
 - ▶ Select the **Stimulus Mask** or **Response Mask** radio button.
- **Show meas. points** - Displays dots in the mask plot at the selected measurement frequency points.
 - ▶ Select the check box to display the dots or clear the check box to remove the dots.



Measurement points are allocated based on the Response Mask, independent of whether the Response Mask or Stimulus Mask is displayed. Extra measurement points are similarly allocated within the range specified by the response mask.

- **Show generator limits** - Displays the mask trace on the mask plot, which represents the maximum jitter amplitude capability of the jitter generator.
 - ▶ Select the check box to display the mask trace or clear the check box to remove mask trace.
- **Cursor** - Allows you to move a vertical cursor across the mask plot from measurement point to measurement point. The value of frequency and level at the current cursor point are shown in the box to the right of the cursor buttons.
 - ▶ Select the left-arrow or right-arrow Cursor button to move the vertical cursor across the plot.
- **Extra measurement points** - Allows you to specify particular frequencies at which you want measurements to be made. These points are independent of automatically assigned frequencies. The frequencies specified must be within the range covered by the mask. This feature may be used to concentrate measurements in a frequency range that is of particular interest. These points are defined by frequency only and do not create vertices.

To edit user-defined mask segments:

- a. To add a new frequency, select **Add** and enter the coordinates.

- b. To delete a frequency, choose the segment and select **Delete**.
- c. To modify a frequency, choose the segment, select **Modify** and enter the new coordinates.

6. Select **OK**.

Calibrating a Transfer Measurement

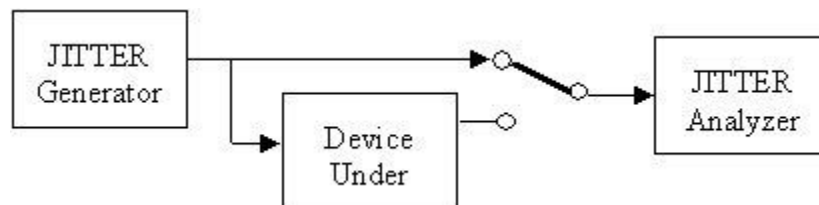
A jitter transfer measurement applies jitter to a device's input and measures the resulting jitter at its output. The jitter amplitude at the output can be small errors or inaccuracies in the jitter measurement. These small problems can be reflected as significant errors in the calculated jitter transfer ratio. There are two opportunities for error in the jitter transfer measurement:

1. Error in generating the applied jitter - This results in the actual amplitude of the applied jitter being different from the intended value.
2. Error in measuring the output jitter - This results in the value measured being different from the actual value.

Because jitter transfer is defined as the ratio of two jitter amplitudes, it is possible to measure not only the jitter at the output of the device under test, but also at its input, and to calculate the jitter transfer ratio from these two measured values. This approach minimizes the effect of both the errors described above for the following reasons:

- Errors in the generated jitter amplitude are irrelevant, because the transfer ratio is calculated from the measured jitter at the input and output of the device under test and not the absolute amplitude to which the jitter generator is set.
- Gain errors in the basic jitter measurement affect measured input and output jitter amplitudes equally and do not enter into the ratio calculation.

Performing a calibration step, in which the NIC's output is connected directly to its input and the jitter amplitude measured at each frequency, can significantly improve the accuracy of jitter transfer measurements. In effect, the measurements are made in a configuration like the one shown below.



 Calibration should be performed after the NIC system has warmed up for 20 minutes or more, and repeated at least once a day.

To start the calibration:

1. From the **Jitter** tab, select **Toler/Transfer**.

 Before continuing, ensure that the system has been set up for a [Jitter Transfer Test](#), looped back to itself for calibration, and that the mask and test settings are configured at the desired values.

2. Select the **Test** tab along the left-side of the screen and choose **Start Calibrate**.

During calibration, the Elapsed Time indicator increments and the Percent Complete progress bar advances. When calibration is complete, the GUI displays "**Calibrated.**"

 Do not change the mask selection or test settings after calibration is completed. Changing these settings erases the calibration data and requires that you repeat of the calibration process.

Starting a Jitter Transfer Measurement Test

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select the **Set** tab along the left-side of the screen and choose **Set 1**.
3. Select **Test Type** and choose a transfer test.
4. Select the **Test** tab along the left-side of the screen and choose **Start Test**.

During the execution of the test the Elapsed Time indicator increments, the Percent Complete progress bar advances, and the graph and results box are updated.

Individual measurements appear as dots on the graph, using a visual coding system, which is described below.

- **Green triangles** - Measurements that pass testing.
- **Red triangles** - Measurements that fail testing.
- **Green or red dot with a black center** - A measurement's whose applied jitter amplitude is limited by the maximum capability of the jitter generator

and has reached its source limit. If space permits, the word **LIMIT** appears next to or below it.

- The frequency, jitter transfer threshold value, measured jitter transfer value, and pass/fail status for each point are shown in the box below the graph. These values also appear in the Cursor window for the point at which the vertical cursor is located on the graph.

To view measurement data results more precisely use the [optimization](#) features.

Jitter Specific Tasks

Jitter Specific Tasks

This section includes other tasks that are specific to the Jitter protocol processor.



For information on performing **Jitter Output**, **Jitter Tolerance**, or **Jitter Transfer** tests, see [Automated Compliance Testing](#).



For a list of general tasks for a NIC test set, see **Common Tasks**, located in the [Getting Started](#) section of the NIC test set's Online Help.

The following Jitter protocol processor specific tasks is provided:

- [Testing OTN Jitter Interfaces](#)
- [Testing SONET Jitter Interfaces](#)
- [Testing SDH Jitter Interfaces](#)
- [Jitter Stimulus Mask](#)
- [Creating a New User-Defined Mask](#)
- [Optimizing Test Screen Results](#)

Testing OTN Jitter Interfaces

NIC units that contain both a jitter testing module and a OTN circuit pack licensed for OTN jitter Interfaces can be set up to the OTN jitter interfaces from either the Jitter tab or the OTN tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the OTN TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

- Notice that OTU-2 Jitter has it's own Jitter TX and RX laser connectors
- OTU-1 Jitter also has its own Jitter TX and RX laser connectors



When testing OTN Jitter, the OTN lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remains ON and active when the optical OTN interface is then changed to a non-jitter Interface rate from the OTN tab, allowing for both the Jitter lasers and OTN lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for an OTN Jitter Interface

1. Select the **OTN** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired **OTN Jitter Interface** for testing.
5. Configure all other necessary OTN parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.



Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for jesting optical jitter.

Testing SONET Jitter Interfaces

NIC units that contain both a jitter testing module and a SONET circuit pack licensed for SONET jitter Interfaces can be set up to the SONET jitter interfaces from either the Jitter tab or the SONET tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the SONET TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

- Notice that OC-192 Jitter has it's own Jitter TX and RX laser connectors
- OC-48 Jitter down to OC-3 Jitter also has its own Jitter TX and RX laser connectors
- And EC-3 Jitter has it's own Jitter TX and RX BNC electrical connectors



When testing SONET Jitter, the SONET lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remains ON and active when the optical SONET interface is then changed to a non-jitter Interface rate from the SONET tab, allowing for both the Jitter lasers and SONET lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for a SONET Jitter Interface

1. Select the **SONET** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired **SONET Jitter Interface** for testing.
5. Configure all other necessary SONET parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

 **Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for testing optical jitter.**

Testing SDH Jitter Interfaces

NIC units that contain both a jitter testing module and a SDH circuit pack licensed for SDH jitter Interfaces can be set up to the SDH jitter interfaces from either the Jitter tab or the SDH tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the SDH TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

- Notice that STM-64 Jitter has it's own Jitter TX and RX laser connectors
- STM-16 Jitter down to STM-1 Jitter also has its own Jitter TX and RX laser connectors
- And STM-1e Jitter has it's own Jitter TX and RX BNC electrical connectors

 When testing SDH Jitter, the SDH lasers are disabled and the Jitter TX/RX lasers are used.

 **The Jitter TX/RX lasers remains ON and active when the optical SDH interface is then changed to a non-jitter Interface rate from the SDH tab, allowing for both the Jitter lasers and SDH lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.**

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for an SDH Jitter Interface

1. Select the **SDH** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired **SDH Jitter Interface** for testing.

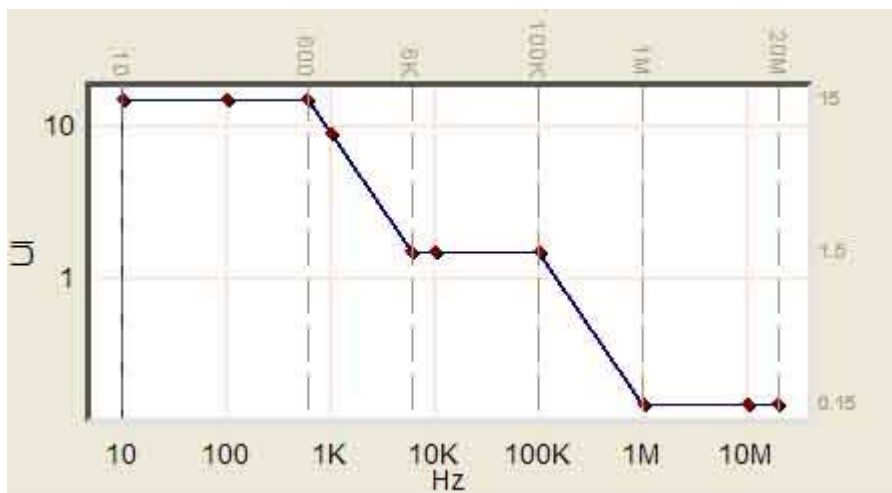
5. Configure all other necessary SDH parameter settings.
6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

⚠ Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for jesting optical jitter.

Jitter Stimulus Mask

The amplitude of jitter that a network element must accept depends on the jitter frequency. It is typically specified by a mask represented in a graph of jitter amplitude, in unit intervals (UI) vs. frequency, called a mask.

The example below, the GR-253 OC-48 Jitter Tolerance Requirement Mask, is a typical jitter mask used for jitter tolerance tests.



In this example:

- The device under test must accept jitter at an amplitude of 15 UI or greater over the frequency range 10 Hz to 1 KHz.
- The required amplitude declines to 1.5 UI at 10 KHz, a slope of one decade of amplitude for one decade of frequency.
- The amplitude value is 1.5 UI to 100 KHz.

- It then declines to 0.15 UI at 1 MHz, again at a slope of one amplitude decade per frequency decade.
- The amplitude remains a constant 0.15 UI up to 20 MHz.
- The frequency range outside of 10 Hz to 20 MHz is not covered by this mask. The standard for which this mask is defined covers only 10 Hz to 20 MHz.

Standard Masks and User-Defined Masks

The telecommunications industry standards define a number of jitter tolerance masks for different line rates and applications. The NIC software includes these [standard masks](#).

In addition to standard masks, there are [user-defined](#) masks whose parameters may be chosen to meet the needs of a particular application. User-defined masks are specified by the frequency and amplitude coordinates of their segment's end points (vertices).

Creating a New User-Defined Mask

When a user-defined mask is selected for the Transfer/Tolerance Test Standard, the Edit Mask screen provides the capability to create a new user-defined mask.

To create a new user-defined mask:

1. Configure a Jitter [Tolerance](#) or [Transfer](#) test. You must select a **User-Defined** mask for the **Test Standard** selection during the configuration.
2. From the **Transmit Set 1** screen, select **Edit Mask**. The Edit Mask screen appears.
3. Select the **Mask name/description** button and enter a new mask name using the keyboard that appears.

 **IMPORTANT:** If you configured the system for a *Transfer* test, then both **Mask name/description** and [Associated stimulus mask name/description](#) options appear. Use the same procedure described below to create a new jitter tolerance mask that will define the stimulus for the jitter transfer mask.

4. Select **Enter**. The new mask name appears in the Mask name/description text field.

5. Select [Auto Distributed Freq Points](#) and enter the number of measurement points to display along the mask curve.
6. From the [Mask Segment definition](#) box, select **Add**. The Modify Jitter Frequency and Amplitude dialog appears.
7. Select **Jitter Frequency** and enter the frequency vertex coordinate using the frequency calculator that appears. Select **OK**.
8. Select **Jitter Amplitude** and enter the amplitude vertex coordinate using the amplitude calculator that appears. Select **OK**.

 **IMPORTANT:** A minimum of two vertices must be defined for the mask segment.

9. From the **Modify Jitter Frequency and Amplitude** dialog box, select **OK** after the segments have been added. Additional segments can be added later and existing segments can be modified by selecting the segment and choosing the appropriate control button. The new segments appear on the mask plot window.
10. You can add extra frequency measurement points to the vertice by selecting **Add** from the [Extra measurement points](#) box.
11. Enter the frequency value using the frequency calculator that appears. Select **OK**. The measurement point appears as a dot on the mask plot.
12. After all coordinates have been configured, select **OK**. The Edit Mask screen closes and the new mask displays as the selected **Test Standard**.

For more information on using the Edit Mask screen, see [Editing a Tolerance Mask](#) and [Editing a Transfer Mask](#).

Optimizing Test Screen Results

The Tolerance/Transfer Test screen contains a variety of options that provide different views of measurement points, frequency and amplitude annotations, coordinate displays, amplitude capability, and measured jitter tolerance values.

To view the test screen results:

1. From the **Jitter** tab, select **Toler/Transfer**.
2. Select **Test** from the tabs along the left-side of the Toler/Transfer screen.
3. Use one of the following display controls to view output information:
 - **Graph Display** - Select or clear the check boxes in the Show group to change the way the graph displays data.

- ▶ **Grid** shows or hides the frequency and amplitude annotations for the graph axis.
- ▶ **Vertices** shows or hides the coordinate display for the mask vertices.
- ▶ **Gen. Limit** shows or hides a display of the maximum amplitude capability of the jitter generator.
- ▶ **Connect** enables or disables a line between adjacent dots that show measured jitter tolerance values. This function is not applicable to acceptance tests.
- **Cursors** - Select a cursor button to move a vertical cursor to various measurement points on the graph. The window immediately below the buttons displays the frequency and mask values for the cursor point.

NIC BP (Battery Power)

The NIC BP is a two-slot portable NIC chassis with battery backup supporting uninterrupted testing, when external AC power is not available or lost.

- Battery run time varies depending on the unit's configuration and amount of battery charge
- Real-time battery status information is provided on the User Interface, with LED indicators on the faceplate, and with SCPI
- The battery pack is located on the back side of the NIC BP chassis, and is field replaceable
- When an external AC power supply is connected to the unit, the battery can be disconnected and exchanged without having to turn off the unit
- Additional batteries, AC power supplies, and external battery charging bays can be purchased from Digital Lightwave
- A fully charged battery at full capacity will completely discharge over a time span of about 76 days, when the unit is powered off and not connected to an AC power source

This section of the online help system discusses the following topics:

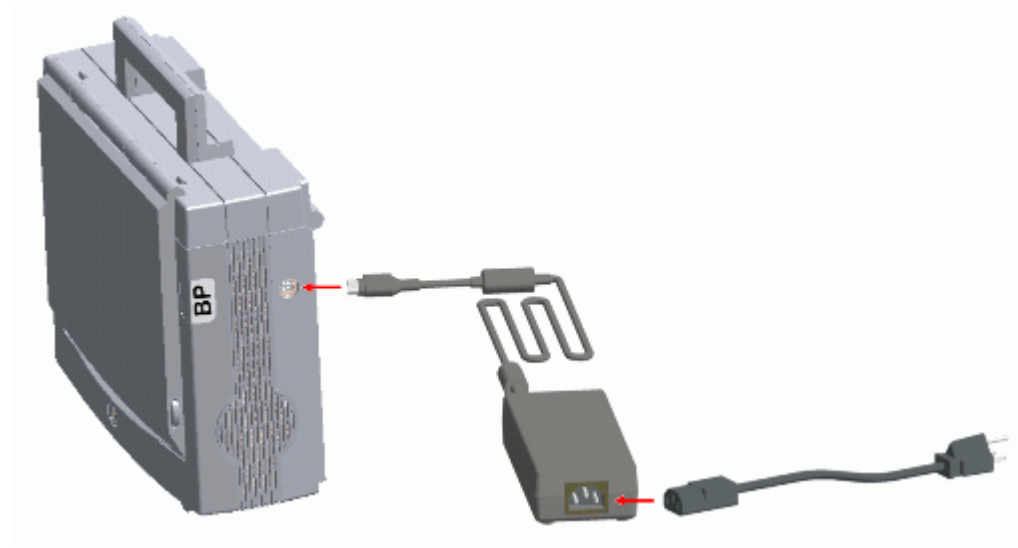
- [NIC BP - AC Power Supply](#)
- [NIC BP - Faceplate](#)
- [NIC BP - Battery Status Display](#)
- [NIC BP - How To's](#)
- [NIC BP - General Precautions](#)
- [NIC BP - Physical Characteristics](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

NIC BP™ “Battery Power” - AC Power Supply

Additional or replacement Batteries and AC power supplies can be purchased from Digital Lightwave. Contact your Digital Lightwave sales representative for more information.

- An external AC power supply (rated for 100V to 240V, 2A, 50-60Hz) is provided with every NIC BP unit, along with a standard three-prong PC power cable
- Only use the external AC power supply provided by Digital Lightwave, and specifically approved for use with the NIC BP, to operate the NIC BP on external AC power, as well as charge the attached NIC BP battery!
- Connect one end of a power cable to the NIC BP's external AC power supply, and connect the other end of the power cable to an AC power source
- Connect the cable from the other end of NIC BP's external AC Power Supply to the NIC BP's power entry connector
- The NIC BP's power entry connector is located on the upper right-hand side of the NIC BP chassis
- The AC Power Status LED on the faceplate will illuminate green, and the battery will recharge whether the system is powered on or off
- Battery charge time (when unit is on): 2 to 6 hours depending on the unit's configuration
- Battery charge time (when unit is off): approximately 2 hours



NIC BP™ “Battery Power” - Faceplate

The NIC BP Faceplate replaces the NIC's usual AC power connection panel and toggle style On/Off power switch.



Power Button

AC Power Status LED

Battery Status LED

Fuse Compartment

Power Button

To turn ON the NIC BP:

- Depress and release to turn the NIC BP unit on

To turn OFF the NIC BP:

- Depress and release to display the system Shutdown option on the screen
- Depress and hold for 3 to 9 seconds to initiate a "warm" shutdown
- Depress and hold for 10 or more seconds to cause an immediate system power off (only use this option if unable to perform a "warm" shutdown, or after a software upgrade has completed)

AC Power Status LED

- Green: Indicates the unit is connected to the external AC power supply
- Off/Clear: External AC power is not connected to the system

Battery Status LED

- Green: The battery has greater than 75% charge
- Yellow: The battery has between 25% and 75% charge
- Red: The battery has less than 25% charge
- Alternating Red & Off: The battery does not have enough charge to power on unit, or the battery is not connected - user must use external AC power supply to turn on unit or charge battery

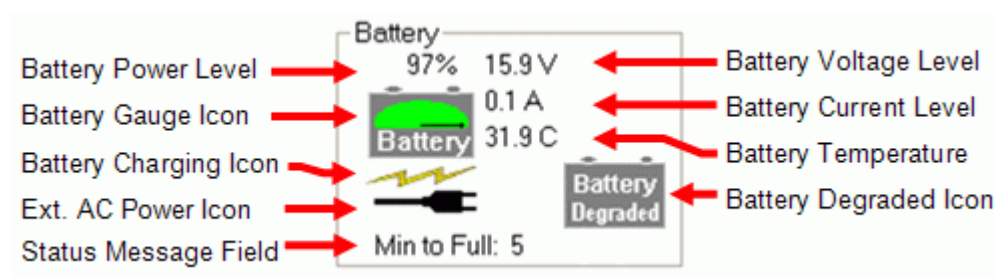
Fuse Compartment

- Contains a field replaceable power fuse, rated for: 250 volts, 8 amps

NIC BP™ “Battery Power” - Battery Status Display

The NIC BP displays the real-time battery status information in the user interface. This information is located in the Battery section, under the System > MISC tab.

The Battery status section displays the following information:



Battery Power Level:	Current percentage of battery power remaining.
Battery Gauge Icon:	A visual display of the battery's power level. "Battery Missing" will display if the battery is not plugged in.
Battery Charging Icon:	The charging icon "lightning bolt" will appear when the battery is charging.
External AC Power Icon:	The AC power cord will appear when the external AC power supply is connected.

Status Message Field:	Min to Full:	Displays when the battery is charging, and shows the number of minutes remaining for the battery to be fully charged.
		“Averaging” appears when the AC Power Supply is first plugged in or removed, while the remaining charge time is being calculated.
		“Standby” appears when the battery is fully charged.
	Min to Run:	Displays when the unit is operating on battery power, and shows the number of minutes remaining before the unit will turn off.
		If the Min to Run reaches 0, the unit will shutdown.
	Battery Equalizing:	Displays if the battery temperature is out of safe operating range for the battery to charge safely.
Battery Voltage Level:	The measured battery voltage, in Volts. If the voltage level drops below 12.5v, the unit will shutdown.	
Battery Current Level:	The measured battery current drain, in Amps. A minus sign in front of this number does not represent a negative amperage value, but rather is an indicator that the battery is discharging, due to lack of AC power. The current level will display 0.0A when the battery is fully charged. If the current level reaches - 9.8A, the unit will shutdown.	
Battery Temperature:	The measured battery temperature, in Celsius. “Battery Equalizing” displays if the battery temperature is too hot for the battery to charge safely. Charging will resume when the battery cools to a safe temperature.	
Battery Degraded Icon:	Only displays if the battery has aged beyond the point where it can not hold more than 75% of full capacity. Degraded batteries can be re-calibrated to restore their full capacity.	

NIC BP™ “Battery Power” - How To...

The "How To" questions are covered in this section:

- [How to replace the existing NIC BP battery](#)
- [How to power on the NIC BP with external AC power supply](#)
- [How to power on the NIC BP without external AC power present – Battery Power Only](#)
- [How to operate the NIC BP without external AC power – Battery only](#)
- [How to perform a "warm shutdown" from the user interface](#)
- [How to perform a "warm shutdown" from the momentary power button](#)
- [How to perform a "cold shutdown" from the momentary power button](#)
- [How to recharge a battery using an external battery charger](#)
- [How to recharge a battery connected to the NIC BP unit](#)
- [How to reinitialize the battery controller module](#)

How to replace the existing NIC BP battery



Follow these steps if replacing an expired battery, or if the battery has reached its end of life condition

- The battery can be replaced in the field, and is "hot-swappable" if the external AC power supply is connected
- The battery compartment protrudes out of the back side of the chassis
- If unit is running, then turn the unit around so the back is facing you and lift the touch screen cover to expose the battery compartment, otherwise lay the NIC BP front side down on a soft surface
- Using a slotted screwdriver, loosen the screw that holds the battery compartment cover on, and remove the cover
- Carefully lift up on the existing battery to remove



Do not throw away damaged or unusable NIC BP batteries!

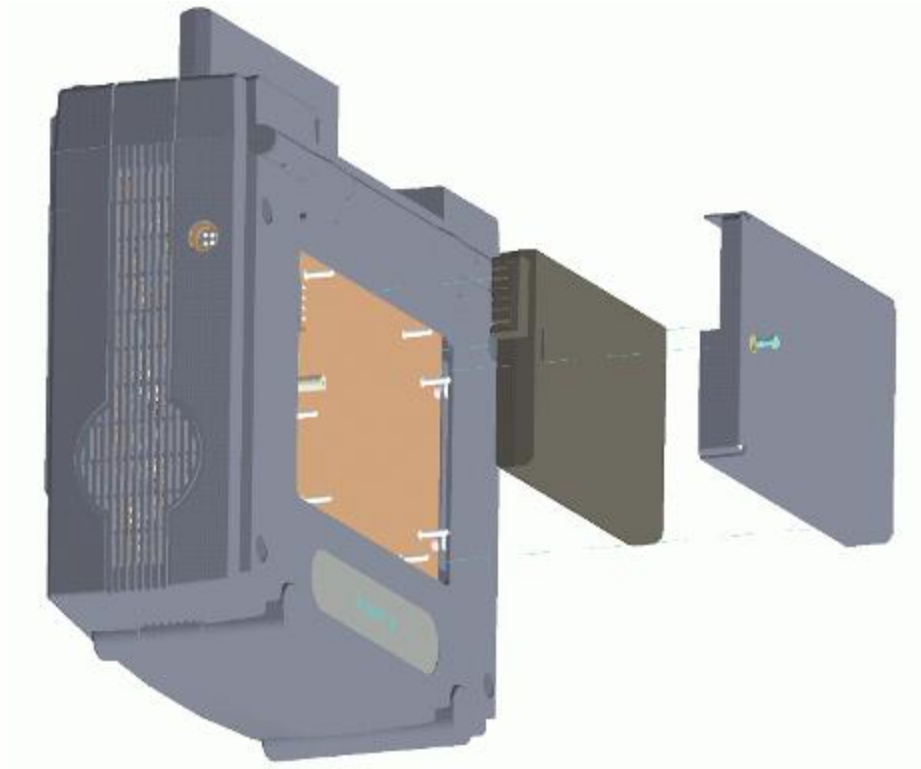
NIC BP rechargeable batteries contain Lithium-ion



Please follow your local recycling guidelines!

- Carefully insert the new battery within the alignment pins, and gently press into the connector

- Replace the battery compartment cover, attaching the edge with the two slots first, and then tighten the captive screw
- The NIC BP can now be used as normal, however a full battery charge cycle may be required for the battery to perform to its maximum potential



How to power on the NIC BP with external AC power supply

- Connect the external AC power supply as described in the [NIC BP - AC Power Supply](#) section
- The NIC BP's power supply connector is located on the upper right-hand side of the NIC BP chassis
- Depress and release the power switch to turn the NIC BP unit on
- When the Graphical User Interface appears, the NIC BP unit is ready for use

How to power on the NIC BP without external AC power present – Battery Power Only

- Depress and release the power switch to turn the NIC BP unit on
- When the Graphical User Interface appears, the NIC BP unit is ready for use

How to operate the NIC BP without external AC power – Battery only

- Power on the NIC BP as described above
- Disconnect the external AC power supply from the NIC – if currently connected
- A Warning message will appear stating AC POWER DISCONNECT, click OK
- The NIC BP will now operate on battery only,
- Refer to the Battery section on the System > MISC screen for the battery status and remaining minutes to Run
- If the battery has drained to the point that it can no longer provide sufficient power to the unit, the NIC BP will automatically perform a warm shutdown

How to perform a "warm shutdown" from the user interface



A "warm shutdown" is the preferred method of turning the NIC BP unit off.

- From the user interface select the "Shutdown" button (located at the bottom right corner of every protocol's screen)
- Select "Shutdown" from the pop up menu, then select "ok"
- After selecting "Shutdown", the shutdown process will take several seconds
- The graphical user interface will shutdown, followed by the Windows operating system, the display will turn black, and finally internal power distribution and cooling fans will then power down
- The shutdown process is complete when the cooling fans stop spinning

How to perform a "warm shutdown" from the momentary power button



A "warm shutdown" is the proffered method of turning the NIC BP unit off.

- Depress and release the power button to display the system Shutdown option on the screen
- A unit shutdown confirmation menu will appear on the user interface
- Select "Shutdown" to initiate a "warm" shutdown, or select "Cancel" to continue using the unit
- Or alternately, depress and hold for 3 to 9 seconds to initiate a "warm" shutdown
- The graphical user interface will shutdown, followed by the Windows operating system, the display will turn black, and finally internal power distribution and cooling fans will then power down
- The shutdown process is complete when the cooling fans stop spinning

How to perform a "cold shutdown" from the momentary power button

 Only perform a "cold shutdown" if unable to perform a "warm shutdown", or after a software upgrade has completed!

- Depress and hold the power button for at least 10 seconds
- The unit will immediately turn off

How to recharge a battery using an external battery charger

 Additional batteries and an external battery charging station can be purchased separately as an accessory for the NIC BP unit. Contact your Digital Lightwave sales representative for more information.

- For specific instructions, reference the external battery charger's user manual

How to reinitialize the battery controller module

 Perform these troubleshooting steps if the Battery Status Display stops providing important status information, or if warning messages cease to display when operating on battery power only.

- Shut down the NIC BP (if necessary hold the power button down for 10 seconds)
- Disconnect external AC power supply
- Remove Battery (as described above)
- The battery's control module will automatically reseal when all power has been disconnected
- Reinstall Battery (as described above)
- Reconnect external AC power supply
- Turn unit back on

NIC BP - General Precautions

Handling Precautions

- Avoid shorting the battery
- Do not immerse in water
- Do not disassemble or deform the battery
- Do not expose to, or dispose of the battery in fire
- Avoid excessive physical shock or vibration
- Keep out of the reach of children
- Never use a battery that appears to have suffered abuse

Storage Precautions

- Store in a cool, dry and well-ventilated environment, with low humidity
- Storage Temperature: -20°C to 60°C, < 80% Relative Humidity
- The battery packs should be stored free from corrosive gas
- Extended exposure to temperatures above 45°C could degrade battery performance and life

Battery Charge & Discharge Precautions

- Operating Temperature: 0° to 40° C < 80% Relative Humidity
- Battery must only be charged when connected to NIC BP or in an approved external charger bay
- Never use a modified or damaged charger
- Specified product use only
- Internal battery protection will prevent the battery from continually charging if the temp goes to $\geq 54^{\circ}\text{C}$
- A charge will not initiate if the battery temp is $\geq 45^{\circ}\text{C}$
- A fully charged battery at full capacity will completely discharge over a time span of about 76 days, when the unit is powered off and not connected to an AC power source

Disposal Precautions

- NIC BP rechargeable batteries contain **Lithium-ion!**
- Do not throw away damaged or unusable NIC BP batteries!

- Battery recycling regulations vary for different countries, if disposal is necessary please follow local recycling guidelines and regulations

NIC Technical Specifications

►The following is a list of technical specifications for NIC units, specifically equipped with the **System Controller 3** module:

- O/S: Microsoft Windows Embedded SP3
- 1.60 GHz CPU
- 1 GB RAM
- Input/Output Trigger: SMA
- 10G and 2.5G Clock Out: SMA
- 10/100Base-T: RJ-45
- Dual BITS, SETS, 2.048Mhz clock inputs/outputs (Bantam and BNC)
- Stratum III Internal Timing Source
- Three (3) USB (Universal Serial Bus) v.2.0, type A female ports; accepts any USB-based flash storage device, e.g., a USB thumb-drive
- Supports Cisco/Linksys AE1000, AE1200 and AE2500 Wireless-N USB adapters (with OS v7.3.3 or later)
- SD (Secure Digital) Card slot, for extra data storage
- USB Printer Drivers
- GPIB: National Instruments GPIB-USB-B (sold separately) adaptor drivers

►The following is a list of technical specifications for NIC units, specifically equipped with the **System Controller 2** module:

- O/S: Microsoft Windows XP Embedded SP2
- 400 MHz CPU
- 240 MB RAM
- RS-232: DB-9 male
- Parallel Port: DB-25 female

- Input/Output Trigger: SMA
 - 10G and 2.5G Clock Out: SMA
 - 10/100Base-T: RJ-45
 - BITS, SETS, 2.048Mhz clock and 1.544Mhz clock input/output (Bantam)
 - Stratum III Internal Timing Source
 - USB (Universal Serial Bus) v.1.1, type A female port; accepts any USB-based flash storage device, e.g., a USB thumb-drive
 - PC Card (PCMCIA): Dual-slot 32-bit PCMCIA CardBus interface for MODEM, GPIB, Wireless-B/G LAN, or Flash memory storage. Supports two Type I or one Type III device cards. Approved cards are:
 - 33.6K and 56K Modems: Viking, 3Com, Xircom, US Robotics
 - Flash: SanDisk and Silicon Compact Flash (CF), with PCMCIA adapter card
 - GPIB: INES GPIB-PCMCIA-XL, 32-bit CardBus card
 - Wi-Fi: HP 11-Mbps Wireless-B/G LAN
-  These cards can either be purchased from Digital Lightwave or independently

NIC, NIC Plus and NIC EP Physical Characteristics

- Operating Temperature: 0° to 40° C < 85% Relative Humidity
- Storage Temperature: -20° to 60° C < 95% Relative Humidity
- Power Requirements: 100–120, 200–240 VAC, 50–60 Hz
- NIC - Dimensions: 10.1 H x 12.3 W x 4.7 D in (257 x 312 x 120 mm)
- NIC - Weight: 11-12.5 lb, depending on configuration
- NIC - Screen: 10.4-inch active matrix color display with touchscreen
- NIC Plus - Dimensions: 13.7 H x 13.0 W x 7.9 D in (348 x 330 x 201 mm)
- NIC Plus - Weight: 14.5 - 25 lb, depending on configuration
- NIC Plus - Screen: 12.1-inch active matrix color display with touchscreen
- NIC EP - Dimensions: 7.0 H x 19.0 W x 10.6 D in (178 x 483 x 269 mm)
- NIC EP - Weight: 14.5 - 25 lb, depending on configuration

NIC BP (Battery Power) Physical Characteristics

- Operating Temperature: 0° to 40° C < 80% Relative Humidity
- Storage Temperature: -20°C to 60°C, < 80% Relative Humidity
- Store in a cool, dry and well-ventilated environment
- The battery packs should be stored free from corrosive gas
- Extended exposure to temperatures above 45°C could degrade battery performance and life
- Power Requirements: 100–120, 200–240 VAC, 50–60 Hz, 2A
- NIC BP - Dimensions: 10.1 H x 12.3 W x 5.5 D in (257 x 312 x 140 mm)
- NIC BP - Weight: 12-13.5 lb, depending on configuration
- NIC BP - Screen: 10.4-inch active matrix color display with touchscreen

OSA Tab

OSA Overview

The ITU channel grid provides a guide for listing wavelengths and frequencies as channel numbers in CWDM and DWDM applications. The Digital Lightwave OSA test module is compliant with the ITU standards and follows G.694.1 and G. 694.2 in order to compare the measured frequencies or wavelengths with the nearest ITU channels as determined by the size of the spacing between each channel.

This section of the online help system has topics that discuss:

- [OSA Screen and Function Descriptions](#)
- [OSA Frequency and Wavelength Tables](#)
- [OSA Specific Tasks](#)
- [OSA Connector Panels](#)
- [OSA Technical Specifications](#)

Screen and Functions Descriptions

OSA Screen Functions and Descriptions Overview

The following function screens are available through the OSA protocol processor tab.

- [OSA Spectrum](#)
- [OSA Channel](#)

Spectrum

OSA Spectrum

The Spectrum screen contains the following:

- [View](#)
- [Set](#)
- [Compare](#)
- [Overlap](#)

Spectrum View

The View screen displays the channel graph in a large, easy-to-read format. The graph's parameters are configured using the [Spectrum Settings](#) screen.

Spectrum Set

The Spectrum Settings screen configures the Spectrum graph's parameters.



The data view that appears on your screen is local and relative to your configuration. Changes you make using the Spectrum Settings do not changing data on the unit.

The following functions appear on the spectrum Set screen:

Function	Description
X Unit of Measure	Determines the unit of measure for the X-axis. Wavelength values (in nanometers) or ITU Frequency values (in terahertz) can appear across the bottom of the spectrum graph.  This setting also affects the Channel table measurement labels and settings.
Span	Indicates the type of wavelength channel band currently selected. • C-Band • L-Band
Start	Displays the lowest wavelength (or frequency) that can be measured for the specified Band. • C-Band starts at 1528.77 nm (196.10 THz) • L-Band starts at 1568.77 nm (191.10 THz)

Stop	Displays the highest wavelength (or frequency) that can be measured for the specified Band. • C-Band stops at 1562.23 nm (191.90 THz) • L-Band stops at 1604.03 nm (186.90 THz)
View	Displays a list of the current (Live) or saved graphs (snapshots). When a snapshot is selected, the data points associated with that graph appear in the graph display. Note: The View button can be selected after a snapshot has been saved.
Snapshot	Assigns a unique 24-character label to a specific data point on the graph. A maximum of 16 snapshots can be saved.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. This restores the graph's original view. Note: Double-tapping the graph will also force a zoom out to occur.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. Note: If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Spectrum Compare

The Spectrum Compare screen allows you to examine live and/or stored graphs together, and then perform comparison operations on the two graphs.

The following functions appear on the screen.

Function	Description
Graph Selection	Selects the first graph used for comparison. The default is Live, which displays the current spectrum data.
Color Choice	Selects the line color used for the first graph.
Graph 2 Selection	Selects the second graph used for comparison.
Color Choice	Selects the line color used for the second graph.
Operation	Selects graph formatting and determines how the information is displayed. • Add: Displays the sum of the two graphs. • Subtract: Displays the difference of the two graphs. • Overlay: The previous graphs remains on the screen and the current graph is placed on top of the earlier graph. This is helpful when monitoring power differences over a period of time.
Color Choice	Selects the line color used for the operation graph.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. This restores the graph's original view. Note: If using a remote GUI, a double-click will zoom out.

	If using a touch screen, double-press using your finger to zoom out.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. Note: If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Spectrum Overlap

The Spectrum Overlap screen displays graphs over a period of time. This provides a visual comparison of the spectrum's highest power limits and lowest power limits at the same time, since the last time the test was restarted.

The following appears on this screen.

Function	Description
Graph Type	Selects one of the following graph formats: • Min: Displays only the spectrum's low power limits. • Max: Displays only the spectrum's high power limits. • Min/Max: Displays both the spectrum's high and low power limits.
High Color Choice	Selects the graph's line color for the Max power limits.
Low Color Choice	Selects the graph's line color for the Min power limits.

Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. Note: If using a remote GUI, a double-click will zoom out. If using a touch screen, double-press using your finger to zoom out.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. Note: If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Channel

OSA Channel

The Channel screen contains the following functions:

- [View](#)
- [Set](#)
- [Alarm](#)
- [Graph](#)
- [Result](#)

Channel View

The View screen displays the following channel statistics in a large, easy-to-read format.

- #: Displays the nearest C-Band or L-Band Channel Number to the measured Wavelength (or Frequency) value.

- **Grid:** Indicates the C-Band or L-Band ITU Grid's Channel Number value based on the [frequency/wavelength](#) table.
- **Wave (nm) or Freq (THz):** Displays the actual measured Wavelength (or Frequency) value for each channel detected, within the configured range.



To change between Wavelength or Frequency, select the Spectrum tab, and configure the X Unit of Measure setting, located on the Set side tab.

- **Dev (pm) or Dev (GHz):** Displays the calculated deviation between the nearest C-Band or L-Band ITU Grid's channel value and the actual measured Wavelength (or Frequency) value
- **Ch Pwr:** Indicates the channel's measured Optical Power (in dBm).
- **SNR:** Indicates the channel's measured Signal-to-Noise Ratio



Based on a Noise Floor of -60 dBm.

Channel Set

 For detailed information configuring the Channel Settings, see [Configuring Channel Settings](#).

The Channel Data settings determines how many channel measurements appear in C-Band and L-Band tables.

The Channel Settings screen also allows you to select either a live graph or a snapshot and compare the channel information between the chart and the graph. The graph will handle zooming and the table will only display the subset of information displayed in the graph.

Function	Description
Channel Set's Table	Displays a subset of channels that appear in the Channel Set graph (located along the bottom of the screen). The following channel information appears in the table: • Channel Number (#) and Type (C-band or L-band) • Grid: Indicates the channel value based on the frequency/wavelength table.

	• Frequency or Wavelength: Indicates the actual channel value in THz or nm. • Deviation: Indicates the difference between the Grid value and the frequency or wavelength value. • Channel Power • Signal-to-Noise Ratio
First Channel	Selects a specific channel as the first channel in the range of channels displayed in the table.
Channel Count	Selects a range of channels.
Channel Spacing	Sets the channel spacing for the table and graph. The following options are available: • 50 (GHz): 20 available channels • 100 (GHz): 40 available channels • 200 (GHz): 80 available channels
View	Displays a list of the current (Live) or saved graphs. When selected, the data points associated with the graph appear in the graph display.
Snapshot	Saves a scan and assigns a unique 24-character label to a specific data point on the graph. A maximum of 16 snapshots can be saved.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. This restores the graph's view as defined by the Spectrum Set's X Unit of Measure, Center, and Span functions. Note: If using a remote GUI, a double-click will zoom out. If using a touch

	screen, double-press using your finger to zoom out.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. Note: If using a remote GUI, define an area of the graph using your mouse pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.

Channel Alarm

Use the Alarm functions to set the criteria, or thresholds, that will trigger alarms. All active alarms appear in the table.

The following functions appear on this screen.

Function	Description
Channel Number	Selects a channel to monitor. If All is selected, then all 80 channels (C- or L-bands) are added to the Alarm table.
SNR Threshold	Sets a limit on the channel's signal-to-noise ratio. An alarm is generated if the SNR exceeds this value. The maximum value is 30.0 dB. The minimum value is 0.0 dB.
Drift Threshold	Determines how far the channel's signal can drift before an alarm is generated. The maximum value is 216.0 nm. The minimum value is 0.0 nm.
Power Low Threshold	Determines the lower power limit. An alarm is generated if the signal exceeds this value. The maximum value is -1.0 dBm. The minimum value allowed is -80.0 dBm.

	 The minimum input power level should not fall below -37 dBm.
Power High Threshold	Determines the upper power limit. An alarm is generated if the signal exceeds this value. The maximum value is 0.0 dBm. The minimum value is -79.9 dBm.  The maximum input power level should never exceed -10 dBm.
Add	Adds one or more channels to the alarm table. Only the channels listed in the table are monitored.  View the Results screen for a list of reported Alarms based on the set conditions
Remove	Removes a channel from the alarm table.
Remove All	Removes all channels from the alarm table.
Channel Alarm Table	Displays all channels selected that are selected for alarm monitoring. The table displays: • Channel number • Signal-to-Noise ratio • Drift • Low Power • High Power
BBand Pwr Low Threshold (dBm)	Determines the Aggregate Optical Power's Low alarm limit. If the received Aggregate Optical Power level falls below the set limit, then all of the text in the upper left corner of the screen turns Red, and the word "Low"

	appears above the Optical Power measurement. The maximum value is -1.0 dBm. The minimum value allowed is -80.0 dBm.  The minimum input power level should not fall below -37 dBm.
BBand Pwr High Threshold (dBm)	Determines the Aggregate Optical Power's High alarm limit. If the received Aggregate Optical Power level exceeds the set limit, then all of the text in the upper left corner of the screen turns Red, and the word "High" appears above the Optical Power measurement. The maximum value is 0.0 dBm. The minimum value allowed is -79.0 dBm.  The maximum input power level should never exceed +23 dBm (Combined Power for All Channels).

Channel Graph

The Graph screen allows you to select a single channel, which will be your reference channel, and then compare and fine-tune the remaining channels based on the reference channel's values.

To use the Graph screen:

1. Select **Reference Channel** and enter a channel that appears in the table above the graph.
2. Select **Deviation** and to set the type of deviation (power, SNR, or wavelength/frequency deviation) to monitor.
3. A bar chart appears showing the other channels' deviations compared to the reference channel.

The following appears on the Graph screen:

Function	Description
Channel Graph Table	Displays a subset of channels that appear in the Channel Set graph. The following channel information appears in the table: • Channel Number (#) • Grid: Indicates the channel value based on the frequency/wavelength table. • Frequency or Wavelength: Indicates the actual channel value in THz or nm. • Deviation: Indicates the difference between the Grid value and the frequency or wavelength value. • Channel Power • Signal-to-Noise Ratio
Reference Channel	Sets the reference channel. All other measured channels will then be compared to the selected reference channel's characteristics.  Select None to set the reference point back to 0.
Deviations	Selects a deviation based on power (dBm), SNR (dB), or wavelength/frequency deviation. The wavelength/frequency deviation is the difference between the expected channel value (Grid) and the actual channel value.
Zoom In (using cursor tracing)	Increases view magnification allowing you to zoom in on a specific area of the graph. Note: If using a remote GUI, define an area of the graph using your mouse

	pointer to select an area to magnify. If using a touch screen, drag your finger diagonally across the screen to zoom-in on a specific area.
Zoom Out	Adjusts the graph's view by allowing you to decrease the view magnification. If using a remote GUI, a double-click will zoom out. Note: If using a remote GUI, a double-click will zoom out. If using a touch screen, double-press using your finger to zoom out.

Channel Result

The [Channel Result](#) screen displays a list of channels currently reporting alarms. When the unit is restarted, the Result table is cleared.

The following information is reported:

- C-band or L-band Channel Number
- Alarm type
- Alarm value

C Band L Band Channel Tables

OSA Default Frequencies and Wavelengths

The NIC's OSA will compare the measured frequencies or wavelengths with the nearest ITU channels as determined by the size of the spacing between each channel.

C-band:

►For DWDM applications, ITU channels wavelengths in the C-band start at 1529.55 nm and will go up to 1561.01 nm.

►For CWDM applications, ITU channels frequencies in the C-band range from 196.0 THz to 192.05 THz.

The NIC's OSA module goes slightly beyond the ITU standard and can measure wavelengths in the **C-band** from **1528.77 nm** up to **1562.23 nm**. The number of channels is determined based on the spacing selected between the channels.

The following tables list the ITU channel lists for **C-band** frequencies and wavelengths:

- [80-channel table with 50 GHz spacing](#) (between 1528.77 nm and 1562.23 nm)
- [40-channel table with 100 GHz spacing](#) (between 1528.77 nm and 1562.23 nm)
- [20-channel table with 200 GHz spacing](#) (between 1529.55 nm and 1559.79 nm)

L-band:

►For DWDM applications, ITU channels wavelengths in the L-band start at 1570.42 nm and will go up to 1603.60 nm.

►For CWDM applications, ITU channels frequencies in the L-band range from 190.90 THz to 186.95 THz.

The NIC's OSA module goes slightly beyond the ITU standard and can measure wavelengths in the **L-band** from **1568.77 nm** up to **1604.03 nm**. The number of channels is determined based on the spacing selected between the channels.

The following tables list the OSA's default **L-Band** frequencies and wavelengths.

- [80-channel table with 50 GHz spacing](#) (between 1568.77 nm and 1604.03 nm)
- [40-channel table with 100 GHz spacing](#) (between 1568.77 nm and 1604.03 nm)
- [20-channel table with 200 GHz spacing](#) (between 1568.77 nm and 1604.03 nm)

80-Channel C-Band Table with 50 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
-	196.10	1528.77
-	196.05	1529.16
1	196.00	1529.55
2	195.95	1529.94

3	195.90	1530.33
4	195.85	1530.72
5	195.80	1531.12
6	195.75	1531.31
7	195.70	1531.90
8	195.65	1532.29
9	195.60	1532.68
10	195.55	1533.07
11	195.50	1533.47
12	195.45	1533.86
13	195.40	1534.25
14	195.35	1534.64
15	195.30	1535.04
16	195.25	1535.43
17	195.20	1535.82
18	195.15	1536.22
19	195.10	1536.61
20	195.05	1537.00
21	195.00	1537.40
22	194.95	1537.79
23	194.90	1538.19
24	194.85	1538.58
25	194.80	1538.98
26	194.75	1539.37
27	194.70	1539.77
28	194.65	1540.16
29	194.60	1540.56
30	194.55	1540.95
31	194.50	1541.35
32	194.45	1541.75
33	194.40	1542.14
34	194.35	1542.54
35	194.30	1542.94
36	194.25	1543.33
37	194.20	1543.73
38	194.15	1544.13

39	194.10	1544.53
40	194.05	1544.92
41	194.00	1545.32
42	193.95	1545.72
43	193.90	1546.12
44	193.85	1546.52
45	193.80	1546.92
46	193.75	1547.32
47	193.70	1547.72
48	193.65	1548.11
49	193.60	1548.51
50	193.55	1548.91
51	193.50	1549.32
52	193.45	1549.72
53	193.40	1550.12
54	193.35	1550.52
55	193.30	1550.92
56	193.25	1551.32
57	193.20	1551.72
58	193.15	1552.12
59	193.10	1552.52
60	193.05	1552.93
61	193.00	1553.33
62	192.95	1553.73
63	192.90	1554.13
64	192.85	1554.54
65	192.80	1554.94
66	192.75	1555.34
67	192.70	1555.75
68	192.65	1556.15
69	192.60	1556.55
70	192.55	1556.96
71	192.50	1557.36
72	192.45	1557.77
73	192.40	1558.17
74	192.35	1558.58

75	192.30	1558.98
76	192.25	1559.39
77	192.20	1559.79
78	192.15	1560.20
79	192.10	1560.61
80	192.05	1561.01
-	192.00	1561.42
-	191.95	1561.83
-	191.90	1562.23

40-Channel C-Band Table with 100 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
-	196.10	1528.77
1	196.00	1529.55
2	195.90	1530.33
3	195.80	1531.12
4	195.70	1531.90
5	195.60	1532.68
6	195.50	1533.47
7	195.40	1534.25
8	195.30	1535.04
9	195.20	1535.82
10	195.10	1536.61
11	195.00	1537.40
12	194.90	1538.19
13	194.80	1538.98
14	194.70	1539.77
15	194.60	1540.56
16	194.50	1541.35
17	194.40	1542.14
18	194.30	1542.94
19	194.20	1543.73
20	194.10	1544.53
21	194.00	1545.32

22	193.90	1546.12
23	193.80	1546.92
24	193.70	1547.72
25	193.60	1548.51
26	193.50	1549.32
27	193.40	1550.12
28	193.30	1550.92
29	193.20	1551.72
30	193.10	1552.52
31	193.00	1553.33
32	192.90	1554.13
33	192.80	1554.94
34	192.70	1555.75
35	192.60	1556.55
36	192.50	1557.36
37	192.40	1558.17
38	192.30	1558.98
39	192.20	1559.79
40	192.10	1560.61
-	192.00	1561.42
-	191.90	1562.23

20-Channel C-Band Table with 200 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
1	196.00	1529.55
2	195.80	1531.12
3	195.60	1532.68
4	195.40	1534.25
5	195.20	1535.82
6	195.00	1537.40
7	194.80	1538.98
8	194.60	1540.56
9	194.40	1542.14
10	194.20	1543.73

11	194.00	1545.32
12	193.80	1546.92
13	193.60	1548.51
14	193.40	1550.12
15	193.20	1551.72
16	193.00	1553.33
17	192.80	1554.94
18	192.60	1556.55
19	192.40	1558.17
20	192.20	1559.79

80-Channel L-Band Table with 50 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
-	191.10	1568.77
-	191.05	1569.18
-	191.00	1569.59
-	190.95	1570.01
1	190.90	1570.42
2	190.85	1570.83
3	190.80	1571.24
4	190.75	1571.65
5	190.70	1572.06
6	190.65	1572.48
7	190.60	1572.89
8	190.55	1573.30
9	190.50	1573.71
10	190.45	1574.13
11	190.40	1574.54
12	190.35	1574.95
13	190.30	1575.37
14	190.25	1575.78
15	190.20	1576.20
16	190.15	1576.61
17	190.10	1577.03
18	190.05	1577.44

19	190.00	1577.86
20	185.95	1578.27
21	189.90	1578.69
22	189.85	1579.10
23	189.80	1579.52
24	189.75	1579.93
25	189.70	1580.35
26	189.65	1580.77
27	189.60	1581.18
28	189.55	1581.60
29	189.50	1582.02
30	189.45	1582.44
31	189.40	1582.85
32	189.35	1583.27
33	189.30	1583.69
34	189.25	1584.11
35	189.20	1584.53
36	189.15	1584.95
37	189.10	1585.36
38	189.05	1585.78
39	189.00	1586.20
40	188.95	1586.62
41	188.90	1587.04
42	188.85	1587.46
43	188.80	1587.88
44	188.75	1588.30
45	188.70	1588.73
46	188.65	1589.15
47	188.60	1589.57
48	188.55	1589.99
49	188.50	1590.41
50	188.45	1590.83
51	188.40	1591.26
52	188.35	1591.68
53	188.30	1592.10
54	188.25	1592.52

55	188.20	1592.95
56	188.15	1593.37
57	188.10	1593.79
58	188.05	1594.22
59	188.00	1594.64
60	187.95	1595.06
61	187.90	1595.49
62	187.85	1595.91
63	187.80	1596.34
64	187.75	1596.76
65	187.70	1597.19
66	187.65	1597.62
67	187.60	1598.04
68	187.55	1598.47
69	187.50	1598.89
70	187.45	1599.32
71	187.40	1599.75
72	187.35	1600.17
73	187.30	1600.60
74	187.25	1601.03
75	187.20	1601.46
76	187.15	1601.88
77	187.10	1602.31
78	187.05	1602.74
79	187.00	1603.17
80	186.95	1603.60
-	186.90	1604.03

40-Channel L-Band Table with 100 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
-	191.10	1568.77
-	191.00	1569.59
1	190.90	1570.42
2	190.80	1571.24
3	190.70	1572.06

4	190.60	1572.89
5	190.50	1573.71
6	190.40	1574.54
7	190.30	1575.37
8	190.20	1576.20
9	190.10	1577.03
10	190.00	1577.86
11	189.90	1578.69
12	189.80	1579.52
13	189.70	1580.35
14	189.60	1581.18
15	189.50	1582.02
16	189.40	1582.85
17	189.30	1583.69
18	189.20	1584.53
19	189.10	1585.36
20	189.00	1586.20
21	188.90	1587.04
22	188.80	1587.88
23	188.70	1588.73
24	188.60	1589.57
25	188.50	1590.41
26	188.40	1591.26
27	188.30	1592.10
28	188.20	1592.95
29	188.10	1593.79
30	188.00	1594.64
31	187.90	1595.49
32	187.80	1596.34
33	187.70	1597.19
34	187.60	1598.04
35	187.50	1598.89
36	187.40	1599.75
37	187.30	1600.60
38	187.20	1601.46
39	187.10	1602.31

40	187.00	1603.17
-	186.90	1604.03

20-Channel L-Band Table with 200 GHz Spacing

Channel Number	Frequency Code (THz)	Wavelength (nm)
-	191.10	1568.77
1	190.90	1570.42
2	190.70	1572.06
3	190.50	1573.71
4	190.30	1575.37
5	190.10	1577.03
6	189.90	1578.69
7	189.70	1580.35
8	189.50	1582.02
9	189.30	1583.69
10	189.10	1585.36
11	188.90	1587.04
12	188.70	1588.73
13	188.50	1590.41
14	188.30	1592.10
15	188.10	1593.79
16	187.90	1595.49
17	187.70	1597.19
18	187.50	1598.89
19	187.30	1600.60
20	187.10	1602.31
-	186.90	1604.03

Specific Tasks

OSA Specific Tasks

This section includes tasks that are specific to the OSA protocol processor. For general tasks, refer to the [Common Tasks](#) section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

- [Configuring Spectrum Settings](#)
- [Configuring Channel Settings](#)
- [Using Snapshots](#)
- [Comparing Graphs](#)
- [Overlapping Graphs](#)
- [Fine-Tuning Channels](#)
- [Viewing SNR](#)
- [Viewing Broadband Power](#)
- [Viewing Channel Power](#)
- [Configuring an OSA Alarm](#)
- [Viewing Channel Results \(Alarms\)](#)
- [Using Zoom](#)

Configuring Spectrum Settings

The Spectrum Settings screen determines how spectrum information is represented and displayed on your screen. After customizing a view, it can be saved using the Snapshot function. The newly created view is entirely local and does not change data on the unit.

Use the Spectrum Settings to:

- Select a wavelength channel-band to monitor
- Define units of measure for the X axis, nm or THz
- Narrow the range of interest by specifying the starting and ending channel range, or zoom using the screen cursor

To configure Spectrum graph settings:

1. Select **Spectrum**.
2. Select **SET**.
3. Use the **Wavelength Settings** to configure the graph's X-axis and channel range.
 - Select **Span** to display C-band or L-band channel ranges.
 - Select **X Unit of Measure** to set the unit of measure to nanometers or terahertz.

4. Select **Snapshot** to save the new graph parameters.

Configuring Channel Settings

The Channel Settings screen allows you to select either a live graph or a snapshot and compare the channel information between the chart and the graph. The graph will handle zooming and the table will only display the subset of information displayed in the graph.

The Channel Data settings determines how many channel measurements appear in C-Band and L-Band tables.

Configuring the Channel Spacing will affect the amount of channels available. The number of available channels vary from 1 to 80, 1 to 40, or 1 to 20, depending on the selected Channel Spacing.

Configuring the First Channel and Last Channel will further narrow the range of channels available, and only display only measured wavelengths that appear within the specified upper and lower limits.

The unit has a default channel table consisting of:

- 80 channels
- A channel spacing of 50 GHz (0.05 THz)
- A C-band channel range from 1529.55 nm to 1561.01 nm
- An L-band channel range from 1570.42 nm to 1603.60 nm

To change the parameters of the channels displayed in tables:

1. Select **Channel**.
2. Select **Set**.
3. Select **Channel Spacing** to change the channel spacing to either 50 GHz, 100 GHz, or 200 GHz. The default is 50 GHz.
4. To view a limited range of measured channels, select **First Channel** to set the starting channel, and select **Last Channel** to set the last channel, or upper limit.

Using Snapshot and Snapshot View

The Snapshot function allow you to Save and Restore graph measurements for both the Spectrum Channel graphs.

To save a snapshot:

1. Select the **Set** side tab from either Spectrum or Channel.
2. Select **Snapshot**. The Snapshot Configuration window appears.
3. Select **Snapshot Name**. An full size touch-screen QWERTY keyboard appears.
4. Enter a unique **name** for the snapshot (up to 24-characters).
5. Select **Enter** (on the keypad) to save the snapshot name.
6. Select **Add** to add the new snapshot to the Snapshot Configuration list.
7. Select **OK** to save the new snapshot.

To delete a snapshot

1. Select **Snapshot**. The Snapshot Configuration window appears.
2. Select a snapshot from the Snapshot Configuration list.
(Select the snapshot number that appears in the View column.)
3. Select **Remove**. The snapshot is deleted and appears as **<Empty>** in the list.
4. Select **OK** to close the window.

To view a snapshot:

1. Select **View** from the [Spectrum Settings](#) screen or [Channel Settings](#) screen. The Select View window appears.
2. Select a snapshot. The snapshot's measurements appear in the graph.
3. Snapshots can also be used on the [Comparing Graphs](#) screen.

Comparing Graphs

Two spectrum graphs ([snapshots](#)) can be selected and displayed simultaneously to view differences between power levels.

To compare graphs:

1. Select **Spectrum**.
2. Select **Compare**.
3. Select **Graph Selection** to select the first graph used in the comparison. Select **Color Choice** to assign a color to the first graph. The default color is Red.

4. Select **Graph Selection 2** to select the second graph to compare. Select **Color Choice** to assign a color to the second graph. The default color is Green, and the line has dashes in it.
5. Select **Operation** to determine the action that the comparison graph displays. The following operations are available:
 - **Add**: The comparison graph displays the sum of the two graphs.
 - **Subtract**: The comparison graph displays the difference of the two graphs.
 - **Overlay**: The comparison graph is superimposed on a previous graph. This is helpful when monitoring power differences over a period of time.
6. Select **Color Choice** to assign a color to the comparison graph. The default color is Blue.
7. The two graphs appear on the screen at the same time. Because the line for Graph selection 2 has dashes in it, then identical measurements that overlap will appear as alternating colors.
8. Refer to [Using Zoom](#) to Zoom In and Zoom Out on the graph.

Overlapping Graphs

Wavelength power levels can be compared over a period of time using the Spectrum Overlay functions.

The Spectrum Overlay screen is a visual comparison of the spectrum's highest power limits and lowest power limits at the same time, since the last time the test was restarted.

To overlap graphs:

1. Select **Spectrum**.
2. Select **Overlap**.
3. Select [Graph Type](#) and set the graph format.
4. Select **High Color Choice** (Max.) and **Low Color Choice** (Min.) to assign colors to each graph type.
5. As the unit completes a spectrum sweep, power levels, based on the Graph Type setting, appear in the graph. Subsequent spectrum sweeps will appear on the graph and be superimposed on the previous graph. This provides a visual comparison of the spectrum sweep.

Fine-Tuning Channels

Using the [OSA Graph screen](#), you can select a single channel, which will be your reference channel, and then compare and fine-tune the remaining channels based on the reference channel's values.

1. Select **Reference Channel** and enter a channel that appears in the table above the graph.
2. Select **Deviation** and to set the type of deviation (power, SNR, or wavelength/frequency deviation) to monitor.
3. A bar chart appears showing the other channels' deviations compared to the reference channel.

Viewing Signal-to-Noise Ratio

1. Select **Channel**.
2. Select **Set**.
3. The Channel Power screen appears and contains a channel list table (based on the [Channel Set](#) configuration) and channel power graph.

The SNR for each channel appears in the **S/N** column. The graph provides a visual display of the peak power for all channels in the list.

Viewing Broadband Power

To view the power levels across the entire bandwidth:

1. Select **Spectrum**.
2. Select **SET**.
3. Select **Span**.
4. Select **C-Band** or **L-Band**.
5. The aggregate broadband power value appears in the upper left corner of the screen.

Related Topic:

[Viewing Channel Power](#)

Viewing Channel Power

1. Select **Channel**.

2. Select **Set**.
3. The Channel Power screen appears and contains a channel list table (based on the [Channel Set](#) configuration) and channel power graph.

The power level for each channel appears in the **Ch Pwr** column. The graph provides a visual display of the peak power for all channels in the list.

4. Select **View** to view a full-screen Channel Power table.

Related Topic:

[Viewing Broadband Power](#)

Configuring an OSA Alarm

You can configure specific thresholds for each channel. When a threshold is exceeded, an alarm is generated and logged. The functions appearing on the Alarm screen allow you to add and remove channels to monitor. Alarm results can be viewed using the [Channel Results](#) screen.

To configure an OSA alarm:

1. Select **Channel**.
2. Select **Alarm**.
3. Select one or all channels using **Channel Number**.
4. Set the SNR, drift, low power, and high power threshold values.
5. Select **Add**. The channels appear in the table.

To remove a channel from the alarm list:

1. Select a channel number (**Channel #** column) from the table.
2. Select **Remove**.

To remove all channels from the alarm list:

- Select **Remove All**.

Viewing Alarms (Channel Results)

The Channel Results table displays a list of all channels reporting alarms. The alarm thresholds are based on settings configured using the [Channel Alarm](#) screen.

To view results:

1. Select **Channel**.
2. Select **Results**
3. The Channel Results table appears. If an alarm condition exists, the following is reported:
 - Channel number, which indicates the C-band or L-band channel reporting the alarm
 - Alarm type, which indicates the type of alarm reported (for example, Drift, SNR, Power High, and Power Low)
 - Current alarm value:
 - For Drift alarms, the channel's current drift value appears in picometers (pm).
 - For Power High or Power Low alarms, the channel's current power level (dBm) appears.
 - For SNR alarms, the channel's current signal-to-noise ratio (dB) appears.



These statistics are cleared when the unit is restarted.

Using Zoom

You can increase or decrease an OSA graph's view magnification using the Zoom In and Zoom Out functions. You can observe greater detail, regarding a particular point on the graph, by zooming-in. Zooming-out restores the graph to its initial settings.

Zoom In

To zoom in on a specific area of the graph using a touch screen:

- Drag your finger diagonally across the screen to select and magnify an area of the graph.

To zoom in on a specific area of the graph using the Remote Control Application:

1. Right-click and drag your mouse pointer across an area of the graph.
2. Release the mouse button.

Zoom Out

To zoom out and restore the graph's initial view magnification using a touch screen:

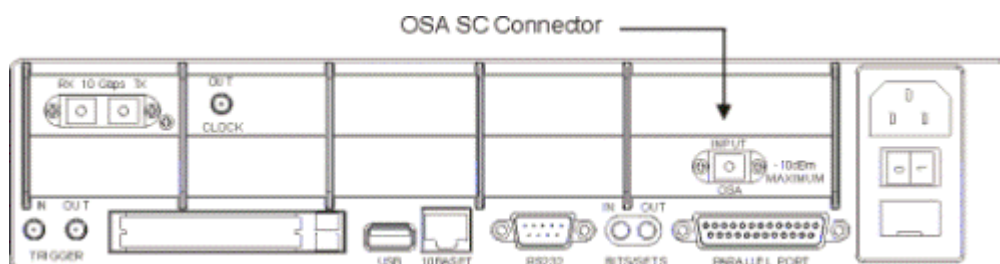
- Press your finger twice (double click) on the graph.

To zoom out and restore the graph's initial view magnification using the Remote Control Application:

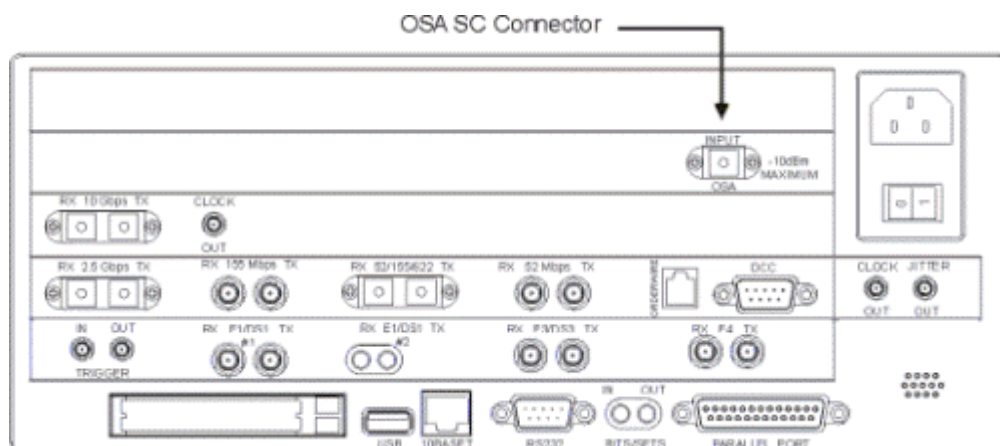
- Select **Zoom Out**.

OSA Connector Panels

The following example shows the location of the OSA connector on a NIC 10G.



The following example shows the location of the OSA connector on a NIC Plus.





The following Specifications apply to OSA modules sold after 2008

Parameters	Specifications
ITU Channel Numbers	C-band: (1-80) 1529.55 nm – 1561.01 nm L-band: (1-80) 1570.42 nm – 1603.60 nm
Wavelength Range	C and L bands C-Band: (80+) 1528.77 nm – 1562.23 nm L-Band: (80+) 1568.77 nm – 1604.03 nm
Channel Spacing	50 GHz (min), 100GHz, 200 GHz (max)
Wavelength Accuracy	± 60 pm
Dynamic Range	60 dB
Minimum Input Power (Per Channel)	-37 dBm
Maximum Input Power (Per Channel)	-10 dBm
Maximum Aggregate Input Power (All Channels)	+ 23 dBm (Combined Power for All Channels)
Channel Power Repeatability	± 0.1 dB
Channel Power Accuracy	± 0.7 dB
Polarization Dependence Loss	< 0.3 dB
Power Resolution	0.1 dB
Noise Floor	- 60 dBm
Peak to Valley	25 dB
OSNR	10 - 25 dB

OSNR Accuracy	± 1.5 dB (Noise Level $\geq$ -50 dBm)
Response Time	2 - 3 seconds
Operating Temperature	0° to 65° C
Optical Connectors	SC (standard), ST, or FC (optional)

OTN Tab

OTN Overview

The OTN (Optical Transport Network) protocol processor provides Forward Error Correction (FEC) testing functionality for G.709 **OTU-1** (2.666 GHz) and **OTU-2** (10.709 GHz) networks, which can be mapped for PRBS, Null client, Unframed BERT, and SONET/SDH Synchronous and Asynchronous add/drop mappings.

This processor can also be licensed for additional Next-Generation Telecom and Datacom mapping and interface test options such as;

- GFP mappings over OTU-1 and OTU-2
- ODTU-01 multiplex mapping
- ODTU-02 multiplex mapping
- ODTU-12 multiplex mapping
- ODTU-012 multiplex mapping
- ODU-Flex mapping (supports 8G Fibre Channel, 4G Fibre Channel, GFP, PRBS and Null Client)
- ITU-T G.709 Sup43 7.3 (10Gbps LAN mapping over OTU-2, with GFP-F, per ITU-T G.709 Supplement 43 Section 7.3)
- 802.3 10G LAN over OTU-2 for both OTU-1e (11.049 GHz) and OTU-2e (11.095 GHz)
- 10G Fibre Channel over OTU-2 for both OTU-1f (11.270 GHz) and OTU-2f (11.317 GHz)



The OTN processor also supports hot-swappable SFP and XFP lasers.



If the SFP or XFP laser is removed, the Interface menu will not display the licensed rates supported by the missing laser module.



Verify that the inserted SFP/XFP module supports the desired Interface rate prior to selecting it.

The OTN Online Help is divided into the following sections:

- [OTN Screen and Function Descriptions](#)

- [OTN Specific Tasks](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen and Function Descriptions

OTN Screen Functions and Descriptions Overview

The following function screens are available through the OTN protocol processor tab on the MSA module.

- [Transmit](#)
- [Receive](#)
- [Results](#)
- [Test](#)
- [LEDs](#)

Transmit

OTN Transmit Screens and Functions

The transmit section allows you to configure the transmit signal parameters used in OTN operations.

The following transmit functionalities are available through the OTN Transmit screen:

- [Set 1](#)
- [Set 2](#)
- [OTN OH](#)
- [A/D OH](#)
- [ERROR & ALARM](#)

OTN Transmit - Set / Set 1

Use the Set 1 screen to configure OTN transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.  Some settings such as Interface are always coupled, regardless of the Settings Control mode.
Passthru Mode	Activates or deactivates passthru mode, allowing an incoming OTN signal to pass through the unit without altering the data in the signal. The following options are available: On and Off.
Interface	Sets the OTN transmit interface rate. The following interface rates <u>may</u> be available: • OTU-1 (2.666 GHz) - Provides OTU-1 testing • OTU-2 (10.709 GHz) - Provides OTU-2 testing • 802.3 LAN (10.3125G) - Provides 10 Gigabit Ethernet LAN testing, without FEC • OTU1e (11.049G) - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2 • OTU2e (11.095G) - Provides 11.095 Gigabit Ethernet LAN testing over OTU-2 • Fibre Chan (8.50G) - Provides 8.50 Gigabit Fibre Channel testing • Fibre Chan (10.52G) - Provides 10.52 Gigabit Fibre Channel testing • OTU1f (11.270G) - Provides 11.270 Gigabit Fibre Channel testing over OTU-2 • OTU2f (11.317G) - Provides 11.317 Gigabit Fibre Channel testing over OTU-2  The OTN processor supports hot-swappable SFP and XFP laser modules.

	 Verify that the inserted SFP/XFP module supports the desired Interface rate prior to selecting it.  The wavelength of the selected interface is determined by the specifications of the SFP or XFP module being used.  Available interface rates are dependent on the licensed-based test options currently enabled.  Not Assigned is displayed if a Non-OTN Interface is currently configured by one of the other processor tabs that share the same SFP/XFP ports.  OTU-1 and OTU-2 interfaces can be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, and can be licensed for GFP and ODU-Flex mappings.  The datacom interface rates allows for packet testing on the Packet tab, without the need for separate circuit packs.
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. BITS/SETS: Derives the transmit's data timing source from the BITS/SETS input ports • BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is

	selected, but BITS clocking is not available, then this function defaults to Internal. The <i>CLK:BITS 1.5MHz</i> displays when configured for BITS clocking. • SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The <i>CLK:SETS 2.0MHz</i> displays when configured for SETS clocking. External 8 KHz - 75 Ohm TTL. Derives timing from an external 8 KHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 8 KHz</i> displays when configured. External 1.544 MHz - 75 Ohm TTL. Derives timing from an external 1.544 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 1.5 MHz</i> displays when configured. External 2.048 MHz - 75 Ohm TTL. Derives timing from an external 2.048 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 2 MHz</i> displays when configured. External 10.0 MHz - 75 Ohm TTL. Derives timing from an external 10.0 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 10 MHz</i> displays when configured.
Mapping Note: The Mapping function is not available when the Interface shows Not Assigned	Selects the type of signals that are combined and inserted into the OTN transmit signal. • Unframed BERT: Transmits an Unframed BERT signal in the OTN frame. • SDH Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. • SDH Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is

	Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. • SONET Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. • SONET Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. • PRBS: The OTN frame is configured with a PRBS pattern. • Null Client: The OTN frame is configured with an All Zeros payload pattern.  The following OTN mapping options are licensable features: • GFP: The OTN frame is configured with a GFP Payload. • ODTU-01: The Optical Channel Payload Unit (OPU) of the OTU 1 interface is configured with two ODU-0 mapping signals. The foreground ODU-0 can then be configured for PRBS Patterns, NULL Client, Transcoded 1000 Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options. • ODTU-02: The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with two ODU-0 mapping signals. The foreground ODU-0 can then be configured for PRBS Patterns, NULL Client, Transcoded 1000 Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options. • ODTU-12: The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with four ODU-1 mapping signals. The foreground ODU 1 can be configured with SONET/SDH Sync/Async mappings, GFP, PRBS, or Null Client mapping options.

	• ODTU-012: The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with four ODU-1 mapping signals, when the foreground ODU-1 is configured for two ODU-0 mapping signals. The foreground ODU-0 can then be configured for PRBS Patterns, NULL Client, Transcoded 1000 Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options. • ITU-T G.709 Sup43 7.3: The OTN processor is configured for a 10Gbps LAN mapping over OTU-2, with a GFP-F structure, per ITU-T G.709 Supplement 43 Section 7.3. • ODU-Flex: OTU-2 can be mapped for ODU-Flex, which supports 8G Fibre Channel (7 ODU-0 containers) and 4G Fibre Channel (4 ODU-0 containers), as well as PRBS, Null Client and GFP over 1 to 8 ODU-0 containers.
Payload Pattern	Selects a test pattern to insert into the payload of an OTN signal, when the Mapping is set to PRBS or Unframed BERT. Select one of the following: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, or a User Defined (32-bit value) pattern.  The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected.
Line Frequency Offset	Adjusts the offset of the transmitted signal's frequency. The frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. • The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 • A 0 (zero) value equals Off.  The Line Frequency Offset setting is only available when the Clock Reference is set to Internal timing.

OPU Frequency Offset	Sets the Optical Channel Payload Unit (OPU) frequency offset. The OPU frequency offset range may vary depending on the configured mapping.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. Off. The unit's laser will be off when the unit is turned on. On. The unit's laser will be on when the unit is turned on. Restore Previous State. When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
ODU-1 Mapping Note: The ODU-1 Mapping function is available when OTU-2 is mapped for ODTU-12	Configures the ODU-1 Add/Drop Mapping structure. Unframed BERT: Transmits an Unframed BERT signal in the foreground ODU-1 Mapping. SDH Synchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. SDH Asynchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. SONET Synchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. SONET Asynchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. PRBS: The foreground ODU-1 Mapping is configured with a PRBS pattern.

	Null Client: The foreground ODU-1 Mapping is configured with an All Zeros pattern. GFP: The foreground ODU-1 Mapping is configured with a GFP Payload.
ODU-1 Added Note: The ODU-1 Added function is available when OTU-2 is mapped for ODTU-12 or ODTU-012	Selects which or the four ODU-1 channels will be the foreground channel.  To configure the ODU-1 Added setting when OTU-2 is mapped for ODTU-012, the ODU-n Selected button (located in the LED Quick Status area) must set for ODU-1 Selected.
ODU-1 OPU Frequency Offset Note: The ODU-1 OPU Frequency Offset function is available when OTU-2 is mapped for ODTU-12	Sets the ODU-1 OPU frequency offset. The offset can be adjusted in ppm ranging from -65.66 ppm to 65.66 ppm.  The ODU-1 OPU Frequency Offset setting is only available when the 10G Mapping is configured for ODTU-12, and the ODU-1 Mapping is configured for SONET/SDH Asynchronous payload.
ODU-0 Mapping Note: The ODU-0 Mapping function is available when OTU-2 or OTU-1 is mapped for ODTU-01, ODTU-02 or ODTU-012	Configures the ODU-0 Add/Drop Mapping structure. PRBS Patterns, NULL Client, Transcoded 1000Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options. PRBS: The foreground ODU-0 Mapping is configured with a PRBS pattern. Null Client: The foreground ODU-0 Mapping is configured with an All Zeros pattern. Transcoded 1000Base-X: The foreground ODU-0 Mapping is configured with a modified GFP-T payload, which supports the Stuff Byte Algorithm per ITU-T G.709/Y.1331. STS-12: In SONET mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SONET processor's STS-12 Interface. From the SONET tab, you can further multiplex the STS-12 Mapping option from an STS-12c Bulk Filled Mapping down to the lowest Mapping option available.

	STS-3: In SONET mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SONET processor's STS-3 Interface. From the SONET tab, you can further multiplex the STS-3 Mapping option from an STS-3c Bulk Filled Mapping down to the lowest Mapping option available. STM-4: In SDH mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SDH processor's STM-4 Interface. From the SDH tab, you can further multiplex the STM-4 Mapping option from an AU-4-4c Bulk Filled Mapping down to the lowest Mapping option available. STM-1: In SDH mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SDH processor's STM-1 Interface. From the SDH tab, you can further multiplex the STM-1 Mapping option from an AU-4 C-4 Bulk Filled Mapping down to the lowest Mapping option available  If the Test Unit is equipped with a PDH module, the SONET/SDH interfaces listed above also support an Add/Drop mapping to E4, E3, DS3, and DS1 payload rates. Use the Preset menu to configure the SONET/SDH rate for the desired PDH Add/Drop prior to configuring the OTN Interface for an ODU-0 mapping.
ODU-0 Added Note: The ODU-0 Added function is available when OTU-2 or OTU-1 is mapped for ODTU-01, ODTU-02 or ODTU-012	Selects which or the ODU-0 channels will be the foreground channel.  For ODTU-02 Mappings, there are 8 ODU-0 channels available.  For ODTU-01 and ODTU-012 Mappings, there are 2 ODU-0 channels available.
ODU-0 OPU Frequency Offset Note: The ODU-0 OPU Frequency Offset function is available	Sets the ODU-0 OPU frequency offset. The offset can be adjusted in ppm ranging from -100.00 ppm to 100.00 ppm.

when OTU-2 or OTU-1 is mapped for ODTU-01, ODTU-02 or ODTU-012

 The ODU-0 OPU Frequency Offset setting is only available when the ODU-0 Mapping is configured for SONET/SDH Asynchronous payload.

OTN Transmit - Set / Set 2

Use the Settings 2 screen to configure OTN transmit parameters. The following describes the functions that appear on this screen.

Functions	Description
Trigger In	Determines how the protocol processor responds when an external +5v "pulse" is detected on the external Trigger In SMA connector. The following options are available: • None: The protocol processor will do nothing when an external pulse is received. (default setting) • Restart: The current test will restart when an external pulse is received. • Error Insert: The protocol processor will insert an error when an external pulse is received. For this to work, you must first select an Error Type to be inserted.
Scramble	Enables/disables the transmit Scramble option, as defined by G.709. The default value is Enable. This setting is not available when the mapping is set to Unframed BERT.
Forward Error Correction	Enables/disables the transmit Forward Error Correction (FEC), as defined by G.709. The default value is Enable.  This setting is not available when the mapping is set to Unframed BERT.
TX Clock Loss Threshold	Configures the user-definable threshold for the TX Clock Loss alarm, in PPM.

	Valid range is from 0 to 100ppm, where 0 is disabled. The default value is 50ppm.  This threshold alarm is only supported when the transmit reference clock is configured for an external clock source. When the transmit reference clock is configured for Internal, this setting and the associated alarm are disabled.
Measured TX Line Frequency	Measures the Transmission Line Frequency value in Hz.  The TX line frequency can be derived from the Internal clock, an External TTL clock, a Recovered clock, or a BITS/SETS timing signal.
Measured TX Line Frequency Offset	Measures the Transmission Line Frequency Offset value in Hz and ppm.  When the transmit reference clock is configured for an External TTL clock, Recovered or BITS/SETS timing, this measurement is the deviation between the internal clock rate and the line rate derived from the external reference clock.

OTN Overhead

OTN Transmit - Overhead (OTN OH)

The OTN OH screen allows you to configure the following overhead signals:

[OTU](#)

[ODU-A](#)

[ODU-B](#)

[TCM](#)

[OPU](#)

[OH INTRUDE](#)

OTN Transmit - OTN OH / OTU

The following overhead options are available from the OTU screen.

Option	Description
OA1	Edits the first three bytes of the Frame Alignment Signal (FAS) OH. The default byte value is 1111 0110 (0xF6).
OA2	Edits the second three bytes of the FAS OH. The default byte value is 0010 1000 (0x28).
MFAS	Edits the Multiframe Alignment Signal OH byte. This byte is located in row1, column 7 of the OTU OH.
TTI	Trail Trace Identifier. The TTI OH byte defines the 64-byte TTI string. The TTI is part of the OTU Section Monitoring (SM) OH.  See SAPI, DAPI and Specific trace settings below.
BIP-8	Edits the OTU SM error detection code signal. It is a single byte that uses a Bit Interleaved Parity-8 code.
BEI/BDI/IAE/RES	The Backward Error Indication (BEI) and Backward Incoming Alignment Error (BIAE) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Incoming Alignment Error (IAE) subfield is a single bit used to indicate a frame alignment error. This bit is set to 1 to indicate an IAE. Two bytes of the Section Monitoring overhead are reserved (RES) for future use.
GCC0-1 and GCC0-2	General Communication Channel 0, Byte 1 and Byte 2.
RES-1 and RES-2	Two bytes of the OTU overhead are reserved for future use.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.

DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / ODU-A

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: ODU-A, [ODU-B](#), and [TCM](#).

Use screen A of the Optical Channel Data Unit (ODU) Overhead to edit the Path Monitoring overhead and the Fault Type and Fault Location (FTFL) overhead bytes and messages. The FTFL is a 256-byte message that is divided into two parts: the Forward FTFL and the Backward FTFL.

Forward FTFL

The Forward FTFL consists of bytes 0 to 127 of the FTFL message.

Option	Description
Fault	Byte 0 is the Fault Identification field. It provides a fault status and uses the following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 1 through 9 are used for the Operator Identifier field.
OS	Bytes 10 through 127 are used for the Operator Specific field.

Backward FTFL

The Backward FTFL consists of bytes 128 to 255 of the FTFL message.

Option	Description

Fault	Byte 128 is the Fault Identification field. It provides a fault status and uses the following codes: 0000 0000: No Fault 0000 0001: Signal Fail 0000 0010: Signal Degrade 0000 0011 through 1111 1111 are reserved for future use.
OI	Bytes 129 through 137 are used for the Operator Identifier field.
OS	Bytes 138 through 255 are used for the Operator Specific field.

ODU Path Monitoring Overhead

Option	Description
TTI	The ODU Trail Trace Identifier (TTI) is a single byte used for Path Monitoring to identify the 64-byte TTI signal message.
BIP-8	A single byte used to define the Error Detection Code signal, which is a Bit Interleaved Parity-8 (BIP-8) code.
BEI/BDI/STAT	The Backward Error Indication (BEI) and Backward Incoming Alignment Error (BIAE) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.

Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / ODU-B

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: [ODU-A](#), ODU-B, and [TCM](#).

Use screen B of the ODU overhead to edit the following bytes.

Option	Description
RES-1 through RES-9	Nine bytes of the ODU overhead are reserved for future use. These bytes are set to all zeros.
EXP-1 and EXP-2	Two bytes of the ODU overhead are reserved for experimental use.
GCC1-1 and GCC1-2	General Communications Channel 1, Byte 1 and Byte 2.
GCC2-1 and GCC2-2	General Communications Channel 2, Byte 1 and Byte 2.
APS/PCC-1 through APS/PCC-4	Automatic Protection Switching and Protection Communication Channel, Byte 1, Byte 2, Byte 3, and Byte 4.

OTN Transmit - OTN OH / TCM

The Transmit Optical Channel Data Unit (ODU) overhead bytes and messages can be edited using three separate screens on the unit: [ODU-A](#), [ODU-B](#), and TCM.

The ODU overhead contains six Tandem Connection Monitoring (TCM) fields. The following overhead bytes can be edited for each TCM field.

Option	Description
TCM Selection	Selects a specific TCM field (TCM1 through TCM6).

BIP-8	One byte of the ODU TCM overhead is used to identify an Error Detection Code signal, which is a BIP-8 signal.
BEI/BDI/STAT	The Backward Error Indication (BEI) and Backward Incoming Alignment Error (BIAE) subfield is a four-bit signal sent in the upstream direction to indicate that an error has been detected. The Backward Defect Indication (BDI) subfield is a single bit sent in the upstream direction to indicate that a signal fail status has been detected. This bit is set to 1 to indicate a BDI. The Status (STAT) bits are three bits used to indicate the use of a maintenance signal.
SAPI	Source Access Point Identifier. The SAPI is the first part of the multi-frame Trail Trace Identifier (TTI) structure. A 15-character string can be entered for the SAPI.
DAPI	Destination Access Point Identifier. The DAPI is part of the multi-frame TTI structure. A 15-character string can be entered for the DAPI.
Specific	Operator Specific. This is part of the TTI structure. A 32-character string can be entered for this value.

OTN Transmit - OTN OH / OPU

Use this screen to edit the Optical Channel Payload Unit (OPU) bytes.

Option	Description
RES-1 through RES-3 and RES-5 through RES-8	Seven bytes of the OPU overhead are reserved for future use. These bytes are set to all zeros.
PT (PSI-0)	Payload Type. This byte identifies the type of signal mapped into an OPU.
Positive Adjust	Positive Justification Opportunity byte.
Negative Adjust	Negative Justification Opportunity byte.



The OPU Positive and Negative Adjust buttons are only available for Asynchronous mappings.

OTN Transmit - OTN OH / INTRUDE

When the unit is in Passthru Mode, the Intrude option allows you intrude on selected byte data in a return signal.

To intrude upon a byte:

1. Select the **OTN** tab.
2. Select **Transmit** and **Set 1**.
3. Verify the **Passthru Mode** setting is set to **On**.
4. Select **OTN OH**.
5. Select the **Intrude** button. The Intrude screen appears displaying byte buttons.
6. Select the button that represents the byte you want to intrude upon. The button turns red while intruding on the byte.



The Passthru mode feature cannot be tested with the unit looped back to itself.

OTN Transmit - A/D OH

The A/D OH settings apply to the additional layer of overhead bytes for lower ODU rate payloads that are multiplexed up to a higher OTU Interface rate.

The Transmit A/D OH screens become enabled when either OTU-1 is configured for an ODTU-01 Add/Drop mapping, or when OTU-2 is configured for ODTU-02 or ODTU-012 Add/Drop mappings.



See the [OTN Transmit - OTN OH](#) section for a description of each of the transmit overhead bytes.

OTN Transmit - Error Alarm

Use this screen to configure and transmit OTN errors and alarms.

For information on inserting errors and alarms see the online help topics, [Inserting Errors](#) and [Inserting Alarms](#) in the Common Tasks section.

The following options are available on the OTN Errors and Alarms screen.

Option	Description
Error to Insert	Allows the user to select an error that is transmitted by the OTN signal. Selecting the Error to Insert button opens the Select Error Insert list. Available errors include: - FEC:UNCOR, FEC:COR, FRAME, MFAS, OTU:BIP8, OTU:BEI, ODU:BIP8, ODU:BEI, BIT, TCM1:BIP8 – TCM6:BIP8, and TCM1:BEI – TCM6:BEI (Note that FEC Correctable & Uncorrectable errors are inserted after the FEC wrapper is created.) Selecting More opens second page of Errors to Insert. - When testing an ODTU Add/Drop mapping, then the following Add/Drop error types are available: - FRAME, MFAS, ODU:BIP8, ODU:BEI, TCM1:BIP8 – TCM6:BIP8, and TCM1:BEI – TCM6:BEI - Selecting More again (or the first time when not testing ODTU mapping), lists the Alarms to Burst list. Select an Alarm to burst (like error insertion), and then configure the Burst settings below. - OTU:IAE, OTU:BIAE, OTU:BDI, ODU:BDI, TCM1:BDI - TCM6:BDI, TCM1:BIAE - TCM6:BIAE
Error Insert Rate	Sets the insertion rate for the selected error type. This setting is not available if Error to Insert is set to None. The following options are available for this command.

	• Off: No errors are inserted for transmission. This command effectively disables the Error Insert Action button. • 1e-X, where X is a value from 3 through 10. • User Defined: Allows you to enter and save a customized error insertion rate.  When an Alarm to Burst is selected, then "Periodic Burst" is displayed.
Error Burst Size	Sets the duration, either in Frames or MilliSec, for the alarm selected from the Alarms to Burst list to be inserted.  This option is not available unless an Alarm to Burst has been selected from the Error to Insert function.
Error Burst Period	Sets the elapsed time (in MilliSec) or Frame count between alarm insertion bursts. This is a repeating action.  This option is not available unless an Alarm to Burst has been selected from the Error to Insert function.
Alarm Generated	Generates a specific alarm that is transmitted by the OTN signal. The following alarms are available: • LOS, LOF, OOF, LOM, OOM, OTU:IAE, OTU:BIAE, OTU:BDI, ODU:AIS, ODU:LCK, ODU:OCI, ODU:BDI, TCM1:BDI – TCM6:BDI, TCM1:BIAE – TCM6:BIAE, and None.

Receive

OTN Receive Screens and Functions

The receive section allows you to configure the receive settings for the parameters used in OTN operations.

The following receive functionalities are available through the OTN Receive screen:

- [Set 1](#)

- [Set 2](#)
- [Set 3](#)
- [OTN OH](#)
- [A/D OH](#)
- [Capture](#)
- [SIG](#)

OTN Receive - Set / Set 1

Use the Set 1 screen to configure OTN receive parameters. The following describes the functions that appear on this screen.

Functions	Description
Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, settings established on the Receive screen will only affect Receive mode.  Some settings such as Interface are always coupled, regardless of the Settings Control mode.
Interface	Sets the OTN receive interface rate. The following interface rates <u>may</u> be available: • OTU-1 (2.666 GHz) - Provides OTU-1 testing • OTU-2 (10.709 GHz) - Provides OTU-2 testing • 802.3 LAN (10.3125G) - Provides 10 Gigabit Ethernet LAN testing, without FEC • OTU1e (11.049G) - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2 • OTU2e (11.095G) - Provides 11.095 Gigabit Ethernet LAN testing over OTU-2 • Fibre Chan (8.50G) - Provides 8.50 Gigabit Fibre Channel testing

	• Fibre Chan (10.52G) - Provides 10.52 Gigabit Fibre Channel testing • OTU1f (11.270G) - Provides 11.270 Gigabit Fibre Channel testing over OTU-2 • OTU2f (11.317G) - Provides 11.317 Gigabit Fibre Channel testing over OTU-2  The OTN processor supports hot-swappable SFP and XFP laser modules.  Verify that the inserted SFP/XFP module supports the desired Interface rate prior to selecting it.  The wavelength of the selected interface is determined by the specifications of the SFP or XFP module being used.  Available interface rates are dependent on the licensed-based test options currently enabled.  Not Assigned is displayed if a Non-OTN Interface is currently configured by one of the other processor tabs that share the same SFP/XFP ports.  OTU-1 and OTU-2 interfaces can be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, and can be licensed for GFP and ODU-Flex mappings.  The datacom interface rates allows for packet testing on the Packet tab, without the need for separate circuit packs.
Mapping Note: The Mapping function is not available when the Interface is configured for G.707/GR-253.	Selects the type of signals that are expected in the OTN receive signal. Unframed BERT: Expects an Unframed BERT signal in the OTN frame. SDH Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab.

SDH Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab.

SONET Synchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab.

SONET Asynchronous: The Optical Channel Payload Unit (OPU) of the OTN frame is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab.

PRBS: Expects a PRBS pattern into the OTN frame.

Null Client: Expects an All Zeros pattern into the OTN frame.



The following OTN mapping options are licensable features:

GFP: Expects an OTN frame configured with a GFP Payload.

ODTU-01: The Optical Channel Payload Unit (OPU) of the OTU 1 interface is configured with two ODU-0 mapping signals. The foreground ODU-0 can then be configured for PRBS Patterns, NULL Client, Transcoded 1000 Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options.

ODTU-02: The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with two ODU-0 mapping signals. The foreground ODU-0 can then be configured for PRBS Patterns, NULL Client, Transcoded 1000 Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options.

ODTU-12: The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with four ODU-1 mapping signals. The foreground ODU 1 can be configured with SONET/SDH Sync/Async mappings, GFP, PRBS, or Null Client mapping options.

ODTU-012: The Optical Channel Payload Unit (OPU) of the OTU 2 interface is configured with four ODU-1 mapping signals, when the foreground ODU-1 is configured for two ODU-0 mapping signals. The foreground ODU-0 can then be

	configured for PRBS Patterns, NULL Client, Transcoded 1000 Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options. ITU-T G.709 Sup43 7.3: The OTN processor is configured for a 10Gbps LAN mapping over OTU-2, with a GFP-F structure, per ITU-T G.709 Supplement 43 Section 7.3. ODU-Flex: OTU-2 can be mapped for ODU-Flex, which supports 8G Fibre Channel (7 ODU-0 containers) and 4G Fibre Channel (4 ODU-0 containers), as well as PRBS, Null Client and GFP over 1 to 8 ODU-0 containers.
Payload Pattern	Selects an expected test pattern in the payload of an OTN signal, when the Mapping is set to PRBS or Unframed BERT. Select one of the following: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
Power Low Threshold	Sets the threshold for which the Power Low alarm occurs. When the received optical power level (in dBm) is lower than the power low threshold setting, the Power Low alarm will occur. The threshold value is entered using an on-screen keypad, and can range from -10.0 dBm to -100.0 dBm in increments of 0.1 dBm. The default value is -100.0 (Disabled).
Out of Frequency Threshold	Sets the threshold for which the Frequency Wide alarm occurs. When the received Line Frequency Offset (in ppm) exceeds the set threshold setting, the Frequency Wide alarm will occur. The threshold value is entered using an on-screen keypad, and can range from 0 ppm to 100.0 ppm in increments of 0.1 ppm. The default value is 0 ppm (Disabled).

Scramble	Enables/disables the received Scramble option, as defined by G.709. The default value is Enable.
Forward Error Correction	Enables/disables the received Forward Error Correction (FEC), as defined by G.709. The default value is Enable.
Trigger Out	Selects a specific receive event that will cause the protocol processor to generate a +5v "pulse" on the external Trigger Out SMA connector.
ODU-1 Mapping Note: The ODU-1 Mapping function is available when OTU-2 is mapped for ODTU-12	Selects the type of signal expected in the foreground ODU-1 Mapping of the ODTU-12 receive signal. Unframed BERT: Expects an Unframed BERT signal in the foreground ODU-1 Mapping. SDH Synchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. SDH Asynchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SDH tab. SONET Synchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is synchronized with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. SONET Asynchronous: The Optical Channel Payload Unit (OPU) of the foreground ODU-1 Mapping is Asynchronous with the rest of the OTN frame, and the payload data is defined by the configuration settings on the SONET tab. PRBS: The expected foreground ODU-1 Mapping is configured with a PRBS pattern. Null Client: The expected foreground ODU-1 Mapping is an All Zeros payload pattern. GFP: The expected foreground ODU-1 Mapping is configured with a GFP Payload.

ODU-1 Dropped Note: The ODU-1 Dropped function is only available when the 10G Mapping is configured for ODTU-12	Selects which or the four ODU-1 channels will be the demultiplexed (dropped) channel.  To configure the ODU-1 Dropped setting when OTU-2 is mapped for ODTU-012, the ODU-n Selected button (located in the LED Quick Status area) must set for ODU-1 Selected.
ODU-0 Mapping Note: The ODU-0 Mapping function is available when OTU-2 or OTU-1 is mapped for ODTU-01, ODTU-02 or ODTU-012	Configures the ODU-0 Add/Drop Mapping structure. PRBS Patterns, NULL Client, Transcoded 1000Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options. PRBS: The foreground ODU-0 Mapping is configured with a PRBS pattern. Null Client: The foreground ODU-0 Mapping is configured with an All Zeros pattern. Transcoded 1000Base-X: The foreground ODU-0 Mapping is configured with a modified GFP-T payload, which supports the Stuff Byte Algorithm per ITU-T G.709/Y.1331. STS-12: In SONET mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SONET processor's STS-12 Interface. From the SONET tab, you can further multiplex the STS-12 Mapping option from an STS-12c Bulk Filled Mapping down to the lowest Mapping option available. STS-3: In SONET mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SONET processor's STS-3 Interface. From the SONET tab, you can further multiplex the STS-3 Mapping option from an STS-3c Bulk Filled Mapping down to the lowest Mapping option available. STM-4: In SDH mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SDH processor's STM-4 Interface. From the SDH tab, you can further multiplex the STM-4 Mapping option from an AU-4-4c Bulk Filled Mapping down to the lowest Mapping option available.

	STM-1: In SDH mode, the foreground ODU-0 is configured for an Asynchronous Add/Drop mapping to the SDH processor's STM-1 Interface. From the SDH tab, you can further multiplex the STM-1 Mapping option from an AU-4 C-4 Bulk Filled Mapping down to the lowest Mapping option available  If the Test Unit is equipped with a PDH module, the SONET/SDH interfaces listed above also support an Add/Drop mapping to E4, E3, DS3, and DS1 payload rates. Use the Preset menu to configure the SONET/SDH rate for the desired PDH Add/Drop prior to configuring the OTN Interface for an ODU-0 mapping.
ODU-0 Dropped Note: The ODU-0 Added function is available when OTU-2 or OTU-1 is mapped for ODTU-01, ODTU-02 or ODTU-012	Selects which or the ODU-0 channels will be the foreground channel.  For ODTU-02 Mappings, there are 8 ODU-0 channels available.  For ODTU-01 and ODTU-012 Mappings, there are 2 ODU-0 channels available.

OTN Receive - Set / Set 2

Use the Set 2 screen to Enable and Disable the following OTN alarm reporting parameters:

- OTU SM TIM Alarm Reporting (OTU SAPI and DAPI - Trace Identifier Mismatch).
- ODU PM TIM Alarm Reporting (ODU SAPI and DAPI - Trace Identifier Mismatch).
- TCM #1 (Tandem Connection Monitoring #1) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #2 (Tandem Connection Monitoring #2) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #3 (Tandem Connection Monitoring #3) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #4 (Tandem Connection Monitoring #4) Alarm Reporting (with or without TIM Alarm Reporting)

- TCM #5 (Tandem Connection Monitoring #5) Alarm Reporting (with or without TIM Alarm Reporting)
- TCM #6 (Tandem Connection Monitoring #6) Alarm Reporting (with or without TIM Alarm Reporting)
- OPU PLM (Payload Label Mismatch) Alarm Reporting
- OPU Out of Frequency Threshold - Sets the threshold (in ppm) for which the OPU:Frequency Wide alarm occurs, based on the measured OPU Justify Frequency Offset. The default value is 0.0 (Disabled).
- Signal Auto-Recovery Method - This is used as an attempt to recover the signal in the event the OTN's client processor signal (SONET/SDH tab, Packet tab, etc) is in an alarm state such as Loss of Frame or Loss of Link.
 - By setting this to **Default**, the OTN processor will refresh every 30 seconds or so, which gives the client processor an opportunity to re-acquire a good framing or link.
 - By setting this to **Alternate**, then the OTN processor will not try to auto-recover (refresh) when the client processor framing or link state is bad. You may need to force an LOS event (and then clear the LOS event) after the signal failure has been resolved, for the client to re-acquire client framing or link state.

OTN Receive - Set / Set 3

Use the SET 3 screen to enable and disable the following Add/Drop ODTU mapping's alarm reporting:

- A/D ODU PM TIM Alarm Reporting (A/D ODU SAPI and DAPI - Trace Identifier Mismatch).
- A/D TCM #1 (Tandem Connection Monitoring #1) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #2 (Tandem Connection Monitoring #2) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #3 (Tandem Connection Monitoring #3) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #4 (Tandem Connection Monitoring #4) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D TCM #5 (Tandem Connection Monitoring #5) Alarm Reporting (with or without TIM Alarm Reporting)

- A/D TCM #6 (Tandem Connection Monitoring #6) Alarm Reporting (with or without TIM Alarm Reporting)
- A/D OPU PLM (Payload Label Mismatch) Alarm Reporting
- A/D OPU Out of Frequency Threshold - Sets the threshold (in ppm) for which the Add/Drop OPU:Frequency Wide alarm occurs, based on the measured A/D OPU Justify Frequency Offset. The default value is 0.0 (Disabled).

 These settings are only available when the OTN Interface is configured for an ODTU Add/Drop mapping.

OTN Receive - OTN OH

The OTN Receive Overhead screen contains the following read-only functions.

Function	Options
OTU Overhead	Displays the Optical Channel Transport Unit (OTU) overhead bytes on the incoming signal. This is a read-only function.
ODU-A Overhead	Displays the first screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function.
ODU-B Overhead	Displays the second screen of the Optical Channel Data Unit (ODU) Overhead bytes on the incoming signal. This is a read-only function.
TCM Overhead	Displays the Tandem Connection Monitoring (TCM) Overhead on the incoming signal. This is a read-only function.
OPU Overhead	Displays the Optical Channel Payload Unit (OPU) Overhead bytes on the incoming signal. This is a read-only function.
Received SAPI Trace	Displays the Source Access Point Identifier (SAPI) trace received on the incoming signal for OTU, ODU, and TCM1-TCM6 OH bytes.
Expected SAPI Trace	The Expected SAPI Trace is a User Defined setting that can be compared to the received SAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's SAPI alarm will increment if the received SAPI Trace is different than the Expected SAPI Trace setting.

Received DAPI Trace	Displays the Destination Access Point Identifier (DAPI) trace received on the incoming signal for OTU, ODU, and TCM1-TCM6 OH bytes.
Expected DAPI Trace	The Expected DAPI Trace is a User Defined setting that can be compared to the received DAPI Trace. When a specific OH section's TIM Alarm Reporting is Enabled, then that section's DAPI alarm will increment if the received DAPI Trace is different than the Expected DAPI Trace setting.

OTN Receive - A/D OH

The A/D OH settings apply to the additional layer of overhead bytes for lower ODU rate payloads that are multiplexed up to a higher OTU Interface rate.

The Receive A/D OH screens become enabled when either OTU-1 is configured for an ODTU-01 Add/Drop mapping, or when OTU-2 is configured for ODTU-02 or ODTU-012 Add/Drop mappings.



See the [OTN Receive - OTN OH](#) section for a description of each of the receive overhead bytes.

OTN Receive - Capture

Use the Capture screen to capture 256 bytes of received overhead bytes, before/after a triggered event occurs.

Function	Description
Byte Select	Select the overhead byte to be captured.

	OTU:FAS OA2 3	ODU:TCM2 BEI	ODU:GCC2 1
	OTU:MFAS	ODU:TCM3 BEI	ODU:GCC1 2
	OTU:SM TTI	ODU:TCM4 BEI	ODU:GCC2 2
	OTU:SM BIP	ODU:TCM5 BEI	ODU:APS PCC 1
	OTU:SM BEI	ODU:TCM6 BEI	ODU:APS PCC 2
	OTU:GCC0 1	ODU:RES 1	ODU:APS PCC 3
	OTU:GCC0 2	ODU:RES 2	ODU:APS PCC 4
	OTU:RES 1	ODU:RES 3	OPU:JC-1
	OTU:RES 2	ODU:RES 4	OPU:JC-2
	ODU:TCM1 TTI	ODU:RES 5	OPU:JC-3
	ODU:TCM2 TTI	ODU:RES 6	OPU:NJO
	ODU:TCM3 TTI	ODU:RES 7	OPU:PSI
	ODU:TCM4 TTI	ODU:RES 8	OPU:RES 1
	ODU:TCM5 TTI	ODU:RES 9	OPU:RES 2
	ODU:TCM6 TTI	ODU:TCM ACT	OPU:RES 3
	ODU:TCM1 BIP	ODU:FTFL	
	ODU:TCM2 BIP	ODU:PM TTI	
Capture Trigger	Select the Capture Trigger event.		
	FRAME ERROR	OOM ALARM	
	BIT ERROR	OTU:AIS ALARM	
	FEC:CORR ERROR	OTU:IAE ALARM	
	FEC:UNCORR ERROR	OTU:BDI ALARM	
	MFAS ERROR	POS JUSTIFY	
	OTU:BIP8 ERROR	NEG JUSTIFY	
	OTU:BEI ERROR	BYTE EQUAL	
	ODU:BIP8 ERROR	BYTE NOT EQUAL	
	ODU:BEI ERROR	MANUAL	
	LOM ALARM		
Match Value	This setting only appears when the Capture Trigger is set to "BYTE EQUAL" or "BYTE NOT EQUAL".		

	Use the keypad to enter the byte value (in Hex) that the selected byte's received value will either need to "equal" or "not equal" in order to trigger the capture event.
Bytes After Trigger	When a Capture event has been triggered, 256 overhead byte values will be captured (from 0 to 255). This setting is used to specify how many of those 256 bytes should be captured immediately following the trigger, and in turn how many of those 256 bytes should be captured immediately preceding the trigger.  If 255 is entered (default), then the triggered byte value, and the following 255 byte values after the trigger event will be captured.  If 254 is entered (default), then the one byte immediately preceding the trigger, the triggered byte value, and the following 254 byte values will be captured.  If 100 is entered, then the 155 bytes immediately preceding the trigger, as well as the triggered byte value, and the following 100 byte values will be captured.  If 0 is entered, then the 255 bytes immediately preceding the trigger, as well as the triggered byte value will be captured, but 0 bytes after the trigger will be captured.
Action buttons	► Capture - Activates the capture feature, and changes the State to "Waiting for Trigger".  If the Capture Trigger setting is set to MANUAL, then the capture will immediately be triggered, otherwise the processor will wait until the selected Capture Trigger event occurs. ► Stop - Deactivates the capture feature, and changes the State from "Waiting for Trigger" to "Start", and re-enables the Capture button. ► Reset - Clears the previously captured byte values

State	Displays the current state of the capture feature. Possible States include: ▶ Start ▶ Waiting for Trigger ▶ Done
OH CAPTURE RESULTS	When a capture event is triggered, the 256 captured bytes are displayed in both Hexadecimal and ASCII. The Frame column displays the frame number for each of the captures bytes. Frame numbers can range from -255 to 255, depending on the Bytes After Trigger setting. The Hex column displays each captured frame's byte value in Hexadecimal format. The ASCII column displays each captured frame's byte value in ASCII format. (A hex value o 0, will be displayed as blank)

OTN Receive - Signal Status (SIG)

Displays the following measurements of the incoming OTN signal:

- Line Frequency in Hz
- Line Frequency Offset Received in Hz and PPM
- Optical Power source in dBm
- OPU Justify Frequency Offset in PPM



The OPU Justify Frequency measurement is only made when the OPU is configured for an Asynchronous Add/Drop mapping.



When the OTU-2 Mapping is configured for ODTU-12 or ODTU-012, the OPU Justify Rate will be -17.65 PPM less than the measured offset.

- A/D OPU Justify Frequency Offset in PPM



The A/D OPU Justify Frequency measurement is only made when the A/D OPU is configured for an Asynchronous Add/Drop mapping.

Results

OTN Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen. This screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The Results screen provides different ways of viewing received statistics. From the left side of the Result screen, select one of the following tabs:

- [Error / Alarm](#)
- [Event Log](#)
- [Large LED](#)
- [Graphs](#)

Error / Alarm

OTN Results - Error & Alarm

The Err screens provides the following options:

- [Scan](#)
- [Errors](#)
- [Add/Drop Errors](#)
- [Alarms](#)
- [Add/Drop Alarms](#)
- [Counts](#)

OTN Results - Error & Alarm - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

- For [Alarms](#), the duration is reported as a count in seconds.

- For [Errors](#), an error count is reported.
- The message **No Errors or Alarms** appears if no events are received by the unit.

OTN Results - Error & Alarm - Errors

The system can monitor and report errors on the incoming OTN signal. The **Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the OTN network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **FRAME**
- **MFAS**
- **FEC:Uncorrected**
- **FEC:Corrected**
- **OTU:BIP8**
- **OTU:BEI**
- **ODU:BIP8**
- **ODU:BEI**
- **BIT**
- **TCM1:BIP8 – TCM6:BIP8**
- **TCM1:BEI – TCM6:BEI**

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format

- Current error rate using an N.NNe-N format

OTN Results - Error & Alarm - Add/Drop Errors

When either OTU-1 is configured for an ODTU-01 Add/Drop mapping, or when OTU-2 is configured for ODTU-02 or ODTU-012 Add/Drop mappings, the system can monitor and report errors on the incoming Add/Drop ODU Mapping. The **Add/Drop Errors** function provides a detailed analysis of the incoming error as described below.

The errors reported are a result of:

- Incoming errors that are generated by the OTN network, or
- Errors being intentionally generated by the system when it is used in a loopback environment

The following errors can be monitored:

- **Add/Drop Frame**
- **Add/Drop MFAS**
- **Add/Drop ODU:BIP8**
- **Add/Drop ODU:BEI**
- **Add/Drop OPU:C8 CRC8**
- **Add/Drop BIT**
- **Add/Drop TCM1:BIP8 – Add/Drop TCM6:BIP8**
- **Add/Drop TCM1:BEI – Add/Drop TCM6:BEI**

The following parameters are measured for these incoming errors:

- Error count using an 11-digit format
- Average error rate using an N.NNe-N format
- Current error rate using an N.NNe-N format

OTN Results - Error & Alarm - Alarms

The system can monitor and report alarms and their duration on the incoming OTN signal. The **Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- **LOS**
- **Power Hot**
- **Power Warm**
- **Power Low**
- **Frequency Wide**
- **LOF**
- **OOF**
- **LOM**
- **OOM**
- **OTU:AIS**
- **OTU:IAE**
- **OTU:BIAE**
- **OTU:BDI**
- **OTU:SAPI**
- **OTU:DAPI**
- **ODU:AIS**
- **ODU:LCK**
- **ODU:OCI**
- **ODU:BDI**
- **ODU:SAPI**
- **ODU:DAPI**
- **TCM1:BDI – TCM6:BDI**
- **TCM1:BIAE – TCM6:BIAE**
- **TCM1:SAPI – TCM6:SAPI**
- **TCM1:DAPI – TCM6:DAPI**
- **OPU:C8 Sync**
- **OPU:PLM**

- OPU:AIS
- Paused
- Pat Sync

OTN Results - Error & Alarm - Add/Drop Alarms

When either OTU-1 is configured for an ODTU-01 Add/Drop mapping, or when OTU-2 is configured for ODTU-02 or ODTU-012 Add/Drop mappings, the system can monitor and report alarms on the incoming Add/Drop ODU Mapping. The **Add/Drop Alarms** function lists the duration of the alarm in seconds.

The following alarms can be monitored:

- Add/Drop Pat Sync
- Add/Drop LOF
- Add/Drop OOF
- Add/Drop LOM
- Add/Drop OOM
- Add/Drop ODU:AIS
- Add/Drop ODU:LCK
- Add/Drop ODU:OCI
- Add/Drop ODU:BDI
- Add/Drop ODU:SAPI
- Add/Drop ODU:DAPI
- Add/Drop TCM1:BDI – A/D TCM6:BDI
- Add/Drop TCM1:BIAE – A/D TCM6:BIAE
- Add/Drop TCM1:SAPI – A/D TCM6:SAPI
- Add/Drop TCM1:DAPI – A/D TCM6:DAPI
- Add/Drop OPU:PLM
- Add/Drop OPU:CSF

OTN Results - Error & Alarm - Counts

The Count screen displays the following statistics:

Count	Description
Positive Justification	Reports the total number of Positive OPU Justification counts.
Negative Justification	Reports the total number of Negative OPU Justification counts.
Justification Seconds	Reports the total duration of OPU Justifications in seconds.
Add/Drop Positive Justification	Reports the total number of Positive Add/Drop OPU Justification counts.
Add/Drop Negative Justification	Reports the total number of Negative Add/Drop OPU Justification counts.
Add/Drop Justification Seconds	Reports the total duration of Add/Drop OPU Justifications in seconds.

OTN Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

OTN Results - Large LEDs

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the OTN protocol processor, see [OTN LEDs](#).

OTN Results - Graph

This function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Test

Test Screens and Functions

(Specifically for OTN testing)

The Test screen configures test parameters associated with an OTN protocol processor.

The Test screen contains the following functions:

- [SET 1](#)
- [Service Disruption](#)

- [RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.

2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.

- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (.). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the

	Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test	Enables real-time reporting. Any event that occurs during a real-time test automatically

 This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.



The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for OTN testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- ▶ For OTU-1 one frame duration is roughly .049 ms (49 μ s)
- ▶ For OTU-2 one frame duration is roughly .012 ms (12 μ s)
- ▶ For OTU-1e one frame duration is roughly .012 ms (12 μ s)
- ▶ For OTU-2e one frame duration is roughly .012 ms (12 μ s)
- ▶ For OTU-1f one frame duration is roughly .012 ms (12 μ s)
- ▶ For OTU-2f one frame duration is roughly .012 ms (12 μ s)
- ▶ For all SONET and SDH rates one frame is roughly .125 ms (125 μ s)

Test Service Disruption functions include:

- **Action (State)** - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.

- ▶ **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- ▶ **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch Criteria** - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.
 - ❗ For all **OTN** processors the Protection Switch Criteria include: **OOF**, **OTU-AIS**, **OTU-BIP8**, **ODU-AIS**, **ODU-BIP8**, and **BIT** (Bit Errors and Loss of Pattern Sync).
- **Good Time** - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
 - ▶ The range for OTU-1 is 0.049 to 802.302 ms, and is entered using a keypad.
 - ▶ The range for OTU-2 is 0.012 to 199.732 ms, and is entered using a keypad.
 - ▶ The range for OTU-1e is 0.012 to 193.588 ms, and is entered using a keypad.
 - ▶ The range for OTU-2e is 0.012 to 192.777 ms, and is entered using a keypad.
 - ▶ The range for OTU-1f is 0.012 to 189.794 ms, and is entered using a keypad.
 - ▶ The range for OTU-2f is 0.012 to 188.997 ms, and is entered using a keypad.
- **Good Frames** - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.
 - ▶ The range is 1 to 16383 frames, and is entered using a keypad.
- **Switch MilliSecs** - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **Switch Frames** - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.

- **History Recent Milliseconds:** The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5).
- **History Recent Frames:** The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

The following chart lists time granular accuracy, per 1 frame duration, for each protocol processor, as well as the max Consecutive Good Frames / Time Required settings.

Protocol Processor	Granular accuracy per frame	Max number of Good Frames (Time) allowed
OTU-1	0.049 ms (49 μ s)	16383 frames (802.302 ms)
OTU-2	0.012 ms (12 μ s)	16383 frames (199.732 ms)
OTU-1e	0.012 ms (12 μ s)	16383 frames (193.588 ms)
OTU-2e	0.012 ms (12 μ s)	16383 frames (192.777 ms)
OTU-1f	0.012 ms (12 μ s)	16383 frames (189.794 ms)
OTU-2f	0.012 ms (12 μ s)	16383 frames (188.997 ms)
SONET / SDH	0.125 ms (125 μ s)	16383 frames (2047.875 ms)

Test - RTD (Round-Trip Delay)

(Specifically for OTN testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

- **Action (State):** Starts and stops round-trip delay mode.
 - ▶ **Single Round-Trip Delay** - If selected, an ODU-BIP8 alarm is inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the ODU-BIP8 frame is received by the unit. Milliseconds indicates how long it took for the ODU-BIP8 frame to travel out and return to the unit.
 - ▶ **Continuous Round-Trip Delay** - If selected, an ODU-BIP8 alarm is inserted into a frame and continuously transmitted through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.
 - ▶ **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.
- **Round Trip Delay Time (milliSec):** Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.
- **Round Trip Delay Time (Frames):** Indicates the number of frames detected after each errored frame is transmitted and return back to the unit.
 - ▶ The **Current** column displays the most recent round trip measurement.

- ▶ The **Minimum** column displays the fastest round trip measurement.
- ▶ The **Maximum** column displays the slowest round trip measurement
- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before round-trip measurements stop accumulating.
 - ▶ The range for OTU-1 is 0.049 to 802.302 ms, and is entered using a keypad.
 - ▶ The range for OTU-2 is 0.012 to 199.732 ms, and is entered using a keypad.
 - ▶ The range for OTU-1e is 0.012 to 193.588 ms, and is entered using a keypad.
 - ▶ The range for OTU-2e is 0.012 to 192.777 ms, and is entered using a keypad.
 - ▶ The range for OTU-1f is 0.012 to 189.794 ms, and is entered using a keypad.
 - ▶ The range for OTU-2f is 0.012 to 188.997 ms, and is entered using a keypad.
- **Consecutive Good Frames Required:** This function allows you to enter the number of consecutive error-free frames to occur before round-trip measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

OTN LED Quick Status Area

When the OTN protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.

- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Indicates current OTN transmit interface wavelength. • Wavelengths are SFP/XFP specific. To change the wavelength, simply hot-swap the SFP/XFP module.  WARNING: Always turn the TX Laser off before hot-swapping SFP or XFP modules. • When the SFP/XFP module has been removed after an OTN interface was selected, "No Laser" will be displayed. • When the laser module is hot-swapped, the laser's transmit wavelength will automatically update for the new SFP/XFP module.  If a non-OTN interface is selected from one of the other tabs, then "Not Assigned" will be displayed.
RX	Displays the received optical power in dBm. • This status indicator will flash when the received optical power level exceeds the SFP's/XFP's Power Warm or Power Hot thresholds. See Power Hot, Power Warm and Power Low Alarms for details. • When the SFP/XFP module has been removed after an OTN interface was selected, "Missing SFP/XFP" will be displayed.
E/A	Indicates the current Error / Alarm configured for transmission in the OTN signal. This is a status indicator.
Test Paused	If red, indicates that the current test has been paused.

CLK	Indicates the value of the Transmit Clock Reference function. This is a status and an alarm indicator.  The text will turn red if TX Clock Loss alarm is present.
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
OTU	Optical channel Transport Unit. Indicates current error, alarm, and event activity for the OTU Section Monitoring. This is a status LED.
AIS	Alarm Indication Signal (OTU). This is an alarm LED.
LOS	Loss of Signal. Indicates that a valid OTN signal is not being received. This is an alarm LED.
BDI	Backward Defect Indication (OTU). This is an alarm LED.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming signal has been detected. This is an alarm LED.
OOF	Out of Frame. Indicates that four consecutive frames have been received with invalid or errored framing patterns. This is an alarm LED.
UNCOR	Forward Error Correction:Uncorrectable. This is an error LED.
COR	Forward Error Correction:Correctable. This is an error LED.
LOM	Loss of Multiframe. This is an alarm LED.

OOM	Out of Multiframe. This is an alarm LED.
BIP8	Bit Interleaved Parity 8 (OTU). This is an error LED.
BEI	Backward Error Indication (OTU). This is an error LED.
IAE	Incoming Alignment Error (OTU). This is an alarm LED.
BIAE	Backward Incoming Alignment Error (OTU). This is an alarm LED.
ODU	Optical channel Data Unit. Indicates current error, alarm, and event activity for the ODU Path Monitoring. This is a status LED.
BIP8	Bit Interleaved Parity 8 (ODU). This is an error LED.
BEI	Backward Error Indication (ODU). This is an error LED.
AIS	Alarm Indication Signal (ODU). This is an alarm LED.
LCK	Lock Indication (ODU). This is an alarm LED.
OCI	Open Connection Indication (ODU). This is an alarm LED.
BDI	Backward Defect Indication (ODU). This is an alarm LED.
<u>TCM Summary</u>	Tandem Connection Monitoring (ODU). This is a Summary LED that indicates if a TCM error or alarm has been detected on any TCM channel.

	 If this LED is red, click the LED text (TCM Summary) to display a detailed LED window with all of the ODU TCM errors and alarms for TCM:1 to TCM:6.  See OTN TCM Summary LEDs for specific TCM error and alarm types.
C8 SYNC	C8 Synchronization (OPU). This is an alarm LED.  This LED is displayed when OTU-2's Mapping is set to ODTU-02.
C8 CRC8	C8 Cyclic Redundancy Check-8 (OPU). This is an error LED.  This LED is displayed when OTU-2's Mapping is set to ODTU-02.
OPU Justify	OPU Justify (OPU). This is a status LED that indicates an OPU Justification Frequency Offset is being received.  This LED is displayed when OTU-1's Mapping is set to ODTU-01.
ODU-0/1 Selected	ODU-0/1 Selected. This button toggles the Add/Drop ODU LEDs and Settings between ODU-1 and ODU-0.  This button is only available when OTU-2's Mapping is set to ODTU-012, which configures both ODU1 and ODU-0 to be enabled at the same time
<u>Add/Drop OTU</u>	Add/Drop Optical channel Transport Unit. Indicates if the Add/Drop mapping is detecting any OTU Section Monitoring alarms such as LOF, OOF, LOM, or OOM. This is a Summary LED.  If this LED is red, click the LED text (Add/Drop OTU) to display a detailed LED window with all of the Add/Drop OTU alarms.

	 This LED is displayed when there is an ODTU Add/Drop mapping.
Add/Drop ODU	Add/Drop Optical channel Data Unit. Indicates current error, alarm, and event activity for the Add/Drop ODU Path Monitoring. This is a status LED.  LEDs in this section are only displayed when there is an ODTU Add/Drop mapping.
BIP8	Bit Interleaved Parity 8 (A/D ODU). This is an error LED.
BEI	Backward Error Indication (A/D ODU). This is an error LED.
AIS	Alarm Indication Signal (A/D ODU). This is an alarm LED.
LCK	ODU Lock Indication (A/D ODU). This is an alarm LED.
OCI	Open Connection Indication (A/D ODU). This is an alarm LED.
BDI	Backward Defect Indication (A/D ODU). This is an alarm LED.
<u>TCM Summary</u>	Tandem Connection Monitoring (A/D ODU). This is a Summary LED that indicates if a TCM error or alarm has been detected on any Add/Drop ODU TCM channel. See OTN TCM Summary LEDs for specific TCM error and alarm types.  If this LED is red, click the LED text (<u>TCM Summary</u>) to display a detailed LED window with all of the A/D ODU TCM errors and alarms for TCM:1 to TCM:6.
PAT SYNC	Loss of Pattern Synchronization. Displays the status of loss of Pattern Synchronization on any active details channel.

	 This LED is <u>not</u> displayed if the Mapping is set to SONET or SDH or GFP, or if the Receive Payload Pattern is set to Live .
BIT ERR	Payload Bit error. This is an error LED, that indicates a Bit error in the received foreground payload pattern was detected..  This LED is <u>not</u> displayed if the Mapping is set to SONET or SDH or GFP, or if the Receive Payload Pattern is set to Live .
C8 SYNC	C8 Synchronization (A/D OPU). This is an alarm LED.
C8 CRC8	C8 Cyclic Redundancy Check-8 (A/D OPU). This is an error LED.

Specific Tasks

OTN Specific Tasks

This section includes tasks that are specific to the OTN protocol processor (G.709 compliant).

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

This section of the online help system discusses the following topics:

- [Configuring the OTN Interface Rate](#)
- [ODTU-jk Add/Drop Mappings](#)
- [GFP Mappings for OTN](#)
- [10G Ethernet LAN over OTU-2 \(11.049G and 11.095G\)](#)
- [10GigE LAN \(non-FEC\) Testing](#)
- [OTN TX Wavelengths and RX OPM](#)
- [Enabling/Disabling OTN FEC Mode](#)

- [Enabling/Disabling OTN Scramble Mode](#)
- [Monitoring OTN SAPI and DAPI Traces](#)
- [Testing OTN Jitter Interfaces](#)

Configuring the OTN Interface Rate

The OTN protocol processor supports testing and verification of OTN rates OTU-1 (2.666 Gbps) and OTU-2 (10.709 Gbps) per ITU-T standard G.709, as well as various Ethernet and Fibre Channel clients within an OTU-2.

To configure the OTN mode:

1. Select the **OTN** protocol processor tab.
2. Select the **Transmit** button.
3. Select the **Set** tab along the left side of the screen and choose **SET 1**.
4. Select the **Interface** button. The Select Interface window appears.
5. Select one of the following licensable test options:
 - **OTU-1 (2.666 GHz)** - Provides OTU-1 testing
 - **OTU-2 (10.709 GHz)** - Provides OTU-2 testing
 - **802.3 LAN (10.3125G)** - Provides 10 Gigabit Ethernet LAN testing
 - **OTU1e (11.049G)** - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2
 - **OTU2e (11.095G)** - Provides 11.095 Gigabit Ethernet LAN testing over OTU-2
 - **Fibre Chan (8.50G)** - Provides 8.50 Gigabit Fibre Channel testing
 - **Fibre Chan (10.52G)** - Provides 10.52 Gigabit Fibre Channel testing
 - **OTU1f (11.270G)** - Provides 11.270 Gigabit Fibre Channel testing over OTU-2
 - **OTU2f (11.317G)** - Provides 11.317 Gigabit Fibre Channel testing over OTU-2



The wavelengths of these interfaces are determined by the specifications of the SFP or XFP module being used.

 OTU-1 and OTU-2 interfaces can be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as [GFP mappings](#).

 OTU-1 and OTU-2 can also be configured for several [ODTU-jk Add/Drop Mappings](#), where jk may be 01, 02, 12, or 012, which allows an ODU-1 and/or an ODU-0 to be multiplexed up to and demultiplexed out of an OTU-1 or OTU-2 interface.

 The 10G/11G LAN interface rates allow for [Ethernet testing](#), without the need for a separate circuit pack.

 The 8G/10G/11G Fibre Channel interface rates allow for Fibre Channel testing, without the need for a separate circuit pack.

ODTU-jk Add/Drop Mappings

For OTN, the Optical channel Data Tributary Unit j into k (ODUj into OTUk) Add/Drop Mapping allows multiple lower ODU/OPU mappings to be multiplexed up to, and demultiplexed out of a higher OTU Interface rate.

For OTU-3, the following ODTU-jk mapping is supported:

- **ODTU-03** - Allows OTU-3 to be filled with 32 ODU-0's

For OTU-2, the following ODTU-jk mappings are supported:

- **ODTU-02** - Allows OTU-2 to be filled with 8 ODU-0's
- **ODTU-12** - Allows OTU-2 to be filled with 4 ODU-1's
- **ODTU-012** - Allows OTU-2 to be filled with 4 ODU-1's, and the foreground ODU-1 is filled with 2 ODU-0's

For OTU-1, the following ODTU-jk mapping is supported:

- **ODTU-01** - Allows OTU-1 to be filled with 2 ODU-0's

 These are licensable options. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

For **ODTU-12**, the [ODU-1 Mapping](#) can then be configured for Unframed BERT, PRBS Patterns, NULL Client, Synchronous and Asynchronous SDH/SONET mappings, as well as [GFP mappings](#).

- Select [ODU-1 Added](#) from Transmit > SET 1 screen, to configure which one of the ODU-1 payloads will be configured for the specified ODU-1 mapping.
- Select [ODU-1 Dropped](#) from Receive > SET 1 screen, to configure which one of the ODU-1 payloads to test. The information contained in the other ODU-1 payloads will be discarded.

For **ODTU-02**, **ODTU-012** and **ODTU-01**, the [ODU-0 Mapping](#) can then be configured for PRBS Patterns, NULL Client, Transcoded 1000Base-X, STM-4/STS-12 and STM-1/STS-3 mapping options

- Select [ODU-0 Added](#) from Transmit > SET 1 screen, to configure which one of the ODU-0 payloads will be configured for the specified ODU-0 mapping.
- Select [ODU-0 Dropped](#) from Receive > SET 1 screen, to configure which one of the ODU-0 payloads to test. The information contained in the other ODU-0 payloads will be discarded.

For **ODTU-03** the [ODU-0 Mapping](#) can then be configured for PRBS Patterns and NULL Client mapping options

- Select [ODU-0 Added](#) from Transmit > SET 1 screen, to configure which one of the ODU-0 payloads will be configured for the specified ODU-0 mapping.
- Select [ODU-0 Dropped](#) from Receive > SET 1 screen, to configure which one of the ODU-0 payloads to test. The information contained in the other ODU-0 payloads will be discarded.

GFP Mappings for OTN

The OTN Protocol Processor can be configured for GFP mappings (Complying with ITU-T G.7041)

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

Both OTU-1 and OTU-2 interface rates can be mapped for GFP.

- For **OTU-1**, select **G.709 2.5G (2.666GHz)** from the **Interface** menu, then select **GFP** from the **Mapping** menu. For GFP-Bulk mode, the max data-rate at 100% BW is **2.488320 GHz**.

- For **OTU-2**, select **G.709 10G (10.709GHz)** from the **Interface** menu, then select **GFP** from the **Mapping** menu. For GFP-Bulk mode, the max data-rate at 100% BW is **9.995277 GHz**.
- For **ODU-1 multiplexed up to OTU-2**, select **G.709 10G (10.709GHz)** from the **Interface** menu, then select **ODTU-12** from the **Mapping** menu, then select **GFP** from the **ODU-1 Mapping** menu. For GFP-Bulk mode, the max data-rate at 100% BW is **2.488320 GHz**.

Select the [Packet tab](#) to test the configured GFP mapping, which can be distributed on one, or to up to 32 independent GFP test streams.



For **GFP-Transparent** mode the maximum data rate is limited to **1 Gbps**

10GigE FEC (11.049G/11.095G) over OTU-2

The OTN Protocol Processor can be configured so that 802.3 10G Ethernet LAN streams can be transported over OTU-2 (G.709 compliant) infrastructures. Two different frequency rates are offered, **11.049G** and **11.095G**



This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

Use the Interface menu in the OTN tab to select either of the following rates.

- **OTU1e (11.049G)** - Provides 11.049 Gigabit Ethernet LAN testing over OTU-2
- **OTU2e (11.095G)** - Provides 11.095 Gigabit Ethernet LAN testing over OTU-2

The main difference between the two rates is that the 11.095 GHz signal fills the fixed-stuff (FS) bytes, as defined in the G.709 standard; where as the 11.049 GHz signal does not utilize the stuff bytes.

After establishing an OTU-2 interface rate mapped with 10G LAN, you will notice that all of the common OTN features remain enabled with the exception of Mapping and Payload Pattern.

Since the mapping defaults to 802.3 10GLAN SYNC, the Ethernet Payload and Streams are intended to be configured and tested from the [Packet tab](#).



The Interface menu also provides the ability to enable 10G LAN Ethernet testing, without FEC.

- **802.3 10G LAN (10.3125 GHz)** - Provides 10 Gigabit Ethernet LAN testing, without FEC

When this Interface rate is selected, the majority of the OTN and SONET/SDH settings are disabled with the exception of the Laser button, Clock Reference, and Line Frequency Offset.

After setting the 10G LAN interface rate, select the [Packet tab](#) to configure and test the Ethernet processor and Streams settings.

802.3 10G LAN Testing

The OTN tab (or SONET/SDH tab OTN tab is not available) can be configured for 10 Gigabit Ethernet LAN Interface testing.

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

If the OTN tab is available, then use the Interface menu on the OTN tab to configure the 10G LAN Interface, otherwise use the Interface menu in the SONET or SDH tab to select the following rate.

- **802.3 10G LAN (10312.5 MHz)** - Provides 10.3125 Gigabit Ethernet LAN, without FEC

After establishing the 10G LAN interface, you will notice that the mapping option is set to LAN, and most of the common OTN and/or SONET/SDH features become disabled.

If the OTN tab is available, then the Laser button, Clock Reference, Line Frequency Offset, and any other Interface specific settings can be modified from the OTN tab.

If the OTN tab is not available, then the Laser button, Clock Reference, Line Frequency Offset, and any other Interface specific settings can be modified from the SONET/SDH tab.



After setting the 10G LAN interface rate, select the [Packet tab](#) to configure and test the 10 Gigabit Ethernet processor and Streams settings.

OTN TX Wavelengths and RX Optical Power Measurements

The OTN protocol processor utilizes hot-swappable **SFP** (for OTU-1), **XFP** (for OTU-2) and **CFP** (for OTU-3 and OTU-4) laser technology, which are equipped with their own internal digital diagnostics tools. The internal diagnostics of these modules provide the transmit laser wavelength, and are capable of measuring the received optical power levels.

TX: Indicates current OTN transmit interface wavelength.

- Wavelengths are laser specific. To change the wavelength, simply hot-swap the laser module.



WARNING: Always turn the TX Laser off before hot-swapping SFP or XFP modules.

- When the laser module has been removed after an OTN interface was selected, "No Laser" will be displayed.
- When the laser module is hot-swapped, the laser's transmit wavelength will automatically update for the new laser module.



If a non-OTN interface is selected from one of the other tabs, then "Not Assigned" will be displayed.

RX: Displays the received optical power in dBm.

- This status indicator will flash when the received optical power level exceeds the SFP's/XFP's **Power Warm** or **Power Hot** thresholds. See Power Hot, Power Warm and Power Low Alarms for details.

This information is then fed to the user interface, and is displayed on the [LED Quick Status Area](#) just below the Laser button.

Enabling/Disabling OTN Scramble Mode

1. Select the **OTN** tab.
2. Select **Transmit** and **Set**.
3. Select the **SET 2** button from the Transmit/Set window.
4. Select **Scramble** and then **Enable** or **Disable**.



If the Transmit and Receive Settings Control is set to Couple, Scramble is automatically changed under the Receive settings. If Settings Control is set to **Independent**, then Scramble mode can be changed for the receive signal by selecting **Receive**, **SET 1**, and changing the **Scramble** setting.



Disabling both **Forward Error Correction** and **Scrambling** at the same time may cause a Loss of Frame condition due to a lack of sufficient zero to one transitions for valid data/clock recovery.

Enabling/Disabling OTN FEC Mode

1. Select the **OTN** tab.
2. Select **Transmit** and **Set**.
3. Select the **SET 2** button from the Transmit/Set window.
4. Select **Forward Error Correction** and then **Enable** or **Disable**.



If the Transmit and Receive Settings Control is set to Couple, FEC is automatically changed under the Receive settings. If Settings Control is set to **Independent**, then FEC mode can be changed for the receive signal by selecting **Receive**, **SET 1**, and changing the **Forward Error Correction** setting.



Disabling both **Forward Error Correction** and **Scrambling** at the same time may cause a Loss of Frame condition due to a lack of sufficient zero to one transitions for valid data/clock recovery.

Monitoring OTN SAPI and DAPI Traces

1. Select the **Receive** button from the **OTN** tab.
2. Select the **OTN OH** tab along the left side of the screen.
3. Select one of the following OTN sections:

OTU, ODU-A, or TCM,
4. The incoming SAPI, DAPI, and Operator Specific traces are decoded from the OTN Overhead, and appear in ASCII format at the bottom of the screen.
5. Expected SAPI or DAPI trace values can also be defined, and the NIC can be setup to display **Trace Identifier Mismatch** (TIM) alarms if the incoming SAPI or DAPI traces do not match what is expected.
6. OTU, ODU, and TCM TIM alarms can be individually enabled from the [SET 2](#) window.



SAPI and DAPI TIM alarms occur when the incoming trace does not match the expected trace, and the TIM Alarm Reporting has been enabled for that trace. There are no LEDS associated with TIM alarms; however TIM alarm durations appear on the Results Scan and Alarm screens .

Testing OTN Jitter Interfaces

NIC units that contain both a jitter testing module and a OTN circuit pack licensed for OTN jitter Interfaces can be set up to the OTN jitter interfaces from either the Jitter tab or the OTN tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the OTN TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

- Notice that OTU-2 Jitter has it's own Jitter TX and RX laser connectors
- OTU-1 Jitter also has its own Jitter TX and RX laser connectors



When testing OTN Jitter, the OTN lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remains ON and active when the optical OTN interface is then changed to a non-jitter Interface rate from the OTN tab, allowing for both the Jitter lasers and OTN lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for an OTN Jitter Interface

1. Select the **OTN** tab.
2. Select **Transmit** and choose **Set 1**.
3. Select **Interface**. The Select Type of Interface dialog box appears
4. Select the desired **OTN Jitter Interface** for testing.
5. Configure all other necessary OTN parameter settings.

6. From the **Jitter** tab, select **Transmit**.
7. Turn the laser **On**.
8. Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

 Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for testing optical jitter.

Packet Tab

Packet Tab Overview

The Packet processor tab allows users to perform high speed packet-level testing by various datacom rates supported by the XFP module, as well as testing GFP packets for SONET/SDH and OTN interfaces.

From the Packet processor tab, users can perform BERT testing on up to 32 independently configured **packet streams** for traffic generation and analysis, including **RFC-2544 (throughput, frame loss, latency, and Back to Back Burst)** testing, **ITU-T Y.1564** Ethernet service testing, and **Service Disruption** testing, and **IP Address Pinging** for the following:

- **802.3 10G LAN, 10G WAN** over SONET/SDH, and **10G LAN over OTU-2 (OTU1e and OTU2e)** Ethernet Interfaces
- **8.5G and 10.52G** Fibre Channel, as well as **10G Fibre Channel over OTU-2 (OTU1f and OTU2f)** Fibre Channel Interfaces
- **GFP (Bulk, Framed and Transparent mode)** payloads for OTN and SONET/SDH mappings (including VCAT)

 The datacom rates and mappings supported on the Packet tab require separate licensable test options. Please contact [Tech Support](#), or your DLI sales representative, to enable any of the following test options on your NIC unit.

The following Packet tab related topics are discussed in this section of the online help system:

- **LAN/WAN** - Screens Functions and Descriptions
- **LAN/WAN** - Specific Tasks Overview
- **Fibre Channel** - Screen Functions and Descriptions
- **Fibre Channel** - Specific Tasks Overview
- **Generic Frame Protocol (GFP)** - Screen Functions and Descriptions
- **Generic Frame Protocol (GFP)** - Specific Tasks Overview

LAN/WAN - Screen and Function Description

Packet Tab - Screen Functions and Descriptions Overview

(Specifically for LAN/WAN Ethernet testing)

This section describes the various screens and functions that control the configurations and operations of the 802.3 10G LAN, 10G WAN over SONET/SDH, and 10G LAN over OTU-2 (OTU1e or OTU2e) Ethernet Interfaces:

The following screens and functions are discussed:

- Config
- [Perf Tests](#) (RFC-2544 and Y.1564)
- [Results](#)
- [Test](#)
- [LEDs](#)

Config

Config - Set screen

(Specifically for LAN/WAN Ethernet testing on the Packet tab)

The **Config > Set** (Settings Configuration) screen allows you to define the Packet tab's Ethernet parameters that will be used to generate a traffic flow into the network. Up to 32 different streams can be generated simultaneously.

 If the Packet tab is disabled, then use the Interface menu from the OTN tab (or SONET/SDH tab) to the left of the Packet tab to configure the processor for [10G LAN Testing](#), [10G WAN Testing](#), or [10G LAN over OTU-2 \(OTU1e or OTU2e\)](#) .

The following functions appear on the Settings Configuration screen:

Function	Description

Mode	Selects or displays which Mode to test. For 10G/11G LAN interface rates the options are 10 Gbps Optical LAN 10 Gbps Seed A/B  For 10G WAN mapping there are no Mode settings.								
Reflect	Allows the user to start IP Packet Reflection Mode. Valid options are: <table border="1"> <tr> <td>Digital Lightwave Packets Only</td><td> This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source. </td></tr> <tr> <td>All Non-Routing Packets</td><td> This will reflect back all data packets, not just from Digital Lightwave test units, but it will not reflect Routing packets such as ARP and negotiation. </td></tr> <tr> <td>Thru Mode</td><td> This will pass through every data packet that is received. </td></tr> <tr> <td>Off</td><td> Turns Reflection mode Off </td></tr> </table>	Digital Lightwave Packets Only	This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source.	All Non-Routing Packets	This will reflect back all data packets, not just from Digital Lightwave test units, but it will not reflect Routing packets such as ARP and negotiation.	Thru Mode	This will pass through every data packet that is received.	Off	Turns Reflection mode Off
Digital Lightwave Packets Only	This will only reflect back data packets that were generated from a Digital Lightwave test unit.  When these packets are reflected, the Source and Destination MAC addresses and IP Addresses are swapped, to allow the packets to be re-routed back to the originating source.								
All Non-Routing Packets	This will reflect back all data packets, not just from Digital Lightwave test units, but it will not reflect Routing packets such as ARP and negotiation.								
Thru Mode	This will pass through every data packet that is received.								
Off	Turns Reflection mode Off								
Dfct Idle	Enables or Disables Deficit Idle Count. In order to achieve the maximum 100% bandwidth, test tools and devices under test require Deficit Idle Count (DIC) to be enabled (default). By providing an option to disable DIC, this								

	allows for compatibility with both current and legacy 10 Gigabit Ethernet equipment which may not support this option.  Deficit Idle Count allows the 10GbE processor to violate the minimum Inter-Packet Gap (IPG) of 12 byte by adding or subtracting up to 3 bytes. This allows the IPG to range between 9 to 15 bytes as need to prevent dropped packets, and averages to around 12 bytes when possible.
Flow Control	Enables or Disables Flow Control.  Important: Flow Control must be enabled in order to count Pause Packets.
Pause	Allows the user to generate Pause frames for a specific Pause Quanta value. Valid values are: 1 to 65535  Important: Flow Control must be enabled in order to count Pause Packets.  Important: Pause is not available when IP Reflection is enabled.  For more information, see the Inserting a Pause (Flow Control) into a Stream specific task.
Preamble	Allows the user to modify the interface Port's Preamble and the Start Frame Delimiter (SFD)  The SFD is designed to break this pattern with a default value of #AB, and signals the start of the actual frame.  Important: The Restore Default button in the keypad will set the Port's Preamble and SFD back to a value of AA-AA-AA-AA-AA-AA-AB.

Port IP Source	Sets the interface Port's Source IP Address used for PING and ARP Requests and to negotiation connections network elements.  Important: If a packet Stream's ARP Request setting is enabled, then this setting will be used as the stream's Source IP Address.  Important: This setting also configures the IP Source address setting located on the Test > Ping screen.
Port MAC Source	Sets the interface Port's Source MAC Address used for PING and ARP Requests and to negotiation connections network elements.  Important: If a packet Stream's ARP Request setting is enabled, then this setting will be used as the stream's Source MAC Address.  Important: This setting also configures the MAC Source address setting located on the Test > Ping screen.
Subnet Address	Sets the interface Port's Source Subnet Mask address used for PING and ARP Requests and to negotiation connections network elements.
Default Gateway	Sets the interface Port's Source Default Gateway address used for PING and ARP Requests and to negotiation connections with network elements.
VLAN RX TPID	Filters the Stream Results RX packet count by the Streams VLAN TPID values. Each DLI test Stream can contain up to (4) stacked VLAN tags, (1) S-VLAN (service provider) tag and up to (3) C-VLAN (customer) tags, each with a unique TPID (Tag Protocol Identifier) value. The VLAN RX TPID section allows the processor to only count those packets whose VLAN TPID are specified by the TPID filter options. Four filters are available, "A" through "D". Filter "A" is mandatory and always enabled, "B" through "D" are optional.

	 Each filter has a menu that allows the user to select a predefined TPID value (0x8100, 0x88A8, 0x9100 and 0x9200), or enter a user defined value.
Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Packets - Displays the total number of packets sent and received since the test was started • Pkts/sec - Displays the current rate of packets sent and received in packets per second • Bytes - Displays the total number of bytes sent and received since the test was started • Mbit/sec - Displays the current rate of packets sent and received in Megabits per second • %BW - Displays the current percentage of bandwidth of packets sent and received
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • Off - The unit's laser will be off when the unit is turned on. • On - The unit's laser will be on when the unit is turned on. • Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Config - Strms Pg 1 and Strms Pg 2

(Specifically for LAN/WAN Ethernet testing)

The **Config > Strms Pg 1 and Strms Pg 2** (Streams Page 1 and Page 2) screens allow up total of 32 test streams to be simultaneously generated and tested, per port.

 The **Strms Pg 1** side tab is used to control Streams 1 through 16, and **Strms Pg 2** controls Streams 17 through 32.

On/Off Checkboxes (1-32)	Enables packet generation for the specified Stream Id.  When enabled (on) the selected stream will begin transmitting packet at the Rate specified in the Traffic Stream Profile dialog box. By default, each stream is configured for 1.00% BW.  If the total configured bandwidth for all streams enabled exceeds 100%, the processor will evenly scale back the actual rates generated to achieve a maximum bandwidth of exactly 100%.
All	Selecting All with Enable/Disable all 32 test streams simultaneously.  If one or more streams are currently enabled, then All disables all enabled streams. If no streams are currently enabled, then All enables all test streams on both Pg1 and Pg2.  If the total configured bandwidth for all streams enabled exceeds 100%, the processor will evenly scale back the actual rates generated to achieve a maximum bandwidth of exactly 100%.

The parameters for each test stream are displayed in the Stream Profile Table as individual rows, with a horizontal scroll bar at the bottom that can be used to see all of the columns in the table.

Selecting a Stream (row) from the profile table opens the [Traffic Stream Profile](#) dialog box from which the stream parameters are configured.

These are the columns displayed in the **Stream Profile Table**, in order by the default arrangement:

Column	Description
TX Status	Indicates whether streams 1-32 are being transmitted (On) or not being transmitted (Off)
Traffic	Displays the configured transmit Rates (in %BW) for each stream.

MAC Dest	Destination MAC address
Length	Frame Length
IP Mode	IPv4 or IPv6  The CSA board currently only supports IPv4
Payload	Payload Pattern selected
VLAN Levels	The number of stacked VLAN tags enables (1 through 4, or N/A for none)
MPLS Levels	The number of stacked MPLS tags enables (1 through 4, or N/A for none)  The CSA board currently only supports VLAN tagging
IP Dest	Destination IP address
UDP Dest	UDP Destination Port
MAC Src	Source MAC address
IP Src	Source IP address
UDP Src	UDP Source Port
IP TOS	IPv4 - IP Type of Service
IP TTL	IPv4 - IP Time to Live
IP FRAG	IPv4 - Select whether to allow or disallow IP fragments
IP TC	IPv6 - Traffic Class (hexadecimal number)
IP HOP	IPv6 - Hop Limit
IP FLOW	IPv6 - Flow Label

Send Burst	The Send Burst button will generate a single burst of packets on the selected stream id, for the number of packets specified by the Burst Size setting, when the selected stream is turned off.

	 The default Burst size is 1 frame, however you can edit the stream's Burst Size setting from the stream's Profile window. Burst sizes can range from 1 to the maximum number of packets per second.

COL button	The COL button allows the user to rearrange the Stream Profile Table's columns display. To use the Rearrange Columns feature: 1. Select the Col button, to display the Rearrange Columns dialog box. 2. In the Rearrange Columns dialog box, select the Columns button to display the Select Next Column dialog box. 3. In the Select Next Column dialog box, select the button for the associated description to appear as the first column (from left to right) in table. The Select Next Column dialog box disappears and your selection appears in the top row of Column dialog box display window. 4. Again, in the Rearrange Columns dialog box, select the Columns button to re-display the Select Next Column dialog box. 5. In the Select Next Column dialog box, select another button for the associated description to appear as the next column (from left to right) in the table. The Select Next Column dialog box disappears again and this selection now appears above the previous selection in the Column dialog box display window. . 6. Repeat Steps 4 and 5 to select the chosen however many of the remaining entries in the Select Next Column dialog box you wish to re-order. 7. There are two choices for submitting the selected column display order: (1) Selecting the Apply button retains the column display order settings until the next time the unit's power is cycled; (2) Selecting the Save

	button retains the column display order settings indefinitely.  The Columns settings entered locally on the touch screen panel and those entered via a remote connection are completely independent of each other. The remote settings are saved on the remotely connected PC, while the local settings are saved in the unit. The Clear button can be used to clear the entries in the Rearrange Columns dialog box display window, should you want to rearrange the existing order in the display window. The Cancel button can be used to cancel out of the operation without changing the existing column display order. Clicking on the Apply button when no items are listed in the display window will set up the default columns display order.

Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Packets - Displays the total number of packets sent and received since the test was started • Pkts/sec - Displays the current rate of packets sent and received in packets per second • Bytes - Displays the total number of bytes sent and received since the test was started • Mbit/sec - Displays the current rate of packets sent and received in Megabits per second • %BW - Displays the current percentage of bandwidth of packets sent and received

Traffic Stream Profile Configuration

(Specifically for LAN/WAN Ethernet testing)

A packet stream's profile defines the type, size, content, destination address, and source addresses for the frame.

 The stream protocol supported is UDP/IP.

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select any of the streams in the Stream Profile Table.

Parameter	Description
Stream ID #	Displays the Stream ID # that the settings are being modified for.  The title bar of this Traffic Stream Profile window also shows which Stream ID # is currently selected.
Dest Port	Sets the Destination Port. The default is “same”. This setting is mainly useful for RFC2544 testing where the test involves sending packets and evaluating received packets for lost packages, latency and other factors. These test can be done using only one port or sending on one port and receiving on another.  This setting is only available on protocol processors that support more than on Port, such as Dual Enet and HDEnet.
Auto Setup Peer	Check “auto setup peer”, and when “Save All” is selected Stream on the Destination Port will automatically be configured to mirror the source port's IP and MAC addresses, swapping the Source and Destination values. This function will also configure the affected Stream with the same values for all of the other stream settings such as; Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc., when the “Save All” button is selected.  This setting is only available on protocol processors that support more than on Port, such as Dual Enet and HDEnet, and is only applicable if Destination Port is set to anything except “Same”.

ARP Request	Each stream can either have the ARP Request setting enabled or disabled. When ARP Request is enabled, the stream's IP Src and MAC Src settings become disabled, and the Port Source IP Address and MAC settings located on the Config > Set screen will be used by the stream.  The stream's Destination MAC Address also becomes disabled, and when the stream's transmission is turned On, an ARP request is performed on the Port. The connected device's source MAC address obtained from the ARP request's reply is then automatically configured as the stream's MAC Dest address setting.  The CSA board does not support this feature.
Multi Stream Config	Automatically increments the Source and Destination IP and MAC address values on up to all 32 Streams, and applies other global changes to each selected Stream, all in one step. See Ethernet Multi-Stream Configuration for details.
MAC Src address	Sets a Source MAC (origination) address for generated traffic. The address is a 12-digit (6-octets) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
MAC Dest address	Sets a Destination MAC address for generated traffic. The address is a 12-digit (6-octets) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on values entered, except that all a value must be entered into all fields.  For "Unicast Packets" the 1st octet for the Destination MAC addresses should be set to an even number such as "00".  For "Multicast Packets" the 1st octet for the Destination MAC addresses should be set to an odd number such as "01".

	 For " Broadcast Packets " all 6 octets of the Destination MAC addresses should be set to "FF".
IP Src address	Sets the IP address of the source (origination). For IPv4, the address is entered in decimal notation using a keypad. There are no restrictions on values entered but the format must be correct, i.e: (0-255.0-255.0-255.0-255). If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually. For IPv6, the address is entered in hexadecimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: (0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF). If four digits are entered in a field, a colon will be automatically added. If only less than four digits are entered, you must enter a colon manually.  The CSA board currently only supports IPv4
IP Dest address	Sets the IP address of the destination. For IPv4, the address is entered in decimal notation using a keypad. There are no restrictions on values entered but the format must be correct, i.e: (0-255.0-255.0-255.0-255). If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually. For IPv6, the address is entered in hexadecimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: (0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF:0-FFFF). If four digits are entered in a field, a colon

	will be automatically added. If only less than four digits are entered, you must enter a colon manually.  The CSA board currently only supports IPv4
IP Mode	Sets the IP version (IPv4 or IPv6) used for the Stream's configuration.
Ether Type	A two-octet field in an Ethernet frame, used to indicate which protocol is encapsulated in the payload. The following menu items are available: • Internet Protocol, Version 4 (IPv4) 0x0800 • Internet Protocol, Version 6 (IPv6) 0x086DD • MPLS 0x8847 • User defined (0x0 to FFFF)
UDP Src port	Selects a User Data Protocol source port number (0 to 65535).
UDP Dest port	Selects a User Data Protocol destination port number (0 to 65535)  Port 0 is an officially reserved port in TCP/IP networking, and should not be used.
Frame Size	Sets the frame length in bytes. The frame size is entered as a decimal value, entered using a keypad, ranging from 64 to 16000. The default value is 128 bytes.  Note that when in 1Gbps Half-Duplex (HDX) mode, the default frame size is 512 bytes.

Payload	Allows the user to select a test pattern to be transmitted in the stream's payload. Select one of the following: PRBS 9, PRBS 9 Inverted, PRBS 11, PRBS 11 Inverted, PRBS 15, PRBS 15 Inverted, PRBS 20, PRBS 20 Inverted, PRBS 23, PRBS 23 Inverted, PRBS 31, PRBS 31 Inverted or a User Defined pattern (32-bit value).
IP TOS (<i>IPv4</i>) / Traffic Class (<i>IPv6</i>)	Sets the Type Of Service/Traffic Class as defined in RFC 791. This can be entered as a 2-character HEX value, or the dialog box lets you configure the TOS based on the individual bit fields. • bits 0-2 sets the Precedence • bit 3 sets the Delay (0 = Normal, 1 = Low) • bit 4 sets the Throughput (0 = Normal, 1 = High) • bit 5 sets the Reliability (0 = Normal, 1 = High) • bit 6 sets the Cost (0 or 1) • bit 7 is reserved for future use (0 or 1)  RFC2474 redefined the TOS fields, where bits 0-5 set the Differentiated Services Code Point (DSCP).
IP TTLs (<i>IPv4</i>) / Hop Limits (<i>IPv6</i>)	Sets the IP Time To Live/Hop Limits. This is a decimal value from 0 to 255.  This is an IP header field designed to keep packets from running in loops, essentially forever, through a network (this can happen when there is a route change, and the routers involved don't all know the same information as new information is being replicated and updated).  The default value is 255, and is reduced by 1 every time it passes through a server (hop). If the this value should ever reach 0, the packet has expired. The router that it is passing through will then send it back to the source.
IP Fragment Flag (<i>IPv4</i>)	Select to either Allow (0) or Disallow (1) IP fragments.

Flow Label (<i>IPv6</i>)	Sets IPv6's IP Flow Label. This is a decimal value from 0 to 1048575.
Rate	Sets the traffic generation rate for the selected Stream. Rates can be configured as: • Constant %Bandwidth (0.01 to 100%) • Constant Mbit/sec (0.1 to max Mb/s, for the selected Interface) • Constant IPG-Bytes • Constant IPG-MS • Ramp %Bandwidth • Ramp Mbit/sec  See How to use the Ramp Mode for Ethernet Traffic Generation for information on Ramp mode testing.
Burst Size	Configures the number of packets to be inserted in each Burst. This setting applies to both the traffic generation rates, and the Send Burst button. The Send Burst button will generate a single burst of packets, for the specified amount of packets.  The default Burst size is 1 frame, and should be set to 1 frame when not intentionally generating bursty traffic, to allow the inner-packet gaps (IPG's) to be evenly distributed. Any value greater than 1 will result in the packets being generated as bursts of packet, with minimal IPG's between the packets within the burst, and longer than normal IPG's between the bursts.  See How to use the Burst Mode for Ethernet Traffic Generation for information on Burst mode testing.

Ramp Mode Settings	The following settings become enabled when a Ramp rate is selected: • Ramp Step: This is the size of the % Bandwidth or Mbps rate that each step (up and down) should change by. • Ramp Floor: This is the minimum % Bandwidth or Mbps rate that the stream will step down to. • Ramp Duration: This is the number of Seconds (1 to 999) that each step (up and down) will transmit for.  See How to use the Ramp Mode for Ethernet Traffic Generation for information on Ramp mode testing.
Select MPLS/VLAN Tagging	Enables either VLAN, MPLS, or No Tagging.  When testing VLAN or MPLS, up to 4 stacked tags can be enabled by selecting the checkbox for the next tag. Each tag adds 4 bytes to the Packet's header fields.  MPLS is a licensable feature and is only available if the enabled in the license key. The VLAN tagging option however is included on all NIC units that support packet streams.  The CSA board currently only supports VLAN, and does not support MPLS.
VLAN TPID	Configures the VLAN Tag Protocol Identifier. The default value is 0x8100, but the menu lets you select 0x88A8, 0x9100, 0x9200 or enter a 2-byte User Defined HEX value.  VLAN Tagging must be enabled to use this parameter
VLAN PCP/QOS	Configures the VLAN Priority Code Point/Quality Of Service. This is the frame's priority level and is a 3-bit field ranging from the default value of 0 (best effort) to 7 (highest priority).  VLAN Tagging must be enabled to use this parameter.

VLAN CFI	Configures the VLAN Canonical Format Indicator. This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.  VLAN Tagging must be enabled to use this parameter.
VLAN DEI	Configures the VLAN Drop Eligible Indicator. This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.  VLAN Tagging must be enabled to use this parameter.
VLAN VID	Assigns a VLAN ID to the VLAN tag. This identifies to which VLAN the frame belongs. IDs are entered as a decimal identifier ranging from 0 to 4095.  VLAN Tagging must be enabled to use this parameter.
Prev	Moves to the stream with the next lower number.  If currently looking at stream #1, selecting "Prev" will bring up stream #32. Note that changes made will not be saved until "Save All" is selected.
Next	Moves to the stream with the next higher number.  If currently looking at stream #32, selecting "Next" will bring up stream #1. Note that changes made will not be saved until "Save All" is selected.
Save All	Saves all changes made and closes the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Errors and Alarms

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.



Note that error insertion is disabled when in IP Reflection Mode.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the “Send Error” button is pressed or when a rate is selected. The following types are available: • Code - Generates line code errors • FCS - Generates an invalid Frame Check Sequence • IP Checksum - Generates an invalid IP header checksum • Runt - Generates an undersized frame (user definable between 12 and 64 bytes), with a bad CRC • Bit Error (Stream #n) - Generates bit errors in the payload for the specified stream number. • Sequence Error (Stream #n) - Generates Sequence errors in the payload for the specified stream number.  The CSA Packet tab currently does not support Line Code or Runt errors.
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following:

	• 1E-<x> - X is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1×10^{-x} (The smaller the exponential the higher the error rate.) • User Defined – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1×10^{-x} but more exact choices are available such as 2.6×10^{-4} or 7.1×10^{-3}
Runt Size	Specify the frame size of the Runt errors to be inserted, between 12 to 63 bytes.  This setting is only available when the Runt error type is selected.
Reply to Local Fault	When enabled, the test interface will respond to Local Fault alarms by generating Remote Faults  This setting is only available for 103 Gbps LAN, 41 Gbps LAN and 10 Gbps Optical LAN/WAN.

Perf Test

Perf Test - Conf (Test Button)

The Performance Test screen allows you test either RFC-2544 or ITU-T Y.1564.

The **Test** button located on the Conf side tab will toggle between the two testing modes.

- Use this section to test [RFC-2544](#)
- Use this section to test [Y.1564 \(Ethernet service tests\)](#)

RFC 2544

RFC 2544 Tests - Screen Functions and Descriptions Overview

The RFC 2544 Tests screen contains the following functions:

- [Conf](#)
- [Thru Put](#)

- [Frame Loss](#)
- [B2B Burst](#)
- Graph



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description
Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544, it will not appear in the Select Port window.

Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-86400 seconds. The default value is 60 seconds.
Stream ID	Allows the user to select one of the four streams for the RFC test.
Dest MAC Address	Reflects the destination MAC address for the selected Stream.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.  For Fibre Channel rates, this is the WWN Dest Address.
Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.
Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 16000.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

Automated Test Sequence	The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes. • Thruput/Latency checkbox and status field • Frame Loss checkbox and status field • B2B Burst checkbox and status field • Start/Stop Button • Test Status field

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.

Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.

Statistics Table	Reports the test results. The following statistics are displayed: Size - Indicates the transmitted test packet size. Rate - Reports the passing rate (percentage) for the specific packet size. TX Packets - Reports the number of packets transmitted in the stream for the frame. RX Packets - Reports the number of packets received by the test set. Latency Min/Max/Avg - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds.  If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.
Start/Stop Test	Starts and stops the Through Put test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select [Frame Loss Testing](#) for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.

Packet Size buttons	Determines which packet size results appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: Rate % - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. Transmit Frames - Reports the total number of frames transmitted. Receive Frames - Reports the total number of frames received. Loss % - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Back-To-Back Burst Test (B2B Burst)

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.  Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.

Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50, however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: • Max Possible Number of Frames - The frame rate (resolution) used as the throughput rate. • Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 Important: The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

Y.1564 Test

Y.1564 Test - Screen Functions and Descriptions Overview

The [Y.1564](#) Tests screen contains the following functions:

- [Conf](#)
- [Test](#)
- [Results](#)



The following link demonstrates how to configure and test Y.1564.

[Y.1564 Service Configuration and Testing](#)

Y.1564 Test - Configuration (Conf)

Y.1564 is an out of-service test methodology created so that service providers may have a standard way of measuring the performance of Ethernet-based services. The Conf screen provides the preliminary Service configuration settings. After these settings are made the user selects the type of Y.1564 test to initiate by selecting the check boxes under Automated Test Sequence and pressing Start.

The following options appear on the Conf screen:

Option	Description
Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544 test, it will not appear in the Select Port window.
Trial Duration	Determines how long the Configuration Ramp test runs for each selected Ramp/Burst Step.

	① “Trial Duration” refers to Configuration test duration, and “Perf Dur” refers to Performance test duration ① The default value of 60 seconds, is the maximum duration specified in the Y.1564 test standard. "The duration for each step size SHOULD be configurable from at least 1 second up to 60 seconds".		
Restore to Default	Returns the Ramp/Burst Step settings to their default %CIR rates when user-defined rates have been set, and unselects all selected checkboxes, and resets the Trial and Performance Durations back to their default values. Any user-define Service Names which were edited from the Test side tab are also restored back to their default names.		
Perf Dur	Determines how long the Performance test runs for each selected Service. ① “Perf Dur” refers to Performance test duration, and “Trial Duration” refers to Configuration test duration ① The Y.1564 test standard calls for test durations of 15 minute, 2 hour, and 24 hour intervals. "For example, an operator MAY test services for 15 minutes if the services are provided over a network already carrying working traffic in a metro application. 2 hour Performance test durations MAY be used for services running over a single operator long-haul network. Finally, a 24 hour Performance test durations MAY be used for services which are being carried internationally over multiple operator networks".		
Service On/Off	Allows the user to select one of the ten Services that will be used for the Y.1564 test. ① Each of the Service's Configuration Test settings can be edited in the Test side tab. ① Each Service selected to be tested should be configured for an increasing number of Frame Lengths, as shown in Table 1. <table border="1"> <thead> <tr> <th>Service #</th><th>Frame Size (bytes)</th></tr> </thead> </table>	Service #	Frame Size (bytes)
Service #	Frame Size (bytes)		

Service 01	64
Service 02	128
Service 03	256
Service 04	512
Service 05	1024
Service 06	1280
Service 07	1518
Service 08	MTU
Service 09	<i>User Defined</i>
Service 10	<i>User Defined</i>

Table 1 – Recommended Frame Sizes/Lengths for each Service Number

Ramp/Burst Steps

The Ramp/Burst Steps section is used to do the following:

- Selects which Steps to test during the Ramp and Burst Configuration tests.
- Allows the user to configure Steps 1 through 5 with a user-defined value for each of the %CIR Steps selected to be tested.
- When selected, Step 6 tests 100% of the CIR% setting, as configured on the Test side tab.
- When selected, Step 7 exceeds the CIR, by adding Excess Information Rate (EIR), as configured on the Test side tab.

 Each Step tests a gradually increasing percentage of the maximum Committed Information Rate (CIR%) bandwidth, as configured on the Test side tab screen for the selected Service.

 The Config Ramp test was designed to gradually reach and then exceed the maximum CIR% by testing all 7 Steps (at their default CIR% values), for each selected Service.

💡 For example, with the [CIR](#) and the Step sizes configured for default values, the CIR is configured for 5% bandwidth, Step 1 is configured for 10% of the CIR, and Step 2 is configured 30% of the CIR, etc. Thus, Step 1 will test at 0.50% bandwidth, which is 10% of 5%. Likewise, Step 2 will test at 1.50% bandwidth, which is 30% of 5%, and so on. Step 6 (CIR) will test at the full 5% bandwidth. And Step 7 (CIR+EIR) will test at whatever the CIR+EIR bandwidth is configured for on the Test side tab, where the [EIR](#) is difference between CIR and the CIR+EIR value.

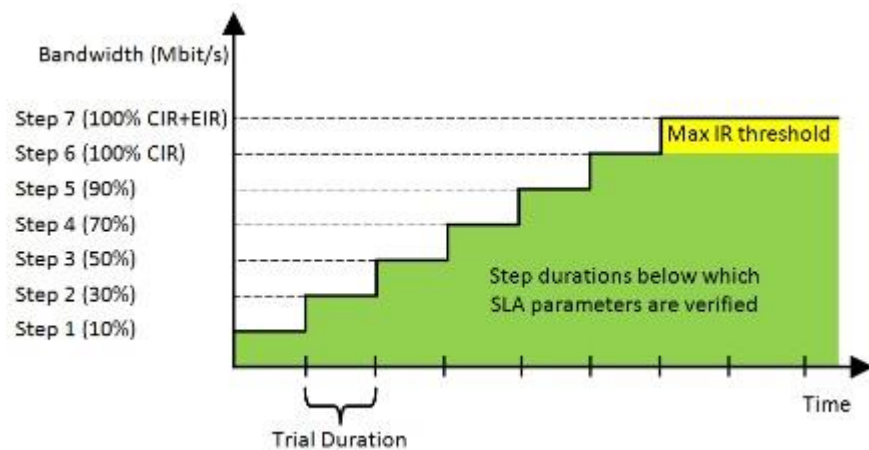


Figure 1 – Step load (Ramp) test used in the service configuration test

💡 Per the Y.1564 test standard, as the performance limits are only used for service acceptance when Ethernet traffic is below or equal to the CIR (green traffic in Figure 1), the performance parameters will not be judged against the limits above the CIR. The next step of the service configuration test is to validate the total information rate of the service (CIR+EIR).

Automated Test Sequence

The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes.

- Config Ramp checkbox and status field
- Config Burst checkbox and status field (***This test is currently unavailable***)
- Perf checkbox and status field

	• Start/Stop Button • Test Status field  Select one or more of the test options under the Automated Test Sequence section. At least one test must be selected.  The Config Ramp checkbox selects the Y.1564 Configuration test  The Perf checkbox selects the Y.1564 Performance test  Select the Start button to begin the selected tests. The selected tests will now start and their real-time status will be displayed in the Test Status field next to the Start/Stop button.

Results

Results Screens and Functions

(Specifically for LAN/WAN Ethernet testing)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Packet and VLAN count statistics.
- [Strm Rslt](#) - Displays Stream ID specific statistics.
- [Event](#) - Displays a summary of error alarm activity.
- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

Results - Scan Screen

(Specifically for LAN/WAN Ethernet testing)

This function displays a list of received errors and alarms.

For [Alarms](#), the duration is reported as a count in seconds.

For [Errors](#), an error count is reported.

The message **No Errors or Alarms** appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors) Screen**(Specifically for LAN/WAN Ethernet testing)**

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

Error Type	Description

Code	A Code error or Symbol error is detected in the line encoding
Undersized	A frame whose length is < 64 bytes, with good FCS/CRC checksum
Invalid FCS	An error in the Frame Check Sequence (CRC checksum), and whose Frame length is $\geq$ 64 bytes
Invalid IP	An error in the frame's IP Checksum
Invalid UDP	An error in the frame's UDP Checksum
Runts	A frame whose length is < 64 byte with an FCS error

Results - Alarm Screen

(Specifically for LAN/WAN Ethernet testing)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

Error Type	Description
CP Power Loss	The Circuit Pack module experience a power loss fault during test
Paused	The test was manually paused by selecting the Pause button or by a SCPI script command
Power Hot	The received optical power level exceeded the laser's maximum input limit
Power Warm	The received optical power level is within 3 dBm of laser's maximum input limit
LOS	A Loss Of Signal alarm has occurred
Link Down	A Loss of Link State alarm occurred
Local Fault	A Local Fault alarm has occurred
Remote Fault	A Remote Fault alarm has occurred
Jabber Condition	A Jabber alarm has occurred, which could be caused by a device that is handling the electrical signals improperly. 💡 10/100/1000BaseT ports only

Results - Strm Rslt (Stream Results) Screen

(Specifically for LAN/WAN Ethernet testing)

The Stream Results screen displays statistics for a specified incoming packet stream. The screen allows you to scroll through the different packet streams and view their individual results.

The following statistics appear:

Statistic	Description
Selected Stream Entry	Displays the selected Stream ID number and the stream's MAC Source and MAC Destination addresses, to which the displayed statistics data belongs.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW, for the selected Stream ID. Transmit Statistics (per stream): • TX PORT # - Show the selected transmit Port #, for Protocol Processors that support more that 1 interface port. • Packets - Total number of Packets transmitted. • Bytes - Total number of Bytes transmitted. • BW - Percent of bandwidth currently being transmitted. Receive Statistics (per stream): • RX PORT # - Show the receive statistics for the stream's configured Destination Port #, for Protocol Processors that support more that 1 interface port. • Packets - Total number of Packets received. • Bytes - Total number of Bytes received. • BW - Percent of bandwidth currently being received. • Loss - Current Packet Loss rate.  For loop backs with large latency, the Loss rate may show greater than 0 while the test stream generation is active, even if no packets are actually being lost (dropped). This is due to the real-time RX packet count being lower than the TX packet count, because of the latency. If no packets were lost during the test, then this

	value will drop to 0 when the test stream generation is turned off.
Pass/Fail Test	Provides User-Defined Acceptance Criteria:  Refer to Timed Test Using Acceptance Criteria • Accept Seq Errors - A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test. • Accept Bit Errors - A user-specified threshold value for determining the acceptable bit error rate for a timed test. • Accept Loss Rate - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. • Pass/Fail - Test results are displayed as "Running" when the test is active (Elapsed Time is incrementing); and displayed as "PASS" or "FAIL" when the test ends, depending on whether or not specified failure criteria was attained.
Errors	Displays Error statistic as Counts, Errored Seconds, Average error rate and Current error rate, for the following Error Types: • Sequence Errors - Each sent packet is marked with a sequence number. This count is incremented when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet. This can be the result of packets being received out of sequence, or due to packets being dropped. • Bit Errors Received
Latency	Displays Minimum , Average , and Maximum latency (delay) measurements, in microseconds (μs) .

	A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated (real-time) as new latency measurements are logged.  If the TX and RX are looped on itself with a short patch cable, the latency may appear as 0 μs.
Alarms	Displays Alarm statistics as total number of Seconds the alarm was active during the test, for the following Alarm type: • Pattern Sync
First, Prev, Next, Last	Allows the user to scroll through all of the packet streams and view their individual results. Selecting First immediately moves the stream statistics to Stream 1; selecting Last immediately moves the last stream's statistics; selecting Prev or Next moves the stream statistics to/from one stream immediately before or after the currently selected stream.

Results - Event Screen

(Specifically for LAN/WAN Ethernet testing)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Count Screen

(Specifically for LAN/WAN Ethernet testing)

The Count screen displays [Utilization](#), [Packets](#), [VLAN](#), [MPLS](#) and [Packet Size](#) statistics by type and count.

To view total transmit and receive utilization statistics, select the **Utilization** button. The following statistics appear:

Desc column	Current / Min / Max / Avg columns
Total - TX BW	Displays the Current, Min, Max and Avg. Total %BW Transmitted
Total - TX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate transmitted
Total - TX PPS	Displays the Current, Min, Max and Avg. Total Packet Per Second rate transmitted
Total - RX BW	Displays the Current, Min, Max and Avg. Total %BW received
Total - RX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate received
Total - RX PPS	Displays the Current, Min, Max and Avg. Total Packet Per Second rate received
TX IPv4 BW	Displays the Current, Min, Max and Avg. IPv4 %BW Transmitted
TX IPv4 Mbps	Displays the Current, Min, Max and Avg. IPv4 Mbps rate transmitted
TX IPv4 PPS	Displays the Current, Min, Max and Avg. IPv4 Packet Per Second rate transmitted
RX IPv4 BW	Displays the Current, Min, Max and Avg. IPv4 %BW received

RX IPv4 Mbps	Displays the Current, Min, Max and Avg. IPv4 Mbps rate received
RX IPv4 PPS	Displays the Current, Min, Max and Avg. IPv4 Packet Per Second rate received
TX IPv6 BW	Displays the Current, Min, Max and Avg. IPv6 %BW Transmitted
TX IPv6 Mbps	Displays the Current, Min, Max and Avg. IPv6 Mbps rate transmitted
TX IPv6 PPS	Displays the Current, Min, Max and Avg. IPv6 Packet Per Second rate transmitted
RX IPv6 BW	Displays the Current, Min, Max and Avg. IPv6 %BW received
RX IPv6 Mbps	Displays the Current, Min, Max and Avg. IPv6 Mbps rate received
RX IPv6 PPS	Displays the Current, Min, Max and Avg. IPv6 Packet Per Second rate received
TX VLAN BW	Displays the Current, Min, Max and Avg. VLAN %BW Transmitted
TX VLAN Mbps	Displays the Current, Min, Max and Avg. VLAN Mbps rate transmitted
TX VLAN PPS	Displays the Current, Min, Max and Avg. VLAN Packet Per Second rate transmitted
RX VLAN BW	Displays the Current, Min, Max and Avg. VLAN %BW received

RX VLAN Mbps	Displays the Current, Min, Max and Avg. VLAN Mbps rate received
RX VLAN PPS	Displays the Current, Min, Max and Avg. VLAN Packet Per Second rate received
TX MPLS BW	Displays the Current, Min, Max and Avg. MPLS %BW Transmitted
TX MPLS Mbps	Displays the Current, Min, Max and Avg. MPLS Mbps rate transmitted
TX MPLS PPS	Displays the Current, Min, Max and Avg. MPLS Packet Per Second rate transmitted
RX MPLS BW	Displays the Current, Min, Max and Avg. MPLS %BW received
RX MPLS Mbps	Displays the Current, Min, Max and Avg. MPLS Mbps rate received
RX MPLS PPS	Displays the Current, Min, Max and Avg. MPLS Packet Per Second rate received

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Packets	Reports the total number of packets sent.
Received Packets	Reports the total number of packets received.

Received Jumbo Packets	Reports the total number of jumbo packets received. Jumbo packets are those from 1519 – 9000 bytes in size.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
Pause Packets Received	Reports the total number of Pause frames received.  Important: Flow Control must be enabled in order to count Pause Packets.
Pause Quantas Taken	Reports the total number of quantas received. A quanta is a 512-bit timing increment used by a Pause frame. The number of quanta (N x 512-bits) indicate the duration of the pause.  Important: Flow Control must be enabled in order to count Pause Packets.
Pause End Packets	Reports the number of times that a Pause condition ended allowing data transmission to resume. The pause condition ends when the Pause frame's time parameter is set to 0.  Important: Flow Control must be enabled in order to count Pause Packets.
IP Packets	Internet Protocol. Reports the total number of IP packets received.
ICMP Packets	Internet Control Message Protocol. Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.

UDP Packets	User Data Protocol. Reports the total number of UDP packets received.
IGMP Packets	Internet Group Management Protocol. Reports the total number of IGMP packets received.
Broadcast Packets	Reports the total number of Broadcast packets received.
Multicast Packets	Reports the total number of Multicast packets received.
Unicast Packets	Reports the total number of Unicast packets received.

To view VLAN results, select the **VLAN** button. The following statistics appear:

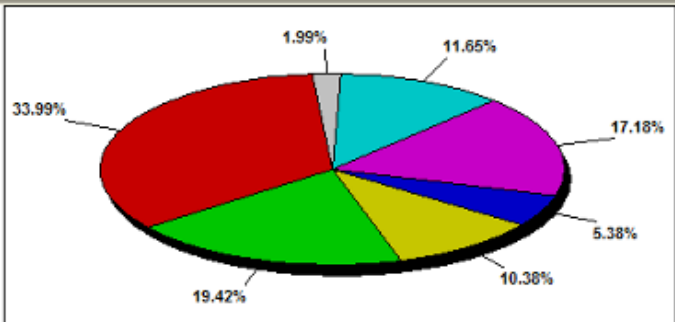
VLAN	Description
VLAN Tagged Frames (per level)	Reports the total number of frames received that are identified as VLAN frames, per tag level. For each tag level enabled (1-4), a 4-byte VLAN tag is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.
Quality of Service Entry	For each stacked VLAN tag level (1-4), separate data rows for QOS Entries 0-7 are displayed. These reports the number of frames received for each user priority level value. A total of 8 different counters appear for each Stacked VLAN level.

To view MPLS results, select the **MPLS** button. The following statistics appear:

MPLS	Description
MPLS Tagged Frames (per level)	Reports the total number of frames received that are identified as MPLS frames, per tag level. For each tag level enabled (1-4), a 4-byte MPLS label is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.

Traffic Class Entry	For each stacked MPLS label level (1-4), separate data rows for TC Entries 0-7 are displayed. These reports the number of frames received for each user priority level value. A total of 8 different counters appear for each Stacked MPLS level.

To view Packet Size results, select the **Packet Sizes** button. The following statistics appear:

Packet Sizes	Description																								
Packet Size Table	Reports the received packet count and percentage of total received packets for each packet byte size range found: 64; 65-127; 128-255; 256-511; 512-1023; 1024-1518; 1519-Max (Jumbo Packets).																								
Packet Size Graph	The measured percentage for each Packet Byte Size range is displayed in a pie chart, where each range has a uniquely colored slice, when that range percentage is greater than 0.00. UtilizationPacketsVLANMPLSPacket Sizes <table><thead><tr><th>Description</th><th>Count</th><th>Percent</th></tr></thead><tbody><tr><td>Packet Byte Size 64</td><td>148792575</td><td>33.99</td></tr><tr><td>Packet Byte Size 65 - 127</td><td>85026428</td><td>19.42</td></tr><tr><td>Packet Byte Size 128 - 255</td><td>45453117</td><td>10.38</td></tr><tr><td>Packet Byte Size 256 - 511</td><td>23539447</td><td>5.38</td></tr><tr><td>Packet Byte Size 512 - 1023</td><td>75204555</td><td>17.18</td></tr><tr><td>Packet Byte Size 1024 - 1518</td><td>51006273</td><td>11.65</td></tr><tr><td>Packet Byte Size 1519 - MAX</td><td>8695092</td><td>1.99</td></tr></tbody></table> 64 65-127 128-255 256-511 512-1023 1024-1518 1519-MAX 	Description	Count	Percent	Packet Byte Size 64	148792575	33.99	Packet Byte Size 65 - 127	85026428	19.42	Packet Byte Size 128 - 255	45453117	10.38	Packet Byte Size 256 - 511	23539447	5.38	Packet Byte Size 512 - 1023	75204555	17.18	Packet Byte Size 1024 - 1518	51006273	11.65	Packet Byte Size 1519 - MAX	8695092	1.99
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Packet Byte Size 1024 - 1518	51006273	11.65																							
Packet Byte Size 1519 - MAX	8695092	1.99																							

Results - Large LEDs Screen

(Specifically for LAN/WAN Ethernet testing)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs for LAN/WAN, see [LAN/WAN LEDs](#).

Test

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test - Service Disruption

(Specifically for LAN/WAN Ethernet testing)

The unit can measure Service Disruption switching intervals in your network. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

When enabled, the trigger event to begin service disruption measurements occurs when it stops detecting incoming packets.



The MSA module's Packet processor tab and Dual Enet processor tab also triggers on incoming packets with CRC/FCS errors.

The duration for every Ethernet service disruption event is measured in milliseconds, with granular accuracy of .1 ms (100 μ s).

When the Action state is configured for Continuous APS, the 10 most recent measurements are displayed in the History window. Also the Minimum and Maximum measurement times are logged, as well as an Average duration based on all measurements taken since the test began.

Test Service Disruption functions include:

- **Resolution:** When testing Service Disruption measurements on lower rate Ethernet bandwidths (≤ 1 Gbps), this setting is used to ensure that at least one Ethernet packet is received within the configured period of time (measurement window). The following options are available:

- ▶ High (.1 ms)

- ▶ Medium (1 ms)

- ▶ Low (10 ms)



When receiving fewer packets per second (lower bandwidths), a lower resolution setting (larger window of time) is required.



Important: This setting is only displayed on ports that support Ethernet rates ≤ 1 Gbps.

- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before

Protection Switch measurements stop accumulating. The range is 10 to 1638.3 milliseconds and is entered using a keypad.

- **Consecutive Bad Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate. The range is 0.1 to 1638.3 milliseconds and is entered using a keypad.
- **Action (State):** Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS:** Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS:** Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.
- **Protection Switch Time (MilliSecs):** Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **History Recent Milliseconds:** The 10 most recent measurements are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For more information about monitoring service disruption activity, select [Measuring Service Disruption Activity](#) in the Specific Tasks section of the online help.

LED Quick Status Area

(Specifically for LAN/WAN Ethernet testing)

When the Packet or CSA-Packet protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the **Large LED Results** screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.
- If an LED is White or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED is White or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.

Indicator, LED or Control	Description
Laser On/Laser Off (button)	Pressing the button will toggle the status of the laser. If no SFP, XFP or CFP module is installed, the button will state "No Laser".
TX:	Indicates current transmit laser wavelength.  This not displayed on CSA modules.
RX:	Displays the received optical power in dBm.  If an SFP, XFP or CFP module has been removed, this will display "Missing SFP", "Missing XFP" or "Missing CFP".  The following rules apply exclusively for CSA modules: ▶ This status indicator will flash when one or more received Optical Lanes' power level exceeds the CFP's Power Warm or Power Hot thresholds.

	►This is an aggregate broadband power value, based on the combined power levels from all of the CFP's received Optical Lanes. ►See the CSA-MLD Receive - SIG screen for individual Optical Lane power levels.
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
Test Paused	If red, indicates that the current test has been paused .
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
LOS	Loss of Signal alarm status LED. When red, indicates that a valid signal is not being received.  If an all zeros pattern exists for 100 milliseconds or longer on the incoming signal, then an LOS is reported.
Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code	Indicates a Code error or Symbol error is detected in the line encoding.
FCS ERR	Frame Check Sequence error status LED
RF	Remote Fault status LED
LF	Local Fault status LED
PAT SYNC	Pattern Synchronization alarm status LED  Indicates a loss of pattern synchronization in at least one of the 32 Streams.
BIT ERR	Bit error status LED  Indicates a detected BIT error in at least one of the 32 Streams.

SEQ ERR	Sequence error status LED  Indicates a sequence error detected in at least one of the 32 Streams.

LAN/WAN - Specific Tasks

Specific Tasks Overview

(Specifically for LAN/WAN Ethernet testing on the Packet tab)

This section includes tasks that are specific to the Packet tab for 802.3 10G LAN, 10G WAN over SONET/SDH, and 10G LAN over OTU-2 (OTU1e or OTU2e) Ethernet Interfaces

For a list of general tasks, see [Common Tasks](#) located in the Getting Started section.

For a description of specific screens and their functionality, refer to [Packet Tab - Screen Functions and Descriptions Overview](#).

The following Specific Tasks for this protocol processor are discussed:

- [Selecting a Dual Enet Port](#)
- [Configuring Packet Streams](#)
- [Initiating Auto Negotiation](#)
- [Multi-Stream Configuration](#)
- [Ramp Mode Traffic Generation](#)
- [Burst Mode Traffic Generation](#)
- [Enabling Stacked VLAN Tagging](#)
- [Enabling MPLS Label Stacking](#)
- [Transmitting Packet Streams](#)
- [Inserting a Pause \(Flow Control\) into a Stream](#)
- [Inserting Errors and Alarms](#)
- [Viewing Error and Alarm Results](#)
- [Configuring an RFC-2544 Test](#)
- [RFC-2544 - Throughput Testing](#)
- [RFC-2544 - Frame Loss Testing](#)

- [RFC-2544 - B2B Burst Testing](#)
- [Timed Test Using Acceptance Criteria](#)
- [Measuring Service Disruption](#)
- [PING Functionality](#)
- [Saving and Printing Statistics and Port Settings](#)

The following subjects will also be available soon:

- 802.3 10G/11G LAN (10 Gbps optical LAN mode)
- 802.3 10G/11G LAN (10 Gbps Seed A/B mode)
- OC-192/STM-64 10G WAN mapping

Configuring Packet Streams

(Specifically for LAN/WAN Ethernet testing)

The [Config > Strms Pg1 and Strms Pg2](#) screens provides the tools required to configure or edit any or all of the available packet streams.

To configure a packet stream:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Select **Config** and choose **SET**.
3. If the current **Interface** rate (or **Mode**) needs to be changed, then configure the setting for the desired rate.
4. Choose a **Strms Pg #** side tab. (Where # is either 1 or 2 depending on which stream(s) you want to set.
5. Select a desired stream to test in the Stream Profile table. The **Traffic Stream Profile** dialog box appears.
6. From the [Traffic Stream Profile](#) dialog box, set the parameters for the packet stream.



If routing the packets through a network switch, the stream's Source and Destination [MAC Addresses](#) should be configured.

 If routing the packets through a network router, the stream's Source and Destination MAC and [IP Addresses](#) should be configured.

6. Select **Save**. The stream configuration parameters display in the Stream Profile table.

Use the horizontal scroll bar at the bottom of the Stream Profile table to view additional columns.

 You can also rearrange the [column order](#) so information that is most important to you can be displayed without needing to use the scroll bar.

7. With all of the test streams turned Off, press the **Restart** button at the bottom of the screen to set the transmitted and received packet counts to 0.
8. **Enable** the desired stream(s) to begin generating traffic on the configured test stream(s).
9. After the desired test time has elapsed, then **Disable** the stream(s) currently generating traffic.

 This is preferred over pressing the Stop button, because this allows any packets in transit to be returned and counted, whereas Stop might stop all packet counters before any packets in transit have been returned.

Initiating Auto Negotiation

Negotiation is an Ethernet handshaking mechanism that looks at the incoming signal and determines the link speed and duplex mode (full-duplex or half-duplex). The Negotiate button enables or disables negotiation mode.

When auto negotiation is first enabled, it attempts to negotiate the link with a remote device. After successful negotiation, negotiation will not be performed again unless the remote device initiates an auto negotiation sequence.

By disabling auto negotiation, the test set can simulate older Ethernet equipment that does not support auto negotiation logic.



Negotiate is not available for Ethernet rates of 10G or higher.

To enable auto negotiation:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Select **Config** and choose **SET**.
3. If the current **Interface** rate (or **Mode**) needs to be changed, then configure the setting for the desired rate.
4. Select **Negotiate** and choose **Enabled**.
 - When first enabled, the Status displays "Enabled" and "Pending link".
 - Upon successful negotiation with a remote device, the Status displays the negotiated Interface Rate and Duplex mode.

To disable auto negotiation:

1. Select **Negotiate** and choose **Disable**.
 - When disabled, the Status displays "Disabled".

Ethernet Multi-Stream Configuration

The Digital Lightwave NIC's Ethernet testing capabilities include simultaneous testing of up to 32 independent Streams. The Multi-Stream Configuration feature allows the user to easily set up the Source and Destination IP and MAC address values on up to all 32 Streams in one step.

Important: This function will also configure each of the affected Streams with the same values for all of the other stream settings such as; **Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc.**, when the "Save All" button is selected.

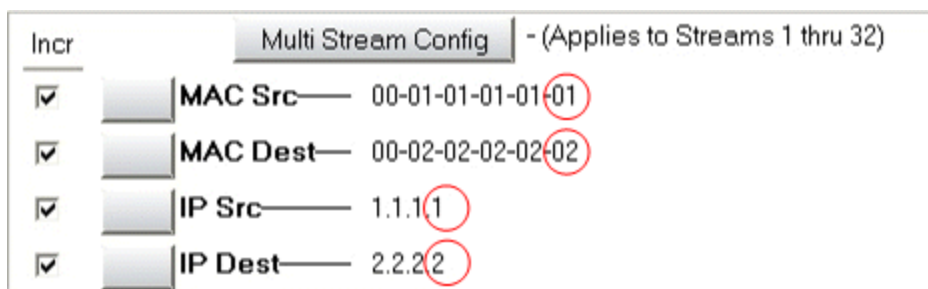
Procedure:

1. With NIC configured for any Ethernet rate, select Config, then Strms Pg 1 or Strms Pg 2. From the [Stream Profile Table](#), select any Stream by touching any Stream (1-16) or (17-32) in the white area. The [traffic Stream profile](#) for the

selected screen will appear. Multi-Stream Configuration will begin from the selected Stream.

2. Select **Multi Stream Config** located above the MAC Src.
3. When this button is selected, the user will be prompted to select the number of additional Streams to edit (from the current Stream id up to #32), keeping in mind that the Multi-Stream Configuration will begin from the selected Stream.

 The increment feature can be applied from the selected Stream up to Stream 32. For example, if Stream 30 is selected, Streams 30, 31, & 32 can be incremented.



Incr	Multi Stream Config	(Applies to Streams 1 thru 32)
☒	MAC Src	00-01-01-01-01-01
☒	MAC Dest	00-02-02-02-02-02
☒	IP Src	1.1.1.1
☒	IP Dest	2.2.2.2

After the number of additional Streams is entered, a new Profile window is displayed.

4. This new Stream Profile window displays the affected Streams id's beside the Multi Stream Config button and also displays the Increment (Incr) checkboxes beside the applicable address buttons. These checkboxes are initially unchecked when the window is opened. Select the appropriate checkboxes and enter the initial Address required for each of the selected addresses.

 If an address Incr checkbox is not selected then the specified address will be applied to all of the affected Streams

5. For each address with its Incr checkbox selected, the last part of the address (circled in red above) will be incremented by 1 for each subsequent Stream when the "Save All" button is selected.

 The MAC addresses and IPv6 IP addresses will increment by hex values

6. The example shown in the Stream Profile window above will result in the following values for each Stream (in this case Streams 1-32).

on, off	MAC Src	MAC Dest	IP Src	IP Dest
1 ☐	00-01-01-01-01-01	00-02-02-02-02-02	1.1.1.1	2.2.2.2
2 ☐	00-01-01-01-01-02	00-02-02-02-02-03	1.1.1.2	2.2.2.3
3 ☐	00-01-01-01-01-03	00-02-02-02-02-04	1.1.1.3	2.2.2.4
4 ☐	00-01-01-01-01-04	00-02-02-02-02-05	1.1.1.4	2.2.2.5
5 ☐	00-01-01-01-01-05	00-02-02-02-02-06	1.1.1.5	2.2.2.6
6 ☐	00-01-01-01-01-06	00-02-02-02-02-07	1.1.1.6	2.2.2.7
7 ☐	00-01-01-01-01-07	00-02-02-02-02-08	1.1.1.7	2.2.2.8
8 ☐	00-01-01-01-01-08	00-02-02-02-02-09	1.1.1.8	2.2.2.9
9 ☐	00-01-01-01-01-09	00-02-02-02-02-0a	1.1.1.9	2.2.2.10
10 ☐	00-01-01-01-01-0a	00-02-02-02-02-0b	1.1.1.10	2.2.2.11
11 ☐	00-01-01-01-01-0b	00-02-02-02-02-0c	1.1.1.11	2.2.2.12
12 ☐	00-01-01-01-01-0c	00-02-02-02-02-0d	1.1.1.12	2.2.2.13
13 ☐	00-01-01-01-01-0d	00-02-02-02-02-0e	1.1.1.13	2.2.2.14
14 ☐	00-01-01-01-01-0e	00-02-02-02-02-0f	1.1.1.14	2.2.2.15
15 ☐	00-01-01-01-01-0f	00-02-02-02-02-10	1.1.1.15	2.2.2.16
16 ☐	00-01-01-01-01-10	00-02-02-02-02-11	1.1.1.16	2.2.2.17
All				

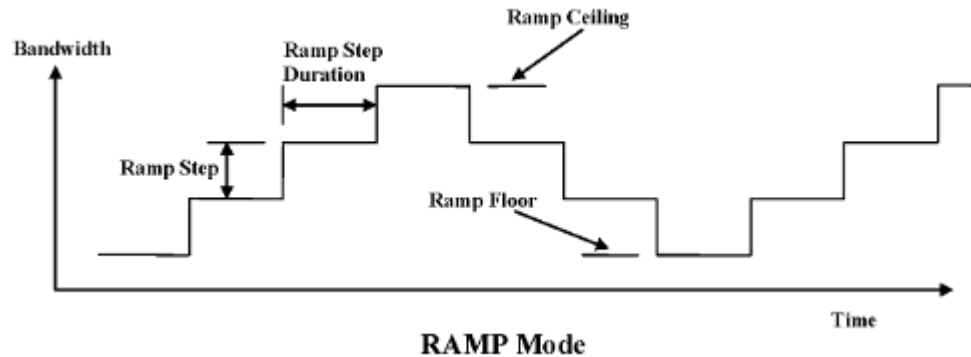
7. The Multi-Stream Configuration feature can also be used to will also configure each of the affected Streams with the same values for all of the other stream settings such as; **Frame Length, Payload, BW, Burst Size, Ether Type, UDP addresses, VLAN/MPLS settings, Etc.**, when the “Save All” button is selected.

How to use the Ramp Mode for Ethernet Traffic Generation

What is Ramp Mode?

Ramp Mode is an Ethernet Traffic Generation method that continuously steps up and down the transmit bandwidth, or Mbps rate.

Ramp mode is a feature that is commonly used to simulate a dynamic increasing and decreasing traffic load on a network device. This is normally performed to monitor a network device's performance, under these varying loads. This mode can also be used as a stress test, when the traffic increase is set to a very steep rate change.



Configuration Settings (from the [Traffic Stream Profile](#) window)

- **Rate:** From this menu select either **Ramp %Bandwidth** or **Ramp Mbit/sec**. Next, enter either the maximum % Bandwidth or Mbps rate that you want the stream traffic to step up to. 💡 This is the **Ramp Ceiling** value.
- **Ramp Step:** This is the size of the % Bandwidth or Mbps rate that each step (up and down) should change by.
- **Ramp Floor:** This is the minimum % Bandwidth or Mbps rate that the stream will step down to.
- **Ramp Duration:** This is the number of Seconds (1 to 999) that each step (up and down) will transmit for.

Setup:

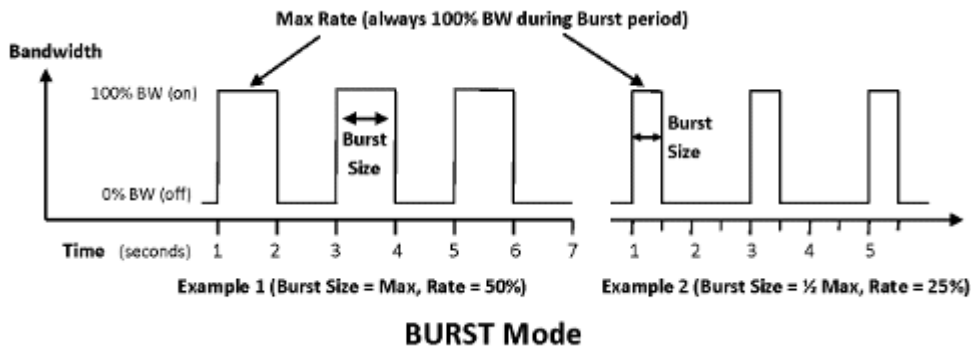
1. Turn **OFF** the test streams, and press the **Restart** button to clear any packet count history.
2. Next turn **ON** the test Stream(s) that are configured for Ramp Mode.
3. Monitor the network device under test (DUT) for anomalies, as the traffic being generated repeatedly steps up and steps back down again, increasing and decreasing its RX traffic load.
4. Turn **OFF** the test Stream(s), and verify that the DUT's RX Packet count and the NIC's TX Packet count match.

How to use the Burst Mode for Ethernet Traffic Generation

What is Burst Mode?

Burst mode is a feature that is commonly used to simulate "bursty" traffic loads on a network device.

This mode is used as a more realistic method of testing network loads than a constant bandwidth, because Ethernet traffic is typically "bursty" by nature.



Configuration Settings (from the [Traffic Stream Profile](#) window)

- **Rate:** From this menu select either **Constant %Bandwidth** or **Constant Mbit/sec**.
💡 For Burst mode, burst of **100% BW** are inserted, but the overall rate is **averaged** over time.
- **Burst Size:** The number of packets within the generated burst, with the Minimum Inter-Packet Gap (IPG) allowed, between each packet.
💡 This is sometimes referred to as the **Burst Width**.

Configuration Notes:

- The maximum Burst Size allowed is equivalent to the maximum Frame Rate, in Packet Per Second (PPS).
- Before adjusting the Burst Size the user should change the test stream's Frame Size and press Save.
- The maximum Burst Size allowed dynamically changes based on the last Frame Size setting to be saved.

Example:

- A 1GigE stream configured for a Frame Size of **128** bytes has a maximum Burst Size of **844594** PPS.
- When the Burst Size is set to 844594, this generates a burst of exactly 844594 packets, at 100% bandwidth for a full 1 second, with the minimum Inter-Packet Gap between each packet, regardless of the Rate setting.
- The Burst Size can be thought of as the amount of time that the burst of 100% BW is "On", up to 1 second for the maximum allowed burst size.
- A Burst Size of 1/2 the max (422297 for 1Gbps) would generate 100% bandwidth for 1/2 a second, then the amount of "Off" time would depend on the Rate setting.
- The Rate is the "ratio of time" that packets are "On" for (100% BW), versus "Off" for (0% BW).
- If the Rate is set to 50%, then the burst of 100% BW would last for the same amount of time as the 0% BW.
- The greater the Rate, the shorter the "Off" time. The lower the Rate, the greater the "Off" time.

Constant Burst Setup:

1. Turn **OFF** the test Stream(s) and press the **Restart** button to clear any packet count history.
2. Next turn **ON** the test Stream(s) that are configured for Burst Mode, as described above.
3. Monitor the network device under test (DUT) for anomalies, as the bursts of generated packets are received.
4. Turn **OFF** the test Stream(s) and verify that the DUT's RX Packet count and the NIC's TX Packet count match.

Single Burst Setup:

1. The user also has the ability to transmit a **Single Burst** using the [Send Burst](#) button to the right of the **Stream Profile Table**.
2. This will generate the exact one burst of the number of packets that the selected stream's **Burst Size** setting is configured for.
3. See the section called [To transmit a single Burst of packets](#) on one stream for more information.

Enabling Stacked VLAN Tagging

Stacked VLAN tags (often referred to as **Q-in-Q** Virtual LANs) allows multiple VLAN tags to be added sequentially to a single Ethernet Stream, as defined in IEEE 802.1Q standard.

The [Traffic Stream Profile](#) dialog box allows up to 4 Stacked VLAN tags to be configured per Ethernet Stream.

To enable Stacked VLAN tagging:

1. Select the Stream you want to enable VLAN tagging on by clicking the desired stream in the **Stream Profile table**. The Traffic Stream Profile dialog box appears.
2. From the Traffic Stream Profile dialog box, select the button next to **No MPLS/VLAN tag** and choose **VLAN Tagging** from the Select Tagging menu.
3. Once VLAN Tagging has been enabled, **VLAN Tag 1** becomes enabled and allows you to modify that tag's settings:
 - Tag 1 is referred to as the **S-Tag** (Service Provider VLAN tag).
4. To enable a second VLAN tag, click the checkbox next to **VLAN Tag 2**. This enables 2 VLAN tags
5. To enable a third VLAN tag, click the checkbox next to **VLAN Tag 3**. And to enable all four VLAN tags click the checkbox next to **VLAN Tag 4**.
 - Tags 2 through 4 are known referred to as the **C-Tags** (Customer VLAN tags).
6. After enabling the desired VLAN tags, the user can modify each tag's **TPID**, **PCP/QOS**, **CFI** or **DEI**, and **VID** settings.
7. Select **Prev** or **Next** to modify the Stacked VLAN tagging for other Ethernet Streams.
8. Select **Save All** to apply the setting and close the Traffic Stream Profile dialog box.

Each VLAN tag adds an addition 4-bytes to the Ethernet Stream, consisting of the following settings:

- **TPID** (Tag Protocol Identifier): The default value is 0x8100, but the menu lets you select 0x88A8, 0x9100, 0x9200 or enter a 2-byte User Defined HEX value.
- **PCP/QOS** (Priority Code Point/Quality Of Service): This indicates the frame priority level and is a 3-bit field ranging from the default value of 0 (best effort) to 7 (highest priority).
- **CFI** (Canonical Format Indicator) / **DEI** (Drop Eligible Indicator): This is a 1-bit setting that should remain set to the default value of 0, for Ethernet networks.
- **VID** (VLAN ID): This is a 12-bit decimal identifier ranging from 0 to 4095, used for the switching operation.

Enabling MPLS Label Stacking

MPLS (**M**ulti-**P**rotocol **L**abel **S**witching) is a set of procedures for augmenting IPv4 and IPv6 packets with "label stacks", thereby turning them into "labeled packets". These labels act as a shorthand representation of the IP packet's header. Routers which support MPLS are known as "Label Switching Routers", or "LSRs".

The [Traffic Stream Profile](#) dialog box allows up to 4 Stacked MPLS labels to be configured per Ethernet Stream.

To enable Stacked MPLS labeling:

1. Select the Stream you want to enable MPLS tagging on by clicking the desired stream in the **Stream Profile table**. The Traffic Stream Profile dialog box appears.
2. From the Traffic Stream Profile dialog box, select the button next to **No MPLS/VLAN tag** and choose **MPLS Tagging** from the Select Tagging menu.
3. Once MPLS has been enabled, **MPLS Level 1** becomes enabled and allows you to modify that label's settings:
4. To enable a second MPLS label, click the checkbox next to **MPLS Level 2**.
5. To enable a third MPLS label, click the checkbox next to **MPLS Level 3**. And to enable all four MPLS labels click the checkbox next to **MPLS Level 4**.
6. After enabling the desired MPLS labels, the user can modify each label's **Label** value, **TC**, **S(Bottom)**, and **TTL** settings.
7. Select **Prev** or **Next** to modify the MPLS labels for other Ethernet Streams.

8. Select **Save All** to apply the setting and close the Traffic Stream Profile dialog box.

Each MPLS label adds an additional 4-bytes to the Ethernet Stream, consisting of the following settings:

- **Label** (value): The default value is 0x1234, but this can be changed to any 20-bit User Defined HEX value from 0x0 to 0xFFFFF.
- **TC** (Traffic Class): This indicates the packet's QoS (quality of Service) priority ranging from 0 (best effort) to 7 (highest).
- **S(Bottom)** (Bottom of Stack): This is a 1-bit bottom of stack flag. This bit is automatically set to 1 for the last MPLS label to be enabled (i.e., the bottom of the stack), and automatically set to 0 for all higher level labels in the stack.
- **TTL** (Time to Live): This is an 8-bit field used to encode a Time-To-Live value ranging from 0 to 255 (default).

Transmitting Packet Streams

(Specifically for LAN/WAN Ethernet testing)

The [Config > Strms Pg1 and Strms Pg2](#) screens provides the tools required to configure or edit any or all of the available packet streams.

To start transmission on specific packet streams:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Configure the [Mode and desired Packet Stream](#) settings.
3. When configuring more than one stream, if the total configured bandwidth exceeds 100% the processor will automatically and proportionately adjust each enabled stream so the total bandwidth being transmitted is exactly 100%.
4. Choose a **Strms Pg #** side tab. (Where # is either 1 or 2 depending on which stream(s) you want to set.
5. **Enable** the desired stream(s) to begin generating traffic on the configured test stream(s).

 **Important:** Streams cannot be enabled when IP Reflection is enabled.

6. Packets begin transmitting as soon as the On/Off checkbox is enabled.

 To begin transmitting packets on multiple streams starting at the exact same time, then first select the **Stop** button from bottom of the screen, then Enable the desired packet streams, then press the **Restart** button from the bottom of the screen. The selected packets will begin simultaneously transmitting.

7. The stream transmission status displays in the TX State column of the [Stream Profile table](#).

8. The total TX and RX packet count statistics for all packet streams are displayed in the Count Statistics table below Stream Profile table.

To start transmission on All packet streams:

1. Repeat steps 1 through 4 above.
2. Select the All button beneath the last stream's On/Off check box.

 If no packet streams are currently enabled, then this will simultaneously enable all 32 packet streams.

 If one or more packet streams are currently enabled, then this will disable all enabled packet streams.

To transmit a single Burst of packets on one stream:

1. Configure the packet stream's setting from the [Traffic Stream Profile](#) window.
2. Select the **Burst Size** setting, and enter the desired number of packets to be transmitted in the burst
3. Press Save All to save the configuration and exit the Traffic Stream Profile window.
4. Press the stream's Number Button under in [Send Burst](#) column to inject a single burst of packets, for the configured burst size.

 When done inserting bursts configuring the stream for transmitting at a Constant %BW rate, set the Burst Size back to 1 to avoid "bursty" transmissions.

Inserting a Pause (Flow Control) into a Stream

Pausing frames is a means of flow control that specifies how long the transmitting device should remain quite. The flow control gives limited ability to regulate a (high bandwidth) source by sending pause frames to the source. Inserting a pause into a stream causes the source to stop sending frames for a specified amount of time (Quanta), allowing the (low bandwidth) receiver to catch up and process queued frames.

 Important: **Flow Control** must be enabled in order to count received Pause Packets.

 Important: Pause is not available when **IP Reflection** is enabled.

To start insert a Pause frame in a packet stream:

1. Select **Config** and choose **Set**.
2. Select **Pause**. *The Enter Pause Quanta keypad appears.*
3. Enter a Pause Quanta value and select **OK**.

 A quanta is the unit of time required for transmitting 512-bits at the speed of the port.

 The number of quanta (N x 512-bits) indicate the duration of the pause.

 Valid pause quanta values are 0-65535.

 A pause frame with a pause quanta of 0 indicates a resume frame to restart the paused traffic.

Inserting Errors and Alarms

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific errors and alarms into an Ethernet stream.



Note: Error insertion is disabled when IP Reflection Mode is enabled.

To insert multiple errors:

1. Select the desired protocol processor tab (**Packet**, **CSA Packet**, **Dual Enet**, Etc.).
2. Configure the [Mode and desired Packet Stream](#) settings.
3. Enable traffic generation from the packet stream to be errored.



Important: Most error types require traffic generation to be enabled on at least one packet stream.

4. Select [Error / Alarm](#) from the tabs along the left side of the Config Screen.
5. Select [Error Type](#) and choose an error type from the Select Error Type dialog box.
6. Select [Error Rate](#) and choose an error rate from the Select Error Rate to Insert dialog box.
7. Errors immediately start injecting into the packet stream when the error rate is selected.
8. View various result statistics by selecting the [Results](#) function.
9. To stop error transmission select **Error Rate** and choose **Off**.

To insert a single error:

1. Repeat steps 1 through 5 above.
2. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
3. Select the **Error Insert** common function button at the bottom of the screen.
4. A single error will be inserted every time the **Error Insert** button is pressed.

 **Note:** If no Error Type has been previously selected, then the Select Error Type menu will appear the first time the Error Insert button is selected.

5. View various result statistics by selecting the [Results](#) function.

To insert an Alarm:

1. Select the **Packet CSA** tab.
2. Configure the [Mode and desired Packet Stream](#).
3. Enable traffic generation from the packet stream to be errored.
4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. Select [Error / Alarm](#) from the tabs along the left side of the Config Screen.
6. Select **Alarm Generated** and choose an alarm type from the Select Alarm dialog box.

 **Important:** Once an alarm is selected, then alarm will continuously insert until turned off.

7. View various result statistics by selecting the [Results](#) function.
8. To stop the alarm generation select **Alarm Generated** and choose **None**.

Viewing Error and Alarm Results

After [inserting error and alarms](#) into a packet stream the receiving equipment detects the event and reports it. The Results screen provides different result reports.

To view error or alarm results:

1. From the protocol processor tab (**Packet, CSA Packet, Dual Enet, Etc.**), select [Results](#).
2. The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Packet and VLAN count statistics.
- [Strm Rslt](#) - Displays Stream ID specific statistics.
- [Event](#) - Displays a summary of error alarm activity.
- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

What are RFC 2544 Tests?

RFC 2544 tests are used as a benchmark test for network devices. They were developed to test throughput, latency, frame loss and burstability across a range of packet sizes and bandwidths. RFC 2544 has become the de facto standard for benchmarking Ethernet networks.

- Throughput Testing determines the maximum data rate which can be transported at each of a series of packet sizes, defined by the standard, i.e. 64, 128, 256, 512, 1024, 1280, 1518 bytes. NOTE: The NIC offers the ability to send non-standard packet sizes.
- Latency Testing measures the time interval required to transport a packet through the device or network under test and back. Low and consistent latency is vital for protocols such VoIP and video applications.
- Frame Loss Testing determines what percentage of frames can be sent across the device or network under test at the series of packet sizes as listed above in Throughput Testing.
- Back-to-Back Burst Testing determines the number of frames that can be sent in a burst with minimum inter-packet gap through the device or network under test without losing any frames.

The RFC 2544 methodology can be used to assess the parameters of service-level agreements (SLAs). A carrier can then determine whether an Ethernet circuit complies with the agreement, based on the test results.

Physical Connections

NOTE: RFC 2544 tests must be performed on a loopback basis, and all testing is typically performed on the NIC at the near end.

NIC – Network without Routers – Loopback

- In networks that do not have routers, it may be possible to use a simple loopback on the equipment.

NIC – Network with Routers – NIC in IP Reflection mode

- In networks with routers, a second NIC in IP Reflection mode can be used as a loopback device.
- Configure the far-end NIC unit's Reflect setting for Digital Lightwave Packets Only.
- In IP Reflection mode, the NIC reverses MAC and IP addresses and loops back the RFC test packets.

How to Configure and perform RFC2544 Testing



Note: The RFC tests are performed over the selected test Stream. The RFC tests will over-ride the test Stream's bandwidth rate, frame size and burst size parameters. However other parameters such as MAC addresses, IP addresses, UDP addresses and VLAN/MPLS settings are not over-written, and should be configured prior to beginning the RFC test.

To configure the test Stream:

1. Press **Config**, then **Strms Pg 1** or **Strms Pg 2**.
2. Select one of the streams by pressing the stream's row in the white area (See figure).

Tab 4 Packet CSA GoTo

MLD CSA OTN CSA SONET CSA Packet CSA Switch Matrix System Help

Config RFC Tests Results Test

Elapsed Time 000:00:01.02

Set Strms Pg 1 Strms Pg 2 Error Alarm Prim Seq RX OH

TX	Traffic	MAC Dest	Len...	IP MO...	Payload	send burst
1 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	1
2 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	2
3 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	3
4 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	4
5 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	5
6 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	6
7 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	7
8 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	8
9 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	9
10 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	10
11 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	11
12 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	12
13 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	13
14 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	14
15 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	15
16 ☐	Off 1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	16

	Packets	Pkts/sec	Bytes	Mbit/sec	%BW
TX	0	0	0	0.000	0.00
RX	0	0	0	0.000	0.00

- Stream settings are made in the [Traffic Stream Profile](#) pop-up window.
- Make any applicable Stream settings such as Source and Destination MAC and IP Addresses, UDP port configuration and/or VLAN/MPLS configuration before continuing.
- It is not necessary to set **Frame Length**, **Rate** or **Burst Size**. These will be set by the RFC 2544 function.
- NOTE: Adding VLAN or MPLS tags will change the minimum frame length that can be used. For example, if a single VLAN tag is selected, the minimum frame length will be changed from 64 to 68 and the first rate tested in the RFC 2544 test will be 68 bytes long.
- Select the On/Off checkbox for the Stream that has just been configured to being generating packets.
- Confirm that packets are being sent and received successfully.
- While the Stream is in On, the TX and RX packet count may not always be equal. This is normal. It is only necessary to determine that packets are being successfully received without any errors to confirm basic connectivity before beginning lengthy RFC 2544 tests.
- Uncheck the On/Off checkbox to turn the Stream off.

 Note that if the Flow Control box is checked (Rx Enabled), it will automatically default to unchecked when an RFC test is activated. This is to ensure test validity and accuracy.

To configure the an RFC test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) that was configured above for the RFC tests.
3. Select **Trial Duration** and set the duration of the test (in seconds).

 RFC-2544 recommends a trial duration of at least 60 seconds for Through Put and Frame Loss testing.

4. Select **Dest Port** and choose the port that will receive the test signal.

 Note, if a port is in IP Reflection Mode, or if it is already in an active RFC test, this setting will be unavailable.

5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.

 **IMPORTANT:** The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

 **IMPORTANT:** The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
- b. Enter a new value and select **OK**. Value ranges are 64 - 16000.

- c. By default, packet sizes 64 - 1518 are already selected, but packet size 9000 is not selected. You can enable 9000 if your test needs to include Jumbo packets.
 - d. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select the type of RFC test that you wish to run by choosing its tab from along the left side of the RFC Tests screen. Complete any necessary configurations these tabs.
- To run a **Thru Put** test see [Throughput Testing](#)
 - To run a **Frame Loss** test see [Frame Loss Testing](#)
 - To run a **B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC-2544 - Thru Put Testing

Throughput testing is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

For example, the Throughput test starts by transmitting a stream at 100% using a packet size of 64 bytes. If it fails (i.e., an unacceptable number of packets are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing packets. The test then tries to zero in on the best throughput rate based on the Resolution Rate. The final rate appears as the Passing Rate.

Once this is completed, the packet size is increased to 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using default packet sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

When performing a throughput test, you can adjust the following parameters to fine-tune your test results:

- [Accept Lost Rate](#) – Defines the percentage of frames that can be lost without being considered a failure.
- [Resolution Rate](#) – Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.



A Throughput test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Throughput test:

configure the Frame Loss test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **Thru Put** from the tabs along the left side of the RFC Tests screen.

9. Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.
10. Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

To start the Throughput test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts transmitting a test stream using the configured parameters, starting with the smallest packet size. The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first packet size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first packet size transmitted is 64-bytes followed by 128-bytes and so on.)

If packet loss is detected in a byte transmission, the stream is re-transmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

3. View Throughput test results on the [statistics table](#) at the bottom of the screen.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - Frame Loss Testing

Frame Loss testing is an RFC 2544 benchmark test. Its purpose is to determine the number of packets lost, by looping a stream through the network at varying transmit packet rates. The Frame Loss screen allows you to select a specific packet size to use in the Ethernet stream.



A Frame Loss test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Frame Loss test:

1. Select **RFC Tests** and choose [Conf.](#)
2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.
4. Select **Dest Port** and choose the port that will receive the test signal.
5. Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

6. Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

7. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **Frame Loss** from the tabs along the left side of the RFC Tests screen.

To start the Frame Loss test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.

2. The unit immediately starts transmitting a test stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, Processing size 64 Rate 10.00. When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

3. View Frame Loss test results on the [statistics table](#) at the bottom of the screen. The table displays the frame loss test results for a specified packet size. The results represent the nine rates determined by the BW Ceiling and BW Floor settings.

To change the packet size and view its results:

- Choose the **Packet Size** button (for example, 256). The Frame Loss table displays the transmit and receive statistics for the selected packet size.

OR

- Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

 **Important:** The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - B2B Burst Testing

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.



A Back-to-Back Burst test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the B2B Burst test:

1. Select **RFC Tests** and choose [Conf.](#)



The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

2. Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.
3. Select **Trial Duration** and set the duration of the test.



This value determines how long each trial runs. Valid values range from 2 to 10 seconds.

4. Select **Dest Port** and choose the port that will receive the test signal.
6. Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

- a. Select a **Packet Size** button (for example, 64). A keypad appears.
 - b. Enter a new value and select **OK**. Value ranges are 64 - 9600.
 - c. To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.
8. Select **B2B Burst** from the tabs along the left side of the RFC Tests screen.
9. Select **Resolution (in frames)**. A keypad appears.
10. Enter a precision level for the test. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.
11. Select **# Of Repetitions**. A keypad appears.
12. Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50.

To start the Back-to-Back test:

1. Select **Start Test**. Once the test begins, this button toggles to Stop Test.
2. The unit immediately starts sending a burst of frames with the minimum inter-frame gap between them. If all frames are received, the burst size is increased and the test repeated. If all frames are not received, the burst size is lowered and the test repeated until the longest burst the DUT can handle (without loss of frames) is determined.
3. View B2B Burst test results on the [statistics table](#) at the bottom of the screen.
 - Frame Size (bytes) – Indicates the tested frame size.
 - Max Possible Number of Frames – Indicates the number of frames transmitted without errors.
 - Avg Observed B2B Frames – Indicates the data stream's average frame count.

Saving or Printing test results:

1. The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.
2. To save or print this test's results see Saving and Printing Statistics and Settings Reports.

Timed Test - Using Acceptance Criteria

The NIC unit has the capability to run a timed test (a test with Ethernet streams enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

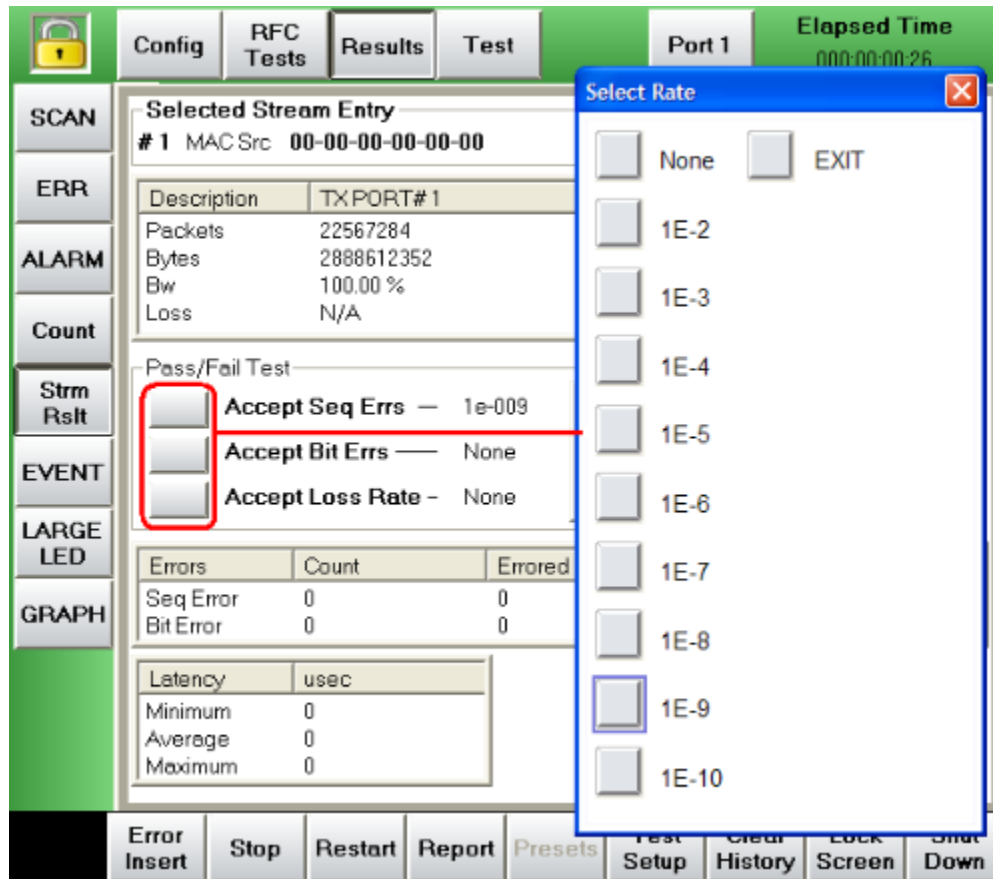
To Set Up the Test

1. Set up the port on which the test will be initiated. This includes the ports Interface, stream parameters, etc.. A test can be performed on a single port or port-to-port basis.
2. Enable the stream(s) to be used for the test.
3. Under the **Results > Strm Rslt** tab, configure the [Pass/Fail Test](#) acceptance criteria options. These include **Acceptable Sequence Error** rate, **Acceptable Bit Error** rate, and **Acceptable Loss Rate**. These values are set up on a per-stream basis.
4. Under the **Test** tab, select the desired **Duration** for the test.



If the "**Continuous**" duration is used, the test will continue to operate until the **Stop** button is pressed.

5. **Restart** the port that will be used for the timed test using the **Restart** button at the bottom of the screen.
6. When the time duration of the test is reached, the streams will automatically stop counting received packets and the Pass/Fail acceptance results are displayed under the **Results > Strm Rslt** tab.



User-Defined Acceptance Criteria:

- **Accept Seq Errors** - A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test.
- **Accept Bit Errors** - A user-specified threshold value for determining the acceptable bit error rate for a timed test.
- **Accept Loss Rate** - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test.

Measuring Service Disruption

(Specifically for LAN/WAN Ethernet testing)

The unit can measure Service Disruption switching intervals in your network. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

When enabled, the trigger event to begin service disruption measurements occurs when it stops detecting incoming packets.

 The MSA module's Packet processor tab and Dual Enet processor tab also triggers on incoming packets with CRC/FCS errors.

The duration for every Ethernet service disruption event is measured in milliseconds, with granular accuracy of .1 ms (100 μ s).

When the Action state is configured for Continuous APS, the 10 most recent measurements are displayed in the History window. Also the Minimum and Maximum measurement times are logged, as well as an Average duration based on all measurements taken since the test began.

To measure Ethernet service disruption activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. When testing low speed Ethernet bandwidths ($\leq$ 1Gbps), you may need to configure the **Resolution** setting in conjunction with the **Consecutive Bad Time Required** setting, to ensure that at least one Ethernet packet is received within the configured period of time (measurement window). The following options are available: **High (.1 ms)**, **Medium (1 ms)** and **Low (10 ms)**.

 When receiving fewer packets per second (lower bandwidths), a lower resolution setting (larger window of time) is required.

 Invert the number of packets per second being received to determine the time between each received packet, and select the Resolution setting that best allows for at least packet to be received within the selected measurement window.

 Important: The Resolution setting is only displayed on ports that support Ethernet rates $\leq$ 1Gbps.

3. Select **Consecutive Good Time Required** and enter a time interval ranging from 10 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.
4. Select **Consecutive Bad Time Required** and enter a time interval ranging from 0.1 milliseconds to 1638.3 milliseconds. This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames (or no frames) to elapse before Protection Switch measurements begin to accumulate.

5. From the **Action** box, select **State**. The Select APS Action dialog box appears.
6. Select [Single APS](#) or [Continuous APS](#) to begin measuring. The test set will begin monitoring the incoming signal for the event. If it occurs, the protection switch state and time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for consecutive good and bad time parameters.
7. In the **Protection Switch Time (MilliSecs)** table, view the duration, in milliseconds, that it took for the service disruption to occur.
8. In the **History Recent MilliSeconds table**, view a history of the 10 most recent measurements.
9. The complete summary of service disruption events for all processors within the NIC unit can be viewed simultaneously by selecting the **System** tab and choosing **Service Disruption**.

To Stop monitoring Service Disruption measurement activity:

1. Select the **Test** tab and choose **Service Disrptn** from the tabs along the left-side of the screen.
2. From the **Action** box, select **State** and choose **Stop APS**.

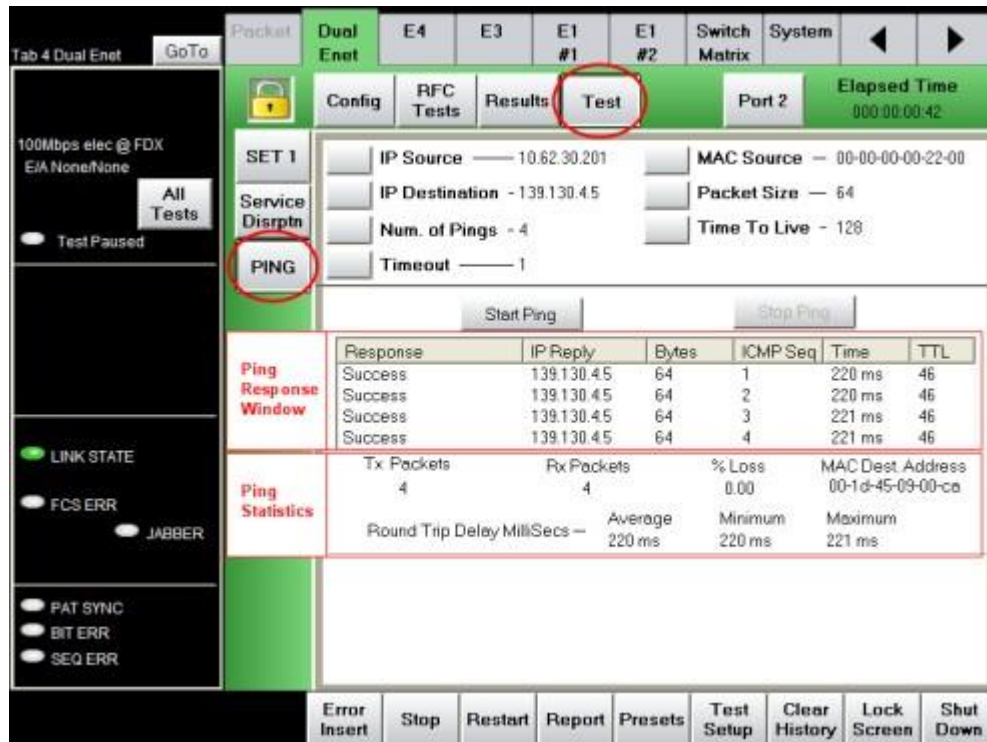
PING Functionality

PING is a utility used to determine whether a specific IP address is accessible. It works by sending a packet to the specified address and waits for a reply. PING is used primarily to troubleshoot Internet connections.

A PING packet is an IP packet requesting that a copy of the contents be echoed back to the sender. This packet type is called an ICMP Echo Request. When a site is "pinged", an echo request is sent, and the destination site that receives it responds back. The response packet is called an ICMP Echo Reply.

The Ping utility is essentially a system administrator's tool that is used to see if a computer is operating and also to see if network connections are intact. Ping uses the Internet Control Message Protocol (ICMP) Echo function which is detailed in RFC 792.

The [PING screen selection](#) is implemented under the Test Tab.



Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).

- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:
 - From Destination Printer:
 - ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.
 - From Destination File:
 - ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.



The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

- ▶ Enter a file name and select **OK**.



Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

- ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.

4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.

5. Select **OK**.

Fibre Channel - Screen Functions and Description

Packet tab - Screen Functions and Descriptions Overview

(Specifically for Fibre Channel SAN testing on the Packet tab)

This section describes the various screens and functions that control **8.5G** and **10.52G** Fibre Channel, as well as **OTU1f (11.270G)** and **OTU2f (11.317G) - 10G Fibre Channel over OTU-2** Fibre Channel configuration and operation:

- [Config](#)
- [Standard Tests](#) (RFC-2544 and Y.1564)
- [Results](#)
- [Test](#)
- [LEDs](#)

Config

Packet tab - Config Screens and Functions

(Specifically for Fibre Channel SAN testing on the Packet tab)

The Config screen contains the following functions:

- [Set \(Settings Configuration\)](#)
- [Traffic Stream Profile](#)
- [Error Alarm](#)
- [Prim Seq](#)

Config - Set screen

(Specifically for Fibre Channel SAN testing on the Packet tab)

The **Config > Set** (Settings Configuration) screen allows you to define the Fibre Channel frame parameters that will be used to generate a traffic flow or stream into the network.

 **8.5G** and **10.52G** Fibre Channel, as well as **OTU1f (11.270G)** and **OTU2f (11.317G)** - **10G Fibre Channel over OTU-2** are supported on the MSA circuit pack's **Packet** tab.

The following functions appear on the Settings Configuration screen:

Function	Description
Interface	Displays the configured Fibre Channel rate.  The 8G, 10G and 10G over OTU-2 Fibre Channel rates need to be configured from the OTN tab's Interface menu, or the SONET/SDH tab's Interface menu.
Fabric Login	Attempts a Fabric Login  This is disabled when the test stream is On.
Name Server Login	Attempts a name server Login  This is disabled when the test stream is On.
Status	Link: – displays the current Link status Fabric: - displays the current Fabric status Name Server: - displays the current status
Col (Columns)	Rearrange order of columns displayed in the Stream Profile Table.  See below for more information on the Stream Profile Table.

R_T_TOV	Sets the R_T_TOV timeout setting. The default value is 100ms, and supports a range of 0.01ms to 655.35ms, specified in units of 10us. This is the timeout value used by the receiver logic to detect loss of synchronization. When the receiver goes into the Loss of Synchronization state for more than the R_T_TOV timeout value, then a link failure is detected.
Stream Profile Table	The Stream Profile Table contains one Fibre Channel stream that can be configured. Selecting the stream from the profile table opens the Traffic Stream Profile dialog box from which the stream parameters are configured. Use the horizontal scroll bar at the bottom of the table to view hidden columns for the stream settings.  See below for more information on the Stream Profile Table.
Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) frames: • TX/RX - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Frames - Displays the total number of frames sent or received since the test was started. • Frms/sec - Displays the current rate of frames sent or received in frames per second. • Bytes - Displays the total number of bytes sent or received since the test was started. • Mbit/sec - Displays the current rate of frames sent or received in Megabits per second. • %BW - Displays the total percent of bandwidth used by each active stream.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: • Off - The unit's laser will be off when the unit is turned on.

	• On - The unit's laser will be on when the unit is turned on. • Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

Information about the configuration of the streams are displayed in the Stream Profile Table.

TX	%BW	WWN Dest	Length	Payload	SEQ_ID
On	100.00 %	00-00-00-00-00-0...	2088	PRBS 31	0

At the left, there is one button to turn on and off the fibre channel stream. The other columns of information can be seen by using the scroll bar at the bottom or by rearranging the columns. These are the columns (note that the sequence may be different, depending upon how the user has arranged the columns):

TX	Indicates whether the Fibre Channel stream is being transmitted (On) or not (Off)
%BW	Percentage of bandwidth selected on that stream
WWN Dest	Destination World Wide Name address
Payload	Payload Pattern selected
Length	Frame Length
SEQ_ID	Sequence Identifier selected
F_CTL	Frame Control address
D_ID	Destination Identifier address
OX_ID	Originator Exchange ID address

WWN Src	Source World Wide Name address
S_ID	Source Identifier address
RX_ID	Responder Exchange Identifier address
R_CTL	Routing Control address

Config - Traffic Stream Profile

(Specifically for Fibre Channel SAN testing)

A frame stream's profile defines the size, content, and several addresses, and other parameters for the frame.

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters. To access this dialog box, select stream #1 in the Stream Profile Table.



The Fibre Channel Class of Service is set to 3 by default.

Parameter	Description
WWN SRC ADDRESS	Sets the World Wide Name Source Address.  Important: This value must be set before a Fabric & Name Server login is attempted
WWN DEST ADDRESS	Sets the World Wide Name Destination Address.  Important: This value must be set before a Fabric & Name Server login is attempted
Class of Service	Supports Class of Service 3

Frame Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad. The default value is 68 bytes.
Rate	Sets the bandwidth percentage used, from 0.01 to 100% BW.
Payload	Sets the type of data used for the stream's payload. The payload can be set to: • PRBS 31 • PRBS 31 INV • User Defined
SOF	Select the Start of Frame Delimiter used. SOF Delimiter Functions are: • SOFc1 – SOF Connect Class 1 • SOFi1 – SOF Initiate Class 1 • SOFn1 – SOF Normal Class 1 • SOFi2 – SOF initiate Class 2 • SOFn2 – SOF Normal Class 2 • SOFi3 – SOF Initiate Class 3 • SOFn3 – SOF Normal Class 3 • SOFc4 – SOF Connect Class 4 • SOFi4 – SOF Initiate Class 4 • SOFn4 – SOF Normal Class 4 • SOFf - SOF Fabric
EOF	Selects the End of Frame Delimiter Used. EOF Delimiter Functions are: • EOFt – EOF Terminate • EOFdt – EOF Disconnect-Terminate • EOFa – EOF Abort • EOFn – EOF Normal • EOFni – EOF Normal-Invalid • EOFdti – EOF Disconnect-Terminate-Invalid • EOFrt – EOF Remove Terminate • EOFrti – EOF Remove Terminate-Invalid

R_CTL	Routing Control – 1 byte, used for categorizing the frame function. The routing portion says if this is a data frame or a link-control frame (either an ACK or a Link Response), and the information portion indicates the type of data.  supports raw edit of field values only
D_ID	Destination Identifier – 3 bytes, address identifier of the FC frame's destination port.  supports raw edit of field values only
CS_CTL	Class Specific Control/Priority - 1 byte, Quality of Service.  supports raw edit of field values only
S_ID	Source Identifier – 3 bytes, address identifier of the FC frame's source port.  supports raw edit of field values only
TYPE	Data Structure Type – 1 byte, categorization of the Frame's data. Indicates the next protocol (what's in the Payload), unless R_CTL indicates a control frame.  supports raw edit of field values only
F_CTL	Frame Control – 3 bytes, contains control information relating to the frames content's various FC options, such as sequencing information.  supports raw edit of field values only
SEQ_ID	Sequence Identifier – 1 byte, unique identifier for the frame's Sequence number, just like the frame sequence for IP.  supports raw edit of field values only

DF_CTL	Data Field Control – 1 byte, specifies the presence of, or absence of, optional headers, and the size, between the frame header and frame payload.  supports raw edit of field values only
SEQ_CNT	Sequence Count – 2 bytes, used to count the number of frames that have been transmitted in a sequence  not editable
OX_ID	Originator Exchange ID – 2 bytes, provides association of frames within specific exchanges originating at a particular port. It is assigned by the initiator, used to group related sequences.  supports raw edit of field values only
RX_ID	Responder Exchange ID – 2 bytes, provides the same function for the exchange responder that the OX_ID provides for the Exchange Originator, but assigned by a target node.  supports raw edit of field values only
PARM	For Link Control frames, indicates the specific type of Link control frame. 4 bytes, used mostly as a "relative offset" in sequences. For ACK frames, used to indicate how many frames are being acknowledged and whether all frames with lower SEQ_CNT values have been acknowledged.  supports raw edit of field values only
Credits	Specifies the initial number of frames that can be sent on the link prior to receiving an R_RDY reply, range of 1 to 65535. default of 16.  Important: This value must be set before a Fabric & Name Server login is attempted
Save All	Saves all changes made to the Traffic Stream Profile window.

Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Error Alarm

(Specifically for Fibre Channel SAN testing)

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the "Send Error" button is pressed or when a rate is selected. The following types are available: • Code - Generates line code errors • Bit Error - Generates bit errors in the payload • CRC - Generates an invalid CRC error
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • 1E-<x> - X is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1×10^{-x} (The smaller the exponential the higher the error rate.) • User Defined – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not

	limited to 1×10^{-x} but more exact choices are available such as 2.6×10^{-4} or 7.1×10^{-3}
Alarm Generated	Selects an alarm to be transmitted. Once selected the system begins sending the alarm condition. Select one of the following: • LOS - Transmits a loss of signal

Config - Prim Seq

(Specifically for Fibre Channel SAN testing)

Supports the generation of Primitive Sequences including:

- **Send NOS** - Non-operational Ordered Set: K28.5 D21.2 D31.5 D5.2
- **Send LR** - Link Response Ordered Set: K28.5 D9.2 D31.5 D9.2
- **Send LRR** - Link Response Reset Ordered Set: K28.5 D21.1 D31.5 D9.2
- **Send OLS** - Off Line Ordered Set: K28.5 D21.1 D10.4 D21.1

Select the option and then the duration:

- **Selectable Duration:** Supports the generation of **1 to 10** consecutive sequences or **continuous** sequence generation.



If **Continuous** sequence generation is selected, then select the option again to turn off the selected Primitive Sequence generation

Perf Test

Perf Test - Conf (Test Button)

(Specifically for Fibre Channel SAN testing on the Packet tab)

The Performance Test screen allows you perform RFC-2544 standard based tests.

- Use this section to test [RFC-2544](#).

RFC Tests

RFC 2544 Tests - Screen Functions and Descriptions Overview

The RFC 2544 Tests screen contains the following functions:

- [Conf](#)
- [Thru Put](#)
- [Frame Loss](#)
- [B2B Burst](#)
- Graph



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description

Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544, it will not appear in the Select Port window.
Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-86400 seconds. The default value is 60 seconds.
Stream ID	Allows the user to select one of the four streams for the RFC test.
Dest MAC Address	Reflects the destination MAC address for the selected Stream.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.  For Fibre Channel rates, this is the WWN Dest Address.
Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.
Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 16000.

BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.
Automated Test Sequence	The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes. • Thruput/Latency checkbox and status field • Frame Loss checkbox and status field • B2B Burst checkbox and status field • Start/Stop Button • Test Status field



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.

	💡 The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.
Statistics Table	Reports the test results. The following statistics are displayed: Size - Indicates the transmitted test packet size. Rate - Reports the passing rate (percentage) for the specific packet size. TX Packets - Reports the number of packets transmitted in the stream for the frame. RX Packets - Reports the number of packets received by the test set. Latency Min/Max/Avg - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds. 💡 If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.
Start/Stop Test	Starts and stops the Through Put test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

💡 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)

- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select [Frame Loss Testing](#) for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.

Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.
Packet Size buttons	Determines which packet size results appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: Rate % - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. Transmit Frames - Reports the total number of frames transmitted. Receive Frames - Reports the total number of frames received. Loss % - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Back-To-Back Burst Test (B2B Burst)

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.

	 Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50, however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: • Max Possible Number of Frames - The frame rate (resolution) used as the throughput rate. • Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 Important: The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

Results

Results - Screens and Functions

(Specifically for Fibre Channel SAN testing)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Frame count statistics.
- [Strm Rslt](#) - Displays the Stream specific statistics.
- [Event](#) - Displays a summary of error alarm activity.
- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.
- [Graph](#) - Displays a graphical representation of the error and alarm history.

Results - Scan

(Specifically for Fibre Channel SAN testing)

This function displays a list of received errors and alarms.

For **alarms**, the duration is reported as a count in seconds.

For **errors**, an error count is reported.

The message *No Errors or Alarms* appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors)

(Specifically for Fibre Channel SAN testing)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

Error Type	Description
Code	A Code error or Symbol error is detected in the line encoding
Oversized	A frame whose length is > 2144 bytes

Undersized	A frame whose length is < 28 bytes, with good FCS/CRC checksum
Invalid FCS	An error in the Frame Check Sequence (CRC checksum), and whose Frame length is ≥ 28 bytes
Alignment Error	An error in the frame's word alignment
EOFA	An error in the frame's EOFa (End Of Frame - Abort) primitive
EOF Error	A frame received that is missing an EOF (End Of Frame)
Disparity	An error in the frame's Ordered Set Disparity

Results - Alarm

(Specifically for Fibre Channel SAN testing)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.
Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

Error Type	Description
CP Power Loss	The Circuit Pack module experience a power loss fault during test
Paused	The test was manually paused by selecting the Pause button or by a SCPI script command
Power Hot	The received optical power level exceeded the laser's maximum input limit
Power Warm	The received optical power level is within 3 dBm of laser's maximum input limit
LOS	A Loss Of Signal alarm has occurred
Link Down	A Loss of Link State alarm occurred

Results - Count

(Specifically for Fibre Channel SAN testing)

The Count screen displays [Utilization](#) and [Packets](#) statistics by type and count.

To view total transmit and receive utilization statistics, select the **Utilization** button. The following statistics appear:

Desc column	Current / Min / Max / Avg columns
Total - TX BW	Displays the Current, Min, Max and Avg. Total %BW Transmitted
Total - TX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate transmitted

Total - TX FPS	Displays the Current, Min, Max and Avg. Total Frames Per Second rate transmitted
Total - RX BW	Displays the Current, Min, Max and Avg. Total %BW received
Total - RX Mbps	Displays the Current, Min, Max and Avg. Total Mbps rate received
Total - RX FPS	Displays the Current, Min, Max and Avg. Total Frames Per Second rate received

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Frames	Reports the total number of frames sent.
Received Frames	Reports the total number of frames received.
Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
R_RDYs Transmitted	Indicates the count of R_RDYs (Receiver Ready) transmitted
R_RDYs Received	Indicates the count of R_RDYs received
BB Credit Available	Indicates the amount of Buffer-to-Buffer credit that is currently available for sending frames to the far end device
R_RDY Credit Pending	Indicates the amount of credit (R_RDYs) currently pending for return to the far end device. The R_RDY counter keeps track of how many R_RDY primitives need to be transmitted based on how many frames

	were received. Credit is returned for frames that have a valid SOF and at least one word of data following the SOF, independent of the validity of the CRC.

Results - Strm Rslt (Stream Results)

(Specifically for Fibre Channel SAN testing)

The Stream Results screen displays the following statistics for the incoming stream:

Statistic	Description
Selected Stream Entry	Displays the stream's WWN source and WWN destination addresses.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW. Transmit Statistics: • Packets - Total number of Packets transmitted. • Bytes - Total number of Bytes transmitted. • BW - Percent of bandwidth currently being transmitted. Receive Statistics: • Packets - Total number of Packets received. • Bytes - Total number of Bytes received. • BW - Percent of bandwidth currently being received. • Loss - Current Packet Loss rate.  For loop backs with large latency, the Loss rate may show greater than 0 while the test stream generation is active, even if no packets are actually being lost (dropped). This is due to the real-time RX packet count being lower than the TX packet count, because of the latency. If no packets were lost during the test, then this

	value will drop to 0 when the test stream generation is turned off.
Pass/Fail Test	Provides User-Defined Acceptance Criteria:  Refer to Timed Test Using Acceptance Criteria • Accept Bit Errors - A user-specified threshold value for determining the acceptable bit error rate for a timed test. • Accept Loss Rate - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. • Pass/Fail - Test results are displayed as "Running" when the test is active (Elapsed Time is incrementing); and displayed as "PASS" or "FAIL" when the test ends, depending on whether or not specified failure criteria was attained.
Errors	Displays Error statistic as Counts, Errored Seconds, Average error rate and Current error rate, for the following Error Types: • Bit Errors Received
Latency	Displays Minimum, Average, and Maximum latency (delay) measurements, in microseconds (µs). A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated (real-time) as new latency measurements are logged.  If the TX and RX are looped on itself with a short patch cable, the latency may appear as 0 µs.
Alarms	Displays Alarm statistics as total number of Seconds the alarm was active during the test, for the following Alarm type: • Pattern Sync

Results - Event

(Specifically for Fibre Channel SAN testing)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Large LEDs

(Specifically for Fibre Channel SAN testing)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs for Fibre Channel, see [Fibre Channel LEDs](#).

Results - Graph

(Specifically for Fibre Channel SAN testing)

This function allows incoming counts and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Test

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- [Duration](#): This function configures how long a timed test runs for.
- [Action After Duration](#): This function defines what activities occur at the conclusion of a timed test
- [Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.

5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.

 After configuring the Duration, you must select Restart in order for the Timed Test to begin.

 To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.

- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (.). The test does not repeat.
Print Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.

Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.

Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

1. Select **Test** and choose **Set 1**.
2. Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

- Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

LED Quick Status Area

(Specifically for Fibre Channel SAN testing)

When **Fibre Channel** is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

Indicator, LED or Control	Description
Laser On/Laser Off Control	Pressing the button will toggle the status of the laser. If no SFP module is installed, the button will state "No Laser".
RX:	Displays the received optical power in dBm.
TX:	Indicates current transmit laser wavelength.
E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.

Test Paused	If red, indicates that the current test has been paused .
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
LOS	Loss of Signal. When red, indicates that a valid signal is not being received. This is an alarm LED.
Link State	Indicates the port's connection status. If green, the port is receiving a valid signal.
Code	Indicates a line code error was detected on the incoming frame.
CRC	Indicates a CRC error was detected on the incoming frame.
Pat Sync	Indicates a loss of pattern synchronization in at least one of the 4 streams. This is an alarm LED.
BIT ERR	Indicates a detected BIT error in at least one of the 4 streams.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with white text	The specific function is active and OK.
Red with white text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.

White with **white** text

No activity from this specific function.

Fibre Channel - Specific Tasks

Fibre Channel Specific Tasks Overview

(Specifically for Fibre Channel SAN testing)

This section includes how to setup and use Fibre Channel procedures, for the configured Fibre Channel SAN Interfaces.

 All Fibre Channel interface rates are licensable test options. Please contact [Tech Support](#), or your DLI sales representative, to enable the Fibre Channel test options on your NIC unit.

 **1G, 2G, and 4G** Fibre Channel rates are supported on the MSA circuit pack's [Dual Enet](#) tab.

 **8.5G and 10.52G** Fibre Channel, as well as **OTU1f (11.270G)** and **OTU2f (11.317G) - 10G Fibre Channel over OTU-2** are supported on the MSA circuit pack's [Packet](#) tab.

The following procedure demonstrates how to interconnect the NIC with a Fibre Channel SAN switch, and establish test-stream data connections.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

- Select [Connect \(without Server login\) procedure](#) to establish connection that does not require a Fabric and Name Server login
- Select [Fabric and Name Server login process](#) to establish connection that requires a Fabric and Name Server login
- Select [Analyzing Fibre Channel Test Results](#) to view statistics for any errors or alarms that occurred
- Select [Timed Test Using Acceptance Criteria](#) to configure user-defined acceptance criteria for Pass/Fail results
- [Saving and Printing Statistics and Port Settings](#)

Connect (without Server login) procedure

(Specifically for Fibre Channel SAN testing)

This procedure demonstrates how to interconnect the NIC with a Fibre Channel SAN switch.

This procedure will establish a connection that does not require a Fabric and Name Server login.

1. Verify the optical SFP/XFP module being used supports the selected Fibre Channel data rate, and the wavelength is compatible SAN equipment being tested.
2. Configure the Fibre Channel test interface.

 1G, 2G and 4G Fibre Channel rates are supported by the [Dual Enet tab](#).

 8G, 10G and 10G over OTU-2 Fibre Channel rates are supported by the [Packet tab](#).

3. Turn the TX Laser on and verify both transmit and receive optical power levels are within specification. Then interconnect the transmit and receive NIC test port interfaces with the SAN equipment.
4. The NIC test port and the SAN equipment should quickly establish a valid Link State. The "Active" link state status can be observed under the Status section in the Config > Set screen, and the Link State LED should be green.
5. Select the stream from the stream profile table to open the [Traffic Stream Profile](#) dialog box, from which the stream parameters need to be configured.

Traffic Stream Profile #1

Stream ID #1

☐ WWN SRC ADDRESS ee-ee-ee-ee-ee-ee-ee-ee

☐ WWN DEST ADDRESS ff-ff-ff-ff-ff-ff-ff-ff

Class of Service — 3

☐ Frame Length — 68

☐ Rate — 20.00 %

☐ Payload — PRBS 31

☐ SOF — SOFi3 ☐ EOF — EOFn

Push Button to Edit

R_CTL: 00	D_ID: 00 00 01	
CS_CTL: 05	S_ID: 01 00 01	
TYPE: 01	F_CTL: 29 00 00	
SEQ_ID: 00	DF_CTL: 00	SEQ_CNT: 00 00
OX_ID: 00 19		RX_ID: FF FF
PARM: 00 00 00 00		

Buffer To Buffer

☐ Credits — 56

7. Configure the desired **Data Rate**, **Frame Length**, and **Payload** test pattern.
8. Select the **Save All** button to save the entered test stream parameters, then select the **Exit** button.
9. The Status menu field will display the following
 - The Fabric Login status will display “Fabric: Not Logged in”
 - The Name Server Login status will display “Named Server: Not Logged in”
10. Select the On/Off button labelled **1** to the left of the stream to turn on stream traffic generation.
11. Fibre Channel verification statistics may now be observed.

Fabric and Name Server login procedure

(Specifically for Fibre Channel SAN testing)

This procedure demonstrates how to interconnect the NIC with a Fibre Channel SAN switch.

This procedure will establish a connection that requires a Fabric and Name Server login.

1. Verify the optical SFP/XFP module being used supports the selected Fibre Channel data rate, and the wavelength is compatible SAN equipment being tested.
2. Configure the Fibre Channel test interface.

 1G, 2G and 4G Fibre Channel rates are supported by the [Dual Enet tab](#).

 8G, 10G and 10G over OTU-2 Fibre Channel rates are supported by the [Packet tab](#).

3. Turn the TX Laser on and verify both transmit and receive optical power levels are within specification. Then interconnect the transmit and receive NIC test port interfaces with the SAN equipment.
4. The NIC test port and the SAN equipment should quickly establish a valid Link State. The "Active" link state status can be observed under the Status section in the Config > Set screen, and the Link State LED should be green.
5. Select the stream from the stream profile table to open the [Traffic Stream Profile](#) dialog box, from which the stream parameters need to be configured.

Traffic Stream Profile #1

Stream ID #1

☐ WWN SRC ADDRESS ee-ee-ee-ee-ee-ee-ee-e

☐ WWN DEST ADDRESS ff-ff-ff-ff-ff-ff-ff

Class of Service — 3

☐ Frame Length — 68

☐ Rate — 20.00 %

☐ Payload — PRBS 31

☐ SOF — SOFi3 ☐ EOF — EOFn

Push Button to Edit

R_CTL: 00	D_ID: 00 00 01
CS_CTL: 05	S_ID: 01 00 01
TYPE: 01	F_CTL: 29 00 00
SEQ_ID: 00	DF_CTL: 00
	SEQ_CNT: 00 00
OX_ID: 00 19	RX_ID: FF FF
PARM: 00 00 00 00	

Buffer To Buffer

☐ Credits — 56

7. Enter the correct **WWN Source and Destination addresses**, Destination ID (**D_ID**), and Source ID (**S_ID**) addresses. These will be network dependent.
8. Also, configure the correct Buffer to Buffer **Credits**, **Data Rate**, **Frame Length**, and **Payload** test pattern.
9. Select the **Save All** button to save the entered test stream parameters, then select the **Exit** button.
10. Verify the test stream is **TX** is set to **Off** before continuing. The required Fabric and Name Server login options are not available while the test stream is enabled.
11. Select the **Fabric Login** button to perform a Fabric Login.
 - The Fabric Login status will display “Waiting for Response” while it attempts to login to the SAN equipment
 - The Fabric Login status will display “Logged In” when the process completes
12. Select the **Name Server Login** button to perform a Name Server Login.
 - The Name Server Login status will display “Waiting for Response” while it attempts to login to the SAN equipment

- The Name Server Login status will display “Logged In” when the process completes
13. At this point the Fibre Channel test interface will have a valid Fabric and Name Server login with the SAN equipment, and the test stream can be enabled.
 14. Select the On/Off button labelled **1** to the left of the stream to turn on stream traffic generation.
 15. Fibre Channel verification statistics may now be observed.

Analyzing Fibre Channel Test Results

(Specifically for Fibre Channel SAN testing)

Error and Alarm activity and other frame statistics can be viewed using the various screens.

- The **Config > Set** screen has a **Count Statistics Table** that displays a summary view of transmitted and received Frame counts and Byte counts, as well as the transmitted and received bandwidth
- The [Results](#) screens display all error and alarm counts and history, as well as transmitted and received Frame statistics
- The [System > All Ether Ports](#) screen displays a summary view for all of the Ethernet and Fiber Channel test ports in the instrument (depending on the mode of the test port)
- The [System > All Test Status](#) screen displays a summary LED view for all of the protocol processors including all HDEnet ports in the instrument
- The status indicators and LEDs are displayed in the [LED Quick Status Area](#) and in the [Large LED](#) screen.

Timed Test - Using Acceptance Criteria

(Specifically for Fibre Channel SAN testing)

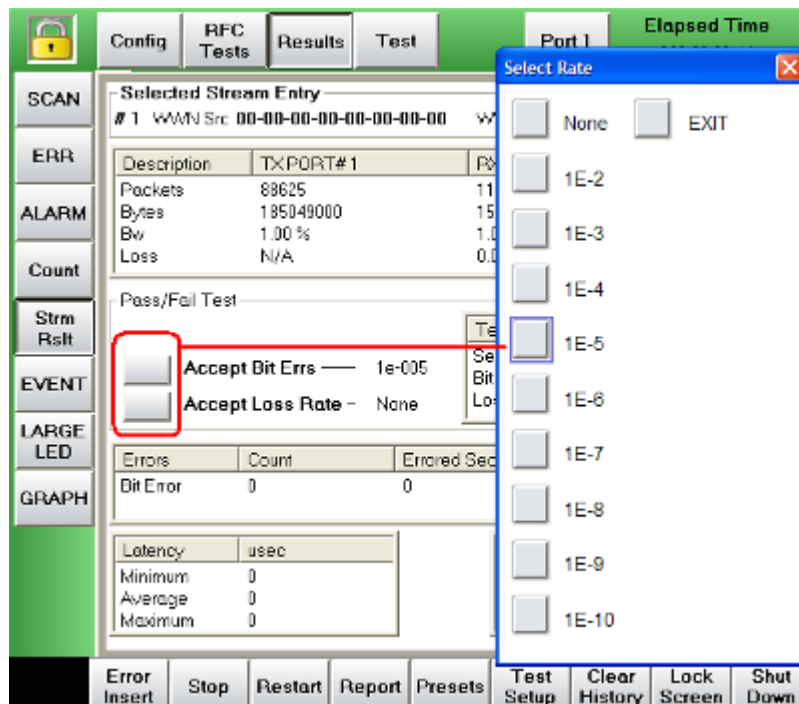
The NIC unit has the capability to run a timed test (a test with Fibre Channel enabled for a certain time period) specifying user-defined acceptance criteria for Pass/Fail results.

To Set Up the Test

1. Set up the Fibre Channel port on which the test will be initiated. This includes the Interface, stream parameters, etc.
2. Enable the test stream.
3. Under the **Results > Strm Rslt** tab, configure the [Pass/Fail Test](#) acceptance criteria options. These include **Acceptable Bit Error** rate, and **Acceptable Loss Rate**.
4. Under the **Test** tab, select the desired **Duration** for the test.

 If the "**Continuous**" duration is used, the test will continue to operate until the **Stop** button is pressed.

5. **Restart** the port that will be used for the timed test using the **Restart** button at the bottom of the screen.
6. When the time duration of the test is reached, the streams will automatically stop counting received packets and the **Pass/Fail** acceptance results are displayed under the **Results > Strm Rslt** tab.



User-Defined Acceptance Criteria:

- **Accept Bit Errors** - A user-specified threshold value for determining the acceptable bit error rate for a timed test.
- **Accept Loss Rate** - A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test.

Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

- Settings - (.set extension) Reports the Stream Settings for the selected Port .
- Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.
- Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.
- APS (.aps extension) Reports Service Disruption statistics.
- RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).
- RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

1. Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.
2. Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.
3. Choose one of the following:

- From Destination Printer:
 - ▶ Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.
- From Destination File:
 - ▶ Select one or multiple reports to print to a file. The File Browser dialog box appears.

 The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

- ▶ Enter a file name and select **OK**.

 **Important:** Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

- ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.
4. Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.
 5. Select **OK**.

GFP - Screen and Function Description

GFP Screen Functions and Descriptions Overview

This section describes the various screens and functions that control **GFP-Bulk**, **GFP-Framed** and **GFP-Transparent** configurations and operations:

- [Config](#)

- [Perf Tests](#) (RFC-2544 and Y.1564)
- [Results](#)
- [Test](#)
- [GFP LEDs](#)

Config

Config Screens and Functions

(Specifically for GFP Mappings)

The Config screen contains the following functions:

- [Set \(GFP-Bulk Fill\)](#)
- [Set \(GFP-F or GFP-T\)](#)
- [Traffic Stream Profile](#) (GFP-F or GFP-T)
- [Error Alarm](#)

Config - Set screen

(Specifically for GFP Mappings and GFP-Bulk Fill mode)

The Config > Set (Stream Control) screen allows you to define the GFP parameters that will be used to generate a traffic flow or stream into the network.

The following functions appear on the Config > Set screen when the GFP Mode is set to **GFP BULK FILL**:

Function	Description
Mode	Selects which GFP Mode to test. • GFP Bulk Fill • GFP Framed Ethernet

	GFP Transparent  Important: GFP-T is only available when the mapping or VCG data rate for SONET, SDH or OTN is equal to or greater than 1Gbps.
PFI	Allows the user to enable or disable the optional Payload FCS Identifier (pFCS) bytes. 0 = pFCS Off: When the pFCS (payload Frame Check Sequence) is turned off, then GFP frame does not utilize the 4 additional bytes after the payload for pFCS error analysis. 1 = pFCS On: When the pFCS (payload Frame Check Sequence) is turned on, then GFP frame does adds 4 additional bytes after the payload for pFCS error analysis.  The pFCS Error Type can only be inserted when pFCS is turned on.
EXI	Allows the user to enable or disable the Extension Header Identifier mode. 0 = Null Extension Header: Disables the Extension Header 1= Linear Frame: Enables and defines the Extension Header as Linear Extension Header  Important: The EXI mode has to be set for Linear for the CID setting to be enabled.
RX Pattern	Selects the type of pattern that the unit expects to receive on the incoming GFP frames. The payload can be set to: PRBS 31

	• User Defined (range from 1 bit to 32 bits and is entered using a touch screen keypad)
TX Pattern	Sets the type of data used for the transmit GFP payload. The payload can be set to: • PRBS 31 • User Defined (range from 1 bit to 32 bits and is entered using a touch screen keypad)
Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad, ranging from 60 to 9000. The default value is 64 bytes.
Rate	Sets the bandwidth percentage (from 0.01% to 100%) of the SONET, SDH or OTN mapping or VCG data rate.
CID	Sets the transmitted Channel ID value, ranging from 0 to 255, in the Extension Header. The default value is 0.  Important: The EXI mode has to be set for Linear for this setting to be enabled.
PTI	Payload Type Identifier  Important: This setting is internally managed by the circuit pack and is <u>not displayed</u> on the GUI. For all GFP modes this setting is set to 000.  See inserting LOCS and LOCCS alarms for their affect on the PTI.
UPI	Displays the User Payload Identifier value. (Read only) For Bulk mode this setting is set to 1111 1110 (0xFE) which is defined as Reserved for proprietary use, which in

	this case is labelled as an O.181 Test Signal.  See inserting LOCS and LOCCS alarms for their affect on the UPI.
Count Statistics Table	The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets: • Type - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX) • Packets - Displays the total number of packets sent and received since the test was started • Pkts/sec - Displays the current rate of packets sent and received in packets per second • Bytes - Displays the total number of bytes sent and received since the test was started • Mbit/sec - Displays the current rate of packets sent and received in Megabits per second • %BW - Displays the current percentage of bandwidth of packets sent and received

Config - Set screen

(Specifically for GFP Mappings and GFP-F or GFP-T modes)

The Config > Set (Stream Control) screen allows you to define the GFP parameters that will be used to generate a traffic flow or stream into the network. Up to four different streams can be generated simultaneous.

The following functions appear on the Config > Set screen when the GFP Mode is set to **GFP Framed Ethernet** or **GFP Transparent**:

Function	Description
Mode	Selects which GFP Mode to test. • GFP Bulk Fill • GFP Framed Ethernet • GFP Transparent  Important: GFP-T is only available when the mapping or VCG data rate for SONET, SDH or OTN is equal to or greater than 1Gbps.
PFI	Allows the user to enable or disable the optional Payload FCS Identifier (pFCS) bytes. 0 = pFCS Off: When the pFCS (payload Frame Check Sequence) is turned off, then GFP frame does not utilize the 4 additional bytes after the payload for pFCS error analysis. 1 = pFCS On: When the pFCS (payload Frame Check Sequence) is turned on, then GFP frame does adds 4 additional bytes after the payload for pFCS error analysis.  The pFCS Error Type can only be inserted when pFCS is turned on.

EXI	Allows the user to enable or disable the Extension Header Identifier mode. 0 = Null Extension Header: Disables the Extension Header 1= Linear Frame: Enables and defines the Extension Header as Linear Extension Header  Important: The EXI mode has to be set for Linear for the CID setting to be enabled.
CID	Sets the transmitted Channel ID value, ranging from 0 to 255, in the Extension Header. The default value is 0.  Important: The EXI mode has to be set for Linear for this setting to be enabled.
PTI	Payload Type Identifier For all GFP modes this setting is set to 000.  See inserting LOCS and LOCCS alarms for their affect on the PTI.
UPI	User Payload Identifier: For GFP Framed Ethernet mode this setting is set to 0000 0001 (0x01) which is defined as "Frame-Mapped Ethernet". For GFP Transparent mode this setting is set to 0000 0110 (0x06) which is defined as "Transparent Gb Ethernet".  See inserting LOCS and LOCCS alarms for their affect on the UPI.

Col (Columns)	Rearrange order of columns displayed in the Stream Profile Table
Reflect  Important: This setting is only supported in GFP-Transparent	Allows the user to start IP Packet Reflection Mode for DLI Packets or All Non-Routing Packets.
TX Mode	Starts and stops the transmission of ALL streams. The status of the stream transmission is displayed in the "TX" column of the Stream Profile table. Selecting TX Mode while all streams are "Off" will turn all streams "On". If at least one stream is "On", selecting TX Mode will turn all streams "Off".
Stream Profile Table	The Stream Profile Table contains four packet streams that can be configured. Selecting a stream from the profile table opens the Traffic Stream Profile dialog box from which the stream parameters are configured. A total of four streams can be configured and saved for each port. Use the horizontal scroll bar at the bottom of the table to view hidden columns for the stream settings.  See below for more information on the Stream Profile Table.

Count Statistics Table

The Count Statistics Table displays the following information for both transmitted (TX) and received (RX) packets:

- **TX/RX** - Defines which row of statistics is designated for Transmit counts (TX) and which row is designated for Receive counts (RX)
- **Packets** - Displays the total number of packets sent and received since the test was started
- **Pkts/sec** - Displays the current rate of packets sent and received in packets per second
- **Bytes** - Displays the total number of bytes sent and received since the test was started
- **Mbit/sec** - Displays the current rate of packets sent and received in Megabits per second
- **%BW** - Displays the current percentage of bandwidth of packets sent and received

Information about the configuration of the streams are displayed in the Stream Profile Table.

on/off	TX	%BW	MAC Dest	Payload	Length	VLAN ID	QOS
1	Off	25.00 %	00-00-00-00-00-00	PRBS	68	0	0
2	Off	25.00 %	00-00-00-00-00-00	PRBS	68	0	0
3	Off	25.00 %	00-00-00-00-00-00	PRBS	68	0	0
4	Off	25.00 %	00-00-00-00-00-00	PRBS	68	0	0

At the left, there are four (4) buttons to turn on and off each individual stream. The other columns of information can be seen by using the scroll bar at the bottom or by rearranging the columns. These are the columns (note that the sequence may be different, depending upon how the user has arranged the columns):

TX	Indicates whether that stream 1-4 is being transmitted
%BW	Percentage of bandwidth selected on that stream
MAC Dest	Destination MAC address
Payload	Payload Pattern selected
Length	Frame Length
VLAN ID	VLAN ID selected
VLAN QOS	VLAN QOS selected
IP Dest	Destination IP address
UDP Port Dest	UDP Destination Port
MAC Src	Source MAC address
IP Src	Source IP address
UDP Port Src	UDP Source Port
VLAN Tag	VLAN Tag (yes or no)
IP TOS	IP Type of Service
IP TTL	IP Time to Live
IP FRAG	Select whether to allow or disallow fragments

Traffic Stream Profile Configuration

(Specifically for GFP Mappings)

A packet stream's profile defines the type, size, content, destination address, and source addresses for the frame

The **Traffic Stream Profile** dialog box is used to set the stream profile parameters when the GFP mode is set to **GFP Framed Ethernet** or **GFP Transparent**. To access this dialog box, select any of the four streams in the Stream Profile Table.

 The stream protocol is set to UDP/IP by default.

Parameter	Description
Stream ID #	Displays which of the four Streams the settings are being modified for. Displays which of the four Streams the settings are being modified for.  The title bar of this Traffic Stream Profile window also shows which Stream ID # is currently selected
MAC Src Address	Sets a MAC source (origination) address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.

MAC Dest Address	Sets a MAC destination address for generated traffic. The address is a 12-digit (6-byte) HEX value that is entered using a keypad. The address is entered into 6 separate fields, 2 characters each. There are no restrictions on value entered but all a value must be entered in all fields.
IP Src Address	Sets the IP address of the source (origination). The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.
IP Dest Address	Sets the IP address of the destination. The address is entered in decimal notation using a keypad. There are no restrictions on value entered but the format must be correct, i.e: xxx.xxx.xxx.xxx. If three digits are entered in a field, a period will be automatically added. If only one or two digits are entered, you must enter a period manually.
UDP Src Port	Selects a User Data Protocol source port number (0 to 65535).
UDP Dest Port	Selects a User Data Protocol destination port number (0 to 65535). Note: Stream Counts are only displayed when UDP Dest Port is 312.

Frame Length	Sets the frame size (bytes). The frame size is entered as a decimal value, entered using a keypad, ranging from 64 to 9600. The default value is 64 bytes.
Rate	Sets the bandwidth percentage used. The value can be set using a bandwidth percent or Mbit/sec. Valid values are: • The %Bandwidth range is from 0.01% to 100% • For GFP-F, the Mbit/sec range is dependant on the mapping or VCG data rate for SONET, SDH or OTN • For GFP-T, the Mbit/sec range is from 0.1 to 1000 Mbps.  If the word "Pending" is shown, then the Mbit/Sec option will not be available until at least on stream is turned on, so that GFP can calculate the proper constraints for the data rate.
Payload	Sets the type of data used for the transmit stream's payload. The payload can be set to: • PRBS 31 • PRBS 31 Inv • User Defined (range from 1 bit to 32 bits and is entered using a touch screen keypad)
VLAN Tag	Enables VLAN tagging for the frame. The VLAN tag is a 4-byte tag that is inserted into the frame.

VLAN ID	Assigns a VLAN ID to the frame. This identifies to which VLAN the frame belongs. IDs are entered as a decimal value from 0 to 4095. (VLAN tagging must be enabled to use this parameter.)
VLAN QOS	Sets the user priority level. Levels range from 0 to 7.
IP TOS	Sets the IP Type of Service. TOS is a 2-character HEX value.
IP TTL	IP Time to Live. TTL is a decimal value from 0 to 255.
IP Fragment Flag	Select whether to allow or disallow fragments
Prev	Moves to the stream with the next lower number. If currently looking at stream #1, selecting "Prev" will bring up stream #4. Note that changes made will not be saved until "Save All" is selected.
Next	Moves to the stream with the next higher number. If currently looking at stream #4, selecting "Next" will bring up stream #1. Note that changes made will not be saved until "Save All" is selected.
Save All	Saves all changes made and closes the Traffic Stream Profile window.
Exit	Closes the Traffic Stream Profile window without saving changes.

Config - Errors and Alarms

(Specifically for GFP Mappings)

The Error and Alarm screen allows the user to configure errors and alarms for insertion into a stream to simulate various defects and anomalies. Simulating defects can determine if the receiving equipment can detect and report an error in the incoming signal.



Note that error insertion is disabled when in IP Reflection Mode.

Option	Description
Error Type	Selects the type of error to transmit into a stream. Selecting one of the following will not send an error immediately but will only select the type of error to send when the “Send Error” button is pressed or when a rate is selected. The following types are available: • Bit Error (Stream #n) - Generates bit errors in the payload for the specified stream number. • Sequence Error (Stream #n) - Generates Sequence errors in the payload for the specified stream number. • Corr cHec - Generates a Correctable Core Header Error Control, which is a CRC-16 error • Uncorr cHec - Generates a Uncorrectable Core Header Error Control, which is a CRC-16 error • Corr tHec - Generates a Correctable Type Header Error Control, which is a CRC-16 error

	• Uncorr tHec - Generates a Uncorrectable Type Header Error Control, which is a CRC-16 error • Corr eHec - Generates a Correctable Extension Header Error Control, which is a CRC-16 error • Uncorr eHec - Generates a Uncorrectable Extension Header Error Control, which is a CRC-16 error • pFCS - Generates an invalid payload Frame Check Sequence error • IP Checksum - Generates an invalid IP header checksum • Line Code - Generates line code errors
Error Rate	Selects the error rate to be transmitted for the selected error type. Once the error rate is selected, the system begins transmitting errors. Select one of the following: • 1E-<x> - X is an exponential value from 2 to 10. Selecting one of these sets the error rate to 1×10^{-x} (The smaller the exponential the higher the error rate.) • User Defined – Enter the desired error rate in increments of 0.1. For example, with user defined, error rates are not limited to 1×10^{-x} but more exact choices are available such as 2.6×10^{-4} or 7.1×10^{-3}

Alarm Generated	Selects an alarm to be transmitted. Once selected the system begins sending the alarm condition. Select one of the following: • None - Turns alarm generation off. • LFD - Generates a constant Loss of Frame Delineation alarm. • LOCS - Generates a constant Loss of Client Signal alarm. (sets the PTI to 100 and UPI to 0000 0001) • LOCCS - Generates a constant Loss of Client Character Synchronization alarm. (sets the PTI to 100 and the UPI to 0000 0010)

Perf Test

Perf Test - Conf (Test Button)

The Performance Test screen allows you test either RFC-2544 or ITU-T Y.1564.

The **Test** button located on the Conf side tab will toggle between the two testing modes.

- Use this section to test [RFC-2544](#)
- Use this section to test [Y.1564 \(Ethernet service tests\)](#)

RFC 2544

RFC 2544 Tests - Screen Functions and Descriptions Overview

The RFC 2544 Tests screen contains the following functions:

- [Conf](#)
- [Thru Put](#)
- [Frame Loss](#)

- [B2B Burst](#)
- Graph



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Configuration (Conf)

RFC testing provides a specific set of tests that can be used to measure and report the performance characteristics of network devices. The RFC Tests Conf screen provides the preliminary stream configuration settings. After these settings are made the user selects the type of RFC test to initiate by choosing its tab along the left side of the RFC Tests screen.

The following options appear on the Conf screen:

Option	Description
Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544, it will not appear in the Select Port window.

Trial Duration	Determines how long the test runs for each packet size. This duration is used each time the test fails. Valid duration values are 1-86400 seconds. The default value is 60 seconds.
Stream ID	Allows the user to select one of the four streams for the RFC test.
Dest MAC Address	Reflects the destination MAC address for the selected Stream.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.  For Fibre Channel rates, this is the WWN Dest Address.
Restore to RFC Standard Setting	Returns frame sizes to default RFC test standards when user-defined sizes have been set.
Enable/Disable check boxes	Allows the user to select the packet sizes that will be used for the RFC tests.
Packet Sizes	Displays the packet sizes. Selecting a Packet Size button allows the user to assign a user-defined frame size to the packet. Valid value ranges are 64 - 16000.
BW Ceiling	Sets the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.
BW Floor	Sets the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.  IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

Automated Test Sequence	The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes. • Thruput/Latency checkbox and status field • Frame Loss checkbox and status field • B2B Burst checkbox and status field • Start/Stop Button • Test Status field

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Through Put Test (Thru Put)

This is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

The following options appear on the Thru Put screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.

Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.
Accept Lost Rate	Sets a packet loss rate threshold. The test fails if packet loss exceeds this value. Valid values are 0-100%. The default is 0%, which means that even one lost packet is a failure.
Resolution Rate	Sets a level of precision for the test. The default resolution is 1%. The finer the resolution (for example, 1%), the longer it takes to complete the test; the less precise the test (for example, 10%), the faster the test completes but with less accuracy.

Statistics Table	Reports the test results. The following statistics are displayed: Size - Indicates the transmitted test packet size. Rate - Reports the passing rate (percentage) for the specific packet size. TX Packets - Reports the number of packets transmitted in the stream for the frame. RX Packets - Reports the number of packets received by the test set. Latency Min/Max/Avg - Reports how long it takes for the test frames to traverse the network and return to the unit. The values that appear are in milliseconds.  If the test set is looped to itself with a short patch cable, the latency may appear as 0 ms.
Start/Stop Test	Starts and stops the Through Put test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Frame Loss Test

This is an RFC 2544 benchmark test. Its purpose is to determine the number of frames lost by looping a stream (with a specified frame size) through the network at varying transmit frame rates. Select [Frame Loss Testing](#) for test procedures.

The following options appear on the Frame Loss screen:

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.
BW Ceiling	Displays the setting for the high-end of the bandwidth test range.  The BW Ceiling is configured from the RFC Tests - Conf screen.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.
BW Floor	Displays the setting for the low-end of the bandwidth test range.  The BW Floor is configured from the RFC Tests - Conf screen.

Packet Size buttons	Determines which packet size results appear in the statistics table. Selecting a packet size button displays its results.
Statistics Table	Displays the frame loss test results for a specified packet size. The results display the nine rates determined by the BW Ceiling and BW Floor settings. The following statistics are displayed: Rate % - Indicates the percentage of bandwidth transmitted using the bandwidth ceiling and floor settings. Transmit Frames - Reports the total number of frames transmitted. Receive Frames - Reports the total number of frames received. Loss % - Reports the percentage of frame loss that occurred during the test. This calculation is the received frames divided by transmitted frames.
First, Prev, Next, Last	Allows the user to scroll through packet sizes to view their test results.
Start/Stop Test	Starts and stops the Frame Loss test. The button toggles between Start (when a test is not running) and Stop (when a test is running).



The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC Tests - Back-To-Back Burst Test (B2B Burst)

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

Option	Description
Stream ID	Displays the ID number of the stream that will be used for the RFC test.  The Stream ID is configured from the RFC Tests - Conf screen.
Trial Duration	Displays how long the test will run for each packet size. This duration is used each time the test fails.  The Trial Duration is configured from the RFC Tests - Conf screen.  Important: The trial duration must be between 2 and 10 seconds.
Dest MAC Address	Displays the destination MAC address of the device that will receive the RFC test.  The Dest MAC Address is configured for the selected Stream ID from the Traffic Stream Profile on the Conf screen.
Dest Port	Displays the destination port that will receive the test signal.  The Dest Port is configured from the RFC Tests - Conf screen.

Resolution (in frame:)	Sets the level of precision for the B2B test, by frames. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames. Valid values are 1-812.
# Of Repetitions	Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50, however valid values are 1-100.
Statistics Table	Reports the test results. The system recovery results are displayed by Frame Size (bytes) tested as follows: • Max Possible Number of Frames - The frame rate (resolution) used as the throughput rate. • Avg Observed B2B Frames - Average frame count for each type of data stream tested.
Start/Stop Test	Starts and stops the Back-to-Back Burst test. The button toggles between Start (when a test is not running) and Stop (when a test is running).

 **Important:** The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

 The following list of tasks demonstrate how to configure and test each of the RFC-2544 benchmark tests.

- To **Configure the RFC-2544 test** settings see [What are RFC 2544 Tests?](#)
- To run an **RFC-2544 Thru Put** test see [Throughput Testing](#)
- To run an **RFC-2544 Frame Loss** test see [Frame Loss Testing](#)
- To run an **RFC-2544 B2B Burst** test see [Back-to-Back Burst Testing](#)

Y.1564 Test

Y.1564 Test - Screen Functions and Descriptions Overview

The [Y.1564](#) Tests screen contains the following functions:

- [Conf](#)
- [Test](#)
- [Results](#)



The following link demonstrates how to configure and test Y.1564.

[Y.1564 Service Configuration and Testing](#)

Y.1564 Test - Configuration (Conf)

Y.1564 is an out of-service test methodology created so that service providers may have a standard way of measuring the performance of Ethernet-based services. The Conf screen provides the preliminary Service configuration settings. After these settings are made the user selects the type of Y.1564 test to initiate by selecting the check boxes under Automated Test Sequence and pressing Start.

The following options appear on the Conf screen:

Option	Description
Test	Allows the user to switch between RFC-2544 and Y.1564 Performance Standard Tests.  If this button is disabled, then only the selected Performance Standard Test is currently available.
Dest Port	Allows the user to select the destination port that will receive the test signals.  If a port is in IP Reflection Mode, or is already in an active Y.1564 or RFC-2544 test, it will not appear in the Select Port window.
Trial Duration	Determines how long the Configuration Ramp test runs for each selected Ramp/Burst Step.

	① “Trial Duration” refers to Configuration test duration, and “Perf Dur” refers to Performance test duration ① The default value of 60 seconds, is the maximum duration specified in the Y.1564 test standard. "The duration for each step size SHOULD be configurable from at least 1 second up to 60 seconds".		
Restore to Default	Returns the Ramp/Burst Step settings to their default %CIR rates when user-defined rates have been set, and unselects all selected checkboxes, and resets the Trial and Performance Durations back to their default values. Any user-define Service Names which were edited from the Test side tab are also restored back to their default names.		
Perf Dur	Determines how long the Performance test runs for each selected Service. ① “Perf Dur” refers to Performance test duration, and “Trial Duration” refers to Configuration test duration ① The Y.1564 test standard calls for test durations of 15 minute, 2 hour, and 24 hour intervals. "For example, an operator MAY test services for 15 minutes if the services are provided over a network already carrying working traffic in a metro application. 2 hour Performance test durations MAY be used for services running over a single operator long-haul network. Finally, a 24 hour Performance test durations MAY be used for services which are being carried internationally over multiple operator networks".		
Service On/Off	Allows the user to select one of the ten Services that will be used for the Y.1564 test. ① Each of the Service's Configuration Test settings can be edited in the Test side tab. ① Each Service selected to be tested should be configured for an increasing number of Frame Lengths, as shown in Table 1. <table border="1"> <thead> <tr> <th>Service #</th><th>Frame Size (bytes)</th></tr> </thead> </table>	Service #	Frame Size (bytes)
Service #	Frame Size (bytes)		

Service 01	64
Service 02	128
Service 03	256
Service 04	512
Service 05	1024
Service 06	1280
Service 07	1518
Service 08	MTU
Service 09	<i>User Defined</i>
Service 10	<i>User Defined</i>

Table 1 – Recommended Frame Sizes/Lengths for each Service Number

Ramp/Burst Steps

The Ramp/Burst Steps section is used to do the following:

- Selects which Steps to test during the Ramp and Burst Configuration tests.
- Allows the user to configure Steps 1 through 5 with a user-defined value for each of the %CIR Steps selected to be tested.
- When selected, Step 6 tests 100% of the CIR% setting, as configured on the Test side tab.
- When selected, Step 7 exceeds the CIR, by adding Excess Information Rate (EIR), as configured on the Test side tab.

 Each Step tests a gradually increasing percentage of the maximum Committed Information Rate (CIR%) bandwidth, as configured on the Test side tab screen for the selected Service.

 The Config Ramp test was designed to gradually reach and then exceed the maximum CIR% by testing all 7 Steps (at their default CIR% values), for each selected Service.



For example, with the [CIR](#) and the Step sizes configured for default values, the CIR is configured for 5% bandwidth, Step 1 is configured for 10% of the CIR, and Step 2 is configured 30% of the CIR, etc. Thus, Step 1 will test at 0.50% bandwidth, which is 10% of 5%. Likewise, Step 2 will test at 1.50% bandwidth, which is 30% of 5%, and so on. Step 6 (CIR) will test at the full 5% bandwidth. And Step 7 (CIR+EIR) will test at whatever the CIR+EIR bandwidth is configured for on the Test side tab, where the [EIR](#) is difference between CIR and the CIR+EIR value.

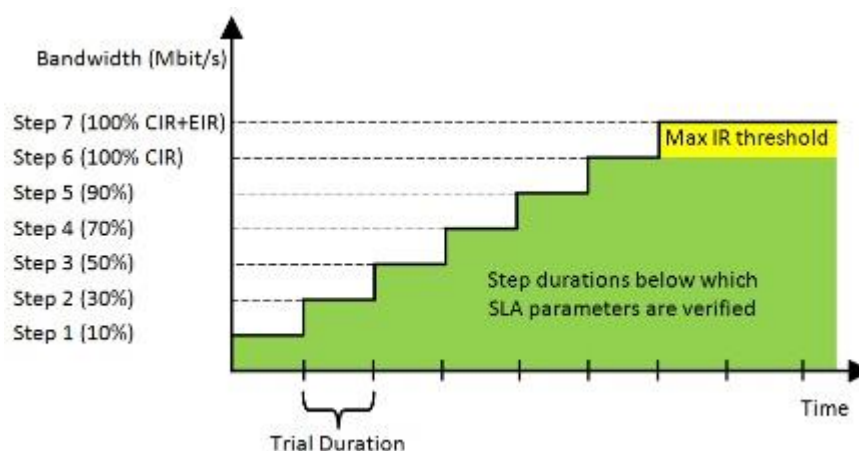


Figure 1 – Step load (Ramp) test used in the service configuration test



Per the Y.1564 test standard, as the performance limits are only used for service acceptance when Ethernet traffic is below or equal to the CIR (green traffic in Figure 1), the performance parameters will not be judged against the limits above the CIR. The next step of the service configuration test is to validate the total information rate of the service (CIR+EIR).

Automated Test Sequence

The following parameters allow the user to configure and test each of the RFC tests, so that one will run after the previous test completes.

- Config Ramp checkbox and status field
- Config Burst checkbox and status field (***This test is currently unavailable***)
- Perf checkbox and status field

	• Start/Stop Button • Test Status field  Select one or more of the test options under the Automated Test Sequence section. At least one test must be selected.  The Config Ramp checkbox selects the Y.1564 Configuration test  The Perf checkbox selects the Y.1564 Performance test  Select the Start button to begin the selected tests. The selected tests will now start and their real-time status will be displayed in the Test Status field next to the Start/Stop button.

Results

Results Screens and Functions

(Specifically for GFP Mappings)

Test activity and event history can be viewed using the various functions of the Results screen.

The Results screen contains the following functions:

- [Scan](#) - Displays a list of errors and alarms along with their count and duration.
- [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
- [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
- [Count](#) - Displays Packet and VLAN count statistics.
- [Strm Rslt](#) - Displays Stream ID specific statistics.
- [Event](#) - Displays a summary of error alarm activity.
- [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

Results - Scan Screen

(Specifically for GFP Mappings)

This function displays a list of received errors and alarms.

For **alarms**, the duration is reported as a count in seconds.

For **errors**, an error count is reported.

The message *No Errors or Alarms* appears if no events are received by the system.

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

Results - ERR (Errors) Screen

(Specifically for GFP Mappings)

The Err screen reports error statistics on the incoming signal.

The following statistics appear:

Statistic	Description
Error	Displays the error type recognized and recorded by the unit.
Count	Displays the number of errors.
Errored Seconds	Displays the number of errored seconds.
Average	Displays the average error rate using an N.NNe-N format.
Current	Displays the current error rate using an N.NNe-N format.

The following error types can be monitored:

- **Undersized**
- **Invalid FCS**

- Invalid IP
- Stream #1 Seq
- Stream #1 Bit
- Stream #2 Seq
- Stream #2 Bit
- Stream #3 Seq
- Stream #3 Bit
- Stream #4 Seq
- Stream #4 Bit
- Runts
- Corr cHEC
- Uncorr cHEC
- Corr tHEC
- Uncorr tHEC
- Corr eHEC
- Uncorr eHEC
- Invalid Superblock (GFP-T mode only)
- Superblock FCS (GFP-T mode only)
- payload FCS

Results - Alarm Screen

(Specifically for GFP Mappings)

The Alarm screen reports the various alarms detected by the receiving equipment.

The following statistics appear:

Statistic	Description
Alarm Description	Displays the alarm type recognized and recorded by the unit.

Seconds	Displays the number of seconds the alarm spent in the alarm condition.

The following alarm types can be monitored:

- **CP Power Loss**
- **Paused**
- **Stream #1 Pat Sync**
- **Stream #2 Pat Sync**
- **Stream #3 Pat Sync**
- **Stream #4 Pat Sync**
- **LFD**
- **LOCS**
- **LOCCS**

Results - Count Screen

(Specifically for GFP Mappings)

The Count screen displays Packets, VLAN, and Packet Size statistics by type and count.

To view packet results, select the **Packets** button. The following statistics appear:

Packets	Description
Transmit Packets	Reports the total number of packets sent.
Received Packets	Reports the total number of packets received.
Received Jumbo Packets	Reports the total number of jumbo packets received. Jumbo packets are those from 1519 – 9600 bytes in size.

Transmit Bytes	Reports the total number of bytes sent.
Received Bytes	Reports the total number of bytes received.
IP Packets	Internet Protocol. Reports the total number of IP packets received.
ICMP Packets	Internet Control Message Protocol. Reports the total number of ICMP packets received.
TCP Packets	Reports the total number of TCP packets received.
UDP Packets	User Data Protocol. Reports the total number of UDP packets received.
IGMP Packets	Internet Group Management Protocol. Reports the total number of IGMP packets received.
TX Super Blocks	Reports the total number of 64B/65B coded Super Blocks transmitted.  GFP-T mode only
RX Super Blocks	Reports the total number of 64B/65B coded Super Blocks received.  GFP-T mode only

To view VLAN results, select the **VLAN** button. The following statistics appear:

VLAN	Description
VLAN Tagged Frames	Reports the total number of frames received that are identified as VLAN frames.

	The 4-byte VLAN tag is inserted in the Ethernet frame between the Source MAC Address field and the Length/Type field.
Quality of Service Entry	Displays separate data rows for QOS entries 1-7. Reports the number of frames received for each user priority level value. A total of 8 different counters appear in the table.

To view Packet Size results, select the **Packet Sizes** button. The following statistics appear:

Packet Sizes	Description
Packet Byte Size  Only displayed when GFP is configured for Transparent mode.	Reports the count and percentage of each packet size range found: 64; 65-127; 128-255; 256-511; 512-1023; 1024-1518; 1519-Max (Jumbo Packets).

Results - Strm Rslt (Stream Results) Screen

(Specifically for GFP Mappings)

The Stream Results screen displays statistics for a specified incoming packet stream. The screen allows you to scroll through the different packet streams and view their individual results.

The following statistics appear:

Statistic	Description
Selected Stream Entry	Displays the stream ID number and its MAC source and MAC destination addresses to which the Total Stream Statistics data on the stream control screen belongs.
Total Stream Statistics Table	Provides transmit and receive statistics by Count and %BW.

	- Count - Displays the total number for the criteria. %BW - Displays the total percent of bandwidth used by the stream.
Transmit Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: - Packets Transmitted - Bytes Transmitted %BW Transmitted
Receive Statistics	Provides statistic totals, by count and/or percent of bandwidth, for the following criteria: - Packets Received - Bytes Received %BW Received - Out of Sequence Packets - Each sent packet is marked with a sequence number. This count is incremented when a packet arrives that has a sequence number different than one plus the sequence number of the previous packet. - Bit Errors Received
Latency Values (in microseconds)	Displays minimum, average, and maximum latency (delay) values over time. A latency measurement is taken every quarter-second (0.25 sec.) during stream transmission. These values are updated

	(realtime) as new latency measurements are logged.  If the unit is looped on itself, the latency may appear as 0 μs.
User-Defined Acceptance Criteria (Refer to "Timed Test Using Acceptance Criteria")	Accept Loss Rate: A user-specified threshold value for determining the acceptable Packet Loss rate for a timed test. Test results are displayed as the calculated loss rate and a Pass/Fail status. Accept Out of Seq: A user-specified threshold value for determining the acceptable Out of Sequence packet rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status. Accept Bit Error: A user-specified threshold value for determining the acceptable bit error rate for a timed test. Test results are displayed as an error count, rate, and Pass/Fail status.
First, Prev, Next, Last	Allows the user to scroll through the four packet streams and view their individual results. Selecting First immediately moves the stream statistics to Stream 1; selecting Last immediately moves the stream statistics to Stream 4; selecting Prev or Next moves the stream statistics to/from one stream to the next.

Results - Event Screen

(Specifically for GFP Mappings)

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Large LEDs Screen

(Specifically for GFP Mappings)

This button displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs for GFP, see [GFP LEDs](#).

Test

Test - Screens and Functions

The Test screen configures test parameters associated with a protocol processor.

The Test screen contains the following functions:

- [Set 1](#)
- [Service Disruption](#)

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

- **Duration**: This function configures how long a timed test runs for.
- **Action After Duration**: This function defines what activities occur at the conclusion of a timed test
- **Pause Test/Resume Test**: This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test - Service Disruption

(Specifically for LAN/WAN Ethernet testing)

The unit can measure Service Disruption switching intervals in your network. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path.

When enabled, the trigger event to begin service disruption measurements occurs when it stops detecting incoming packets.



The MSA module's Packet processor tab and Dual Enet processor tab also triggers on incoming packets with CRC/FCS errors.

The duration for every Ethernet service disruption event is measured in milliseconds, with granular accuracy of .1 ms (100 μ s).

When the Action state is configured for Continuous APS, the 10 most recent measurements are displayed in the History window. Also the Minimum and Maximum measurement times are logged, as well as an Average duration based on all measurements taken since the test began.

Test Service Disruption functions include:

- **Resolution:** When testing Service Disruption measurements on lower rate Ethernet bandwidths (≤ 1 Gbps), this setting is used to ensure that at least one Ethernet packet is received within the configured period of time (measurement window). The following options are available:

▶ High (.1 ms)

▶ Medium (1 ms)

▶ Low (10 ms)



When receiving fewer packets per second (lower bandwidths), a lower resolution setting (larger window of time) is required.



Important: This setting is only displayed on ports that support Ethernet rates ≤ 1 Gbps.

- **Consecutive Good Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating. The range is 10 to 1638.3 milliseconds and is entered using a keypad.
- **Consecutive Bad Time Required:** This function allows you to enter the time-duration (in milliseconds) of consecutive errored frames to elapse before Protection Switch measurements begin to accumulate. The range is 0.1 to 1638.3 milliseconds and is entered using a keypad.
- **Action (State):** Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:
 - ▶ **Single APS:** Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
 - ▶ **Continuous APS:** Constantly monitors for service disruption events, and updates the seconds and frames reported.
 - ▶ **Stop APS:** Stops service disruption monitoring. The State returns to Inactive.

- **Protection Switch Time (MilliSecs):** Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.
- **History Recent Milliseconds:** The 10 most recent measurements are displayed from left to right (5 on the top line and 5).



A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For more information about monitoring service disruption activity, select [Measuring Service Disruption Activity](#) in the Specific Tasks section of the online help.

LED Quick Status Area

(Specifically for GFP Mappings)

When the **Packet** tab is selected for a GFP payload, the following status indicators and LEDs may appear in the **LED Quick Status Area** and the [Large LED](#) screen, depending on the selected GFP mode.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

- If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.
- If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.
- If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

Indicator, LED or Control	Description
TX:	Displays the maximum transmit data-rate for 100% TX bandwidth, based on the mapping or VCG for the SONET, SDH or OTN Interface.
RX:	Displays the maximum receive data-rate for 100% RX bandwidth, based on the mapping or VCG for the SONET, SDH or OTN Interface.

E/A	Error/Alarm Indicator. Indicates the type of error inserted and/or alarm generated.
Test Paused	If red, indicates that the current test has been paused .
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
LFD	Loss of Frame Delineation alarm status LED
LOCS	Loss of Client Signal alarm status LED  Indicates the received PTI value is 100, and the UPI value is 0000 0001.
LOCCS	Loss of Client Character Synchronization alarm status LED  Indicates the received PTI value is 100, and the UPI value is 0000 0010.
cHEC	Core-Header Error Check error status LED  Indicates that one or more Correctable or Uncorrectable cHEC errors were detected.
eHEC	Extension-Header Error Check error status LED  Indicates that one or more Correctable or Uncorrectable eHEC errors were detected.
tHEC	Type-Header Error Check error status LED  Indicates that one or more Correctable or Uncorrectable tHEC errors were detected.
pFCS	Payload-Frame Check Sequence error status LED
sFCS	Superblock-Frame Check Sequence error status LED  GFP-T mode only

FCS	Frame Check Sequence error status LED
PAT SYNC	Pattern Synchronization alarm status LED  Indicates a loss of pattern synchronization in at least one of the 4 streams. This is an alarm LED.
BIT ERR	Bit error status LED  Indicates a detected BIT error in at least one of the 4 streams.
SEQ ERR	Sequence error status LED  Indicates a sequence error detected in at least one of the 4 streams.

GFP - Specific Tasks

GFP (Generic Frame Protocol) Specific Tasks Overview

This section includes tasks that are specific to GFP payloads for OTN and SONET/SDH mappings (including VCAT).

For a description of specific screens and their functionality, refer to [GFP Screen Functions and Descriptions Overview](#).

For a list of general tasks, see [Common Tasks](#) located in the Getting Started section.

Please use the **Contents** tab and window (left side of the Help screen) to select, open, and view Specific Tasks for this protocol processor.

- [Configuring GFP Packet Streams](#)
- [Transmitting GFP Packet Streams](#)
- [Inserting GFP Errors and Alarms](#)
- [Viewing GFP Error and Alarm Results](#)
- [GFP payloads for SONET mappings \(including VCAT\)](#)

- [GFP payloads for SDH mappings \(including VCAT\)](#)
- [GFP mapping for OTU-1 and OTU-2 OTN interfaces](#)

Configuring GFP Packet Streams

(Specifically for GFP Mappings and GFP-F or GFP-T modes)

The [Config > Set \(Stream Control\)](#) screen provides the tools required to configure or edit any or all of the four packet streams.

To configure a packet stream:

1. Select the **Packet** tab, select either **GFP Framed Ethernet** or **GFP Transparent** mode. *(After configuring the GFP payload setting from the SONET/SDH tab, or GFP mapping from the OTN tab)*
2. Select **Config** and choose **Set**.
3. Select a stream (1, 2, 3, or 4) from the Stream Profile table. The Traffic Stream Profile table appears.
4. From the [Traffic Stream Profile](#) table, set the parameters for the packet stream.
5. Select **Save**. The stream configuration parameters display in the Stream Profile table.



Use the vertical scroll bar at the bottom of the Stream Profile table to view hidden columns.

To use the **Order Columns** feature :

1. Select the **Columns** button, to display the **Rearrange Columns** dialog box.
2. In the **Rearrange Columns** dialog box, select the **Columns** button to display the **Select Next Column** dialog box.
3. In the **Select Next Column** dialog box, select a button for the associated description to appear in the top row of the display. The **Select Next Column** dialog box disappears and your selection appears in the top row of **Rearrange Columns** dialog box display window.
4. Again, in the **Rearrange Columns** dialog box, select the **Columns** button to redisplay the **Select Next Column** dialog box.

5. In the **Select Next Column** dialog box, select another button for the associated description to appear in order immediately following the previous row entry. The **Select Next Column** dialog box again disappears.
6. Repeat Steps 4 and 5 to select the chosen order for all remaining entries in the **Select Next Column** dialog box.
7. There are two choices for submitting the selected column display order: (1) Selecting the **Apply** button retains the column display order settings until the next time the unit's power is cycled; (2) Selecting the **Save** button retains the column display order settings indefinitely.



The **Columns** settings entered locally on the touch screen panel and those entered via a remote connection are completely independent of each other. The remote settings are saved on the remotely connected PC, while the local settings are saved in the unit. The **Clear** button can be used to clear the entries in the **Rearrange Columns** dialog box display window, should you want to rearrange the existing order in the display window. The **Cancel** button can be used to cancel out of the operation without changing the existing column display order. Clicking on the **Apply** button when no items are listed in the display window will set up the default columns display order.

Transmitting GFP Packet Streams

(Specifically for GFP Mappings and GFP-F or GFP-T modes)

The [Config > Set \(Stream Control\)](#) screen provides the tools required to configure or edit any or all of the four packet streams.

To start transmission of all packet streams:

1. Select the **Packet** tab, select either **GFP Framed Ethernet** or **GFP Transparent** mode. *(After configuring the GFP payload setting from the SONET/SDH tab, or GFP mapping from the OTN tab)*
2. Select **Config** and choose **Set**.
3. Select **Tx Mode** to turn all streams On or Off.

 Important: "Tx Mode" and individual stream TX on/off buttons are not available when IP Reflection is enabled.

4. The stream transmission status displays in the TX State column of the [Stream Profile table](#).
5. Packets begin or stop transmitting as soon as the Tx Mode is selected. Count statistics continually increment in the Count Statistics table while the streams are active.

To start transmission of specific packet streams:

1. Select the **Packet** tab, select either **GFP Framed Ethernet** or **GFP Transparent** mode.
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to transmit. The Traffic Stream Profile dialog box appears.
4. From the Traffic Stream Profile dialog box, select **TX Enable** to turn the stream On or Off.
5. Select **Save**. The Traffic Stream Profile dialog box closes and the stream transmission status displays in the TX State column of the Stream Profile table.
6. The packet begins or stops transmitting as soon as the TX Enable command is saved. Count statistics continually increment in the [Count Statistics](#) table while the stream is active.

Inserting GFP Errors and Alarms

(Specifically for GFP Mappings)

To determine if receiving equipment can detect an error on an incoming signal, you can configure the system to insert specific errors and alarms into an Ethernet stream.

To insert multiple errors:

1. Select the **Packet** tab, select either **GFP Bulk**, **GFP Framed Ethernet** or **GFP Transparent** mode. *(After configuring the GFP payload setting from the SONET/SDH tab, or GFP mapping from the OTN tab)*
2. Select **Config** and choose **Set**.
3. From the **Stream Profile** table, select the packet stream (**1**, **2**, **3**, or **4**) that you want to inject errors into. The Traffic Stream Profile dialog box appears.

4. Select **TX Enable** to turn the transmission status **On** and choose **Save**.
5. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
6. Select [Error Type](#) and choose an error type from the Select Error Type dialog box.
7. Select [Error Rate](#) and choose an error rate from the Select Error Rate to Insert dialog box.
8. Errors immediately start injecting into the packet stream when the error rate is selected.
9. View various result statistics by selecting the [Results](#) function.

To stop error transmission select **Error Rate** and choose **Off**.

To insert a single error:

1. Select the **Packet** tab, select either **GFP Bulk**, **GFP Framed Ethernet** or **GFP Transparent** mode.

 Important: Traffic generation on at least one stream must be enabled to inject errors.

2. Select **Error / Alarm** from the tabs along the left side of the Config Screen.
3. Select [Error Type](#) and choose an error type from the Select Error Type dialog box.

 Important: DO NOT set an Error Rate when inserting a single error.

4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. Select the **Error Insert** common function button at the bottom of the screen.
6. View various result statistics by selecting the [Results](#) function.

To insert an Alarm:

1. Select the **Packet** tab, select either **GFP Bulk**, **GFP Framed Ethernet** or **GFP Transparent** mode.

 Important: Traffic generation on at least one stream must be enabled to inject errors.

2. Select **Error Alarm** from the tabs along the left side of the Config Screen.
3. Select [Alarm Generated](#) and choose an alarm type from the Select Alarm dialog box.

 Important: Once an alarm is selected, then alarm will continuously insert until turned off.

4. If you want to clear any previously collected data, select **Restart** from the common function button at the bottom of the screen before inserting the error.
5. View various result statistics by selecting the [Results](#) function.

Viewing GFP Error and Alarm Results

(Specifically for GFP Mappings)

After [inserting error and alarms](#) into a packet stream the receiving equipment detects the event and reports it. The Results screen provides different result reports.

To view error or alarm results:

1. From the **Packet** tab, select **Results**.
2. Select one of the following:
 - [Scan](#) - Displays a list of errors and alarms along with their count and duration.
 - [ERR](#) - Displays a list of errors along with their count, errored seconds, average and current rates.
 - [ALARM](#) - Displays a list of alarms along with the number of seconds spent in the alarm condition.
 - [Count](#) - Displays Packet and VLAN count statistics.
 - [Strm Rslt](#) - Displays Stream ID specific statistics.
 - [Event](#) - Displays a summary of error alarm activity.
 - [Large LEDs](#) - Displays easy to read LEDs of error alarm activity.

What are RFC 2544 Tests?

RFC 2544 tests are used as a benchmark test for network devices. They were developed to test throughput, latency, frame loss and burstability across a range of packet sizes and bandwidths. RFC 2544 has become the de facto standard for benchmarking Ethernet networks.

Throughput Testing determines the maximum data rate which can be transported at each of a series of packet sizes, defined by the standard, i.e. 64, 128, 256, 512, 1024, 1280, 1518 bytes. NOTE: The NIC offers the ability to send non-standard packet sizes.

Latency Testing measures the time interval required to transport a packet through the device or network under test and back. Low and consistent latency is vital for protocols such VoIP and video applications.

Frame Loss Testing determines what percentage of frames can be sent across the device or network under test at the series of packet sizes as listed above in Throughput Testing.

Back-to-Back Burst Testing determines the number of frames that can be sent in a burst with minimum inter-packet gap through the device or network under test without losing any frames.

The RFC 2544 methodology can be used to assess the parameters of service-level agreements (SLAs). A carrier can then determine whether an Ethernet circuit complies with the agreement, based on the test results.

Physical Connections

NOTE: RFC 2544 tests must be performed on a loopback basis, and all testing is typically performed on the NIC at the near end.

NIC – Network without Routers – Loopback

In networks that do not have routers, it may be possible to use a simple loopback on the equipment.

NIC – Network with Routers – NIC in IP Reflection mode

In networks with routers, a second NIC in IP Reflection mode can be used as a loopback device.

Configure the far-end NIC unit's Reflect setting for Digital Lightwave Packets Only.

In IP Reflection mode, the NIC reverses MAC and IP addresses and loops back the RFC test packets.

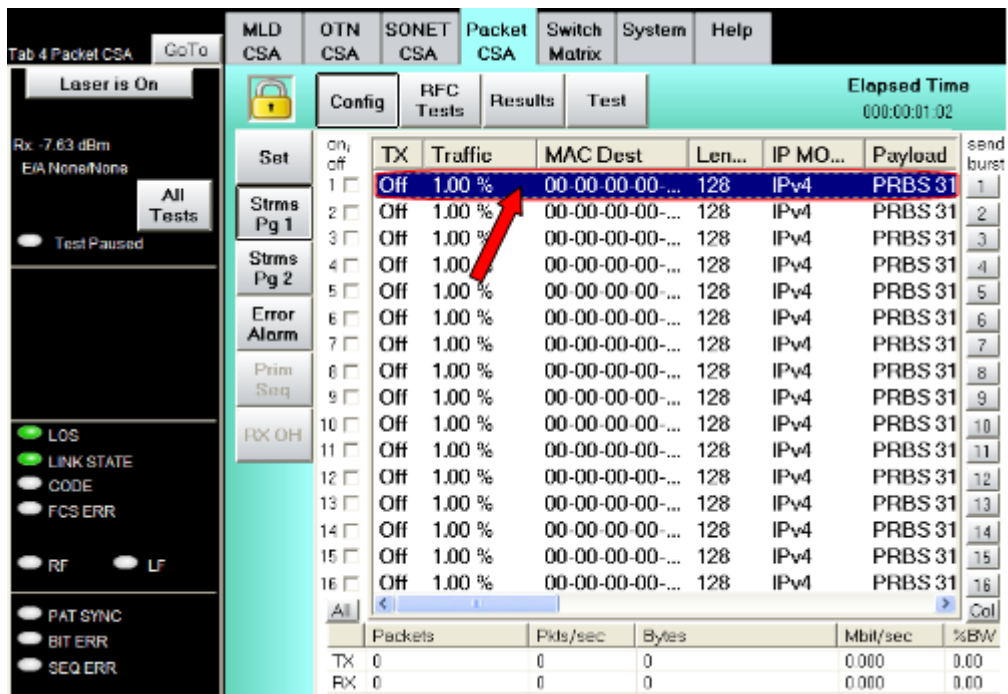
How to Configure and perform RFC2544 Testing

 Note: The RFC tests are performed over the selected test Stream. The RFC tests will over-ride the test Stream's bandwidth rate, frame size and burst size parameters. However other parameters such as MAC addresses, IP addresses, UDP addresses and VLAN/MPLS settings are not over-written, and should be configured prior to beginning the RFC test.

To configure the test Stream:

Press **Config**, then **Strms Pg 1** or **Strms Pg 2**.

Select one of the streams by pressing the stream's row in the white area (See figure).



The screenshot shows the 'Packet Tab' interface with the 'Config' tab selected. The 'Strms Pg 1' tab is active, displaying a table of 16 streams. A red arrow points to the first row (Stream 1). The table columns are: TX, Traffic, MAC Dest, Len..., IP MO..., Payload, and send burst. The first row has the following values: TX: Off, Traffic: 1.00 %, MAC Dest: 00-00-00-00-..., Len...: 128, IP MO...: IPv4, Payload: PRBS 31, send burst: 1.

TX	Traffic	MAC Dest	Len...	IP MO...	Payload	send burst
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	1
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	2
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	3
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	4
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	5
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	6
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	7
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	8
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	9
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	10
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	11
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	12
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	13
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	14
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	15
Off	1.00 %	00-00-00-00-...	128	IPv4	PRBS 31	16

Below the table, there is a summary section with the following data:

	Packets	Pkts/sec	Bytes	Mbit/sec	%BW
TX	0	0	0	0.000	0.00
RX	0	0	0	0.000	0.00

Stream settings are made in the [Traffic Stream Profile](#) pop-up window.

Make any applicable Stream settings such as Source and Destination MAC and IP Addresses, UDP port configuration and/or VLAN/MPLS configuration before continuing.

 It is not necessary to set **Frame Length**, **Rate** or **Burst Size**. These will be set by the RFC 2544 function.

NOTE: Adding VLAN or MPLS tags will change the minimum frame length that can be used. For example, if a single VLAN tag is selected, the minimum frame length will be changed from 64 to 68 and the first rate tested in the RFC 2544 test will be 68 bytes long.

Select the On/Off checkbox for the Stream that has just been configured to being generating packets.

Confirm that packets are being sent and received successfully.

 While the Stream is in On, the TX and RX packet count may not always be equal. This is normal. It is only necessary to determine that packets are being successfully received without any errors to confirm basic connectivity before beginning lengthy RFC 2544 tests.

Uncheck the On/Off checkbox to turn the Stream off.

 Note that if the Flow Control box is checked (Rx Enabled), it will automatically default to unchecked when an RFC test is activated. This is to ensure test validity and accuracy.

To configure the an RFC test:

Select **RFC Tests** and choose [Conf](#).

Select **Stream ID** and choose the packet stream (**1 - 32**) that was configured above for the RFC tests.

Select **Trial Duration** and set the duration of the test (in seconds).

 RFC-2544 recommends a trial duration of at least 60 seconds for Through Put and Frame Loss testing.

Select **Dest Port** and choose the port that will receive the test signal.

 Note, if a port is in IP Reflection Mode, or if it is already in an active RFC test, this setting will be unavailable.

Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 0.10 – 100.

ⓘ IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

ⓘ IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

Select a **Packet Size** button (for example, 64). A keypad appears.

Enter a new value and select **OK**. Value ranges are 64 - 16000.

By default, packet sizes 64 - 1518 are already selected, but packet size 9000 is not selected. You can enable 9000 if your test needs to include Jumbo packets.

To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

Select the type of RFC test that you wish to run by choosing its tab from along the left side of the RFC Tests screen. Complete any necessary configurations these tabs.

To run a **Thru Put** test see [Throughput Testing](#)

To run a **Frame Loss** test see [Frame Loss Testing](#)

To run a **B2B Burst** test see [Back-to-Back Burst Testing](#)

RFC-2544 - Thru Put Testing

Throughput testing is an RFC 2544 benchmark test that calculates your network's throughput rate. The fastest throughput speed is indicated by the rate at which the transmission and reception of the Ethernet test stream is accomplished without packet loss.

For example, the Throughput test starts by transmitting a stream at 100% using a packet size of 64 bytes. If it fails (i.e., an unacceptable number of packets are lost), the stream transmission rate falls back a certain percentage and is transmitted again. This process continues until the test passes without losing packets. The test then tries to zero in on the best throughput rate based on the Resolution Rate. The final rate appears as the Passing Rate.

Once this is completed, the packet size is increased to 128 bytes, and the test is repeated until a passing rate is achieved. Subsequent tests are performed using default packet sizes of 256, 512, 1024, 1280, and 1518 bytes, or any user-defined sizes.

When performing a throughput test, you can adjust the following parameters to fine-tune your test results:

[Accept Lost Rate](#) – Defines the percentage of frames that can be lost without being considered a failure.

[Resolution Rate](#) – Sets the level of precision for the test. The finer the resolution, the longer it takes to complete the test.



A Throughput test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Throughput test:

configure the Frame Loss test:

Select **RFC Tests** and choose [Conf](#).

Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.

Select **Trial Duration** and set the duration of the test.

Select **Dest Port** and choose the port that will receive the test signal.

Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

ⓘ IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

ⓘ IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

Select a **Packet Size** button (for example, 64). A keypad appears.

Enter a new value and select **OK**. Value ranges are 64 - 9600.

To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

Select **Thru Put** from the tabs along the left side of the RFC Tests screen.

Select **Accept Lost Rate** and enter an acceptable packet loss rate ranging from 0% to 100%. This value serves as a threshold. The default rate is 0%, which means that even one lost packet is a failure.

Select **Resolution Rate**, and enter a value ranging from 1% to 100%. The lower the rate, the more precise the measurement. The default rate is 1%.

To start the Throughput test:

Select **Start Test**. Once the test begins, this button toggles to Stop Test.

The unit immediately starts transmitting a test stream using the configured parameters, starting with the smallest packet size. The packets are looped through the network and returned to the unit. If no packet loss is reported, results are posted for the first packet size and the unit starts transmitting a stream containing packets for the next size byte frame. (For example, the first packet size transmitted is 64-bytes followed by 128-bytes and so on.)

If packet loss is detected in a byte transmission, the stream is re-transmitted at a reduced rate. This process continues until results are within the Resolution Rate percentage.

View Throughput test results on the [statistics table](#) at the bottom of the screen.

Saving or Printing test results:

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - Frame Loss Testing

Frame Loss testing is an RFC 2544 benchmark test. Its purpose is to determine the number of packets lost, by looping a stream through the network at varying transmit packet rates. The Frame Loss screen allows you to select a specific packet size to use in the Ethernet stream.



A Frame Loss test cannot be performed if another RFC Test is running.



Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the Frame Loss test:

Select **RFC Tests** and choose [Conf](#).

Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.

Select **Trial Duration** and set the duration of the test.

Select **Dest Port** and choose the port that will receive the test signal.

Select **BW Ceiling** to set the high-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are 1.1 – 100.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Floor is set to 9, then the BW Ceiling must be set to 10, or greater.

Select **BW Floor** to set the low-end of the bandwidth test range. The RFC test will not exceed the setting. Valid values are .01 – 99.

IMPORTANT: The minimum delta between the ceiling and floor setting is 1. For example, if the BW Ceiling is set to 10, then the BW Floor must be set to 9, or lower.

Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

Select a **Packet Size** button (for example, 64). A keypad appears.

Enter a new value and select **OK**. Value ranges are 64 - 9600.

To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

Select **Frame Loss** from the tabs along the left side of the RFC Tests screen.

To start the Frame Loss test:

Select **Start Test**. Once the test begins, this button toggles to Stop Test.

The unit immediately starts transmitting a test stream at 10% of the maximum byte-size rate. When multiple frame sizes are selected, the transmission starts at the lowest size.

A status message appears at the bottom of the screen indicating the current frame size and stream rate that is being transmitted. For example, Processing size 64 Rate 10.00. When this completes, the number of frames transmitted and the number of frames received appears in the Frame Loss table. This process continues until 100% of the maximum byte-size rate is reached (at 10% increments).

After transmitting at 100%, the entire test is repeated using the next larger frame size, for example, 128, 256, 512, 1024, 1280, and 1518 bytes.

View Frame Loss test results on the [statistics table](#) at the bottom of the screen. The table displays the frame loss test results for a specified packet size. The results represent the nine rates determined by the BW Ceiling and BW Floor settings.

To change the packet size and view its results:

► Choose the **Packet Size** button (for example, 256). The Frame Loss table displays the transmit and receive statistics for the selected packet size.

OR

► Select the **First**, **Prev**, **Next**, or **Last** button to move through the frame sizes.

 **Important:** The status message that appears at the bottom of the screen always indicates which frame size and stream rate is currently being transmitted and not the report statistics selected.

Saving or Printing test results:

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

To save or print this test's results see Saving and Printing Statistics and Settings Reports.

RFC-2544 - B2B Burst Testing

This is an RFC 2544 benchmark test. Back-to-Back Burst test is used to determine the buffering capability of the Device Under Test (DUT). This is done by sending a burst of frames to the unit, and then counting how many frames are forwarded by the unit.

During the test a burst of fixed length frames with the minimum inter-frame gap between them is sent through the packet stream. The trial duration must be between 2 and 10 seconds. The RFC standard recommends (but does not required) that this trial should be repeated at least 50 times with the average value reported.

If the unit successfully transmits all the frames that it receives, the frame burst size is increased and the test is repeated. If this stage of the test fails, the frame burst size is

halved and the test is repeated until the unit successfully transmits the frame burst. The default frame burst sizes used are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.

-  A Back-to-Back Burst test cannot be performed if another RFC Test is running.
-  Do not activate a BERT or Packet streams while an RFC 2544 test is active. Turning on or off a test Stream, while an RFC test is in progress, will disrupt test results.

To configure the B2B Burst test:

Select **RFC Tests** and choose [Conf.](#)

 The **BW Ceiling** and **BW Floor** settings do not apply to the Back-to-Back Burst test.

Select **Stream ID** and choose the packet stream (**1 - 32**) for the Frame Loss test.

Select **Trial Duration** and set the duration of the test.

 This value determines how long each trial runs. Valid values range from 2 to 10 seconds.

Select **Dest Port** and choose the port that will receive the test signal.

Choose the **Packet Sizes** to use for the test by selecting its **Enable/Disable** check box. You can use standard packet sizes for the test or assign a user-defined packet size(s).

To assign a user-defined frame size:

Select a **Packet Size** button (for example, 64). A keypad appears.

Enter a new value and select **OK**. Value ranges are 64 - 9600.

To return frame sizes to default settings, select the **Restore to RFC Standard Settings**.

Select **B2B Burst** from the tabs along the left side of the RFC Tests screen.

Select **Resolution (in frames)**. A keypad appears.

Enter a precision level for the test. The value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.

Select **# Of Repetitions**. A keypad appears.

Enter the number of times the trial length should be repeated. The RFC recommended repetition is 50.

To start the Back-to-Back test:

Select **Start Test**. Once the test begins, this button toggles to Stop Test.

The unit immediately starts sending a burst of frames with the minimum inter-frame gap between them. If all frames are received, the burst size is increased and the test repeated. If all frames are not received, the burst size is lowered and the test repeated until the longest burst the DUT can handle (without loss of frames) is determined.

View B2B Burst test results on the [statistics table](#) at the bottom of the screen.

Frame Size (bytes) – Indicates the tested frame size.

Max Possible Number of Frames – Indicates the number of frames transmitted without errors.

Avg Observed B2B Frames – Indicates the data stream's average frame count.

Saving or Printing test results:

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and stream test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

To save or print this test's results see Saving and Printing Statistics and Settings Reports.

Saving and Printing Statistics and Port Settings

The NIC test set provides the option to save RFC Throughput, RFC Frame Loss, RFC B2B Burst, and Stream Test Statistics, Settings, Event and Service Disruption measurements to a file for access later or for immediate printing.

The following reports are available:

Settings - (.set extension) Reports the Stream Settings for the selected Port .

Statistics - (.stat extension) Reports all Steam Tx/Rx Packet counts, Errors, and Alarms.

Events - (.evt extension) Reports a summary of Events, such as alarm and error activity.

APS (.aps extension) Reports Service Disruption statistics.

RFC Thru Put - (.thru extension) Reports the Throughput test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).

RFC Frame Loss - (.loss extension) Reports the Frame Loss test settings and a summary of the test results for each packet size (passing rate, transmitted and received packets, minimum/maximum/average latency).

RFC B2B Burst - (.b2b extension) Reports the Back to Back Burst test settings and a summary of the test results for each packet size (Max Possible Number of Frames, and Average Observed B2B Frames).

To save or print RFC test results:

Configure and run Packet Stream transmissions or run an RFC test such as Throughput, Frame Loss, B2B Burst.

Select the **Print Report** common function button located at the bottom of the screen. The Report Setup dialog box appears.

Choose one of the following:

From Destination Printer:

- Select one or multiple reports to print directly to a printer. If printing a report from the NIC unit, make sure that a printer is attached to the unit's parallel or serial port.

From Destination File:

- Select one or multiple reports to print to a file. The File Browser dialog box appears.



The Comma Delimiter option can be applied to the Settings To File and Statistics To File reports.

- ▶ Enter a file name and select **OK**.

 Important: Files saved when working with the Remote Control Application will not be accessible from the NIC unit touch-screen and visa-versa. The remote application saves the files to the Remote Control (GalaxyNIC) directory on the PC. The NIC unit saves the files to its default D:\DLI... drive on the test unit.

- ▶ For instructions on retrieving saved files see Printing or Viewing Saved Files.

Click the **Input** button to enter any User Comments that you wish to appear in the printed or saved report file. Press the **Clear** button to clear the User Comments.

Select **OK**.

SDH Tab

SDH Overview

The test options available under the SDH tab can vary from one NIC test set to another, depending on which SDH circuit pack and which Interface rates and Next Generation test options are currently licensed in the test set.

The SDH Online Help is divided into the following sections:

[SDH Screen and Function Descriptions](#)

[SDH Specific Tasks](#)

Packet Tab (Available for testing GFP mappings, and 10G LAN/WAN and 8G/10G Fibre Channel Interfaces)

Screen Functions and Descriptions

SDH Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control SDH configuration and operation.

The following screens and functions are discussed:

[Transmit](#)

[Receive](#)

[Results](#)

[Test](#)

[Perf Monitor](#)

[LEDs](#)

Transmit

SDH Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SDH transmitting operations.

The following parameter setting options are available from the Transmit screen:

[Set > Set 1](#)

[Set > Set 2](#)

[SOH](#)

[POH](#)

[PTR](#)

[APS](#)

[VCAT](#) (Only appears when the test set is configured for VCAT)

[LCAS So](#) (Only appears when the LCAS is enabled)

[Error Alarm](#)

SDH Transmit - Set / Set 1

The SDH Transmit Settings 1 screen configures the unit's transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STM signal to pass through the unit without altering the data in the signal. The following options are available: On and Off .
Interface	Selects the optical or electrical transmit interface. The following SDH options are available, depending on the licensed configuration:

	STM-64, STM-16, STM-4, STM-1, STM-0, STM-1E, and STM-0E If the test set is equipped for Jitter operation, the following options may also be available: STM-1-Jitter, STM-4-Jitter, STM-16-Jitter, and STM-64-Jitter If the test set is licensed for 8G or 10G Fibre Channel, or 10GigE LAN, the following options may also be available, and can be tested using the Packet tab: Fibre Chan (8.50G), Fibre Chan (10.52G), 802.3 10G LAN (10.3125 GHz)  The SDH processor supports hot-swappable SFP and XFP laser modules.  Verify that the inserted SFP/XFP module supports the desired Interface rate prior to selecting it.  The wavelength of the selected interface is determined by the specifications of the SFP or XFP module being used.  Available interface rates are dependent on the licensed-based test options currently enabled.  Not Assigned is displayed if one of the Interfaces listed above is currently not configured.
Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-16c's can be mapped into an STM-64 signal. Mapping options are dependent on the selected Interface. The following options may be available: Unframed Bulk Fill AU-4-64c Bulk Fill AU-4-16c Bulk Fill

	AU-4-4c Bulk Fill AU-4 C-4 Bulk Fill C-3 Bulk Fill (AU-3 or AU-4) C-2 Bulk Fill (AU-3 or AU-4) C-12 Bulk Fill (AU-3 or AU-4) C-11 Bulk Fill (AU-3 or AU-4)  If the test set is licensed for VCAT, the following options are also available: VC-4-Xv Bulk Fill (AU-4) VC-3-Xv Bulk Fill (AU-3 or AU-4) VT-2-Xv Bulk Fill (AU-3 or AU-4) VT-12-Xv Bulk Fill (AU-3 or AU-4) VT-11-Xv Bulk Fill (AU-3 or AU-4)  If the test set is licensed for 10G WAN, the following options are also available: AU-4-64c Ethernet WAN  If the test set is licensed for All Path Testing, the following option is also available: All Path
AU-<#> Added	Displays the mapped signal. When available, select the AU-<#> Added button to enter the number of the specific AU channel to set as the <i>foreground</i> (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.
VCAT Channel	Allows the user to select a foreground VCAT channel, from the specified VCAT group, for Error and Alarm insertion.

 Appears only when VCAT is licensed, and a VCAT mapping is chosen.	 See How to Set Up and Use VCAT Features for details
LCAS Mode  Appears only when LCAS is licensed, and the VCAT group has more than one member added.	Enables or Disables LCAS (Link Capacity Adjustment Scheme) mode.  See How to Set Up and Use LCAS Features for details
Background AU-<#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining <i>background</i> channels for the SDH signal. Select one of the following: User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.
Payload Pattern	Allows the user to select a test pattern to transmit over the SDH signal. Select one of the following: PRBS 9 , PRBS 9 Inv , PRBS 11 , PRBS 11 Inv , PRBS 15 , PRBS 15 Inv , PRBS 20 , PRBS 20 Inv , PRBS 23 , PRBS 23 Inv , PRBS 31 , PRBS 31 Inv , or a User Defined pattern (32-bit value)  The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected.  If the test set is licensed for GFP, then GFP mapping option is also available.
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking.

	Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. BITS/SETS: Derives the transmit's data timing source from the BITS/SETS input ports. BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. The <i>CLK:BITS 1.5MHz</i> displays when configured for BITS clocking. SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The <i>CLK:SETS 2.0MHz</i> displays when configured for SETS clocking. External 8 KHz - 75 Ohm TTL. Derives timing from an external 8 KHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 8 KHz</i> displays when configured. External 1.544 MHz - 75 Ohm TTL. Derives timing from an external 1.544 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 1.5 MHz</i> displays when configured. External 2.048 MHz - 75 Ohm TTL. Derives timing from an external 2.048 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 2 MHz</i> displays when configured. External 10.0 MHz - 75 Ohm TTL. Derives timing from an external 10.0 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 10 MHz</i> displays when configured.

SDH Transmit - Set / Set 2

The SDH Transmit Settings 2 screen contains the following functions:

Function	Description
Line Frequency Offset	Adjusts the offset of the transmitted signal's frequency. The frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 A 0 (zero) value equals Off.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: Off - The unit's laser will be off when the unit is turned on. On - The unit's laser will be on when the unit is turned on. Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.
SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: SONET (00), SDH (10), Undefined (01), or Undefined (11).

HP Signal Label	The Higher-Order Path Signal Label is part of the HPOH and identifies the type of traffic contained in the Virtual Container (VC). The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: 00 (Unequipped) 01 (Equipped) 02 (TUG Structured) 03 (Lock TU Mode) 04 (Async 34M/45M Mapping) 12 (Async 140M Mapping) 13 (ATM Mapping) 14 (DQDB Mapping) 15 (FDDI Mapping) 1A (10G WAN IEEE802.3ae) 1B (GFP Mapping) FE (O.181 Test Signal) FF (VC-AIS) User Defined (any eight bit pattern 0 to FF).  This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

LP Signal Label	Bits 5 through 7 of the V5 byte are allocated for a LP Signal Label to indicate the content of the LP SPE, including the status of the LP mapped payload. The following options are available: 00 (Unequipped) 01 (Equipped) 02 (Asynchronous) 03 (Bit Synchronous) 04 (Byte Synchronous) (05) ATM 06 (O.181 Test Signal Mapping) 07 (VC-AIS) User Defined - Any 3-bit value 0h to 7h  This option is only available for C-2, C-12, and C-11 mappings.
Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: 00 (Quality Unknown): Sets byte value to 00000000. 02 (Rec. G.811): Sets byte value to 00000010. 04 (Rec. G.812 Transit): Sets byte value to 00000100. 08 (Rec. G.812 Local): Sets byte value to 00001000. 0B (Sync Equip Timing Src (SETS)): Sets byte value to 00001011. 0F (Do Not Use for Sync) User Defined (any eight bit pattern 0 to FF)

Trigger In	Determines how the protocol processor responds when an external +5v "pulse" is detected on the external Trigger In SMA connector. The following options are available: None: The protocol processor will do nothing when an external pulse is received. (default setting) Restart: The current test will restart when an external pulse is received. Error Insert: The protocol processor will insert an error when an external pulse is received. For this to work, you must first select an Error Type to be inserted.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. Path Enable: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. VT Enable: For SDH, the unit uses its TCM circuitry and the N2 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z6 byte. Disable: TCM mode is disabled, and the N1/N2 and Z5/Z6 bytes follow normal operation.
TX Clock Loss Threshold	Configures the user-definable threshold for the TX Clock Loss alarm, in PPM. Valid range is from 0 to 100ppm, where 0 is disabled. The default value is 50ppm.  This threshold alarm is only supported when the transmit reference clock is configured for an external clock source. When the transmit reference clock is configured for Internal, this setting and the associated alarm are disabled.

Measured TX Line Frequency	Measures the Transmission Line Frequency value in Hz.  The TX line frequency can be derived from the Internal clock, an External TTL clock, a Recovered clock, or a BITS/SETS timing signal.
Measured TX Line Frequency Offset	Measures the Transmission Line Frequency Offset value in Hz and ppm.  When the transmit reference clock is configured for an External TTL clock, Recovered or BITS/SETS timing, this measurement is the deviation between the internal clock rate and the line rate derived from the external reference clock.

SDH Transmit - SOH

The Transmit SOH screen contains the following options:

Function	Description
Showing	Select Showing to choose an Overhead slot within the SDH signal. The overhead bytes that appear on the SOH screen are associated with this slot.
MS and RS Overhead bytes	Allows the user to select an Overhead byte to edit its value. Selecting an Overhead byte button will either open a user-define keypad, or a menu screen if there are pre-defined byte options to select from.
J0 Trace	The J0 byte is part of the MS Overhead and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern. The following options are available: Default (64 byte) - Selects the Digital Lightwave ASCII message as the transmit J0 trace pattern. The

	message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the transmit J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit J0 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit J0 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit J0 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

SDH Transmit - POH

The Transmit POH screen contains the following options:

Function	Description
AU-<#> Added	Allows the user to enter the number of the specific AU channel to set as the <i>foreground</i> (source) channel. The default setting is 1.

	 When a VCAT mapping is chosen, this setting changes to VCAT Channel.
HP and LP Overhead Bytes	Path Overhead Bytes include: B3, J1, C2, G1, F2, H4, F3, K3, and N1. VT Overhead Bytes include: V5, J2, N2, and K4. Selecting an Overhead byte button will either open a user-define keypad, or a menu screen if there are pre-defined byte options to select from. Note: This option will be disabled if Passthru mode is enabled.
HP J1 Trace	Selects a default or customized pattern to be used as the HP J1 trace. Select one of the following patterns: Default (64 byte) - Selects the Digital Lightwave ASCII message as the transmit J1 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the transmit J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit J1 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit J1 trace pattern.

	User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit J1 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.
LP J2 Trace	Selects a default or customized pattern to be used as the LP J2 trace. Select one of the following patterns: Default (64 byte) - Selects the Digital Lightwave ASCII message as the transmit J2 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the transmit J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit J2 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit J2 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit J2 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.  This option is only available for C-2, C-12, and C-11 mappings.

TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern.  Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit TC trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit TC trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit TC trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit TC trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit TC trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

SDH Transmit - PTR

The Transmit PTR screen allows the user to perform SDH pointer sequence actions, as defined per the ITU-T G.783 telecommunication standard, and contains the following options:

Function	Description

NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: Yes (On): Generates an NDF when a new Pointer is transmitted. No (Off): Disables NDF functionality.						
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.						
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.						
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Single options - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. Increment/Decrement option -Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Continuous options - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.  For SDH mode, the following Pointer Actions are available, as defined in ITU-T G.783 (03/2006) per the stated Figure number. <table border="1"> <thead> <tr> <th>SDH Pointer Sequences</th><th>Figure #</th></tr> </thead> <tbody> <tr> <td>AU Single and TU Single</td><td>Figure 15-3a</td></tr> <tr> <td>AU Single Add and TU Single Add</td><td>Figure 15-3b</td></tr> </tbody> </table>	SDH Pointer Sequences	Figure #	AU Single and TU Single	Figure 15-3a	AU Single Add and TU Single Add	Figure 15-3b
SDH Pointer Sequences	Figure #						
AU Single and TU Single	Figure 15-3a						
AU Single Add and TU Single Add	Figure 15-3b						

	AU Single Cancel and TU Single Cancel	Figure 15-3c
	AU Increment/Decrement and TU Increment/Decrement	Figure 15-3d
	AU Continuous and TU Continuous	Figure 15-3e, h2
	AU Continuous Phase and TU Continuous Phase	Figure 15-3f
	AU Continuous Add and TU Continuous Add	Figure 15-3i, h3
	AU Continuous Cancel and TU Continuous Cancel	Figure 15-3i, h4
	AU 87-3	Figure 15-3g
	AU 87-3 Add	Figure 15-3g
	AU 87-3 Cancel	Figure 15-3g
	TU-26-1	Figure 15-3j
	TU 26-1 Add	Figure 15-3j
	TU 26-1 Cancel	Figure 15-3j
	💡 See Application Note AP-00168-Pointer Sequences for detailed information on each pointer sequence.	
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.	
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid values are 5.5 - 35000.	
INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.	

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

New Item - Opens the [Apply Maintenance to Entry](#) window, from which you configure K1 and K2 bytes.

Start - Begins transmission of the K1 and K2 byte configuration.

Clear - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

[K1 Full Byte \(Linear Mode\)](#)

[K1 Bits 1-4 \(Linear Mode\)](#)

[K1 Bits 5-8 \(Linear Mode\)](#)

[K2 Full Byte \(Linear Mode\)](#)

[K2 Bit 5 \(Provisioned\) \(Linear Mode\)](#)

[K2 Bits 1-4 \(Linear Mode\)](#)

[K2 Bits 6-8 \(Linear Mode\)](#)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

[K1 Full Byte \(Ring Mode\)](#)

[K1 Bits 1-4 \(Ring Mode\)](#)

[K1 Bits 5-8 \(Ring Mode\)](#)

[K2 Full Byte \(Ring Mode\)](#)

[K2 Bit 5 \(Provisioned\) \(Ring Mode\)](#)

[K2 Bits 1-4 \(Ring Mode\)](#)

[K2 Bits 6-8 \(Ring Mode\)](#)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011
(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)

(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010
(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)

(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011

#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.

#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100

#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100

#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description

Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

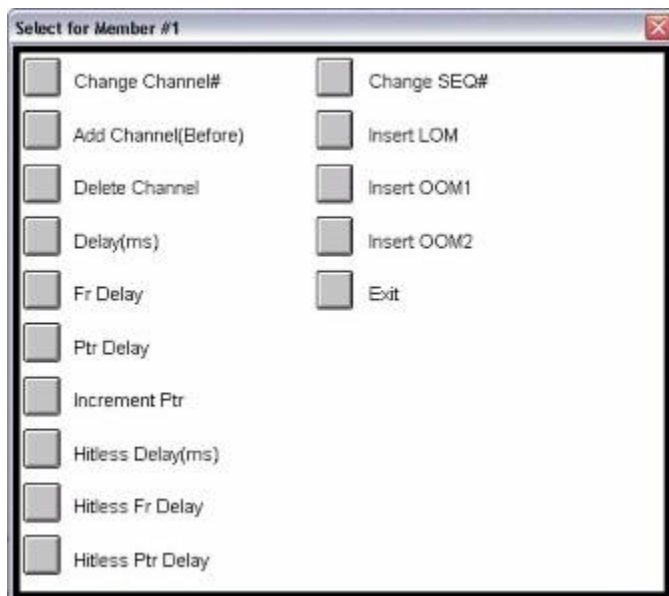
Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

Transmit - VCAT

Add	Click on Add to select members for the VCAT Group (VCG). A Select Channel screen appears which shows all possible channel member available to choose from. When a channel has been selected, the channel button will gray-out to indicate that it is already selected.  If the Setting Control are set to Coupled, then members added to the Transmit VCG will also be added to the Receive VCG.
Member	Sequential list indicating the order in which the payload will be transmitted into the VCAT channels, regardless of the number indicated by "Seq-SQM".
Chan	Channel Number. Displays the VCAT Member's channel number. For High-Order mappings, the number will just be the AU#(for SDH) or STS#(for SONET). For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Seq # or Seq-SQM	The default and normal condition for Sequence Indicator is from 0 to N. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver. This column indicates the Sequence Indicator

	Number not the actual order that the payload is transmitted, as displayed in the "Member" column.  The "Seq#" label changes to "Seq-SQM" when inserting a Sequence Mismatch.
Delay (ms)	Combined Delay. The amount of time to delay this member as compared to the earliest member. This delay is calculated based on the combined time for the specified frame and pointer delays, and is expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames to delay this member as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. Sets the pointer value for this member, creating a very small delay.
Operation	Indicates whether an alarm condition has been turned on for this member, either Out of Multiframe (OOM1 or OOM2) or Loss of Multiframe (LOM).

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:



The first three menu items (Change Channel#, Add Channel and Delete Channel) specifically apply to the Transmit VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	Description
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member, entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of frames.

Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.
Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.
Change SEQ#	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing the setup of the member

Transmit - LCAS So

 For detailed information about LCAS, and instructions on configuring LCAS, see [How to Set Up and Use LCAS Features](#).

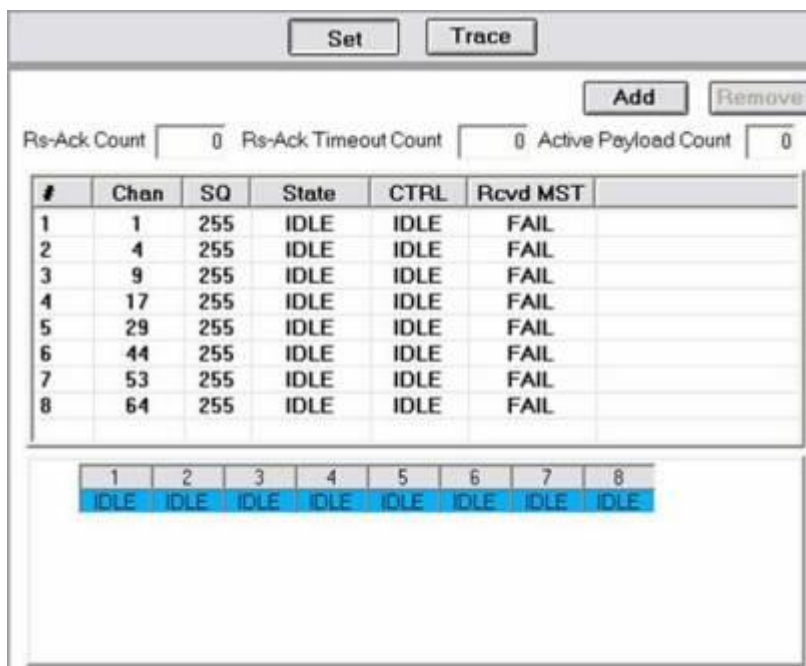
Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit - LCAS So screen, and the Sink functionality is available from the [Receive - LCAS Sk](#) screen.

 Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Transmit Settings

Access LCAS Transmit features by the selecting  (LCAS Source) side tab from the Transmit screen. The LCAS Settings table will appear, listing all of the members within the transmit VCG.



#	Chan	SQ	State	CTRL	Rcvd MST
1	1	255	IDLE	IDLE	FAIL
2	4	255	IDLE	IDLE	FAIL
3	9	255	IDLE	IDLE	FAIL
4	17	255	IDLE	IDLE	FAIL
5	29	255	IDLE	IDLE	FAIL
6	44	255	IDLE	IDLE	FAIL
7	53	255	IDLE	IDLE	FAIL
8	64	255	IDLE	IDLE	FAIL

The transmit LCAS settings table is used to configure LCAS Source functions.

The following functions are found in the transmit LCAS settings table

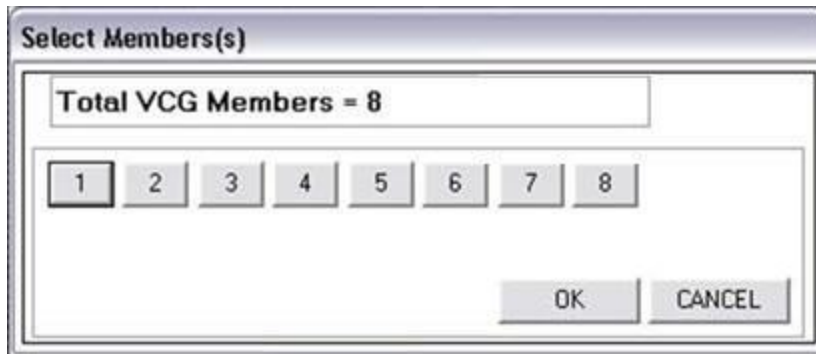
Function	Description
Set (button)	Selects the LCAS Settings Table

Trace (button)	Selects the LCAS Trace Table
Add (button)	Adds selected VCG members to the LCAS data stream
Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequenece - Acknowledge messages received
Rs-Ack Timeout Count	Number of times when no Resequenece - Acknowledge was received before the timeout period
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member's channel number. For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
SQ	Sequence number. If this member is not active, the sequence number will an invalid number (255 for high-order mapping, lower values for low-order mapping). For active members, the sequence number will be 0, 1, 2, etc.
State	Indicates the state of this VCG member. The possible states are:

	IDLE: This member is not in use. NORM: This member is part of the payload. DNU: Do Not Use. Failure state. ADD: Source has requested to add this member to the payload. Waiting for Sink response. REMOVE: Source has requested to remove this member from the payload. Waiting for Sink response.
CTRL	Control message sent from Source to Sink. Possible values are: ADD: Member to be added to the VCG NORM: Normal LCAS transmission EOS: End of Sequence, highest member in group IDLE: Member is part of the VCG or to be removed DNU: Do not use, Sink reports failure
Rcvd MST	Member Status received from Sink (Sk)
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload. DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Add and Remove

Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Transmit Trace

Press **Trace** to display the LCAS Trace Table.

☐ Filter Trace by Member Number— Off

Mem	ElapsedTime	SQ	State	CTRL	MST	RsAck	
4	000:00:00:38	1*	ADD*	ADD*	FAIL	0	
4	000:00:00:47	255*	REMOVE*	IDLE*	FAIL	0	
4	000:00:00:47	255	REMOVE*	IDLE*	FAIL	0	
2	000:00:01:48	1*	ADD*	ADD*	FAIL	0	
2	000:00:02:02	0*	NORM	EOS*	OK	0	
-	000:00:02:03	-	-	-	-	1*	
5	000:00:02:43	1*	ADD*	ADD*	FAIL	1	
6	000:00:02:43	2*	ADD*	ADD*	FAIL	1	
7	000:00:02:43	3*	ADD*	ADD*	FAIL	1	
8	000:00:02:43	4*	ADD*	ADD*	FAIL	1	
2	000:00:02:54	0	NORM	NORM*	OK	1	
5	000:00:02:54	1	NORM	NORM*	OK	1	
6	000:00:02:54	2	NORM	NORM*	OK	1	
7	000:00:02:54	3	NORM	NORM*	OK	1	
8	000:00:02:54	4	NORM	EOS*	OK	1	
-	000:00:02:55	-	-	-	-	0*	
4	000:00:04:07	5*	ADD*	ADD*	FAIL	0	
8	000:00:04:07	4	NORM	NORM*	OK	0	

The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description

Filter Trace by Member Number	Select User Defined to specify an individual member number. Only the activity of the selected member will be displayed. Select Off to display the activity of all members.

SDH Transmit - Error Alarm

The test unit can transmit errors and alarms to simulate various defects and anomalies to determine if the receiving equipment can detect an error or alarm in the incoming signal.

For information on inserting errors and alarms see the online help topics, [Inserting Errors](#) and [Inserting Alarms](#) in the Common Tasks section.

The following options are available one the Error Alarm screen:

[Error to Insert](#)

[Error Insert Rate](#)

[Alarm Generated](#)

Error to Insert

This SDH Transmit function determines the type of error transmitted by the system.

The purpose of generating an error with system is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates.

The following options are available:

Option	Description
None	No errors are generated. Turns errors off.
Frame	Inserts a frame alignment error in the A1 and A2 bytes.

B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Regenerator Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Multiplex Section layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
MS-REI	Generates a Remote Error Indicator over the Multiplex Section layer. An MS-REI is a count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SDH signal. The system uses the M1 byte of the MSOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
B3 Error	Generates a BIP-8 error over the Higher-Order Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
HP-REI	Generates a Remote Error Indicator over the Higher-Order Path layer. An HP-REI is a count of B3 errors received at the far end.

	When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the G1 byte of the HPOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
LP-BIP	Generates a BIP-2 error over the Lower-Order Path layer. Bits in the V5 byte are toggled to create an error.
LP-REI	Generates a Remote Error Indicator over the Lower-Order Path layer. An LP-REI is a count of LP-BIP errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the V5 byte of the LPOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
HP-TC-IEC  Only appears when the TC Overhead Processing is configured for "HP Enable".	Generates a Tandem Connection Incoming Error Count over the Higher-Order Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.
HP-TC-REI  Only appears when the TC Overhead Processing is configured for "HP Enable".	Generates a Tandem Connection Remote Error Indicator over the Higher-Order Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
HP-TC-OEI  Only appears when the TC Overhead Processing is configured for "HP Enable".	Generates a Tandem Connection Outgoing Error Indicator over the Higher-Order Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.

Processing is configured for " HP Enable ".	
LP-TC-BIP  Only appears when the TC Overhead Processing is configured for " LP Enable ".	Generates a Tandem Connection Bit Interleaved Parity error over the Lower-Order Path layer. Bits 1-2 of the N2 byte are the BIP bits.
LP-TC-REI  Only appears when the TC Overhead Processing is configured for " LP Enable ".	Generates a Tandem Connection Remote Error Indicator over the Lower-Order Path layer between TCM equipment. A LP-TC-REI is a count of LP-TC-BIP errors received by TCM equipment at the far end. Bit 5 of the N2 byte is used for this error.
LP-TC-OEI  Only appears when the TC Overhead Processing is configured for " LP Enable ".	Generates a Tandem Connection Outgoing Error Indicator over the Lower-Order Path layer between TCM equipment. Bit 6 of the N2 byte is used for this error.
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.

Error Insert Rate

This SDH Transmit function sets the error rate for the selected error. The system starts transmitting errors after the insertion rate is selected.

For information about inserting errors, see [Inserting Errors](#) in the Common Tasks section of the online help.

The following Error Insert Rate options are available:

Option	Description
Off	Turns error transmission off. This command effectively disables the Error Insert Action button.
Maximum	Generates errors at the maximum rate listed below.
1e - X	X is a value from 3 to 10; for example, 1e-3 through 1e-10. X will vary based on the type of error selected.
User Defined	Allows the user to enter a custom error rate anywhere between the Minimum and Maximum allowed rates.

Alarm Generated

This function configures the system to generate an alarm in the transmit SDH signal. Alarm generation by the system is one way to test if downstream SDH equipment reacts properly to the alarm it receives in the incoming SDH signal.

For information about generating alarms, see [Inserting Alarms](#) in the Common Tasks section of the online help.

The following alarms are available:

Alarm	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SDH equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SDH equipment to generate an AIS alarm to its

	downstream network elements (NE)and generate an RDI alarm to its upstream NEs.
MS-AIS	Multiplex Section Alarm Indication Signal. The transmission of an MS-AIS to a downstream NE forces that NE to send an AU-AIS alarm to the next downstream NE. The NE will also send an MS-RDI alarm to its upstream equipment. An MS-AIS simulates an alarm generated by Line terminating equipment (LTE).
MS-RDI	Multiplex Section Remote Defect Indicator. This generates an MS-RDI condition using the K2 byte of the Line OH. This simulates a downstream NE at the Line layer, reporting a failure to an upstream NE. The downstream NE has encountered a downstream failure and is alerting upstream SDH equipment. To do this, the system changes the pattern of the K2 byte. The NE receiving the MS-RDI alarm should detect a change to the K2 byte on the incoming SDH signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
AU-LOP	Administrative Unit Loss of Pointer. This simulates a loss of a valid Pointer. When the downstream NE receives an AU-LOP, it generates a DSn AIS alarm to its downstream equipment and an HP-RDI alarm to its upstream equipment.
AU-AIS	Administrative Unit Alarm Indication Signal. The transmission of an AU-AIS to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AU-AIS simulates an alarm generated by Path terminating equipment (PTE).
HP-RDI	Higher-Order Path Remote Defect Indicator. This generates an HP-RDI condition using the G1 byte of the Higher-Order Path OH. This simulates a downstream NE at the Path layer, reporting a failure to an upstream NE.

	To do this, the system changes the pattern of the G1 byte in the HPOH. The NE receiving the HP-RDI alarm should detect a change to the G1 byte on the incoming SDH signal.
HP-UNEQ	Higher-Order Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the HPOH. The C2 byte is the HP Signal Label. (This type of error is used between Higher-Order Path terminating equipment-PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.
HP-TC-RDI  Only appears when the TC Overhead Processing is configured for " HP Enable ".	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
HP-TC-ODI  Only appears when the TC Overhead Processing is configured for " HP Enable ".	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.
HP-TC-AIS  Only appears when the TC Overhead Processing is configured for " HP Enable ".	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
HP-TC-UNEQ  Only appears when the TC Overhead Processing is	Tandem Connection-Unequipped. An all-zeros pattern is inserted into the N1 byte of the Path OH.

configured for "HP Enable".	
HP-TC-LOF  Only appears when the TC Overhead Processing is configured for "HP Enable".	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

Receive

SDH Receive Screens and Functions

The Receive function allows you to define the parameters used in SDH receiving operations.

The following parameter setting options are available from the Receive screen:

[Set > Set 1](#)

[Set > Set 2](#)

[Set > Set 3](#)

[SOH](#)

[POH](#)

[SIG](#)

[VCAT](#) (Only appears when the test set is configured for VCAT)

[LCAS](#)-Sink (Only appears when the LCAS is enabled)

SDH Receive - Set / Set 1

The SDH Receive Settings 1 screen configures the unit's receive parameters. It contains the following functions:

Function	Description

Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, settings established on the Receive screen will only affect Receive mode.
Interface	Selects the optical or electrical interface. The following options are available: STM-64, STM-16, STM-4, STM-1, STM-0, STM-1E, and STM-0E.  If the test set is licensed for Jitter operation, the following options are also available: STM-1-Jitter, STM-4-Jitter, STM-16-Jitter, and STM-64-Jitter.  If the test set is licensed for 1G or 10G LAN, the following options are also available: 802.3 1G LAN (1.250 GHz), 802.3 10G LAN (10.3125 GHz)

Mapping	Defines the type of signals that are combined to create an SDH signal. For example, four AU-4-16c's can be mapped into an STM-64 signal. Mapping options are dependent on the selected Interface. The following options may be available: Unframed Bulk Fill AU-4-64c Bulk Fill AU-4-16c Bulk Fill AU-4-4c Bulk Fill AU-4 C-4 Bulk Fill C-3 Bulk Fill (AU-3 or AU-4) C-2 Bulk Fill (AU-3 or AU-4) C-12 Bulk Fill (AU-3 or AU-4) C-11 Bulk Fill (AU-3 or AU-4)  If the test set is licensed for VCAT, the following options are also available: VC-4-Xv Bulk Fill (AU-4) VC-3-Xv Bulk Fill (AU-3 or AU-4) VT-2-Xv Bulk Fill (AU-3 or AU-4) VT-12-Xv Bulk Fill (AU-3 or AU-4) VT-11-Xv Bulk Fill (AU-3 or AU-4)  If the test set is licensed for 10G WAN, the following options are also available: AU-4-64c Ethernet WAN
AU Type	Selects an Administrative Unit type to include AU-3 or AU-4.

AU-<#> Dropped	Select the foreground Administrative Unit to be dropped.  The options that appear will depend on your current configuration. The default setting is 1.
TUG-3 Dropped	Select the foreground TUG-3 to be dropped.  TUG-3 will only display for LP mappings, if the AU type is set as AU-4.
TUG-2 Dropped	Select the foreground TUG-2 to be dropped.  TUG-2 is only available for LP mappings C-12 and C-11.
TU-<#> Dropped	Select the foreground Tributary Unit to be dropped.  This setting is only available for LP mappings.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SDH signal. Select one of the following patterns: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  If the test set is licensed for GFP, then GFP mapping option is also available.  When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
Power Low Threshold	Sets the power threshold. If the power drops below the threshold, the Power Low alarm initiates. When the threshold is reached, the LOS alarm signals.
Out of Frequency Threshold	Sets the frequency threshold for the Line Frequency Offset. When the threshold is reached, the Frequency Wide alarm is triggered.

Trigger Out	Allows the user to select the way that the protocol processor will respond to an external "pulse" received.

SDH Receive - Set / Set 2

The SDH Receive Settings 2 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
PLM Alarm Reporting	Disable or Enable Payload Label Mismatch reporting.

Expected HP Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: 00 (Unequipped) 01 (Equipped) 02 (TUG Structured) 03 (Lock TU Mode) 04 (Async 34M/45M Mapping) 12 (Async 140M Mapping) 13 (ATM Mapping) 14 (DQDB Mapping) 15 (FDDI Mapping) 1A (10G WAN IEEE802.3ae) 1B (GFP Mapping) FE (O.181 Test Signal) FF (VC-AIS) User Defined (any eight bit pattern 0 to FF)  This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

Expected LP Signal Label	Select one of the following values for the expected Lower Order Path Signal: The following options are available: 00 (Unequipped) 01 (Equipped) 02 (Asynchronous) 03 (Bit Synchronous) 04 (Byte Synchronous) 06 (O.181 Test Signal Mapping) 07 (VC-AIS) User Defined - Any 3-bit value 0h to 7h  This option is only available for C-2, C-12, and C-11 mappings.
TIM Alarm Reporting	An Trace Identifier Mismatch (TIM) alarm occurs for any of the overhead traces, when the incoming overhead trace values does not match the expected trace settings. The following options are available: Enabled - TIM alarms are recognized and reported. Disabled - TIM alarms are ignored.

Expected J0	Defines the expected J0 trace received on the incoming SDH signal. A RS-TIM alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Regenerator Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected J0 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected J0 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected J0 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

Expected HP J1	Defines the expected J1 trace received on the incoming SDH signal. A HP-TIM alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Higher-order Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected J1 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected J1 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected J1 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

Expected LP J2	Defines the expected J2 trace received on the incoming SDH signal. A LP-TIM alarm occurs if the incoming J2 trace does not match the expected J2 trace. The J2 byte is part of the Lower-order Path OH and is known as the Path trace, or J2 trace. The J2 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected J2 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected J2 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected J2 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.  This option is only available for C-2, C-12, and C-11 mappings.

SS Bits Alarm Reporting	Disables or Enables SS bits reporting. This function is used in conjunction with the Expected SS Bits function. If enabled, and an SS Bits mismatch is detected on the received signal, the duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: 00 (SONET) 01 (Undefined) 10 (SDH) 11 (Undefined)
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TC Trace function. The TC Summary LED turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. HP Enable - Turns on N1 byte for TCM error and alarm reporting mode. LP Enable - Turns on the N2 byte for TCM error and alarm reporting mode. Disable - Turns off TCM error and alarm reporting mode.  Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.

Expected TC Trace	Defines the expected TCM trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: Default (16 byte): Selects the Digital Lightwave ASCII message as the expected TC trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected TC trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected TC trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected TC trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

SDH Receive - Set / Set 3

The SDH Receive Settings 3 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Monitor Mode	Expands the receive sensitivity for the 52M or 155M electrical interfaces. Use this setting for better clock and data recovery, when the received voltage levels are lower than normal.

Signal Auto-Recovery Method	This is used as an attempt to recover the signal in the event the SDH's client processor signal (Packet tab, etc) is in an alarm state such as Loss of Frame or Loss of Link. By setting this to Default, the SDH processor will refresh every 30 seconds or so, which gives the client processor an opportunity to re-acquire a good framing or link. By setting this to Alternate, then the SDH processor will not try to auto-recover (refresh) when the client processor framing or link state is bad. You may need to force an LOS event (and then clear the LOS event) after the signal failure has been resolved, for the client to re-acquire client framing or link state.

SDH Receive - SOH

The Receive SOH screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SDH signal.
RS/MS Section Overhead	The following bytes appear for the selected SOH slot: Regenerator Section Overhead bytes (A1, A2, Z0, B1, E1, F1, and D1-D3) B1, E1, F1 and D1-D3 are only available for Slot 1, and usage of those bytes in other slots is undefined Pointer bytes (H1, H2, and H3) Multiplex Section Overhead bytes (B2, K1, K2, D4-D12, S1, M1, and E2) K1, K2, D4-D12, E2 and S1 are only available for Slot 1, and usage of those bytes in other slots is undefined

	S1 can be selected to display the received byte's translated value M1 is only available for Slot 3, and usage of this byte in other slots is undefined
J0	Displays the J0 trace received on the incoming SDH signal. This is a read-only function.

 An [Trace Identifier Mismatch \(TIM\)](#) alarm can be enabled to alert the user when the J0 overhead trace values being received does not match the expected trace setting.

SDH Receive - POH

The Receive POH screen contains the following options:

Option	Description
AU-<#> Dropped	Allows the user to enter the number of the specific AU channel to monitor. The default setting is 1.  When a VCAT mapping is chosen, this setting changes to VCAT Channel.
HP Overhead	Displays the Overhead bytes (B3, C2, G1, F2, H4, Z3, Z4, and Z5) for a specific Higher-Order Path OH slot on the incoming SDH signal. This is a read-only function.
LP Overhead	Displays the Overhead bytes (V5, N2 and K4) for a specific Lower-Order OH slot on the incoming SDH signal. This is a read-only function.
HP J1 Trace	Displays the HP J1 trace received on the incoming SDH signal. This is a read-only function.
LP J2 Trace	Displays the LP J2 trace received on the incoming SDH signal. This is a read-only function.
TC Trace	Displays the TC trace received on the incoming SDH signal. This is a read-only function.



An [Trace Identifier Mismatch \(TIM\)](#) alarm can be enabled to alert the user when any of the above overhead trace values being received does not match the expected trace setting.

SDH Receive - SIG

Displays the following measurements of the incoming SDH signal:

Frequency in Hz

Line Frequency Offset Received in Hz and ppm

Optical power in dBm

AU Pointer Frequency Offset in ppm

TU Pointer Frequency Offset in ppm

Update Signal Calibration (*only available when Enable Calibration is selected*)

See [Calibrating SDH/SONET Electrical Interface Power Meters](#) for calibration instructions.

Receive - VCAT

The Receive VCAT function allows you to setup the parameters of what the NIC expects to see on an incoming VCAT signal and to view certain parameters of the incoming signal.

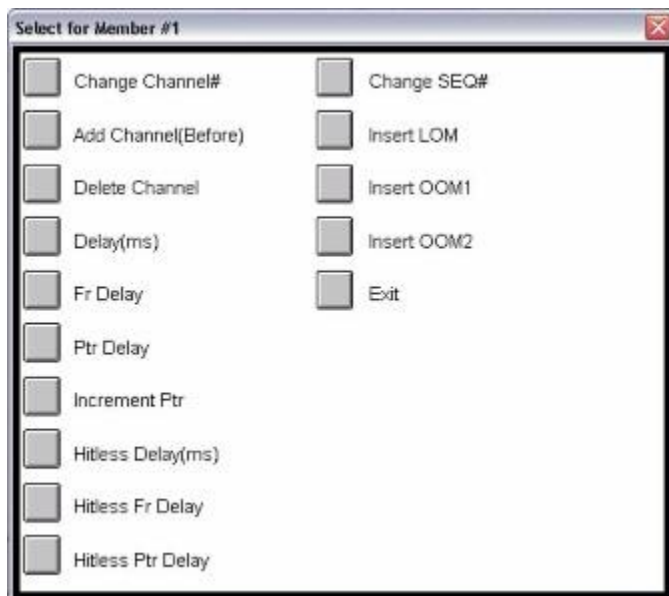
For instructions on configuring VCAT see [How to Set Up and Use VCAT Features](#).

VCAT channels created and various other parameters are displayed in the VCAT Table.

	For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Exp Seq	Expected Sequence Number. This is the sequence of VCG members expected, based on the sequence of the Members column.
Seq #	This is the detected Sequence Number Indicator.  If the detected Seq# differs from the Expected Sequence number, and a Sequence Mismatch alarm is reported.
Delay (ms)	Combined Delay. The amount of time this member is delayed as compared to the earliest member. This delay is the same as indicated in Frame and Pointer Delays, expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames this member is delayed as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. This indicates the pointer delay value detected on this member.

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:

 For user convenience, the same transmit settings found on the Transmit VCAT screen are also available on the Receive VCAT screen.



Many of the options in the menu actually apply to Transmit settings. The first three menu items (Change Channel #, Add Channel and Delete Channel) specifically apply to the Receive VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	Description
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member, entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of frames.
Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.

Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.
Change SEQ #	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing the setup of the member

Receive - LCAS Sk

 For detailed information about LCAS, and instructions on configuring LCAS, see [How to Set Up and Use LCAS Features](#).

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the [Transmit - LCAS So](#) screen, and the Sink functionality is available from the Receive - LCAS Sk screen.

 Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated "Source" and the receive is designated "Sink". LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Receive Settings

Access LCAS Receive features by the selecting **LCAS Sk** (LCAS Sink) side tab from the Receive screen. The LCAS Settings table will appear, listing all of the members within the receive VCG.

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	IDLE	FAIL	255	IDLE
2	4	IDLE	FAIL	255	IDLE
3	9	IDLE	FAIL	255	IDLE
4	17	IDLE	FAIL	255	IDLE
5	29	IDLE	FAIL	255	IDLE
6	44	IDLE	FAIL	255	IDLE
7	53	IDLE	FAIL	255	IDLE
8	64	IDLE	FAIL	255	IDLE

The receive LCAS settings table is used to configure LCAS Sink functions.

The following functions are found in the receive LCAS settings table

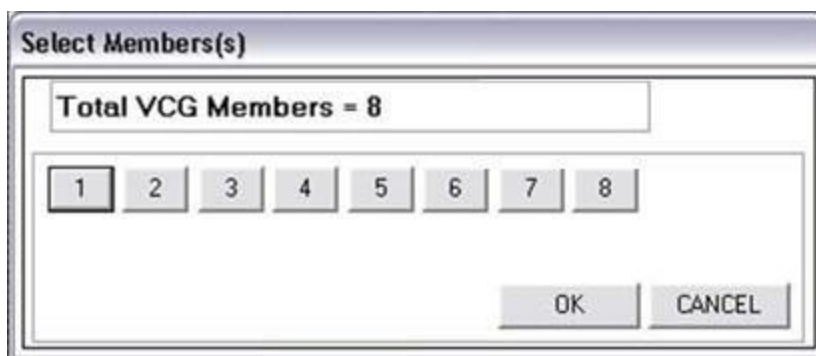
Function	Description
Set (button)	Selects the LCAS Settings Table
Trace (button)	Selects the LCAS Trace Table
Hold Off (button)	Delays sending a failure message back to the source, in seconds
Wait to Restore (button)	Delays sending an "OK" back to the source, in seconds
Add (button)	Adds selected VCG members to the LCAS data stream

Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequenece - Acknowledge messages received
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member's channel number. For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
State	Indicates the state of this VCG member. The possible states are: IDLE: This member is not in use. OK: This member is configured as part of the receive payload, and data is being received as expected. Fail: This member is configured as part of the receive payload, but no data is being received.
MST	Displays the Member Status, being sent to Source (So) from Sink (Sk)
Rcvd SQ	Sequence Number received from Sink (Sk)

Rcvd CTRL	Control message sent from Source to Sink. Possible values are: ADD: Member to be added to the VCG NORM: Normal LCAS transmission EOS: End of Sequence, highest member in group IDLE: Member is part of the VCG or to be removed DNU: Do not use, Sink reports failure
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Add and Remove

Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Receive Trace

Press **Trace** to display the LCAS Trace Table.

☐ Filter Trace by Member Number— Off

Mem	ElapsedTime	State	MST	SQ	CTRL	RsAck
-	000:00:16:01	-	-	-	-	0*
1	000:00:16:29	IDLE*	FAIL	255	IDLE	0
2	000:00:19:57	FAIL*	FAIL	1	ADD	0
-	000:00:19:58	-	-	-	-	0*
5	000:00:20:50	FAIL*	FAIL	1	ADD	0
6	000:00:20:50	FAIL*	FAIL	2	ADD	0
7	000:00:20:50	FAIL*	FAIL	3	ADD	0
8	000:00:20:50	FAIL*	FAIL	4	ADD	0
-	000:00:20:51	-	-	-	-	0*
4	000:00:21:51	FAIL*	FAIL	255	IDLE	0
-	000:00:22:04	-	-	-	-	0*
7	000:00:22:24	IDLE*	FAIL	3	NORM	0
-	000:00:23:10	-	-	-	-	0*
4	000:00:23:23	IDLE*	FAIL	255	IDLE	0
-	000:00:29:36	-	-	-	-	0*
2	000:00:29:50	IDLE*	FAIL	255	IDLE	0
5	000:00:29:50	IDLE*	FAIL	255	IDLE	0
6	000:00:29:50	IDLE*	FAIL	255	IDLE	0

The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description
Filter Trace by Member Number	Select User Defined to specify an individual member number. Only the activity of the selected member will be displayed. Select Off to display the activity of all members.

Results

SDH Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides information used for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

[Scan / Error / Alarm](#)

[PTR](#)

[Event](#)

[APS](#)

[Large LED](#)

[Graph](#)

[VCAT](#) (Only appears when the test set is configured for VCAT)

[LCAS](#) (Only appears when the LCAS is enabled.)

SDH Results - Scan / Errors / Alarms

The Results ERR screen contains the following options:

Scan - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

Errors - The unit can monitor and report errors on the incoming SDH signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the SDH network, or errors that are intentionally generated by the system when it is used in a loopback environment.

The following errors can be monitored:

▶ BPV (Bi-Polar Violation, for STM-0e only)	▶ LP-BIP (Low-Order Path - Bit Interleaved Parity)
▶ LCV (Line Code Violation, for STM-1e only)	▶ LP-REI (Low-Order Path - Remote Error Indication)
▶ Frame	▶ BIT (BIT errors reported in the payload)
▶ B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)	▶ HP/LP-TC-IEC (Tandem Connection-Incoming Error Count)
▶ B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)	▶ HP/LP-TC-REI (Tandem Connection-Remote Error Indicator)

▶ B3 (Path BIP-8, also known as an STS Path Coding Violation - CV-P)	▶ HP/LP-TC-OEI (Tandem Connection-Outgoing Error Indicator)
▶ MS-REI (Multiplex Section - Remote Error Indication)	▶ AU-NDF (Administrative Unit - New Data Flag)
▶ HP-REI (Higher-Order Path - Remote Error Indication)	▶ TU-NDF (Tributary Unit - New Data Flag)

The following parameters are measured for the incoming errors:

- ▶ Error count using an 11-digit format
- ▶ Average error rate using an N.NNe-N format
- ▶ Current error rate using an N.NNe-N format
- ▶ Error-free seconds using an 8-digit format
- ▶ Errored seconds
- ▶ Severely Errored seconds
- ▶ Unavailable errored seconds

Alarms - The system can monitor and report alarms and their duration on the incoming SDH signal. The alarms are shown in duration of the alarm in seconds.

The following alarms can be monitored:

▶ LOS (Loss of Signal)	▶ HP-RDI (Higher-Order Path Remote Defect Indicator)
▶ Power Hot - See Power Hot Alarm for details.	▶ HP-TIM (Higher Order Path Trace Identifier Mismatch for the J1 byte)
▶ Power Warm - See Power Warm Alarm for details.	▶ SS MISMATCH (Signal Status bits mismatch)
▶ Power Low - See Power Low Alarm for details.	▶ TU-AIS (Tributary Unit - Alarm Indication Signal)
▶ Frequency Wide	▶ TU-LOP (Tributary Unit - Loss of Pointer)

▶ OPU Generic AIS (Unframed - PRBS 11)	▶ TU-LOM (Tributary Unit - Loss of Multiframe Alignment)
▶ LOF (Loss of Frame)	▶ LP-UNEQ (Low-Order Path Unequipped Payload)
▶ MS-AIS (Multiplex Section Alarm Indication Signal)	▶ LP-RDI (Low-Order Path Remote Defect Indicator)
▶ APS-L (Automatic Protection Switching)	▶ LP-RFI (Low-Order Path Remote Failure Indicator)
▶ OOF (Out of Frame)	▶ LP-TIM (Low-Order Path Trace Identifier Mismatch for J2 byte)
▶ MS-RDI (Multiplex Section Remote Defect Indicator)	▶ LP-PLM (Low-Order Path Payload Label Mismatch)
▶ RS-TIM (Regenerator Section Trace Identifier Mismatch for J0 byte)	▶ HP/LP-TC-RDI (Tandem Connection-Remote Defect Indicator)
▶ Pattern Sync	▶ HP/LP-TC-ODI (Tandem Connection-Outgoing Defect Indicator)
▶ HP-PLM (Higher-Order Path Payload Label Mismatch)	▶ HP/LP-TC-AIS (Tandem Connection-Alarm Indication Signal)
▶ Concat (Concatenated)	▶ HP/LP-TC-UNEQ (Tandem Connection-Unequipped)
▶ AU-AIS (Administrative Unit Alarm Indication Signal)	▶ HP/LP-TC-LOF (Tandem Connection-Trace Identifier Mismatch)
▶ AU-LOP (Administrative Unit Loss of Pointer)	▶ HP/LP-TC-TIM (Tandem Connection-Trace Identifier Mismatch)
▶ HP-UNEQ (Higher-Order Path Unequipped Payload)	

SDH Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

Pointer Justification - Indicates the Positive Pointer Justification count.

Negative Justification - Indicates the Negative Pointer Justification count.

Positive Justification Seconds - Indicates the duration of a Pointer adjustment.

NDF Count - Indicates the New Data Flag count.

Rx Pointer Bytes (HEX) and **Rx Pointer Value** (in decimal) - Valid Pointers range from 0 to 782.



When lower-order mapping is configured TU Pointer results also appear.

SDH Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

SDH Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description
APS Summary	When selected, the following information appears in the results table last 15 K1 and K2 byte sequences received: The HEX value of the K1 byte.

	The HEX value of the K2 byte. The number of frames received that contain the K1 and K2 bytes. The elapsed time of the frames that contain the K1 and K2 bytes.  To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.
APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either Linear Protection Switching Mode or Ring APS Signaling Mode.

 Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

SDH Results - Large LED

This displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the SDH protocol processor, see [Quick Status LEDs](#).

SDH Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Results - VCAT

All monitored VCAT channel activity that the system receives is reported to the Results screen. The Results functionally provides several drill-down layers for analyzing the incoming signal, alarms, and errors.

For instructions on configuring VCAT see [How to Set Up and Use VCAT Features](#).

The following screen displays Alarm and Error counts that are common to all channel and access to the detailed information on each channel.

Alarm		Seconds	
LOA		0	
Pat Sync		0	

Error Description	Count	Average Rate	Current Rate
BIT	0	0.00e+000	0.00e+000

#	Chan	Seq	LOM	OOM1	OOM2	SQM	Path	TCM
-	Detail View							
1	45	0	[X]					
2	43	1		[X]				
3	25	2			[X]			
6	51	66				[X]		

The following is found on the Results screen:

Options	Description
Alarm	The following statistics are displayed: Alarm - Displays the alarm types that are common to the entire VCG. LOA – Loss of Alignment. Indicates that the receiver is unable to align all members of the VCG. Patt Sync – Loss of synchronization of the payload pattern. Seconds - Displays the number of seconds that an alarm was present since the last time the restart button was pressed.
Error	The following statistics are displayed:

	Error Description - Displays the error types that are common to the entire VCG. BIT – Payload Bit Errors Count - Displays the error count using an 11-digit format. Average Rate - Displays the average error rate over the full elapsed time. Current Rate - Displays the current error rate (the error rate in the last one second).
Detail View  You can drill down to channel-specific details by selecting "Detail View" or any Member in the Detail View table. This opens the VCAT Detail View dialog box that allows you to select a specific channel and view its errors and alarms. See below.	The following statistics are displayed: # - Displays the Member number. Chan - Displays the Channel number. Seq - Displays the VC sequence number. LOM - Loss of Multiframe alignment. [X] indicates a LOM is detected on this channel. OOM1 - Out of Multiframe alarm, level 1. [X] indicates an OOM1 is detected on this channel. OOM2 - Out of Multiframe alarm, level 2. [X] indicates an OOM2 is detected on this channel. SQM - Sequence Number Mismatch. [X] indicates a SQM is detected on this channel. Path - Path summary indication. [X] indicates a Path error/alarm is detected on the channel. TCM - Tandem Connection Monitoring

Detail View

Touching "Detail View" or any member in the Detail View table brings up a window like this SONET example:

Now Showing VCAT Channel AU#160 6.1 (Member #14) Exit

AU#1 1.1	AU#1 5.1	AU#20 3.1	AU#20 6.1	AU#79 2.1	AU#79 7.1	AU#101 1.1	AU#101 4.1
AU#121 3.1	AU#121 6.1	AU#121 7.1	AU#160 3.1	AU#160 1.1	AU#160 6.1		

Error Description	Count	Average Rate	Current Rate

Alarm	Seconds
LOM	0
OOM1	0
OOM2	0
SQM	0
MSU	0
TU-AIS	0
TU-LDP	0

Or like this SDH example:

Now Showing VCAT Channel STS# 1 3.2 (Member #1) Exit

STS# 1 3.2	STS# 1 5.3	STS# 1 7.4	STS# 2 2.4	STS# 2 4.2	STS# 2 7.1	STS# 3 4.3	STS# 3 4.4

Error Description	Count	Average Rate	Current Rate

Alarm	Seconds
LOM	35
OOM1	1
OOM2	1
SQM	0
MSU	0
AIS-V	0
LDP-V	0

Select the desired channel at the top of the window and full error and alarm information will be displayed for that member.

Results - LCAS

 For detailed information about LCAS, and instructions on configuring LCAS, see [How to Set Up and Use LCAS Features](#).

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit LCAS So screen, and the Sink functionality is available from the Receive LCAS Sk screen.

 Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Results

Access the LCAS Results measurements by the selecting  side tab from the Results screen. Select to view the [Summary](#), [Source](#) or [Sink](#) results screen.

Summary Screen

Select “Summary” to display an overview of LCAS alarms. This screen shows a split view of the condition or status for both the transmit (Source) and receive (Sink) VCAT Group (VCG) members.

 IDLE members are VCG members that have not been configured as part of the LCAS data stream.

Summary			Source			Sink		
Source								
VC Group Alarms: PLCT TLCT LOCT								
Per Member Alarm NaMST dUMST								
1	2	3	4	5	6	7	8	9
ADD	ONU	NORM	IDLE	NORM	REM	IDLE	IDLE	IDLE
Sink								
VC Group Alarms: PLCR TLCR LOCR dSONC								
Per Member Alarm Summary: Non LCAS								
1	2	3	4	5	6	7	8	9
FAIL	IDLE	OK	IDLE	OK	OK	FAIL	IDLE	IDLE

[See below for definitions of all alarm conditions](#)

White boxes with black text indicate that the alarm condition has not been detected during the current test.

A white box with red text is a history indication; the alarm condition has been detected during the current test but is not present at this time.

A red box indicates a current alarm condition.

Source Screen

Select "Source" to display detailed LCAS Source alarms.

Summary Source Sink		
Alarm		Seconds
LOCT (Loss Of Capacity Transmit)		0
PLCT (Partial Loss of Capacity Transmit)		0
TLCT (Total Loss of Capacity Transmit)		0
#	No MST	dUMST
Detail View		
1	[X]	
2	[X]	
3	[X]	
4	[X]	
5	[X]	
6	[X]	
7	[X]	
8	[X]	

[See below for definitions of all alarm conditions](#)

The Alarm View reports the duration of all alarm types in seconds.

The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Sink Screen

Select “Sink” to display detailed LCAS Sink alarms.

Summary		
Source		
Sink		
Alarm	Seconds	
LOCR (Loss Of Capacity Receive)	18	
PLCR (Partial Loss of Capacity Receive)	0	
TLCR (Total Loss of Capacity Receive)	18	
SQNC (Inconsistent sequence number)	0	
#	Non LCAS	
-	Detail View	
1	[X]	
2	[X]	
3	[X]	
4	[X]	
5	[X]	
6	[X]	
7	[X]	
8	[X]	

[See below for definitions of all alarm conditions](#)

The Alarm View reports the duration of all alarm types in seconds.

The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Definitions

Source Conditions	Description
LOCT	Loss of Capacity Transmit
PLCT	Partial Loss of Capacity Transmit
TLCT	Total Loss of Capacity Transmit
No MST	Multiframe Status not received
dUMST	Unexpected Multiframe Status counts
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are:

	IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload. DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Sink Conditions	Description
LOCR	Loss of Capacity Receive
PLCR	Partial Loss of Capacity Receive
TLCR	Total Loss of Capacity Receive
SQNC	Inconsistent Sequence Number
Non LCAS	At least one member is not configured as LCAS
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Test

Test Screens and Functions

(Specifically for SDH testing)

The Test screen configures test parameters associated with an SDH protocol processor.

The Test screen contains the following functions:

[SET 1](#)

[Service Disruption](#)

[RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

[Duration](#): This function configures how long a timed test runs for.

[Action After Duration](#): This function defines what activities occur at the conclusion of a timed test

[Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is

 This option appears when Repeat Actions is selected.	stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test	Enables real-time reporting. Any event that occurs during a real-time test automatically

 This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

Select **Test** and choose **Set 1**.

Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.



The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for SDH testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- For all **SDH** rates one frame is roughly .125 ms (125 μ s)

Test Service Disruption functions include:

Action (State) - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

Protection Switch Criteria - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

 For all **SDH** processors the Protection Switch Criteria include: **B1**, **OOF**, **MS-AIS**, **AU-AIS**, **TU-AIS**, and **PRBS** (Bit Errors and Loss of Pattern Sync).

Good Time - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.

► For all **SDH** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.

Good Frames - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating.

► The range is 1 to 16383 frames, and is entered using a keypad.

Switch MilliSecs - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.

Switch Frames - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.

History Recent Milliseconds: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5).

History Recent Frames: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5).

 A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

Test - RTD (Round-Trip Delay)

(Specifically for SONET and SDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

Action (State): Starts and stops round-trip delay mode.

► **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the errored frame is received by the unit. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.

► **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

► **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.

Round Trip Delay Time (milliSec): Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.

Round Trip Delay Time (Frames): Indicates the number of frames detected after each errored frame is transmitted and return back to the unit.

► The **Current** column displays the most recent round trip measurement.

► The **Minimum** column displays the fastest round trip measurement.

► The **Maximum** column displays the slowest round trip measurement

Consecutive Good Time Required: This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement.

► For all **SONET** and **SDH** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.

Consecutive Good Frames Required: This function allows you to enter the number of consecutive error-free frames to occur before round-trip

measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

Perf Monitor

Performance Monitor Screens and Functions

Specifically for SDH testing

Performance Monitoring provides greater detail about incoming Regenerator Section (RS), Multiplex Section (MS), Higher-Order Path (HP), Lower-Order Path (LP), BIT errors, and M.2120 / M.2110 compliant Performance Monitoring.

The following options are available:

[RS](#)

[MS](#)

[HP](#)

[LP](#) *(only available when in a LP mapping)*

[BIT](#)

[M.2120 / M.2110](#)

Perf Monitor - RS

Specifically for SDH testing

This provides a detailed breakdown for Regenerator Section errors detected and logged by the SDH protocol processor.

G.826 Near B1 Errors

Errored Block (EB) count

Background Block Error (BBE) by count, rate percentage, and objective percentage.

Errored Seconds (ES) by count, rate percentage, and objective percentage.

Error Free Seconds (EFS) by count, rate percentage, and objective percentage.

Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

G.826 Allocation: Select an allocation percentage from 0 to 100.

Status: Pass, Uncertain, or failure

Perf Monitor - MS

Specifically for SDH testing

The MS screen provides a detailed breakdown for Multiplexor section errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.829** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.829 results.

This section is broken down into the following areas:

 **Important:** Select the G.826/G.829 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.829 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

G.826 and G.829 Near B2 Errors and Far MS REI Errors

Errored Block (EB) count

Background Block Error (BBE) by count, rate percentage, and objective percentage.

Errored Seconds (ES) by count, rate percentage, and objective percentage.

Error Free Seconds (EFS) by count, rate percentage, and objective percentage.

Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.

G.826 Allocation: Select an allocation percentage from 0 to 100.

Status: Pass or failure

G.826/G.829: Select the command button to toggle between G.826 and G.829 error statistics.

M.2101.1 Near B2 Errors and Far MS REI Errors

Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.

M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

Duration: Set to 2 hours, 1 day, or 7 days.

Status: Pass, Uncertain, or failure

Perf Monitor - HP

Specifically for SDH testing

The HP screen provides a detailed breakdown for Higher-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the **G.826/G.828** toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

G.826 and G.828 Near B3 Errors and Far HP REI Errors

 **IMPORTANT:** Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B3 Errors output also toggles the Far HP REI Errors output.

Errored Block (EB) count

Background Block Error (BBE) by count, rate percentage, and objective percentage.

Errored Seconds (ES) by count, rate percentage, and objective percentage.

Error Free Seconds (EFS) by count, rate percentage, and objective percentage.

Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.

G.826 Allocation: Select an allocation percentage from 0 to 100.

Status: Pass, Uncertain, or failure

G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near B3 Errors and Far HP REI Errors

Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.

M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

Duration: Set to 2 hours, 1 day, or 7 days.

Status: Pass, Uncertain, or failure

Perf Monitor - LP

Specifically for SDH testing

The LP screen provides a detailed breakdown for Lower-Order Path errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set **allocation** percentages and **durations** by selecting their respective buttons.

For the ITU Standards option, you can select the G.826/G.828 toggle button in the lower-right corner of the ITU Standards error window to toggle the statistics between G.826 and G.828 results.

This section is broken down into the following areas:

 **IMPORTANT:** Select the G.826/G.828 button in the lower-right corner of the ITU Standards window to toggle between G.826 and G.828 statistics. Toggling the Near B2 Errors output also toggles the Far MS REI Errors output.

This section is broken down into the following areas:

G.826 and G.828 Near LP BIP Errors and Far LP REI Errors

Errored Block (EB) count.

Background Block Error (BBE) by count, rate percentage, and objective percentage.

Errored Seconds (ES) by count, rate percentage, and objective percentage.

Error Free Seconds (EFS) by count, rate percentage, and objective percentage.

Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.

G.826 Allocation: Select an allocation percentage from 0 to 100.

Status: Pass, Uncertain, or failure.

G.826/G.828: Select the command button to toggle between G.826 and G.828 error statistics.

M.2101.1 Near LP BIP Errors and Far LP REI Errors

Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.

M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

Duration: Set to 2 hours, 1 day, or 7 days.

Status: Pass, Uncertain, or failure

Perf Monitor - BIT

Specifically for SDH testing

The BIT screen provides a detailed breakdown for BIT errors detected and logged by the SDH protocol processor.

In addition to monitoring the errors, you can set allocation percentages and durations by selecting their respective buttons.

This section is broken down into the following areas:

G.821 BIT Errors

Errored Seconds (ES) by count, rate percentage, and objective percentage.

Error Free Seconds (EFS) by count and rate percentage.

Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.

G.821 Allocation: Select an allocation percentage from 0 to 100.

Status: Pass, Uncertain, or failure

G.826 BIT Errors

Errored Block (EB) count

Background Block Error (BBE) by count, rate percentage, and objective percentage.

Errored Seconds (ES) by count, rate percentage, and objective percentage.

Error Free Seconds (EFS) by count and rate percentage.

Severely Errored Seconds (SES) by count, rate percentage, and objective percentage.

Unavailable Seconds (UAS) by count, rate percentage, and objective percentage.

G.826 Allocation: Select an allocation percentage from 0 to 100.

Status: Pass, Uncertain, or failure

M.2101.1 BIT Errors

Errored Seconds (ES) by count, percentage and S1 and S2 percentage.

Severely Errored Seconds (SES) by count, percentage and S1 and S2 percentage.

M.2101.1 Allocation: Select an allocation percentage from 0 to 100.

Duration: Set to 2 hours, 1 day, or 7 days.

Status: Pass, Uncertain, or failure

Perf Monitor - M.2120 / M.2110

Specifically for SDH testing

The M.2120 / M.2110 screen provides a detailed breakdown for errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period.

[Error thresholds can be set directly from the M.2120 / M.2110 screen.](#)

The following statistics appear on the M.2120 / M.2110

Statistic	Description
Event	Lists the error type and error.
TR15	Threshold Report 15-minute evaluation period. A TR is an error performance report with respect to a 15-minute evaluation period. There are one TR15 and one Reset TR15 (RTR15) for each performance event. The start and end time for the 15-minute evaluation window must occur on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. The TR15 evaluation period occurs as soon as the 15-minute threshold is reached or exceeded. If the number of errors for an event cross the threshold during the 15-minute period the test records "fail"; if the errors do not exceed the threshold the test records "pass." The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result records

	in the Prev15 column and the performance evaluation continues and records the new result in the Cur15 column.
RTR15	Reset Threshold Report 15-minute evaluation period. There are one RTR15 and one TR15 for each performance event. The start and end time for the 15-minute evaluation window must occur on the hour and at 15, 30, and 45 minutes with respect to the elapsed time for each test. An RTR15 occurs at the end of a 15-minute period in which the count is less than or equal to the reset threshold and there has not been any unavailable time during that period. An RTR15 can only occur subsequent to a 15-minute period containing a TR15.
TR24	Threshold Report 24-hour evaluation period. There is one TR24 for each performance event. The start and end time for the 24-hour evaluation window must occur on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded.
Cur15	Displays the pass or fail state for the current 15-minute evaluation period. After the evaluation period ends the registers reset to zero and the pass/fail state records in the Prev15 column and the performance evaluation continues.
Prev15	Displays the pass or fail state for the previous 15-minute evaluation period. The history periods are used as a stack, i.e. the values held in each register are pushed down the stack one place at the end of each 15-minute period, and the oldest value at the bottom of the stack is discarded.
Cur24	Displays the pass or fail state for the current 24-hour evaluation period.
Prev24	Displays the pass or fail state for the previous 24-hour evaluation period.

SDH LED Quick Status Area

When the SDH protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the **Large LED** screen.

 Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.

If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.

If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

 The following acronyms will be used LED Description table below

<u>RSOH</u> = Regenerator Section Overhead
<u>MSOH</u> = Multiplex Section Overhead
<u>HPOH</u> = Higher Order Path Overhead
<u>LPOH</u> = Lower Order Path Overhead
<u>AU</u> = Administrative Unit
<u>TU</u> = Tributary Unit

LED	Description

TX	Indicates current SDH transmit interface wavelength. Wavelengths are SFP/XFP specific. To change the wavelength, simply hot-swap the SFP/XFP module.  WARNING: Always turn the TX Laser off before hot-swapping SFP or XFP modules. When the SFP/XFP module has been removed after an SDH interface was selected, "No Laser" will be displayed. When the laser module is hot-swapped, the laser's transmit wavelength will automatically update for the new SFP/XFP module.  If a non-SDH interface is selected from one of the other tabs, then "Not Assigned" will be displayed.
RX	Displays the received optical power in dBm. This status indicator will flash when the received optical power level exceeds the SFP's/XFP's Power Warm or Power Hot thresholds. See Power Hot, Power Warm and Power Low Alarms for details. When the SFP/XFP module has been removed after an SDH optical interface was selected, "Missing SFP/XFP" will be displayed.
E/A	Indicates the current Error / Alarm configured for transmission in the SDH signal. This is a status indicator.
Test Paused	If red, indicates that the current test has been paused.
CLK	Indicates the value of the Transmit Clock Reference function. This is a status and an alarm indicator.  The text will turn red if TX Clock Loss alarm is present.
All Tests (button)	This is a short-cut button to the general "All Test Status" summary LED screen for all circuit packs installed in the unit.

RS	RSOH Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received, including a Frame error. This is a status LED.
LOS	Loss of Signal. Indicates that a valid SDH signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SDH signal, then an LOS is reported.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming SDH signal has been detected. An LOF is reported if an Out Of Frame (OOF) defect continues for 3 milliseconds or longer. This is alarm LED.
OOF	Out Of Frame. Declared when four or more consecutive errored frames are detected on the incoming SDH signal. This is an alarm LED.
B1	RSOH BIP-8 Code Violation. Indicates an error in the SDH frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is an RS error that applies not only to the RSOH, but the entire SDH frame. Any error in the frame will result in B1 error. This is an error LED.
MS	MSOH Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
MS-REI	MSOH Remote Error Indication. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the MSOH are used for this indicator. This is an error LED.
MS-AIS	MSOH Alarm Indication Signal. Indicates if an alarm is being received from upstream MS terminating equipment. This is an alarm LED.
APS	Automatic Protection Switching. Indicates that the K1 and K2 bytes on the incoming SDH signal have changed.
MS-RDI	MSOH Remote Defect Indication. Indicates that a downstream defect has occurred along the MS layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.

B2	MSOH BIP-8 Code Violation. Indicates that parity errors were detected at the MS layer of the incoming SDH signal. This is calculated over the MSOH, HPOH, and payload of each STM-n. This is an error LED
HP	HPOH Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AU-AIS	AU Alarm Indication Signal. Indicates if an alarm is being received from upstream HP terminating equipment. This is an alarm LED.
HP-RDI	HPOH Remote Defect Indication. Indicates that a remote alarm is being received from downstream HP terminating equipment. The G1 byte of the HPOH is used for this indicator. This is an alarm LED.
AU-LOP	AU Loss of Pointer. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SDH signal. This is an alarm LED.
HP-REI	HPOH Remote Error Indication. Indicates that an error count is being received from downstream HP terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
AU-PTR	AU Pointer Adjustments. Indicates Pointer offsets or adjustments between the payload and the STM-N frame are occurring. This is a status LED.
B3	HPOH BIP-8 Code Violations. Indicates that parity errors were detected at the HP layer of the incoming SDH signal. This is calculated over the HPOH and payload of each STM-N. This is an error LED.
HP-UNEQ	HPOH Unequipped Payload. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from HP terminating equipment. This is an alarm LED.
LP	LPOH Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.  This section is only available when C-2, C-12, or C-11 is mapped.

TU-AIS	TU Alarm Indication Signal. Indicates an all-ones characteristic or adapted information signal was detected on the TU. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
TU-LOP	TU Loss of Pointer. Indicates that an invalid Pointer has been received or a TU Pointer loss has been detected on the incoming SDH signal. This is an alarm LED.
TU-PTR	TU Pointer Adjustments. Indicates Pointer offsets or adjustments between the VC payload and the STM-N frame are occurring. This is a status LED.
TU-LOM	TU Loss of Multiframe Alignment. Indicates a Loss of Multiframe Alignment in the TU. This is an alarm LED.
LP-RDI	LPOH Remote Defect Indication. Indicates that a remote alarm is being received from downstream LP terminating equipment. The V5 byte of the LPOH is used for this indicator. This is an alarm LED.
LP-RFI	LPOH Remote Failure Indication. Indicates a defect on the TU has persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a LP protection switch. This is an alarm LED.
LP-REI	LPOH Remote Error Indication. Indicates to the transmitting node that an errored block has been detected at the LP receiving node. This is an error LED.
LP-UNEQ	LPOH Unequipped Payload. Indicates that an all-zeros patterns has been detected in the LP Signal Label of the V5 byte. This is an alarm LED.
LP-BIP	LPOH BIP-2 Code Violations. Indicates an error occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of each bit position in the group. This is calculated over the LPOH and payload of each VC. This is an error LED.
PAT SYNC	Pattern Sync Mismatch. Indicates a loss of pattern synchronization. This is an alarm LED.

BIT ERR	BIT Error. Indicates a Bit error was detected in the payload. This is an error LED.
TCM  This LED only appears when TCM Overhead Processing has to be enabled in the Receive settings.	Tandem Connection Status LED. Indicates if a TCM error or alarm has been detected.  If this LED is red, select the "TCM" text to display the TCM Summary LEDs.
VCAT  This LED only appears for VCAT mappings, when one or more channels have been added to the Receive VCG.	Virtual Concatenation. Indicates if any of the errors or alarms within the received VCG. This is a status LED.  If this LED is red, select the "VCAT" text to display the VCAT Summary LEDs.
LCV	Line Code Violations. Indicates that the 155M Electrical Interface received a CMI Line Encoding error. This is an error LED.
BPV	Bi-Polar Violations. Indicates that the 52M Electrical Interface received a B3ZS Line Encoding error. This is an error LED.
SSM	Signal Status Mismatch - Displays when the expected SS bits setting in the H1 byte do not match what is received. This is an alarm LED.  SS Bits Alarm Reporting must be enabled for this alarm to occur..

Specific Tasks

SDH Specific Tasks Overview

This section includes tasks that are specific to the SDH protocol processor. For general tasks, refer to the [Common Tasks](#) section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

[How to Set Up and Use VCAT Features](#)

[How to Set Up and Use LCAS](#)

[Make Pointer Adjustments](#)

[GFP Payloads for SDH mappings](#)

[802.3 10G LAN Testing](#)

[10G WAN Testing](#)

[Configuring APS \(K1 and K2\) Commands](#)

[Decoding APS \(K1 and K2\) Values](#)

[Using M.2120 / M.2110 PM](#)

[Testing SDH Jitter Interfaces](#)

[Add/Drop an E1 Signal from an STM-1 Signal](#)

[Add/Drop SONET/SDH and PDH Signals](#)

VCAT

How to Set Up and Use VCAT Features

NIC test sets licensed for VCAT functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing VCAT (Virtual Concatenation) for more efficient data transfer.

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

VCAT features are accessed under the SONET or SDH tab, in Transmit, Receive, and Results sections.

[Configuring VCAT Mapping](#)

[Adding and Editing VCAT Channels](#)

[Inserting VCAT Delays](#)

[Inserting VCAT Errors and Alarms](#)

[Viewing VCAT Alarm and Error LEDs](#)

[Viewing VCAT Alarm and Error Results](#)



After configuring a VCAT group, see [How to Set Up and Use LCAS](#) for LCAS configuration and information.

How to Set Up and Use VCAT Features

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[Viewing VCAT Alarm and Error LEDs](#)

[Viewing VCAT Alarm and Error Results](#)



After configuring a VCAT group, see [How to Set Up and Use LCAS](#) for LCAS configuration and information.

Configuring VCAT Mappings

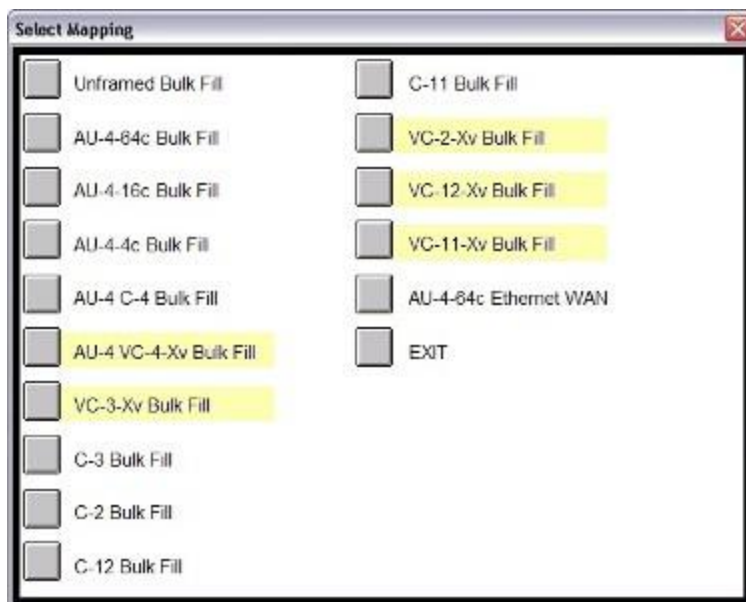
The following procedures describe how to configure the NIC for VCAT mapping in SDH and SONET. The NIC unit must be equipped with High-Order or Low-Order VCAT test options.

VCAT Mappings in SDH mode:

Select the **SONET** or **SDH** tab.

Select **Transmit**, and then select the **Set 1** side tab.

Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

Choose any of the following selections as applicable:

Higher-Order Mappings

AU-4 VC-4-Xv Bulk Fill (Not applicable when using STM-0, STM-0e, STM-1 or STM-1e Interface)

AU-3 VC-3-Xv Bulk Fill (Not applicable when using STM-0 or STM-0e Interface)

Lower-Order Mappings

VC-3-Xv Bulk Fill (when AU-Type is AU-4)

VC-2-Xv Bulk Fill

VC-12-Xv Bulk Fill

VC-11-Xv Bulk Fill

Select **AU-Type** and choose **AU-3** or **AU-4**; if available for the selected mapping..



The mapping will be displayed as AU-3 or AU-4, followed by the selected VC mapping. The above mapping choices plus the selection of AU-3 or AU-4 make it possible to do any of the following mappings:

AU-4 VC-4-Xv Bulk Fill

AU-4 VC-3-Xv Bulk Fill

AU-4 VC-2-Xv Bulk Fill

AU-4 VC-12-Xv Bulk Fill

AU-4 VC-11-Xv Bulk Fill

AU-3 VC-3-Xv Bulk Fill

AU-3 VC-2-Xv Bulk Fill

AU-3 VC-12-Xv Bulk Fill

AU-3 VC-11-Xv Bulk Fill

Select **Payload**, and choose the desired [Payload Pattern](#) (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).

Once the mapping is configured for VCAT, see [Adding and Editing VCAT Channels](#).

VCAT Mappings in SONET mode:

Select the **SONET** tab.

Select **Transmit**, and then select the **Set 1** side tab.

Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

Choose any of the following selections as applicable:

STS Mappings

STS-3c-Xv Bulk Fill (Not applicable when using OC-1, EC-1, OC-3 or EC-3 Interface)

STS-1-Xv Bulk Fill (Not applicable when using OC-1 or EC-1 Interface)

VT Mappings

VT-6-Xv Bulk Fill

VT-2-Xv Bulk Fill

VT-1.5-Xv Bulk Fill

Select **Payload**, and choose the desired [Payload Pattern](#) (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).

Once the mapping is configured for VCAT, see [Adding and Editing VCAT Channels](#).

Adding and Editing VCAT Channels

Adding VCAT Channels

The following procedure describe how to add VCAT channels, to form a VCG (Virtual Concatenation Group). Before channels can be added, the NIC must be configured for VCAT Mapping. See [Configuring VCAT Mapping](#).

Select **SDH** or **SONET** tab.

💡 This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

Select Transmit or Receive.

💡 All functions of setting up VCAT channels can be added through either Transmit or Receive, even functions that involve the Transmit only. If “Settings Control” (Under Transmit or Receive “Set 1”) is Coupled, both Transmit and Receive will be configured.

Select the **VCAT** side-tab. The VCAT Table will be displayed.

This is the **Transmit** VCAT Table:

[illegible]

This is the **Receive** VCAT Table:

[illegible]

Adding Channels in High-Order Mappings

Select **Add**. The Select Channel(s) window will appear.

Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:

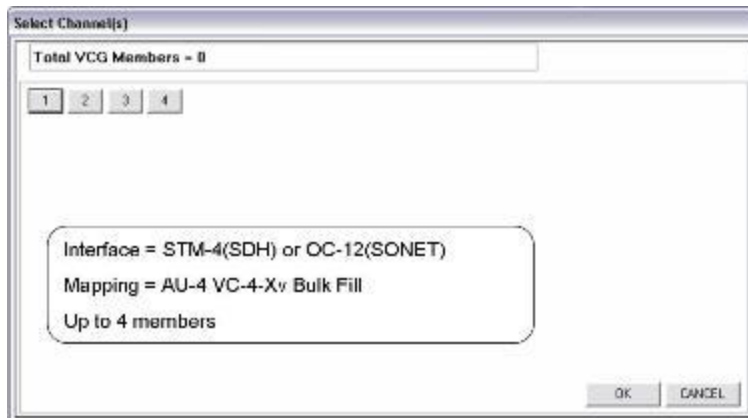
Select Channel(s)

Total VCG Members - 0

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63	64								

Interface = STM-64(SDH) or OC-192(SONET)
 Mapping = AU-4 VC-4-Xv Bulk Fill
 Up to 64 members

OK CANCEL



Select any channel. **Total VCG Members** will change from 0 to 1.

Continue to select additional members as required.

When you select a member, the member button become disabled, to indicate that the channel has been selected.

This window will alert you when the maximum number of members has been selected.

Select **OK**.

The Select Channel(s) window will close, and the newly added channels will appear in the VCAT Table, as in this example:

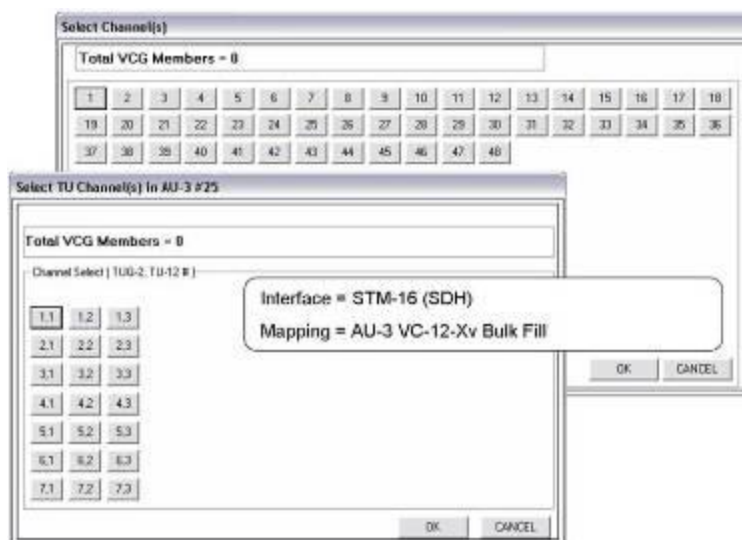
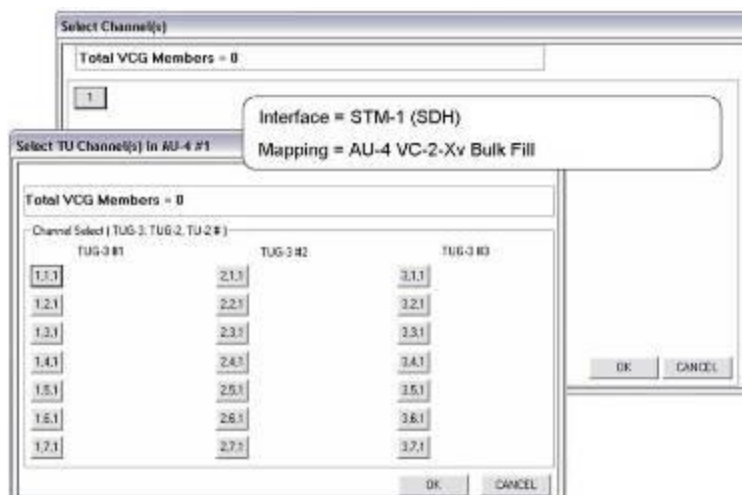
[illegible]

Adding Channels in Low-Order Mappings

The basic procedure for low-order mappings is the same as high-order mappings except that there is two-stage channel-selection process.

Select Add. The Select Channel(s) window will appear.

Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:





Select TU or VT channels as required.

Continue to select additional channels as required.

Select OK.

SDH Example (*STM-64, AU-3 VC-11-Xv mapping*):Add

1374

[illegible]

Insert a channel before an existing channel in the VCAT Table

Select a Member row. The Select for Member <#> dialog box appears.

Select **Add Channel (Before)**. The **Select Channel to Insert** dialog box appears.

Select the desired channel.

Both dialog boxes automatically close and a new channel is inserted above the previously selected line, automatically renumbering the Member column.

 After configuring a VCAT group, see [How to Set Up and Use LCAS](#) for LCAS configuration and information.

Editing VCAT Channel Configurations

Changing a Channel Assignment

Select the **Member** row to be changed. The Select for Member <#> dialog box appears.

Selected **Change Channel #.**

Select the desired Channel as described above.

The window will close and the selected member will be changed to the requested channel.

Deleting VCAT Channels

Deleting a Channel

Select the **Member** row to be deleted. The **Select for Member <#>** dialog box appears.

Select **Delete Channel**.

The window will close and the selected channel will be deleted.

Deleting All Channels

Select **Delete All** (located above the VCAT Table).

All members will be deleted.

Inserting VCAT Delays

The NIC can insert delay on any of the VCAT channels individually.

Select **SDH** or **SONET** tab.



This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

Select **Transmit**.



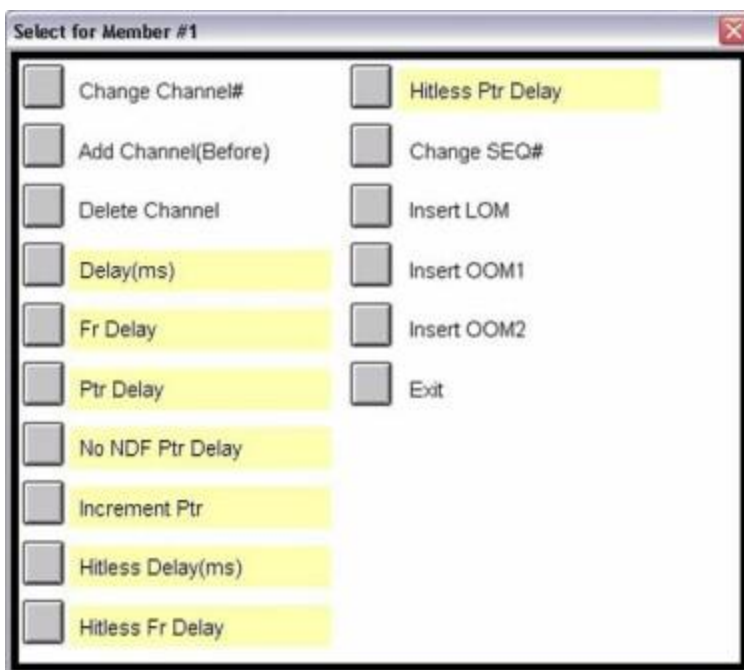
The delay can actually be inserted from the Receive screen as well but the Receive VCAT Table will not display the inserted delay. The Receive VCAT Table displays measured delay.

Select the **VCAT** side-tab. The VCAT Table will be displayed.

[illegible]

Select the desired **Member** row to insert delay. The Select for Member <#> dialog box appears.

The highlighted items in the image below are the options for delay insertion.



(Highlights do not appear in the NIC screen.)

Select the desired delay type as detailed below.

Delay(ms) - Inserts Combined Delay, the amount of time to delay this member as compared to the earliest member, entered in milliseconds

(ms). Acceptable values are 0 to 255.99984, other values for Low-Order mappings.

Fr Delay - Inserts Frame Delay, the number of frames to delay this member as compared to the earliest member, entered in number of frames.

Acceptable values are 0 to 2047, other values for Low-Order mappings.

Ptr Delay - Changes the pointer value of the selected member, creating a very small delay. Acceptable values are 0 to 782 for High-Order mappings, other values for Low-Order mappings.

No NDF Ptr Delay - Changes the pointer value without New Data Flag (NDF).

Increment Ptr - Increase pointer value by 1.

Hitless Delay(ms) - Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 255.99984, other values for Low-Order mappings.

Hitless Fr Delay - Inserts Frame Delay on the selected member, entered in number of frames, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 2047, other values for Low-Order mappings.

Hitless Ptr Display - Changes the pointer value of the selected member, creating a very small delay, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 782, other values for Low-Order mappings.

Once the error type is selected, a window with numeric keypad will appear. The title, max. value and min. value will differ depending upon the delay type selected. The following example is for Delay(ms).

Enter Delay in ms

Max. Value: 255.99519
Min. Value: 0.00000

Enter the desired delay value.

Press **OK**. The numeric keypad will disappear and the requested delay will be displayed in the VCAT Table. See example below.

Delete All Reset Seq #s ClearOperations						
M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2,3	0	5.00000	10	0	
2	AU#20 4,3	1	200.00000	400	0	
3	AU#60 1,1	2	6.00000	12	0	
4	AU#60 1,4	3	255.00000	510	0	
5	AU#100 3,2	4	0.00481	0	1	
6	AU#100 5,4	5	0.01442	0	3	
7	AU#132 5,3	6	0.04808	0	10	
8	AU#132 7,4	7	1.00481	2	1	
9	AU#156 4,4	8	0.49519	0	103	
10	AU#156 7,1	9	11.50000	23	0	
11	AU#192 7,4	10	0.24038	0	50	
12	AU#192 3,2	11	12.50000	25	0	
13	AU#192 1,2	12	255.49519	510	103	
Add						

To Reset Delays on All Members:

Select the **Clear Operations** button.

All delay values will be set to zero, and the VCAT Table Delay columns will be blank for all members.

Inserting VCAT Errors and Alarms

When the NIC unit is configured for VCAT, errors and alarms can be sent from the Transmit/Error Alarm menu. Section and Line errors and alarms (SONET) and RS and MS errors and alarms (SDH) are sent just as in non-VCAT mappings. Path errors and alarms are sent only on the selected VCAT member.

To select VCAT Channel:

Select the **SDH** or **SONET** tab.

Select **Transmit**, and then select the **Set 1** side tab.

Select **VCAT Channel** and choose which channel in which you would like to send errors or alarms.

The selected channel will be displayed in the menu, as in this example:



Select **Transmit > Error Alarm**.

The transmitted path errors and alarms will now be inserted in to the selected VCAT member.



For more information and specific procedure on sending errors and alarms, see SDH/SONET Transmit specific tasks.

VCAT-Specific Alarms

There are three VCAT-specific alarms:

LOM - Loss of Multiframe alarm

OOM1 - Out of Multiframe alarm 1

OOM2 - Out of Multiframe alarm 2

These alarms can be sent on individual VCAT members, even on multiple members simultaneously.

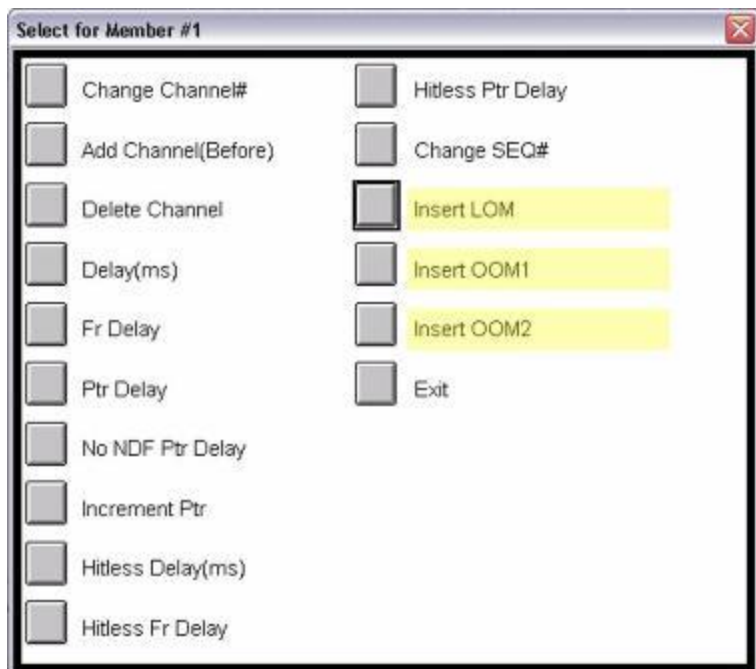
How to Send VCAT-Specific Alarms

Select **SDH** or **SONET** tab.

💡 The alarms can actually be inserted from the Receive screen as well but the Receive VCAT Table will not display the selected alarm type.

[illegible]

Highlighted items are the options for alarm insertion.



(Highlights do not appear in the NIC screen.)

Select **alarm type**.

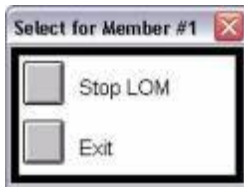
The window will disappear and the selected alarm type will appear in the VCAT Table under Operation as in this example:

Delete All Reset Seq #s ClearOperations						
M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2.3	0	0.00000	0	0	LOM
2	AU#20 4.3	1	0.00000	0	0	OOM1
3	AU#60 1.1	2	0.00000	0	0	OOM2
4	AU#60 1.4	3	0.00000	0	0	
5	AU#100 3.2	4	0.00000	0	0	
6	AU#100 5.4	5	0.00000	0	0	LOM
7	AU#132 5.3	6	0.00000	0	0	
8	AU#132 7.4	7	0.00000	0	0	
9	AU#156 4.4	8	0.00000	0	0	OOM1
10	AU#156 7.1	9	0.00000	0	0	
11	AU#192 7.4	10	0.00000	0	0	
12	AU#192 3.2	11	0.00000	0	0	OOM2
13	AU#192 1.2	12	0.00000	0	0	
Add						

To Stop Sending Errors / Alarms on One Member:

Select the desired **Member** row to stop sending alarm.

The following window will appear. (LOM is used only as an example.)



Select **Stop <alarm type>**.

The window will disappear and Operation for that member in the VCAT Table will be blank.

To Stop Sending Errors / Alarms on All Members:

Select the **Clear Operations** button.

The VCAT Table Operation column will be blank for all members.

Viewing VCAT Summary LEDs

The LED statuses indicate the current condition and history of a test that is currently running. For VCAT, the LEDs can be viewed in four levels:

VCAT summary LED. A summary LED for all VCAT members.

VCAT Summary. A screen which shows a single LED for each VCAT member.

VCAT LEDs. An individual LED panel for each VCAT member displaying all applicable alarm and error conditions for that VCAT member only.

VCAT LEDs (Summary). An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT members.



Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

VCAT Summary LED

When SONET/SDH is configured for VCAT, an interactive VCAT LED appears at the bottom of the LED Quick Status Area.



The LED + the text “VCAT” serve as a summary indicator for all VCAT members.

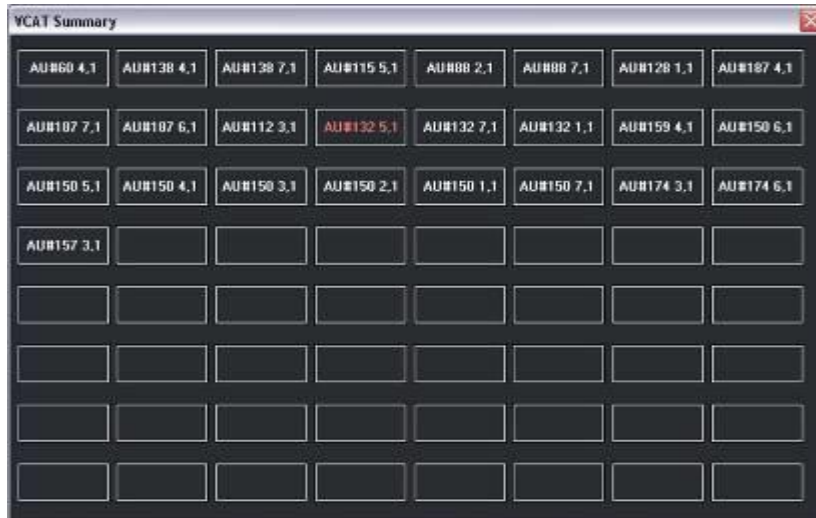
Green LED + White “VCAT” = No VCAT member has detected any errors or alarms during the current test.

Green LED + Red “VCAT” = History indicator. At least one VCAT member has detected errors or alarms during the current test.

Red LED = Red “VCAT” = At least one VCAT member is detecting errors or alarms right now.

VCAT Summary

Selecting the text “**VCAT**” next to the Summary LED and the VCAT Summary screen will appear.



Each block provides a summary for a single VCAT member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT member. Red Text indicates the detection of a least error or alarm on the VCAT member during the current test.

VCAT LEDs

Select any block in the VCAT Summary window and the VCAT LEDs window will appear.



The VCAT LEDs window provides full information regarding all alarm and error conditions for the selected VCAT member. As in the Summary LED, the LED itself plus the text serve as indicators.

Green LED +White text = This error or alarm has not been detected during the current test.

Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT LEDs (Summary)

Select **Summary** on the VCAT LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT member.

Green LED +White text = This error or alarm has not been detected during the current test on any VCAT member.

Green LED + Red text = This error or alarm has been detected during the current test on any VCAT member but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now on any VCAT member.

Viewing VCAT Alarm and Error Results

The VCAT Results screen allows you to view VCAT-specific Alarm and Error results.

Select the **SDH** or **SONET** tab.

Select **Results**, then the **VCAT** side-tab. The VCAT Results screen will be displayed.

Error and alarm information is presented in two ways:

Overall View – Displays information common to all members of the VCAT Group (VCG)

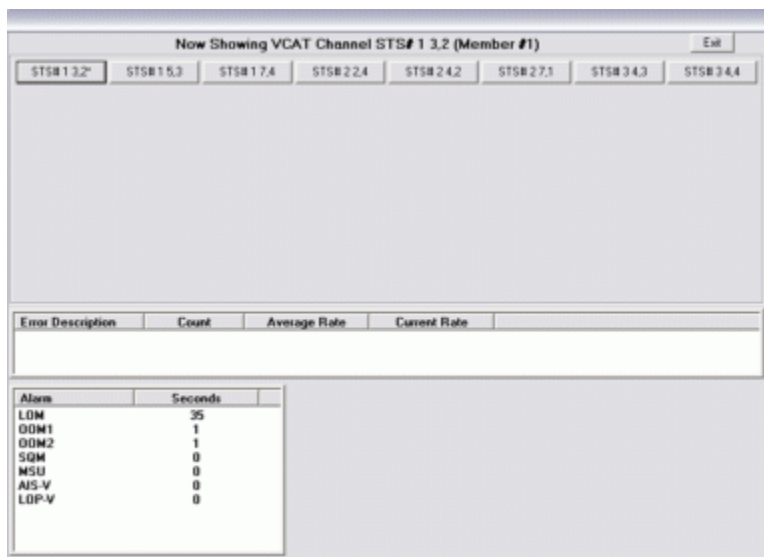
Detail View – Displays full information about any one member, within the (VCG)

Overall View

Alarm		Seconds	
LOA		416	
Pat Sync		0	

Error Description	Count	Average Rate	Current Rate
BIT	40617	4.50e-006	0.00e+000

#	Chan	Seq	LDM	DDM1	DDM2	SQM	Path	TCM
-	Detail View							
1	AU#20 2,3	0	[X]					
2	AU#20 4,3	1		[X]	[X]			
3	AU#60 1,1	2			[X]			
4	AU#60 1,4	55				[X]		



How to Set Up and Use LCAS

NIC test sets licensed for LCAS (**Link Capacity Adjustment Scheme**) functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing LCAS for dynamic bandwidth allocation and protection against failures. LCAS functions work with VCAT (**Virtual Concatenation**) to increase or decrease the number of VCAT Group (VCG) members in use, and therefore bandwidth, dynamically or to automatically protect data integrity by disabling failed VCG members.

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

 LCAS is only available if the NIC unit is licensed for both VCAT and LCAS.

 To enable LCAS, a VCAT mapping has to be selected, and at least one member must be added to the VCAT Group.

 The LCAS Transmit, Receive, and Results function screens are only displayed when LCAS is enabled. The LCAS option will then be displayed on the TX and RX SET1 screens.

LCAS works only with VCAT mappings, however VCAT can operate without LCAS. LCAS does not add or delete members from the VCG. The LCAS simulation will support from 0 to N members, where N is defined by the total number of members in the VCG.

For detailed instructions on configuring and using LCAS, see these links:

[Configuring LCAS](#)

[Adding and Removing LCAS Channels](#)

[Viewing VCAT/LCAS Summary LEDs](#)

Configuring LCAS

The following procedures describe how to configure the NIC for LCAS testing in SDH and SONET. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.



LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before LCAS can be configured, there must be at least one member in the VCAT Table. To configure VCAT and add channels, see these links:

[Configuring VCAT Mapping](#)

[Adding and Editing VCAT Channels](#)



Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated “Source” and the receive is designated “Sink”.



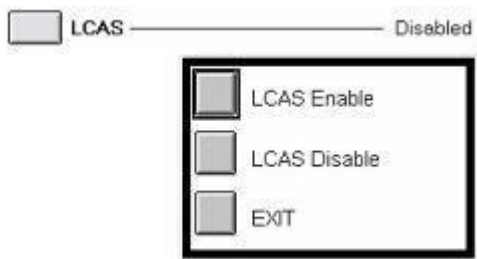
LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.

Enabling LCAS:

Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.

Select **Set** and choose **Set 1**.

Select **LCAS** and then choose **LCAS Enable**.



i If the **LCAS** option is not displayed on the **Set 1** screen, then either no members have been added to the VCAT group or the unit is not licensed for LCAS.

Once LCAS is enabled, no members can be added to or deleted from the VCAT Table. The “Add” and “Delete All” buttons will be unavailable.

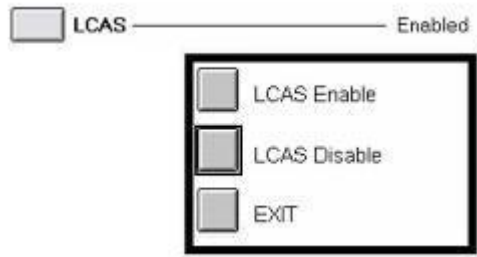
For adding and removing channels, see [Adding and Removing LCAS Channels](#).

Disabling LCAS:

Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.

Select **Set** and choose **Set 1**.

Select **LCAS** and then choose **LCAS Disable**.



Configuring Hold Off and Wait to Restore

In the event of a VCG member failure, the Sink will send a failure message to the Source.

Hold Off puts a delay between the detection of the failure and sending the message.

Wait to Restore puts a delay between the clearing of the alarm and when an “OK” message is sent to the source.

From the **SDH** or **SONET** tab, select **Receive**.



Select (LCAS Sink) side tab from the Receive screen.

The LCAS Settings table will appear, listing all of the members within the receive VCG.

Set Trace

Hold Off 1 Wait to Restore 6 Add Remove

Rs-Ack Count 1 Active Payload Count 4

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	OK	OK	0	NORM
2	4	IDLE	FAIL	255	IDLE
3	9	OK	OK	1	NORM
4	17	IDLE	FAIL	255	IDLE
5	29	OK	OK	2	NORM
6	44	IDLE	FAIL	255	IDLE
7	53	OK	OK	3	EOS
8	64	IDLE	FAIL	255	IDLE

1 2 3 4 5 6 7 8

OK IDLE OK IDLE OK IDLE OK IDLE

Select **Hold Off** or **Wait to Restore**. The **Enter User Data** key pad will appear.

Enter User Data

Max. Value: 10
Min. Value: 0

0 1 2 3 4 5 6 7 8 9 +/- OK

ALL NONE

Enter **0** to **10** (seconds) for the required delay.

Select OK.

Adding and Removing LCAS Channels

The following procedure describes how to add LCAS channels to the data stream from the selection of available VCG (Virtual Concatenation Group) members configured in

VCAT. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.



LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before adding LCAS channels, there must be at least one member in the VCAT Table and LCAS must be enabled. To configure VCAT and add channels, see these links:

[Configuring VCAT Mapping](#)

[Adding and Editing VCAT Channels](#)

[Configuring LCAS](#)



Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated “Source” and the receive is designated “Sink”.



LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.



The Source and the Sink are not coupled. Thus adding members to the LCAS Source does not automatically add members to the LCAS Sink, and visa-versa.

Adding LCAS Members to Source

From the **SDH** or **SONET** tab, select [Transmit](#).



Select (LCAS Source) side tab from the Transmit screen. .

The LCAS Settings table will appear, listing all of the members within the receive VCG.

The screenshot shows a window with buttons 'Set', 'Trace', 'Add', and 'Remove'. Below these are three counters: 'Rs-Ack Count' (0), 'Rs-Ack Timeout Count' (0), and 'Active Payload Count' (0). A table lists 8 members with columns: #, Chan, SQ, State, CTRL, and Rcvd MST. All members are in 'IDLE' state with 'FAIL' status. Below the table is a row of 8 buttons labeled 1 through 8, each with the text 'IDLE' below it.

#	Chan	SQ	State	CTRL	Rcvd MST
1	1	255	IDLE	IDLE	FAIL
2	4	255	IDLE	IDLE	FAIL
3	9	255	IDLE	IDLE	FAIL
4	17	255	IDLE	IDLE	FAIL
5	29	255	IDLE	IDLE	FAIL
6	44	255	IDLE	IDLE	FAIL
7	53	255	IDLE	IDLE	FAIL
8	64	255	IDLE	IDLE	FAIL

Select **Add**. The Select Member(s) window will appear.

The screenshot shows a window titled 'Select Member(s)'. It contains a text box 'Total VCG Members = 8' and a row of 8 buttons labeled 1 through 8. The buttons are gray, indicating they are disabled. At the bottom are 'OK' and 'CANCEL' buttons.

The **Select Member(s)** window contains one button for each VCG member.

If the member is available to be added into the LCAS data stream, the number on the button will be black (enabled).

If the member is already a part of the data stream, the number will be gray (disabled) and the button cannot be selected.

Select the required **members** and press **OK**.

 Refer to the [LCAS Transmit Settings](#) for Source Member's State-LED status descriptions

Adding LCAS Members to Sink

From the **SDH** or **SONET** tab, select [Receive](#).

Select **LCAS Sk** (LCAS Sink) side tab from the Receive screen.

The LCAS Settings table will appear, listing all of the members within the receive VCG.

The screenshot shows the 'LCAS Settings' window with 'Set' and 'Trace' buttons at the top. Below are input fields for 'Hold Off' (0), 'Wait to Restore' (0), 'Rs-Ack Count' (8), and 'Active Payload Count' (0). There are 'Add' and 'Remove' buttons. The main table lists 8 members with columns: #, Chan, State, MST, Rcvd SQ, and Rcvd CTRL.

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	IDLE	FAIL	255	IDLE
2	4	IDLE	FAIL	255	IDLE
3	9	IDLE	FAIL	255	IDLE
4	17	IDLE	FAIL	255	IDLE
5	29	IDLE	FAIL	255	IDLE
6	44	IDLE	FAIL	255	IDLE
7	53	IDLE	FAIL	255	IDLE
8	64	IDLE	FAIL	255	IDLE

Below the table is a status bar with 8 buttons labeled 1 through 8, each with the text 'IDLE' below it.

Select **Add**. The Select Member(s) window will appear.

The screenshot shows the 'Select Member(s)' window. It has a title bar and a text field displaying 'Total VCG Members = 8'. Below this is a row of 8 buttons numbered 1 through 8. At the bottom right are 'OK' and 'CANCEL' buttons.

The **Select Member(s)** window contains one button for each VCG member. Refer the VCG for channel information for each member.

If the member is available to be added into the LCAS data stream, the number on the button will be black (button enabled).

If the member is already a part of the data stream, the number will be gray (button disabled) and the button cannot be selected.

Select the required **members** and press **OK**.

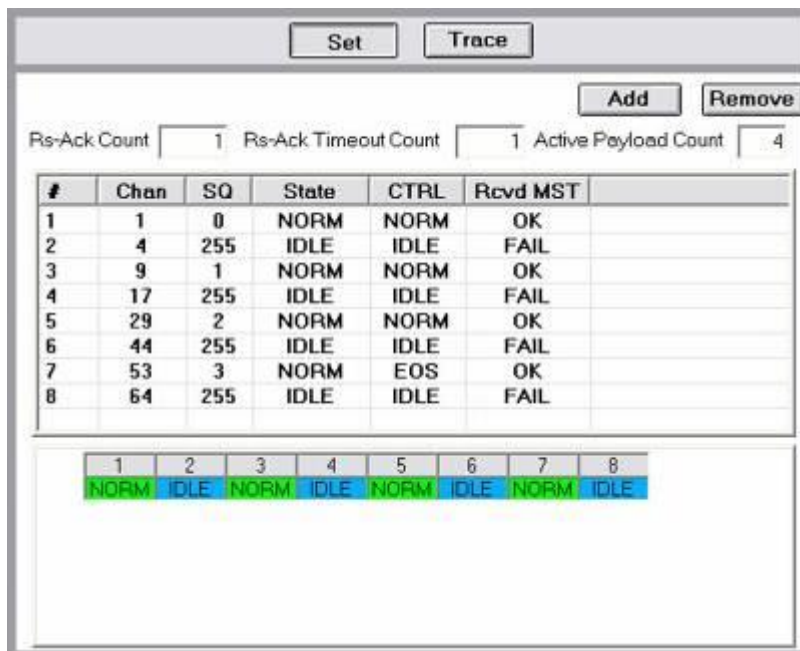
 Refer to the [LCAS Receive Settings](#) for Sink Member's State-LED status descriptions

Removing LCAS Members from Source

From the **SDH** or **SONET** tab, select **Transmit**.

Select  (LCAS Source) side tab from the Transmit screen. .

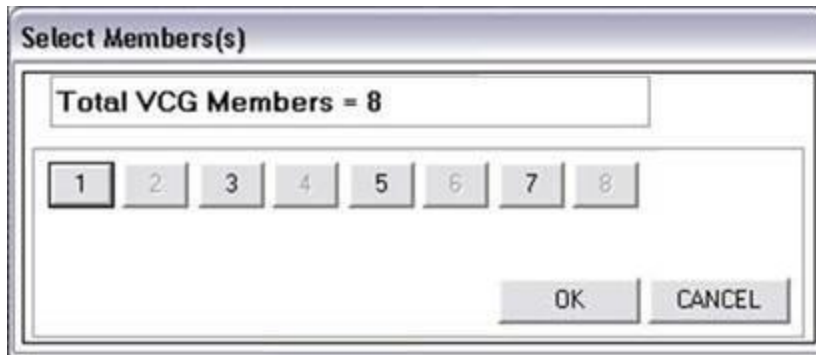
The LCAS Settings table will appear, listing all of the members within the receive VCG.



#	Chan	SQ	State	CTRL	Rcvd MST
1	1	0	NORM	NORM	OK
2	4	255	IDLE	IDLE	FAIL
3	9	1	NORM	NORM	OK
4	17	255	IDLE	IDLE	FAIL
5	29	2	NORM	NORM	OK
6	44	255	IDLE	IDLE	FAIL
7	53	3	NORM	EOS	OK
8	64	255	IDLE	IDLE	FAIL

1	2	3	4	5	6	7	8
NORM	IDLE	NORM	IDLE	NORM	IDLE	NORM	IDLE

Select **Remove**. The Select Member(s) window will appear.



The **Select Member(s)** window contains one button for each VCG member.

If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.

If the member is not active, the number will be gray (disabled) and the button cannot be selected.

Select the **members** to remove and press **OK**.

Removing LCAS Members from Sink

From the **SDH** or **SONET** tab, select **Receive**.



Select (LCAS Sink) side tab from the Receive screen.

The LCAS Settings table will appear, listing all of the members within the receive VCG.

The screenshot shows a window with a title bar containing 'Set' and 'Trace' buttons. Below the title bar, there are input fields for 'Hold Off' (value 1), 'Wait to Restore' (value 6), 'Add', and 'Remove' buttons. Below these are 'Rs-Ack Count' (value 1) and 'Active Payload Count' (value 4). The main part of the window is a table with 8 rows and 6 columns: #, Chan, State, MST, Rcvd SQ, and Rcvd CTRL. Below the table is a row of 8 buttons, each labeled with a number (1-8) and a status (OK or IDLE).

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	OK	OK	0	NORM
2	4	IDLE	FAIL	255	IDLE
3	9	OK	OK	1	NORM
4	17	IDLE	FAIL	255	IDLE
5	29	OK	OK	2	NORM
6	44	IDLE	FAIL	255	IDLE
7	53	OK	OK	3	EOS
8	64	IDLE	FAIL	255	IDLE

Below the table, there is a row of 8 buttons with the following labels: 1 OK, 2 IDLE, 3 OK, 4 IDLE, 5 OK, 6 IDLE, 7 OK, 8 IDLE.

Select **Remove**. The Select Member(s) window will appear.

The screenshot shows a window titled 'Select Member(s)'. It contains a text box labeled 'Total VCG Members = 8'. Below this is a row of 8 buttons, each labeled with a number (1-8). The buttons are arranged in a single row. At the bottom right of the window are 'OK' and 'CANCEL' buttons.

The **Select Member(s)** window contains one button for each VCG member.

If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.

If the member is not active, the number will be gray (disabled) and the button cannot be selected.

Select the **members** to remove and press **OK**.

Viewing VCAT/LCAS Summary LEDs

Refer to the [LCAS Transmit Settings](#) for Source Member's State-LED status descriptions

Refer to the [LCAS Receive Settings](#) for Sink Member's State-LED status descriptions

LCAS Summary LEDs are combined with VCAT Summary LEDs. The LED statuses indicate the current condition and history of a test that is currently running. For VCAT/LCAS, the Summary LEDs can be viewed in four levels:

VCAT summary LED. A summary LED for all VCAT/LCAS members.

VCAT Summary. A screen which shows a single LED for each VCAT/LCAS member.

VCAT LEDs. An individual LED panel for each VCAT/LCAS member displaying all applicable alarm and error conditions for that VCAT/LCAS member only.

VCAT LEDs (Summary). An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT/LCAS members.

Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

Summary LED

When configured for VCAT and LCAS, an interactive **VcatLcas** LED appears at the bottom of the LED Quick Status Area.



The LED + the text “VcatLcas” serve as a summary indicator for all VCAT members.

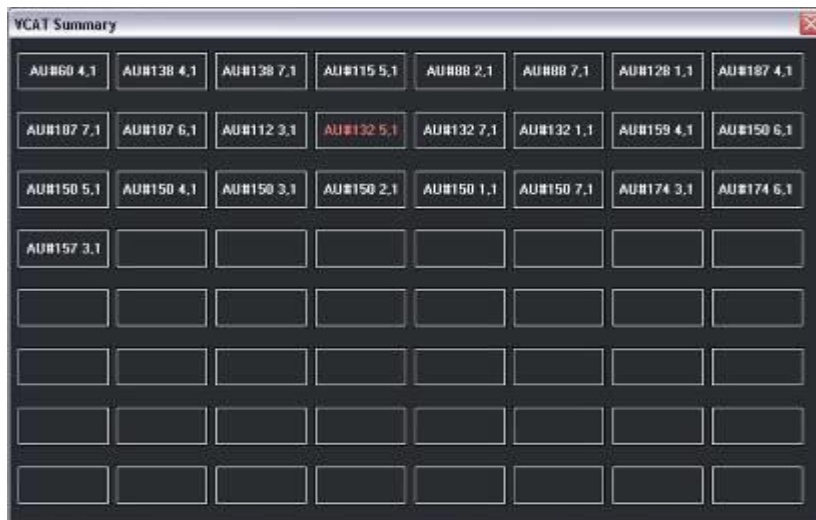
Green LED + White "VcatLcas" = No VCAT member has detected any errors or alarms during the current test.

Green LED + Red "VcatLcas" = History indicator. At least one VCAT member has detected errors or alarms during the current test.

Red LED = Red "VcatLcas" = At least one VCAT member is detecting errors or alarms right now.

VCAT Summary

Selecting the text "**VcatLcas**" next to the Summary LED and the VCAT Summary screen will appear.



Each block provides a summary for a single VCAT/LCAS member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT/LCAS member. Red Text indicates the detection of a least error or alarm on the VCAT/LCAS member during the current test.

VCAT/LCAS LEDs

Select any block in the VCAT Summary window and the VCAT/LCAS LEDs window will appear.



The VCAT/LCAS LEDs window provides full information regarding all alarm and error conditions for the selected VCAT/LCAS member. As in the Summary LED, the LED itself plus the text serve as indicators.

Green LED + White text = This error or alarm has not been detected during the current test.

Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT/LCAS LEDs (Summary)

Select **Summary** on the VCAT/LCAS LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT/LCAS member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT/LCAS member.

Green LED + White text = This error or alarm has not been detected during the current test on any VCAT/LCAS member.

Green LED + Red text = This error or alarm has been detected during the current test on any VCAT/LCAS member but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now on any VCAT/LCAS member.



Refer to [LCAS Results](#) for detailed LCAS Results statistics

Using Pointers

Making Pointer Adjustments

The beginning of a SONET or SDH payload is identified by a **Pointer**. It consists of the H1 and H2 Pointer bytes. You can stress a network by manually adjusting the Pointer using the Increment and Decrement Pointer buttons. By performing this task, you can stress your SONET or SDH equipment to verify if it can tolerate Pointer adjustments, and how your equipment will react and report these adjustments.

There are several Pointer parameters that must be configured before making a positive or negative Pointer adjustment.

To make Pointer adjustments:

Select a protocol processor mode.

Select **Transmit** and choose **PTR**.

Configure the Pointer Adjustment parameters. For example,

Select [NDF Flag](#) to allow a New Data Flag to be set when a new Pointer value has been transmitted.

Select [Pointer Value](#) to change the Pointer value from 0 to 782.

Select [Frequency Offset](#) to increase or decrease the speed of the Pointer adjustments.

Select [Pointer Action](#) to select the type of Pointer activity that occurs when the Increment Pointer or Decrement Pointer buttons are selected.

Use [Burst Count](#) to set the number of Pointer location movements (ranging from 1 to 8) to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.

Select **INC Pointer** to make a positive pointer adjustment, or select **DEC Pointer** to make a negative pointer adjustment.

These buttons generate and control Pointer movements within the transmitted signal. You can stress test a network by changing pointers or introducing an offset that continuously adjusts the STS or AU Pointer.

NDF on New Pointer

The first four bits of the H1 byte are called the New Data Flag (NDF). These bits are used to indicate if a new Pointer is present. If a new Pointer value is present, then the NDF bits are toggled.

The **NDF on New Pointer** function allows you to accept or ignore changes to the NDF bits.

The following options are available:

Options	Description

Yes (On)	Generates an NDF when a new Pointer is transmitted.
No (Off)	Disables NDF functionality.

Pointer Value

The Pointer Value function provides another method for stressing an SDH or SONET network to verify if the receiving SDH or SONET equipment can detect Pointer Value changes.

The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container (VC) or Synchronous Payload Envelope (SPE) . The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from **0 to 782**.

After entering the new value, the Pointer automatically moves to the new position.

Pointer Actions

This function determines the type of Pointer activity that occurs when the **Inc Pointer** and **Dec Pointer** buttons are selected.

The following options are available:

Options	Description
Single	Inserts a single Pointer movement with each selection of the Inc Pointer or Dec Pointer button. The Pointer value changes by one.
Bursts	Inserts a burst of Pointer movements with each selection of the Inc Pointer or Dec Pointer button. Each Pointer burst consists of a series of one-location Pointer movements spaced four frames apart (maximum legal rate). The burst count is determined by the Burst Count function.

Incr - Decr	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.
Decr - Incr	Alternates the Pointer insertion from decrement to increment with a 200-msec delay in between.

Burst Count

This function allows you to determine the number of Pointer location movements to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.

The Pointer burst count ranges from 1 to 8.

Pointer Frequency Offset

The **Pointer Frequency Offset** function adjusts the rate at which Pointer adjustments are needed in the payload.

By slowing the rate, the SDH or SONET network is forced to increment the H1 and H2 Pointer bytes. This is known as **positive frequency justification**. By increasing the rate, the network is forced to decrement the H1 and H2 Pointer bytes. This is known as **negative frequency justification**.

This type of adjustment simulates network clocks that either run fast or slow. By adjusting the rate, this forces the SDH equipment to compensate by decrementing or incrementing the H1 and H2 Pointer bytes.

The **Pointer Frequency Offset** function uses a keypad to enter a frequency offset ranging from -100.0 ppm to +100.0 ppm.

This function is disabled by entering 0 for the frequency offset.

GFP Payloads for SDH mappings

The SDH Protocol Processor on the NGMR circuit pack can be configured for GFP payloads (Complying with ITU-T G.7041).

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

To enable GFP, first configure the desired SDH **Interface** rate and **Mapping** from the SDH tab. Next, select the **Payload** menu, and choose **GFP**.

The following SDH mappings support the GFP payload:

SDH Mapping	Max GFP-Bulk data rate (100% BW)	Supports GFP-T?
AU-4-64c	9584.640 Mbps	No
AU-4-16c	2396.160 Mbps	Yes
AU-4-4c	599.040 Mbps	No
AU-4 C-4	149.760 Mbps	No
AU-3 C-3	48.384 Mbps	No

VCAT Mapping	Max GFP-Bulk data rate (max VCG members)	Minimum # of VCG members for GFP-T?
VC-4c-Xv	3594.240 Mbps	7
VC-3c-Xv	1161.216 Mbps	21
VC-2c-Xv	434.176 Mbps	N/A
VC-12c-Xv	139.264 Mbps	N/A
VC-11c-Xv	102.400 Mbps	N/A

 For **GFP-Framed** and **GFP-Transparent** modes, the maximum data rate is limited to **1 Gbps**; which can be distributed on one, or to up to four independent GFP streams from the [Packet tab](#).

802.3 10G LAN Testing

The OTN tab (or SONET/SDH tab OTN tab is not available) can be configured for 10 Gigabit Ethernet LAN Interface testing.

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

If the OTN tab is available, then use the Interface menu on the OTN tab to configure the 10G LAN Interface, otherwise use the Interface menu in the SONET or SDH tab to select the following rate.

802.3 10G LAN (10312.5 MHz) - Provides 10.3125 Gigabit Ethernet LAN, without FEC

After establishing the 10G LAN interface, you will notice that the mapping option is set to LAN, and most of the common OTN and/or SONET/SDH features become disabled.

If the OTN tab is available, then the Laser button, Clock Reference, Line Frequency Offset, and any other Interface specific settings can be modified from the OTN tab.

If the OTN tab is not available, then the Laser button, Clock Reference, Line Frequency Offset, and any other Interface specific settings can be modified from the SONET/SDH tab.

 After setting the 10G LAN interface rate, select the [Packet tab](#) to configure and test the 10 Gigabit Ethernet processor and Streams settings.

10G WAN Testing over SONET/SDH

The **OC-192** and **STM-64** Interfaces can be configured for testing a **10 WAN Mapping**.

 OC-192/STM-64 and 10G WAN are licensable test options. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

 For SONET mode, 10G WAN is tested over OC-192

 For SDH mode, 10G WAN is tested over STM-46

Select the **SONET** or **SDH** tab, depending on the configured protocol mode.

Select **Transmit** and choose **Set 1**.

Verify that the **Settings Control** setting is set to **Coupled**.

Select **Interface**. The Select Type of Interface menu box appears.

Choose the **(9953.28 Mbps)** interface option. For SONET mode this is **OC-192**, for SDH mode this is **STM-64**.

 If OC-192/STM-64 option is not listed in the Interface menu verify that the 10G XFP is fully inserted into the 10G XFP slot.

Select the **Mapping**. The Select Mapping menu box appears.

Choose the **STS-192c Ethernet WAN** or **AU-4-64c Ethernet WAN** mapping option.

Turn the laser **On**.

Select **Receive** and choose **SIG**. Ensure that a valid signal is being received.

If any errors or alarms are being received, then resolve the errors or alarms being detected before continuing.

 Select the [Packet tab](#) to configure and test the 10G WAN mapping and Streams settings.

Configuring APS (K1 and K2) Commands

 The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

Select a protocol processor mode.

Select the **Transmit** button.

Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.

Select a byte sequence button (for example, ).

The [Apply Maintenance to Entry](#) screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.

Edit the K1 byte.

The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.

Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.

Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

Edit the K2 byte.

The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.

Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.

Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.

Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.

Select **Update**. The initial APS screen appears on the touch screen.

To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

Make sure that K1 and K2 byte sequences are configured as described above.

Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

Select a protocol processor mode.

Select the **Transmit** button.

Select the **APS** button. The initial APS screen appears.

Select **Stop**.

Related Topic:

[Decoding APS \(K1 and K2\) Values](#)

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

Select the **Results** button.

Select **APS** from the tabs along the left side of the Results screen.

Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring** Mode.

From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

► Select **APS Summary**.

The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.

You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

- Select **APS Decode**.

The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Setting Thresholds for M.2120 Performance Events

The [M.2120](#) screen provides a detailed breakdown for errors meeting the ITU-T M.2120 standard. The results table displays errors detected and logged by the SDH protocol processor by using threshold error performance criteria with respect to either a 15-minute (TR15) or 24-hour (TR24) evaluation period. Error thresholds can be set directly from the M.2120 screen.

Threshold Report 15-Minute (TR15) and Reset Threshold Report 15-Minute (RTR15)

When evaluating TR15, performance events are counted separately, second by second, over each 15-minute fixed window period. A threshold can be crossed at any second within the 15-minute period. As soon as a threshold is crossed a 'fail' message is displayed in the Cur15 column. The performance events continue to be counted to the end of the 15-minute period, at which time the current performance event counts are stored in the historical registers and the current performance event registers are reset to zero. After resetting the registers to zero the 'pass' or 'fail' result moves to the Prev15

column and the performance evaluation continues and records the new result in the Cur15 column.

If the event is in the fail state, the value of the counter is compared to the reset threshold (RTR15) at the end of each period. If the count is less than or equal to the reset threshold, and there has been no unavailable time during that period, a RTR15 is generated and the state changes back to acceptable. If there has been unavailable time during the period or the count crosses the RTR15 threshold then the event remains in the fail state.

Threshold Report 24-Hour (TR24)

The TR24 filter is a 24-hour fixed window. The start and end time for the 24-hour window must occur on a 15-minute window boundary. TR24s occur as soon as the 24-hour threshold is reached or exceeded. The resultant pass or fail state displays the Cur24 column and records to the Prev24 column as the next evaluation period begins. There is no RTR24 for the 24-hour evaluation period.

To set an evaluation threshold:

From the **SDH** tab, select **Perf Monitor**.

Select **M.2120** from the tabs along the left side of the Perf Monitor screen.

Select the desired performance event for an error type (for example, from the B2 error type, select the SES row). The Select Threshold dialog box appears.

Select **TR15**. A keypad appears.

Set the error threshold for the 15-minute evaluation period and choose **OK**.

Reselect the event row to display the Select Threshold dialog box and choose **RTR15**.



Setting a RTR15 is optional.

Set the error reset error threshold and choose **OK**.

Reselect the event row to display the Select Threshold dialog box and choose **TR24**.

Set the error threshold for the 24-hour evaluation period and choose **OK**.

Testing SDH Jitter Interfaces

NIC units that contain both a jitter testing module and a SDH circuit pack licensed for SDH jitter Interfaces can be set up to the SDH jitter interfaces from either the Jitter tab or the SDH tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the SDH TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

Notice that STM-64 Jitter has it's own Jitter TX and RX laser connectors

STM-16 Jitter down to STM-1 Jitter also has its own Jitter TX and RX laser connectors

And STM-1e Jitter has it's own Jitter TX and RX BNC electrical connectors



When testing SDH Jitter, the SDH lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remains ON and active when the optical SDH interface is then changed to a non-jitter Interface rate from the SDH tab, allowing for both the Jitter lasers and SDH lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for an SDH Jitter Interface

Select the **SDH** tab.

Select **Transmit** and choose **Set 1**.

Select **Interface**. The Select Type of Interface dialog box appears

Select the desired **SDH Jitter Interface** for testing.

Configure all other necessary SDH parameter settings.

From the **Jitter** tab, select **Transmit**.

Turn the laser **On**.

Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.

 **Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for jesting optical jitter.**

Add/Drop an E1 Signal from an SDH Signal

Select **Presets**, from the Common Function buttons.

Select **Interface** and choose the desired SDH interface (such as **STM-1**) from the Select Interface list.

Select the **Configuration** button and choose either one of the following from the Select To Configuration list:

E1 #1 A/D or E1 #2 A/D: The E1 Add/Drop setting multiplexes the E1 signal generated by the E1#1 (or E1#2) processor up to the SDH processor, and transmits it out the SDH transmit interface port (along with other background E1 signals generated by the SDH processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received SDH signal and dropped down to the E1 #1 (or E1#2) processor for Error and Alarm analysis. The selected E1 port's TX/RX interfaces are not used in this configuration.

E1 #1 A/D LI or E1 #2 A/D LI: The E1 Line Interface (LI) Add/Drop setting multiplexes the received E1#1 (or E1#2) signal up to the SDH processor, and transmits it out the SDH transmit interface port (along with other background E1 signals generated by the SDH processor) in the specified E1 Channel from the Transmit E1 #1 (or E1#2) Channel Inserted setting. The specified E1 #1 (or E1#2) Channel Dropped from the Receive settings, is demultiplexed out of the received SDH signal and dropped down to the E1 processor and transmitted out to the selected E1 Interface port.

Select the **Apply** button.

The unit is configured to drop an E1 out of the SDH signal. Additionally, you can specify different frames and patterns for the dropped/inserted signal (see the section below).

Specifying Frames and Patterns for the Dropped/Inserted Signal

Select **SDH**.

Select **Transmit** and **Set 1**.

If you wish to enable Pass Thru Mode, select **Pass Thru Mode** and select **On**. Otherwise, keep this option turned off.

If you dropped the E1 #1 signal, select **E1 #1 Channel Inserted** and select the channel in which you want to drop the E1 signal.

If you dropped the E1 #2 signal, select **E1 #2 Channel Inserted** and select the channel in which you want to drop the E1 signal.

Select **E1 Background Frame** and select the background frame for the specified channel.

Select **E1 Background Pattern**. Select a pattern to fill the background E1 channels. A variety of [PRBS](#) patterns are available, as well as a 32-bit User Defined pattern, and Broadcast E1 #1 (and/or Broadcast E1 #2).

Broadcast E1 #1 and Broadcast E1 #2 will broadcast the Framing and Payload Pattern from the selected E1 port, over all of the background E1 channels.

Select the **E1** tab being dropped.

Select **Transmit** and **Set 1**.

Configure the Mapping, Framing, Payload Pattern, etc. that you wish to multiplex up to the selected SDH channel.

Select **Receive** and **Set 1**.

If any of the Mapping, Framing, Payload Pattern or other settings need to be set differently between the Transmit and the Receive settings, then set the Setting Control to Independent.

Configure the expected Mapping, Framing, Payload Pattern, etc.

View the Event Activity of the Dropped and Inserted Signals

Select the **Results** screen from the specified E1 #1 (or E1#2) processor tab to view the received error and alarm activity.

Press the Restart button from the [Common Function Buttons](#), and verify that no errors or alarms are being detected.

If an LOF alarm is being detected, then the SDH processor is likely in an errored state.

Adding/Dropping SONET/SDH and PDH Signals

The NIC allows you to set up single, or multiple test sets, and provides multiplexing and demultiplexing functionality for signal levels. Using the NIC's Preset mode, you can add or drop a signal from optical/electrical SDH and SONET, or electrical PDH into another protocol processor's signal levels in order to monitor for error and alarm conditions. For additional information on test units see [Understanding Test Units](#).

 **Important:** When the NIC/NAA has multiple test units you must first select the desired test unit protocol tab before selecting the Presets button. The configuration options available through the Preset Selection screen are dependent on the test set that is selected.

Select the protocol processor.

Select **Presets**. The Apply Presets dialog box appears. Several examples are provided below.

To add (multiplex) an E1 into an E3 signal:

Select the **Interface** button and choose **E3**.

Select the **Configuration** button and choose either **E1 #1 A/D** or **E1 #2 A/D**.

Select **Apply**.

Both E1#1 and E1#2 signals can simultaneously be added to the E3 interface by pressing Presets and selecting E3 from the Interface menu again, and then choose the other E1 processor from the Configuration menu.

The same example also applies to adding a **DS1** into a **DS3** signal, depending on the current Protocol Mode.

To add an E1 signal into an E3 signal, and then into an SDH signal:

Select the **Interface** button and choose SDH interface rate such as **STM-64**.

Select the **Configuration** button and choose **E3**.

Select the **Configuration** button **again** and choose either **E1 #1 A/D** or **E1 #2 A/D**.

The same example also applies to adding a DS1 into a DS3 and then into a SONET signal, depending on the current Protocol Mode.

To add a E1 #2 A/D LI (Line Interface) into an E3 signal:

Select the **Interface** button and choose **E3**.

Select the **Configuration** button and choose **E1 #2 A/D LI**.

Select **Apply**.

The Line Interface Add/Drop setting transmits the de-multiplexed signal from a higher interface rate out to the lower interface's transmit port, rather than just terminating the demultiplexed signal. This also multiplexes the received lower interface rate up to and out of the higher interface's transmit port.

For this example, the E3 signal is received and the specified E1 channel is demultiplexed down to the E1 processor and transmitted out to the E1#2 Interface port. Also the received E1#2 signal gets multiplexed up to the E3 processor, and is transmitted out the E3 transmit interface port (along with other background E1 signals generated by the E3 processor).

The unit is configured for Add/Drop mode. Go to the next section to specify different frames and patterns for the added signal.



If you make a mistake while creating connections, simply select **Interface** and reenter the interface value. This action erases any previously entered interface or configuration values.



Pressing the **All to Tx/Rx** button will sever all Add/Drop connections and force each protocol processors to use their own Transmit and Receive connectors for sending and receiving data.

Specify Frames and Patterns for the Added Signal

If you have added either E1#1 and/or E1#2 signals to an E3 signal:

Select **E3**.

Select **Transmit**.

Select **SET 2**. The E3 Transmit Mapping screen appears.

Select **E1#1 Channel Inserted** and select from channels 1 through 16 for E1 #1.

Select **E1#2 Channel Inserted** and select from channels 1 through 16 for E1 #2.

Select **E1 Background Frame** and select the background frame (Unframed, PCM30, PCM30CRC, PCM31, PCM31CRC) for the specified channel.

Select **E1 Background Pattern** and select up to a 32-bit background pattern for the specified channel.

Serial Tab

RS-232 / EIA-530 Serial Overview

The Serial Interfaces RS-232 and EIA/TIA-530, are recommended standard (RS) interfaces established by the Electronic Industries Association (EIA). The standard is used for interconnecting data terminal equipment (DTE) and data communications equipment (DCE), and defines the specific electrical, functional, and mechanical characteristics used in transmitting serial binary data, either synchronously or asynchronously, using a 25-pin DB connector.



To use RS-232 / EIA-530 functionalities your unit must contain the Serial circuit pack.

To assist you in performing tasks and understanding protocol functionalities, this Online Help is divided into the following sections:

[RS-232 / EIA-530 Serial Specific Tasks](#)

[RS-232 / EIA-530 Serial Screen Functions and Descriptions](#)

You may also navigate through the topics by using the **Contents** tab and window that appear on the left side of the screen.

Screen Functions and Descriptions

RS-232 / EIA-530 Screen Functions and Descriptions

The following function screens are available through the RS-232 / EIA-530 Serial protocol processor tab.

[Transmit](#)

[Receive](#)

[Results](#)

[Test](#)

[Signal Control](#)

[LEDs](#)

Transmit

Transmit Screens and Functions

The Transmit function allows you to define the parameters used for RS-530 transmitting operations.

The following parameter setting options are available from the Transmit screen:

[Set](#)

[Async](#)

[ERROR ALARM](#)

Transmit - Settings (Set)

The Transmit Set screen allows you to configure transmit signal parameters for the Serial line interface in your test environment.

The Set screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, Payload Pattern settings established on the Transmit screen will only affect Transmit mode. All other Transmit parameter settings will be coupled.  Independent mode affects Payload Pattern settings only.

Interface	Selects the electrical interface. The following options are available: RS-232 - Can be configured to act as DTE or DCE, operating in unbalanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds from 50 bps up to 120 Kbps. EIA-530 Async - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps.  For EIA-530 interfaces, all signals are balanced with exception of Remote Loop (RL) and Local Loop (LL). EIA-530 Sync - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps. EIA-530A Async - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps.  For EIA-530A interfaces, the Data Terminal Ready (DTR) signal changes to single ended. EIA-530A Sync - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps.

Emulation	Selects the emulation type for the interface. The following options are available: DTE - Data Terminal Equipment DCE-ST - Data Communications Equipment-Send Timing. Provides transmit signal element timing information to the DTE. DCE-TT - Data Communications Equipment-Terminal Timing. Provides transmit signal element timing information to the DCE. TT is the ST signal echoed back to the DCE by the DTE.  When an RS-232 interface is selected operation is in unbalanced mode and data transmission is supported in asynchronous timing only. When an EIA-530 interface is selected operation is in balanced mode and data transmission is supported in synchronous or asynchronous timing.

Payload Pattern	Selects the signal pattern to be transmitted. The following options are available: QRSS - $2^{20}-1$ pattern modified to transmit a maximum of consecutive zeros data. Simulation of live data. Cannot be used in asynchronous timing mode. PRBS - Pseudorandom Bit Patterns: PRBS 6, PRBS 6 INV, PRBS 9, PRBS 9 INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV T1 - T1-1 through T1-6 DDS - DDS-1 through DDS-6 All Ones - 'MARK' fixed pattern All Zeros - 'SPACE' fixed pattern User-defined - 32-bit repeating pattern Fox - A message that includes the numbers 0-9 and all uppercase letters. In asynchronous mode, the Fox message is transmitted according to the number of data bits specified in the character format.

Flow Control	The Flow Control box allows you to set the following parameters: Type - Set to one of the following: None Out of Band - In out-of-band flow control a specific sequence of signals must take place between the DCE and DTE in order for transmission to occur. When Out of Band is selected, the Signal Control screen allows you to ignore a signal and still allow transmission to occur. In Band - When ON, the RS-530 scans the incoming data for XON and XOFF characters and responds accordingly. XON Code - Sets XON value for resuming transmission of data. XOFF Code - Sets XOFF value for halting transmission of data.
Clock Rate	Provides a Programmable option. Clock rate can be set in kHz.  Must match the clock/ baud rate between the DCE and DTE.
Clock Source	Determines the timing source for transmit signals. The following options are available: Internal - Derives the transmit data's timing from the unit's internal clock. Interface - Derives the transmit data's timing from an external timing source attached to the Datacom Interface connector.

Operation Mode	Monitors the Serial protocol's transmit and receive operation. When turned on, the protocol is placed in internal/external loopback mode. The following options are available: Normal (TX/RX) - Unit operates in normal transmit and receive mode. RX Data Only - Unit monitors all of the receive lines as is normal, but does not transmit anything out to the EIA-530/RS-232 interface. Selecting RX Data Only disables all output signals, making the Signal Control screen nonfunctional. Self Loop - The internal interface's transmit side loops back to the receive side, which makes it a useful self-test. In addition, the incoming receive lines on the interface loop back out to the interface's transmit lines resulting in a loopback to the far-end device. The loopback lines for the internal interface are: TXD connects to RXD RTS connects to CTS DTR connect to DSR

Transmit - Asynchronous (Async)

The Transmit Async screen allows you to configure character formatting for the asynchronous timing mode.

The Async screen contains the following parameters:

Parameter	Description
Stop Bits	Designates the stopping point for data transmission. Set to 1 , 1.5 , or 2 .

Data Bits	Sets the hexadecimal type. Select one of the following: 5 - Baudot 6 - BCDIC 7 - ASCII 8 - EBCDIC
Parity	Set to Even , Odd , or None .
Async Timeout	Sets the action taken if no data is received in asynchronous timing mode. Set to On or Off.  If no data is received the On option forces a synchronization loss after 10 seconds.

Transmit - Error Alarm

The Transmit Error Alarm screen allows you to insert errors or alarms into a signal.

The Error Alarm screen contains the following options:

Option	Description
Error to Insert	Inserts an error that is transmitted by the Serial protocol processor. The options available include: None: Turns off error insertion. Parity: Transmits a parity error. This option is only available for asynchronous interfaces.  An even or odd parity setting must have been configured from the Transmit Async screen. Bit: Transmits a bit error which results in a frame synchronization bit error event. This also inserts a frame bit error into the received frame bit pattern.

Error Insert Rate	Allows you to set the error insertion rate or turn the setting off. The following error rate options are available: Off 1E-1 through 1E-6

Receive

Receive Screens and Functions

The Receive function allows you to define the parameters used RS-530 receiving operations.

The following parameter settings options are available from the Receive screen:

[Set](#)

[Async](#)

[SIG](#)

Receive - Settings (Set)

The Receive Set screen allows you to configure the receive signal parameters for the RS-530 test environment.

The Set screen contains the following parameters:

Parameter	Description
Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, Payload Pattern settings established on the Receive screen will only affect Receive mode. All other parameter settings will be coupled.

	 Independent mode affects Pattern settings only.
Interface	Selects the electrical interface. The following options are available: RS-232 - Can be configured to act as DTE or DCE, operating in unbalanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds from 50 bps up to 120 Kbps. EIA-530 Async - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps.  For EIA-530 interfaces, all signals are balanced with exception of Remote Loop (RL) and Local Loop (LL). EIA-530 Sync - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps. EIA-530A Async - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous timing. Data analysis can be performed at speeds up to 120 Kbps.  For EIA-530A interfaces, the Data Terminal Ready (DTR) signal changes to single ended. EIA-530A Sync - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous timing. Data analysis can be performed at speeds up to 15 Mbps.
Termination	Sets the impedance for the interface. The following options are available:

	78 Ohm 100 Ohm 124 Ohm Unterminated
Emulation	Selects the emulation type for the interface. The following options are available: DTE - Data Terminal Equipment DCE-ST - Data Communications Equipment-Send Timing. DCE-TT - Data Communications Equipment-Terminal Timing.
Payload Pattern	Selects the signal pattern to be received. The following options are available: QRSS - $2^{20}-1$ pattern modified to transmit a maximum of consecutive zeros data. Simulation of live data. Cannot be used in asynchronous timing mode. PRBS - Pseudorandom Bit Patterns: PRBS 6, PRBS 6 INV, PRBS 9, PRBS 9 INV, PRBS 11, PRBS 11 INV, PRBS 15, PRBS 15 INV, PRBS 20, PRBS 20 INV, PRBS 23, PRBS 23 INV TL - TL-1 through TL-6 DDS - DDS-1 through DDS-6 All Ones - 'MARK' fixed pattern All Zeros - 'SPACE' fixed pattern User-defined - 8 character repeating pattern Fox - A message that includes the numbers 0-9 and all uppercase letters. In asynchronous mode, the Fox message is transmitted according to the

	number of data bits specified in the character format.
Pat Loss Threshold	Sets the threshold that determines when pattern loss will begin. Select one of the following: Synchronous timing mode: ▶ Low - 100 bit errors in less than 1000 bits of data ▶ Medium - 250 bit errors in less than 1000 bits of data ▶ High - 20,000 bit errors in less than 100,000 bits of data Asynchronous timing mode: ▶ Low - 30 character errors are counted in less than 60 received characters ▶ Medium - 30 character errors are counted in less than 60 received characters ▶ High - 20,000 bit errors in less than 100,000 bits of data
Pat Acq Threshold	Pattern Acquisition Threshold. Sets the number of bytes, between 10 and 2048, that determine when pattern sync is reached.
Block Length	Sets the block length for incoming data. The allowable range is 100 to 1,000,000 bits.

Receive - Asynchronous (Async)

The Receive Async screen allows you to configure character formatting for the asynchronous timing mode.

The Async screen contains the following parameters:

Parameter	Description

Stop Bits	Designates the stopping point for receiving data. Set to 1 , 1.5 , or 2 .
Data Bits	Sets the hexadecimal type. Select one of the following: 5 - Baudot 6 - BCDIC 7 - ASCII 8 - EBCDIC
Parity	Set to Even , Odd , or None .
Async Timeout	Sets the action taken if no data is received in asynchronous timing mode. Set to On or Off .  If no data is received the On option forces a synchronization loss after 20 seconds.

Receive - Signal Status (SIG)

The Receive SIG screen displays the following measurements for the incoming Serial signal:

Frequency - Shows the current measured frequency of the incoming signal.

Line Frequency Offset Received - Shows the difference, in ppm, between the incoming line frequency and the reference clock frequency.

Results

Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides several layers of granularity for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

[STATS](#)

[EVENT](#)

[LARGE LED](#)

[GRAPH](#)

Results - Stats

The system can monitor and report errors on the incoming Serial signal. The Stats screen provides a detailed analysis of incoming errors that are generated by the network, or intentionally generated by the system when it is used in a loopback environment.

The Stats screen provides the following detailed analysis screens:

[Scan](#)

[Scan](#)

[Errors](#)

[Alarms](#)

[Counts](#)

[Perf](#) (Performance Monitoring)

[Errors](#)

[Alarms](#)

[Counts](#)

[Perf](#)

Results Stats - Scan

This function provides a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected.

For alarms, the duration is reported as a count in seconds. For errors, an error count is reported. The message "No Errors or Alarms" appears if no events are received by the system.

Results Stats - Errors

The Stats Errors screen allows you to view and monitor incoming Bit, Stop Bits, and Parity errors for the following parameters:

Count - Using an 11-digit format.

Average Rate - Using an N.NNe-N format.

Current Rate - Using an N.NNe-N format.

Results Stats - Alarms

The Stats Alarms screen monitors and reports alarm duration (in seconds) on the incoming signal.

The following alarms can be monitored:

Power Loss	RX Clock Loss
Pat Sync Loss	Async Timeout

Results Stats - Counts

The Stats Counts screen allows you to view the following count statistics:

RX Bits	TX Bits
RX Bit Rate	TX Bit Rate

Results Stats - Performance Monitoring (Perf)

The Stats Perf screen provides a detailed breakdown of detected Payload Bit errors.

The following statistics are reported:

Statistic	Description
EB	Errored Blocks by count and seconds.
BBE	Background Block Errors by count and seconds.
ES	Errored Seconds by count, rate percentage, and objective percentage.
EFS	Error-Free Seconds by count, rate percentage, and objective percentage.
SES	Severely Errored Seconds by count, rate percentage, and objective percentage.
UAS	Unavailable Seconds by count, rate percentage, and objective percentage.

Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

Results - Large LED

The Large LED screen displays error and alarm indicators in a large, easy to read format. This is especially useful for viewing error and alarm status from a distance, such as across the room from a test bay.

LED colors are described below.

If the LED color is ...	This indicates ...

Green with black text	The specific function is active and OK.
Red with red text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart .
White with black text	No activity from this specific function.

Results - Graph

The Graph screen displays alarm and bit count results. The graphs show the test history for either the current test or the previous test. You can configure the graph function to display any combination of Serial alarms and bit counts.

To use the various graph features, see [Use Graphs](#) in the Common Tasks section of the NIC unit's online help.

Test

Test Screens and Functions

The Test function allows you to configure test parameters, such as how long the test will run, printing and recording events, and what action will take place after the test is complete.

The following options are available from the Test screen:

[SET 1](#)

[Delay](#)

Test - Settings 1 (SET 1)

Settings that are made from the SET 1 screen determine how long a protocol test runs and what activities occur at the end of the test.

The following options appear on the SET 1 screen:

[Duration](#)

[Action After Duration](#)

Pause Test/Resume Test: Select this button to toggle the pausing and continuing mode of an active test. The button's label indicates the action that will happen when it is selected.

For more information about tests, see [Executing Tests](#) in the RS-530 Specific Tasks section or [Start a Test](#) in the Common Tasks section of the online help.

Test - Delay

The Delay function reports the most recently measured time interval between the start and finish of specific events.



The start and stop parameters that reference control signals are only valid for interfaces that use these signals.

Test Delay functions include:

Start Criteria: Sets the delay timing measurement start signal. The following start criteria measurement signals are available:

► **DTR, DSR, RTS, CTS, DCD, TX Data, TX Pattern Sync**



Either the rising (off-to-on) or falling (on-to-off) edge of the signal can be selected.

Stop Criteria: Sets the delay timing measurement stop signal. The following stop criteria measurement signals are available:

► **DTR, DSR, RTS, DCD, RX Data, RX Pattern Sync**



Either the rising (off-to-on) or falling (on-to-off) edge of the signal can be selected.

Action - State: Starts and stops the delay test mode. Select one of the following:

- **Stop Delay Test** - Stops delay activity. The State returns to Inactive.
- **Single Delay Test** - If selected, the delay value is transmitted once through your network.
- **Continuous Delay Test** - If selected, the delay value is continuously measured.

The Delay Time is recorded in milliseconds; indicating the duration in seconds that it took for the known frame to return to the unit. The current frame count and duration

appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

Signal Control

Signal Control Screens and Functions

The Signal Control screen allows you to query, enable, disable, and view the state of the following RS-530 signal control components:

[Flow Control](#)

[Data and Clock](#)

[Loopback](#)

Signal Control - Flow Control

The Flow Control area of the Signal Control screen allows you query, monitor, and change the status of one or multiple signal controls.



When RX Data Only is selected for the [Operation Mode](#) setting, all output signals are disabled, making the Signal Control screen nonfunctional.

The following Flow Control options are available:

Send XON - Only available when one of the following interfaces is selected: RS-232, EIA-530 Async, and EIA-530A Async. Selecting the **Send XON** button sends a message to the transmitting device signaling that the receiver is able to accept more data.

Send XOFF - Only available when one of the following interfaces is selected: RS-232, EIA-530 Async, and EIA-530A Async. Selecting the **Send XOFF** button sends a message to the transmitting device signaling that the receiver is unable to accept more data.

Invert - Select the Invert button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.

[Ignore](#) - Select the Ignore button to disregard a control signal during out-of-band flow control.

Toggle - Select the Toggle button to temporarily switch a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted.

Status - Displays a green box when the control signal is in 'High' logic (Active/On).

You can apply Flow Control options to the following signal controls:

rlsd (dcd) - Received Line Signal Detector/Data Carrier Detect

ri - Ring Indicator

dsr - Data Set Ready

dtr - Data Terminal Ready

cts - Clear to Send

rts (rr) - Request to Send/Receiver Ready

Signal Control - Data and Clock

The Data and Clock area of the Signal Control screen allows you to invert data and clock settings, and check their status.

Use the **Invert** button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.

The **Status** indicator column displays a blinking green box when the control is in 'High' logic (Active/On).

 When RX Data Only is selected for the [Operation Mode](#) setting, all output signals are disabled, making the Signal Control screen nonfunctional.

The following control signals can be monitored and inverted:

rxd - Receive Data

rxc - Receive Clock

txd - Transmit Data

txc - Transmit Clock

Signal Control - Loopback

The Loopback area of the Signal Control screen allows you to change the loopback and test mode controls, and check their status.



When RX Data Only is selected for the [Operation Mode](#) setting, all output signals are disabled, making the Signal Control screen nonfunctional.

You can perform the following actions on a loopback signal:

Invert - Use the Invert button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.

Toggle - Use the Toggle button to temporarily switch a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted.

Status - Displays a green box when the control signal is a logic 'High' (active/on)

You can apply the action to the following signals:

Local Loopback (LL) - Provides a way for DTE to check the functioning of the DTE/DCE interface and the transmit and receive sections of the local DCE.

Remote Loopback (RL) - Allows end-to-end testing of a circuit from a central site or DTE for checking the transmission path up to and through the remote DCE to the DTE interface and the similar return transmission path.

Test Mode (TM) - Provides indication from the DCE to the DTE that the DCE is in a test condition and verifies completion of a requested action.

Signal Control Function - Ignore

During out-of-band flow control, a certain sequence of signals must take place between the DCE and DTE in order for transmission to occur. The Ignore function allows you to select an input signal that is disregarded during out-of-band flow control.

The **Out of Band** flow control setting is selected from the **Transmit Set** screen, **Type** options.

 The Ignore check boxes are *disabled* when **In Band** or **None** is selected for the flow control setting.

Emulating a DTE

When emulating a DTE, the following input signals can be ignored:

DCD (RLSD/DCD) - When the DCD **Ignore** checkbox is selected the **DTR** toggle button appears allowing control of the output signal.

DSR - When the DSR **Ignore** checkbox is selected the **RTS (RR)** toggle button appears allowing control of the output signal.

CTS - When the CTS **Ignore** checkbox is selected the unit will not expect the CTS signal to become active in order for transmission to begin.

 When an input signal is ignored, the associated output signal is automatically placed in the ON condition.

Emulating a DCE

When emulating a DCE, the following input signals can be ignored:

DTR - When the DTR **Ignore** checkbox is selected the **DSR** toggle button appears allowing control of the output signal.

RTS (RR) - When the RTS **Ignore** checkbox is selected the **CTS** toggle button appears allowing control of the output signal.

 When an input signal is ignored, the associated output signal is automatically placed in the ON condition.

Signal Control Function - Toggle

The Toggle button temporarily switches a control signal from On to Off, or Off to On, depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted. In contrast to the Ignore function, toggle functionality is available regardless of the flow control setting.

The following output signals can be controlled by selecting the **Toggle** button:

If Flow Control setting is **In Band** or **Out of Band** and you are

emulating a DTE:

RL

LL

emulating a DCE (RS-530):

DCD

TM

emulating a DCE (RS-530A and RS-232):

DCD

RI

TM

If Flow Control setting is **NONE** and you are

emulating a DTE:

DTR

RTS

RR

LL

emulating a DCE (RS-530):

DCD

DSR

CTS

TM

emulating a DCE (RS-530A and RS-232):

DCD

RI

DSR

CTS

TM



When the RS-530 is emulating a DCE and LL is activated by the DTE, the RS-530 will enable a local loopback to the DTE until the DTE deactivates LL.

Serial LED Quick Status Area

When the Serial (RS-530) protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) screen.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.

If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.

If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description

E/A	Displays the error and/or alarm currently generated by the unit.
Test Paused	Indicates if a timed test has been paused using the Pause Test button from the Test screen.
RX CLOCK	Indicates if the receive clock is working.
ASYNC TIMEOUT	Indicates a loss of data from the asynchronous timing mode.
PAT SYNC	Indicates when pattern synchronization is established.
BIT ERR	Indicates a bit error was detected in the payload.
STOP BIT ERR	Indicates when a stop bit error is detected.
PARITY	Indicates when a parity error is detected.
MARK	Indicates when a mark is present at input.
SPACE	Indicates when a space is present at input.

Serial Specific Tasks

RS-232 / EIA-530 Specific Tasks Overview

This section includes a series of tasks that are specific to the RS-232 / EIA-530 Serial protocol processor.

For a list of general tasks, see [Common Tasks](#), located in the Getting Started section of the NIC unit's Online Help.

[Connecting External Equipment](#)

[Self-Diagnostic Loopback Plug](#)

[Configuring an Interface](#)

[Configuring Emulation Settings](#)

[Configuring Flow Control](#)

[Working with Signal Controls](#)

[Executing Tests](#)

[Insert a Single Error](#)

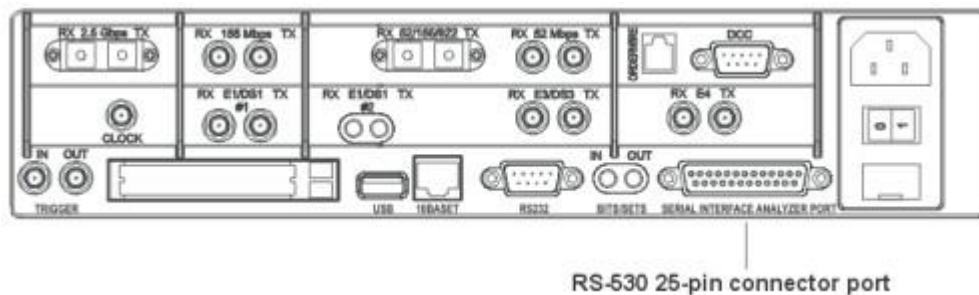
[Insert Multiple Errors](#)

[Initiate a Delay Test](#)

Connecting External Equipment

The RS-530's functionalities include bit error rate testing with performance, signal, and timing analysis by using a 25-pin female DB connector to connect an external device to the NIC unit. Units containing the RS-530 circuit pack have a serial interface port installed on the connector panel.

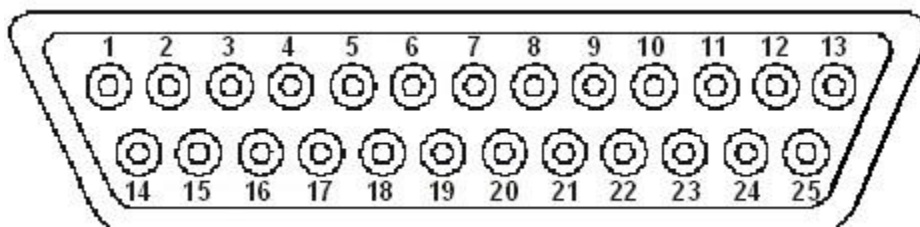
For NIC 10G and NIC 2.5G units the Parallel Port is replaced with the Serial Interface Analyzer Port, as shown in the NIC 2.5G connector panel below.



For NIC Plus units the Serial Interface Analyzer Port is placed in any available slot on the connector panel.

Serial Interface Analyzer Port

The figure and table below provide the pin number and associated pin assignments for the serial port.



In the chart and table below, the A column corresponds to single ended protocols (such as RS-232), and the A and B columns together are used for differential signalling protocols (such as EIA-530).

25 Pin D Type Connector Pin Assignments

25 Pin Designations						Description
A	B	EIA	CCITT	DTE	DCE	
1		Shield	-			Shield
7		AB	102			Signal Ground
2	14	BA	103	Out	In	Transmitted Data
3	16	BB	104	In	Out	Received Data
4	19	CA	105	Out	In	RTS
5	13	CB	106	In	Out	CTS
6	22	CC	107	In	Out	DSR
20	23	CD	108	Out	In	DTR
8	10	CF	109	In	Out	RLSD (DCD)
24	11	DA	113	Out	In	Transmit Signal Element Timing (DTE)
15	12	DB	114	In	Out	Transmit Signal Element Timing (DCE)
17	9	DD	115	In	Out	Receive Signal Element Timing (DCE)
18		LL	141	Out	In	Local Loopback
21		RL	140	Out	In	Remote Loopback
25		TM	142	In	Out	Test Mode

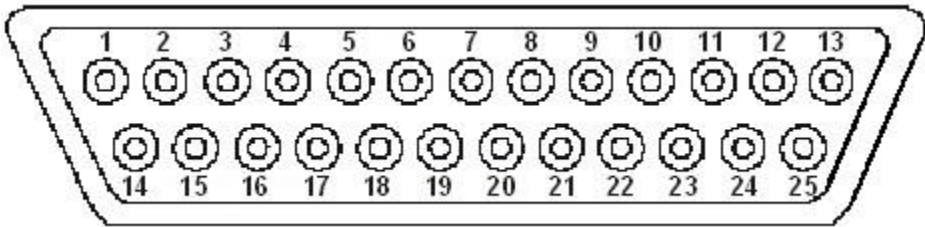
Pin #	Signal / Description	Pin #	Signal / Description
1	Protective Ground Shield (A)	14	TXD - Transmitted Data (B)
2	TXD - Transmitted Data (A)	15	DCE - Transmit Signal Element Timing (A)
3	RXD - Received Data (A)	16	RXD - Received Data (B)
4	RTS/RR - Request to Send/Receiver Ready (A)	17	DCE - Receive Signal Element Timing (A)
5	CTS - Clear to Send (A)	18	LL - Local Loopback (A)
6	DSR - Data Set Ready (A)	19	RTS/RR - Request to Send/Receiver Ready (B)
7	Signal Ground (A)	20	DTR - Data Terminal Ready
8	RLSD/DCD - Received Line Signal Detector/Data Carrier Detect (A)	21	RL - Remote Loopback (A)
9	DCE - Receive Signal Element Timing (B)	22	DSR - Data Set Ready (B)

10	RLSD/DCD - Received Line Signal Detector/Data Carrier Detect (B)	23	DTR - Data Terminal Ready (B)
11	DTE - Transmit Signal Element (B)	24	DTE - Transmit Signal Element (A)
12	DCE - Transmit Signal Element Timing (B)	25	TM - Test Mode (A)
13	CTS - Clear to Send (B)		

Self-Diagnostic Loopback Plug

A self-diagnostic loopback plug connects serial inputs to serial outputs, allowing for port testing. When using the loopback plug make sure the pin assignments are in accordance with the following table.

Loopback Pin Assignment Table

	
Pin Number	Description
2 to 3	TX- to RX-
14 to 16	TX+ to RX+
5 to 4	RTS- to CTS+
13 to 19	RTS+ to CTS+
10 to 22 to 23	DCD+ to DSR+ to DTR+
6 to 8 to 20	DSR- to DCD- to DTR-
9 to 11	TX Timing Rtn to RX Timing Rtn

17 to 24	TX Timing Sig to RX Timing Sig

Configuring an Interface

The interface setting impacts framing, signaling, and other parameters necessary for connecting to a circuit under test.

Select the **Serial** protocol processor tab.

From the Serial screen select the **Transmit** button and **Set** tab.

Select the **Interface** button and choose the desired interface. The following interfaces are available:

RS-232 - Can be configured to act as DTE or DCE, operating in unbalanced mode with data transmission supported in asynchronous operation. Data analysis can be performed at speeds from 50 bps up to 128 Kbps.

- ▶ Activates the **XON/ XOFF** message-sending option on the Signal Control screen.
- ▶ Allows [Out of Band](#) or [In Band](#) flow control.

EIA-530 Async - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous operation. Data analysis can be performed at speeds up to 120 Kbps.

 For EIA-530 interfaces, all signals are balanced with exception of Remote Loop (RL) and Local Loop (LL).

- ▶ Activates the **XON/XOFF** message-sending option on the Signal Control screen.
- ▶ Allows **Out of Band** or **In Band** flow control.

EIA-530 Sync - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous operation. Data analysis can be performed at speeds up to 40 Mbps.

- ▶ Allows **Interface** or **Internal** clock source.

EIA-530A Async - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous operation. Data analysis can be performed at speeds up to 120 Kbps.

 For EIA-530A interfaces, the Data Terminal Ready (DTR) signal changes to single ended.

- ▶ Activates the **XON/XOFF** message- sending option on the Signal Control screen.
- ▶ Allows **Out of Band** or **In Band** flow control

EIA-530A Sync - Can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in synchronous operation. Data analysis can be performed at speeds up to 40 Mbps.

- ▶ Allows **Interface** or **Internal** clock source.

 The selected interface name appears in the Quick Status Area, located at the top left corner of the screen.

Select the [Payload Pattern](#) button and set the desired test pattern.

Select the [Flow Control](#) options (**Type**, **XON Code**, **XOFF Code**) and set the data flow parameters.

Select the **Clock Rate** button to set a Programmable value.

Select the **Clock Source** button and set as **Internal** or **Interface**.

Internal - Derives the transmit data's timing from the unit's internal clock.

Interface - Derives the transmit data's timing from the external timing source attached to the Datacom Interface connector.

 Internal clock source is only available when an async interface is selected.

Select the [Operation Mode](#) button and set the protocol's transmit and receive operating mode.

Select the **Restart** common function button located at the bottom of the touch screen.

Configuring Emulation Settings

The **Emulation** button, located on the Transmit and Receive settings screens, allows you to configure the interface for emulating Data Terminal Equipment (DTE) or Data Communications Equipment (DCE).

To configure DTE emulation:

DTE emulation provides signal element timing information to the DCE.

Select the **Serial** protocol processor tab.

From the Serial screen select the **Transmit** button and **Set** tab.

Select the [Interface](#) button and choose the desired interface.

Select the **Emulation** button and choose **DTE** for connection to DCE.



The name of the selected emulation equipment type appears in the Quick Status Area, located at the top left corner of the screen.

Select the **Restart** common function button located at the bottom of the touch screen.

To configure DCE emulation:

DCE emulation provides signal element timing information to the DTE.

Select the **Serial** protocol processor tab.

From the Serial screen select the **Transmit** button and **Set** tab.

Select the [Interface](#) button and choose the desired interface.

Select the **Emulation** button and choose one of the following for connection to DTE:

DCE-ST - Data Communications Equipment-Send Timing. Provides transmit signal element timing information to the DTE.

DCE-TT - Data Communications Equipment-Terminal Timing. Terminal Timing. Provides transmit signal element timing information to the DCE. TT is the ST signal echoed back to the DCE by the DTE.



The name of the selected emulation equipment type appears in the Quick Status Area, located at the top left corner of the screen.

Select the **Restart** common function button located at the bottom of the touch screen.

Configuring Flow Control

The Flow Control box, located on the **Transmit Set** screen, allows you to set data flow parameters.

Select the **Serial** protocol processor tab.

From the Serial screen select the **Transmit** button and **Set** tab.

In the Flow Control box on the Set screen, select the **Type** button and choose one of the following:

None

Out of Band - In out-of-band flow control a specific sequence of signals must take place between the DCE and DTE in order for transmission to occur. When Out of Band is selected, the Signal Control screen allows you to [ignore](#) a signal and still allow transmission to occur.

In Band - When ON, the Serial protocol scans the incoming data for XON and XOFF characters and responds accordingly.



The In Band option is only available when an EIA-530 Async or RS-232 interface is selected.

Select the **XON Code** button to set the value for resuming transmission of data for asynchronous interfaces.

Select the **XOFF Code** button to set the value for halting transmission of data for asynchronous interfaces.

Select the **Restart** common function button located at the bottom of the touch screen.

Working with Signal Controls

The Signal Control screen allows you to monitor and change the status of one or multiple signal controls. Active signal controls display a green status box and are dependent on interface, emulation, and flow control settings.



When RX Data Only is selected for the [Operation Mode](#) setting, all output signals are disabled, making the Signal Control screen nonfunctional.

When the interface is emulating DTE the following control signals and switches display:

rlsd (dcd)	cts	rts (rr)
dsr	TM	dtr

When the interface is emulating DCE the following control signals and switches display:

rts (rr)	LL	rlsd (dcd)
dtr	RL	dsr

Changing the status of control signals is normally associated with out-of-band flow control, which allows the user to specify which signal controls must be in the On/Enabled (High logic) state for data transmission to take place. In either DTE or DCE emulation, transmission may be conditioned upon the enabling of any or all of the following signal controls: dtr, dsr, rts (rr), cts, rlsd (dcd). See the help topic [Signal Control](#) for information about signal control screen functionalities.

To change signal control statuses:

Select the **Serial** protocol processor tab.

From the Serial screen select the **Signal Control** button.

Determine the signal control you want to change and the type of change.

Invert - Select the Invert button to change a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.

Ignore - Select the Ignore button to disregard a control signal during out-of-band flow control.

Toggle - Select the Toggle button to temporarily switch a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current condition. The signal returns to its previous condition when the NIC unit is rebooted.

Select the signal control's checkbox for the desired action (Invert, Ignore, or Toggle) to activate the change.

The **Status** column displays a green box when the control signal is in 'High' logic (On/Enabled).

Executing Tests

The Serial protocol allows you to check equipment performance by setting up test parameters and initiating tests. To facilitate a self-diagnostic test use a [Self-diagnostic Loopback Plug](#).

You can choose to:

[Insert a Single Error](#)

[Insert Multiple Errors](#)

[Initiate a Delay Test](#)

 The type of test that can be performed is directly related to the interface selection.

Insert a Single Error

Select the **Serial** protocol processor tab.

From the Serial screen select the **Transmit** button.

Configure the [Set](#) tab and [Async](#) tab options.

Select the [Error Alarm](#) tab.

Select the **Error to Insert** button and choose **Parity** or **Bit**.

 DO NOT set an **Error Insert Rate** when inserting a single error.

 Select the **Restart** button at the bottom of the touch screen to clear any previously collected data.

Select the **Error Insert** button at the bottom of the touch screen.

The [LED](#) status changes for the selected error type.

Choose the [Results](#) button to view event statistics from the various Results screens.

To print or record test statistics see the [Print Report](#) topic in Common Tasks, located in the NIC unit's online help.

Insert Multiple Errors

Inserting multiple errors not only allows you to initiate a continuous test, but it also allows you to set up a specific test duration and action to take when the duration ends. For example, you could set the test duration to run for five minutes, the action after test to repeat the test, and print the statistics to a file or printer.

To insert multiple errors:

Select the **Serial** protocol processor tab.

From the Serial screen select the **Transmit** button.

Configure the [Set](#) tab and [Async](#) tab options.

Select the [Error Alarm](#) tab.

Select the **Error to Insert** button and choose **Parity** or **Bit**.

Select the [Error Insert Rate](#) button and choose an insertion rate from the Error Rate dialog box. The unit starts transmitting errors.



Select the **Restart** button at the bottom of the touch screen to clear any previously collected data.

The [LED](#) status changes for the selected error type.

Choose the [Results](#) button to view event statistics from the various Results screens.

To set up duration and after test actions:

Choose the Serial screen's [Test](#) button.

Select the [Duration](#) button and choose how long you want to run the test for.

Select the [Action After Test](#) button and choose the desired actions.

To print or record test statistics see the **Report** topic in Common Function Buttons chapter.

Initiate a Delay Test

The Delay function reports the most recently measured time interval between the start and finish of specific events.

Select the **Serial** protocol processor tab.

From the Serial screen select the **Test** button and **Delay** tab.

Select the **Start Criteria** button and choose the start action criteria. The following start criteria measurement signals are available:

DTR, DSR, RTS, CTS, DCD, TX Data, TX Pattern Sync (Either the rising [off-to-on] or falling [on-to-off] edge of the signal can be selected.)

 The start parameters that reference control signals are only valid for interfaces that use these signals.

Select the **Stop Criteria** button and choose the delay timing measurement stop-signal. The following stop criteria measurement signals are available:

DTR, DSR, RTS, DCD, RX Data, RX Pattern Sync (Either the rising [off-to-on] or falling [on-to-off] edge of the signal can be selected.)

 The stop parameters that reference control signals are only valid for interfaces that use these signals.

Select the **State** button and choose the delay test action from the following options:

Stop Delay Test - Stops delay activity. The State returns to Inactive.

Single Delay Test - The delay value is measured.

Continuous Delay Test - The delay value is measured continuously.

The Delay Time is recorded in milliseconds; indicating the duration that it took for the known frame to return to the unit. The current delay value appears in the **Current** column. The fastest delay value appears in the **Minimum** column and the slowest delay value appears in the **Maximum** column.

SONET Tab

SONET Overview

The test options available under the SONET tab can vary from one NIC test set to another, depending on which SONET circuit pack and which Interface rates and Next Generation test options are currently licensed in the test set.

The SONET Online Help is divided into the following sections:

[SONET Screen and Function Descriptions](#)

[SONET Specific Tasks](#)

Packet Tab (Available for testing GFP mappings, and 10G LAN/WAN and 8G/10G Fibre Channel Interfaces)

Screen Functions and Descriptions

SONET Screen Functions and Descriptions Overview

This section of the online help system describes the various functions, buttons, and tabs that control SONET configuration and operation.

The following screens and functions are discussed:

[Transmit](#)

[Receive](#)

[Results](#)

[Test](#)

[Perf Monitor](#)

[LEDs](#)

Transmit

SONET Transmit Screens and Functions

The Transmit functions allow you to define the parameters used for SONET transmitting operations.

The following parameter setting options are available from the Transmit screen:

[Set > Set 1](#)

[Set > Set 2](#)

[SOH](#)

[POH](#)

[PTR](#)

[APS](#)

[VCAT](#) (Only appears when the test set is configured for VCAT)

[LCAS](#)-Source (Only appears when the LCAS is enabled)

[Error Alarm](#)

SONET Transmit - Set / Set 1

The SONET Transmit Settings 1 screen configures the unit's transmit parameters. It contains the following functions:

Function	Description
Settings Controls	If Coupled is selected, settings changed on the Transmit screen will automatically change on the Receive screen as well. If Independent is selected, settings established on the Transmit screen will only affect Transmit mode.
Pass Thru Mode	Activates or deactivates passthru mode, allowing an incoming STS signal to pass through the unit without altering the data in the signal. The following options are available: On and Off .

Interface	Selects the optical or electrical transmit interface. The following SONET options are available, depending on the licensed configuration: OC-192, OC-48, OC-12, OC-3, OC-1, EC-3, and EC-1 If the test set is equipped for Jitter operation, the following options may also be available: OC-3-Jitter, OC-12-Jitter, OC-48-Jitter, and OC-192-Jitter If the test set is licensed for 8G or 10G Fibre Channel, or 10GigE LAN, the following options may also be available, and can be tested using the Packet tab: Fibre Chan (8.50G), Fibre Chan (10.52G), 802.3 10G LAN (10.3125 GHz)  The SONET processor supports hot-swappable SFP and XFP laser modules.  Verify that the inserted SFP/XFP module supports the desired Interface rate prior to selecting it.  The wavelength of the selected interface is determined by the specifications of the SFP or XFP module being used.  Available interface rates are dependent on the licensed-based test options currently enabled.  Not Assigned is displayed if one of the Interfaces listed above is currently not configured.
Mapping	Defines the type of signals that are combined to create an SONET signal. For example, four STS-48c's can be mapped into an OC-192 signal. Mapping options are dependent on the selected Interface. The following options may be available: Unframed Bulk Fill

	STS 192c Bulk Fill STS-48c Bulk Fill STS-12c Bulk Fill STS-3c Bulk Fill STS-1 Bulk Fill VT-6 Bulk Fill VT-2 Bulk Fill VT-1.5 Bulk Fill  If the test set is licensed for VCAT, the following options are also available: STS-3c-Xv Bulk Fill STS-1-Xv Bulk Fill VT-6-Xv Bulk Fill VT-2-Xv Bulk Fill VT-1.5-Xv Bulk Fill  If the test set is licensed for 10G WAN, the following option is also available: STS-192c Ethernet WAN  If the test set is licensed for All Path Testing, the following option is also available: All Path
STS-<#> Added	Selects foreground STS# of the mapped signal. When available, select the STS-<#> Added button to enter the number of the specific STS channel to set as the <i>foreground</i> (source) channel. The default setting is 1. The

	source channel can be used to transmit alarms, errors, or patterns.
VT Added	Selects foreground VT# of the mapped signal. When available, select the VT Added button to enter the number of the specific VT channel to set as the <i>foreground</i> (source) channel. The default setting is 1. The source channel can be used to transmit alarms, errors, or patterns.  This option appears when VT mapping is selected.
VCAT Channel  Appears only when VCAT is licensed, and a VCAT mapping is chosen.	Allows the user to select a foreground VCAT channel, from the specified VCAT group, for Error and Alarm insertion.  See How to Set Up and Use VCAT Features for details
LCAS Mode  Appears only when LCAS is licensed, and the VCAT group has more than one member added.	Enables or Disables LCAS (Link Capacity Adjustment Scheme) mode.  See How to Set Up and Use LCAS Features for details
Background STS-<#> Pattern	Allows the user to select the type of pattern to be inserted into the remaining <i>background</i> channels for the SONET signal. Select one of the following: User-Defined (32 bit value), PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv.
Payload Pattern	Allows the user to select a test pattern to transmit over the SONET signal. Select one of the following: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, or a User Defined pattern (32-bit value)

	 The User Defined Payload Pattern is unsupported when Unframed BERT mode is selected.  If the test set is licensed for GFP, then GFP mapping option is also available.
Clock Reference	Determines the timing source for the transmit signal. Select one of the following: Internal. Derives the transmit data's timing source from the unit's internal clock. The <i>CLK:INT</i> displays when configured for Internal clocking. Recovered (RX Clock). Derives the transmit timing source from the clock signal on the receive interface. If this option is selected, but a signal is not available, then this function defaults to Internal. The <i>CLK:REC</i> displays when configured for Recovered clocking. Note: The Recovered clock option is not available in Asynchronous mappings. BITS/SETS: Derives the transmit's data timing source from the BITS/SETS input ports. BITS: Synchronizes the transmitted signal to the BITS (Building Integrated Timing Supply) clock input, which is 1.544 Mbps. If this option is selected, but BITS clocking is not available, then this function defaults to Internal. The <i>CLK:BITS 1.5MHz</i> displays when configured for BITS clocking. SETS: Synchronizes the transmitted signal to the SETS (Synchronous Equipment Timing Source) clock input, which is 2.048 Mbps. If this option is selected, but SETS clocking is not available, then this function defaults to Internal. The <i>CLK:SETS 2.0MHz</i> displays when configured for SETS clocking. External 8 KHz - 75 Ohm TTL. Derives timing from an external 8 KHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 8 KHz</i> displays when configured. External 1.544 MHz - 75 Ohm TTL. Derives timing from an external 1.544 MHz 75 Ohm TTL timing source attached to

	the Clock In connector. The <i>CLK:Ext 1.5 MHz</i> displays when configured. External 2.048 MHz - 75 Ohm TTL. Derives timing from an external 2.048 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 2 MHz</i> displays when configured. External 10.0 MHz - 75 Ohm TTL. Derives timing from an external 10.0 MHz 75 Ohm TTL timing source attached to the Clock In connector. The <i>CLK:Ext 10 MHz</i> displays when configured.

SONET Transmit - Set / Set 2

The SONET Transmit Settings 2 screen contains the following functions:

Function	Description
Line Frequency Offset	Adjusts the offset of the transmitted signal's frequency. The frequency can be adjusted in parts per million (ppm). Use the keypad to adjust the frequency offset. The frequency offset ranges from -100.0 to 100.0, in increments of 0.1 A 0 (zero) value equals Off.
Initial Laser Setting	Controls whether the laser is on or off when the unit is turned on. The following options are available: Off - The unit's laser will be off when the unit is turned on. On - The unit's laser will be on when the unit is turned on. Restore Previous State - When the unit is turned on, the laser will be on or off based on its previous setting before the unit was turned off.

SS Bits in the H1 Label	This function allows bits 5 and 6, which are the SS bits, of the H1 Pointer byte to be set to support a SONET or SDH Transport OH. Changes to the Transport OH are another way to stress an SDH network by simulating errors, alarms, and other stress conditions. The following options are available: SONET (00), SDH (10), Undefined (01), or Undefined (11).
Path Signal Label	The Path Signal Label is part of the POH and identifies the type of traffic contained in the SPE. The C2 byte is used to indicate the content of the SPE, including the status of the mapped payload. The following options are available: 00 (Unequipped) 01 (Equipped) 02 (VT Structured STS) 03 (Lock VT Mode) 04 (Async DS3 Mapping) 12 (Async DS4NA Mapping) 13 (ATM Mapping) 14 (DQDB Mapping) 15 (Async FDDI Mapping) 16 (HDLC Over SONET) 1A (10G WAN IEEE802.3ae) 1B (GFP Mapping) User Defined (any eight bit pattern 0 to FF).

	 This option is coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will change in the Overhead screen as well.

VT Signal Label	Bits 5 through 7 of the V5 byte are allocated for a VT Signal Label to indicate the content of the VT SPE, including the status of the VT mapped payload. The following options are available: (00) Unequipped (01) Equipped (02) Asynchronous (03) Bit Synchronous (04) Byte Synchronous (05) ATM User Defined - Any 3-bit value 0h to 7h  This option is only available for VT-1.5, VT-2, and VT-6 mappings.
Synchronization Status (S1)	Allows the user to set the S1 byte to one of the following: 00 (Sync Trace Unknown-STU) 01 (Stratum 1 Trace-PRS) 04 (Transit Node Clock-TNC) 07 (Stratum 2 Trace-ST2) 0A (Stratum 3 Trace-ST3) 0C (SONET Minimum Clk-SMC) 0D (Stratum 3E Trace-ST3E) 0F (Do Not Use for Sync-DUS) User Defined (any eight bit pattern 0 to FF)

Trigger In	Determines how the protocol processor responds when an external +5v "pulse" is detected on the external Trigger In SMA connector. The following options are available: None: The protocol processor will do nothing when an external pulse is received. (default setting) Restart: The current test will restart when an external pulse is received. Error Insert: The protocol processor will insert an error when an external pulse is received. For this to work, you must first select an Error Type to be inserted.
TC Overhead Processing	Enables Tandem Connection Monitoring (TCM) transmit mode. Path Enable: For SDH, the unit uses its TCM circuitry and the N1 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z5 byte. VT Enable: For SDH, the unit uses its TCM circuitry and the N2 byte to generate errors and alarms between TCM equipment. For SONET, the unit uses the Z6 byte. Disable: TCM mode is disabled, and the N1/N2 and Z5/Z6 bytes follow normal operation.
TX Clock Loss Threshold	Configures the user-definable threshold for the TX Clock Loss alarm, in PPM. Valid range is from 0 to 100ppm, where 0 is disabled. The default value is 50ppm.  This threshold alarm is only supported when the transmit reference clock is configured for an external clock source. When the transmit reference clock is configured for Internal, this setting and the associated alarm are disabled.

Measured TX Line Frequency	Measures the Transmission Line Frequency value in Hz.  The TX line frequency can be derived from the Internal clock, an External TTL clock, a Recovered clock, or a BITS/SETS timing signal.
Measured TX Line Frequency Offset	Measures the Transmission Line Frequency Offset value in Hz and ppm.  When the transmit reference clock is configured for an External TTL clock, Recovered or BITS/SETS timing, this measurement is the deviation between the internal clock rate and the line rate derived from the external reference clock.

SONET Transmit - SOH

The Transmit SOH screen contains the following options:

Function	Description
Showing	Select Showing to choose an Overhead slot within the SONET signal. The overhead bytes that appear on the SOH screen are associated with this slot.
Section and Line Overhead bytes	Allows the user to select an Overhead byte to edit its value. Selecting an Overhead byte button will either open a user-define keypad, or a menu screen if there are pre-defined byte options to select from.

J0 Trace	The J0 byte is part of the Section Overhead and is known as the Section trace or J0 trace. The J0 trace is a 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the system's default pattern or a customized pattern. The following options are available: Default (64 byte) - Selects the Digital Lightwave ASCII message as the transmit J0 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the transmit J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit J0 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit J0 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit J0 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

The Transmit POH screen contains the following options:

Function	Description
STS-<#> Added	Allows the user to enter the number of the specific STS channel to set as the <i>foreground</i> (source) channel. The default setting is 1.  When a VCAT mapping is chosen, this setting changes to VCAT Channel.
Path and VT Overhead Bytes	Path Overhead Bytes include: B3, J1, C2, G1, F2, H4, Z3, Z4, and Z5. VT Overhead Bytes include: V5, J2, Z6, and Z7. Selecting an Overhead byte button will either open a user-define keypad, or a menu screen if there are pre-defined byte options to select from. Note: This option will be disabled if Passthru mode is enabled.
J1 Trace	Selects a default or customized pattern to be used as the Path J1 trace. Select one of the following patterns: Default (64 byte) - Selects the Digital Lightwave ASCII message as the transmit J1 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the transmit J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit J1 trace pattern. The message is entered and saved using a touch screen

	keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit J1 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit J1 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit J1 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.
J2 Trace	Selects a default or customized pattern to be used as the VT J2 trace. Select one of the following patterns: Default (64 byte) - Selects the Digital Lightwave ASCII message as the transmit J2 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the transmit J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit J2 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit J2 trace pattern.

	User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit J2 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.  This option is only available for VT-1.5, VT-2, and VT-6 mappings.
TC Trace	The TC Trace is a 16-byte pattern that can be created for repeated transmission between TCM equipment. The pattern is a string of ASCII characters and can be configured to send the unit's default pattern or a customized pattern.  Enable TCM mode (using TC Overhead Processing) before sending the TC Trace. Select one of the following patterns: Default (16 byte): Selects the Digital Lightwave ASCII message as the transmit TC trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the transmit TC trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the transmit TC trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the transmit TC trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the transmit TC trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

SONET Transmit - PTR

The Transmit PTR screen allows the user to perform SONET pointer sequence actions, as defined per the ANSI T1.105.03 telecommunication standard, and contains the following options:

Function	Description
NDF Flag	The NDF Flag allows you to specify whether the NDF bits are set when a new Pointer is present in the generated signal. The following options are available: Yes (On): Generates an NDF when a new Pointer is transmitted. No (Off): Disables NDF functionality.
Pointer Value	The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container. The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from 0 to 782. After entering the new Pointer Value, the Pointer automatically moves to the new position.
Frequency Offset	Adjusts the rate at which AU Pointer adjustments are needed in the Administrative Unit (AU). Enter a frequency type ranging from -100.0 ppm to +100.0 ppm. This function is disabled by entering 0.
Pointer Action	Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Single options - Inserts a single Pointer movement with each selection of the INC Pointer or DEC Pointer button. The Pointer value changes by one. Increment/Decrement option -Determines the type of Pointer activity that occurs when the INC Pointer and DEC Pointer buttons are selected. Continuous options - Inserts a continuous Pointer movement with the selection of the INC Pointer or DEC Pointer button. The movement continues until the Stop Sequence button is selected.

	 For SONET mode, the following Pointer Actions are available, as defined in ANSI T1.105.03 (2002) per the stated Figure number. <table border="1"> <thead> <tr> <th>SONET Pointer Sequences</th><th>Figure #</th></tr> </thead> <tbody> <tr> <td>STS Single and VT Single</td><td>Figures 2, 3 and 10</td></tr> <tr> <td>STS Single Add and VT Single Add</td><td>Figure 5a</td></tr> <tr> <td>STS Single Cancel and VT Single Cancel</td><td>Figure 5a</td></tr> <tr> <td>STS Increment/Decrement and VT Increment/Decrement</td><td>Figure 5a</td></tr> <tr> <td>STS Continuous and VT Continuous</td><td>Figures 6b* and 12a</td></tr> <tr> <td>STS Continuous Phase and VT Continuous Phase</td><td>Figures 3 and 4</td></tr> <tr> <td>STS Continuous Add and VT Continuous Add</td><td>Figures 6c and 13a</td></tr> <tr> <td>STS Continuous Cancel and VT Continuous Cancel</td><td>Figures 6db and 13b</td></tr> <tr> <td>STS 87-3</td><td>Figure 5b</td></tr> <tr> <td>STS 87-3 Add</td><td>Figure 5c</td></tr> <tr> <td>STS 87-3 Cancel</td><td>Figure 5d</td></tr> <tr> <td>VT 26-1</td><td>Figure 12b</td></tr> <tr> <td>VT 26-1 Add</td><td>Figure 13c</td></tr> <tr> <td>VT 26-1 Cancel</td><td>Figure 13d</td></tr> </tbody> </table> * ANSI Standard T1.105.03 (2002) mistakenly labeled Figure 6b as "87-3 pattern". Instead Figure 6b should be labeled "Continuous pointers".  See Application Note AP-00168-Pointer Sequences for detailed information on each pointer sequence.	SONET Pointer Sequences	Figure #	STS Single and VT Single	Figures 2, 3 and 10	STS Single Add and VT Single Add	Figure 5a	STS Single Cancel and VT Single Cancel	Figure 5a	STS Increment/Decrement and VT Increment/Decrement	Figure 5a	STS Continuous and VT Continuous	Figures 6b* and 12a	STS Continuous Phase and VT Continuous Phase	Figures 3 and 4	STS Continuous Add and VT Continuous Add	Figures 6c and 13a	STS Continuous Cancel and VT Continuous Cancel	Figures 6db and 13b	STS 87-3	Figure 5b	STS 87-3 Add	Figure 5c	STS 87-3 Cancel	Figure 5d	VT 26-1	Figure 12b	VT 26-1 Add	Figure 13c	VT 26-1 Cancel	Figure 13d
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VT 26-1 Add	Figure 13c																														
VT 26-1 Cancel	Figure 13d																														
Burst Count	This function allows you to determine the number of Pointer location movements to occur when the INC Pointer or DEC Pointer buttons are pressed. The Pointer burst count ranges from 1 to 8.																														
Ms between Bursts	Allows the user to set the number of Milliseconds between bursts. Valid valued are 5.5 - 350000.																														

INC Pointer / DEC Pointer	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.

APS

Transmit APS

This is an Automatic Protection Switching (APS) function used to configure transmit APS activity. APS is a feature that allows the LTE to switch to a backup line in case of errors or failures on the main line. APS commands can be configured for either Linear- or Ring-based networks and are transmitted using bytes K1 and K2 of the Line overhead.

You can test the network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response.

The following options are available on the APS screen:

New Item - Opens the [Apply Maintenance to Entry](#) window, from which you configure K1 and K2 bytes.

Start - Begins transmission of the K1 and K2 byte configuration.

Clear - Clears the table.

The following Apply Maintenance to Entry window APS Transmit functions are available:

APS Mode - Linear

This function configures the system to transmit APS functions for a Linear (span) network.

[K1 Full Byte \(Linear Mode\)](#)

[K1 Bits 1-4 \(Linear Mode\)](#)

[K1 Bits 5-8 \(Linear Mode\)](#)

[K2 Full Byte \(Linear Mode\)](#)

[K2 Bit 5 \(Provisioned\) \(Linear Mode\)](#)

[K2 Bits 1-4 \(Linear Mode\)](#)

[K2 Bits 6-8 \(Linear Mode\)](#)

APS Mode - Ring

This function configures the system to transmit APS functions for a Ring network.

[K1 Full Byte \(Ring Mode\)](#)

[K1 Bits 1-4 \(Ring Mode\)](#)

[K1 Bits 5-8 \(Ring Mode\)](#)

[K2 Full Byte \(Ring Mode\)](#)

[K2 Bit 5 \(Provisioned\) \(Ring Mode\)](#)

[K2 Bits 1-4 \(Ring Mode\)](#)

[K2 Bits 6-8 \(Ring Mode\)](#)

Duration in Frames

The Duration in Frames function determines the number of frames transmitted that contain specific K1 and K2 bytes. These bytes are configured using the functionality located on the transmit APS screen.

Frame count is entered using a keypad. Values ranging from 1 to 65535 frames can be entered.

K1 Bits 1-4 (Linear Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No Request, Bit pattern 0000
(0001) Non Rev	Do not revert, Bit pattern 0001
(0010) RR	Reverse Request (Ring), Bit pattern 0010
(0011) Unused	Not Used, Bit pattern 0011

(0100) EXER	Exerciser (Ring), Bit pattern 0100
(0101) Unused	Not used, Bit pattern (0101)
(0110) WTR	Wait to restore, Bit pattern (0110)
(0111) Unused	Not used, Bit pattern (0111)
(1000) MS	Manual switch, Bit Pattern 1000
(1001) Unused	Not used, Bit pattern (1001)
(1010) SD-LP	Signal degrade low priority, Bit pattern (1010)
(1011) SD-HP	Signal degrade high priority, Bit pattern (1011)
(1100) SF-LP	Signal fail low priority, Bit pattern (1100)
(1101) SF-HP	Signal fail high priority, Bit pattern (1101)
(1110) FS	Forced switch, Bit pattern (1110)
(1111) LP	Lockout of protection, Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K1 byte. The options for this function are predefined and use mnemonics to identify bit patterns.

The following options are available:

Options	Description
(0000) NR	No request, Bit pattern 0000
(0001) RR-R	Reverse request (Ring), Bit pattern 0001
(0010) RR-S	Reverse request (Span), Bit pattern 0010

(0011) EXER-R	Exerciser (Ring), Bit pattern 0011
(0100) EXER-S	Exerciser (Span), Bit pattern 0100
(0101) WTR	Wait to restore, Bit pattern (0101)
(0110) MS-R	Manual switch (Ring), Bit pattern (0110)
(0111) MS-S	Manual switch (Span), Bit pattern (0111)
(1000) SD-R	Signal degrade (Ring), Bit Pattern 1000
(1001) SD-S	Signal degrade (Span), Bit pattern (1001)
(1010) SD-P	Signal degrade (Path), Bit pattern (1010). This is the Transmit Default button setting.
(1011) SD-R	Signal degrade (Ring), Bit pattern (1011)
(1100) SF-S	Signal fail (Span), Bit pattern (1100)
(1101) FS-R	Forced switch (Ring), Bit pattern (1101)
(1110) FS-S	Forced switch (Span), Bit pattern (1110)
(1111) LP-S	Lockout of protection (Span), Bit pattern (1111). This is also the Transmit Illegal button setting.

K1 Bits 5-8 (Linear Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Linear mode, these bits indicate the channel number. For example, Code 0 is the Null Channel, Codes 1-14 are the working channels, and Code 15 is an extra traffic channel.

The following options are available:

Options	Description

Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101

#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Bits 5-8 (Ring Mode)

This function edits the last four bits of the K1 byte. When APS commands are configured for Ring mode, these bits contain the Destination Code Identification.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101

#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K1 Full Byte (Linear Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description

Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K1 Full Byte (Ring Mode)

This function configures the bit pattern of the K1 byte using either predefined or user defined settings by individually setting the eight bits of the K1 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K1 byte to 00000000 bit pattern.
Default (10101010)	Configures the K1 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K1 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Bit 5 (Provisioned) (Linear Mode)

This function edits the 5th bit of the K2 byte. In Linear mode. This bit controls the type of protection switching architecture used.

The following options are available:

Options	Description
1+1	Provisioned for 1+1 mode; Bit 5 = 0
1 : n	Provisioned for 1:n mode; Bit 5 = 1

K2 Bit 5 (Provisioned) (Ring Mode)

This function edits the 5th bit of the K2 byte. In Ring mode, this bit controls the type of path code used.

The following options are available:

Options	Description
SHT / OTO	Short Path Code; Bit 5 = 0
LNG / OTN	Long Path Code; Bit 5 = 1. When selected, both the Transmit Default and Transmit Illegal button settings are configured for LNG/OTN.

K2 Bits 1-4 (Linear Mode - SDH)

This function edits the first four bits of the K2 byte. In Linear mode, the first four bits indicate which working channel is bridged onto the protection channel during a traffic switching event.

The following options are available:

Options	Description
Null (#0)	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101
#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100

#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15 (EXTRA)	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 1-4 (Ring Mode)

This function edits the first four bits of the K2 byte. In Ring mode, the first four bits are the Source Node Identification. (The Source Node ID is set to the Node's own ID.)

The following options are available:

Options	Description
#0	Protection channel requesting switch action. The protection channel is supplied with a signal containing valid Transport Overhead for carriage of the APS bytes and BIP-8, Bit pattern 0000.
#1	Channel 1 requests switch action, Bit pattern 0001
#2	Channel 2 requests switch action, Bit pattern 0010
#3	Channel 3 requests switch action, Bit pattern 0011
#4	Channel 4 requests switch action, Bit pattern 0100
#5	Channel 5 requests switch action, Bit pattern 0101

#6	Channel 6 requests switch action, Bit pattern 0110
#7	Channel 7 requests switch action, Bit pattern 0111
#8	Channel 8 requests switch action, Bit pattern 1000
#9	Channel 9 requests switch action, Bit pattern 1001
#10	Channel 10 requests switch action, Bit pattern 1010. This is the Transmit Default button setting.
#11	Channel 11 requests switch action, Bit pattern 1011
#12	Channel 12 requests switch action, Bit pattern 1100
#13	Channel 13 requests switch action, Bit pattern 1101
#14	Channel 14 requests switch action, Bit pattern 1110
#15	Extra traffic channel requesting switch, bit pattern 1111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Linear Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description

(000) Unused	Not used, Bit pattern 000
(001) Unused	Not used, Bit pattern 001
(010) Unused	Not used, Bit pattern 010
(100) Unused	Not used, Bit pattern 100
(100) Uni-direct	Provisioned for Unidirectional switching, Bit pattern 10
(101) Bi-direct	Provisioned for Bidirectional switching, Bit pattern 101
(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Bits 6-8 (Ring Mode)

This function edits the 6th, 7th, and 8th bits of the K2 byte. These bits indicate if a FERF or FEBE occurs at the line level. The current value displays in the User Setup column of the APS Commands function.

Options	Description
(000) Idle	Idle, Bit pattern 000
(001) Br	Bridged, Bit pattern 001
(010) Br&Sw	Bridged and switched, Bit pattern 010. This is the Transmit Default button setting.
(100) Ex Tr	Extra traffic on protection channel, Bit pattern 100
(100) Unused	Not used, Bit pattern 10
(101) Unused	Not used, Bit pattern 101

(110) MS-RDI / RDI-L	Multiplex Section Remote Defect Indicator, Bit pattern 110
(111) MS-AIS / AIS-L	Multiplex Section Alarm Indication Signal, Bit pattern 111. This is the Transmit Illegal button setting.

K2 Full Byte (Linear Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

K2 Full Byte (Ring Mode)

This function configures the bit pattern of the K2 byte using either predefined or user defined settings by individually setting the eight bits of the K2 byte using the touch screen keypad.

The following options are available:

Options	Description
Set to 00000000	Configures the K2 byte to 00000000 bit pattern.
Default (10101010)	Configures the K2 byte to 10101010 bit pattern.
Illegal (11111111)	Configures the K2 byte to 11111111 bit pattern.
User Defined	Allows you to configure the bit pattern one bit at a time using the touch screen keypad.

Transmit - VCAT

The Transmit VCAT function allows you to add and configure VCAT channels for transmitting operations.

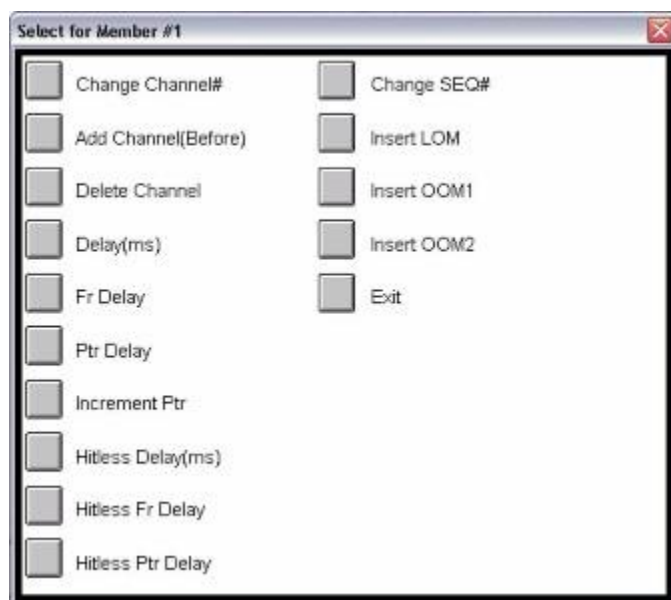
For instructions on configuring VCAT see [How to Set Up and Use VCAT Features](#).

VCAT channels created and various other parameters are displayed in the VCAT Table.

	button will gray-out to indicate that it is already selected.  If the Setting Control are set to Coupled, then members added to the Transmit VCG will also be added to the Receive VCG.
Member	Sequential list indicating the order in which the payload will be transmitted into the VCAT channels, regardless of the number indicated by "Seq-SQM".
Chan	Channel Number. Displays the VCAT Member's channel number. For High-Order mappings, the number will just be the AU#(for SDH) or STS#(for SONET). For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Seq # or Seq-SQM	The default and normal condition for Sequence Indicator is from 0 to N. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver. This column indicates the Sequence Indicator Number not the actual order that the payload is transmitted, as displayed in the "Member" column.  The "Seq#" label changes to "Seq-SQM" when inserting a Sequence Mismatch.

Delay (ms)	Combined Delay. The amount of time to delay this member as compared to the earliest member. This delay is calculated based on the combined time for the specified frame and pointer delays, and is expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames to delay this member as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. Sets the pointer value for this member, creating a very small delay.
Operation	Indicates whether an alarm condition has been turned on for this member, either Out of Multiframe (OOM1 or OOM2) or Loss of Multiframe (LOM).

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:



The first three menu items (Change Channel#, Add Channel and Delete Channel) specifically apply to the Transmit VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit

and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	Description
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member, entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of frames.
Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.
Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.

Change SEQ#	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing the setup of the member

Transmit - LCAS So

 For detailed information about LCAS, and instructions on configuring LCAS, see [How to Set Up and Use LCAS Features](#).

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit - LCAS So screen, and the Sink functionality is available from the [Receive - LCAS Sk](#) screen.

 Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated "Source" and the receive is designated "Sink". LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Transmit Settings



Access LCAS Transmit features by the selecting  (LCAS Source) side tab from the Transmit screen. The LCAS Settings table will appear, listing all of the members within the transmit VCG.

Set Trace

Add Remove

Rs-Ack Count 0 Rs-Ack Timeout Count 0 Active Payload Count 0

#	Chan	SQ	State	CTRL	Rcvd MST
1	1	255	IDLE	IDLE	FAIL
2	4	255	IDLE	IDLE	FAIL
3	9	255	IDLE	IDLE	FAIL
4	17	255	IDLE	IDLE	FAIL
5	29	255	IDLE	IDLE	FAIL
6	44	255	IDLE	IDLE	FAIL
7	53	255	IDLE	IDLE	FAIL
8	64	255	IDLE	IDLE	FAIL

1 2 3 4 5 6 7 8

IDLE IDLE IDLE IDLE IDLE IDLE IDLE IDLE

The transmit LCAS settings table is used to configure LCAS Source functions.

The following functions are found in the transmit LCAS settings table

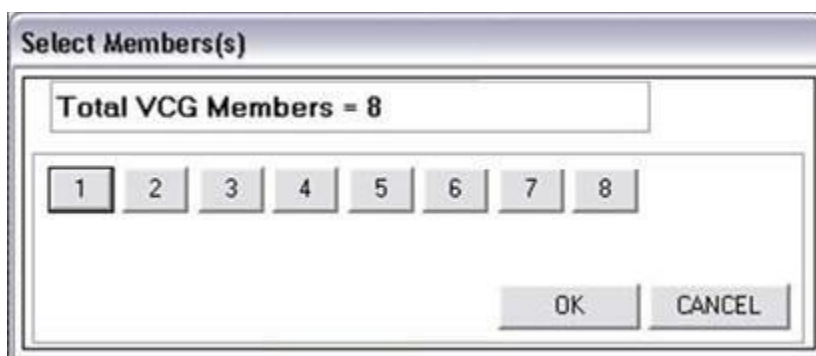
Function	Description
Set (button)	Selects the LCAS Settings Table
Trace (button)	Selects the LCAS Trace Table
Add (button)	Adds selected VCG members to the LCAS data stream
Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequene - Acknowledge messages received
Rs-Ack Timeout Count	Number of times when no Resequene - Acknowledge was received before the timeout period
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member's channel number.

	For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
SQ	Sequence number. If this member is not active, the sequence number will an invalid number (255 for high-order mapping, lower values for low-order mapping). For active members, the sequence number will be 0, 1, 2, etc.
State	Indicates the state of this VCG member. The possible states are: IDLE: This member is not in use. NORM: This member is part of the payload. DNU: Do Not Use. Failure state. ADD: Source has requested to add this member to the payload. Waiting for Sink response. REMOVE: Source has requested to remove this member from the payload. Waiting for Sink response.
CTRL	Control message sent from Source to Sink. Possible values are: ADD: Member to be added to the VCG NORM: Normal LCAS transmission

	EOS: End of Sequence, highest member in group IDLE: Member is part of the VCG or to be removed DNU: Do not use, Sink reports failure
Rcvd MST	Member Status received from Sink (Sk)
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload. DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Add and Remove

Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Transmit Trace

Press **Trace** to display the LCAS Trace Table.

☐ Filter Trace by Member Number — Off

Mem	ElapsedTime	SQ	State	CTRL	MST	RsAck
4	000:00:00:38	1*	ADD*	ADD*	FAIL	0
4	000:00:00:47	255*	REMOVE*	IDLE*	FAIL	0
4	000:00:00:47	255	REMOVE*	IDLE*	FAIL	0
2	000:00:01:48	1*	ADD*	ADD*	FAIL	0
2	000:00:02:02	0*	NORM	EOS*	OK	0
-	000:00:02:03	-	-	-	-	1*
5	000:00:02:43	1*	ADD*	ADD*	FAIL	1
6	000:00:02:43	2*	ADD*	ADD*	FAIL	1
7	000:00:02:43	3*	ADD*	ADD*	FAIL	1
8	000:00:02:43	4*	ADD*	ADD*	FAIL	1
2	000:00:02:54	0	NORM	NORM*	OK	1
5	000:00:02:54	1	NORM	NORM*	OK	1
6	000:00:02:54	2	NORM	NORM*	OK	1
7	000:00:02:54	3	NORM	NORM*	OK	1
8	000:00:02:54	4	NORM	EOS*	OK	1
-	000:00:02:55	-	-	-	-	0*
4	000:00:04:07	5*	ADD*	ADD*	FAIL	0
8	000:00:04:07	4	NORM	NORM*	OK	0
-	-----	-	-----	-----	---	-

The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description
Filter Trace by Member Number	Select User Defined to specify an individual member number. Only the activity of the selected member will be displayed. Select Off to display the activity of all members.

SONET Transmit - Error Alarm

The test unit can transmit errors and alarms to simulate various defects and anomalies to determine if the receiving equipment can detect an error or alarm in the incoming signal.

For information on inserting errors and alarms see the online help topics, [Inserting Errors](#) and [Inserting Alarms](#) in the Common Tasks section.

The following options are available one the Error Alarm screen:

[Error to Insert](#)

[Error Insert Rate](#)

Alarm Generated

Error to Insert

This SONET Transmit function determines the type of error transmitted by the system.

The purpose of generating an error with system is to stress the network element that is receiving the error by testing if it can detect the incoming error and then report error statistics such as error counts and rates.

The following options are available:

Option	Description
None	No errors are generated. Turns errors off.
Frame	Inserts a frame alignment error in the A1 and A2 bytes.
B1 Error	Generates a BIP-8 (Bit Interleaved Parity, 8-bit) error over the Section layer. Bits in the B1 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
B2 Error	Generates a BIP-8 error over the Line layer. Bits in the B2 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
REI-L	Generates a Remote Error Indicator over the Line layer. An REI-L is a count of B2 errors received at the far end. When the system transmits this error, it simulates a downstream NE sending an error count back to the source of its incoming SONET signal. The system uses the M1 byte of the Line OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming

	remote errors, and (2) then conduct performance monitoring such as error counts and rates. (This type of error was formerly called a Line Far End Block Error - FEBE-L.)
B3 Error	Generates a BIP-8 error over the STS Path layer. Bits in the B3 byte are toggled to create an error. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and rates.
REI-P	Generates a Remote Error Indicator over the Path layer. An REI-P is a count of B3 errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SONET signal. The system uses the G1 byte of the Path OH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates. (This type of error was formerly called a Path Far End Block Error - FEBE-P.)
BIP-V	Generates a BIP-2 error over the VT layer. Bits in the V5 byte are toggled to create an error.
REI-V	Generates a Remote Error Indicator over the VT layer. An REI-V is a count of BIP-V errors received at the far end. When the system transmits this error, it simulates an NE sending an error count back to the source of its incoming SDH signal. The system uses the V5 byte of the VTOH to transmit the error count. This type of simulation allows an NE (in this case, the upstream equipment) to be tested to verify if (1) it can detect incoming remote errors, and (2) then conduct performance monitoring such as error counts and error rates.
TC-IEC-P  Only appears when the TC	Generates a Tandem Connection Incoming Error Count over the Path layer. A TC-IEC is a count of B3 errors received by TCM equipment at the far end. Bits 1-4 of the N1 byte are the IEC bits.

Overhead Processing is configured for "Path Enable".	
TC-REI-P  Only appears when the TC Overhead Processing is configured for "Path Enable".	Generates a Tandem Connection Remote Error Indicator over the Path layer between TCM equipment. Bit 5 of the N1 byte is used for this error.
TC-OEI-P  Only appears when the TC Overhead Processing is configured for "Path Enable".	Generates a Tandem Connection Outgoing Error Indicator over the Path layer between TCM equipment. Bit 6 of the N1 byte is used for this error.
TC-BIP-V  Only appears when the TC Overhead Processing is configured for "VT Enable".	Generates a Tandem Connection Bit Interleaved Parity error over the VT layer. Bits 1-2 of the N2 byte are the BIP bits.
TC-REI-V  Only appears when the TC Overhead Processing is configured for "VT Enable".	Generates a Tandem Connection Remote Error Indicator over the VT layer between TCM equipment. A TC-REI-V is a count of TC-BIP-V errors received by TCM equipment at the far end. Bit 5 of the N2 byte is used for this error.
TC-OEI-V  Only appears when the TC Overhead	Generates a Tandem Connection Outgoing Error Indicator over the VT layer between TCM equipment. Bit 6 of the N2 byte is used for this error.

Processing is configured for "VT Enable".	
BIT Error	Generates bit errors. This type of simulation allows an NE (in this case, the downstream equipment) to be tested to verify if (1) it can detect incoming errors, and (2) then conduct performance monitoring such as error counts and error rates.

Error Insert Rate

This SONET Transmit function sets the error rate for the selected error. The system starts transmitting errors after the insertion rate is selected.

For information about inserting errors, see [Inserting Errors](#) in the Common Tasks section of the online help.

The following Error Insert Rate options are available:

Option	Description
Off	Turns error transmission off. This command effectively disables the Error Insert Action button.
Maximum	Generates errors at the maximum rate listed below.
1e - X	X is a value from 3 to 10; for example, 1e-3 through 1e-10. X will vary based on the type of error selected.
User Defined	Allows the user to enter a custom error rate anywhere between the Minimum and Maximum allowed rates.

Alarm Generated

This function configures the system to generate an alarm in the transmit SONET signal. Alarm generation by the system is one way to test if downstream SONET equipment reacts properly to the alarm it receives in the incoming SONET signal.

For information about generating alarms, see [Inserting Alarms](#) in the Common Tasks section of the online help.

The following alarms are available:

Alarm	Description
None	No alarms are generated. Turns alarms off.
LOS	Loss of Signal. An all-zeros pattern is transmitted to simulate a loss of signal or loss of optical power. This forces the downstream SONET equipment to (1) generate an AIS alarm to its downstream network elements (NE), and (2) generate an RDI alarm to its upstream NEs.
LOF	Loss of Frame. An all-zeros pattern is inserted into the A1 and A2 framing bytes of the Section OH. This simulates the absence of a valid framing pattern. This forces the downstream SONET equipment to generate an AIS alarm to its downstream network elements (NE) and generate an RDI alarm to its upstream NEs.
AIS-L	Line Alarm Indication Signal. The transmission of an AIS-L to a downstream NE forces that NE to send an AIS-P alarm to the next downstream NE. The NE will also send an RDI-L alarm to its upstream equipment. An AIS-L simulates an alarm generated by Line terminating equipment (LTE).
RDI-L	Line Remote Defect Indicator. This generates an RDI-L condition using the K2 byte of the Line OH. This simulates a downstream NE (in this case the NIC) at the Line layer, reporting a failure to an upstream NE. The downstream NE (NIC 10G) has encountered a downstream failure and is alerting upstream SONET equipment. To do this, the NIC 10G changes the pattern of the K2 byte. The NE receiving the RDI-L alarm should detect a change to the K2 byte on the incoming SONET signal. This forces the NE to generate a Remote Alarm Indicator (RAI) to its upstream NEs.
LOP-P	STS Path Loss of Pointer. This simulates a loss of a valid STS Pointer. When the downstream NE receives an LOP-P, it generates a DS _n AIS alarm to its downstream equipment and an RDI-P alarm to its upstream equipment.

AIS-P	Path Alarm Indication Signal. The transmission of an AIS-P to a downstream NE forces that NE to send an AIS alarm to the next downstream NE. The NE will also send an RDI alarm to its upstream equipment. An AIS-P simulates an alarm generated by Path terminating equipment (PTE).
RDI-P	Path Remote Defect Indicator. This generates an RDI-P condition using the G1 byte of the Path OH. This simulates a downstream NE (in this case, the NIC), at the Path layer, reporting a failure to an upstream NE. To do this, the system changes the pattern of the G1 byte in the Path OH. The NE receiving the RDI-P alarm should detect a change to the G1 byte on the incoming SONET signal.
UNEQ-P	Path Unequipped Alarm. An all-zeros pattern is inserted into the C2 byte of the Path OH. The C2 byte is the STS Path Signal Label. (This type of error is used between Path terminating equipment - PTE) When a PTE receives this alarm, it will generate an AIS to downstream NEs.
TC-RDI-P  Only appears when the TC Overhead Processing is configured for "Path Enable".	Tandem Connection-Remote Defect Indicator. Generates an alarm to upstream equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 8 in multiframe 73 of the N1 byte.
TC-ODI-P  Only appears when the TC Overhead Processing is configured for "Path Enable".	Tandem Connection-Outgoing Defect Indicator. Generates an alarm to upstream TCM equipment indicating that defects have been detected within the Tandem Connection. The TCM equipment receiving this alarm should detect a change to Bit 7 in multiframe 74 of the N1 byte.

TC-AIS-P  Only appears when the TC Overhead Processing is configured for "Path Enable".	Tandem Connection-Alarm Indication Signal. Generates an AIS alarm to downstream TCM equipment by setting Bits 1-4 of the N1 byte to 1110.
TC-UNEQ-P  Only appears when the TC Overhead Processing is configured for "Path Enable".	Tandem Connection-Unequipped. An all-zeros pattern is inserted into the N1 byte of the Path OH.
TC-LOF-P  Only appears when the TC Overhead Processing is configured for "Path Enable".	Tandem Connection-Loss of Frame. Generates a loss of a valid multiframe pattern to downstream equipment.

Receive

SONET Receive Screens and Functions

The Receive function allows you to define the parameters used in SONET receiving operations.

The following parameter setting options are available from the Receive screen:

[Set > Set 1](#)

[Set > Set 2](#)

[Set > Set 3](#)

[SOH](#)

[POH](#)

[SIG](#)

[VCAT](#) (Only appears when the test set is configured for VCAT)

[LCAS](#)-Sink (Only appears when the LCAS is enabled)

SONET Receive - Set / Set 1

The SONET Receive Settings 1 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Settings Control	If Coupled is selected, settings changed on the Receive screen will automatically change on the Transmit screen as well. If Independent is selected, settings established on the Receive screen will only affect Receive mode.
Interface	Selects the optical or electrical interface. The following options are available: OC-192, OC-48, OC-12, OC-3, OC-1, EC-3, EC-1  If the test set is licensed for Jitter operation, the following options are also available: OC-3-Jitter, OC-12-Jitter, OC-48-Jitter  If the test set is licensed for 1G or 10G LAN, the following options are also available: 802.3 1G LAN (1.250 GHz), 802.3 10G LAN (10.3125 GHz)

Mapping	Defines the type of signals that are combined to create an SONET signal. For example, four STS-48c's can be mapped into an OC-192 signal. Mapping options are dependent on the selected Interface. The following options may be available: Unframed Bulk Fill STS-192c Bulk Fill STS-48c Bulk Fill STS-12c Bulk Fill STS-3c Bulk Fill STS-1 Bulk Fill VT-6 Bulk Fill VT-2 Bulk Fill VT-1.5 Bulk Fill  If the test set is licensed for VCAT, the following options are also available: STS-3c-Xv Bulk Fill STS-1-Xv Bulk Fill VT-6-Xv Bulk Fill VT-2-Xv Bulk Fill VT-1.5-Xv Bulk Fill  If the test set is licensed for 10G WAN, the following options are also available: STS 192c Ethernet WAN

STS-<#> Dropped	Selects a specific signal to monitor in the SONET signal. The test set receives the SONET signal that is demuxed into dropped signals and then processed.  The options that appear will depend on your current configuration. The default setting is 1.
VT Dropped	Selects a Virtual Tributary to dropped.  This option appears when VT mapping is selected.
VCAT Channel  Appears only when VCAT is licensed, and a VCAT mapping is chosen.	Allows the user to select a VCAT channel, from the specified VCAT group, for Error and Alarm insertion.
LCAS  Appears only when LCAS is licensed, and the VCAT group has more then one member added.	Enables or Disables LCAS (Link Capacity Adjustment Scheme) mode.
Payload Pattern	Selects the type of pattern that the unit expects to receive on the incoming SONET signal. Select one of the following patterns: PRBS 9, PRBS 9 Inv, PRBS 11, PRBS 11 Inv, PRBS 15, PRBS 15 Inv, PRBS 20, PRBS 20 Inv, PRBS 23, PRBS 23 Inv, PRBS 31, PRBS 31 Inv, User Defined (32-bit value), or Live.  If the test set is licensed for GFP, then GFP mapping option is also available.

	 When the actual pattern being received does not match the expected payload pattern, then a pattern mismatch (Pat Sync) alarm occurs.
Power Low Threshold	Sets the received optical power level (in dBm) threshold. If the power drops below the threshold, the Power Low alarm initiates. The threshold range is from 0 to -100 dBm ppm, in increments of 0.1. (-100 dBm is disabled.)
Out of Frequency Threshold	Sets the frequency threshold (in ppm) for the Line Frequency Offset. When the threshold is reached, the Frequency Wide alarm is triggered. The threshold range is from 0 to 120 ppm, in increments of 0.1. (0 ppm is disabled.)
Trigger Out	Allows the user to select the way that the protocol processor will respond to an external "pulse" received.

SONET Receive - Set / Set 2

The SONET Receive Settings 2 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
PLM Alarm Reporting	Disable or Enable Payload Label Mismatch reporting.

Expected Path Signal Label	Enter any eight bits for the Higher-Order Path Signal Label for byte C2 expected. Configure to receive a specific value for the C2 byte. The following options are available: 00 (Unequipped) 01 (Equipped) 02 (VT Structured STS) 03 (Lock VT Mode) 04 (Async 34M/45M Mapping) 12 (Async DS4NA Mapping) 13 (ATM Mapping) 14 (DQDB Mapping) 15 (Async FDDI Mapping) 16 (HDLC Over SONET) 1A(10G WAN IEEE802.3ae) User Defined (any eight bit pattern 0 to FF)  This option is not coupled with the C2 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.

Expected VT Signal Label	Select one of the following values for the expected Lower Order Path Signal: 00 (Unequipped) 01 (Equipped) 02 (Asynchronous) 03 (Bit Synchronous) 04 (Byte Synchronous) User Defined (any eight bit pattern 0 to FF)  This option only appears when VT mapping is configured. It is not coupled with the V5 byte option in the Transmit Overhead screen. If it is changed in this screen, it will not change the Transmit setting.
TIM Alarm Reporting	An Trace Identifier Mismatch (TIM) alarm occurs for any of the overhead traces, when the incoming overhead trace values does not match the expected trace settings. The following options are available: Enabled - TIM alarms are recognized and reported. Disabled - TIM alarms are ignored.

Expected J0	Defines the expected J0 trace received on the incoming SONET signal. A TIM-S alarm occurs if the incoming J0 trace does not match the expected J0 trace. The J0 byte is part of the Section OH and is known as the Section trace, or J0 trace. The J0 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J0 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected J0 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected J0 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected J0 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected J0 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

Expected J1	Defines the expected J1 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J1 trace does not match the expected J1 trace. The J1 byte is part of the Higher-order Path OH and is known as the Path trace, or J1 trace. The J1 trace is a pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The following options are available: Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J1 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected J1 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected J1 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected J1 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected J1 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

Expected J2	Defines the expected J2 trace received on the incoming SONET signal. A TIM-P alarm occurs if the incoming J2 trace does not match the expected J2 trace. The J2 byte is part of the Lower-order Path OH. The J2 trace is a pattern that can be created for repeated transmission. This 16-byte frame is identical to the 16-byte frame of the J1 and J0 bytes. The following options are available: Default (64 byte) - Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 62 characters appended with a CR and LF. User Defined (64 byte) - Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 64 characters in length (62 characters plus CR and LF). Default (16 byte): Selects the Digital Lightwave ASCII message as the expected J2 trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected J2 trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected J2 trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected J2 trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected J2 trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.  This option is only available for VT-1.5, VT-2, and VT-6 mappings.

SS Bits Alarm Reporting	Disables or Enables Signal Status bits reporting. This function is used in conjunction with the Expected SS bits function. If enabled, and an Signal Status bits mismatch is detected on the received signal, the duration in seconds will appear under the Results Scan function.
Expected SS Bits	Selects one of the following as the expected SS Bits value: 00 (SONET) 01 (Undefined) 10 (SDH) 11 (Undefined)
TC Error/Alarm Processing	Enables or disables Tandem Connection Monitoring (TCM) mode. This function is used in conjunction with the Expected TCM Trace function. The TC Summary LED turns red if a TCM error or alarm is reported. Select the TC Summary text for more details. Path Enable - Turns on Z5 byte for TCM error and alarm reporting mode. VT Enable - Turns on the Z6 byte for TCM error and alarm reporting mode. Disable - Turns off TCM error and alarm reporting mode.  Disable this option if you are not performing TCM testing. This will prevent false error and alarm reporting.

Expected TC Trace	Defines the expected TCM trace received on the incoming signal. For SONET, this is in the Z5 byte. For SDH, this is in the N1 byte. The following options are available: Default (16 byte): Selects the Digital Lightwave ASCII message as the expected TC trace pattern. The message consists of 15 characters, appended with a CRC-7. User Defined (16 byte): Selects a user-defined ASCII message as the expected TC trace pattern. The message is entered and saved using a touch screen keyboard. The message can be up to 15 characters, appended with a CRC-7. All 01's - Selects an All Ones (0x01) pattern as the expected TC trace pattern. All 00's - Selects an All Zeros (0x00) pattern as the expected TC trace pattern. User Defined (1 byte): Selects a user-defined Hexadecimal byte value as the expected TC trace pattern. The byte value is entered and saved using a touch screen keypad (from 0x00 to 0xFF). The byte value repeats indefinitely and does not contain CRC-7.

SONET Receive - Set / Set 3

The SONET Receive Settings 3 screen configures the unit's receive parameters. It contains the following functions:

Function	Description
Monitor Mode	Expands the receive sensitivity for the 52M or 155M electrical interfaces. Use this setting for better clock and data recovery, when the received voltage levels are lower than normal.

Signal Auto-Recovery Method	This is used as an attempt to recover the signal in the event the SONET's client processor signal (Packet tab, etc) is in an alarm state such as Loss of Frame or Loss of Link. By setting this to Default, the SONET processor will refresh every 30 seconds or so, which gives the client processor an opportunity to re-acquire a good framing or link. By setting this to Alternate, then the SONET processor will not try to auto-recover (refresh) when the client processor framing or link state is bad. You may need to force an LOS event (and then clear the LOS event) after the signal failure has been resolved, for the client to re-acquire client framing or link state.

SONET Receive - SOH

The Receive SOH screen contains the following options:

Option	Description
Showing	Selects a specific SOH slot to monitor on the incoming SONET signal.
Section Overhead	The following bytes appear for the selected SOH slot: Regenerator Section Overhead bytes (A1, A2, Z0, B1, E1, F1, and D1-D3) B1, E1, F1 and D1-D3 are only available for Slot 1, and usage of those bytes in other slots is undefined Pointer bytes (H1, H2, and H3) Multiplex Section Overhead bytes (B2, K1, K2, D4-D12, S1, Z1, Z2, M1, and E2) K1, K2, D4-D12, E2 and S1 are only available for Slot 1, and usage of those bytes in other slots is undefined

	S1 can be selected to display the received byte's translated value M1 is only available for Slot 3, and usage of this byte in other slots is undefined
J0	Displays the J0 trace received on the incoming SONET signal. This is a read-only function.

 An [Trace Identifier Mismatch \(TIM\)](#) alarm can be enabled to alert the user when the J0 overhead trace values being received does not match the expected trace setting.

SONET Receive - POH

The Receive POH screen contains the following options:

Option	Description
STS-<#> Dropped	Allows the user to enter the number of the specific STS channel to monitor. The default setting is 1.  When a VCAT mapping is chosen, this setting changes to VCAT Channel.
Path Overhead	Displays the Overhead bytes (B3, C2, G1, F2, H4, Z3, Z4, and Z5) for a specific Path OH slot on the incoming SONET signal. This is a read-only function.
VT Overhead	Displays the VT Overhead bytes (V5, Z6 and Z7) for a specific VT Dropped channel. This is a read-only function.
J1 Trace	Displays the Path J1 trace received on the incoming SONET signal. This is a read-only function.
J2 Trace	Displays the VT J2 trace received on the incoming SONET signal. This is a read-only function.
TC Trace	Displays the TC trace received on the incoming SONET signal. This is a read-only function.

 An [Trace Identifier Mismatch \(TIM\)](#) alarm can be enabled to alert the user when any of the above overhead trace values being received does not match the expected trace setting.

SONET Receive - SIG

Displays the following measurements of the incoming SONET signal:

Frequency in Hz

Line Frequency Offset Received in Hz and ppm

Optical power in dBm

STS Pointer Frequency Offset in ppm

VT Pointer Frequency Offset in ppm

Update Signal Calibration (*only available when Enable Calibration is selected*)

See [Calibrating SDH/SONET Electrical Interface Power Meters](#) for calibration instructions.

Receive - VCAT

The Receive VCAT function allows you to setup the parameters of what the NIC expects to see on an incoming VCAT signal and to view certain parameters of the incoming signal.

For instructions on configuring VCAT see [How to Set Up and Use VCAT Features](#).

VCAT channels created and various other parameters are displayed in the VCAT Table.

[illegible]

The Receive VCAT contains one function button, as defined below:

Function Button	Description
Delete All	Deletes all channels from the VCAT table.

Definitions of VCAT Table columns:

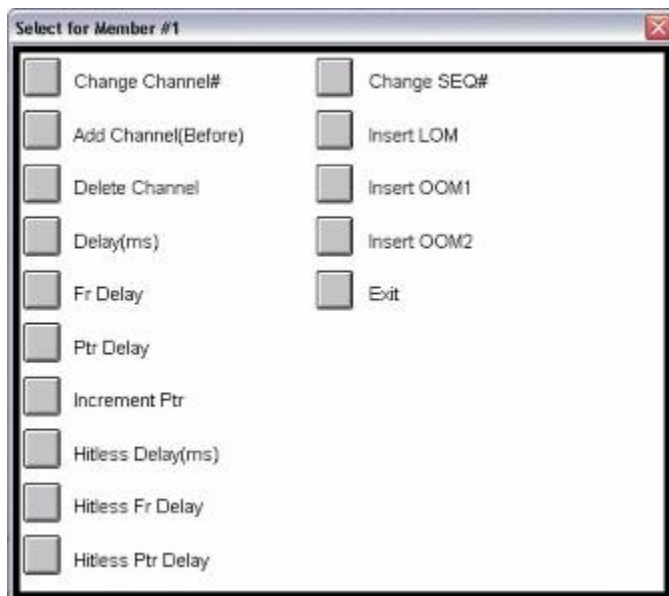
Function	Description
Add	Click on Add to select members for the VCAT Group (VCG). A Select Channel screen appears which shows all possible channel member available to choose from. When a channel has been selected, the channel button will gray-out to indicate that it is already selected.  If the Setting Control are set to Coupled, then members added to the Receive VCG will also be added to the Transmit VCG.
Member	Sequential list of VCG members.
Chan	Channel Number. Displays the VCAT Member's channel number. For High-Order mappings, the number will just be the AU#(for SDH) or STS#(for SONET).

	For Low-Order mappings SDH mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For Low-Order SONET mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
Exp Seq	Expected Sequence Number. This is the sequence of VCG members expected, based on the sequence of the Members column.
Seq #	This is the detected Sequence Number Indicator.  If the detected Seq# differs from the Expected Sequence number, and a Sequence Mismatch alarm is reported.
Delay (ms)	Combined Delay. The amount of time this member is delayed as compared to the earliest member. This delay is the same as indicated in Frame and Pointer Delays, expressed in milliseconds. 1 ms = 8 frames.
Fr Delay	Frame Delay. The number of frames this member is delayed as compared to the earliest member. This delay is the same as indicated in Delay (ms), expressed in frames. 1 frame = .125 ms.
Ptr Delay	Pointer Delay. This indicates the pointer delay value detected on this member.

Click on any row of the VCAT Table to bring up the "Select for Member #N" menu as seen here:



For user convenience, the same transmit settings found on the Transmit VCAT screen are also available on the Receive VCAT screen.



Many of the options in the menu actually apply to Transmit settings. The first three menu items (Change Channel #, Add Channel and Delete Channel) specifically apply to the Receive VCAT Table. However, If "Settings Control" is set for "Coupled" (see Transmit or Receive "Set" tab), the changes will apply to both Transmit and Receive VCAT Tables. If "Settings Control" is set for independent, the change will apply only to the Receive VCAT Table.

This menu is used to setup the selected member with any of the following menu functions.

Function	Description
Change Channel #	Selects which channel (time slot) will be used by this member.
Add Channel (before)	Adds one additional member in the next slot above the selected member. Selecting this menu item will bring up another menu where channel number is selected.
Delete Channel	Deletes the selected channel (member).
Delay (ms)	Inserts Combined Frame and Pointer Delays on the selected member, entered in milliseconds (ms).
Fr Delay	Inserts Frame Delay on the selected member entered in number of frames.
Ptr Delay	Changes the pointer value of the selected member, creating a very small delay.

Increment Ptr	Increases pointer value of the selected member by a value of 1.
Hitless Delay (ms)	Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm.
Hitless Fr Delay	Inserts Frame Delay on the selected member entered in number of frames) without causing a Loss of Multiframe (LOM) alarm.
Hitless Ptr Delay	Changes the pointer value of the selected member, creating a very small delay) without causing a Loss of Multiframe (LOM) alarm.
Change SEQ #	Changes the Sequence Indicator, not the actual order that the payload is transmitted, as displayed in the "Member" column. Changing the Sequence Indicator manually will create a Sequence Mismatch (SQM) at the receiver.
Insert LOM	Inserts Loss of Multiframe alarm
Insert OOM1	Inserts Out of Multiframe alarm 1
Insert OOM2	Inserts Out of Multiframe alarm 2
Exit	Closes the window without changing the setup of the member

Receive - LCAS Sk

 For detailed information about LCAS, and instructions on configuring LCAS, see [How to Set Up and Use LCAS Features](#).

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the [Transmit - LCAS So](#) screen, and the Sink functionality is available from the Receive - LCAS Sk screen.



Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated "Source" and the receive is designated "Sink". LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Receive Settings

Access LCAS Receive features by the selecting **LCAS Sk** (LCAS Sink) side tab from the Receive screen. The LCAS Settings table will appear, listing all of the members within the receive VCG.

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	IDLE	FAIL	255	IDLE
2	4	IDLE	FAIL	255	IDLE
3	9	IDLE	FAIL	255	IDLE
4	17	IDLE	FAIL	255	IDLE
5	29	IDLE	FAIL	255	IDLE
6	44	IDLE	FAIL	255	IDLE
7	53	IDLE	FAIL	255	IDLE
8	64	IDLE	FAIL	255	IDLE

The receive LCAS settings table is used to configure LCAS Sink functions.

The following functions are found in the receive LCAS settings table

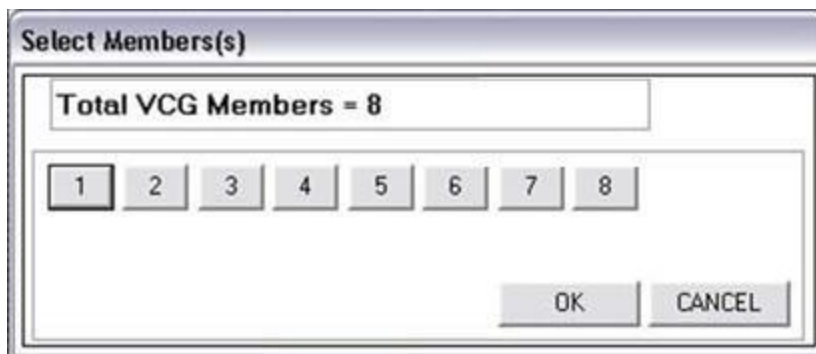
Function	Description
Set (button)	Selects the LCAS Settings Table
Trace (button)	Selects the LCAS Trace Table
Hold Off (button)	Delays sending a failure message back to the source, in seconds
Wait to Restore (button)	Delays sending an "OK" back to the source, in seconds
Add (button)	Adds selected VCG members to the LCAS data stream

Remove (button)	Removes selected VCG members from the LCAS data stream
Rs-Ack Count	Number of Resequenece - Acknowledge messages received
Active Payload Count	Number of VCG members that make up the payload
#	Member number, sequential
Chan	Channel. Displays the VCAT Member's channel number. For SDH High-Order mappings, the number will just be the AU#. For SONET STS mappings, the number will just be the STS#. For SDH Low-Order mappings, the address will be displayed in the following format: AU# N K,L,M, with N indicating the AU#, and the others indicating TUG-3, TUG-2 and TU# as applicable. For SONET VT mappings, the address will be displayed in the following format: STS# N K,L, with N indicating the STS#, and the others indicating VT group# and VT# as applicable.
State	Indicates the state of this VCG member. The possible states are: IDLE: This member is not in use. OK: This member is configured as part of the receive payload, and data is being received as expected. Fail: This member is configured as part of the receive payload, but no data is being received.
MST	Displays the Member Status, being sent to Source (So) from Sink (Sk)
Rcvd SQ	Sequence Number received from Sink (Sk)

Rcvd CTRL	Control message sent from Source to Sink. Possible values are: ADD: Member to be added to the VCG NORM: Normal LCAS transmission EOS: End of Sequence, highest member in group IDLE: Member is part of the VCG or to be removed DNU: Do not use, Sink reports failure
Member State-LED	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Add and Remove

Press **Add** or **Remove** to select which VCG members are to be added or removed from the LCAS data stream.



When adding or removing members, the button becomes disabled to indicate that the member has already been added or removed.

LCAS Receive Trace

Press **Trace** to display the LCAS Trace Table.

☐ Filter Trace by Member Number— Off

Mem	ElapsedTime	State	MST	SQ	CTRL	RsAck
-	000:00:16:01	-	-	-	-	0*
1	000:00:16:29	IDLE*	FAIL	255	IDLE	0
2	000:00:19:57	FAIL*	FAIL	1	ADD	0
-	000:00:19:58	-	-	-	-	0*
5	000:00:20:50	FAIL*	FAIL	1	ADD	0
6	000:00:20:50	FAIL*	FAIL	2	ADD	0
7	000:00:20:50	FAIL*	FAIL	3	ADD	0
8	000:00:20:50	FAIL*	FAIL	4	ADD	0
-	000:00:20:51	-	-	-	-	0*
4	000:00:21:51	FAIL*	FAIL	255	IDLE	0
-	000:00:22:04	-	-	-	-	0*
7	000:00:22:24	IDLE*	FAIL	3	NORM	0
-	000:00:23:10	-	-	-	-	0*
4	000:00:23:23	IDLE*	FAIL	255	IDLE	0
-	000:00:29:36	-	-	-	-	0*
2	000:00:29:50	IDLE*	FAIL	255	IDLE	0
5	000:00:29:50	IDLE*	FAIL	255	IDLE	0
6	000:00:29:50	IDLE*	FAIL	255	IDLE	0

The Trace table displays an event log history of changes in the LCAS configuration since the last time the test was restarted.

Function	Description
Filter Trace by Member Number	Select User Defined to specify an individual member number. Only the activity of the selected member will be displayed. Select Off to display the activity of all members.

Results

SONET Results Screens and Functions

All monitored activity that the system receives is reported to the Results screen for viewing and analyzing. The Results screen provides information used for analyzing the incoming signal, pattern, errors, and alarms.

The following options are available from the Results screen:

[Scan / Error / Alarm](#)

[PTR](#)

[Event](#)

[APS](#)

[Large LED](#)

[Graph](#)

[VCAT](#) (Only appears when the test set is configured for VCAT.)

[LCAS](#) (Only appears when the LCAS is enabled.)

SONET Results - Error / Alarm

The Results Error / Alarm screen contains the following options:

Scan - Select Scan to access a quick summary of incoming errors and alarms. It is effective in identifying a general area to investigate when error or alarm activity is detected. This function displays a list of received errors and alarms. For alarms, the duration is reported as a count in seconds. For errors, an error count is reported.

When no activity is occurring, the screen displays, "No errors or alarms."

Errors - The unit can monitor and report errors on the incoming SDH signal. The Errors function provides a detailed analysis of the incoming error as described below. The reported errors are a result of incoming errors that are generated by the SDH network, or errors that are intentionally generated by the system when it is used in a loopback environment.

The following errors can be monitored:

▶ BPV (Bi-Polar Violation, for EC-1 only)	▶ BIP-V (Bit Interleaved Parity - Virtual Tributary)
▶ LCV (Line Code Violation, for EC-3 only)	▶ REI-V (Remote Error Indication - Virtual Tributary)
▶ Frame	▶ BIT (BIT errors reported in the payload)
▶ B1 (Section BIP-8, also known as a Section Coding Violation - CV-S)	▶ TC-IEC-P/V (Tandem Connection-Incoming Error Count)
▶ B2 (Line BIP-8, also known as a Line Coding Violation - CV-L)	▶ TC-REI-P/V (Tandem Connection-Remote Error Indicator)

- ▶ B3 (Path BIP-8, also known as a Path Coding Violation - CV-P)
- ▶ TC-OEI-P/V (Tandem Connection-Outgoing Error Indicator)
- ▶ REI-L (Remote Error Indication - Line)
- ▶ NDF-P (New Data Flag - Path)
- ▶ REI-P (Remote Error Indication - Path)
- ▶ NDF-V (New Data Flag - Virtual Tributary)

The following parameters are measured for the incoming errors:

- ▶ Error count using an 11-digit format
- ▶ Average error rate using an N.NNe-N format
- ▶ Current error rate using an N.NNe-N format
- ▶ Error-free seconds using an 8-digit format
- ▶ Errored seconds
- ▶ Severely Errored seconds
- ▶ Unavailable errored seconds

Alarms - The system can monitor and report alarms and their duration on the incoming SDH signal. The alarms are shown in duration of the alarm in seconds.

The following alarms can be monitored:

- ▶ LOS (Loss of Signal)
- ▶ RDI-P (Remote Defect Indicator - Path)
- ▶ Power Hot - See Power Hot Alarm for details.
- ▶ TIM-P (Trace Identifier Mismatch - Path, for J1 byte)
- ▶ Power Warm - See Power Warm Alarm for details.
- ▶ SS MISMATCH ([Signal Status bits mismatch](#))
- ▶ Power Low - See Power Low Alarm for details.
- ▶ AIS-V (Alarm Indication Signal - Virtual Transport)
- ▶ Frequency Wide
- ▶ LOP-V (Loss of Pointer - VT)
- ▶ OPU Generic AIS (Unframed - PRBS 11)
- ▶ LOM-V (Loss of Multiframe Alignment - VT)

▶ LOF (Loss of Frame)	▶ UNEQ-V (Unequipped - Virtual Transport)
▶ AIS-L (Alarm Indication Signal - Line)	▶ RDI-V (Remote Defect Indicator - Virtual Transport)
▶ APS-L (Automatic Protection Switching-Line)	▶ RFI-V (Remote Failure Indicator - Virtual Transport)
▶ SEF (Severely Errored Frame)	▶ TIM-V (Trace Identifier Mismatch - Virtual Transport, for J2 byte)
▶ RDI-L (Remote Defect Indicator - Line)	▶ PLM-V (Payload Label Mismatch - Virtual Transport)
▶ TIM-S (Trace Identifier Mismatch - Section, for J0 byte)	▶ TC-RDI-P/V (Tandem Connection-Remote Defect Indicator)
▶ Pat Sync (Pattern Synchronization)	▶ TC-ODI-P/V (Tandem Connection-Outgoing Defect Indicator)
▶ PLM-P (Payload Label Mismatch - Path)	▶ TC-AIS-P/V (Tandem Connection-Alarm Indication Signal)
▶ Concat (Concatenated)	▶ TC-UNEQ-P/V (Tandem Connection-Unequipped)
▶ AIS-P (Alarm Indication Signal - Path)	▶ TC-LOF-P/V (Tandem Connection-Trace Identifier Mismatch)
▶ LOP-P (Loss of Pointer - Path)	▶ TC-TIM-P/V (Tandem Connection-Trace Identifier Mismatch)
▶ UNEQ-P (Unequipped - Path)	

SONET Results - PTR

This PTR function monitors and reports received Pointer statistics. A count of the following Pointer statistics appear:

The following STS Pointer results appear:

Pointer Justification - Indicates the Positive Pointer Justification count.

Negative Justification - Indicates the Negative Pointer Justification count.

Positive Justification Seconds - Indicates the duration of a Pointer adjustment.

NDF Count - Indicates the New Data Flag count.

Rx Pointer Bytes (HEX) and **Rx Pointer Value** (in decimal) - Valid Pointers range from 0 to 782.



When lower-order mapping is configured VT Pointer results also appear.

SONET Results - Event

The Results - Event function provides a detailed summary of when and how many errors, alarms, and other specific activity that has occurred and has been recorded by the unit since the time the test was started

The events appear in a table that lists events, the number of events logged, the start and stop time of the event, and the duration of the event.

Select the **Descending/Ascending** button to toggle between the order you wish to view the results.

Select **Pause** to temporarily halt the display of results, and press **Resume** to continue displaying results in real-time.

For more information, see the [Use the Event Log](#) section.

SONET Results - APS

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen.

The Results APS screen contains the following options:

Option	Description
APS Summary	When selected, the following information appears in the results table last 15 K1 and K2 byte sequences received: The HEX value of the K1 byte. The HEX value of the K2 byte.

	The number of frames received that contain the K1 and K2 bytes. The elapsed time of the frames that contain the K1 and K2 bytes.  To view decoded values for a specific Item, select the Item number. The APS Decode dialog box appears displaying the Item's configuration.
APS Decode	When selected, the results table splits into two horizontal tables: the top table displaying K1 results; the bottom table displaying K2 results. The K1 table decodes the value for bits 1-4 and bits 5-8. The K2 table decodes the value for bits 1-4, bit 5, and bits 6-8. Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes for the last 15 byte sequences received.
APS View Mode	Allows the user to view decoded values in either Linear Protection Switching Mode or Ring APS Signaling Mode.

 Per GR-253-CORE, only the upper 12 bits of the K1/K2 bytes (K1 bits 1-8 and the K2 bits 1-4) are used for APS operation. K2 bit 5 sets the APS mode type (1+1, 1:n) and cannot be changed during operation. K2 bits 6-8 are for alarms. Any changes to the lower four bits of the K2 byte do not affect APS operation. The Results APS table only starts and displays a new entry item if the upper 12 K1/K2 bits stabilize on a new value for a minimum of three consecutive frames.

SONET Results - Large LEDs

This displays the LED Error and Alarm Indicators in a large, easy to read format that covers the entire screen area. This is especially useful for viewing any errors or alarms from a long distance, such as across the room from a test bay.

The following describes the LED colors:

If the LED color is ...	Then this indicates ...
Green with black text	The specific function is active and OK.
Red with black text	An error or alarm event is in progress.
White with red text	This function experienced an error or alarm event. This event is cleared by selecting Restart.
White with black text	No activity from this specific function.

For a list of available LEDs in the SONET protocol processor, see [Quick Status LEDs](#).

SONET Results - Graph

The Graph function allows incoming errors and alarms to be graphed. The graphs can be saved, recalled, and printed from a history file.

For more information about graphs, select [Using Graphs](#) in the Common Tasks section of the online help.

Results - VCAT

All monitored VCAT channel activity that the system receives is reported to the Results screen. The Results functionally provides several drill-down layers for analyzing the incoming signal, alarms, and errors.

For instructions on configuring VCAT see [How to Set Up and Use VCAT Features](#).

The following screen displays Alarm and Error counts that are common to all channel and access to the detailed information on each channel.

Alarm	Seconds
LOA	0
Pat Sync	0

Error Description	Count	Average Rate	Current Rate
BIT	0	0.00e+000	0.00e+000

#	Chan	Seq	LOM	OOM1	OOM2	SQM	Path	TCM
-	Detail View							
1	45	0	[X]					
2	43	1		[X]				
3	25	2			[X]			
6	51	66				[X]		

The following is found on the Results screen:

Options	Description
Alarm	The following statistics are displayed: Alarm - Displays the alarm types that are common to the entire VCG. LOA – Loss of Alignment. Indicates that the receiver is unable to align all members of the VCG. Patt Sync – Loss of synchronization of the payload pattern. Seconds - Displays the number of seconds that an alarm was present since the last time the restart button was pressed.
Error	The following statistics are displayed:

	Error Description - Displays the error types that are common to the entire VCG. BIT – Payload Bit Errors Count - Displays the error count using an 11-digit format. Average Rate - Displays the average error rate over the full elapsed time. Current Rate - Displays the current error rate (the error rate in the last one second).
Detail View  You can drill down to channel-specific details by selecting "Detail View" or any Member in the Detail View table. This opens the VCAT Detail View dialog box that allows you to select a specific channel and view its errors and alarms. See below.	The following statistics are displayed: # - Displays the Member number. Chan - Displays the Channel number. Seq - Displays the VC sequence number. LOM - Loss of Multiframe alignment. [X] indicates a LOM is detected on this channel. OOM1 - Out of Multiframe alarm, level 1. [X] indicates an OOM1 is detected on this channel. OOM2 - Out of Multiframe alarm, level 2. [X] indicates an OOM2 is detected on this channel. SQM - Sequence Number Mismatch. [X] indicates a SQM is detected on this channel. Path - Path summary indication. [X] indicates a Path error/alarm is detected on the channel. TCM - Tandem Connection Monitoring

Detail View

Touching "Detail View" or any member in the Detail View table brings up a window like this SONEt example:

The screenshot shows a window titled "Now Showing VCAT Channel AU#160 6.1 (Member #14)". At the top, there is a row of buttons for different AU members: AU#1 1.1, AU#1 5.1, AU#20 3.1, AU#20 6.1, AU#79 2.1, AU#79 7.1, AU#101 1.1, and AU#101 4.1. Below this is another row of buttons: AU#121 3.1, AU#121 6.1, AU#121 7.1, AU#160 3.1, AU#160 1.1, and AU#160 6.1. The main area of the window is empty. Below the buttons, there is a table with the following headers: Error Description, Count, Average Rate, and Current Rate. The table is currently empty. At the bottom, there is a table with the following headers: Alarm and Seconds. The table contains the following data:

Alarm	Seconds
LOW	0
OOM1	0
OOM2	0
SQM	0
MSU	0
TU-AIS	0
TU-LDP	0

Or like this SDH example:

The screenshot shows a window titled "Now Showing VCAT Channel STS# 1 3.2 (Member #1)". At the top, there is a row of buttons for different STS members: STS#1 3.2, STS#1 5.3, STS#1 7.4, STS#2 2.4, STS#2 4.2, STS#2 7.1, STS#3 4.3, and STS#3 4.4. The main area of the window is empty. Below the buttons, there is a table with the following headers: Error Description, Count, Average Rate, and Current Rate. The table is currently empty. At the bottom, there is a table with the following headers: Alarm and Seconds. The table contains the following data:

Alarm	Seconds
LOW	35
OOM1	1
OOM2	1
SQM	0
MSU	0
AIS-V	0
LDP-V	0

Select the desired channel at the top of the window and full error and alarm information will be displayed for that member.

Results - LCAS

 For detailed information about LCAS, and instructions on configuring LCAS, see [How to Set Up and Use LCAS Features](#).

Definition of Source (So) and Sink (Sk)

The Source functionality is available from the Transmit LCAS So screen, and the Sink functionality is available from the Receive LCAS Sk screen.

 Unlike VCAT, which is bi-directional, LCAS operates on a one-way basis. The transmit of an LCAS system is designated “Source” and the receive is designated “Sink”. LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but there is no correlation between the two.

LCAS Results

Access the LCAS Results measurements by the selecting  side tab from the Results screen. Select to view the [Summary](#), [Source](#) or [Sink](#) results screen.

Summary Screen

Select “Summary” to display an overview of LCAS alarms. This screen shows a split view of the condition or status for both the transmit (Source) and receive (Sink) VCAT Group (VCG) members.

 IDLE members are VCG members that have not been configured as part of the LCAS data stream.

Summary			Source			Sink		
Source								
VC Group Alarms: PLCT TLCT LOCT								
Per Member Alarm NaMST dUMST								
1	2	3	4	5	6	7	8	9
ADD	ONU	NORM	IDLE	NORM	REM	IDLE	IDLE	IDLE
Sink								
VC Group Alarms: PLCR TLCR LOCR dSQNC								
Per Member Alarm Summary: Non LCAS								
1	2	3	4	5	6	7	8	9
FAIL	IDLE	OK	IDLE	OK	OK	FAIL	IDLE	IDLE

[See below for definitions of all alarm conditions](#)

White boxes with black text indicate that the alarm condition has not been detected during the current test.

A white box with red text is a history indication; the alarm condition has been detected during the current test but is not present at this time.

A red box indicates a current alarm condition.

Source Screen

Select "Source" to display detailed LCAS Source alarms.

Summary Source Sink		
Alarm	Seconds	
LOCT (Loss Of Capacity Transmit)	0	
PLCT (Partial Loss of Capacity Transmit)	0	
TLCT (Total Loss of Capacity Transmit)	0	
#	No MST	dUMST
Detail View		
1	[X]	
2	[X]	
3	[X]	
4	[X]	
5	[X]	
6	[X]	
7	[X]	
8	[X]	

[See below for definitions of all alarm conditions](#)

The Alarm View reports the duration of all alarm types in seconds.

The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Sink Screen

Select “Sink” to display detailed LCAS Sink alarms.

Summary		
Source		
Sink		
Alarm	Seconds	
LOCR (Loss Of Capacity Receive)	18	
PLCR (Partial Loss of Capacity Receive)	0	
TLCR (Total Loss of Capacity Receive)	18	
SQNC (Inconsistent sequence number)	0	
#	Non LCAS	
-	Detail View	
1	[X]	
2	[X]	
3	[X]	
4	[X]	
5	[X]	
6	[X]	
7	[X]	
8	[X]	

[See below for definitions of all alarm conditions](#)

The Alarm View reports the duration of all alarm types in seconds.

The Detail View – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an [X] is placed in the column for the error/alarm type.

Definitions

Source Conditions	Description
LOCT	Loss of Capacity Transmit
PLCT	Partial Loss of Capacity Transmit
TLCT	Total Loss of Capacity Transmit
No MST	Multiframe Status not received
dUMST	Unexpected Multiframe Status counts
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are:

	IDLE This VCG member has not been added to LCAS. NORM This member is part of the payload. DNU Do Not Use. Failure state. ADD Source has requested to add this member to the payload. Waiting for Sink response. REM Source has requested to remove this member from the payload. Waiting for Sink response.

Sink Conditions	Description
LOCR	Loss of Capacity Receive
PLCR	Partial Loss of Capacity Receive
TLCR	Total Loss of Capacity Receive
SQNC	Inconsistent Sequence Number
Non LCAS	At least one member is not configured as LCAS
Member State-LED (Summary)	The State-LED provides a visual indication of which LCAS State or condition the VCG member is in. The possible states are: IDLE This VCG member has not been added to LCAS. OK This member is configured as part of the receive payload, and data is being received as expected. FAIL This member is configured as part of the receive payload, but no data is being received.

Test

Test Screens and Functions

(Specifically for SONET testing)

The Test screen configures test parameters associated with a SONET protocol processor.

The Test screen contains the following functions:

[SET 1](#)

[Service Disruption](#)

[RTD](#) (Round Trip Delay)

SET 1

Test - Settings (SET 1)

The SET 1 functions determine how long a protocol processor's test runs and what activities occur at the end of the test.

The following appears on the SET 1 screen.

[Duration](#): This function configures how long a timed test runs for.

[Action After Duration](#): This function defines what activities occur at the conclusion of a timed test

[Pause Test/Resume Test](#): This button switches between pausing an active test and continuing an paused test. The button's label indicates the action that will happen when it is selected.

For more information about tests, select [Start a Test](#) in the Common Tasks section of the online help.

Test SET 1 - Duration

This function configures how long a timed test runs. The following options are available:



After configuring the Duration, you must select Restart in order for the Timed Test to begin.

Options	Description
Continuous	Test is untimed, and unit is always collecting data.
5 Minutes	Test runs for 5 minutes.
15 Minutes	Test runs for 15 minutes.
1 Hour	Test runs for 1 hour.
2 Hours	Test runs for 2 hours.
24 Hours	Test runs for 24 hours.
72 Hours	Test runs for 72 hours.
1 Week	Test runs for 1 week.
2 Weeks	Test runs for 2 weeks.
User Defined	Allows a specific test duration to be entered using a touch screen keypad. The minimum duration is 1 minute. The maximum duration is 99 days, 23 hours, and 59 minutes.

Action after Duration

Action after Duration defines what activities occur at the conclusion of a timed test. It allows several different options, including printing results to a printer or recording them to a file; repeating a test or just processing one test. Test results appear in a columned report format; however, there is one option available to record the statistics using a delimiter.



After configuring the Duration, you must select Restart in order for the Timed Test to begin.



To determine how long a test will run, refer to [Duration](#).

Print Options

When a print option is chosen, the report prints directly to a printer. If you are using the NIC touch-screen, a printer must be attached to the NIC's parallel or serial port. (See Printer Port Configuration.)

Record Options

When a record option is chosen, the results are saved to a file with one of the following extensions:

- **.evt** - Event Report. A detailed summary of alarms, errors, and pointer activity.
- **.statE** - Event Report. Used when the *Record Statistics/Events and Repeat Test* option is selected.
- **.stat** - Results Report. A statistics report of the Scan, Errors, Alarms, and PTR functions.
- **.real** - Real-time Test Report. Real-time reports generated only from the NIC touch screen.

The file naming convention is: **xxhhmmss.<extension>** (where **xx** is the protocol processor, **hh** is hours, **mm** is minutes, **ss** is seconds). For example, a file named "OC163035.evt" represents an OC-192/48/12 test event that was recorded at 16:30:35.

To learn how to print or view a saved file, see the topic [Print or View Saved Files](#).

The table below describes the Action after Duration options.

Repeat Test and Realtime Test Options	Description
None	No action occurs at the end of the test duration.
Print Current Statistics	Test statistics are printed to a printer at the end of a timed test. The test does not repeat.
Record Current Statistics	Test statistics are printed to a file (.stat) at the end of a timed test. The test does not repeat.
Record Current Statistics using a delimiter	Test statistics are printed to a file (.stat) at the end of a timed test. The results appear in a quote/comma-report format, meaning that error and/or alarm values are enclosed in quotes (") and separated by commas (,). The test does not repeat.
Print Statistics and Repeat Test	Test statistics are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is

 This option appears when Repeat Actions is selected.	stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics and Repeat Test  This option appears when Repeat Actions is selected.	Test statistics are printed to a file (.stat) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Events and Repeat Test  This option appears when Repeat Actions is selected.	Test events are printed to a file (.evt) at the end of a timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Print Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics and events are automatically printed to a printer at the end of the timed test and the test restarts. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.
Record Statistics/Events and Repeat Test  This option appears when Repeat Actions is selected.	Both test statistics (.stat) and events (.statE) are printed to a file at the end of a timed test and the test repeats. This cycle continues until the test is stopped by selecting Stop from the Common Function Buttons, or by changing the Action After Duration value.  Both .statE and .stat files are recorded.
Print Events and Repeat Test	Enables real-time reporting. Any event that occurs during a real-time test automatically

 This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	prints to a printer that is attached to the NIC unit. When the test duration expires, the test restarts.
Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). When the test duration expires, the test restarts.
Print and Record Events and Repeat Test  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). When the test duration expires, the test restarts.
Print Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit. The test does not repeat.
Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a file (.evt). The test does not repeat.
Print and Record Events  This option only appears on the <u>NIC unit's touch screen</u> when Realtime Actions is selected.	Enables real-time reporting. Any event that occurs during a real-time test automatically prints to a printer that is attached to the NIC unit and prints to a file (.evt). The test does not repeat.

Pausing/Resuming a Test

To pause a test:

Select **Test** and choose **Set 1**.

Select **Pause Test**. When Pause is selected, the system stops collecting data, but the Elapsed Time counter continues. Additionally, when Pause is selected, a red **Test Paused** LED appears in the LEDs/Quick Status area.

To resume a test:

Select **Resume Test**.

The Test Paused LED turns white with red text, indicating that the test was paused earlier. A restart or new test will clear the LED's history.

 The events occurring while in pause mode will be recorded in the Event Log.

Test - Service Disruption

(Specifically for SONET testing)

The test set can measure service disruption intervals in your network. The unit can be configured to monitor for a specific event that will cause a service disruption. When this event occurs, the duration in both seconds and frames is logged. These statistics can be used to determine how long it takes for your network equipment to react to a service disruption event and switch to a backup path. The service disruption measurements show a granular accuracy of 1 frame duration.

- For all **SONET** rates one frame is roughly .125 ms (125 μ s)

Test Service Disruption functions include:

Action (State) - Starts and stops Service Disruption mode. If an event occurs, the protection switch time will appear in both seconds and frames present. The results will not include the number of good frames, but the number of errored frames that occur before the first good frame. This is based on the previously selected criteria for the consecutive time and frame requirements. The unit begins monitoring the incoming signal for a service disruption measurement event as soon as one of the following State options is selected:

- **Single APS** - Monitors for a single service disruption event. Seconds and frames are reported and the State returns to Inactive.
- **Continuous APS** - Constantly monitors for service disruption events, and updates the seconds and frames reported.
- **Stop APS** - Stops service disruption monitoring. The State returns to Inactive.

Protection Switch Criteria - Determines the type of alarm, error, or pattern event that is used as a trigger to generate service disruption activity in your network. The unit monitors the incoming signal for the specified event. If it occurs, its duration in both seconds and frames is measured and logged.

 For all **SONET** processors the Protection Switch Criteria include: **B1**, **SEF**, **AIS-L**, **AIS-P**, **AIS-V**, and **PRBS** (Bit Errors and Loss of Pattern Sync).

Good Time - This function allows you to enter the time-duration (in milliseconds) of consecutive error-free frames to elapse before Protection Switch measurements stop accumulating.

► For all **SONET** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.

Good Frames - This function allows you to enter the number of consecutive error-free frames to occur before Protection Switch measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

Switch MilliSecs - Indicates the Current (most recent), Average, Minimum and Maximum durations (in milliseconds) that it took for the service disruption events (errored frames) to occur.

Switch Frames - Indicates the Current (most recent), Average, Minimum and Maximum number of errored frames received during the service disruption event.

History Recent Milliseconds: The 10 most recent measurements (in ms) are displayed from left to right (5 on the top line and 5.

History Recent Frames: The 10 most recent measurements (in frames) are displayed from left to right (5 on the top line and 5.

 A complete summary of Service Disruption measurements for all processors in the unit can be viewed by selecting the **System tab** and choosing [Service Disruption](#).

For instruction on monitoring service disruption activity, select Measuring Service Disruption Activity in the Common Tasks section of the online help.

Test - RTD (Round-Trip Delay)

(Specifically for SONET and SDH testing)

The round-trip delay function allows you to transmit a known frame into your network and measure how long it takes for the frame to return to the unit.

Test RTD functions include:

Action (State): Starts and stops round-trip delay mode.

► **Single Round-Trip Delay** - If selected, a burst of payload BIT errors are inserted into a frame and transmitted once through your network. The frame's transmission through the network is measured in frame counts and milliseconds. Frame counts indicates the number of frames received before the errored frame is received by the unit. Milliseconds indicates how long it took for the errored frame to travel out and return to the unit.

► **Continuous Round-Trip Delay** - If selected, a continuous burst of payload BIT errors are inserted into each frame and transmitted continuously through your network. The current frame count and duration appear in the **Current** column. The fastest round trip appears in the **Minimum** column and the slowest round trip appears in the **Maximum** column.

► **Stop Round-Trip Delay** - Stops round-trip delay activity. The State returns to Inactive.

Round Trip Delay Time (milliSec): Indicates the duration in milliseconds that it takes for each errored frame transmitted to return back to the unit.

Round Trip Delay Time (Frames): Indicates the number of frames detected after each errored frame is transmitted and return back to the unit.

► The **Current** column displays the most recent round trip measurement.

► The **Minimum** column displays the fastest round trip measurement.

► The **Maximum** column displays the slowest round trip measurement

Consecutive Good Time Required: This function allows you to enter the duration (in milliseconds) of valid frames to occur before the round-trip delay function is confirmed to be activated. It is used to fine-tune the measurement.

► For all **SONET** and **SDH** processors the range is 0.125 to 2047.875 ms, and is entered using a keypad.

Consecutive Good Frames Required: This function allows you to enter the number of consecutive error-free frames to occur before round-trip measurements stop accumulating. The range is 1 to 16383 frames and is entered using a keypad.

Perf Monitor

Performance Monitor Screens and Functions

Specifically for SONET testing

Performance Monitoring provides greater detail about incoming Section, Line, Path, VT and BIT errors.

The following options are available:

[Sect](#)

[Line](#)

[Path](#)

[VT Path](#) *(only available when in a VT mapping)*

[BIT](#)

Perf Monitor - Sect

Specifically for SONET testing

This Section screen provides a detailed breakdown for Section errors detected and logged by the SONET protocol processor.

Section Near End B1 Errors

CV - Coding Violations. Error count of incoming B1 errors.

ES - Errored Seconds. Reports the duration of the incoming B1 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.

EFS - Error Free Seconds. Reports the duration of the incoming B1 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.

SES - Severely Errored Seconds. Reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 8554 or more B1 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, or Loss of Signal (LOS) alarm occurs.

Perf Monitor - Line

Specifically for SONET testing

The Line screen displays a detailed breakdown of incoming B2 (Line BIP-8, also known as Coding Violations) and Line Remote Error Indicator (REI-L) errors.

The following statistics are reported:

Line - Near End B2 Errors

CV - Coding Violations. Reports an error count of incoming B2 errors.

ES - Errored Seconds. Reports the duration of the incoming B2 errors in seconds and the percentage of errored seconds compared to the duration of error free seconds.

EFS - Error Free Seconds. Reports the duration of the incoming B2 error free seconds and the percentage of error free seconds compared to the duration of errored seconds.

SES - Severely Errored Seconds. Reports the duration of SES on the incoming SONET signal. An SES is reported when 9835 or more B2 errors occur in one second, or when a Severely Errored Frame (SEF) alarm, Loss of Frame (LOF) alarm, Loss of Signal (LOS) alarm, or Line Alarm Indication Signal (AIS-L) alarm occurs.

UAS - Unavailable Seconds. Reports the number of seconds that the Line layer was considered unavailable. A Line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.

Line - Far End REI Errors

CV - Coding Violations. Reports an error count of the number of B2 errors detected by the far-end Line Terminating Equipment (LTE). These errors are reported back to the unit using the M1 byte of the Line overhead. The M1 byte is also known as the Line Remote Error Indicator - REI-L. (A CV-LFE was formerly known as a Line FEBE.)

ES - Errored Seconds. This counter reports the number of seconds that an REI-L alarm is reported

EFS - Error Free Seconds. Reports the duration of the incoming REI-L error free seconds and the percentage of error free seconds compared to the duration of errored seconds.

SES - Severely Errored Seconds. Reports the duration when 9835 or more REI-L errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-L) alarm is present.

UAS - Reports a count of the number of seconds that an SES-LFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-LFE errors must be present before a UAS-LFE is declared.

Perf Monitor - Path

Specifically for SONET testing

The Path screen displays a detailed breakdown of incoming B3 (Path BIP-8, also known as Path Coding Violations) and STS Path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Path - Near End B3 Errors

CV - Code Violations. This is an error count of incoming B3 errors.

ES - Errored Seconds. This reports the duration of the incoming B3 errors (in seconds). This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.

EFS - Error Free Seconds. This reports the duration of the incoming B1 error free seconds. This statistic also reports the percentage of error-free seconds compared to the duration of errored seconds.

SES - Severely Errored Seconds. This reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal. An SES is reported when 2400 or more B3 errors occur in one second, or when an AIS-P alarm, UNEQ-P alarm, LOS alarm, LOF alarm, AIS-L alarm, or LOP-P alarm occurs.

UAS - Unavailable Seconds. This reports the number of seconds that the STS Path layer was considered unavailable. A Path is unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.

Path Far End REI Errors

CV - Code Violations. This is an error count of the number of B3 errors detected by the far-end STS Path Terminating Equipment (PTE). These errors are reported back to the unit using the G1 byte of the STS Path overhead. The G1 byte is also known as the STS Path Remote Error Indicator - REI-P. (A CV-PFE was formerly known as an STS Path FEBE.)

ES - Errored Seconds. This is a counter that indicates the number of seconds that an REI-P alarm is reported.

EFS - Error Free Seconds. Reports the duration of the incoming REI-P error free seconds and the percentage of error free seconds compared to the duration of errored seconds.

SES - Severely Errored Seconds. This reports the duration when 2400 or more REI-P errors are present at the far-end LTE, or when a Line Remote Defect Indicator (RDI-P) alarm is present.

UAS - Unavailable Seconds. This is a counter that indicates the number of seconds that an SES-PFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

Perf Monitor - VT Path

Specifically for SONET testing

The VT Path screen displays a detailed breakdown of incoming Virtual Tributary path BIP (Section BIP-8, also known as Coding Violations) errors and Virtual Tributary path Remote Error Indicator (REI-P) errors.

The following statistics are reported:

Payload - BIT Errors

CV - Code Violations. Reports the code violations by count.

ES - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.

EFS - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.

SES - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.

UAS - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

Perf Monitor - BIT

Specifically for SONET testing

Bit analysis provides a detailed breakdown for detected Payload Bit errors.

The following statistics are reported:

Payload - BIT Errors

CV - Code Violations. Reports the code violations by count.

ES - Errored Seconds. Reports the errored seconds by count, rate, and objective percentage.

EFS - Error Free Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.

SES - Severely Errored Seconds. Reports the error free seconds by count, rate percentage, and objective percentage.

UAS - Unavailable Seconds. Reports the unavailable seconds by count, rate percentage, and objective percentage.

SONET LED Quick Status Area

When the SONET protocol processor tab is selected, the following status indicators and LEDs are displayed in the **LED Quick Status Area** and the [Large LED](#) screen.



Quick Status Area LED's that are underlined are "Summary Status" LEDs and can be selected to display a summary pop-up window to show the individual LEDs ,and sometimes error/alarm statistics, related to that status LED.

Typically a **Red** LED indicates a problem, whereas a **Green** or **White** LED indicates error-free operation.

If an LED is **White** or **Green** and the LED's Text is **White**, then that Error or Alarm condition has not occurred at any time during the current test.

If an LED is **White** or **Green** but the LED's Text is **Red**, then that Error or Alarm condition was active at some point during the current test's history.

If an LED and the LED's Text are both **Red**, then that Error or Alarm condition is currently active.

LED	Description
TX	Indicates current SONET transmit interface wavelength. Wavelengths are SFP/XFP specific. To change the wavelength, simply hot-swap the SFP/XFP module.  WARNING: Always turn the TX Laser off before hot-swapping SFP or XFP modules. When the SFP/XFP module has been removed after an SONET interface was selected, "No Laser" will be displayed. When the laser module is hot-swapped, the laser's transmit wavelength will automatically update for the new SFP/XFP module.  If a non-SONET interface is selected from one of the other tabs, then "Not Assigned" will be displayed.
RX	Displays the received optical power in dBm. This status indicator will flash when the received optical power level exceeds the SFP's/XFP's Power Warm or Power Hot thresholds. See Power Hot, Power Warm and Power Low Alarms for details. When the SFP/XFP module has been removed after a SONET optical interface was selected, "Missing SFP/XFP" will be displayed.
E/A	Indicates the current Error / Alarm configured for transmission in the SONET signal. This is a status indicator.
Test Paused	If red, indicates that the current test has been paused .

CLK	Indicates the value of the Transmit Clock Reference function. This is a status and an alarm indicator.  The text will turn red if TX Clock Loss alarm is present.
All Tests (button)	This is a short-cut button to the general " All Test Status " summary LED screen for all circuit packs installed in the unit.
Section	Section Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received, including a Frame error. This is a status LED.
LOS	Loss of Signal. Indicates that a valid SONET signal is not being received. If an all-zeros pattern exists for 100 milliseconds or longer on the incoming SONET signal, then an LOS is reported.
LOF	Loss of Frame. Indicates that a frame alignment problem with the incoming SONET signal has been detected. An LOF is reported if a severely errored framing (SEF) defect continues for 3 milliseconds or longer. This is alarm LED.
SEF	Severely Errored Frame. Declared when four or more consecutive errored frames are detected on the incoming SONET signal. This is an alarm LED.
B1	Section Overhead BIP-8 Code Violation. Indicates an error in the SONET frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is a Section error that applies not only to the Section OH, but the entire frame. Any error in the frame will result in B1 error. This is an error LED.
Line	Line Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
REI-L	Line Remote Error Indicator. Indicates that an error is occurring at downstream Line terminating equipment. An REI is also known as a Far-End Block Error (FEBE). The M0 and M1 bytes of the SONET Line Overhead are used for this indicator. This is an error LED.
AIS-L	Line Alarm Indication Signal. Indicates if an alarm is being received from upstream Line terminating equipment. This is an alarm LED.

APS	Automatic Protection Switching. Indicates that the K1 and K2 bytes on the incoming SONET signal have changed.
RDI-L	Line Remote Defect Indicator. Indicates that a downstream defect has occurred along the Line layer. (An RDI is also known as a Far-End Remote Failure, FERF). This is an alarm LED.
B2	Line Overhead BIP-8 Code Violation. Indicates that parity errors were detected at the Line layer of the incoming SONET signal. This is calculated over the Line OH, Path OH, and payload of each STS-1. This is an error LED
Path	STS Path Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.
AIS-P	STS Path Alarm Indication Signal. Indicates if an alarm is being received from upstream Path terminating equipment. This is an alarm LED.
RDI-P	STS Path Remote Defect Indicator. Indicates that a remote alarm is being received from downstream Path terminating equipment. The G1 byte of the SONET Path Overhead is used for this indicator. This is an alarm LED.
LOP-P	STS Path Loss of Pointer. Indicates that an invalid Pointer has been received or a Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
REI-P	STS Path Remote Error Indicator. Indicates that an error count is being received from downstream Path terminating equipment. An REI is also known as a Far-End Block Error (FEBE). This is an error LED.
PTR-P	STS Path Pointer Adjustments. Indicates Pointer offsets or adjustments between the STS payload and the OC-N frame are occurring. This is a status LED.
B3	STS Path Overhead BIP-8 Code Violations. Indicates that parity errors were detected at the Path layer of the incoming SONET signal. This is calculated over the Path OH and payload of each STS-1. This is an error LED.
UNEQ-P	STS Path Unequipped Payload. Indicates that a 00h pattern has been detected in the C2 byte. This byte is being received from Path terminating equipment. This is an alarm LED.

VT	Virtual Tributary Status LED. Indicates if any of the errors or alarms within this portion of the overhead are being received. This is a status LED.  This section is only available when VT-1.5, VT-2 or VT-6 is mapped.
AIS-V	VT Alarm Indication Signal. Indicates an all-ones characteristic or adapted information signal was detected on the VT. It is generated to replace the normal traffic signal when it contains a defect condition in order to prevent consequential downstream failures being declared or alarms being raised. This is an alarm LED.
LOP-V	VT Loss of Pointer. Indicates that an invalid Pointer has been received or a VT Pointer loss has been detected on the incoming SONET signal. This is an alarm LED.
PTR-V	VT Pointer Adjustments. Indicates Pointer offsets or adjustments between the VT payload and the OC-N frame are occurring. This is a status LED.
LOM-V	VT Loss of Multiframe Alignment. Indicates a Loss of Multiframe Alignment in the VT. This is an alarm LED.
RDI-V	VT Remote Defect Indicator. Indicates that a signal was returned to the transmitting VT Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect. This is an alarm LED.
RFI-V	VT Remote Failure Indicator. Indicates a defect on the VT at persisted beyond the maximum time allocated to the transmission system protection mechanisms. When this occurs, the RFI is sent to the far end and initiates a path protection switch. This is an alarm LED.
REI-V	VT Remote Error Indicator. Indicates to the transmitting node that an errored block has been detected at the VT receiving node. This is an error LED.
UNEQ-V	VT Unequipped Payload. Indicates that an all-zeros patterns has been detected in the VT Signal Label of the V5 byte. This is an alarm LED.
BIP-V	VT Overhead BIP-2 Code Violations. Indicates an error occurred during a parity check, which involves grouping all the bits in a block into units and then performing a parity check of

	each bit position in the group. This is calculated over the VT OH and payload of each VT. This is an error LED.
PAT SYNC	Pattern Sync Mismatch. Indicates a loss of pattern synchronization. This is an alarm LED.
BIT ERR	BIT Error. Indicates a Bit error was detected in the payload. This is an error LED.
TCM  This LED only appears when TCM Overhead Processing has to be enabled in the Receive settings.	Tandem Connection Status LED. Indicates if a TCM error or alarm has been detected.  If this LED is red, select the "TCM" text to display the TCM Summary LEDs.
VCAT  This LED only appears for VCAT mappings, when one or more channels have been added to the Receive VCG.	Virtual Concatenation. Indicates if there are any errors or alarms within the received VCG. This is a status LED.  If this LED is red, select the "VCAT" text to display the VCAT Summary LEDs .
VcatLcas  This LED only appears for when LCAS is enabled.	VCAT configured with LCAS. Indicates if there are any errors or alarms within the received VCG or LCAS data stream. This is a status LED.  If this LED is red, select the "VcatLcas" text to display the VCAT/LCAS Summary LEDs .
LCV	Line Code Violations. Indicates that the 155M Electrical Interface received a CMI Line Encoding error. This is an error LED.
BPV	Bi-Polar Violations. Indicates that the 52M Electrical Interface received a B3ZS Line Encoding error. This is an error LED.
SSM	Signal Status Mismatch - Displays when the expected SS bits setting in the H1 byte do not match what is received. This is an alarm LED.



[SS Bits Alarm Reporting](#) must be enabled for this alarm to occur..

Specific Tasks

SONET Specific Tasks Overview

This section includes tasks that are specific to the SONET protocol processor. For general tasks, refer to the [Common Tasks](#) section.

Please use the **Contents** tab and window (left side of the screen) to select, open, and view Specific Tasks for this protocol processor.

[How to Set Up and Use VCAT Features](#)

[How to Set Up and Use LCAS](#)

[Make Pointer Adjustments](#)

[GFP Payloads for SONET mappings](#)

[802.3 10G LAN Testing](#)

[10G WAN Testing](#)

[Configuring APS \(K1 and K2\) Commands](#)

[Decoding APS \(K1 and K2\) Values](#)

[Testing SONET Jitter Interfaces](#)

[Add/Drop SONET/SDH and PDH Signals](#)

VCAT

How to Set Up and Use VCAT Features

NIC test sets licensed for VCAT functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing VCAT (Virtual Concatenation) for more efficient data transfer.

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

VCAT features are accessed under the SONET or SDH tab, in Transmit, Receive, and Results sections.

[Configuring VCAT Mapping](#)

[Adding and Editing VCAT Channels](#)

[Inserting VCAT Delays](#)

[Inserting VCAT Errors and Alarms](#)

[Viewing VCAT Alarm and Error LEDs](#)

[Viewing VCAT Alarm and Error Results](#)

 After configuring a VCAT group, see [How to Set Up and Use LCAS](#) for LCAS configuration and information.

Configuring VCAT Mappings

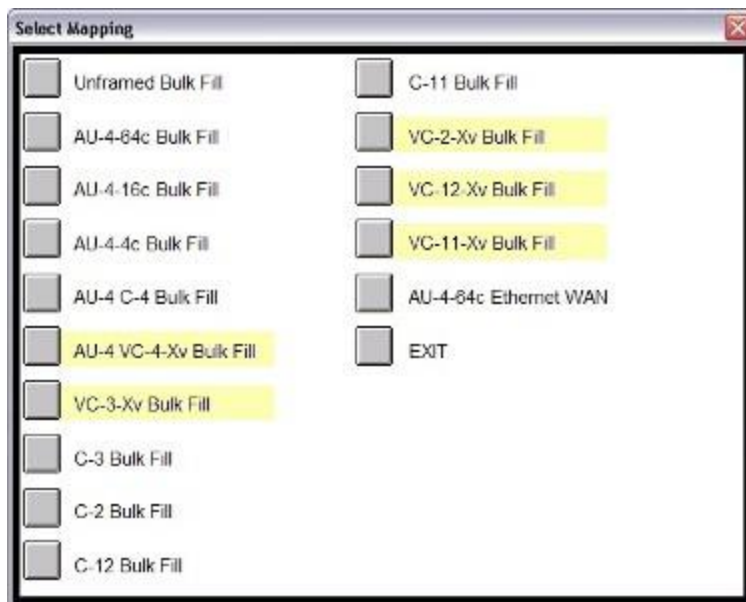
The following procedures describe how to configure the NIC for VCAT mapping in SDH and SONET. The NIC unit must be equipped with High-Order or Low-Order VCAT test options.

VCAT Mappings in SDH mode:

Select the **SONET** or **SDH** tab.

Select **Transmit**, and then select the **Set 1** side tab.

Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

Choose any of the following selections as applicable:

Higher-Order Mappings

AU-4 VC-4-Xv Bulk Fill (Not applicable when using STM-0, STM-0e, STM-1 or STM-1e Interface)

AU-3 VC-3-Xv Bulk Fill (Not applicable when using STM-0 or STM-0e Interface)

Lower-Order Mappings

VC-3-Xv Bulk Fill (when AU-Type is AU-4)

VC-2-Xv Bulk Fill

VC-12-Xv Bulk Fill

VC-11-Xv Bulk Fill

Select **AU-Type** and choose **AU-3** or **AU-4**; if available for the selected mapping..



The mapping will be displayed as AU-3 or AU-4, followed by the selected VC mapping. The above mapping choices plus the selection of AU-3 or AU-4 make it possible to do any of the following mappings:

AU-4 VC-4-Xv Bulk Fill

AU-4 VC-3-Xv Bulk Fill

AU-4 VC-2-Xv Bulk Fill

AU-4 VC-12-Xv Bulk Fill

AU-4 VC-11-Xv Bulk Fill

AU-3 VC-3-Xv Bulk Fill

AU-3 VC-2-Xv Bulk Fill

AU-3 VC-12-Xv Bulk Fill

AU-3 VC-11-Xv Bulk Fill

Select **Payload**, and choose the desired [Payload Pattern](#) (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).

Once the mapping is configured for VCAT, see [Adding and Editing VCAT Channels](#).

VCAT Mappings in SONET mode:

Select the **SONET** tab.

Select **Transmit**, and then select the **Set 1** side tab.

Select **Mapping** and the following window will appear:



(Highlights do not appear in the NIC screen.)

Choose any of the following selections as applicable:

STS Mappings

STS-3c-Xv Bulk Fill (Not applicable when using OC-1, EC-1, OC-3 or EC-3 Interface)

STS-1-Xv Bulk Fill (Not applicable when using OC-1 or EC-1 Interface)

VT Mappings

VT-6-Xv Bulk Fill

VT-2-Xv Bulk Fill

VT-1.5-Xv Bulk Fill

Select **Payload**, and choose the desired [Payload Pattern](#) (including PRBS or **GFP** if licensed) to be used as the test pattern for the entire VCG (Virtual Concatenation Group).

Once the mapping is configured for VCAT, see [Adding and Editing VCAT Channels](#).

Adding and Editing VCAT Channels

Adding VCAT Channels

[illegible]

Adding Channels in High-Order Mappings

Select **Add**. The Select Channel(s) window will appear.

Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:

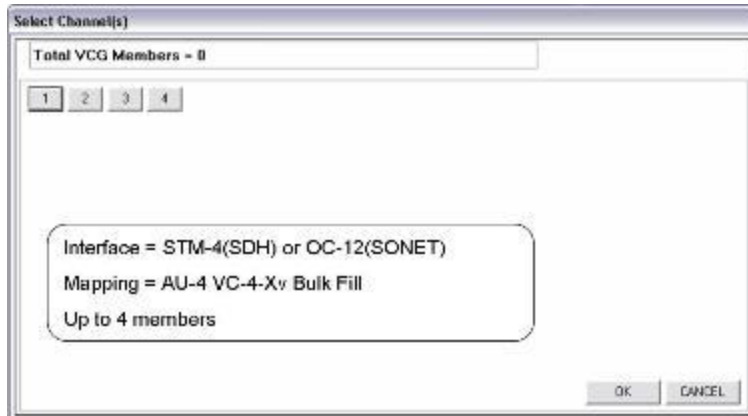
Select Channel(s)

Total VCG Members = 0

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63	64								

Interface = STM-64(SDH) or OC-192(SONET)
 Mapping = AU-4 VC-4-Xv Bulk Fill
 Up to 64 members

OK CANCEL



Select any channel. **Total VCG Members** will change from 0 to 1.

Continue to select additional members as required.

When you select a member, the member button become disabled, to indicate that the channel has been selected.

This window will alert you when the maximum number of members has been selected.

Select **OK**.

The Select Channel(s) window will close, and the newly added channels will appear in the VCAT Table, as in this example:

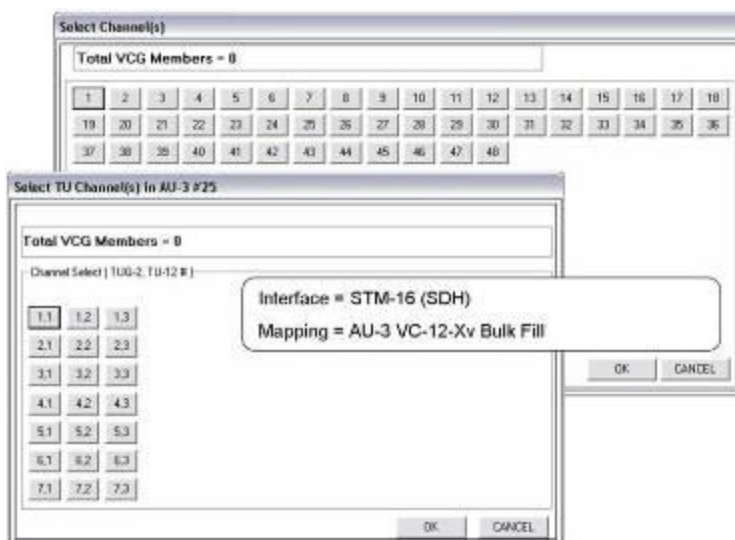
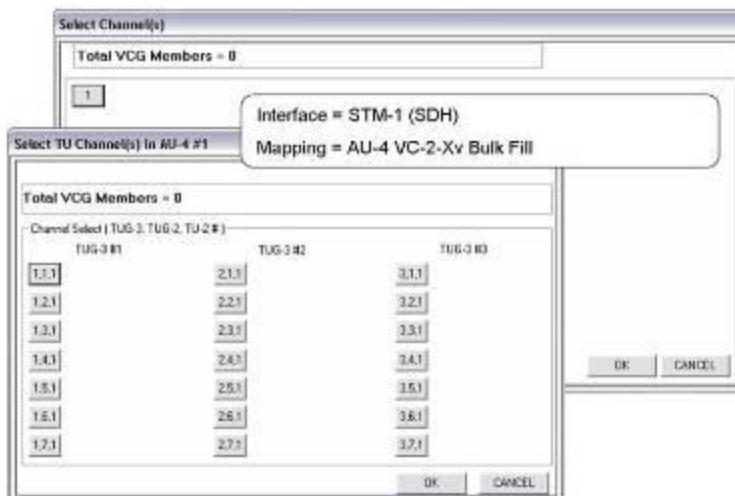
[illegible]

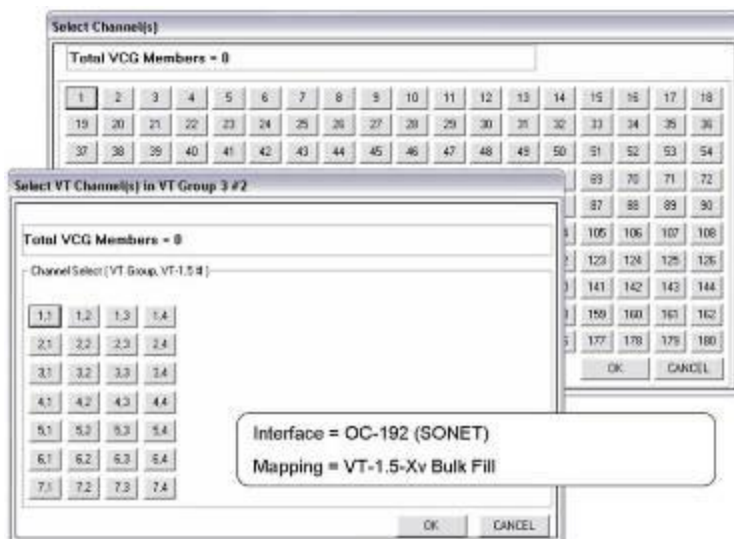
Adding Channels in Low-Order Mappings

The basic procedure for low-order mappings is the same as high-order mappings except that there is two-stage channel-selection process.

Select Add. The Select Channel(s) window will appear.

Depending upon the Interface and Mapping selected the number of available channels will be different. The following are examples:





Select any channel from the Select Channel(s) menu. The Select TU Channel(s) window, for SDH mapping, or Select VT Channel(s) window, for SONET mapping will appear.

Select TU or VT channels as required.

Continue to select additional channels as required.

Select OK.

The Select Channel(s) window will close and the new channels will appear in the VCAT Table, as in these examples:

SDH Example (*STM-64, AU-3 VC-11-Xv mapping*):[illegible]

SONET Example (OC-192, VT-1.5-Xv mapping):

The window will close and the selected member will be changed to the requested channel.

Deleting VCAT Channels

Deleting a Channel

Select the **Member** row to be deleted. The **Select for Member <#>** dialog box appears.

Select **Delete Channel**.

The window will close and the selected channel will be deleted.

Deleting All Channels

Select **Delete All** (located above the VCAT Table).

All members will be deleted.

Inserting VCAT Delays

The NIC can insert delay on any of the VCAT channels individually.

Select **SDH** or **SONET** tab.



This procedure is the same in SDH or SONET. The channel numbers will appear differently depending upon the protocol in use. SDH was used for the examples in this document.

Select **Transmit**.



The delay can actually be inserted from the Receive screen as well but the Receive VCAT Table will not display the inserted delay. The Receive VCAT Table displays measured delay.

Select the **VCAT** side-tab. The VCAT Table will be displayed.

(ms). Acceptable values are 0 to 255.99984, other values for Low-Order mappings.

Fr Delay - Inserts Frame Delay, the number of frames to delay this member as compared to the earliest member, entered in number of frames. Acceptable values are 0 to 2047, other values for Low-Order mappings.

Ptr Delay - Changes the pointer value of the selected member, creating a very small delay. Acceptable values are 0 to 782 for High-Order mappings, other values for Low-Order mappings.

No NDF Ptr Delay - Changes the pointer value without New Data Flag (NDF).

Increment Ptr - Increase pointer value by 1.

Hitless Delay(ms) - Inserts Combined Delay on the selected member, entered in milliseconds (ms) without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 255.99984, other values for Low-Order mappings.

Hitless Fr Delay - Inserts Frame Delay on the selected member, entered in number of frames, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 2047, other values for Low-Order mappings.

Hitless Ptr Display - Changes the pointer value of the selected member, creating a very small delay, without causing a Loss of Multiframe (LOM) alarm. Acceptable values are 0 to 782, other values for Low-Order mappings.

Once the error type is selected, a window with numeric keypad will appear. The title, max. value and min. value will differ depending upon the delay type selected. The following example is for Delay(ms).

Enter Delay in ms

Max. Value: 255.99519
Min. Value: 0.00000

Enter the desired delay value.

Press **OK**. The numeric keypad will disappear and the requested delay will be displayed in the VCAT Table. See example below.

Delete All Reset Seq #s ClearOperations						
M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2,3	0	5.00000	10	0	
2	AU#20 4,3	1	200.00000	400	0	
3	AU#60 1,1	2	6.00000	12	0	
4	AU#60 1,4	3	255.00000	510	0	
5	AU#100 3,2	4	0.00481	0	1	
6	AU#100 5,4	5	0.01442	0	3	
7	AU#132 5,3	6	0.04808	0	10	
8	AU#132 7,4	7	1.00481	2	1	
9	AU#156 4,4	8	0.49519	0	103	
10	AU#156 7,1	9	11.50000	23	0	
11	AU#192 7,4	10	0.24038	0	50	
12	AU#192 3,2	11	12.50000	25	0	
13	AU#192 1,2	12	255.49519	510	103	
Add						

To Reset Delays on All Members:

Select the **Clear Operations** button.

All delay values will be set to zero, and the VCAT Table Delay columns will be blank for all members.

Inserting VCAT Errors and Alarms

When the NIC unit is configured for VCAT, errors and alarms can be sent from the Transmit/Error Alarm menu. Section and Line errors and alarms (SONET) and RS and MS errors and alarms (SDH) are sent just as in non-VCAT mappings. Path errors and alarms are sent only on the selected VCAT member.

To select VCAT Channel:

Select the **SDH** or **SONET** tab.

Select **Transmit**, and then select the **Set 1** side tab.

Select **VCAT Channel** and choose which channel in which you would like to send errors or alarms.

The selected channel will be displayed in the menu, as in this example:



Select **Transmit > Error Alarm**.

The transmitted path errors and alarms will now be inserted in to the selected VCAT member.



For more information and specific procedure on sending errors and alarms, see SDH/SONET Transmit specific tasks.

VCAT-Specific Alarms

There are three VCAT-specific alarms:

LOM - Loss of Multiframe alarm

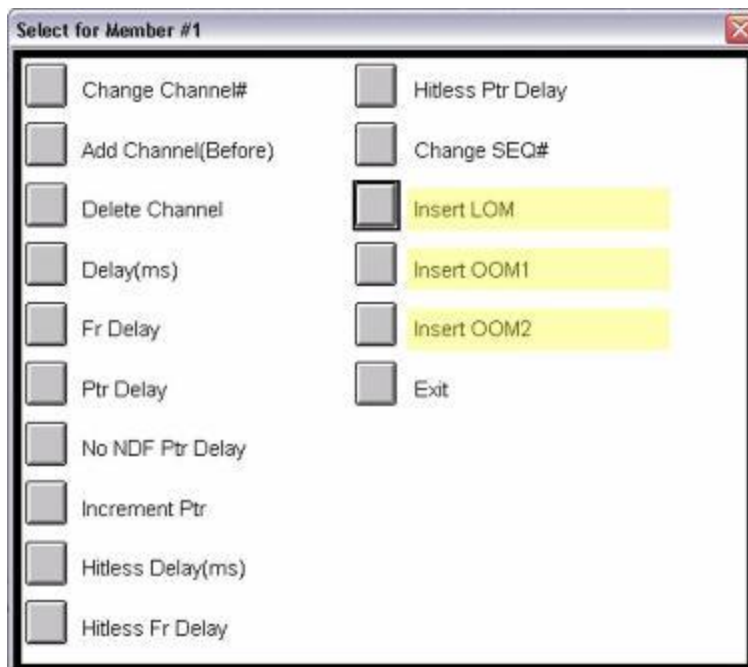
OOM1 - Out of Multiframe alarm 1

OOM2 - Out of Multiframe alarm 2

These alarms can be sent on individual VCAT members, even on multiple members simultaneously.

How to Send VCAT-Specific Alarms

Select **SDH** or **SONET** tab.



(Highlights do not appear in the NIC screen.)

Select **alarm type**.

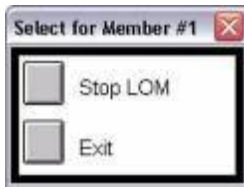
The window will disappear and the selected alarm type will appear in the VCAT Table under Operation as in this example:

Delete All Reset Seq #s ClearOperations						
M...	Chan	Seq #	Delay (ms)	Fr Delay	Ptr Delay	Operation
1	AU#20 2.3	0	0.00000	0	0	LOM
2	AU#20 4.3	1	0.00000	0	0	OOM1
3	AU#60 1.1	2	0.00000	0	0	OOM2
4	AU#60 1.4	3	0.00000	0	0	
5	AU#100 3.2	4	0.00000	0	0	
6	AU#100 5.4	5	0.00000	0	0	LOM
7	AU#132 5.3	6	0.00000	0	0	
8	AU#132 7.4	7	0.00000	0	0	
9	AU#156 4.4	8	0.00000	0	0	OOM1
10	AU#156 7.1	9	0.00000	0	0	
11	AU#192 7.4	10	0.00000	0	0	
12	AU#192 3.2	11	0.00000	0	0	OOM2
13	AU#192 1.2	12	0.00000	0	0	
Add						

To Stop Sending Errors / Alarms on One Member:

Select the desired **Member** row to stop sending alarm.

The following window will appear. (LOM is used only as an example.)



Select **Stop <alarm type>**.

The window will disappear and Operation for that member in the VCAT Table will be blank.

To Stop Sending Errors / Alarms on All Members:

Select the **Clear Operations** button.

The VCAT Table Operation column will be blank for all members.

Viewing VCAT Alarm and Error Results

The VCAT Results screen allows you to view VCAT-specific Alarm and Error results.

Select the **SDH** or **SONET** tab.

Select **Results**, then the **VCAT** side-tab. The VCAT Results screen will be displayed.

Error and alarm information is presented in two ways:

Overall View – Displays information common to all members of the VCAT Group (VCG)

Detail View – Displays full information about any one member, within the (VCG)

Overall View

Alarm		Seconds						
LOA		416						
Pat Sync		0						
Error Description	Count	Average Rate	Current Rate					
BIT	40617	4.50e-006	0.00e+000					
#	Chan	Seq	LOM	OOM1	OOM2	SQM	Path	TCM
-	Detail View							
1	AUR20 2,3	0	[X]					
2	AUR20 4,3	1		[X]	[X]			
3	AUR60 1,1	2			[X]			
4	AUR60 1,4	55				[X]		

Alarm Description – Provides alarm statistics that are common to the entire VCG.

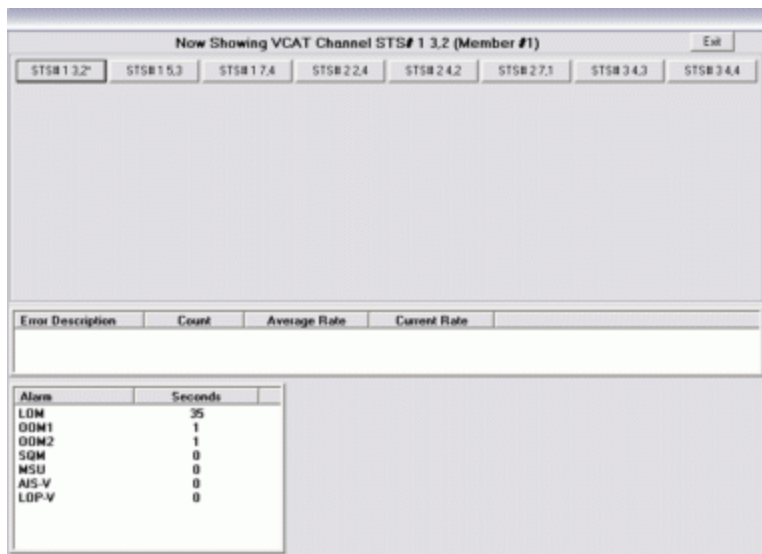
Error Description – Provides error statistics that are common to the entire VCG.

Detail – Provides the Trouble Scan View of any Member/Channel that has detected an alarm condition during the current test. The Member is listed and an **[X]** is placed in the column for the error/alarm type.

Detail View

To drill-down to channel-specific details:

Select any **Member** or **Detail View** text in the **Detail** box. The VCAT Detail View window appears.



The Detail View window will initially display either member #1 or the last member viewed, no matter whether the user clicked “detail view” or one of the members to bring up the window.

Select a **VCAT channel** to view its alarm and error statistics.

Select another **VCAT channel** as required, to view its alarm and error statistics.

Select **Exit** to close the VCAT Detail View window.

Viewing VCAT Summary LEDs

The LED statuses indicate the current condition and history of a test that is currently running. For VCAT, the LEDs can be viewed in four levels:

VCAT summary LED. A summary LED for all VCAT members.

VCAT Summary. A screen which shows a single LED for each VCAT member.

VCAT LEDs. An individual LED panel for each VCAT member displaying all applicable alarm and error conditions for that VCAT member only.

VCAT LEDs (Summary). An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT members.

Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

VCAT Summary LED

When SONET/SDH is configured for VCAT, an interactive VCAT LED appears at the bottom of the LED Quick Status Area.



The LED + the text “VCAT” serve as a summary indicator for all VCAT members.

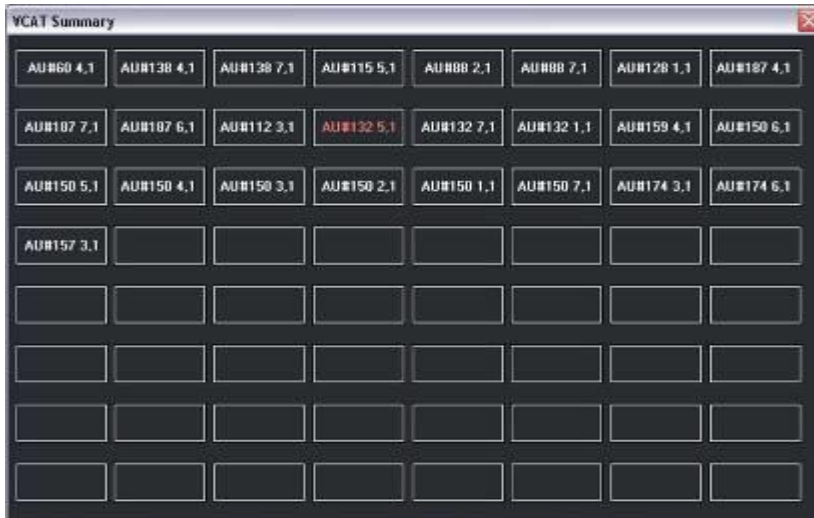
Green LED + White “VCAT” = No VCAT member has detected any errors or alarms during the current test.

Green LED + Red “VCAT” = History indicator. At least one VCAT member has detected errors or alarms during the current test.

Red LED = Red “VCAT” = At least one VCAT member is detecting errors or alarms right now.

VCAT Summary

Selecting the text “**VCAT**” next to the Summary LED and the VCAT Summary screen will appear.



Each block provides a summary for a single VCAT member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT member. Red Text indicates the detection of a least error or alarm on the VCAT member during the current test.

VCAT LEDs

Select any block in the VCAT Summary window and the VCAT LEDs window will appear.



The VCAT LEDs window provides full information regarding all alarm and error conditions for the selected VCAT member. As in the Summary LED, the LED itself plus the text serve as indicators.

Green LED +White text = This error or alarm has not been detected during the current test.

Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT LEDs (Summary)

Select **Summary** on the VCAT LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT member.

Green LED +White text = This error or alarm has not been detected during the current test on any VCAT member.

Green LED + Red text = This error or alarm has been detected during the current test on any VCAT member but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now on any VCAT member.

LCAS

How to Set Up and Use LCAS

NIC test sets licensed for LCAS (**Link Capacity Adjustment Scheme**) functionality allow Digital Lightwave® customers to test NextGeneration optical networks utilizing LCAS for dynamic bandwidth allocation and protection against failures. LCAS functions work with VCAT (**Virtual Concatenation**) to increase or decrease the number of VCAT Group (VCG) members in use, and therefore bandwidth, dynamically or to automatically protect data integrity by disabling failed VCG members.

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

 LCAS is only available if the NIC unit is licensed for both VCAT and LCAS.

 To enable LCAS, a VCAT mapping has to be selected, and at least one member must be added to the VCAT Group.

 The LCAS Transmit, Receive, and Results function screens are only displayed when LCAS is enabled. The LCAS option will then be displayed on the TX and RX SET1 screens.

LCAS works only with VCAT mappings, however VCAT can operate without LCAS. LCAS does not add or delete members from the VCG. The LCAS simulation will support from 0 to N members, where N is defined by the total number of members in the VCG.

For detailed instructions on configuring and using LCAS, see these links:

[Configuring LCAS](#)

[Adding and Removing LCAS Channels](#)

[Viewing VCAT/LCAS Summary LEDs](#)

Configuring LCAS

The following procedures describe how to configure the NIC for LCAS testing in SDH and SONET. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.



LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before LCAS can be configured, there must be a least one member in the VCAT Table. To configure VCAT and add channels, see these links:

[Configuring VCAT Mapping](#)

[Adding and Editing VCAT Channels](#)



Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated “Source” and the receive is designated “Sink”.



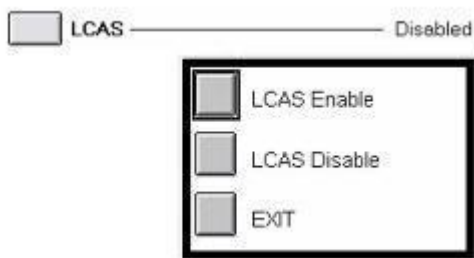
LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.

Enabling LCAS:

Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.

Select **Set** and choose **Set 1**.

Select **LCAS** and then choose **LCAS Enable**.



i If the **LCAS** option is not displayed on the **Set 1** screen, then either no members have been added to the VCAT group or the unit is not licensed for LCAS.

Once LCAS is enabled, no members can be added to or deleted from the VCAT Table. The “Add” and “Delete All” buttons will be unavailable.

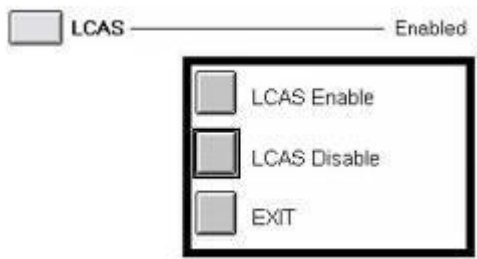
For adding and removing channels, see [Adding and Removing LCAS Channels](#).

Disabling LCAS:

Under the **SDH** or **SONET** tab, select **Transmit** or **Receive**.

Select **Set** and choose **Set 1**.

Select **LCAS** and then choose **LCAS Disable**.



Configuring Hold Off and Wait to Restore

In the event of a VCG member failure, the Sink will send a failure message to the Source.

Hold Off puts a delay between the detection of the failure and sending the message.

Wait to Restore puts a delay between the clearing of the alarm and when an “OK” message is sent to the source.

From the **SDH** or **SONET** tab, select **Receive**.



Select **Sk** (LCAS Sink) side tab from the Receive screen.

The LCAS Settings table will appear, listing all of the members within the receive VCG.

The SONET Tab interface includes a 'Set' button and a 'Trace' button. Below these are two input fields: 'Hold Off' with a value of 1 and 'Wait to Restore' with a value of 6. To the right are 'Add' and 'Remove' buttons. Below these are 'Rs-Ack Count' with a value of 1 and 'Active Payload Count' with a value of 4. A table displays channel status for 8 channels.

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	OK	OK	0	NORM
2	4	IDLE	FAIL	255	IDLE
3	9	OK	OK	1	NORM
4	17	IDLE	FAIL	255	IDLE
5	29	OK	OK	2	NORM
6	44	IDLE	FAIL	255	IDLE
7	53	OK	OK	3	EOS
8	64	IDLE	FAIL	255	IDLE

Below the table is a summary row with 8 columns, each containing a status: OK, IDLE, OK, IDLE, OK, IDLE, OK, IDLE.

Select **Hold Off** or **Wait to Restore**. The **Enter User Data** key pad will appear.

The 'Enter User Data' keypad interface shows a title bar, 'Max. Value: 10', and 'Min. Value: 0'. It features a numeric keypad with buttons for digits 0-9, a '+/-' button, and an 'OK' button. There are also buttons for 'Hex', 'Dec', 'Bin', 'Clear', and 'Cancel'. At the bottom are 'ALL' and 'NONE' buttons.

Enter **0** to **10** (seconds) for the required delay.

Select OK.

Adding and Removing LCAS Channels

The following procedure describes how to add LCAS channels to the data stream from the selection of available VCG (Virtual Concatenation Group) members configured in

VCAT. The NIC unit must be equipped with LCAS Test Option plus High-Order or Low-Order VCAT.



LCAS configuration is virtually identical in SONET and SDH.

Configuring VCAT (preliminary step):

Before adding LCAS channels, there must be a least one member in the VCAT Table and LCAS must be enabled. To configure VCAT and add channels, see these links:

[Configuring VCAT Mapping](#)

[Adding and Editing VCAT Channels](#)

[Configuring LCAS](#)



Unlike VCAT which is bidirectional, LCAS operates on a unidirectional, or one-way basis. The transmission of an LCAS system is designated "Source" and the receive is designated "Sink".



LCAS is configured between a source and a sink uni-directionally regardless of how the other direction is configured. The other direction may be configured as LCAS as well but as far as testing purposes, there is no correlation between the two.



The Source and the Sink are not coupled. Thus adding members to the LCAS Source does not automatically add members to the LCAS Sink, and visa-versa.

Adding LCAS Members to Source

From the **SDH** or **SONET** tab, select [Transmit](#).



Select (LCAS Source) side tab from the Transmit screen. .

The LCAS Settings table will appear, listing all of the members within the receive VCG.

The SONET Tab window displays a table with the following columns: #, Chan, SQ, State, CTRL, and Rcvd MST. Below the table is a row of 8 buttons labeled 1 through 8, each with a status indicator (IDLE or FAIL).

#	Chan	SQ	State	CTRL	Rcvd MST
1	1	255	IDLE	IDLE	FAIL
2	4	255	IDLE	IDLE	FAIL
3	9	255	IDLE	IDLE	FAIL
4	17	255	IDLE	IDLE	FAIL
5	29	255	IDLE	IDLE	FAIL
6	44	255	IDLE	IDLE	FAIL
7	53	255	IDLE	IDLE	FAIL
8	64	255	IDLE	IDLE	FAIL

Below the table, there is a row of 8 buttons labeled 1 through 8. Each button has a status indicator: 1 IDLE, 2 IDLE, 3 IDLE, 4 IDLE, 5 IDLE, 6 IDLE, 7 IDLE, 8 IDLE.

Select **Add**. The Select Member(s) window will appear.

The Select Member(s) window displays a row of 8 buttons labeled 1 through 8. Each button has a status indicator (IDLE or FAIL). Below the buttons are OK and CANCEL buttons.

Total VCG Members = 8

1 2 3 4 5 6 7 8

OK CANCEL

The **Select Member(s)** window contains one button for each VCG member.

If the member is available to be added into the LCAS data stream, the number on the button will be black (enabled).

If the member is already a part of the data stream, the number will be gray (disabled) and the button cannot be selected.

Select the required **members** and press **OK**.

 Refer to the [LCAS Transmit Settings](#) for Source Member's State-LED status descriptions

Adding LCAS Members to Sink

From the **SDH** or **SONET** tab, select [Receive](#).

Select **LCAS Sk** (LCAS Sink) side tab from the Receive screen.

The LCAS Settings table will appear, listing all of the members within the receive VCG.

The screenshot shows the 'LCAS Sk' settings window. At the top are 'Set' and 'Trace' buttons. Below them are input fields for 'Hold Off' (0), 'Wait to Restore' (0), 'Rs-Ack Count' (8), and 'Active Payload Count' (0). There are 'Add' and 'Remove' buttons. The main part of the window is a table with 8 rows and 6 columns: #, Chan, State, MST, Rcvd SQ, and Rcvd CTRL.

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	IDLE	FAIL	255	IDLE
2	4	IDLE	FAIL	255	IDLE
3	9	IDLE	FAIL	255	IDLE
4	17	IDLE	FAIL	255	IDLE
5	29	IDLE	FAIL	255	IDLE
6	44	IDLE	FAIL	255	IDLE
7	53	IDLE	FAIL	255	IDLE
8	64	IDLE	FAIL	255	IDLE

Below the table is a row of 8 buttons, each labeled with a number (1-8) and the word 'IDLE'.

Select **Add**. The Select Member(s) window will appear.

The screenshot shows the 'Select Member(s)' window. It has a title bar 'Select Member(s)'. Inside, there is a text box that says 'Total VCG Members = 8'. Below this is a row of 8 buttons, each labeled with a number (1 through 8). At the bottom right are 'OK' and 'CANCEL' buttons.

The **Select Member(s)** window contains one button for each VCG member. Refer the VCG for channel information for each member.

If the member is available to be added into the LCAS data stream, the number on the button will be black (button enabled).

If the member is already a part of the data stream, the number will be gray (button disabled) and the button cannot be selected.

Select the required **members** and press **OK**.

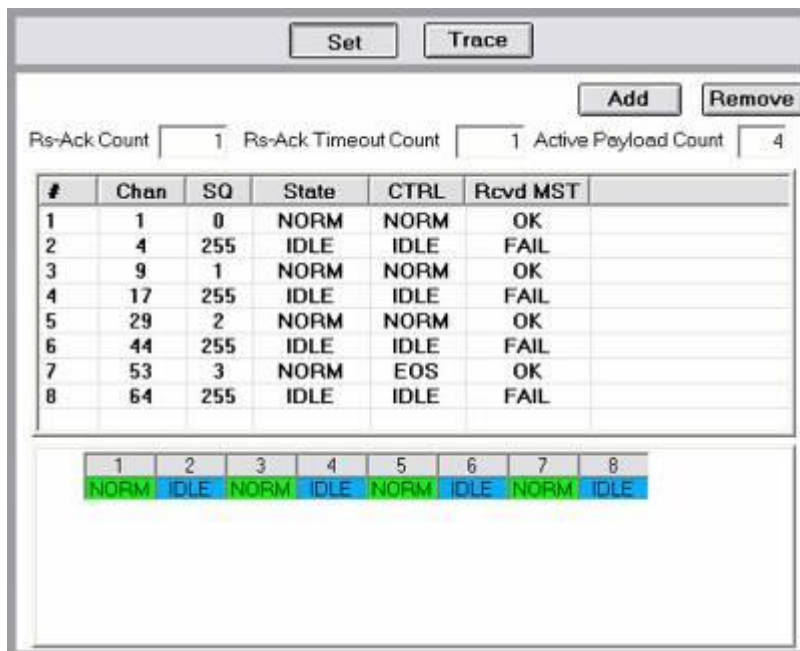
 Refer to the [LCAS Receive Settings](#) for Sink Member's State-LED status descriptions

Removing LCAS Members from Source

From the **SDH** or **SONET** tab, select **Transmit**.

Select  (LCAS Source) side tab from the Transmit screen. .

The LCAS Settings table will appear, listing all of the members within the receive VCG.

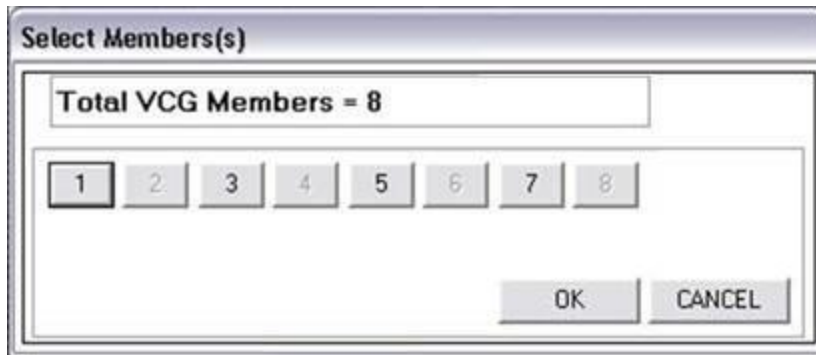


Rs-Ack Count Rs-Ack Timeout Count Active Payload Count

#	Chan	SQ	State	CTRL	Rcvd MST
1	1	0	NORM	NORM	OK
2	4	255	IDLE	IDLE	FAIL
3	9	1	NORM	NORM	OK
4	17	255	IDLE	IDLE	FAIL
5	29	2	NORM	NORM	OK
6	44	255	IDLE	IDLE	FAIL
7	53	3	NORM	EOS	OK
8	64	255	IDLE	IDLE	FAIL

1 2 3 4 5 6 7 8
 NORM IDLE NORM IDLE NORM IDLE NORM IDLE

Select **Remove**. The Select Member(s) window will appear.



The **Select Member(s)** window contains one button for each VCG member.

If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.

If the member is not active, the number will be gray (disabled) and the button cannot be selected.

Select the **members** to remove and press **OK**.

Removing LCAS Members from Sink

From the **SDH** or **SONET** tab, select **Receive**.



Select (LCAS Sink) side tab from the Receive screen.

The LCAS Settings table will appear, listing all of the members within the receive VCG.

The SONET Tab interface includes a 'Set' button and a 'Trace' button. Below these are input fields for 'Hold Off' (1), 'Wait to Restore' (6), 'Add', and 'Remove'. There are also counters for 'Rs-Ack Count' (1) and 'Active Payload Count' (4).

#	Chan	State	MST	Rcvd SQ	Rcvd CTRL
1	1	OK	OK	0	NORM
2	4	IDLE	FAIL	255	IDLE
3	9	OK	OK	1	NORM
4	17	IDLE	FAIL	255	IDLE
5	29	OK	OK	2	NORM
6	44	IDLE	FAIL	255	IDLE
7	53	OK	OK	3	EOS
8	64	IDLE	FAIL	255	IDLE

Below the table is a row of status indicators for each member:

1	2	3	4	5	6	7	8
OK	IDLE	OK	IDLE	OK	IDLE	OK	IDLE

Select **Remove**. The Select Member(s) window will appear.

The 'Select Member(s)' window displays 'Total VCG Members = 8'. Below this is a row of buttons numbered 1 through 8. Button 1 is highlighted with a black border, indicating it is selected. Buttons 2 through 8 are grayed out, indicating they are disabled. At the bottom right are 'OK' and 'CANCEL' buttons.

The **Select Member(s)** window contains one button for each VCG member.

If the member is active, the number on the button will be black (enabled) and the button can be selected to remove that member.

If the member is not active, the number will be gray (disabled) and the button cannot be selected.

Select the **members** to remove and press **OK**.

Viewing VCAT/LCAS Summary LEDs

 Refer to the [LCAS Transmit Settings](#) for Source Member's State-LED status descriptions

 Refer to the [LCAS Receive Settings](#) for Sink Member's State-LED status descriptions

LCAS Summary LEDs are combined with VCAT Summary LEDs. The LED statuses indicate the current condition and history of a test that is currently running. For VCAT/LCAS, the Summary LEDs can be viewed in four levels:

VCAT summary LED. A summary LED for all VCAT/LCAS members.

VCAT Summary. A screen which shows a single LED for each VCAT/LCAS member.

VCAT LEDs. An individual LED panel for each VCAT/LCAS member displaying all applicable alarm and error conditions for that VCAT/LCAS member only.

VCAT LEDs (Summary). An LED panel containing all possible error/alarm conditions with each LED indicating “summary” of all VCAT/LCAS members.

 Note that Low-Order SDH configuration was used in the following examples, but VCAT Alarm and Status LEDs are the same for High-Order, and for SONET.

Summary LED

When configured for VCAT and LCAS, an interactive **VcatLcas** LED appears at the bottom of the LED Quick Status Area.



The LED + the text “VcatLcas” serve as a summary indicator for all VCAT members.

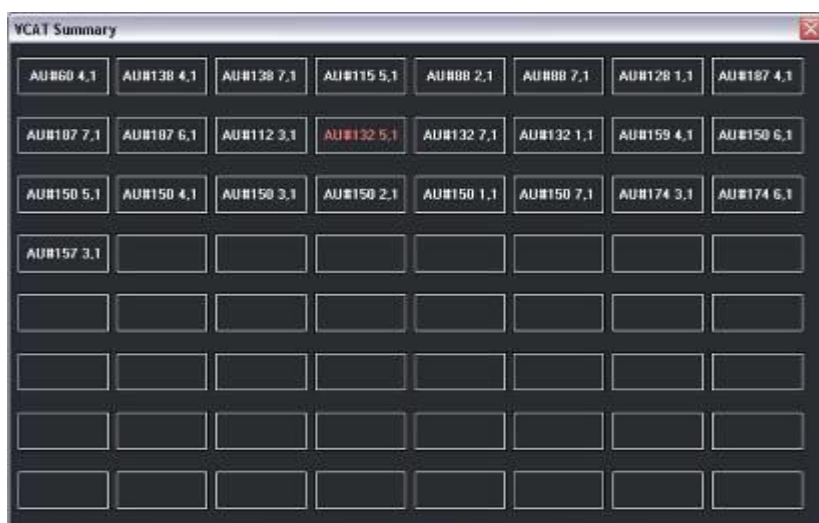
Green LED + White “VcatLcas” = No VCAT member has detected any errors or alarms during the current test.

Green LED + Red “VcatLcas” = History indictor. At least one VCAT member has detected errors or alarms during the current test.

Red LED = Red “VcatLcas” = At least one VCAT member is detecting errors or alarms right now.

VCAT Summary

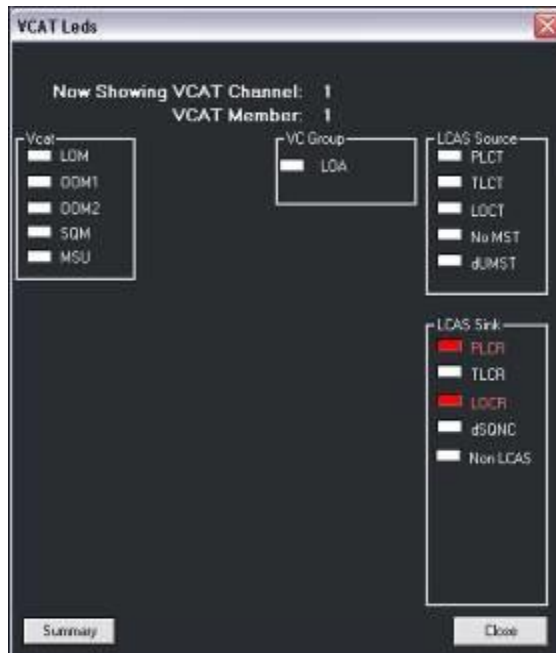
Selecting the text “**VcatLcas**” next to the Summary LED and the VCAT Summary screen will appear.



Each block provides a summary for a single VCAT/LCAS member. In this case, white text indicates that no errors or alarms have been detected in the current test on the VCAT/LCAS member. Red Text indicates the detection of a least error or alarm on the VCAT/LCAS member during the current test.

VCAT/LCAS LEDs

Select any block in the VCAT Summary window and the VCAT/LCAS LEDs window will appear.



The VCAT/LCAS LEDs window provides full information regarding all alarm and error conditions for the selected VCAT/LCAS member. As in the Summary LED, the LED itself plus the text serve as indicators.

Green LED + White text = This error or alarm has not been detected during the current test.

Green LED + Red text = This error or alarm has been detected during the current test but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now.

Select **Close** to return to the VCAT Summary window.

VCAT/LCAS LEDs (Summary)

Select **Summary** on the VCAT/LCAS LEDs window. The window and all LEDs will change from reporting the condition of just one VCAT/LCAS member to a summary function.



Each LED indicates whether that error or alarm has been or is being detected on any VCAT/LCAS member.

Green LED + White text = This error or alarm has not been detected during the current test on any VCAT/LCAS member.

Green LED + Red text = This error or alarm has been detected during the current test on any VCAT/LCAS member but is not present at this time.

Red LED = Red text = This error or alarm is being detected right now on any VCAT/LCAS member.



Refer to [LCAS Results](#) for detailed LCAS Results statistics

Using Pointers

Making Pointer Adjustments

The beginning of a SONET or SDH payload is identified by a **Pointer**. It consists of the H1 and H2 Pointer bytes. You can stress a network by manually adjusting the Pointer using the Increment and Decrement Pointer buttons. By performing this task, you can stress your SONET or SDH equipment to verify if it can tolerate Pointer adjustments, and how your equipment will react and report these adjustments.

There are several Pointer parameters that must be configured before making a positive or negative Pointer adjustment.

To make Pointer adjustments:

Select a protocol processor mode.

Select **Transmit** and choose **PTR**.

Configure the Pointer Adjustment parameters. For example,

Select [NDF Flag](#) to allow a New Data Flag to be set when a new Pointer value has been transmitted.

Select [Pointer Value](#) to change the Pointer value from 0 to 782.

Select [Frequency Offset](#) to increase or decrease the speed of the Pointer adjustments.

Select [Pointer Action](#) to select the type of Pointer activity that occurs when the Increment Pointer or Decrement Pointer buttons are selected.

Use [Burst Count](#) to set the number of Pointer location movements (ranging from 1 to 8) to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.

Select **INC Pointer** to make a positive pointer adjustment, or select **DEC Pointer** to make a negative pointer adjustment.

These buttons generate and control Pointer movements within the transmitted signal. You can stress test a network by changing pointers or introducing an offset that continuously adjusts the STS or AU Pointer.

NDF on New Pointer

The first four bits of the H1 byte are called the New Data Flag (NDF). These bits are used to indicate if a new Pointer is present. If a new Pointer value is present, then the NDF bits are toggled.

The **NDF on New Pointer** function allows you to accept or ignore changes to the NDF bits.

The following options are available:

Options	Description

Yes (On)	Generates an NDF when a new Pointer is transmitted.
No (Off)	Disables NDF functionality.

Pointer Value

The Pointer Value function provides another method for stressing an SDH or SONET network to verify if the receiving SDH or SONET equipment can detect Pointer Value changes.

The Pointer Value indicates the offset between the H1/H2 bytes and the first byte of the Virtual Container (VC) or Synchronous Payload Envelope (SPE) . The actual Pointer Value consists of the last 10 bits (bits 7 through 16) that span the H1 and H2 bytes. Pointer Values are entered using a keypad. A valid Pointer Value is a binary number ranging from **0 to 782**.

After entering the new value, the Pointer automatically moves to the new position.

Pointer Actions

This function determines the type of Pointer activity that occurs when the **Inc Pointer** and **Dec Pointer** buttons are selected.

The following options are available:

Options	Description
Single	Inserts a single Pointer movement with each selection of the Inc Pointer or Dec Pointer button. The Pointer value changes by one.
Bursts	Inserts a burst of Pointer movements with each selection of the Inc Pointer or Dec Pointer button. Each Pointer burst consists of a series of one-location Pointer movements spaced four frames apart (maximum legal rate). The burst count is determined by the Burst Count function.

Incr - Decr	Alternates the Pointer insertion from increment to decrement with a 200-msec delay in between.
Decr - Incr	Alternates the Pointer insertion from decrement to increment with a 200-msec delay in between.

Burst Count

This function allows you to determine the number of Pointer location movements to occur when the **Inc Pointer** or **Dec Pointer** buttons are pressed.

The Pointer burst count ranges from 1 to 8.

Pointer Frequency Offset

The **Pointer Frequency Offset** function adjusts the rate at which Pointer adjustments are needed in the payload.

By slowing the rate, the SDH or SONET network is forced to increment the H1 and H2 Pointer bytes. This is known as **positive frequency justification**. By increasing the rate, the network is forced to decrement the H1 and H2 Pointer bytes. This is known as **negative frequency justification**.

This type of adjustment simulates network clocks that either run fast or slow. By adjusting the rate, this forces the SDH equipment to compensate by decrementing or incrementing the H1 and H2 Pointer bytes.

The **Pointer Frequency Offset** function uses a keypad to enter a frequency offset ranging from -100.0 ppm to +100.0 ppm.

This function is disabled by entering 0 for the frequency offset.

GFP Payloads for SONET mappings

The SONET Protocol Processor on the NGMR circuit pack can be configured for GFP payloads (Complying with ITU-T G.7041).



This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

To enable GFP, first configure the desired SONET **Interface** rate and **Mapping** from the SONET tab. Next, select the **Payload** menu, and choose **GFP**.

The following SONET mappings support the GFP payload:

SONET Mapping	Max GFP-Bulk data rate (100% BW)	Supports GFP-T?
STS-192c	9584.640 Mbps	No
STS-48c	2396.160 Mbps	Yes
STS-12c	599.040 Mbps	No
STS-3c	149.760 Mbps	No
STS-1	48.384 Mbps	No

VCAT Mapping	Max GFP-Bulk data rate (max VCG members)	Minimum # of VCG members for GFP-T?
STS-3c-Xv	3594.240 Mbps	7
STS-1-Xv	1161.216 Mbps	21
VT-6-Xv	434.176 Mbps	N/A
VT-2-Xv	139.264 Mbps	N/A
VT-1.5-Xv	102.400 Mbps	N/A

 For **GFP-Framed** and **GFP-Transparent** modes, the maximum data rate is limited to **1 Gbps**; which can be distributed on one, or to up to four independent GFP streams from the [Packet tab](#).

802.3 10G LAN Testing

The OTN tab (or SONET/SDH tab OTN tab is not available) can be configured for 10 Gigabit Ethernet LAN Interface testing.

 This is a licensable option. Please contact [Tech Support](#), or your DLI sales representative, to enable this option on your NIC unit.

If the OTN tab is available, then use the Interface menu on the OTN tab to configure the 10G LAN Interface, otherwise use the Interface menu in the SONET or SDH tab to select the following rate.

802.3 10G LAN (10312.5 MHz) - Provides 10.3125 Gigabit Ethernet LAN, without FEC

After establishing the 10G LAN interface, you will notice that the mapping option is set to LAN, and most of the common OTN and/or SONET/SDH features become disabled.

If the OTN tab is available, then the Laser button, Clock Reference, Line Frequency Offset, and any other Interface specific settings can be modified from the OTN tab.

If the OTN tab is not available, then the Laser button, Clock Reference, Line Frequency Offset, and any other Interface specific settings can be modified from the SONET/SDH tab.

 After setting the 10G LAN interface rate, select the [Packet tab](#) to configure and test the 10 Gigabit Ethernet processor and Streams settings.

Configuring APS (K1 and K2) Commands

 The following only applies to SONET and SDH protocol processors.

Automatic Protection Switching (APS) is a function that allows an LTE to switch to a backup (or protection) channel in case errors or failures occur on the working channel. APS commands can be configured for either Linear- or Ring-based SONET and SDH networks and are transmitted using the K1 and K2 bytes of the Line Overhead.

You can test your network's APS response by generating a condition that is likely to cause APS switching. You also have the capability to generate specific APS messages and monitor the response by configuring the K1 and K2 bytes.

You can create up to 16 different K1 and K2 byte configurations (known as byte sequences) to measure and stress your equipment's APS switching capabilities.

To configure K1 and K2 byte values:

1600

Select a protocol processor mode.

Select the **Transmit** button.

Select the **APS** button. The initial APS screen appears containing a table of the K1 and K2 byte sequences that can be transmitted. A total of 16 K1 and K2 byte sequences can appear in the table.

Select a byte sequence button (for example, ).

The [Apply Maintenance to Entry](#) screen appears. It contains functions used to configure and set the measurement criteria of the K1 and K2 bytes.

Use the **APS Mode** function to configure APS commands for **Linear** protection switching mode or **Ring** APS signaling mode.

Edit the K1 byte.

The K1 byte is a request for switch action. There are three functions that allow you to edit the K1 byte:

Use the **K1 Full Byte** function to set all eight bits of the K1 byte at once.

Use the **K1 Bits 1-4** function to set the first four bits of the K1 byte.

Use the **K1 Bits 5-8** function to set the last four bits of the K1 byte.

Edit the K2 byte.

The K2 byte provides additional information about SONET network architecture and alarm conditions. There are four functions that allow you to edit the K2 byte:

Use the **K2 Full Byte** function to set all eight bits of the K2 byte at once.

Use the **K2 Bits 1-4** function to set the first four bits of the K2 byte.

Use the **K2 Bit 5 (provisioned)** function to set the fifth bit of the K2 byte.

Use the **K2 Bits 6-8** function to set the last three bits of the K2 byte.

Select **Duration in Frames** to determine how many frames will be transmitted containing the newly configured K1 and K2 bytes.

Select **Update**. The initial APS screen appears on the touch screen.

To configure additional K1 and K2 bytes, repeat steps 3-8 as described above. Otherwise, proceed to the next section to transmit K1 and K2 bytes.

To transmit K1 and K2 bytes:

Make sure that K1 and K2 byte sequences are configured as described above.

Select **Start** to transmit the K1 and K2 bytes.

To stop transmitting K1 and K2 bytes:

Select a protocol processor mode.

Select the **Transmit** button.

Select the **APS** button. The initial APS screen appears.

Select **Stop**.

Related Topic:

[Decoding APS \(K1 and K2\) Values](#)

Decoding APS (K1 and K2) Values

The APS function monitors incoming APS activity. It logs and displays the K1 and K2 byte sequences received by the unit. A maximum of 15 byte sequences can appear on the screen. You can choose to view APS activity in either K1 and K2 Hex values or decode them.

To view received K1 and K2 values:

Select the **Results** button.

Select **APS** from the tabs along the left side of the Results screen.

Select **APS View Mode**, and choose whether to decode the K1/K2 byte's value in either **Linear or Ring** Mode.

From the APS Results screen, you can decode a **specific** K1/K2 byte's value or decode the values for **all** K1/K2 bytes.

To decode a specific K1/K2 byte value:

► Select **APS Summary**.

The results table displays the K1 byte HEX value, K2 byte HEX value, number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Select the desired **Item** row. The APS Decode dialog box appears with the K1 and K2 byte values decoded.

You can scroll through the Items by selecting the **Prev** and **Next** buttons at the bottom of the APS Decode dialog box. Choose **Cancel** when finished.

To decode all K1/K2 byte values:

- Select **APS Decode**.

The results table splits into two horizontal tables: the top table displaying K1 byte results; the bottom table displaying K2 byte results.

The K1 table decodes the values for bits 1-4 and bits 5-8. The K2 table decodes the values for bits 1-4, bit 5, and bits 6-8.

Also displayed in the tables are the number of frames received that contain the K1 and K2 bytes, and the elapsed time of the frames that contain the K1 and K2 bytes, for the last 15 byte sequences received.

Testing SONET Jitter Interfaces

NIC units that contain both a jitter testing module and a SONET circuit pack licensed for SONET jitter Interfaces can be set up to the SONET jitter interfaces from either the Jitter tab or the SONET tab.

Attaching Optical/Electrical Cables

Before starting jitter tests you must disconnect the cables from the SONET TX and RX connectors on the connector panel and reconnect them to the Jitter TX and RX connectors.

Notice that OC-192 Jitter has it's own Jitter TX and RX laser connectors

OC-48 Jitter down to OC-3 Jitter also has its own Jitter TX and RX laser connectors

And EC-3 Jitter has it's own Jitter TX and RX BNC electrical connectors



When testing SONET Jitter, the SONET lasers are disabled and the Jitter TX/RX lasers are used.



The Jitter TX/RX lasers remains ON and active when the optical SONET interface is then changed to a non-jitter Interface rate from the SONET tab, allowing for both the Jitter lasers and SONET lasers to remain on at the same time. This provides the ability to test TX and RX laser functionality from each circuit board, using the other circuit board as the transmitter/receiver.

For instructions on connecting cables, see the **Common Tasks** section of [Getting Started](#), located in the NIC Online Help.

Configuring the test set for a SONET Jitter Interface

Select the **SONET** tab.

Select **Transmit** and choose **Set 1**.

Select **Interface**. The Select Type of Interface dialog box appears

Select the desired **SONET Jitter Interface** for testing.

Configure all other necessary SONET parameter settings.

From the **Jitter** tab, select **Transmit**.

Turn the laser **On**.

Select **Receive** and choose **SIG**. Ensure that a valid signal is being received for the configured line rate.



Attenuate the received optical power level if necessary so that the power level going into the Jitter RX laser is less than -10 dBm. -11 dBm is the most preferred RX optical power level for testing optical jitter.

Adding/Dropping SONET/SDH and PDH Signals

The NIC allows you to set up single, or multiple test sets, and provides multiplexing and demultiplexing functionality for signal levels. Using the NIC's Preset mode, you can add or drop a signal from optical/electrical SDH and SONET, or electrical PDH into another

protocol processor's signal levels in order to monitor for error and alarm conditions. For additional information on test units see [Understanding Test Units](#).

 **Important:** When the NIC/NAA has multiple test units you must first select the desired test unit protocol tab before selecting the Presets button. The configuration options available through the Preset Selection screen are dependent on the test set that is selected.

Select the protocol processor.

Select **Presets**. The Apply Presets dialog box appears. Several examples are provided below.

To add (multiplex) an E1 into an E3 signal:

Select the **Interface** button and choose **E3**.

Select the **Configuration** button and choose either **E1 #1 A/D** or **E1 #2 A/D**.

Select **Apply**.

Both E1#1 and E1#2 signals can simultaneously be added to the E3 interface by pressing Presets and selecting E3 from the Interface menu again, and then choose the other E1 processor from the Configuration menu.

The same example also applies to adding a **DS1** into a **DS3** signal, depending on the current Protocol Mode.

To add an E1 signal into an E3 signal, and then into an SDH signal:

Select the **Interface** button and choose SDH interface rate such as **STM-64**.

Select the **Configuration** button and choose **E3**.

Select the **Configuration** button **again** and choose either **E1 #1 A/D** or **E1 #2 A/D**.

The same example also applies to adding a DS1 into a DS3 and then into a SONET signal, depending on the current Protocol Mode.

To add a **E1 #2 A/D LI (Line Interface)** into an **E3** signal:

Select the **Interface** button and choose **E3**.

Select the **Configuration** button and choose **E1 #2 A/D LI**.

Select **Apply**.

The Line Interface Add/Drop setting transmits the de-multiplexed signal from a higher interface rate out to the lower interface's transmit port, rather than just terminating the demultiplexed signal. This also multiplexes the received lower interface rate up to and out of the higher interface's transmit port.

For this example, the E3 signal is received and the specified E1 channel is demultiplexed down to the E1 processor and transmitted out to the E1#2 Interface port. Also the received E1#2 signal gets multiplexed up to the E3 processor, and is transmitted out the E3 transmit interface port (along with other background E1 signals generated by the E3 processor).

The unit is configured for Add/Drop mode. Go to the next section to specify different frames and patterns for the added signal.



If you make a mistake while creating connections, simply select **Interface** and reenter the interface value. This action erases any previously entered interface or configuration values.



Pressing the **All to Tx/Rx** button will sever all Add/Drop connections and force each protocol processors to use their own Transmit and Receive connectors for sending and receiving data.

Specify Frames and Patterns for the Added Signal

If you have added either E1#1 and/or E1#2 signals to an E3 signal:

Select **E3**.

Select **Transmit**.

Select **SET 2**. The E3 Transmit Mapping screen appears.

Select **E1#1 Channel Inserted** and select from channels 1 through 16 for E1 #1.

Select **E1#2 Channel Inserted** and select from channels 1 through 16 for E1 #2.

Select **E1 Background Frame** and select the background frame (Unframed, PCM30, PCM30CRC, PCM31, PCM31CRC) for the specified channel.

Select **E1 Background Pattern** and select up to a 32-bit background pattern for the specified channel.

LAST, after making the connections between elements, select the **Apply** button for the new configuration and connections to take affect.

Using the Switch Matrix

The [Switch Matrix](#) is a graphical display of the unit's current interface and mapping connections. It allows you to configure the unit from a single screen using the following methods:

Switch Matrix components

[Presets button](#)

To configure the unit using the Switch Matrix components:

Select the **Switch Matrix** tab.

Starting from the left, select an **Interface** button. After selecting an interface, the appropriate Mapping, Container, and Payload buttons are enabled on the Switch Matrix. This will help you create a valid configuration.

From the **Mapping** and **Payload** columns, select the desired, and available, Mapping and Payload buttons.

Select **Apply**. The unit applies the new configuration. Signal lines appear to illustrate the new data flow.

To disengage the configured protocol connections:

Select **All to Tx/Rx**. This globally disconnects any internal connections between multiple protocol processors. A protocol processor will now expect to receive a signal using its line interface.

To configure the unit using the Presets button:

Select the **Switch Matrix** tab.

Select the **Presets** button located below the Switch Matrix. The Presets window appears.

Select the **Interface** button and choose an interface as a starting point.

Select the **Configuration** button and choose a protocol to connect to the selected interface. If necessary, select the Configuration button again to create additional connections.

Select the **Apply** button. The unit takes a few moments to apply the new protocol connections. When complete, the mappings and configurations associated with the selected Preset are automatically made. Signal lines appear to illustrate the new data flow.

For more information, see [Presets](#).

Technical Specifications

NIC Technical Specifications

►The following is a list of technical specifications for NIC units, specifically equipped with the **System Controller 3** module:

O/S: Microsoft Windows Embedded SP3

1.60 GHz CPU

1 GB RAM

Input/Output Trigger: SMA

10G and 2.5G Clock Out: SMA

10/100Base-T: RJ-45

Dual BITS, SETS, 2.048Mhz clock inputs/outputs (Bantam and BNC)

Stratum III Internal Timing Source

Three (3) USB (Universal Serial Bus) v.2.0, type A female ports; accepts any USB-based flash storage device, e.g., a USB thumb-drive

Supports Cisco/Linksys AE1000, AE1200 and AE2500 Wireless-N USB adapters (with OS v7.3.3 or later)

SD (Secure Digital) Card slot, for extra data storage

USB Printer Drivers

GPIO: National Instruments GPIO-USB-B (sold separately) adaptor drivers

►The following is a list of technical specifications for NIC units, specifically equipped with the **System Controller 2** module:

O/S: Microsoft Windows XP Embedded SP2

400 MHz CPU

240 MB RAM

RS-232: DB-9 male

Parallel Port: DB-25 female

Input/Output Trigger: SMA

10G and 2.5G Clock Out: SMA

10/100Base-T: RJ-45

BITS, SETS, 2.048Mhz clock and 1.544Mhz clock input/output (Bantam)

Stratum III Internal Timing Source

USB (Universal Serial Bus) v.1.1, type A female port; accepts any USB-based flash storage device, e.g., a USB thumb-drive

PC Card (PCMCIA): Dual-slot 32-bit PCMCIA CardBus interface for MODEM, GPIB, Wireless-B/G LAN, or Flash memory storage. Supports two Type I or one Type III device cards. Approved cards are:

33.6K and 56K Modems: Viking, 3Com, Xircom, US Robotics

Flash: SanDisk and Silicon Compact Flash (CF), with PCMCIA adapter card

GPIB: INES GPIB-PCMCIA-XL, 32-bit CardBus card

Wi-Fi: HP 11-Mbps Wireless-B/G LAN

 These cards can either be purchased from Digital Lightwave or independently

NIC, NIC Plus and NIC EP Physical Characteristics

Operating Temperature: 0° to 40° C < 85% Relative Humidity

Storage Temperature: -20° to 60° C < 95% Relative Humidity

Power Requirements: 100–120, 200–240 VAC, 50–60 Hz

NIC - Dimensions: 10.1 H x 12.3 W x 4.7 D in (257 x 312 x 120 mm)

NIC - Weight: 11-12.5 lb, depending on configuration

NIC - Screen: 10.4-inch active matrix color display with touchscreen

NIC Plus - Dimensions: 13.7 H x 13.0 W x 7.9 D in (348 x 330 x 201 mm)

NIC Plus - Weight: 14.5 - 25 lb, depending on configuration

NIC Plus - Screen: 12.1-inch active matrix color display with touchscreen

NIC EP - Dimensions: 7.0 H x 19.0 W x 10.6 D in (178 x 483 x 269 mm)

NIC EP - Weight: 14.5 - 25 lb, depending on configuration

NIC BP (Battery Power) Physical Characteristics

Operating Temperature: 0° to 40° C < 80% Relative Humidity

Storage Temperature: -20°C to 60°C, < 80% Relative Humidity

Store in a cool, dry and well-ventilated environment

The battery packs should be stored free from corrosive gas

Extended exposure to temperatures above 45°C could degrade battery performance and life

Power Requirements: 100–120, 200–240 VAC, 50–60 Hz, 2A

NIC BP - Dimensions: 10.1 H x 12.3 W x 5.5 D in (257 x 312 x 140 mm)

NIC BP - Weight: 12-13.5 lb, depending on configuration

NIC BP - Screen: 10.4-inch active matrix color display with touchscreen

ATM Technical Specifications

Specification	Description
Physical Interfaces	STM-0/STM-0e, STM-1/STM-1e, STM-4, E1 (HEC, PLCP), E3 (HEC, PLCP)
Physical Layer	SDH bulk filled; C-3 (into VC-3), C-4 into VC-4, C4-4c Structure into VC-4-4c
Adaptation Layers	AAL0, AAL1, AAL5
Header and Interface Support	Control of all cell header bits, UNI and NNI support, filter on CLP and CI bits

Channel Capacity	Transmit: 255 channels (independent AAL, service class, and bandwidth on all VCCs) Receive: 256 channels (cell count, bandwidth, AAL5 PDU counts and errors on all channels), stress testing at full STS-12c rate
Traffic Management	Constant Bit Rate (CBR), real time/non-real time Variable Bit Rate (VBR), Unspecified Bit Rate (UBR), Available Bit Rate (ABR)
Quality of Service	Cell transfer delay (min, max, mean), cell delay, variation (1 and 2 point measurement), cell bandwidth analysis, correctable/uncorrectable HEC errors, BERT analysis, real-time channel analysis, CLP monitoring, CI monitoring
Performance Analysis	CER, CLR, CMR, SECBR
Protocol Analysis	AAL0: Cell count and bandwidth utilization, Bit error count, Pattern sync errors AAL1: AAL1 SAR PDU header SNP errors, Lost cells, misinserted cells for AAL1 VCCs AAL5: CPCS analysis, VCC simultaneous analysis, CRC, PDU length errors Network Impairment: Cell error generation, cell loss, cell misinsertion, CDV, cell reordering, test traffic insertion, VPI/VCI remapping, CLP tagging, CI setting
Error Measurement	HEC correctable and uncorrectable error counts and rates; AAL5 CRC errors, AAL5 length errors; PRBS bit error measurement, loss of PRBS sync; AAL1 SN/SNP error, lost cells, misinserted cell counts and rates; PLCP framing errors, PLCP BIP, PLCP FEBE counts and rates; PLCP B1 CNT, PLCP Framing Error Cnt, cell overflow
Error Injection	HEC-correctable and uncorrectable errors, HEC error rate from continuous to 10^{-9} , HEC error burst from 1 to 10 on consecutive cells; PLCP B1, PLCP, FEBE, PLCP POI, PLCP Frame (A1A2), PLCP (POI)
Alarm Detection	Cell synchronization loss, F4 and F5 AIS OAM flow (end-to-end/segment), F4 and F5 RDI OAM flow (end-to-end/segment); PLCP yellow alarm (RAI)
Cell Payload Patterns	PRBS $2^{15} - 1$, all 1's, 10101010, user-defined pattern
Alarm Generation	Cell synchronization loss, F4 and F5 AIS OAM flow (end-to-end/segment), F4 and F5 RDI flow (end-to-end/segment), PLCP yellow alarm
SVC Support	Self call SVC, Calling SVC's, Called SVC's
SVC Signaling Support	Call establishment, Cyclic calls, Call bursts, user defined SETUP message, background traffic

SVC Monitoring	All statistics, UNI signalling, ATM layer, AAL-5, Signaling filters, UNI signaling errors, SSCOP errors, port, errors/alarms
ATM Management	Analysis of F4, F5, and loopback OAM cells (ITU I.610), OAM performance monitoring

E3/E4 Technical Specifications

E3/E4 Specification	Description
Line code	E3: HDB3 E4: CMI
Framing	Framed, unframed
Line Rates	E3: 34.368 MHz $\pm$ 4.6 ppm (TX), -2 ppm/yr 34.368 MHz $\pm$ 50 ppm (RX) E4: 139.264 MHz +20 ppm (TX), -2 ppm/yr 139.264 MHz +50 ppm (RX)
Impedance	75 ohm unbalanced
Level (TX)	E3: 1.00 Vp $\pm$ 0.1v E4: .5 Vp + .1v
Connectors	BNC: 75 ohm unbalanced
Synchronization	Internal, recovered, SETS
Input Signal Measurement	E3: Peak voltage range: $\pm$ 0.31 Vp to $\pm$ 1.2 Vp Frequency measurement range: 34.368 MHz $\pm$ 200 ppm E4: Peak voltage range: $\pm$ 0.3 Vp to $\pm$.7 Vp Frequency measurement range: 139.264 MHz $\pm$ 200 ppm
Input Jitter Tolerance	Per G.823
Frequency Offset Generation	$\pm$ 100 ppm in units of .1ppm
Error Measurement	E3: BPV, BIT, Frame E4: Bit, Frame
Alarm Detection	LOS, LOF, pattern sync, AIS, RDI
Alarm Generation	LOS, LOF, AIS, RDI
Error Injection	E3: BPV, bit, frame E4: Bit, Frame
Error Injection Rate	Single, 10^{-7} to 10^{-3} , user-programmable
Patterns	E3: 2^9 -1, 2^9 -1 inverted, 2^{11} -1, 2^{11} -1 inverted, 2^{15} -1, 2^{15} -1 inverted, 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits, ATM (mapping)

	Pass through with Drop & Insert: E3 pass thru with Drop/Insert of a single E1 for test E4: 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits.
E3 Jitter Measurement	Jitter Measurement Characteristics: Acquisition time: 2 seconds typical, 5 seconds maximum Jitter resolution: 0.01 UI Filter Characteristics: Wideband measurement: 10 Hz to 400 KHz Highband measurement: 30 KHz to 400 KHz Nominal filter attenuation at Fc: 3dB Jitter Output Characteristics: Scale: 0.1 V/UI Bandwidth: 10 Hz to 40 KHz

OSA Technical Specifications



The following Specifications apply to OSA modules sold after 2008

Parameters	Specifications
ITU Channel Numbers	C-band: (1-80) 1529.55 nm – 1561.01 nm L-band: (1-80) 1570.42 nm – 1603.60 nm
Wavelength Range	C and L bands C-Band: (80+) 1528.77 nm – 1562.23 nm L-Band: (80+) 1568.77 nm – 1604.03 nm
Channel Spacing	50 GHz (min), 100GHz, 200 GHz (max)
Wavelength Accuracy	± 60 pm
Dynamic Range	60 dB
Minimum Input Power (Per Channel)	-37 dBm
Maximum Input Power (Per Channel)	-10 dBm
Maximum Aggregate Input	+ 23 dBm (Combined Power for All Channels)

Power (All Channels)	
Channel Power Repeatability	± 0.1 dB
Channel Power Accuracy	± 0.7 dB
Polarization Dependence Loss	< 0.3 dB
Power Resolution	0.1 dB
Noise Floor	- 60 dBm
Peak to Valley	25 dB
OSNR	10 - 25 dB
OSNR Accuracy	± 1.5 dB (Noise Level ≥ -50 dBm)
Response Time	2 - 3 seconds
Operating Temperature	0° to 65° C
Optical Connectors	SC (standard), ST, or FC (optional)

Troubleshooting

This topic is intended to aid in resolving common user interface problems. For additional assistance, please contact [Customer Service](#).

Interface	Symptom	Resolution
Power	No power (fans silent)	Check input power cord seating on both ends. Ensure input voltage and frequency is correct (100-120 VAC and 200-240 VAC, 50-60Hz). Check the fuse. If fuse is blown, contact Customer Service.
Touch Screen	Will not respond	Remove anything resting against the screen (cables, etc.) and restart the unit if it is still not responding.
Speaker	Volume too loud or too soft	Adjust desired volume from the System, Misc screen.
Optical	SONET B1, B2 errors appearing when locally looped.	Inspect and clean fiber-optic surfaces. Check the Receive signal status and ensure that the optical power is -2dBm to -14dBm for OC-192/STM-64 and -2dBm to -26dBm for OC-48/STM-16. Also that the frequency is within +/- 100ppm. Note: Attenuation is required for local loopback of OC-48/STM-16.
Optical	Loss of signal or power level low	Check for optical connector tightness and eliminate any fiber kinks or knots.

Ethernet	Device not communicating	Set up a valid IP address in the System, I/O, Settings screen. IP addresses 192.168.138.000 through 192.168.138.255 are reserved and should not be used. A system conflict can occur if these IP addresses are entered.
USB	Storage device will function when inserted.	Check device for proper seating. Remove the device, reboot the NIC, and attempt to insert the USB device again. Contact Customer Support if the above measures fail to work.
BITS	Unit not synchronizing up to timing source	Check that the cables are connected correctly (IN/OUT). Ensure the clock source is set to "BITS" from the System, Misc screen and enabled on the protocol processor's Transmit screen, Clock Reference option. Verify that the input clock source is a clean signal with a frequency of 1.544 MHz into a 100-ohm termination.
SETS	Unit not synchronizing up to timing source	Check that the cables are connected correctly (IN/OUT). Ensure the clock source is set to "SETS" from the System, Misc screen and enabled on the protocol processor's Transmit screen, Clock Reference option. Verify that the input clock source is a clean signal with a frequency of 2.048 MHz into a 120-ohm termination.

NIC BP Battery Status	Information is no updating or messages not appearing	Shut down the NIC BP (if necessary hold the power button down for 10 seconds) Disconnect external AC power Remove Battery Reinstall Battery Reconnect external AC power Turn unit back on

Term Definitions

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>J</u>
<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>	<u>P</u>	<u>Q</u>	<u>R</u>	<u>S</u>	<u>T</u>
<u>U</u>	<u>V</u>	<u>W</u>	<u>X</u>	<u>Y</u>	<u>Z</u>				

A

A1 and A2 bytes

Framing bytes. These two bytes indicate the beginning of the STM-N frame. The A1 and A2 bytes are unscrambled. A1 has the binary value 11110110, and A2 has the binary value 00101000. The frame alignment work of an STM-N frame is composed of (3 x N) A1 bytes followed by (3 x N) A2 bytes.

AAL

ATM Adaptation layer. (1) Two sublayers concerned with segmenting large PDUs into ATM cells; type 1 = CBR, 2 = VBR, 5 = for LAN and FR frames. (2) An ATM LED indicating that an AAL1 SN or SNP error, or a lost or misinserted cell, occurred; or an AAL5 PDU length or CRC error occurred.

AAL0

ATM Adaptation Layer 0. AAL0 denotes an absence of any AAL function, meaning that AAL0 is not really an AAL type in the true sense of the term. AAL0 simply is the transfer of individual cells with no protocol processing of the cell payloads.

AAL1

ATM Adaptation Layer 1 protocol. The ATM Cell consists of a 47 byte payload, a 1 byte sequence number, sequence number protection field and convergence ID field, and a 5 byte header.

AAL5

ATM Adaptation Layer 5 protocol. AAL 5 supports variable length data packets or PDUs (1 to 65,535 octets). AAL5 utilizes a minimum of overhead for each PDU it sends. The entire payload is used for data except for the last cell in the PDU. Functionally, this

larger type supports variable bit rate, delay tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support.

A-Bit

Eight bits of the E1 multiframe located in the third bit of TS0 of odd-numbered E1 frames. They carry the RAI (yellow signal) and are set on when the remote end has a defect such as LOS or LOF.

acMstTimeout (Ack Mst Timeout)

This event indicates a Member Status Signal (MST) timeout. When you add a VC-n to the upstream capacity, MST=OK for this VC-n is expected to be received from the opposite end. If the source does not receive an MST=OK within a reasonable amount of time, the source declares a timeout. Check the configuration and cross-connects.

AIS

Also known as a *Blue Alarm*. A signal that replaces the normal traffic signal when a maintenance alarm indication has been activated. In DS1, AIS replaces the entire frame structure with a predetermined signal (bit pattern). This is done to inhibit alarms in downstream sections caused by identified upstream failures. In DS1, AIS is an unframed all ones signal. In DS3, AIS is a signal with a valid M-frame Alignment channel, M-subframe Alignment and valid P bits. The information bits are set to 10...sequence, starting with a one (1) after each M-frame Alignment bit, M-subframe Alignment bit, X-bit, P-bit, and C-bit channel. The C-bits are set to zero and the X-bits are set to one. For ATM, AIS is an all ones signal. For SONET, AIS can occur due to an LOS, LOF, or LOP failure on Line layer, Path layer, or Virtual Tributary.

AIS-L

Line Alarm Indication Signal. All ones pattern used to indicate if an alarm is being received from upstream Line terminating equipment.

AIS-P

Path Alarm Indication Signal. Indicates if an alarm is being received from upstream Path terminating equipment.

AISS

Alarm Indication Signal Seconds.

All Ones

Transmits a continuous test pattern of all ones (111111. . .). This pattern is generally used to stress span repeater current regulator circuits. It can be used as an AIS in unframed circuits, or a keep alive signal, idle code, or red alarm in other circuits.

All Zeros

Transmits a continuous test pattern of all zeros (000000. . .).

ANSI

American National Standards Institute. A standards setting, non-government organization founded in 1918, which develops and publishes standards for transmission codes, protocols, and high-level languages for voluntary use in the United States.

APS

Automatic Protection Switching. The K1 and K2 bytes of the line overhead section of the Synchronous Payload Envelope are reserved for APS signaling. APS commands are those signals loaded in the K1 and K2 bytes that control the APS functions. Also see [Line Overhead](#) and [Synchronous Payload Envelope](#).

ASA 312

Asynchronous/Synchronous Analyzer. Digital Lightwaves first-generation functionally and technologically innovative diagnostic analyzer for high-speed telecommunications.

ATM

Asynchronous Transfer Mode. A multiplexing/switching technique in which information is organized into fixed-length cells with each cell consisting of an identification header field and an information field. The transfer mode is asynchronous in the sense that the use of the cells depends on the required or instantaneous bit rate.

AU

Administrative Unit. The information structure which provides adaptation between the Higher-Order path layer and the Multiplex Section layer. The Virtual Container (VC) plus the pointers (H1, H2, H3 bytes) is called the AU.

AU-AIS

Administrative Unit - Alarm Indication Signal (SDH only). In the Quick Status LEDs area, an alarm LED indicating an all-ones characteristic or adapted information signal was detected on the AU. It is generated to replace the normal traffic signal when it contains

a defect condition. This prevents consequential downstream failures being declared or alarms being raised.

AU-LOP

Administrative Unit - Loss of Pointer (SDH only). In the Quick Status LEDs area, an alarm LED indicating a consecutive number of invalid pointers or NDFs were received on the AU.

Auto Conf (Auto Configuration)

A common function button that detects various parameters about the incoming signal, such as signal rate, mapping, and payload pattern, and configures the unit accordingly.

B

B1 byte

RS Bit interleaved parity code (BIP-8) byte. This is a parity code (even parity) used to check for transmission errors over a Regenerator Section. Its value is calculated over all bits of the previous STM-N frame after scrambling, and then placed in the B1 byte of STM-1 before scrambling. Therefore, this byte is defined only for STM-1 number 1 of an STM-N signal.

B2 byte

Multiplex Section (MS) bit interleaved parity code (MS BIP-8). This bit interleaved parity N x 24 code is used to determine if a transmission error has occurred over a multiplex section. It's even parity and is calculated overall bits of the MS Overhead and the STM-N frame of the previous STM-N frame before scrambling. The value is placed in the three B2 bytes of the MS Overhead before scrambling. These bytes are provided for all STM-1 signals in STM-N signals.

B3 byte

Path bit interleaved parity code (Path BIP-8) byte. This is a parity code (even) used to determine if a transmission error has occurred over a path. Its value is calculated over all the bits of the previous Virtual Container before scrambling and placed in the B3 byte of the current frame.

B1 ERR

B1 Error. Indicates an error in the SONET frame. B1 errors are parity errors. The B1 byte carries the parity information, so a B1 error is a Section error that applies not only to the Section OH, but the entire frame. Any error in the frame will result in a B1 error. A B1 error is also known as a Section BIP-8.

B2 ERR

B2 Error. A B2 error is also known as a Line BIP-8. Indicates the number of parity errors detected at the Line layer of the incoming SONET signal. This is calculated over the Line OH, Path OH, and payload of each STS-1.

B3 ERR

B3 Error. A B3 error is also known as a Path BIP-8. Indicates that parity errors were detected at the Path layer of the incoming SONET signal. This is calculated over the Path OH and payload of each STS-1.

BBE

Background Block Errors. This is a count of errored blocks which do not occur during a severely errored second

BDI

Backward Defect Indication

BEI

Backward Error Indication

BIAE

Backward Incoming Alignment Error

BPV Error

Bipolar Violation. Indicates that two consecutive pulses of the same polarity occurred in the same digital bit stream

BGP

Border Gateway Protocol

Bit Errors

Errors in the expected bit pattern in the payload (data channels)

BITS

Building Integrated Timing Supply 1.544 MHz.

BIP-8

Bit Interleaved Parity, 8-bit code. An error monitoring code

Burst Count

Determines the number of Pointer location movements when the Increment or Decrement Pointer buttons on the unit are pressed. The Pointer burst count ranges from one to eight.

C

C2 byte

Path Signal Label byte. This byte specifies the mapping type in the VC-N.

CAS

Channel Associated Signaling. An E1 signaling protocol that utilizes all of TS16, where each byte is broken into two nibbles, and each nibble contains the ABCD bits for one of the 30 data channels

CASMFL

Channel Associated Signaling Multiframe Loss. Occurs when the four zeros at the start of TS16 in frame 0 cannot be found.

CBR

Constant Bit Rate. Supports a constant or guaranteed rate to transport services.

CBS

Committed Burst Size. In Y.1564, CBS is the number of allocated bytes available for bursts of ingress service frames transmitted at temporary rates above the [CIR](#) while meeting the [SLA](#) guarantees provided at the CIR.

CDV

Cell Delay Variation. A component of cell transfer delay induced by call scheduling and buffering.

CDVT

Cell Delay Variation Tolerance. The upper limit of acceptable random arrival times between consecutive cells of a connection.

cHEC

Core Header Error Checksum.

CIR

Committed Information Rate. In Y.1564, the CIR can be interpreted as the maximum sustained information rate (bandwidth) that the network is committed to transfer while meeting the performance level guaranteed in the service level agreement (SLA). Performance metrics in terms of [FTD](#), [FDV](#) and [FLR](#) are applicable only to those frames that are transmitted at or below the CIR.

CLK

Indicates the timing source for the transmit signal. The timing source is set using the **Clock Reference** function. This is a status indicator.

Clock Alarm

Indicates an anomaly with the selected timing source for the transmit signal.

CLP

Cell Loss Priority, signaling bit in ATM header cell (0=high priority, 1=low priority).

CLR

Cell Loss Ratio. Lost Cells/Total Transmitted Cells. It is also a parameter that the network agrees to offer as an objective over the lifetime of a connection.

CMR

Cell Misinsertion Rate. The ratio of cells that were received (but were not transmitted by the source) in relation to the total number of cells correctly transmitted.

CONCAT

Concatenated. See also [VC](#); [VCAT](#).

C-Parity Error

An error in the C-bit channel of the DS3 channel, which is used to denote the presence or absence of stuffed bits.

CPCS

Common Part Convergence Sub-layer.

CRC

Cyclic Redundancy Check. An error-detection scheme that uses parity bits generated by polynomial encoding of digital signals, then appends those parity bits to the digital signal; finally, decoding algorithms are employed that detect errors in the received digital signal. In E1, this consists of 4 bits, and is a CRC-4.

CSF

Client signal fail (CSF) alarms are generated in the GFP layer of the DUT. They are triggered by malfunctions in the physical Ethernet interface or link, and are transmitted in GFP over SONET/SDH. The cause of this alarm is often no light or too high an offset at the Ethernet port on the physical interface, resulting in the loss of client signal (LOCS) See also [LOCS](#); [GFP](#).

CTD

Cell Transfer Delay. Elapsed time between a cell exit event at the source and the corresponding cell entry event at the destination.

ctrlOor (CTRL word undefined)

This alarm indicates the receipt of an illegal or undefined CTRL word value. Check the configuration at both ends.

CTS

Clear to Send. RS-530 control signal from the DCE that alerts the DTE device that the DCE is ready to receive data.

CV-L

Line Coding Violation. This is an error count of incoming B2 errors (also known as a Line BIP-8).

CV-LFE

Far End Coding Violation. This is an error count of the number of B2 errors detected by the far end Line Terminating Equipment. These errors are reported to the unit using the M1 byte of the Line overhead.

CV-P

Path Coding Violation. This is a B3 error, which is also known as a Path BIP-8.

CV-PFE

Far End Coding Violation. This is an error count of the number of B3 errors detected by the far end STS Path Terminating Equipment (PTE). These errors are reported back to the unit using the G1 byte of the STS Path Overhead.

CV-S

Section Coding Violation. This is a B1 error, which is also known as a Section BIP-8.

D**dBm**

Power level expressed in relation to 1 milliwatt. For example: 0dBm = 1 milliwatt; +3 dBm = 2 milliwatt; -3 dBm = 0.5 milliwatt.

D1D3 bytes

Regenerator Section Data Communications Channel (DCC) bytes. These three bytes form a 192 kbits/s message channel providing a message-based channel for Operations, Administration and Maintenance (OAM) between pieces of section terminating equipment. The channel can be used from a central location for control, monitoring, administration, and other communication needs.

D4D12

Multiplex Section (MS) Data Communications Channel (DCC) bytes. These nine bytes form a 576 kbits/s message channel from a central location for OAM information (control, maintenance, remote provisioning, monitoring, administration another communication needs).

DAPI

Destination Access Point Identifier

DCD

Data Carrier Detect. RS-530 signal control. DCD shares the same pin with RLSD (Receive Line Signal Detect).

DCE

Data Communications Equipment. A device that communicates with a DTE device in RS-232C communications. An example is a modem. In a typical RS-232 or RS-530 link a DTE device, such as a PC, talks to a DCE device, such as a modem DTE and DCE are complimentary interfaces.

Drop and Insert

The process in which a signal, or part of a signal, in transit is dropped off at an intermediate location, and other information is inserted into the signal for subsequent transmission.

DS

Digital Service. A hierarchy of digital signal speeds used to classify capacities of signal lines. The fundamental speed level is DS-0 (64 kilobits per second) and the highest is DS-4 (about 274 million bits per second).

DS-0

Digital Service, level 0. It is 64,000 bps, the worldwide standard speed for digitizing one voice conversation using Pulse Code Modulation. There are 24 DS-0 channels in a DS-1.

DS-1

Digital Service, level 1. It is 1.544 Mbps signal rate. The standard for 1.544 Mbps is 24 voice conversations each encoded at 64 Kbps. DS-1 is also called T-1.

DS-2

Digital Service, level 2. Equivalent of 4 DS-1 channels, and operating at 6.312 Mbps. Also called T-2.

DS-3

Digital Service, level 3. Equivalent of 28 DS-1 channels, and operating at 44.736 Mbps. Also called T-3. Framing specification used for transmitting a digital signal at 45 Mbps through the telephone switching network on a T3 digital WAN carrier facility.

DSR

Data Set Ready. RS-530 control signal that is sent by a DCE device indicating to the DTE device that the DCE is ready to transmit or receive data.

DTE

Data Terminal Equipment. A device that controls data flow to or from a computer. An example would be a PC serial port. In a typical RS-232 or RS-530 link a DTE device, such as a PC, talks to a DCE device, such as a modem. DTE and DCE are complimentary interfaces.

DTR

Data Terminal Ready. RS-530 control signal sent by the DTE device to the DCE, letting it know that the DTE is ready.

DWDM

Dense Wavelength Division Multiplexing. The higher-capacity version of WDM, which is a means of increasing the capacity of fiber-optic data transmission systems through the multiplexing of multiple wavelengths of light.

E

E1

The European equivalent of the North American 1.544 million bits per second (Mbps) T1, except that E1 carries information at the rate of 2.048 million bits per second.

E1 byte

RS orderwire byte. This byte is allocated to be used as a local orderwire channel for voice communication between regenerators.

E1 Frame

32-byte frame containing the framing byte in the first byte (TS0) that signals information for a 64k-bit data channel in TS16 and 64k bit data channels in the other time slots.

E2 byte

MS Orderwire byte. This orderwire byte provides a 64 kbits/s channel between multiplex entities for an express orderwire. It's a voice channel for use by craftspeople and can be accessed at multiplex section terminations.

E3

Wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34.368 Mbps. E3 lines can be leased for private use from common carriers.

EB

Errored Block. In E1, a block is an SMF, consisting of 8 E1 frames or half of a Multi-frame. Each block contains one CRC-4 in E1. An E1 block occurs 1000 times per second.

E-Bit

Two bits of the E1 multiframe, located in the first bit of the last two odd-numbered E1 frames. They carry the FEBE, one for each SMF, and are set when the corresponding CRC-4 at the remote end is in error.

EBS

Excess Burst Size. In Y.1564, EBS is the number of allocated bytes available for bursts of ingress service frames sent at temporary rates above the CIR+EIR while remaining EIR-conformant. Performance metrics in terms of [FTD](#), [FDV](#) and [FLR](#) are not applicable to the frames that are transmitted at rates above the [CIR](#) but within the service [EIR](#).

EC

Error Count. An incrementing value indicating the cumulative singular occurrences of any specific error.

EFS

Error Free Seconds. A measurement of the time, in seconds, in which there were no errors detected in the signal being monitored.

EFSR

Error Free Seconds Rate. A measurement of the time, in seconds, in which there were no errors detected in the signal being monitored.

eHEC

Extended Header Error Checksum. Also known as Extension Header Error Control.

EIA-530

Electrical interface for the RS-530 Serial Protocol Processor that can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous or synchronous timing. Asynchronous data analysis can be performed at speeds up to 120 Kbps, while synchronous data analysis can be performed at speeds up to 40 Mbps. For EIA-530 interfaces, all signals are balanced with exception of Remote Loop (RL) and Local Loop (LL).

EIA-530A

Electrical interface for the RS-530 Serial Protocol Processor that can be configured to act as DTE or DCE, operating in balanced mode with data transmission supported in asynchronous or synchronous timing. Asynchronous data analysis can be performed at speeds up to 120 Kbps, while synchronous data analysis can be performed at speeds up to 40 Mbps. For EIA-530A interfaces, the Data Terminal Ready (DTR) signal changes to single ended.

EIR

Excess Information Rate. In Y.1564, EIR can be interpreted as the maximum sustained IR by which a user can exceed its [CIR](#) with some expectation that the excess traffic might be carried though the network.

Encapsulation Schemes

The key to making EoS architectures lies in the encapsulation schemes available. Currently, there are four encapsulation techniques available--virtual concatenation (VC) and the link capacity adjustment scheme (LCAS) techniques, which define the method for transport, and the generic framing procedure (GFP) and link access procedure for SDH (LAPS) techniques, which are layer 1 adaptation protocols for transport. See also [GFP](#); [LAPS](#); [LCAS](#); [VC](#)

EoS

Ethernet over SDH/SONET. A technique based on a group of industry standards including SONET/SDH and virtual concatenation (VC), which is a recent extension to ITU-T G.707 SDH standards. In combination, the specifications support the mapping and aligning of Ethernet frames into SONET frames, while preserving the Ethernet frame structure. See also [Ethernet](#).

eosMissing (No channel has EoS)

None of the received channels has End of Sequence (EoS). One and only one channel must have EOS. Look for other alarms at both ends. See also [sgnc](#).

eosMultiple (Two or more chan. have EoS)

This event occurs when two or more received channels have End of Sequence (EoS). One and only one channel must have EOS. Look for other alarms at both ends. See also [sgnc](#).

Error Checking

A procedure performed by computer-based communications programs, hardware, software, or firmware in a network monitoring device, instrument or equipment to ensure complete and accurate data transfer.

Error Injection

The process of purposely adding errors into a data transmission in order to see if the errors are detected. See also [Error Insert](#).

Error Insert

A common function button that allows a single error to be inserted into the transmit data stream. The type of error and insertion rate are determined using the Error to Insert and Error Insert Rate functions.

Error Ratio

In data transmission, the ratio of the number of incorrect elements transmitted to the total number of elements transmitted.

ES

Errored Seconds. An incrementing value showing the number of seconds in which errors were detected in the transmitted signal.

ESA

Errored Seconds Type A. This is an errored second that has a single error, and has no defects that make it an SES.

ESB

Errored Seconds Type B. This is an errored second that has more than one error, but not enough errors to be an SES, and no defects that would make it an SES.

ES-L

Errored Seconds - Line. This reports the duration of the incoming B2 errors in seconds. This statistic also reports the percentage of errored seconds compared to the duration of error-free seconds.

ES-LFE

Errored Seconds - Line Far End. This is a counter that indicates the number of seconds that an REI-L alarm is reported.

ES-P

Near End Coding Violations - Path. Reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal.

ES-PFE

Far End Errored Seconds. This is a counter that indicates the number of seconds that an REI-P alarm is reported.

ESR

Errored Seconds Ratio. The percentage of errored seconds for available seconds.

ET

Elapsed Time. The duration in seconds of a test.

Ethernet

A local area network used for connecting computers, printers, workstations, etc., within the same building or campus. Ethernet operates over twisted wire and coaxial cable at speeds up to 10Mbps. The theoretical limit of Ethernet, measured in 64-byte packets, is 14,800 packets per second.

ETSI

European Telecommunications Standards Institute. The European counterpart to [ANSI](#).

Event Log

A function that displays the alarm, error, and pointer activity in a four-column table under the Results tab.

EXI

The GFP extension header identifier (EXI) is a 4-b field that indicates the type of extension header in use. EXI = 0 implies a null header, EXI = 1 implies a linear frame; and EXI = 2 implies a ring frame. Other values of EXI are currently not defined.

F**F1 byte**

Regenerator Section user channel byte. This byte is set aside for the user's purposes. It can be read and/or written to at each section terminating equipment in that line.

F2 byte

Path user channel byte. This byte is used for user communication between path elements.

F3 byte

Path user channel byte. This byte is allocated for communication purposes between path elements and is payload dependent.

F4 AIS (End-to-End)

In ATM, an Alarm Indication Signal detected throughout the virtual path.

F4 AIS (Segment)

In ATM, an Alarm Indication Signal detected over a segment of a virtual path.

F5 AIS (End-to-End)

In ATM, an Alarm Indication Signal detected throughout the virtual channel.

F5 AIS (Segment)

In ATM, an Alarm Indication Signal detected over a segment of the virtual channel.

F4 RDI (End-to-End)

In ATM, a Remote Defect Indication detected throughout the virtual path.

F4 RDI (Segment)

In ATM, a Remote Defect Indication detected over a segment of the virtual path.

F5 RDI (End-to-End)

In ATM, a Remote Defect Indication detected throughout the virtual channel.

F5 RDI (Segment)

In ATM, a Remote Defect Indication detected over a segment of the virtual channel.

FAS

Frame Alignment Signal.

FC

Failure Count. The number of times a particular failure has been started.

FCS

Frame Check Sequence. The extra characters added to a frame for error detection and correction. FCS is used in X.25, HDLC, Frame Relay, and other data link layer protocols.

FCS Error (CRC)

Indicates that frames received do not pass the FCS check, which is a type of CRC (Cyclic Redundancy Check). The FCS is a mathematical way to ensure that all the frame's bits are correct without having the system examine each bit and compare it to the original. In Ethernet networks, a 1 in 10^8 bit error rate is acceptable, although typical Ethernet performance is 1 in 10^{12} or better. Also see [CRC](#), [FCS](#).

FDV

Frame Delay Variation

FEBE

Far End Block Errors. Count of E-Bit errors, which are SMFs in error at the far end, as determined by a CRC-4 error.

FEC

See [Forward Error Correction](#).

FERF

Far End Receive Failure. A signal generated and sent upstream that informs the transmitting line terminating equipment that the receiving equipment has detected an incoming failure.

Flow Control

A method of using a particular character (XON and XOFF codes) for controlling when a device sends (or does not send) data.

Forward Error Correction

Forward error correction (FEC) is a method of obtaining error control in data transmission in which the source (transmitter) sends redundant data and the destination (receiver) recognizes only the portion of the data that contains no apparent errors. Because FEC does not require handshaking between the source and the destination, it can be used for broadcasting of data to many destinations simultaneously from a single source.

Because the decoder only uses the information received and never requests a retransmission, the flow of data is always moving forward. The process is therefore known as forward error correction.

FEC correctable and uncorrectable errors are inserted after the FEC wrapper is created.

FLR

Frame Loss Ratio

FOS

Frequency Offset Alarm

Frame Error

An invalid frame identified by the unit.

Framed GFP

Generic Framing Procedure provides for mapping various clients signals over a SONET/SDH/OTN transport network. Frame-Mapped GFP (GFP-F) maps individual client frames to individual GFP frames (such as Ethernet frames mapped directly to GFP frames). See also [GFP](#).

FTD

Frame Transfer Delay

FTFL

Fault Type and Fault Location

G

GCRA

Generic Cell Rate Algorithm.

GFC

Generic Flow Control. Available for UNI Interface only. Sets the first four bits of the ATM cell header for a UNI interface. The GFC field allows the use of wild card characters. A wild card is transmitted as a 0 and can be received as a 0 or 1.

GFP

Generic Framing Procedure. A generic mechanism for PDU (protocol data unit)-oriented client signal adaptation which enables data mapping into a Sonet/SDH Virtual Container. See also [Encapsulation Schemes](#); [GFP](#); [Virtual Container](#).

gidErr (GID different for active chan)

This alarm appears when active channels within the same VCGroup receive different Group ID. Check the configuration.

Go To

This button allows you to quickly select and jump to a specific tabbed function, a protocol processor, or a chassis.

H

H1 byte

STM Pointer byte. Bits 1 through 4 represent the New Data Flag (NDF) value. Bits 5 and 6 are reserved. Bits 7 and 8 are combined with the H2 byte to identify the beginning of a payload. This marker is called a Pointer.

H2 byte

STM Pointer byte. This byte is combined with the H1 byte to create the Pointer.

H3 byte

STM Pointer Action.

H4 byte

Position and Sequence Indicator byte. This byte provides a multiframe and sequence indicator for virtual VC-3/4 concatenation and a generalized position indicator for payloads. See also [VC](#); [VCAT](#).

HDB3

High Density Bipolar 3. Bipolar coding method that does not allow more than three zeros.

Header

Protocol control information located at the beginning of a protocol data unit (PDU).

HEC

Header Error Control. **(1)** Provides error correction for the ATM Cell Header. It is the last byte of the 5-byte ATM Cell Header. **(2)** It also appears as an ATM LED and indicates if a correctable or uncorrectable HEC error has been received.

HP (HPOH)

For SDH, refers to Higher-Order Path of Section Overhead.

HP-OK

Higher-Order Path OK (SDH only). In the Quick Status LEDs area, this is a status LED.

HP-RDI

Higher-Order Path - Remote Defect Indicator (SDH only). In the Quick Status LEDs area, an alarm LED indicating a signal was returned to the transmitting HP Terminating Equipment upon detecting a Loss of Signal, Loss of Frame, or AIS defect.

HP-REI

Higher-Order Path - Remote Error Indication (SDH only). In the Quick Status LEDs area, an error LED indicating to the transmitting node that an errored block has been detected at the HP receiving node.

HP-UNEQ

Higher-Order Path - Unequipped (SDH only). In the Quick Status LEDs area, an alarm LED indicating an all-zeros pattern was detected in the C2 byte. This byte is received from the HP terminating equipment.

I

ICMP

Internet Control Message Protocol. A TCP/IP protocol used to send error and control messages. The ICMP reports errors that occur during transmission of IP datagram packets. For example, a router uses ICMP to notify the sender that its destination node is not available. A ping utility then sends ICMP echo requests to verify the existence of an IP address.

Idle Alarm

In DS3, an alarm LED that indicates an idle alarm was received.

IGMP

Internet Group Management Protocol. Used by IP hosts to report multicast group memberships to neighboring multicast routers.

Insert

That process wherein part of the information carried in a transmission system is modulated (inserted) into a higher speed signal.

Invert

Used for RS-530 signal controlling. Inverting a signal changes a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting.

IP

Internet Protocol. A DOD standard protocol designed for use in interconnected systems of packet-switched computer communication networks.

IR

Information Rate. In Y.1564, this is the average bit rate (in bps) of Ethernet service frames at the measurement point starting with the first MAC address bit and ending with the last [FCS](#) bit.

ITU

The International Telecommunication Union (ITU), headquartered in Geneva, Switzerland, is an international organization within the United Nations System where governments and the private sector coordinate global telecom networks and services.

ITU-T

The ITU Telecommunication Standardization Sector (ITU-T) is one of the three Sectors of the International Telecommunication Union. ITU-T's mission is to ensure an efficient and on-time production of high quality standards (Recommendations) covering all fields of telecommunications. It was formerly known as the CCITT.

Invert

Changes a control signal from 0 to 1 (Off to On), or 1 to 0 (On to Off), depending on its current setting. The signal remains at this setting when the NIC unit is rebooted.

J

J0 Byte

The J0 byte is part of the Section OH and is known as the Section trace or J0 trace.

J0 Trace

A 64-byte pattern that can be created for repeated transmission. The pattern is a string of ASCII characters. The J0 trace can be configured to send the unit's default pattern or a customized pattern.

J1 byte

Higher-Order VC-N path trace byte. This user-programmable byte repetitively transmits a 15-byte, E.64 format string plus 1 byte CRC-7. A 64 byte free format string is also permitted for this Access Point Identifier. This allows the receiving terminal in a path to verify its continued connection to the intended transmitting terminal.

J2 byte

Used to repetitively transmit a Lower-Order Access Path Identifier so that a path receiving terminal can verify its continued connection to the intended transmitter. A 16-byte frame is defined for the transmission of Path Access Point Identifiers. This 16-byte frame is identical to the 16-byte frame of the J1 and J0 bytes.

J1 Trace

The 64-byte fixed length string transmitted in the J1 Byte. See also [J1 Byte](#).

Jitter

On a network where all devices must operate in a synchronized manner, relative to the same timing source, jitter is the lack of synchronization between network devices caused by mechanical or electrical changes. Jitter is the phase shift of digital pulses over a transmission medium.

K

K1 Bits 14

K1 Bits 1-4 indicates the type of APS request.

K1 Bits 58

In Linear APS mode, indicates the number of the channel. Code 0 = Null Channel, Code 1-14 Working channel, Code 15 = Extra traffic channel. In Ring APS mode, Bit 5-8 contains Destination Code Identification.

K1 Byte

The K1 byte is used to indicate a request by a channel for a switch action. K1 is used by APS (Automatic Protection Switching).

K1 Full Byte

The K1 Full byte configures the bit pattern of the K1 byte using either predefined settings (00000000; 1010101010 - default; or 11111111 - illegal) or user defined settings, which are set using the touch screen keypad, to set the eight bits of the K1 byte.

K2 Bits 14

In APS Linear Mode: Bits 1-4 indicate the number of the channel that is bridged onto protection unless channel 0 is received on bits 5-8 of K1 byte, when they shall be set to zero. In APS Ring Mode: Bits 1-4 is Source Node Identification. Source node ID is set to the nodes own ID.

K2 Bits 5

In APS Linear Mode: 0 = provisioned for 1 + 1 mode, 1 = provisioned for 1:n mode. In APS Ring Mode, it indicates short or long path code. 0 = Short Path Code and 1 = Long Path Code.

K2 Bits 68

In APS Linear mode: Bits 6-8 indicate the status, such as idle, Br, Br&Sw, or Unused. In APS Ring mode: Bits 6-8 indicate the status such as idle, Ex Tr, or L-RDI.

K2 Byte

The K1 byte is used to indicate a request by a channel for a switch action. K1 is used by APS.

K2 Full Byte

The K2 Full byte configures the bit pattern of the K2 byte using either predefined settings (00000000; 1010101010 - default; or 11111111 - illegal) or user defined settings, which are set using the touch screen keypad, to set the eight bits of the K2 byte.

L

-L

Suffix indicating line level.

LAN

Local Area Network. A LAN typically connects workstations, peripherals, terminals, and other devices in a single building, campus, or other geographically limited areas. LAN technologies usually employed include Ethernet, FDDI, and Token Ring. LANs are usually not subject to public telecommunications regulations.

LAPS

Link Access Procedure SDH. A type of high-level data link controller (HDLC) that includes data link service and protocol specification used in transporting IP packets over SDH networks. LAPS enables the encapsulation of IPv6, IPv4, PPP, and other higher-layer protocols. See also [Encapsulation Schemes](#).

Large LEDs

A common function tab that displays LED Error and Alarm indicators in a large, easy-to-read format, which covers the entire touch screen area.

Laser

An acronym for Light Amplification by Stimulated Emission of Radiation. A device which is able to produce light at a single frequency and phase. Light that has a single frequency and a single phase is said to be coherent, in contrast to normal light which has multiple frequencies and random phase combinations. The waves of non-coherent light can be likened to a crowd of people rushing down the street in contrast to coherent light which in the same example, is more like a group of soldiers marching down the street in row formation with each soldier in step.

LCAS

Link Capacity Adjustment Scheme. By dynamically altering the bandwidth of Sonet/SDH transport pipes, LCAS allows designers to adjust bandwidth based on quality of service (QoS) or other priority considerations. See also [Encapsulation Schemes](#).

IcasCrc (CRC error detected)

This alarm appears when the Cyclic Redundancy Check (CRC) fails. Check the configuration at the other end, and look for other alarms. See also [CRC](#).

LCV

Line Code Violation. A signal error in the physical layer of an electrical link.

LFD

Loss of frame delineation. Frame delineation is lost whenever multiple bit errors are detected in the Core Header by the cHEC. In this case, a GFP Loss of Frame Delineation event is declared.

Lightwave

Refers to the use of light as a communication signal when transmitted over fiber-optic cable. Light itself can travel over distances as a wave of energy, hence lightwave. The light signal communication travels as a discrete series of pulses of light.

Line

A line is a transport entity that provides the means of moving a digital signal between two consecutive NE (Network Elements) - one originating the line signal and the other terminating it. A SONET network Line comprises the transmission medium, together with the associated equipment, and provides the means of transporting information between two consecutive network elements. One of the network elements originates the Line Overhead and the other terminates the Line Overhead. A Line span in the SONET network has special significance as it is protected in case of equipment failure or deterioration in performance. The transportation of information across a network Line span will be maintained by switching to standby (or protection) facilities provided in case of failure.

Line AIS

Line Alarm Indication Signal. An alarm signal generated when an error is detected in the Line Overhead portion of the Synchronous Transport Frame. See also [AIS](#); [Line Overhead](#).

Linear

(1.) Refers to the unit's ability to transmit APS functions for a Linear (span) network. (2.) A Linear network refers to the design of a Local Area Network in which the wiring loops from one workstation to another is structured in a linear direction (as opposed to a [Ring Network](#)).

Line B2 Error

The B2 byte is a parity code in the Line Overhead section of the Transport Overhead in the Synchronous Transport Frame. It is even parity, and is calculated over all the bits of the Line Overhead and STS-1 envelope capacity of the previous STS-1 frame before scrambling. Used at the receiving end to determine if a transmission error has occurred over the line.

Line FEBE

Line Far End Block Error. An alarm signal generated and sent upstream to the transmitting Line Terminating Equipment, signaling that errors have been detected in the data block at the receiving Line Terminating Equipment.

Line FERF

Line Far End Receive Failure. A signal generated and sent upstream that informs the transmitting line terminating equipment upstream that the receiving equipment has detected an incoming failure in the Line Overhead portion of the Synchronous Transport Frame. See also [FERF](#).

Line Frequency

The frequency of the transmitted signal on the network line, measured in megahertz (MHZ).

Line Overhead

In a Synchronous Transport Frame, 18 bytes are delegated in the Transport Overhead section of the frame for monitoring and maintenance of the frame signal across a line span. The Line Overhead data is updated each time the frame passes through a Line Terminating Equipment. The functions of the Line Overhead include the Payload Pointer bytes, a parity byte, Automated Protection Switching signaling, a data communications channel for message based administration, monitoring, maintenance, alarm and other communications needs between line terminating equipment, and an order-wire channel for voice communications between line terminating equipment.

Line Terminating Equipment (LTE)

Equipment, at either end of a Line span in a SONET network that originates the Line Overhead or terminates the Line Overhead.

Live (RX Pattern)

Expects the received payload data to be random and unpredictable, as is the case with live traffic. When selected, payload Bit errors and Pattern Sync alarms are not monitored and their LEDs becomes non-functional.

LL

Local Loopback. RS-530 loopback signal control. Provides a way for a DTE to check the functioning of the DTE/DCE interface and the transmit and receive sections of the local DCE.

LOCS

Loss of Client Signal

LOCS

(Alternate definition): Loss of Cell Synchronization. An ATM LED that indicates the loss of Cell Sync. This happens when seven consecutive bad HECs are received. Cell Sync returns when six consecutive good HECs are received.

Loss of Frame (LOF)

(1.) DS-1, a loss of frame is declared when an OOF condition has existed for a certain period of time. DS-1 criteria to declare LOF is 2.5 s. (0.5 s. of persistent OOF. DS-1 criteria to clear LOF is twenty or fewer contiguous seconds with no OOF defects. (2.) DS-3, a loss of frame is declared when an OOF condition has existed for a certain period of time. DS-3 criteria to declare LOF is 2.5 s. (s. 3. SONET, a loss of Frame failure is declared when a Loss of Frame Defect persists for 2.5 s (an alarm signal generated when an Out of Frame condition exists for 3 microseconds or longer). (3.) An ATM LED that indicates a loss of frame. See also [Out of Frame](#).

Loss of Frame Defects

Loss of Frame Defects, in SONET, is synonymous to Out of Frame (OOF).

LOF-P

Loss of Frame - Path.

LOFS

Loss of Frame Seconds.

LOF-V

Loss of Frame - Virtual Tributary.

LOM

Loss of Multiframe alignment (H4).

LOM-V

Loss of Multiframe alignment - Virtual Tributary.

Looped (Signal Timing)

A method of synchronizing a circuit by taking a synchronizing clock signal from incoming digital pulses.

LOP-P

Loss of STS pointer.

LOP-V

Loss of VT pointer.

LOSS

Loss of Signal Seconds.

Loss of Pattern (LOP)

An alarm signal generated for a DS3 signal when the signal pattern is errored.

Loss of Pattern Synchronization (LOPS)

An ATM LED that Indicates a loss of Cell Sync on any active detail channel. Detail channels are available only on virtual channels configured for AAL0.

Loss of Pointer (LOP)

An alarm signal generated when no valid pointer is received in eight consecutive frames, or when eight consecutive New Data Flags are received.

Loss of Signal (LOS)

An alarm signal generated when the data signal has an all zeros pattern lasting 55 microseconds or longer.

LP (LPOH)

For SDH, Lower-Order Path. This is comparable to a VT Path in SONET for VC-11, VC-12, and VC-2.

LP

Lockout of Protection (111). See also [K1 Bits 1-4](#).

LP-PLM

For SDH, Lower Path Order - Payload Level Mismatch from a V5 byte.

LP-RDI

For SDH, Lower Path Order - Remote Defect Indication from a V5 byte.

LP-REI

For SDH, Lower Path Order - Remote Error Indication from a V5 byte.

LP-TIM

For SDH, Lower Path Order - Trace Identifier Mismatch from a J2 byte.

LP-UNEQ

For SDH, Lower Path Order - Unequipped from a V5 byte.

LSS

Loss of Sequence Synchronization. Also known as Loss of Pattern Sync.

M

MAC

Media Access Control. The lower of two sublayers of the data link layer defined by the IEEE. The MAC sublayer handles access to shared media, such as whether token passing or contention will be used.

MAC Address

The hardware address of a device connected to a shared network medium.

MBS

Maximum Burst Size. The maximum number of cells which can be transmitted at peak cell rate.

MF

Multiframe. Consists of 16 E1 frames, and broken into two SMFs. The E1 multiframe is used for all types of framing (except unframed). Its purpose is to supply bits for CRC-4 checking, remote errors and alarms, and spare bits which can be used for signaling or other purposes.

MFAS

Multi Frame Alignment Signal

MPLS

Multiple Protocol Label Switching. A packet switching protocol developed to improve switching speed. MPLS adds a 32-bit label to each packet to improve network efficiency and to enable routers to direct packets along predefined routes in accordance with the required quality of service.

MS

For SDH, Multiplex Section. Contains the information required between the multiplex section termination equipment at each end of the MS (that is, between consecutive network elements excluding the regenerators).

MSOH

For SDH, Multiplex Path Overhead. 18 bytes of overhead accessed, generated, and processed by MS terminating equipment. This overhead supports functions such as locating the payload in the frame, multiplexing, or concatenating signals, performance monitoring, automatic protection switching, and line maintenance.

MS-AIS

For SDH, Multiplex Section - Alarm Indication Signal. MS-AIS is generated by Section Terminating Equipment (STE) upon the detection of a Loss of Signal or Loss of Frame defect, on an equipment failure. MS-AIS maintains operation of the downstream regenerators, and therefore prevents generation of unnecessary alarms. At the same time, data and orderwire communication is retained with the downstream equipment.

MS OK

For SDH, Multiplex Section Overhead OK. In the Quick Status LEDs area, this is a status LED.

MS-RDI

For SDH, Multiplex Section - Remote Defect Indication from a K2 byte. A signal returned to the transmitting equipment upon detecting a Loss of Signal, Loss of Frame, or MS-AIS defect. MS-RDI was previously known as MS-FERF.

MS-REI

For SDH, Multiplex Section - Remote Error Indication from a K2 byte. A signal returned to the transmitting equipment upon detecting a Loss of Signal, Loss of Frame, or MS-AIS defect

MTU

Maximum Transmission Unit

Multiplexor

A device for combining several channels to be carried by a single physical channel.

MUX

To transmit two or more signals over a single channel.

N

N2 byte

Allocated for Tandem Connection Monitoring for the VC2, VC-12, and VC-11 level.

NDF

New Data Flag. The first four bits of the Payload Pointer in the Transport Overhead portion of the Synchronous Transport Frame. These bits indicate a change in the payload, and thus a change in the Payload Pointer.

NIC

Digital Lightwave's second-generation Network Information Computer (NIC) is a portable test unit used to verify and qualify the performance of OC-192 SONET telecommunications and PDH networks.

NNI

Network Node Interface. For ATM, if NNI is selected, then the Header Field uses a 12-bit VPI and no GFC.

nonLcas (Non-LCAS source detected)

This alarm implies that the NE at the other end is not in LCAS mode. Check the configuration.

NPJ

Negative Pointer Justification.

NPJC

Negative Pointer Justification Count.

NRT

Non-real-time.

O

OA1

The OTU FAS is a 6-byte structure that occupies row 1, columns 1 to 6 of the OTU overhead. The first three bytes (columns 1 to 3) of the OTU FAS are OA1. The default value is 111 0110.

OA2

The OTU FAS is a 6-byte structure that occupies row 1, columns 1 to 6 of the OTU overhead. The second three bytes (columns 4 to 6) of the OTU FAS are OA2. The default value is 0010 1000.

OAM Cell

Operation and Maintenance Cell. A cell that contains ATM LM information. It does not form part of the upper layer information transfer.

OC

A SONET optical signal. Results from direct electrical-to-optical mapping of the corresponding STS signal. The base rate for OC signals is 51.84 Mbps (OC-1).

OC-1

Optical Carrier level 1. OC-1 is 51.840 million bits per second. Its electrical equivalent is an STS-1.

OC-3

Optical Carrier level 3. A SONET channel equal to three DS3s, which is equal to 155.52 million bits per second.

OC-12

Optical Carrier level 12. A SONET channel of 622.08 thousand million bits per second.

OC-48

Optical Carrier level 48. A SONET channel of 2.488 thousand million bits per second (Gbps).

OC-192

Optical Carrier level 192. A SONET channel of 9.953 thousand million bits per second (Gbps).

ODTU-jk (where jk may be 01, 02, 03, 12, or 012, etc.)

Optical channel Data Tributary Unit - j into k

ODU

Optical channel Data Unit

OPU

Optical channel Payload Unit

Orderwire

Four-pin modular handset jack for technician use at either the E1 Section Overhead Level or the E2 Line Overhead Level.

OH (Overhead)

See [Overhead \(OH\)](#).

OMR

Digital Lightwaves Optical Multi-Rate module. The OMR is an optional circuit pack that combines the functionality of OC-192, OC-48, and SDH circuit packs on one circuit

card. This offers multiple interface and mapping functionalities from one location. The OMR also provides testing of OTN, GG.709 (OTU 1 and OTU 2) networks and SONET/SDH protocols.

OMR (Alternate Definition)

Optical Mark Reader. An input device (scanner) which reads marks made in pencil or pen in predetermined positions on special forms or cards

OSPF

Open Shortest Path First

OTN

Optical Transport Network. Considered to be a successor to SONET. OTN elements include optical channels, optical multiplex sections, and optical transmission sections. OTN also allows for deployment of Wavelength Division Multiplexing (WDM). Conceptually similar to SONET, since both share the goal of providing end-to-end networking.

Out of Frame

A condition entered when four consecutive frames are received with invalid (errored) framing patterns.

Out of Frame Event

Indicates the actual event of going from correct framing condition to an Out of Frame condition. As soon as frame is lost, this is one OOF Event regardless of how long it lasts.

Overhead (OH)

Extra bits in a digital stream used to carry information besides traffic signals. Orderwire, for example, would be considered overhead information.

P

-P (Suffix)

Suffix indicating Path level.

Passthru

A function that allows an incoming signal to pass through the unit without altering the data in the signal.

-PFE

Suffix indicating Path Far End (Remote Path).

Path Overhead

Those bytes placed in an STS-N (or OC-N) frame by the Path Terminating Equipment and that stay with the frame through its whole transport across the transmission path. The Path Overhead consists of the first 9-byte column of the Synchronous Payload Envelope and contains the identification of the originating source of the traffic, a parity check, path status, a signal label (identifying what type of traffic is in the payload envelope), and a data communications channel.

PAT Sync

Pattern Synchronization. Indicates a loss of pattern synchronization. This is an alarm LED.

Paused Alarm

The total duration that the test has been [Paused](#) for.

Payload

Portion of the SDH signal available to carry service signals such as E1 and E3. The contents of a Virtual Container (VC).

Payload Pointer

Indicates the beginning of a Virtual Container.

Payload Type Indicator (PTI)

An ATM term that means that a Payload Type Indicator is the Payload Type field value distinguishing the various management cells and user cells.

PCM30

An E1 frame that has FAS byte in TS0, CAS in TS16, plus 30 data channels (CRC bits set to 1 on transmit, ignored on receive)

PCM31

An E1 frame that has FAS byte in TS0, plus 31 data channels (no CAS or CRC)

PCM30CRC

An E1 frame that has FAS byte in TS0 with the CRC bits set to do a CRC-4 check, CAS in TS16, plus 30 data channels

PCM31CRC

An E1 frame that has FAS byte in TS0 with the CRC bits set to do a CRC-4 check, plus 31 data channels (no CAS)

PCMCIA

Personal Computer Memory Card International Association standardizes credit-card size packages for memory and input/output (modem, LAN cards, etc.) for computers, laptops, palmtops, etc.

PCR

Peak Cell Rate.

PDH

Plesiochronous Digital Hierarchy. Developed to carry digitalized voice over twisted pair cabling more efficiently. This evolved into the North American, European, and Japanese Digital Hierarchies where only a discrete set of fixed rates is available; namely, nxDS0 (DS0 is a 64 KBPS rate) and then the next levels in the respective multiplex hierarchies.

PDU

Protocol Data Unit. A packet comprising payload and protocol-specific control information.

pFCS

Payload Frame Check Sequence (pFCS) field. The GFP Payload FCS is an optional frame check sequence containing a CRC-32 sequence that protects the contents of the payload information field. Also known as Payload Frame Checksum.

PFI

The GFP payload FCS identifier (PFI) is a 1-b field that indicates use of the optional payload FCS. See also [PTI](#).

PJCS

1660

Pointer Adjustment Count in Seconds.

PLCP

Physical Layer Convergence Protocol.

PLCP Yellow Alarm

Inserts a Yellow alarm on the PLCP for ATM/DS1 PLCP or ATM/DS3 PLCP mapping.

PLCR (Partial loss capacity rx)

This alarm appears when the received capacity is less than expected. Check the operational-capacity, VC-n alarms, and configuration parameters on the opposite port.

PLCT (Partial loss capacity tx)

This alarm appears when the send capacity is less than expected. Check the operational capacity. Check for configuration parameters on this side, and also check the cross-connect status, and alarm status on the opposite port.

PLM

Payload Label Mismatch alarm.

PM

Path Monitoring

Pointer

The Payload pointer indicates the offset between the VC payload and the STM-N frame by identifying the location of the first byte of the VC in the payload. In other words, the VC is allowed to "float" within the STM-1 frame capacity.

PTR-ADJ

Pointer Adjustment. In the Quick Status LEDs area, an event LED indicating a Pointer adjustment has been received.

Pointer Value

The offset in bytes from the pointer to the first byte of the VC, which is the J1 byte. Because the Section Overhead bytes are not counted, and starting points are at 3-byte increments for a VC-4 payload, the possible range is: Total STM-1 bytes minus Section Overhead bytes = Pointer value range.

PoS

Packet over SDH/SONET. Uses SONET/SDH as the Layer 1 (physical layer) protocol, encapsulating IP or other packet traffic in High Level Data Link Control (HDLC) frames and using Point-to-Point Protocol at Layer 2 (data link layer), with IP traffic running at Layer 3 (network layer). See section on SONET Versus SDH Terminology.

Power Loss Alarm

The duration that the unit was without power (turned off) during a [Real-Time](#) test.

P-Parity Error

An error in the P-bit channel (P1 and P2) that provides parity information for the preceding M-frame.

PPJ

Positive Pointer Adjustment.

PPJC

Positive Pointer Adjustment Count.

ppm

Parts per million.

PP Name

A section of the touch screen that displays which common function tab, protocol processor/slot, and chassis is selected. See also [Go To](#); [SLT](#).

PPP

Point-to-Point Protocol. A protocol allowing computers to use TCP/IP to connect to other computers over standard phone lines using high-speed modems.

PRBS (Pseudo-Random Bit Sequence)

A test pattern having the properties of random data, but generated in such a manner that another circuit, operating independently, can synchronize on the pattern and detect individual transmission bit errors. This test pattern is useful for simulating live data traffic. PRBS patterns vary in size based on the maximum number of consecutive zeros and consecutive ones allowed.

PRBS 6

PRBS 2^6-1 generates a maximum of 5 consecutive zeros and 6 consecutive ones.

PRBS 6 Inv

PRBS 2^6-1 Inverted generates a maximum of 6 consecutive zeros and 5 consecutive ones.

PRBS 9

PRBS 2^9-1 generates a maximum of 8 consecutive zeros and 9 consecutive ones.

PRBS 9 Inv

PRBS 2^9-1 Inverted generates a maximum of 9 consecutive zeros and 8 consecutive ones.

PRBS 11

PRBS $2^{11}-1$ generates a maximum of 10 consecutive zeros and 11 consecutive ones.

PRBS 11 Inv

PRBS $2^{11}-1$ Inverted generates a maximum of 11 consecutive zeros and 10 consecutive ones.

PRBS 15

PRBS $2^{15}-1$ is a 32,767-bit pseudorandom pattern, which generates a maximum of 14 consecutive zeros and 15 consecutive ones.

PRBS 15 Inv

PRBS $2^{15}-1$ Inverted is a 32,767-bit pseudorandom pattern, which generates a maximum of 15 consecutive zeros and 14 consecutive ones.

PRBS 20

PRBS $2^{20}-1$ generates a maximum of 19 consecutive zeros and 20 consecutive ones.

PRBS 20 Inv

PRBS $2^{20}-1$ Inverted generates a maximum of 20 consecutive zeros and 19 consecutive ones.

PRBS 23

PRBS $2^{23}-1$ is a 8,388,607-bit pseudorandom pattern, which generates a maximum of 22 consecutive zeros and 23 consecutive ones.

PRBS 23 Inv

PRBS $2^{23}-1$ Inverted is a 8,388,607-bit pseudorandom pattern, which generates a maximum of 23 consecutive zeros and 22 consecutive ones.

PRBS 31

PRBS $2^{31}-1$ is a 2,147,483,647-bit pseudorandom pattern, which generates a maximum of 30 consecutive zeros and 31 consecutive ones.

PRBS 31 Inv

PRBS $2^{31}-1$ Inverted is a 2,147,483,647-bit pseudorandom pattern, which generates a maximum of 31 consecutive zeros and 30 consecutive ones.

Protocol

A specific set of rules, procedures, standards or agreements as to exactly how data is to be formatted and transmitted between two computers, devices or facilities in a network.

Protocol Control Information

Information exchanged between corresponding entities, using a lower layer connection, to coordinate their joint operation.

Protocol Data Unit (PDU)

A segment of data generated by a specific layer of a protocol stack; usually contains information from the next higher layer encapsulated with header and trailer data generated by the layer in question.

Pseudo-Random Bit Sequence (PRBS)

See [PRBS](#)

PTI

The GFP payload type identifier (PTI) is a 3-b field that indicates a data frame (PTI = 0) or a management frame (PTI = 4) with other values currently undefined. See also [PFI](#).

Pulse Code Modulation (PCM)

The most common method of encoding an analog voice signal into a digital bit stream. First, the amplitude of the voice conversation is sampled. This sample is then coded into a binary (digital) number, consisting of ones and zeros. The voice signal can then be switched, transmitted and stored digitally. The most common PCM method is to sample a voice conversation at 8000 times a second. The theory is that if the sampling is at least twice the highest frequency on the channel then the result sounds OK. Thus, the highest frequency on a voice phone line being 4,000 Hertz, the sample of it must be at 8,000 times a second. These 8,000 bytes sampled per second then become 64,000 bits per second, the base signal rate for a DS-0 signal, a single phone conversation.

PVC

Permanent Virtual Circuit. A point-to-point connection established ahead of time. A pre-selected and defined number of PVCs is known as a "Virtual Private Network," or VPN. See also [VPN](#) and [SVC](#).

PTR

See [Pointer](#).

Q

QOS

Quality of Service. (1) When referring to ATM, has four classes. Class 1: Equivalent to digital private line; Class 2: Multimedia, audio and video conferencing; Class 3: Connection-oriented protocols like SDLC and Frame Relay Class; and Class 4: Connectionless data protocols like SMDS. ATM performance parameters include: CER, SECBR, CLR, CMR, CTD, MCTD, and CDV. (2) When referring to telephone service, is a subjective measurement of the quality of the phone call with clearness and loudness being important factors.

QRSS

Quasi-Random Signal Source. Transmits a modified [PRBS 20](#) which allows a maximum of 14 sequential zeros and 20 sequential ones. This pattern simulates live data.

Quanta

A quanta is a 512-bit timing increment used by a Pause frame. The number of quanta ($N \times 512$ -bits) indicates the duration of the pause.

R

RAI

See [Remote Alarm Indication](#).

RDI Alarm

Remote Defect Indication (formally: [FERF](#)).

RDI-L

For SONET, Remote Defect Indication - Line (K2).

RDI-P

For SONET, Remote Defect Indication - Path (G1).

RDI-V

For SONET, Remote Defect Indication - Virtual Tributary (V5).

Remote Alarm Indication (RAI)

A code sent upstream in a DSN network as a notification that a failure condition has been declared downstream. RAI signals were previously referred to as Yellow signals.

Remote Block Errors (RBE)

Errored blocks detected by one or more remote errors in the Remote Error Indication (REI) (formally FERF).

Remote Error Indication (REI)

An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink). This indication was formerly known as Far End Block Error ([FEBE](#)).

Remote Error Indication Line (REI-L)

An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink) at the line level.

Remote Error Indication Path (REI-P)

An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink) at the path level.

Restart

A common function button that clears and resets all error, alarm, and event activity counters, statistics, and LEDs. It also starts any activity that was stopped using the Stop button.

Remote Monitoring

MIB agent specification described in RFC 1271 that defines functions for the remote monitoring of networked devices. The RMON specification provides numerous monitoring, problem detection, and reporting capabilities.

RFI

Remote Failure Indicator.

RI

Ring Indicator. RS-530 control signal used by a modem to indicate the occurrence of a telephone ring signal. Used by auto-answer modems so that they know when to answer the incoming call.

Ring

(1.) Refers to the unit's ability to transmit APS functions for a Ring network. (2.) A Ring network refers to the design of a Local Area Network in which the wiring loops from one workstation to another form a circle.

RL

Remote Loopback. RS-530 loopback signal control. Allows end-to-end testing of a circuit from a central site or DTE for checking the transmission path up to and through the remote DCE to the DTE interface and the similar return transmission path.

RLSD

Received Line Signal Detector. RS-530 signal control. RLSD shares the same pin with DCD (Data Carrier Detect).

RMFAI

Remote Multiframe Alarm Indication. Indicated by the Y-bit. Set true when the remote end experiences CASMFL.

RR

- Receiver Ready - RS-530 Signal control. RR shares the same pin with RTS (Request to Send).
- Reverse Request (0010) in APS Linear mode. See also [K1 Bits 1-4](#).

RR-R

Reverse Request-Ring (0001) in APS Ring mode. See also [K1 Bits 1-4](#).

RR-S

Reverse Request-Span (0010) in APS Ring mode. See also [K1 Bits 1-4](#).

RS

Regenerator Section. An SDH term that is equivalent to Section in SONET.

rsAckTimeout (RS ACK Timeout)

This event indicates that an RS-sequence Acknowledge has timed out. When an LCAS source re-sequences the VC-n channels, the LCAS source expects the opposite end to acknowledge this operation through an RS-ACK. If the source does not receive an RS-ACK within a reasonable amount of time, the source declares a timeout. Look for other alarms in both ends. See also [LCAS](#).

RSOH

For SDH, Regenerator Section Overhead. This is equal to a SOH in SONET.

RS-TIM

For SDH, Regenerator Section Overhead - Trace Identifier Mismatch for J0.

RT

Real Time.

RTS

Request to Send. RS-530 control signal sent by a DTE device to a DCE device to inform the DCE that the DTE has data ready to send. RTS shares the same pin with RR (Receiver Ready).

RX

Receive Clock Indicator.

RXC

Receive Clock. RS-530 clock signal control.

RXCE

Receive Signal Element. RS-530 signal control.

RXD

Receive Data. RS-530 clock signal control.

S**SAN**

Storage Area Network. A centralized storage repository that provides physical security in an environmentally regulated location. The data in a SAN can be easily managed (i.e., backed up regularly, etc.) and is protected from equipment, software, and procedural failures.

SAPI

Source Access Point Identifier

Scan

Trouble Scan. A scan function that lists received errors and alarms.

SCNR (Selected Cells Not Received)

An ATM LED that indicates if monitor or detail channels are not receiving cells.

SCPI

Standard Commands for Programmable Instrumentation. This is an instrument command language for controlling a wide variety of instrument test functions in a standard manner. SCPI promotes consistency, from the remote programming standpoint, between instruments of the same class and between instruments with the same functional capability. The NIC's SCPI port can be accessed via TCP/IP using Port 8090. You can find more information about SCPI as well as a complete list of all available SCPI command in the SCPI Command Reference Guide.

SCR

Sustained Cell Rate. The average or constant traffic that the network agrees to carry with the Quality of Service specified in the traffic contract. SCR is less than or equal to the Peak Cell Rate (PCR). Several time intervals are defined to fit in the Generic Cell Rate Algorithm that allow for clumping, CDV, etc. and a Maximum Burst Size (MBS).

SDH

Synchronous Digital Hierarchy. A set of standard fiber-optic-based serial standards planned for use with SONET and ATM in Europe. Some of the SDH and SONET standards are identical. See also SONET Versus SDH Terminology.

SECBR

Severely Errored Cell Block Ratio.

Section

A SONET network Section span comprises the transmission medium and associated equipment between a network element and a regenerator, or two regenerators. The associated equipment includes optical interface and SONET processing equipment which originates the Section Overhead or terminates the Section Overhead.

Section Overhead

In a Synchronous Transport Frame, nine bytes are delegated in the Frame Overhead area of the frame for monitoring and maintenance of the frame signal across a section span. The Section Overhead data is updated each time the frame passes through Section Terminating Equipment. The functions of the Section Overhead include a frame alignment pattern, a byte giving the order of appearance of this frame in a multiplexed higher-rate signal, a parity check byte, a local orderwire channel for voice communications between section terminating equipment, a data communications channel for message-based network management and maintenance information, and a user channel for network operator communications. See also [Section Terminating Equipment](#).

Section Terminating Equipment (STE)

Equipment at either end of a Section span in a SONET network which either originates the Section Overhead or terminates the Section Overhead.

SEF

Severely Errored Frame. A SONET defect that is the first indication of trouble in detecting valid signal framing patterns. Four consecutive errored framing patterns constitute an SEF defect.

SEFS

Severely Errored Frame Seconds. The number of seconds in which an entity has an extremely high frame error rate or major defect.

Service Disruption

Measurement of service disruption intervals in the network. Statistics can be used to determine how long it takes network equipment to react to a disruption event and switch to a backup path.

SES

Severely Errored Seconds. The number of seconds in which an entity has an extremely high error rate.

SES-L

Severely Errored Seconds - Line. This reports the duration of Severely Errored Seconds on the incoming SONET signal. An SES is reported when 9,835 or more B2 errors occur in one second or when a SEF, LOF, LOS, or AIS-L alarm occurs.

SES-LFE

This reports the duration when 9,835 or more REI-L errors are present at the far-end LTE, or when a Line Remote Defect Indicator (**RDI-L**) alarm is present.

SES-P

Severely Errored Seconds - Path. Reports the duration of Severely Errored Seconds (SES) on the incoming SONET signal.

SES-PFE

This reports the duration when 2400 or more REI-P errors are present at the far end LTE or when a Path Remote Defect Indicator (RDI-P) alarm is present.

SESR

Severely Errored Seconds Ratio. The percentage of severely errored seconds for available seconds.

SETS

Synchronous Equipment Timing Source 2.048 MHz.

Signal Status

Indicates line frequency received by the unit.

SLA

Service Level Agreement

SLT

Slot Number. For a portable unit, such as the NIC, the slot number indicates which protocol processor tab is selected. For a rack-mounted product, such as an NAA IV, the slot number indicates which slot you are connected to in the chassis. Slots are numbered from left to right beginning with slot number 1. The protocol processor name associated with the slot appears next to the slot number.

SM

Section Monitoring

SN Error

Sequence Number error.

SNP Error

Sequence Number Protection error.

SONET

Synchronous Optical Network. A family of fiber-optic transmission rates from 51.84 million bits per second to 13.27 gigabits (thousand million) per second (with time, this will go higher), which was created to provide the flexibility needed to transport many digital signals with different capabilities and to provide a design standard for manufacturers. Also see SONET Versus SDH Terminology.

SMF

Sub-multiframe. Eight E1 frames, each having its own optional CRC-4 bits.

SPE

See [Synchronous Payload Envelope](#).

sqMultiple (Equal SQ for two or more chan)

This message appears when two or more channels have the same sequence number. Check for configuration mismatch or other alarms. See also [sqnc](#).

sqnc (sequence nbr not consistent)

This alarm appears when one or more of these alarms occur: eosMultiple, eosMissing, sqNonCont, sqOor and sqMultiple. Channels must have unique sequence numbers. Check the received sequence numbers. This alarm can indicate a signaling problem at the opposite port, or cross-connect problems.

sqNonCont (Missing SQ detected)

This alarm appears when a sequence number is missing. Check for configuration mismatch or other alarms. See also [sqnc](#).

sqOor (SQ outside of range)

This alarm occurs when the received sequence number is outside of the valid range (VC-4: 0-6, VC-3: 0-20, VC-12: 0-62). Check for configuration mismatch or other alarms. See also [sqnc](#).

STA (Status)

An ATM LED indicating that one or more of the active VCCs has the status field set in the VCC table. For example, the RX CLP bit has been set on a received cell.

STM

Synchronous Transport Module. A structure in the SDH transmission hierarchy. STM-1 is SDH's base-level transmission rate equal to 155.52 MBit/s. Higher rates of STM-4, STM-16, and STM-64 are also defined.

STS-1

Synchronous Transport Signal Level 1. Basic building block of a SONET signal. It has a bit rate of 51.84 Mbps. Its optical equivalent is an OC-1.

STS-48c

Synchronous Transport Signal Level 48 concatenated.

STS-192

Synchronous Transport Signal Level 192.

SVC

Switched Virtual Circuit. A network connection established at the time a transmission is required and disconnected when the session is completed. Usually found in systems such as analog telephone networks and ATM networks. See also [PVC](#).

Synchronous Payload Envelope

That section of the STS-N or OC-N frame that carries the data payload plus the Path Overhead. Also see [Payload](#) and [Path Overhead](#).

T

TCA

Threshold Crossing Alert. A message sent when the preset value in one of the predefined bins (15 minute or 1 day) of a Performance Parameter has been met or exceeded.

TC-AIS

Tandem Connection-Alarm Indication Signal. Indicates if IEC bits 1110 are being received from upstream TCM equipment. (Bits 1-4 of the N1 byte are the IEC bits.) This is an alarm.

TC-IEC

Tandem Connection-Incoming Error Count. Indicates a B3 error count is being received from downstream TCM equipment. Bits 1-4 of the N1 byte are used for this indicator. This is an error.

TC-LOF

Tandem Connection-Loss of Frame. Indicates the loss of a valid multiframe pattern from upstream TCM equipment. This is an alarm.

TC-ODI

Tandem Connection-Outgoing Defect Indicator. Indicates that the unit is sending an ODI alarm to upstream TCM equipment. Bit 7 in multiframe 74 of the N1 byte is used for this indicator. This is an alarm.

TC-OEI

Tandem Connection-Outgoing Error Indication. Indicates that the unit is sending an OEI error to upstream TCM equipment. Bit 6 of the N1 byte is used for this indicator. This is an error.

TC-RDI

Tandem Connection-Remote Defect Indication. Indicates that a defect has occurred at the downstream TCM equipment. The unit is receiving an alarm. Bit 8 in multiframe 73 of the N1 byte is used for this indicator. This is an alarm.

TC-REI

Tandem Connection-Remote Error Indication. Indicates that an error has occurred at the downstream TCM equipment. The unit is receiving an error. Bit 5 of the N1 byte is used for this indicator. This is an error.

TC Summary LED

Tandem Connection Summary. Indicates if a TCM error or alarm has been detected. If this LED is red, select the LED text (TC Summary) to display the TC LEDs.

TC-TIM

Tandem-Connection Trace Identifier Mismatch. Indicates an alarm has occurred because the incoming TC trace does not match the expected TC trace. The alarm's duration-in-seconds appears on the Results' Alarm screen.

TC-UNEQ

Tandem Connection-Unequipped. Indicates that a 00h pattern has been detected in the N1 byte of a Tandem Connection. This is an alarm.

TDM

Time Division Multiplexing. Digital multiplexing in which two or more apparently simultaneous channels are derived from a given frequency spectrum (bit stream), by interleaving pulses representing bits from different channels.

Test Set

A "Test Set" (sometimes referred to as "Test Unit") is a series of adjacent Circuit Packs and/or Protocol Processors, installed in one chassis, which can perform an Add/Drop Mapping configuration. The Test Set is based on a Circuit Pack's internal addressing and provides Add/Drop Mapping functionality between higher speed and lower speed Protocol Processors.

Test Unit

See Test Set

tHEC

Type Header Error Checksum.

TIM

Trace Identifier Mismatch alarm. Enabled from the Receive/SET page. Records the number of seconds that the J0, J1, J2, or TC traces do not match the expected values.

Time Slot (TS)

One of the 32 bytes in an E1 Frame, numbered from 0 to 31.

TLCR

Total Loss Capacity Rx. This message indicates that the port receives no traffic. Check for VC-n alarms and configuration parameters on the opposite port.

TLCT

Total Loss Capacity Tx. This message indicates that no traffic is sent.

TM

Test Mode. RS-530 loopback signal control. Provides indication from the DCE to the DTE that the DCE is in a test condition and verifies completion of a requested action.

Touch Screen

The interactive interface screen on the unit that is touch sensitive, and that the user touches to make selections of menu items, thereby controlling the functions of the tester.

TTI

Trail Trace Identifier

TU

For SDH, a Tributary Unit is an information structure which provides adaption between the Lower-Order path layer and the Higher-Order path layer. It contains the VC, plus a tributary unit pointer.

TUG

For SDH, a Tributary Unit Group contains several Tributary Units (TU)

TXC

Transmit Clock. RS-530 clock signal control.

TXCE

Transmit Signal Element Time. RS-530 signal control.

TXD

Transmit Data. RS-530 clock signal control.

U

UAS

Unavailable Seconds.

UAS-L

Near End Unavailable Seconds - Line. Reports the number of seconds that the Line layer was considered unavailable. A line is unavailable when 10 consecutive seconds that qualify as SES-L seconds occur.

UAS-P

Near End Unavailable Seconds - Path. Reports the number of seconds that the STS path layer was considered unavailable. A path is unavailable when 10 consecutive seconds that qualify as SES-P seconds occur.

UAS-PFE

Far End Unavailable Seconds. This is a counter that indicates the number of seconds that an SES-PFE error was present at the far-end LTE. At least 10 consecutive errored seconds of SES-PFE errors must be present before a UAS-PFE is declared.

UASR

Unavailable Seconds Ratio.

UBR

Undefined or Unassigned Bit Rate. UBR is an ATM service category which does not specify traffic related service guarantees. Specifically, UBR does not include the notion of a per-connection negotiated bandwidth.

UDP

User Data Protocol.

UNEQ-P

Unequipped STS Payload. Indicates that an all-zeros pattern is being received from Path terminating equipment. The C2 byte is used for this indicator. This is an alarm LED.

UNI

User-to-Network Interface. For ATM, if UNI is selected, then the Header Field uses a 4-bit GFC and an 8-bit VPI.

UPI

The user payload identifier (UPI) is an 8-b field such that when PTI = 0, it identifies the type of payload and mapping in the data frame, e.g., frame-mapped Ethernet (UPI=1), frame-mapped PPP (UPI=2), transparent fibre channel (UPI=3), transparent FICON (UPI=4), transparent ESCON (UPI=5), transparent Gigabit Ethernet (UPI=6), and frame-mapped multiple access protocol over SDH (MAPOS) (UPI=8).

User Defined Pattern (32-bit value)

Users can specify a repeating 32-bit binary value to be configured as the transmitted and expected received payload pattern. The pattern is entered using a keypad, and can be entered in Hex, Decimal, or Binary format.

UUI

User-to-user information. An ISDN term. UUI comprises information of end-to-end significance sent over the ISDN D (data) channel in the context of UUS (User-to-User Signaling) as defined by the ITU-T and ETSI.

V

-V

Suffix indicating SONET Virtual Tributary Near End.

-VFE

Suffix indicating SONET Virtual Tributary Far End.

V5

Virtual Tributary Path Overhead byte.

VBR

Variable Bit Rate. A voice service over an ATM switch.

VC

Virtual Concatenation. International standard for SONET/SDH-based networks that optimizes bandwidth utilization. VC requires concatenation functionality only at the path termination equipment, while contiguous concatenation also requires functionality at each intermediate network element. Thus, incorporating VC functionality only involves upgrading the ends of the path, while the intermediate nodes with older legacy equipment are left alone. Payloads that exceed the standard payload container capacity (a VC-3) may be transported using a concatenation method. See also [VCAT](#); [Encapsulation Schemes](#).

VCAT

VCAT is another acronym for Virtual Concatenation, which is an international standard for SONET/SDH-based networks that optimizes bandwidth utilization. See also [VC](#).

VCC

Virtual Channel Connection. As an ATM term, it is a concatenation of VCLs that extend between the points where the ATM service users access the ATM layer. The points at which the ATM cell payload is passed to or received from the users of the ATM layer (i.e., a higher layer or ATM entity) for processing signify the endpoints of a VCC. VCCs are unidirectional.

VCG

A Virtual Concatenation Group is the group of channels or members selected or enabled to be transport the [VCAT](#) mapping's payload.

VCI

Virtual Channel Identifier. The address or label of a Virtual Channel (VC).

Virtual Channel

A communications path between two nodes identified by label rather than fixed physical path.

Virtual Channel Link

A means of unidirectional transport of ATM cells between the point where a VCI value is assigned and the point where that value is translated or removed.

Virtual Channel Link

A network element that connects VCLs. It terminates VPCs and translates VCI values. It is directed by Control Plane functions and relays the cells of a VC.

Virtual Container

Sometimes abbreviated VC. A signal designed for transport and switching of sub-SDH payloads. GFP [G.7041] is a generic mechanism for protocol data unit (PDU)-oriented client signal adaptation to enable data mapping into a Sonet/SDH virtual container. The Gigabit Ethernet, 10/100 Mbps Ethernet, packet over PPP, and packet over simple data link (SDL) protocols are examples of client signals that can be mapped in this manner.

Virtual Path

A unidirectional logical association or bundle of VCs traveling between common points.

Virtual Path Connection (VPC)

A concatenation of VPLs between virtual path Terminators (VPTs). VPCs are unidirectional.

Virtual Path Identifier (VPI)

The address of a Virtual Path. An eight-bit field in the ATM header that identifies the Virtual Path (i.e., virtual circuit) over which the transmitted data will flow from the transmitting device to the target device.

Virtual Path Link

A means of unidirectional transport of ATM cells between the point where a VPI value is assigned and the point where that value is translated or removed.

VT Path Remote Defect Indication (RDI-V)

A signal returned to the transmitting VT PTE upon detection of certain defects on the incoming path.

VT Path Remote Failure Indication (RFI-V)

A signal, applicable only to a VT1.5 with byte-synchronous DS1 mapping that is returned to the transmitting VT PTE upon declaring certain failures.

Virtual Path Switch

A network element that connects VPLs. It translates VPI (not VCI) values and is directed by Control Plane functions. It relays the cells of the VP.

VPN

Virtual Private Network. A private network that is configured within a public network so as to take advantage of large networks. VPNs can be used to create wide area networks (WANs) that span large geographic areas. Allows, for example, mobile users to dial up their company LANs.

W**WAN**

Wide Area Network. A WAN typically serves users across a broad geographic area and generally makes use of transmission devices provided by common carriers. Technologies involved with WANs can include Integrated Services Digital Networks (ISDNs), T1 networks, X.25, Frame Relay, and SMDS.

X**X-Bit**

For E1, bits 5, 7, and 8 of the CAS channel (Timeslot 16) in the first frame of the multiframe.

X-Bit Alarm

The two X-Bits in the frame are set to 00 and returned to the near end when there is an SEF or AIS at the far end. Otherwise, they are set to 11.

XON

RS-530 Signal Control. Available when one of the following interfaces is selected: RS-232, EIA-530 Async, and EIA-530A Async. Sends a message to the transmitting device advising that the receiver is able to accept more data.

XOFF

RS-530 Signal Control. Available when one of the following interfaces is selected: RS-232, EIA-530 Async, and EIA-530A Async. Sends a message to the transmitting device advising that the receiver is unable to accept more data.

Y

Y-bit

Bit 6 of frame 0 of TS16 (the CAS byte). Used to indicate RMFAI.

Yellow Signal

A Yellow Signal is sent to the far-end network element that terminates a service when a service-affecting failure is detected at a terminal. Once a Yellow Signal has been sent, automatic service management processes are initiated, and these processes are maintained for the duration of the failure. See also [Remote Alarm Indication \(RAI\)](#).

Z

Z0 byte

Section growth byte. These bytes, which are located at positions S[1, 6N+2] to S[1, 7N] of an STM-N signal (N>1), are reserved for future international standardization.