

S300

MODULAR POWER SUBSYSTEM

USER'S MANUAL



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TABLE OF CONTENTS

1. GENERAL INFORMATION	7
1.1 OVERVIEW	7
1.1.1 TOPOLOGY	7
1.2 S300 SYSTEM SPECIFICATIONS	7
1.2.1 REMOTE INTERLOCK	7
1.2.2 INPUT POWER	7
1.2.3 INPUT VOLTAGE RANGES - EXTENDED (OPTIONAL)	8
1.2.4 SOFT START	8
1.2.5 PHYSICAL	8
1.2.6 AIRFLOW	8
1.2.7 MODULE REMOVAL	9
1.2.8 REAR PANEL CONNECTIONS	9
1.2.9 LINE INPUT FUSE, CHASSIS	9
1.3 DESIGN AND CONSTRUCTION	9
1.3.1 RELIABILITY	10
1.3.2 VIBRATION AND ENVIRONMENTAL	10
1.4 DELIVERABLE DOCUMENTATION	10
1.5 FIRMWARE CAPABILITY	10
1.5.1 SELF-TEST AND BUILT-IN-TEST	11
1.5.2 CLOSED COVER CALIBRATION	11
1.6 QUALITY PROVISIONS	11
1.7 APPLICABLE SPECIFICATIONS	12
1.8 OPTIONAL FEATURES	12
2. CONTROL CABLING HOOKUP	13
2.1 INITIAL INSPECTION	13
2.2 OPERATING ENVIRONMENT	13
2.2.1 COOLING SYSTEM	13
2.2.2 POWER REQUIREMENTS	14
2.2.3 RACK MOUNTING	14
2.3 CABLING HOOKUP	14
2.3.1 AC POWER CONNECTIONS	15
2.3.2 COM INPUT & OUTUT CONNECTION	16
2.4 MODULE INSTALLATION AND REMOVAL	21
2.4.1 CHASSIS COMM IN CONNECTOR	22
2.4.2 CHASSIS COMM OUT CONNECTOR	22
2.4.3 MANUFACTURES DESCRIPTION	22
2.5 MODULE TYPES	23

1. GENERAL INFORMATION

1.1 Overview

The S300 modular design offers a level of flexibility normally associated with custom design instruments. It has the revolutionary ability to control DC power supplies along with DC Dynamic loads within the same 5 ¼ chassis. The S300 is ideally suited to support the diversified requirements of ATE systems.

The S300 DC Modules easily install into one of the six available motherboard slots located in the S300 Power Subsystem Chassis. A maximum of 2,400 Watts can be delivered per chassis.

The S300 DC Modules are a “Constant Power” design, meaning that the module can deliver current up to 400w at any point within its operating envelope down to approximately 30% of full scale voltage. Constant power operation automatically extends the number of output voltage and current combinations available within the maximum power rating of the module.

The 4100 Series Modular Dynamic Load Modules also use a “Constant Power” design. These loads use a state-of-the-art thermal management system to achieve a power density of 300W per slot, for a maximum of 1800W per 5¼ inch S300 chassis. A unique multirange design is used to cover test requirements from 1.5V to 450V, and current from milliamps to 60A, in five different output ranges. The power handling capability can be expanded through paralleling additional modules.

1.1.1 Topology

The S300 DC Modules employ switching technology for high operational efficiency and power density. The filtering used achieves low noise performance comparable to linear converters.

The 4100 Series Loads employ a linear power design for fastest response time and quiet operation. Constant current, constant power, constant resistance, and constant voltage operating modes are provided, along with a true hardware SCR and relay crowbar-type short circuit mode. An advanced Texas Instruments DSP processor is used to tightly synchronize paralleled modules, as well as provide programmable output waveforms with unprecedented accuracy compared with older, more limited analog designs.

1.2 S300 System Specifications

1.2.1 Remote Interlock

Each system includes a single rear panel connector for remote TTL output inhibit.

The DFI may be strapped to the interlock line to inhibit output when a fault occurs.

1.2.2 Input Power

The instrument can be ordered from the factory for either single phase 115 VAC, single phase 230 VAC or three phase 208 VL-L input power operation.

Single Phase Power 115 VAC	
Input Voltage Range	103 to 126 VAC
Frequency	47 to 440 Hz
Input Current	20 Amps Max
Maximum Output Power	1,200 Watts per Chassis
Single Phase Power 230 VAC	
Input Voltage Range	208 to 264 VAC
Frequency	47 to 440 Hz
Input Current	20 Amps Max
Maximum Output Power	2,400 Watts per Chassis

1.2.3 Input Voltage Ranges - Extended (optional)

The instrument can be operated from the foreign power levels with the following deratings:

INPUT LEVEL

MAX OUTPUT POWER

Single Phase 90* VAC to 105 VAC: 1000W

Single Phase 180* VAC to 208 VAC: 2000W

*400V DC Module requires a minimum of 95/190VAC to operate.

1.2.4 Soft Start

Instrument includes soft start circuitry to limit turn-on surge current.

1.2.5 Physical

Size: 5 1/4" (h) x 19" (w) x 22" (d)

Weight: Master Chassis: <26 lb.
Modules: <6 lb.

Chassis slides: The instrument accommodates CHASSIS TRAK P/N CTHRS-1-18 slides.

1.2.6 Airflow

The cooling fans are located in the front of the S300 chassis. Air is drawn in from ventilation holes located in the front section of the top, side and bottom panels. The air exits through the rear panel.

1.2.7 Module Removal

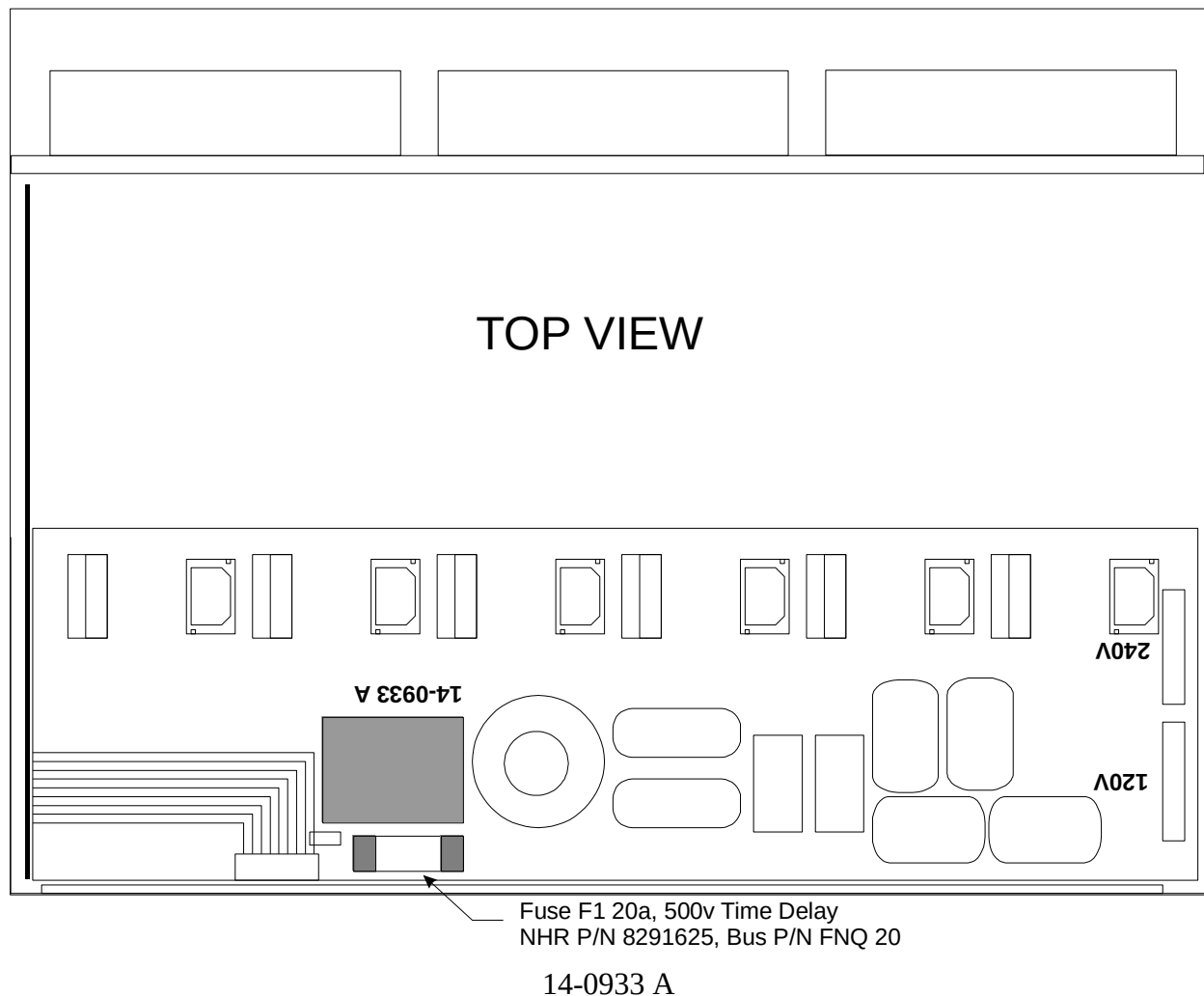
The modules are easily removed/replaced by first uncovering the top cover and then extracting from the instrument.

1.2.8 Rear Panel Connections

All I/O functions are accomplished using rear panel mounted connectors.

1.2.9 Line Input Fuse, Chassis

FUSE LOCATION MODELS S300, S310 & S320 P/Ns 1108049, 1108061, 1107895, 1107990.



1.3 Design and Construction

The instrument is designed and built to MIL-STD-28800C Type III hardware requirements for commercial off-the-shelf hardware as well as MIL-STD-45208 quality assurance standards.

1.3.1 Reliability

The fully loaded instrument with six 400W modules installed has a total system MTBF of 15,000 hours as a minimum.

1.3.2 Vibration and Environmental

The S300 meets the following requirements:

Temperature:

Temp (op): -10 to 50 deg C (Max inlet air temperature)
Temp (non-op): -40 to 85 deg C

Humidity:

95% @ 50 deg C, (Non condensing environments only)

Altitude:

Altitude (op): 6,000 ft
Altitude (non-op): 40,000 ft

Vibration:

3 g's in three planes for 15 minutes as follows:

Freq: 10-2000 Hz
Excursion: 0.015 inches

Shock:

15g's on three axis for 11mSec duration using half sinewave shock waveforms.

EMI/RFI:

The instrument is compliant with MIL-STD-461C.

1.4 Deliverable Documentation

NH Research delivers a manual with each instrument:

The User's Manual includes all documentation and procedures to install and interface the instrument. Included are initial inspection procedures, power and grounding requirements, safety and hazard warnings, environmental information, operating instructions and remote IEEE-488 software specifications.

1.5 Firmware Capability

The S300 firmware contains an extensive command set for control of the instrument over the IEEE-488 bus interface and via an optional front panel interface. These commands include instrument settings as a stimulus, and readback instrumentation capability. Additionally, commands are available for diagnostics, software calibration and configuration/identification readings. Examples of configuration/identification functions are reading instrument model number, serial number and firmware version as well as define and/or review logical/physical settings. Refer to Section 4 for a description of front panel operation. Refer to sections 5, 6, and 7 for a description of SCPI commands.

1.5.1 Self-test and Built-In-Test

The instrument contains advanced on-command and continuous Built-in-test. Two levels of self-diagnostics are supported:

CONTINUOUS BIT

The instruments firmware continuously monitors numerous fault flags. Should any failure or out-of-tolerance condition result the instrument will automatically alert the host computer and turn off the output, thus providing protection to the UUT. If the optional isolation relay is installed the output will be switched to a high impedance state. The fault flags are:

Fault	Load	DC Source
Over current	No	Yes
Over voltage	Yes	Yes
Under Voltage	No	Yes
Over temperature	Yes	Yes

SELF-TEST

The self-test assures early detection of hardware problems and minimum time to repair when a failure does occur. A main status word (1 byte) summarizes the hardware status and firmware error detection flags. A discrete fault line is also provided. Should more detailed information be required, status registers provide complete status information on the performance and state of the hardware. All output voltages shall be isolated from the output terminals via the isolation relay option during testing. If this option is not installed the set voltage and overvoltage tests are not performed. The test runs in less than 3 minutes and identifies over 90% of all possible faults.

1.5.2 Closed Cover Calibration

Software calibration is provided for the DC Source modules. The DC Source may be fully calibrated through the IEEE-488 interface bus - no internal adjustments are required.

Load calibration requires a Load Calibrator due to the high accuracy tolerance of the load.

Calibration parameters are stored on EEPROM, which resides on each module. Thus, replacing failed modules does not require recalibration of the instrument.

1.6 Quality Provisions

NH Research designs and manufactures its instrumentation products to normal commercial practices and conforms to MIL-I-45208A quality assurance standards and MIL-STD-28800C performance requirements. Each instrument undergoes 100 hours of elevated temperature burn-in testing (50 deg C) prior to final acceptance testing and delivery. Written verification and performance data are delivered with each unit.

1.7 Applicable Specifications

The instrument complies with the following specifications:

MIL-STD-28800D Type III, Class 3	MIL-STD-45208 Quality Standards
MATE Spec 2806763C	VDE Compliant
UL Compliant	CSA Compliant
IEC 435 Safety and Isolation	IEC 380 Safety Requirements
MIL-STD-461C EMI Part 7 (for commercial test equip.)	

1.8 Optional Features

The following feature is offered as options on the S300 chassis:

Chassis Slides
400 Hz Operation

The following features are offered as options for a DC module:

Reverse Polarity Relay
SCR crowbar Circuit
Isolation Relay (standard on 60v, 80v and 400v)

All load features are included as standard equipment. There are no hardware options.

2. CONTROL CABLING HOOKUP

2.1 Initial Inspection

The instrument is delivered as follows:

One or more boxes, each containing an S300 chassis.
One box containing miscellaneous accessories and cables.

The miscellaneous accessories and cables include:

Power cord for each S300 chassis.
Auxiliary chassis cables (as required)
Mating connector set
The S300 Power Analyzer User's Manual

This instrument was carefully tested and inspected for mechanical and electrical defects prior to shipment. The instrument should be inspected for any visible damage that may have occurred in transit. If the shipping container is damaged, report any damage immediately to the carrier and our factory.

2.2 Operating Environment

*******WARNING*******

**TO PREVENT POTENTIAL ELECTRICAL OR FIRE HAZARD,
DO NOT EXPOSE EQUIPMENT TO RAIN OR MOISTURE.**

**TO MINIMIZE SHOCK HAZARD, THE INSTRUMENT AND CABINET
MUST BE CONNECTED TO AN ELECTRICAL GROUND.**

In order for the S300 to meet its specifications, the operating environment must be within the following limits:

Temperature 0 to +50 Degrees C
Relative Humidity < 95% at 50 Degrees C (non-condensing)

2.2.1 Cooling System

The cooling fans are located in the front of the S300 chassis. Air is drawn in from ventilation holes located in the front section of the top, side and bottom panels. This air temperature must be maintained below the maximum specified operating temperature of the load. The air exits through the rear panel. When operating the instrument, provide at least 75mm (3 inches) of clearance at the rear of the instrument. Provide at least 50mm (2 inches) of clearance above and below the front of the instrument. Provide at least 25mm (1 inch) of clearance at the sides of the

instrument. Failure to allow adequate air circulation will result in excessive internal temperature, reducing the instrument's safe operating range.

2.2.2 Power Requirements

The S300 chassis power connection requires one of the following:

Single phase 115VAC (L-N) $\pm 10\%$, 20A (6 modules, FL) Chassis DC sources limited to 1200W
Single phase 230VAC (L-N) $\pm 10\%$, 20A (6 modules, FL)

The instrument is marked by the factory at the POWER INPUT connector on the rear panel. The marking indicates either a 115VAC or 230VAC input level. If 115VAC is indicated, then the single phase cable provided is used. If 230VAC is indicated, then single phase 230VAC cable is used.

*******WARNING*******

**DO NOT CONNECT 230VAC SINGLE PHASE TO THE S300
IF 115VAC IS INDICATED AT THE POWER INPUT CONNECTOR.**

The POWER INPUT setting is selectable by a jumper inside the unit as described in section 2.3.1.

2.2.3 Rack Mounting

The S300 chassis can be rack mounted. Maintenance access and removal is enhanced by adding the optional rack mounting slide rails.

2.3 Cabling Hookup

******* WARNING *******

**LOSS OF LIFE OR SERIOUS INJURY COULD
RESULT FROM UNSAFE OPERATION OF THIS POWER SYSTEM**

Remove the instruments from the shipping crates and install the unit in the cabinet. Do the installation as follows:

Before an S300 may be powered on the chassis cabling setup must be made.

2.3.1 AC Power Connections

*******WARNING*******

**TO PREVENT POTENTIAL ELECTRICAL OR FIRE HAZARD,
DO NOT EXPOSE EQUIPMENT TO RAIN OR MOISTURE.**

*******WARNING*******

**LOSS OF LIFE OR SERIOUS INJURY COULD
RESULT FROM UNSAFE OPERATION OF THIS UNIT.**

**TO MINIMIZE SHOCK HAZARD, THE INSTRUMENT AND CABINET
MUST BE CONNECTED TO EARTH GROUND.**

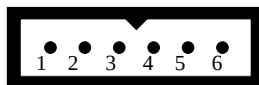
*******WARNING*******

**THE GROUND PIN ON THE POWER CORD MUST BE CONNECTED TO EARTH
GROUND DURING OPERATION OF THIS UNIT OR ELSE YOUR LIFE IS IN
DANGER FROM SHOCK OR ELECTRICAL FIRE.**

The S300 chassis comes pre-configured to operate from either:

- a) 115VAC 1-ph
- b) 230VAC 1-ph

Power is connected to the S300 chassis using the power cord supplied with the unit. The cord mates to the blue 6 pin male connector located at the bottom of the S300 rear panel and labeled "INPUT POWER."



115VAC LINE*

- 1. HOT 120VAC
- 2. NO CONNECTION
- 3. NEUTRAL 120V
- 4. NO CONNECTION
- 5. CHASSIS GROUND
- 6. CHASSIS GROUND

230VAC LINE*

- 1. HOT 220VAC
- 2. NO CONNECTION
- 3. LOW 220VAC
- 4. NO CONNECTION
- 5. CHASSIS GROUND
- 6. CHASSIS GROUND

This configuration may be determined by looking at the factory setting which is labeled with a check mark next to the correct voltage setting.

*The line input may be changed by rewiring the line input connector wiring and moving a cable connector on the S300 mother board inside the unit. Move the cable connector to P3 for 115VAC nominal or P4 for 230VAC nominal.

2.3.2 COM INPUT & OUTUT Connection

1. Trigger Connection

The external trigger line is connected to the S300 chassis at the male 15 pin D-sub located on the lower left corner of the rear panel and is labeled "COMM IN". This is a differential input pair with 10K ohm pull-up and pull-down. This input must be allowed to maintain greater than +200 mV differential at "TRIGIN+" relative to "TRIGIN-" during normal operation. After the external trigger circuit is "ARM'd" (see section 5.10 Trigger Subsystem) a minimum 50 msec low pulse is required to execute the external trigger function. The trigger input must receive a pulse more negative than -200 mV differential at "TRIGIN+" relative to "TRIGIN-". **This differential voltage must not exceed ± 5 volts or trigger input circuitry will be damaged.** The Trigger input pins are:

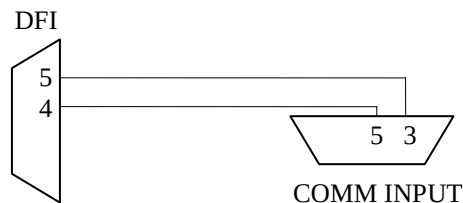
pin 2: TRIGIN+

pin 13: TRIGIN-

2. Interlock Connection

The S300 chassis interlock inhibits module outputs. It is connected at the COMM IN connector. This signal enables S300 operation by shorting pins 3 and 5. When shipped the S300 has the connector installed with pins 3 and 5 shorted to avoid any start up problems. The short should be removed when wiring this interlock into a system.

This interlock could be wired to the DFI which would inhibit all outputs if an error was detected. The following connection could be made to achieve this:



The interlock pins are:

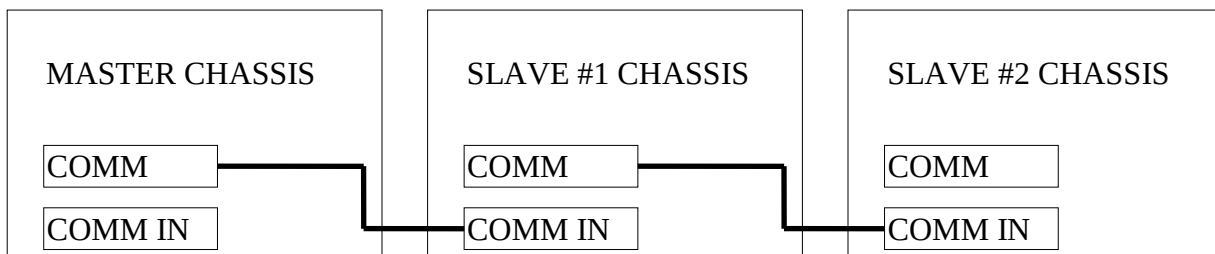
pin 5: INTERLOCK

pin 3: GNDSYS

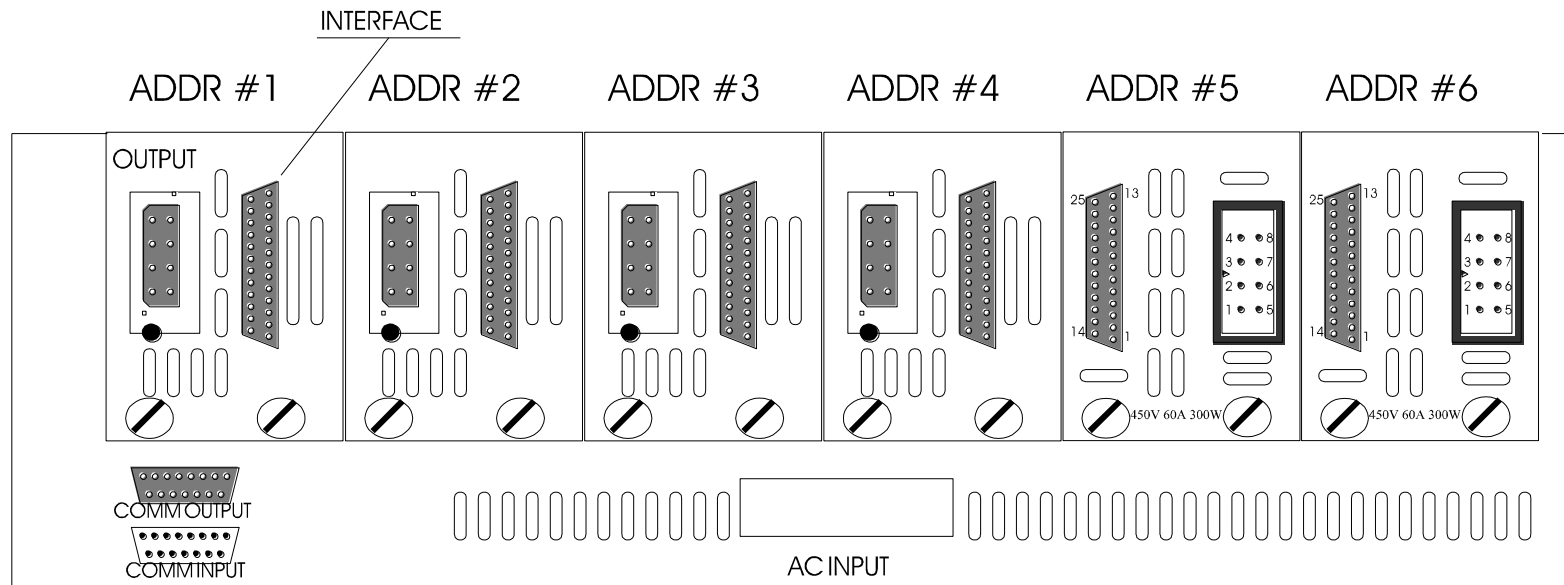
3. Auxiliary Chassis Connection

If an auxiliary chassis is being used, a cable is provided to connect the controlling S300 chassis to the auxiliary chassis. Connection is made from the connector labeled "COMM OUT" on the controlling chassis to the connector labeled "COMM IN" on the auxiliary chassis.

Additional auxiliary units can be daisy chained from auxiliary chassis #1 to auxiliary chassis #2 and so on in the same fashion.

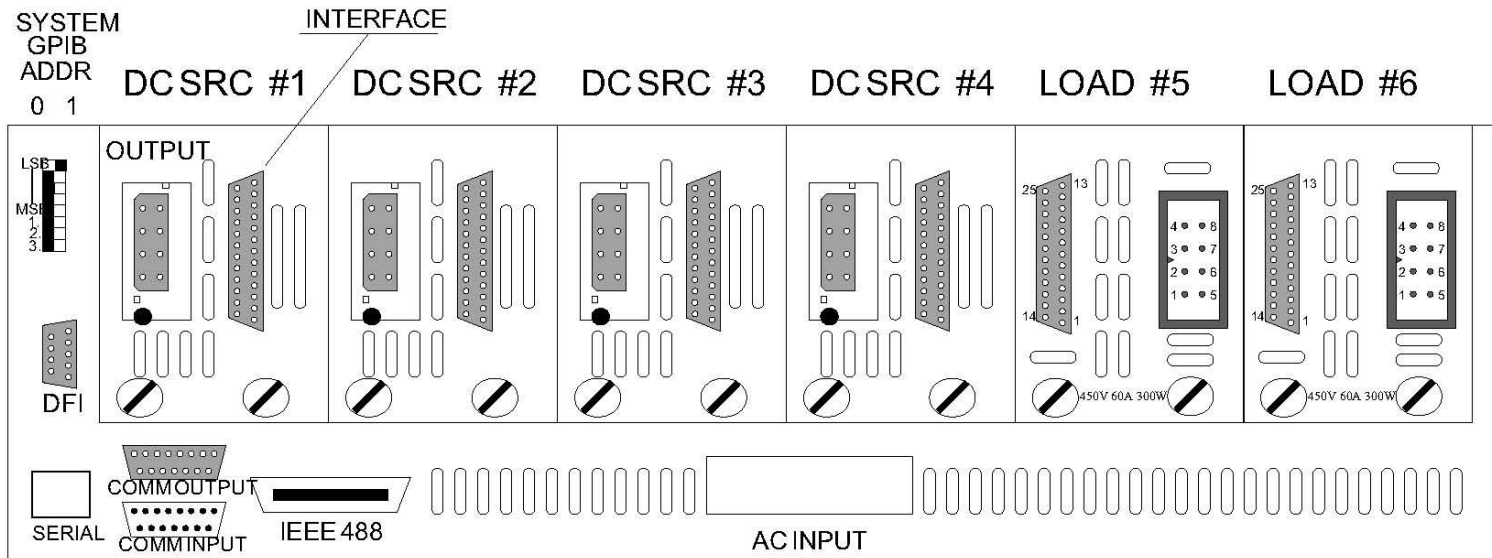


Auxiliary Output Connections



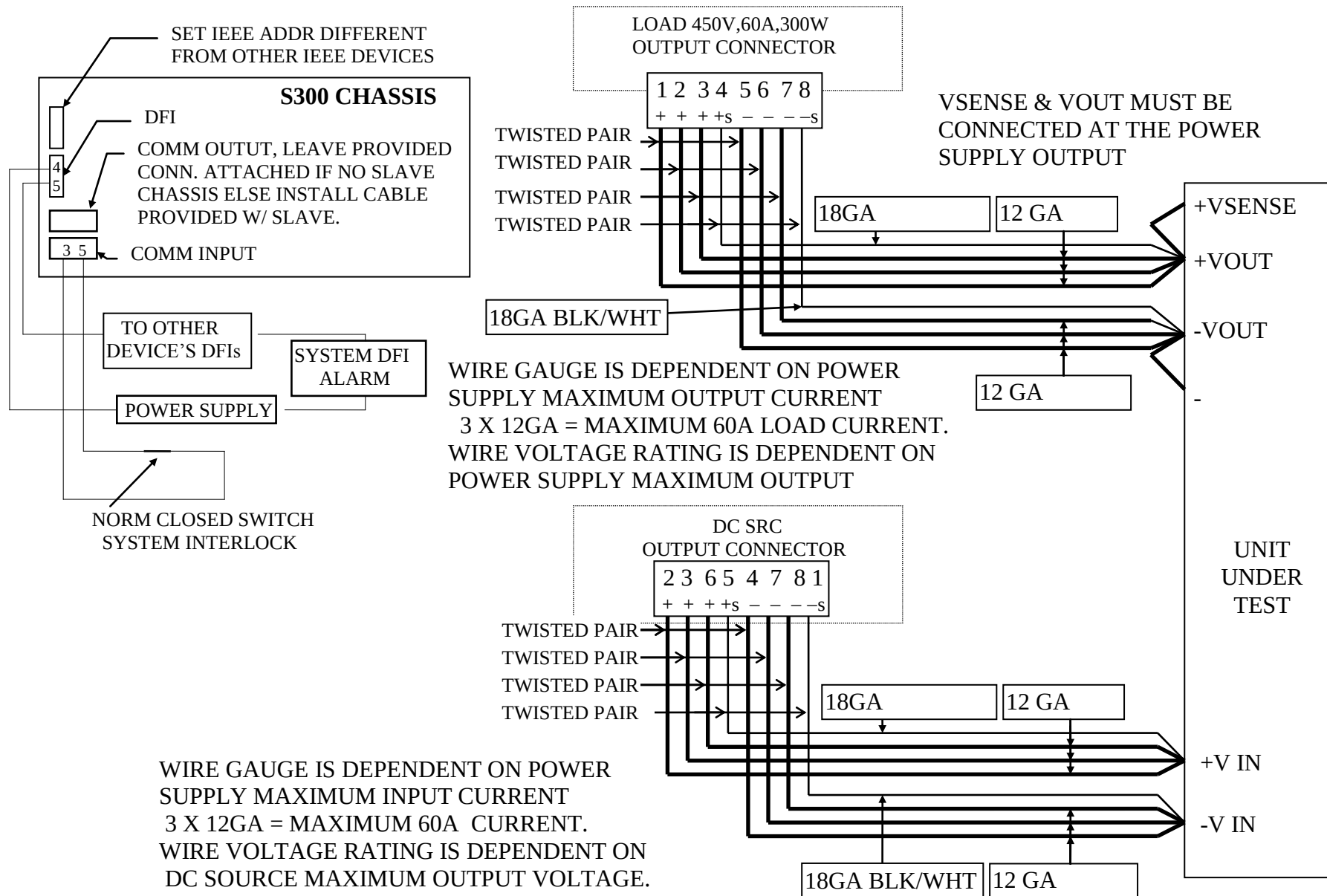
NOTE: SYSTEM INTERLOCK OF THE COMM INPUT
PINS 3 & 5 MUST BE SHORTED TOGETHER
TO ALLOW SYSTEM OPERATION.

1. S6000 Emulation Mode Enable
2. Macro Operator Mode
3. Flash download and Calibrate Enable



NOTE: SYSTEM INTERLOCK OF THE COMM INPUT
PINS 3 & 5 MUST BE SHORTED TOGETHER
TO ALLOW SYSTEM OPERATION.

1. S6000 Emulation Mode Enable
2. Macro Operator Mode
3. Flash download and Calibrate Enable



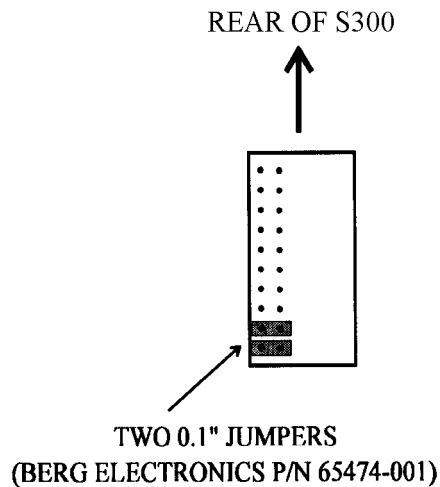
2.4 Module Installation and Removal

Before a module is inserted into the S300 chassis, the MODULE ADDRESS needs to be set. The address must be a unique number (for a given controller chassis) between hexadecimal 1 and 3F (decimal 1 and 63). This address is programmed into the module using the dip switch. On DC source modules, this switch is located in the front (air entry end) of the module; on load modules it is located near the rear of the module, at the bottom edge. To set a binary zero, press the corresponding switch down, to set a one, leave the switch up.

Each S300 module has two connectors which plug into the motherboard inside the S300 chassis. Mate modules with the motherboard from the rightmost slot toward the leftmost with respect to the S300 front panel. If there is a filler panel in that slot, remove it first by unscrewing the two holding screws. Once the module has been placed firmly into the S300 slot, align and tighten the thumbscrews located on the rear of the DC module.

If it is desired to leave a slot blank, two bus continuation connectors must be placed in each slot that is to be skipped.

NOTE: You must not leave a blank slot between paralleled load modules.



2.4.1 Chassis COMM IN Connector

N.H. P/N	DESCRIPTION	QTY	COMMERCIAL PART NUMBER	MANUFACTURER.
6200844	DSUB 15 SOCKET PLUG	1	DA15S	ITT CANNON
6200800	DSUB SHELL	1	DA24658	ITT CANNON
6201309	DSUB SCREW LOCK	2	D20419-21	ITT CANNON

2.4.2 Chassis COMM OUT Connector

N.H. P/N	DESCRIPTION	QTY	COMMERCIAL PART NUMBER	MANUFACTURER.
6200799	DSUB 15 PIN SOCKET	1	DA15P	ITT CANNON
6200800	DSUB SHELL	1	DA24658	ITT CANNON
6201309	DSUB SCREW LOCK	2	D20419-21	ITT CANNON

2.4.3 Manufactures Description

POSITRONICS INDUSTRIES, INC.
423 N. CAMPBELL AVE.
P.O. BOX 8247
SPRINGFIELD, MO. 65801
PH# 417-866-2322 FAX# 417-866-4115

CANNON ITT
10550 TALBERT AVE.
P.O. BOX 8040
FOUNTAIN VALLEY, CA. 92708
PH# 714-964-7400

AVAILABLE OPTIONS

2.5 Module Types

Type	Voltage (V)	Current (A)	Power (W)	Description
0	-	-	-	System Controller
1	10	60	400	DC Source Module
2	60	16	400	DC Source Module
3	80	12	400	DC Source Module
4	400	3	400	DC Source Module
11*	10	30	200	DC Source Module
12*	60	8	200	DC Source Module
13*	80	6	200	DC Source Module
14*	400	1.5	200	DC Source Module
31	450	60	300	Load Module
33	80	60	300	Load Module

* These module types have been discontinued.