Chroma

Programmable DC Electronic Load

63600 Series

Operation & Programming Manual

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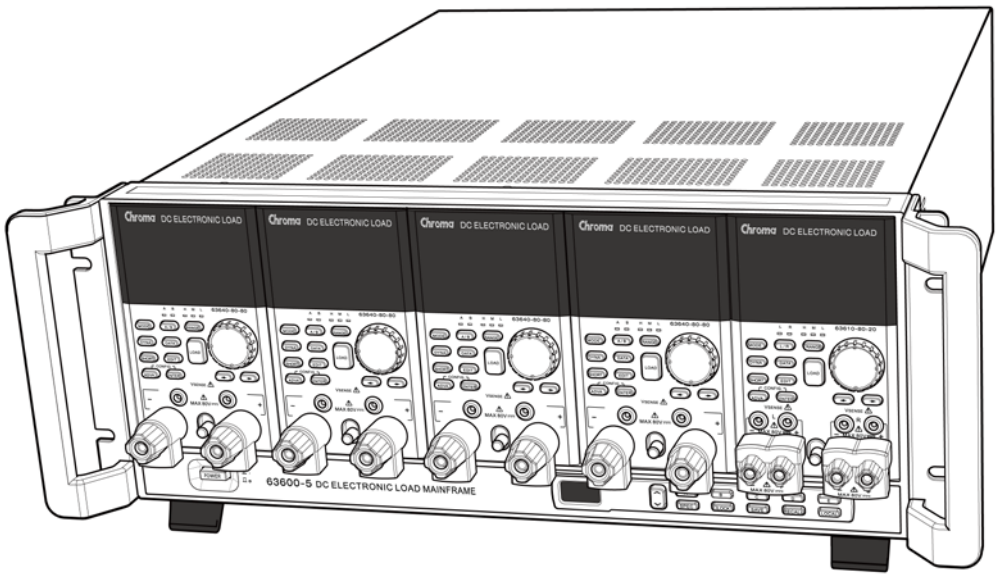

Version 2.5
December 2019

Legal Notices

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CHROMA ATE INC.
66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

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Fax: 886-3-327-8898
e-mail: info@chromaate.com

http://www.chromaate.com

Material Contents Declaration

The recycling label shown on the product indicates the Hazardous Substances contained in the product as the table listed below.


: See **<Table 1>**.


: See **<Table 2>**.

<Table 1>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls/ Polybromodiphenyl Ethers	Selected Phthalates Group
	Pb	Hg	Cd	Cr^{6+}	PBB/PBDE	DEHP/BBP/DBP/DIBP
PCBA	O	O	O	O	O	O
CHASSIS	O	O	O	O	O	O
ACCESSORY	O	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

“O” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

“×” indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

Remarks:
1. The CE marking on product is a declaration of product compliance with EU Directive 2011/65/EU.
2. This product is complied with EU REACH regulation and no SVHC in use.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

<Table 2>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls/ Polybromodiphenyl Ethers	Selected Phthalates Group
	Pb	Hg	Cd	Cr^{6+}	PBB/PBDE	DEHP/BBP/DBP/DIBP
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

"O" indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

1. Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product's specification.
3. This product is complied with EU REACH regulation and no SVHC in use.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

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CE

Declaration of Conformity

For the following equipment :

Programmable DC Electronic Load

(Product Name/ Trade Name)

63600-1, 63600-5, 63601-5, 63610-80-20, 63630-80-60, 63640-80-80

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2013,Table 2, CISPR 11:2009+A1:2010 Group 1 Class A

EN 61000-3-2:2006+A1:2009+A2:2009 Class A, EN 61000-3-3:2013

IEC 61000-4-2:2008, IEC 61000-4-3:2006+A1:2007+A2:2010, IEC 61000-4-4:2012,
IEC 61000-4-5:2005, IEC 61000-4-6:2008, IEC 61000-4-8:2009, IEC 61000-4-11:2004

EN 61010-1:2010

The equipment describe above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The following importer/manufacturer or authorized representative established within the EUT is responsible for this declaration :

CHROMA ATE INC.

(Company Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

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CE

Declaration of Conformity

For the following equipment :

Programmable DC Electronic Load

(Product Name/ Trade Name)

63600-2

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2013

EN 55011:2009+A1:2010 Group 1 Class A, EN 61000-3-2:2014, EN 61000-3-3:2013,
IEC 61000-4-2 Edition 2.0 2008-12, IEC 61000-4-3 Edition 3.2 2010-04,
IEC 61000-4-4 Edition 3.0 2012-04, IEC 61000-4-5 Edition 2.0 2005-11,
IEC 61000-4-6 Edition 3.0 2008-10, IEC 61000-4-8 Edition 2.0 2009-09,
IEC 61000-4-11 Edition 2.0 2004-03

EN 61010-1:2010

The equipment describe above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The following importer/manufacturer or authorized representative established within the EUT is responsible for this declaration :

CHROMA ATE INC.

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66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

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Declaration of Conformity

For the following equipment :

Programmable DC Electronic Load

(Product Name/ Trade Name)

63630-600-15

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2013,Table 2, CISPR 11:2009+A1:2010 Group 1 Class A

EN 61000-3-2:2006+A1:2009+A2:2009 Class A, EN 61000-3-3:2013

IEC 61000-4-2:2008, IEC 61000-4-3:2006+A1:2007+A2:2010, IEC 61000-4-4:2012,
IEC 61000-4-5:2005, IEC 61000-4-6:2008, IEC 61000-4-8:2009, IEC 61000-4-11:2004

EN 61010-1:2010 and EN 61010-2-030:2010

The equipment describe above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The following importer/manufacturer or authorized representative established within the EUT is responsible for this declaration :

CHROMA ATE INC.

(Company Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

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Declaration of Conformity

For the following equipment :

Programmable DC Electronic Load

(Product Name/ Trade Name)

63640-150-60

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2013

EN 55011:2009+A1:2010 Class A, EN 61000-3-2:2006/A1:2009 and /A2:2009,
EN 61000-3-3:2008, IEC 61000-4-2:2008, IEC 61000-4-3:2006/A1:2007/A2:2010,
IEC 61000-4-4:2004/A1:2010, IEC 61000-4-5:2005, IEC 61000-4-6:2008,
IEC 61000-4-8:2009, IEC 61000-4-11:2004

EN 61010-1:2010 and EN 61010-2-030:2010

The equipment describe above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The following importer/manufacturer or authorized representative established within the EUT is responsible for this declaration :

CHROMA ATE INC.

(Company Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

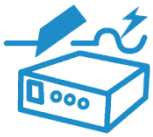
Warning:
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the instrument. *Chroma* assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER
Verify that the power is set to match the rated input of this power supply.

PROTECTIVE GROUNDING
Make sure to connect the protective grounding to prevent an electric shock before turning on the power.



NECESSITY OF PROTECTIVE GROUNDING
Never cut off the internal or external protective grounding wire, or disconnect the wiring of protective grounding terminal. Doing so will cause a potential shock hazard that may bring injury to a person.

FUSES
Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE
Do not operate the instrument in the presence of flammable gases or fumes. The instrument should be used in an environment of good ventilation.

DO NOT REMOVE THE COVER OF THE INSTRUMENT
Operating personnel must not remove the cover of the instrument. Component replacement and internal adjustment can be done only by qualified service personnel.

Safety Symbols

	**DANGER –** High voltage.
	**Explanation:** To avoid injury, death of personnel, or damage to the instrument, the operator must refer to the explanation in the instruction manual.
	**High temperature:** This symbol indicates the temperature is hazardous to human beings. Do not touch it to avoid any personal injury.
	**Protective grounding terminal:** This symbol indicates that the terminal must be connected to ground before operation of the equipment to protect against electrical shock in case of a fault.
	**Functional grounding:** To identify an earth (ground) terminal in cases where the protective ground is not explicitly stated. This symbol indicates the power connector does not provide grounding.
	**Frame or chassis:** To identify a frame or chassis terminal.
	**Alternating Current (AC)**
	**Direct Current (DC) / Alternating Current (AC)**
	**Direct Current (DC)**
	**Push-on/Push-off power switch**
	The **WARNING** sign highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.
	The **CAUTION** sign highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in damage to, or destruction of, equipment.
	The **Notice** sign highlights an essential operating or maintenance procedure, condition, or statement.

Hazardous Operating Conditions

1. Do not touch the test area when the Electronic Load's output is enabled. Electrical shock could result in physical injury or death.

   Be sure to observe the following rules:
   - Use a standard power cord and make sure the earth ground is properly connected.
   - Do not touch the output terminal.
   - Do not touch the test wire that is connected to the terminal under test.
   - Do not touch any unit under test.
   - Do not touch the test unit right after the test has ended or when the output has just been turned off. It can take several seconds for the high voltage to bleed off.

2. Shock accidents usually occur under the following conditions:
   - The earth terminal is not properly connected.
   - Insulating gloves are not used during testing.
   - Touching the test unit immediately after the test is done.

3. Remote control mainframe: The high voltage output of this DC Electronic Load can be remotely controlled via an external control signal. When the Electronic Load is being remotely controlled, be sure to follow the safety guidelines below:

   - Do not allow any operator or other personnel to touch the DUT or test cable when high voltage is being output from the mainframe.

CAUTION

1. Do not bundle or cross the high voltage cable with the RS-232, GPIB control cables, or other low voltage side wires. It could damage the product or PC controller.
2. To avoid fire, overheating and electrical hazards from occurring, be sure to check the alligator clips attached to the cable and the COMON (RTN/LOW) and OUTPUT (high voltage output) terminals on the connector are not fallen or damaged before operation.

Storage, Freight, Maintenance, and Cleaning

Storage
When not in use, pack the device properly and store in a suitable environment.

Freight
Pack the device carefully before moving it. If any of the original packing material is missing, use suitable alternative material and mark it “fragile” and “keep away from water” to avoid damaging the product. This product is a piece of precision test equipment; do not drop or hit it.

Maintenance
In case of any malfunction or abnormality, refer to the manual, or contact your local distributor for prompt service. Do not touch any parts inside the instrument to avoid any danger to yourself or damage to the product.

Cleaning
Be sure to unplug the input power cord from the device and remove all other connected wires before cleaning. Use a brush to clean the dust off the machine surface and a low pressure air gun to clean the dust inside the device or send it to your local distributor for cleaning.

Revision History

The following lists the additions, deletions and modifications in this manual at each revision.

Date	Version	Revised Sections
Feb. 2008	1.0	Complete this manual.
Sep. 2008	1.1	Modify the description of section "*Protection Features*" in the chapter of "*Operation Overview*." Modify the following sections in the chapter of "*Local Operation*": – "*Setting Dynamic Load Frequency Sweep Value*" for setting slew rate. – "*Setup of Current Interrupt Function*" for setting Load On Time. – "*Setup of Program Sequences Function*" for selecting range. Add the following chapters: – "*Remote Operation*" – "*Status Reporting*"
Mar. 2009	1.2	Correct the errors in the manual. Add the following sections: – "*Load ALL RUN*" and "*Sine Wave Dynamic*" in the chapter of "*Operation Overview*." – "*Sine Wave Dynamic*" in the chapter of "*Local Operation*." – "*Selecting the LAN Type to be Connected*", "*Setting Network Parameter (IP, Subnet Mask, Gateway)*", "*Confirming Network Connection is Successful*" and "*Communicating with Instruments*" in the chapter of "*Remote Operation*."
Apr. 2010	1.3	Add the followings: – Digitizing function. – 63600-2 Pin Assignments of the System I/O Port Connector. – 63600-1 Pin Assignments of the System I/O Port Connector. – Description of SYNCW. – 63600-1 & 63600-2 mainframe layout dimensions. – 63610-80-20 & 63640-80-80 outlines. – 63600-1 mainframe outline. – 63600-2 specification. – 63610-80-20, 63630-80-60, 63640-80-80 Constant Impedance Mode specification. Modify the followings: – 63600-1 Input Rating specification. – 63610-80-20, 63630-80-60, 63640-80-80 specification (Power, CR Mode range, Voltage read back accuracy, Others & Note 3.) Correct the following errors: – CONFigure:ALLRun – DIGitizing:WAVeform:DATA? – FETCh:AH? – FETCh:WH? – System Bus Port: 8-pin connector to 10-pin connector.
May 2012	1.4	Add the following: – CE Declaration for model 63600-1, 63600-2 & 63630-600-15. – Diagram for standard package and accessories list. – Specification of new model 63630-600-15.

		– Caution for securing binding post. – Caution for Timing Measurement Function. – Definition of minimum drive current for Ext. Wave. – Configuration list on the panel for factory default. – "*Verification*" and "*Appendix A*" new chapters. Modify the following: – Program sequence flow chart.
Dec. 2012	1.5	Add "*MPP Tracker*" section in the chapter of "*Local Operation*." Modify the Input Rating specification for model 63600-1, 63600-2 and 63600-5.
Mar. 2013	1.6	Add the following: − "*User Defined Waveform*" section in the chapter of "*Local Operation*." − Appendix "*How to Use 63600 UDW to Download Softpanel*." Modify the following in the chapter of "*Remote Operation*": − "*ADVANCE Subsystem*" − "*CONFIGURE Subsystem*" − "*FETCH Subsystem*" − "*MODE Subsystem*" − "*SYSTEM Subsystem*"
Aug. 2013	1.7	Update the CE Declaration.
Feb. 2014	1.8	Update the CE Declaration. Modify "*Digitizing Function*" section in the chapter of "*Operation Overview*." Add a Notice in the section of "*Remote Sensing Connections*." Add the contents of "*Select the current range*" in the section of "*Setting CR Values.*" Modify the syntax description in the sections of "*CONFIGURE Subsystem*", "*DIGITIZING Subsystem*" and "*RESISTANCE Subsystem.*
Jul. 2014	1.9	Add specifications and the related information of Model 63601-5 in the manual.
Feb. 2015	2.0	Add the following: − S*pecifications* and related information of Model 63640-150-60 in the manual. − "LVP" related information in the section of "*Protection Features*." − Operating conditions in CR mode.
Oct. 2016	2.1	Update CE "*Declaration of Conformity*". Update the specification tables in the following sections for "*CV Mode Verification*" under the chapter of "*Verification*": − "*Checking High Voltage Range*". − "*Checking Medium Voltage Range*". − "*Checking Low Voltage Range*".
Jul. 2017	2.2	Update "*Material Contents Declaration*" and CE "*Declaration of Conformity*". Update the accessory list and icon in "*Inspection*" section. Add example to "*CP Mode Verification*" in the chapter of "*Verification*". Add Ext Wave_Bandwidth to Dynamic CC Mode in "*Specifications*" section.
Apr. 2019	2.3	Add the following: − General descriptions of "*Hazardous Operating Conditions*" and

		"*Storage, Freight, Maintenance, and Cleaning*". − "*Precautions before Installation*" and "*Maintenance Precautions*" sections in "*Installation and Maintenance*" chapter. Modify the following sections: − "*Specifications*" in "*General Information*" chapter. − "*Dynamic and Slew Rate Circuit Test*" in "*Verification*" chapter.
Sep. 2019	2.4	Modify the following: − "Inspection" section in "Installation and Maintenance" chapter − "User Defined Waveform (UDW)" in "Local Operation" chapter − "*ADVANCE Subsystem*" section in "*Remote Operation*" chapter − Appendix "*Using the 63600 Soft Panel Downloaded UDW*" Add the following: − "*COMMUNICATE Subsystem*" section to "*Remote Operation*" chapter
Dec. 2019	2.5	Update "*Setting CV Values*" and "*Setup of System Configuration*" sections in "*Local Operation*" chapter.

Table of Contents

1. General Information

1.1 Introduction

This manual contains specifications, installation, operation and programming of 63600 Programmable DC Electronic Load.

The Chroma 63600 Programmable DC Electronic Load System consists of model 63600-1, 63600-2, 63600-5, 63601-5 mainframes, and 63630-80-60, 63610-80-20, 63640-80-80, 63630-600-15 and 63640-150-60 Electronic Load modules.

1.2 Description

The 63600-5, 63601-5 Electronic Load mainframes contain slot for 5 load modules. The 63600-5 mainframe contains a processor, two System Bus ports, a USB port, a GPIB card (optional), an Ethernet card (optional), a front-panel keypad, a memory channel indicator, and other circuits common to all the load modules.

The Electronic Load module is designed to be plugged into any mainframe and offers a stand-alone operational mode. In addition, the 63600-5 and 63601-5 mainframes can be controlled via a A636000 GPIB or A636001 Ethernet or USB bus by a remote computer (see *Chapter 5 Remote Operation*), or via the System Bus by the remote controller.

The functions of the 63610-80-20, 63630-80-60, 63630-600-15, 63640-80-80, 63640-150-60…etc. modules are all the same except the variations in input voltage, load current, and power ratings. An individual module may have one or two channels. Each channel has its own channel number, load and measurement connectors, and operates independently in constant current (CC) mode, constant resistance (CR) mode, constant voltage (CV) mode, constant power (CP) mode, or Constant Impedance (CZ) mode.

The 63600 Programmable DC Electronic Load System is used for design, manufacturing, and evaluation of DC power supplies, batteries, and power components. This chapter contains the specifications of Electronic Load modules that apply to the Chroma 63600-5, 63601-5 Electronic Load mainframes, as well as key features concerning their application. The remaining chapters in this manual contain instructions for installing, operating, and programming the Electronic Load. The Chroma 63600-5 Mainframe with 5 Load Modules is shown in Figure 1-1 and the Chroma 63601-5 Mainframe with 5 Load Modules is shown in Figure 1-3. The Chroma 63600-2 Mainframe with 2 Load Modules is shown in Figure 1-3 while the Chroma 63600-1 Mainframe with single Load Module is shown in Figure 1-4. The Chroma 63610-80-20, 63630-80-60, 63640-80-80, 63640-150-60 and 63630-600-15 Load Modules are shown in Figure 1-5~Figure 1-9.

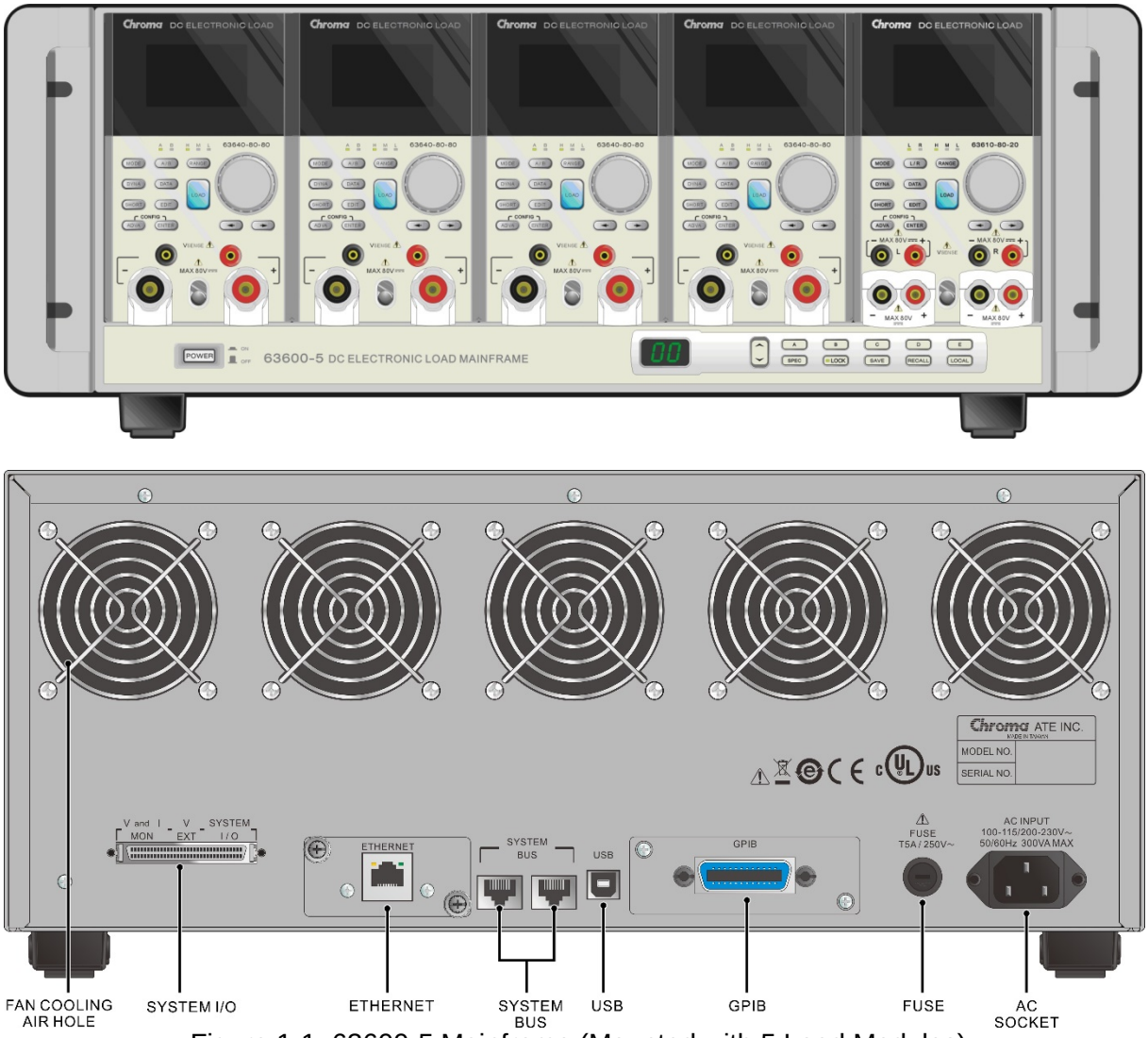


Figure 1-1 63600-5 Mainframe (Mounted with 5 Load Modules)

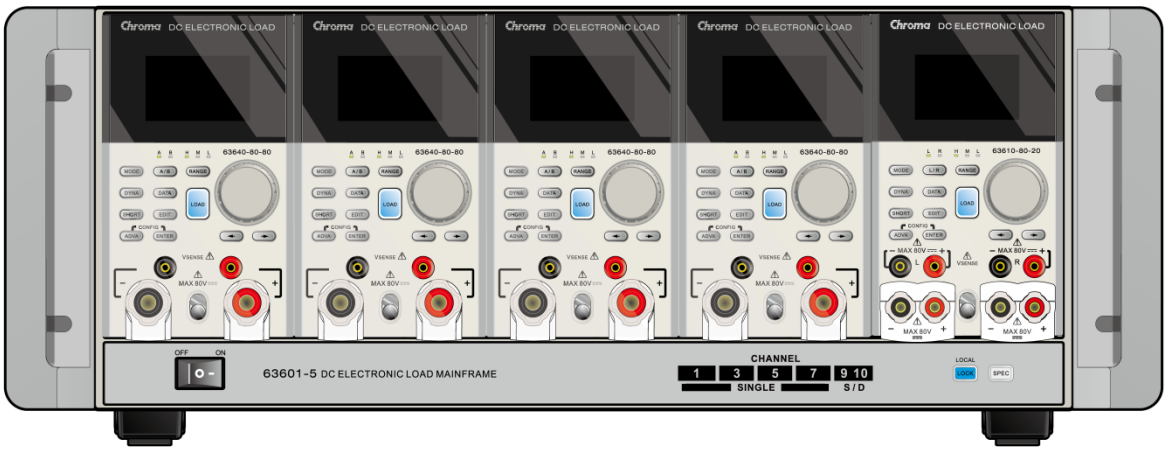


Figure 1-2 63601-5 Mainframe (Mounted with 5 Load Modules)

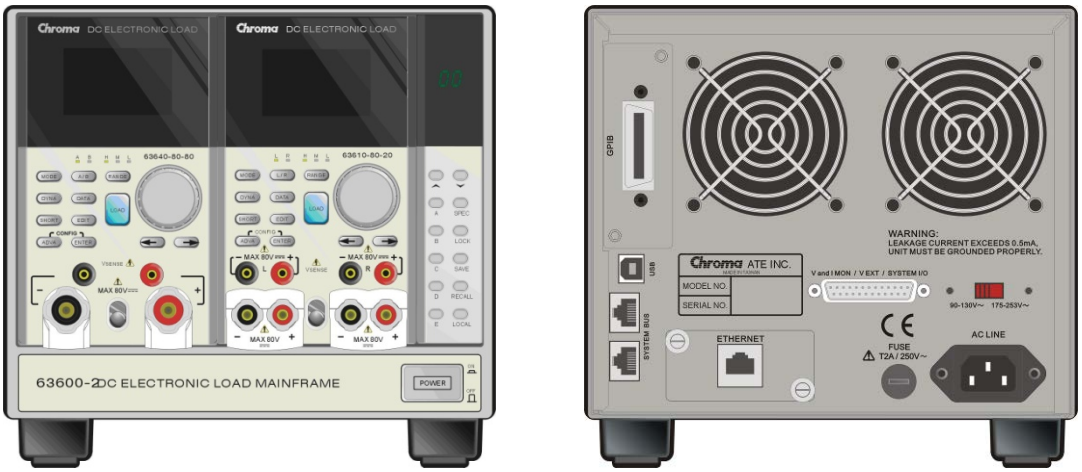


Figure 1-3 63600-2 Mainframe (Mounted with 2 Load Modules)

Figure 1-4 63600-1 Mainframe (Mounted with 1 Load Module)

Figure 1-5 63610-80-20 Load Module

Figure 1-6 63630-80-60 Load Module

Figure 1-7 63640-80-80 Load Module

Figure 1-8 63630-600-15 Load Module

Figure 1-9 63630-600-15 Load Module

1.3 Key Features Overview

1.3.1 Mainframe

- Flexible configuration using plug-in electronic load modules.
- Local operation from front panel keypad.
- Computer control via GPIB or Ethernet or USB and Remote controller via System Bus interface.
- Photo coupler isolation offers true floating Load.
- Automatic fan speed control to reduce noise. The maximum standby noise is 63dB[*1].
- Up to 10 channels in one Mainframe.

1.3.2 Load

- Constant current (CC), constant resistance (CR), constant voltage (CV), constant power (CP), and constant impedance (CZ) operation modes.
- Programmable slew rate, load levels, load periods, and conduct voltage (Von).
- Programmable dynamic loading with speed up to 50 kHz. (Limited by Minimum Rise Time.)
- Minimum input resistance allows load to sink high current even with low input voltage

(0.8 V).
- Selective voltage and current ranges.
- Remote sensing capability.
- 100 sets of memories to save/recall user-definable setups.
- 10 sets of programs to link files for automatic test.
- 16-bit A/D converter with precision measurement.
- Short circuit simulation.
- Master/Slave parallel control mode allows synchronous load control under static and dynamic loading mode.
- Automatic GO/NG inspection to examine if the UUT is within spec.
- Independent GO/NG signals for each channel.
- Protection Over voltage, Over current, Overpower, Over temperature, Reverse polarity.

1.4 Specifications

Mainframe:	63600-5
AC input range:	1φ 100~115VAC ±10%V_{LN} Auto range
	1φ 200~230VAC ±10%V_{LN} Auto range
Fuse:	5A, 250V, Fast, Littelfuse, 5*20mm
Frequency:	50 to 60 Hz
Maximum VA:	300VA
Weight:	15.6kg / 34.39lbs
Dimension:	
Width:	447 mm / 17.6 inch
Height:	177 mm / 7.0 inch (without foot stand)
	194.8 mm / 7.7 inch (with foot stand)
Depth:	554.2 mm / 21.8 inch (with Load Module)

Mainframe:	63601-5
AC input range:	1φ 100~240VAC ±10%V_{LN}
Fuse:	10A, 250V
Frequency:	47 to 63 Hz
Maximum VA:	1000VA
Weight:	13.6kg / 29.98lbs.
Dimension:	
Width:	447 mm / 17.6 inch
Height:	177 mm / 7.0 inch (without foot stand)
	194.8 mm / 7.7 inch (with foot stand)
Depth:	554.2 mm / 21.8 inch (with Load Module)

★ The detail specifications of Load are listed in the next page.

CAUTION This equipment is not intended for performing measurements on CAT II, III or IV.

Notice

1. The equipment is for indoor use only.
2. The equipment may be used up to 2,000 meters altitude.
3. All specifications are tested under 20°C ~ 30°C unless otherwise noted.
4. The operational temperature range is 0°C ~ 40°C.
5. The operational relative humidity range is 10% to 90%. In a high

humidity environment, the equipment should be put in standby for half an hour before use in order to lower the humidity inside the unit.

6. The DC current accuracy specifications are generated after the input has been applied for 30 seconds.
7. The pollution degree of the equipment is 2.
8. The power for the 63600 series load module is supplied by the mainframe.
9. Do not hot swap a load module when the power is on.

SPECIFICATIONS-1						
Model	**63610-80-20**			**63630-80-60**		
Configuration	100Wx2			300Wx1		
Voltage *1*8	0~80V			0~80V		
Current	0~0.2A	0~2A	0~20A	0~0.6A	0~6A	0~60A
Power *2	0~16W	0~30W	0~100W	0~30W	60W	300W
Static Mode						
Typical min. operating voltage (DC)	0.5V@0.2A	0.5V@2A	0.5V@20A	0.5V@0.6A	0.5V@6A	0.5V@60A
Constant Current Mode						
Range	0~0.2A	0~2A	0~20A	0~0.6A	0~6A	0~60A
Resolution	0.01mA	0.1mA	1mA	0.01mA	0.1mA	1mA
Accuracy	0.1%+0.1%F.S.			0.1%+0.1%F.S.		
Constant Resistance Mode						
Range	CRL : 0.04~80Ω (100W/6V) CRM: 1.44~2.9kΩ (100W/16V) CRH: 5.76~12kΩ (100W/80V)			CRL : 0.015~30Ω (300W/6V) CRM: 0.3~600Ω (300W/16V) CRH: 1.5~3kΩ (300W/80V)		
Resolution *9	0.3288mS			0.9864mS		
Accuracy *3	0.1%+0.075S (6V) 0.1%+0.01S (16V) 0.1%+0.00375S (80V)			0.1%+0.2S (6V) 0.1%+0.03S (16V) 0.1%+0.01S (80V)		
Constant Voltage Mode						
Range	6V	16V	80V	6V	16V	80V
Resolution	0.1mV	1mV	1mV	0.1mV	1mV	1mV
Accuracy	0.05%+0.1%F.S.			0.05%+0.1%F.S.		
Constant Power Mode						
Range	0~2W	0~10W	0~100W	0~6W	0~30W	0~300W
Resolution *9	1mW	10mW	100mW	3.2mW	32mW	320mW
Accuracy *4	0.3%+0.3%F.S.			0.3%+0.3%F.S.		
Von/Voff Control*13						
Von&Voff Mode	CC / CR /CP			CC / CR /CP		
Accuracy	0.2%FS			0.2%FS		
Dynamic Mode - CC						
Min. Operating Voltage *11	1.5V			1.5V		
T1&T2	0.01ms~99.999ms / 100ms~100s					
Accuracy	1μs/1ms+100ppm			1μs/1ms+100ppm		
Slew rate	0.04A/ms~ 0.02A/μs	0.4A/ms~ 0.2A/μs	4A/ms~2A/μs	0.12A/ms~ 0.06A/μs	1.2A/ms~ 0.6A/μs	12A/ms~6A/μs
Resolution	0.01mA/μs	0.1mA/μs	1mA/μs	0.01mA/μs	0.1mA/μs	1mA/μs
Accuracy	10% ±20μs			10% ±20μs		
Min. Rise Time	10μs			10μs		
Current						
Range	0~0.2A	0~2A	0~20A	0~0.6A	0~6A	0~60A
Resolution	0.01mA	0.1mA	1mA	0.01mA	0.1mA	1mA
Ext Wave						
Mode	CC			CC		
Bandwidth	20kHz			20kHz		
Range	0~0.2A	0~2A	0~20A	0~0.6A	0~6A	0~60A
Level	0~10V			0~10V		
Accuracy	0.5%F.S.			0.5%F.S.		
Program mode						
Sequence No.	100/Program			100/Program		
Dwell / SEQ	0.1ms ~ 30s (Resolution : 0.1ms)			0.1ms ~ 30s (Resolution : 0.1ms)		
Load Setting	Refer to Static mode specifications			Refer to Static mode specifications		
Spec Check	Voltage/Current/Power			Voltage/Current/Power		
Measurement						
Voltage Read Back						
Range	0~6V	0~16V	0~80V	0~6V	0~16V	0~80V
Resolution	0.1069mV	0.2849mV	1.3537mV	0.1069mV	0.2849mV	1.3537mV
Accuracy *5	0.025%+0.01%F.S.		0.01%+0.025%F.S.	0.025%+0.01%F.S.		0.01%+0.025%F.S.
Current read back						
Range	0~0.2A	0~2A	0~20A	0~0.6A	0~6A	0~60A
Resolution	0.003349mA	0.034628mA	0.329561mA	0.009942mA	0.101748mA	1.009878mA
Accuracy *5	0.05%+0.05%F.S.			0.05%+0.05%F.S.		
Power read back						
Range	16W	30W	100W	30W	60W	300W
Accuracy *4 *5	0.1%+0.1%F.S.			0.1%+0.1%F.S.		

Voltage Monitor						
Bandwidth	20 kHz			20 kHz		
Range	0~6V	0~16V	0~80V	0~6V	0~16V	0~80V
Output	0~10V			0~10V		
Accuracy	0.5%F.S.			0.5%F.S.		
Current Monitor						
Bandwidth	20 kHz			20 kHz		
Range	0~0.2A	0~2A	0~20A	0~0.1A	0~1A	0~10A
Output	0~10V			0~10V		
Accuracy	0.5%F.S.			0.5%F.S.		
Protection						
Over Power	Yes			Yes		
Over Current	Yes			Yes		
Over Voltage Alarm *[8]	Yes			Yes		
Over Temperature	Yes			Yes		
Reverse	Yes			Yes		
Interface						
USB	Standard			Standard		
Remote controller	Optional			Optional		
Ethernet	Optional			Optional		
GPIB	Optional			Optional		
System Bus	Master/Slave & Remote Controller			Master/Slave & Remote Controller		
Others						
Dout						
No. of bits	2 bits per mainframe			2 bits per mainframe		
Level - H	1.8V/3.3V/5V switchable			1.8V/3.3V/5V switchable		
Level - L	<0.6V@Isink=10mA			<0.6V@Isink=10mA		
Drive	Pull_up resistor = 4.7kΩ			Pull_up resistor = 4.7kΩ		
Din (TTL Compatible)						
No. of bits	2 bits per mainframe			2 bits per mainframe		
External Trig. for Digitizing(TTL Compatible, Rising edge)						
No. of bits	1 bit per mainframe			1 bit per mainframe		
External Trig. for Auto Sequences(TTL Compatible, Rising edge)						
No. of bits	1 bit per mainframe			1 bit per mainframe		
Load ON - O/P						
Level	TTL Compatible, Active High			TTL Compatible, Active High		
Short ON - O/P						
No. of channels	2 channels per 63600-1 mainframe 4 channels per 63600-2 mainframe 10 channels per 63600-5 mainframe			2 channels per 63600-1 mainframe 4 channels per 63600-2 mainframe 10 channels per 63600-5 mainframe		
Level	TTL Compatible, Active High			TTL Compatible, Active High		
Input Capacity	4.7µF+0.56Ω(2W)			4.7µF+0.56Ω(2W)		
General						
Short circuit						
Current *[6]	Set to 100% of rated current			Set to 100% of rated current		
Input Resistance (Load Off), Typical *[12]	60kΩ (6V) 150kΩ (16V) 700kΩ (80V)			60kΩ (6V) 150kΩ (16V) 700kΩ (80V)		
Dimensions (HxWxD)	142x86x514mm / 5.6x3.4x20.2 inch			142x86x514mm / 5.6x3.4x20.2 inch		
Weight	5kg / 11 lbs			4kg / 8.8 lbs		
Operating Temperature	0~40°C			0~40°C		
Storage Temperature	-20~80°C			-20~80°C		
Power	Supply from mainframe			Supply from mainframe		
EMC & Safety	CE			CE		

SPECIFICATIONS-2						
Model	**63630-600-15**			**63640-80-80**		
Configuration	300Wx1			400Wx1		
Voltage *1*8	0~600V			0~80V		
Current	0~0.15A	0~1.5A	0~15A	0~0.8A	0~8A	0~80A
Power *2	90W	300W	300W	60W	60W	400W
Static Mode						
Typical min. operating voltage (DC)	2V@0.15A	2V@1.5A	2V@15A	0.4V@0.8A	0.4V@8A	0.4V@80A
Constant Current Mode						
Range	0~0.15A	0~1.5A	0~15A	0~0.8A	0~8A	0~80A
Resolution	0.005mA	0.05mA	0.5mA	0.01mA	0.1mA	1mA
Accuracy	0.1%+0.1%F.S.			0.1%+0.1%F.S.		
Constant Resistance Mode						
Range	CRL : 0.133~270Ω (300W/80V) CRM: 1.92~4kΩ (300W/150V) CRH: 208~200kΩ (300W/600V)			CRL : 0.01~20Ω (400W/6V) CRM: 0.36~720Ω (400W/16V) CRH: 1.45~2.9kΩ (400W/80V)		
Resolution *9	0.2661mS			1.322mS		
Accuracy *3	0.1%+0.02S (80V) 0.1%+0.0005S (150V) 0.1%+0.0003S (600V)			0.1%+0.275S (6V) 0.1%+0.036S (16V) 0.1%+0.01375S (80V)		
Constant Voltage Mode						
Range	80V	150V	600V	6V	16V	80V
Resolution	1mV	10mV	10mV	0.1mV	1mV	1Mv
Accuracy	0.05%+0.1%F.S.			0.05%+0.1%F.S.		
Constant Power Mode						
Range	0~6W	0~30W	0~300W	0~8W	0~40W	0~400W
Resolution *9	5.625mW	56.25mW	562.5mW	4mW	40mW	400mW
Accuracy *4	0.3%+0.3%F.S.			0.3%+0.3%F.S.		
Von/Voff Control*13						
Von&Voff Mode	CC / CR /CP			CC / CR /CP		
Accuracy	0.2%FS			0.2%FS		
Dynamic Mode - CC						
Min. Operating Voltage *11	3V			1.5V		
T1&T2	0.01ms~99.999ms / 100ms~100s					
Accuracy	1μs/1ms+100ppm			1μs/1ms+100ppm		
Slew rate	0.03A/ms~ 0.015A/μs	0.3A/ms~ 0.15A/μs	3A/ms~ 1.5A/μs	0.16A/ms~ 0.08A/μs	1.6A/ms~ 0.8A/μs	16A/ms~ 8A/μs
Resolution	0.005mA/μs	0.05mA/μs	0.5mA/μs	0.01mA/μs	0.1mA/μs	1mA/μs
Accuracy	10% ±20μs			10% ±20μs		
Min. Rise Time	10μs			10μs		
Current						
Range	0~0.15A	0~1.5A	0~15A	0~0.8A	0~8A	0~80A
Resolution	0.005mA	0.05mA	0.5mA	0.01mA	0.1mA	1mA
Ext Wave						
Mode	CC			CC		
Bandwidth	20kHz			20kHz		
Range	0~0.15A	0~1.5A	0~15A	0~0.8A	0~8A	0~80A
Level	0~10V			0~10V		
Accuracy	0.5%F.S.			0.5%F.S.		
Program mode						
Sequence No.	100/Program			100/Program		
Dwell / SEQ	0.1ms ~ 30s (Resolution : 0.1ms)			0.1ms ~ 30s (Resolution : 0.1ms)		
Load Setting	Refer to Static mode specifications			Refer to Static mode specifications		
Spec Check	Voltage/Current/Power			Voltage/Current/Power		
Measurement						
Voltage Read Back						
Range	0~80V	0~150V	0~600V	0~6V	0~16V	0~80V
Resolution	1.4194mV	2.661mV	10.645mV	0.1069mV	0.2849mV	1.3537mV
Accuracy *5	0.025%+0.01%F.S.		0.01%+0.025%F.S.	0.025%+0.01%F.S.		0.01%+0.025%F.S.
Current read back						
Range	0~0.15A	0~1.5A	0~15A	0~0.8A	0~8A	0~80A
Resolution	0.00275mA	0.0266mA	0.255mA	0.013695mA	0.138766mA	1.31406mA
Accuracy *5	0.05%+0.05%F.S.			0.05%+0.05%F.S.		
Power read back						
Range	0~90W	0~300W	0~300W	0~60W	0~60W	0~400W
Accuracy *4 *5	0.1%+0.1%F.S.			0.1%+0.1%F.S.		

Voltage Monitor						
Bandwidth	20 kHz			20 kHz		
Range	0~80V	0~150V	0~600V	0~6V	0~16V	0~80V
Output	0~10V			0~10V		
Accuracy	0.5%F.S.			0.5%F.S.		
Current Monitor						
Bandwidth	20 kHz			20 kHz		
Range	0~0.15A	0~1.5A	0~15A	0~0.8A	0~8A	0~80A
Output	0~10V			0~10V		
Accuracy	0.5%F.S.			0.5%F.S.		
Protection						
Over Power	Yes			Yes		
Over Current	Yes			Yes		
Over Voltage Alarm *[8]	Yes			Yes		
Over Temperature	Yes			Yes		
Reverse	Yes			Yes		
Interface						
USB	Standard			Standard		
Remote controller	Optional			Optional		
Ethernet	Optional			Optional		
GPIB	Optional			Optional		
System Bus	Master/Slave & Remote Controller			Master/Slave & Remote Controller		
Others						
Dout						
No. of bits	2 bits per mainframe			2 bits per mainframe		
Level - H	1.8V/3.3V/5V switchable			1.8V/3.3V/5V switchable		
Level - L	<0.6V@Isink=10mA			<0.6V@Isink=10mA		
Drive	Pull_up resistor = 4.7kΩ			Pull_up resistor = 4.7kΩ		
Din (TTL Compatible)						
No. of bits	2 bits per mainframe			2 bits per mainframe		
External Trig. for Digitizing(TTL Compatible, Rising edge)						
No. of bits	1 bit per mainframe			1 bit per mainframe		
External Trig. for Auto Sequences(TTL Compatible, Rising edge)						
No. of bits	1 bit per mainframe			1 bit per mainframe		
Load ON - O/P						
Level	TTL Compatible, Level, Active High			TTL Compatible, Level, Active High		
Short ON - O/P						
No. of channels	2 channels per 63600-1 mainframe 4 channels per 63600-2 mainframe 10 channels per 63600-5 mainframe			2 channels per 63600-1 mainframe 4 channels per 63600-2 mainframe 10 channels per 63600-5 mainframe		
Level	TTL Compatible, Level, Active High			TTL Compatible, Level, Active High		
Input Capacity	2.2μF+1.12Ω(2W)			9.4μF+0.675Ω(8W)		
General						
Short circuit						
Current *[6]	Set to 100% of rated current			Set to 100% of rated current		
Input Resistance (Load Off), Typical *[12]	366kΩ (80V) 600kΩ (150V) 2MΩ (600V)			60kΩ (6V) 150kΩ (16V) 700kΩ (80V)		
Dimensions (HxWxD)	142x86x514mm / 5.6x3.4x20.2 inch			142x86x514mm / 5.6x3.4x20.2 inch		
Weight	5kg / 11 lbs			4.5kg / 9.9 lbs		
Operating Temperature	0~40°C			0~40°C		
Storage Temperature	-20~80°C			-20~80°C		
Power	Supply from mainframe			Supply from mainframe		
EMC & Safety	CE			CE		

SPECIFICATIONS-3			
Model	**63640-150-60**		
Configuration	400Wx1		
Voltage *1~*8	0~150V		
Current	0~1A	0~6A	0~60A
Power	90W	400W	400W
Static Mode			
Typical min. operating voltage (DC)	0.3V@1A	0.3V@6A	1.8V@60A*15
Constant Current Mode			
Range	0~1A	0~6A	0~60A
Resolution	0.02mA	0.1mA	1mA
Accuracy	0.04%+0.04%F.S.*17		
Constant Resistance Mode			
Range	CRL : 0.03~60Ω (400W/16V)		
	CRM: 0.64~800Ω (400W/80V)		
	CRH: 6.25~1.5kΩ (400W/150V)		
Resolution *9	1mS		
Accuracy *3	0.1%+0.067S (16V)		
	0.1%+0.00625S (80V)		
	0.1%+0.002S (150V)		
Constant Voltage Mode			
Range	16V	80V	150V
Resolution	1mV	1mV	10mV
Accuracy	0.025%+0.025%F.S.		
Constant Power Mode			
Range	0~8W	0~40W	0~400W
Resolution *9	4mW	40mW	400mW
Accuracy *4	0.3%+0.3%F.S.		
Von/Voff Control*13			
Von&Voff Mode	CC / CR / CP		
Accuracy	0.2%FS		
Dynamic Mode - CC			
Min. Operating Voltage *11~*16	1.8V		
T1&T2	0.01ms~99.999ms / 100ms~100s		
Accuracy	1µs/1ms+100ppm		
Slew rate	0.2A/ms~	1.2A/ms~	12A/ms~
	0.1A/µs	0.6A/µs	6A/µs
Resolution	0.02mA/µs	0.1mA/µs	1mA/µs
Accuracy	10% ±20µs		
Min. Rise Time	10µs		
Current			
Range	0~1A	0~6A	0~60A
Resolution	0.02mA	0.1mA	1mA
Ext Wave			
Mode	CC		
Bandwidth	20kHz		
Range	0~1A	0~6A	0~60A
Level	0~10V		
Accuracy	0.5%F.S.		
Program mode			
Sequence No.	100/Program		
Dwell / SEQ	0.1ms ~ 30s (Resolution : 0.1ms)		
Load Setting	Refer to Static mode specifications		
Spec Check	Voltage/Current/Power		
Measurement			
Voltage Read Back			
Range	0~16V	0~80V	0~150V
Resolution	0.27mV	1.3mV	2.5mV
Accuracy *5	0.025%+0.01%F.S.		
Current read back			
Range	0~1A	0~6A	0~60A
Resolution	0.02mA	0.1mA	1mA
Accuracy *5	0.04%+0.04%F.S.		
Power read back			
Range	0~90W	0~400W	0~400W
Accuracy *4 *5	0.1%+0.1%F.S.		
Voltage Monitor			
Bandwidth	20 kHz		

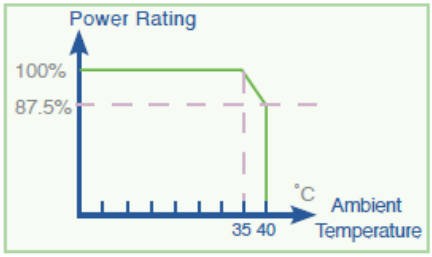
Range	0~16V	0~80V	0~150V
Output	0~10V		
Accuracy	0.5%F.S.		
Current Monitor			
Bandwidth	20 kHz		
Range	0~1A	0~6A	0~60A
Output	0~10V		
Accuracy	0.5%F.S.		
Protection			
Over Power	Yes		
Over Current	Yes		
Over Voltage Alarm *[8]	Yes		
Over Temperature	Yes		
Reverse	Yes		
Interface			
USB	Standard		
Remote controller	Optional		
Ethernet	Optional		
GPIB	Optional		
System Bus	Master/Slave & Remote Controller		
Others			
Dout			
No. of bits	2 bits per mainframe		
Level - H	1.8V/3.3V/5V switchable		
Level - L	<0.6V@Isink=10mA		
Drive	Pull_up resistor = 4.7kΩ		
Din (TTL Compatible)			
No. of bits	2 bits per mainframe		
External Trig. for Digitizing(TTL Compatible, Rising edge)			
No. of bits	1 bit per mainframe		
External Trig. for Auto Sequences(TTL Compatible, Rising edge)			
No. of bits	1 bit per mainframe		
Load ON - O/P			
Level	TTL Compatible, Level, Active High		
Short ON - O/P			
No. of channels	2 channels per 63600-1 mainframe 4 channels per 63600-2 mainframe 10 channels per 63600-5 mainframe 6 channels per 63601-5 mainframe		
Level	TTL Compatible, Level, Active High		
Input Capacity	2.35μF+0.9Ω(4W)		
General			
Short circuit			
Current *[6]	Set to 100% of rated current		
Input Resistance(Load Off), Typical *[12]	700kΩ		
Dimensions (HxWxD)	142x86x514mm / 5.6x3.4x20.2 inch		
Weight	4.5kg / 8.8 lbs		
Operating Temperature	0~40°C		
Storage Temperature	-20~80°C		
Power	Supply from mainframe		
EMC & Safety	CE		

Model	**63600-1**	**63600-2**
Number of slots	1 slot	2 slots
Operating temperature	0~40°C	0~40°C
Input Rating	1φ 100~115VAC ±10%V_{LN} 1φ 200~230VAC ±10%V_{LN} Switchable / 47~63Hz	1φ 100~115VAC ±10%V_{LN} 1φ 200~230VAC ±10%V_{LN} Switchable / 47~63Hz
Mainframe dimension (HxWxD)	177x90x554mm / 7.0x3.5x21.8 inch	177x210x554mm / 7.0x8.27x21.8 inch
Weight	7.5kg / 16.53lbs	11.5kg / 25.35lbs

Model*[14]	**63600-5**	**63601-5**
Number of slots	5 slots	5 slots
Operating temperature	0~40°C	0~40°C
Input Rating	1φ 100~115VAC ±10%V_{LN} 1φ 200~230VAC ±10%V_{LN}	1φ 100~240VAC ±10%V_{LN}

	Auto Range / 50~60Hz	Auto Range / 47~63Hz
Mainframe dimension (HxWxD)	177x447x554mm / 7.0x17.6x21.8 inch (Full Rack)	177x447x554mm / 7.0x17.6x21.8 inch (Full Rack)
Weight	15.6kg / 34.39lbs	13.6kg / 29.98lbs

NOTE*1: The maximum current loading below the minimum operating voltage (0.5V) will follow a derating curve.
NOTE*2: The 400W power rating of the 63640-80-80 is specified at an ambient temperature of 35°C; refer to the power rating curve on the right.
NOTE*3: Does not apply to setting current < 0.25% full scale current in high range. Does not apply to setting current < 0.05% full scale current in low and middle range.
NOTE*4: The full scale is Vmax x Imax.
NOTE*5: The DC level measurements are made over a period of 20ms. Transient signals are not measured in the DC measurements.
NOTE*6: Its limits are the maximum power and maximum current of the current range.
NOTE*7: The 63600 is guaranteed to meet the specified performance in the 25±5°C temperature range.
NOTE*8: If the operating voltage exceeds the rated voltage by 1.1 times, it will cause permanent damage to the device.



NOTE*9: Refer to the User's Manual for detail specifications. S (Siemens) is the SI unit of conductance, equal to one reciprocal ohm.
NOTE*10: Ext. Wave Mode: CC minimum driving current is 0.2mA.
NOTE*11: The minimum voltage of the load measured by an oscilloscope.
NOTE*12: The current setting and measurement spec. of each mode not including the leakage current caused by Input Resistance. If leakage current exceeds 0.05%FS, the influence of Input Resistance needs to be taken into consideration.
NOTE*13: Besides the accuracy 0.2%F.S for voltage measurement, 300μs delay time needs to be added.
NOTE*14: The 63601-5 only supports 6 Channels (CH1, CH3, CH5, CH7, CH9, and CH10.)
NOTE*15: The minimum working voltage can drop to 1.6V when pulling 60A continuously for 1 minute.
NOTE*16: The test conditions are 0.5μH under for line sense, CCDH loading 0~60A, SR: 0.4A/μs and Overshoot <5%. If the SR is 6A/μs, the Overshoot should be smaller than 5% and the minimum working voltage must be above 2.5V.
NOTE*17: CCM: When the loading current is <10mA: 0.04%+0.12% F.S

Table 1

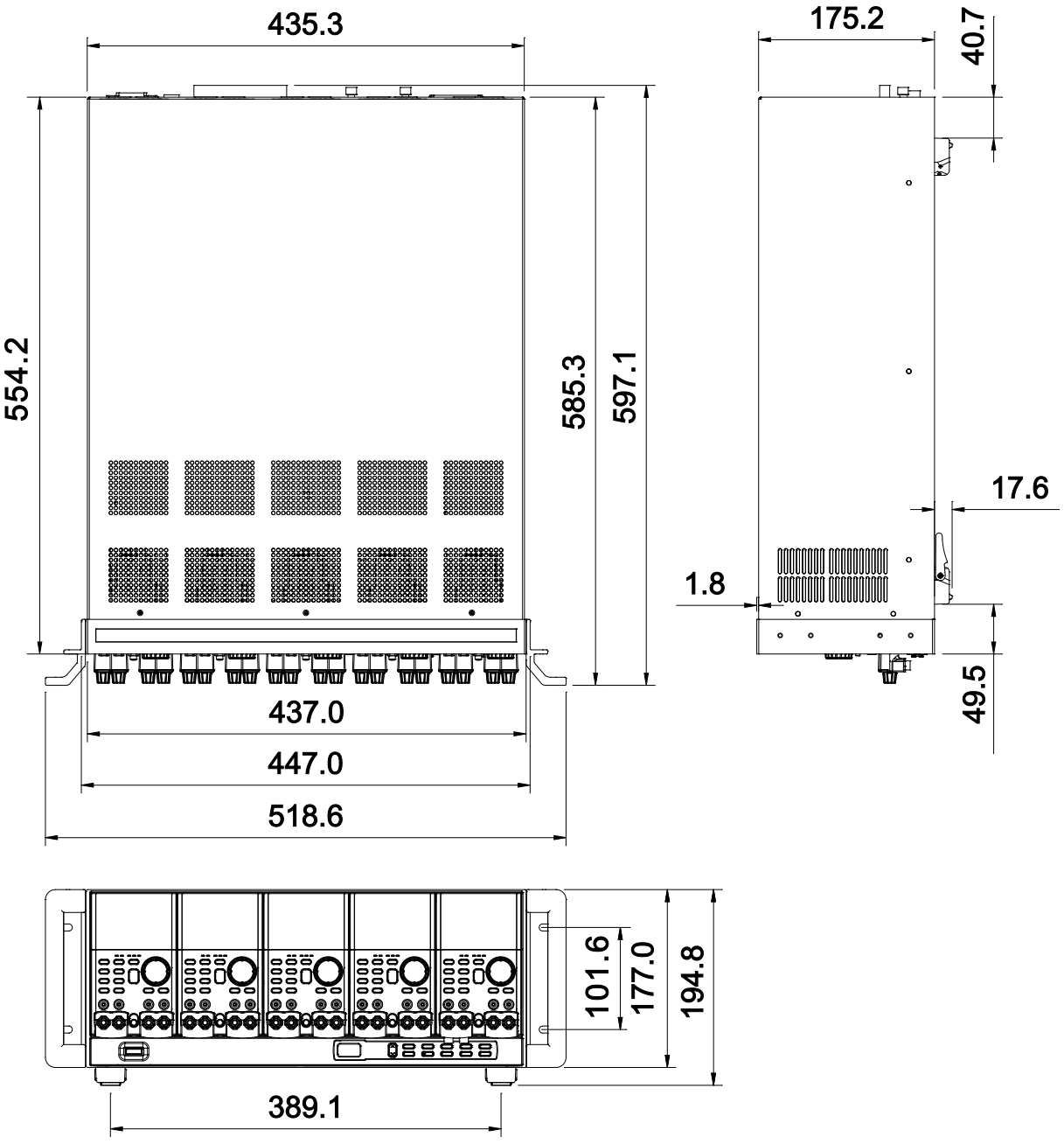
	63610-80-20	63630-80-60	63640-80-80	63630-600-15	63640-150-60
CRH (unit: S)	0.32879m / V_{sense}	0.98638m / V_{sense}	1.32206m / V_{sense}	0.2661m / V_{sense}	1m/V_{sense}
CRM (unit: S)					
CRL (unit: S)					

Table 2

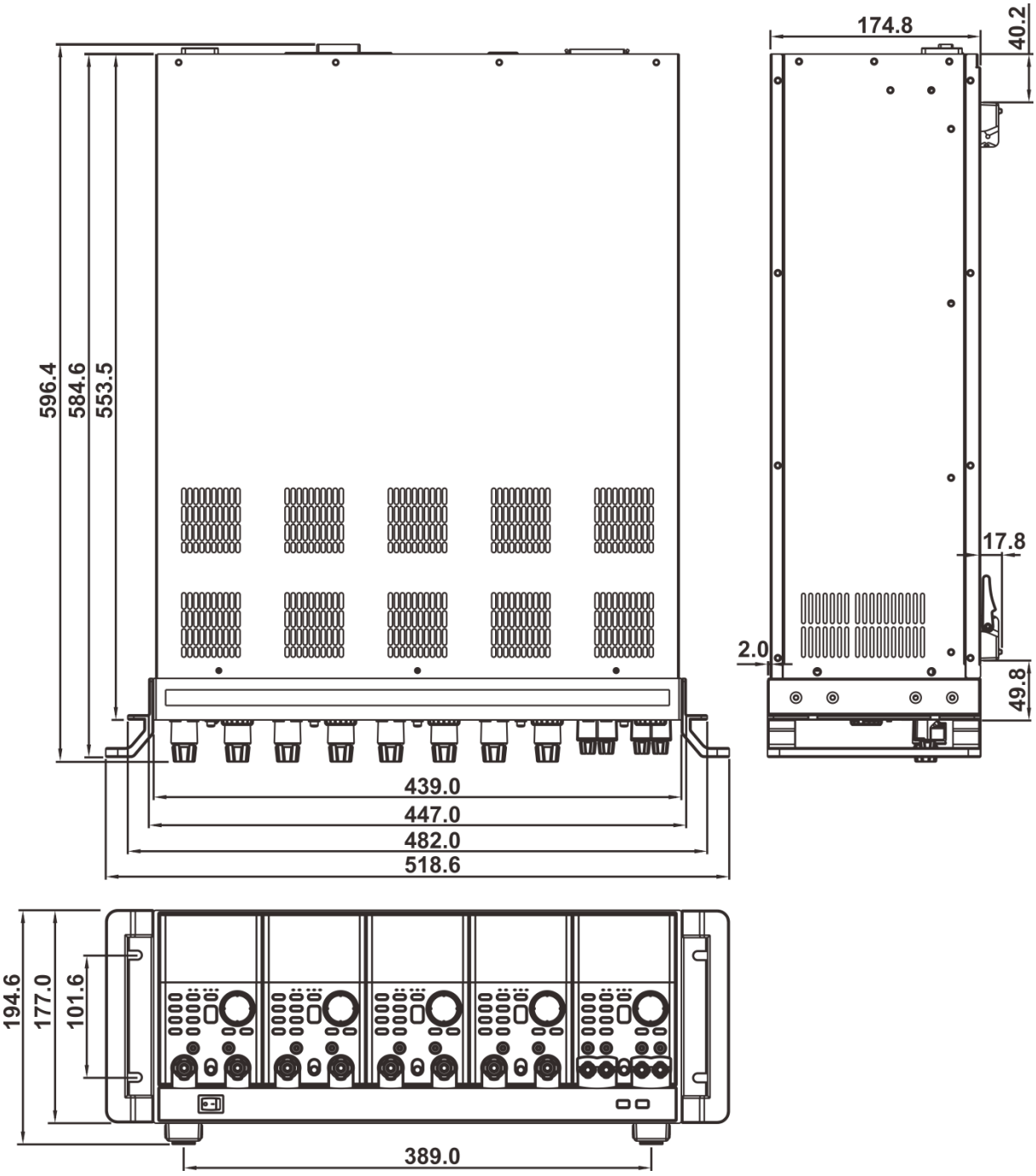
	63610-80-20	63630-80-60	63640-80-80	63630-600-15	63640-150-60
CPH (unit: W)	0.32879m x V_{sense}	0.98638m x V_{sense}	1.32206m x V_{sense}	0.2661m x V_{sense}	1m x V_{sense}
CPM (unit: W)	0.03285m x V_{sense}	0.09861m x V_{sense}	0.131517m x V_{sense}	0.026m x V_{sense}	0.1m x V_{sense}
CPL (unit: W)	0.00326m x V_{sense}	0.00984m x V_{sense}	0.01310m x V_{sense}	0.00277m x V_{sense}	0.02m x V_{sense}

1.5 Dimension Outline of 63600 Series

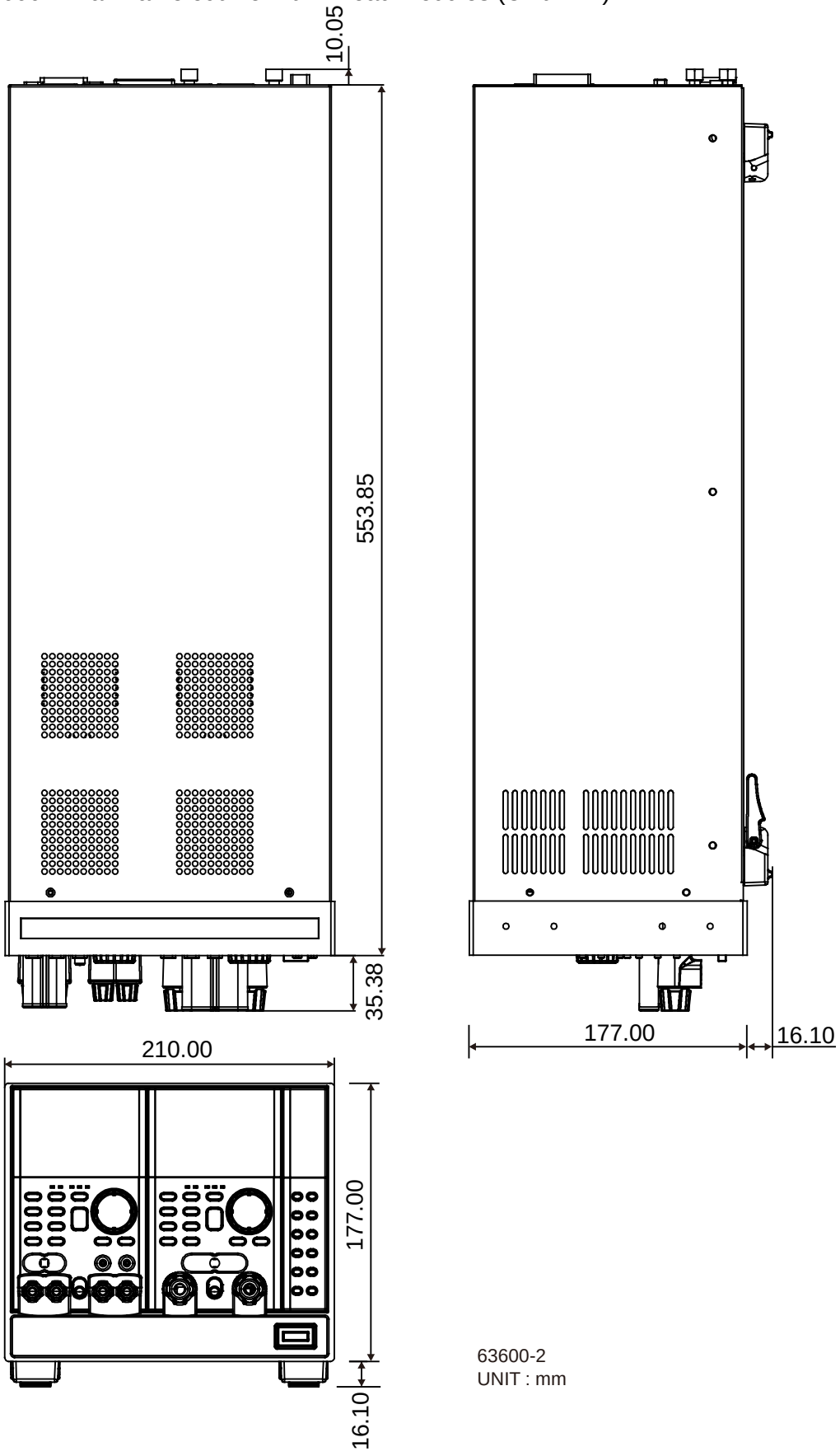
- 63600-5 Mainframe outline with 5 Load Modules (Unit: mm)



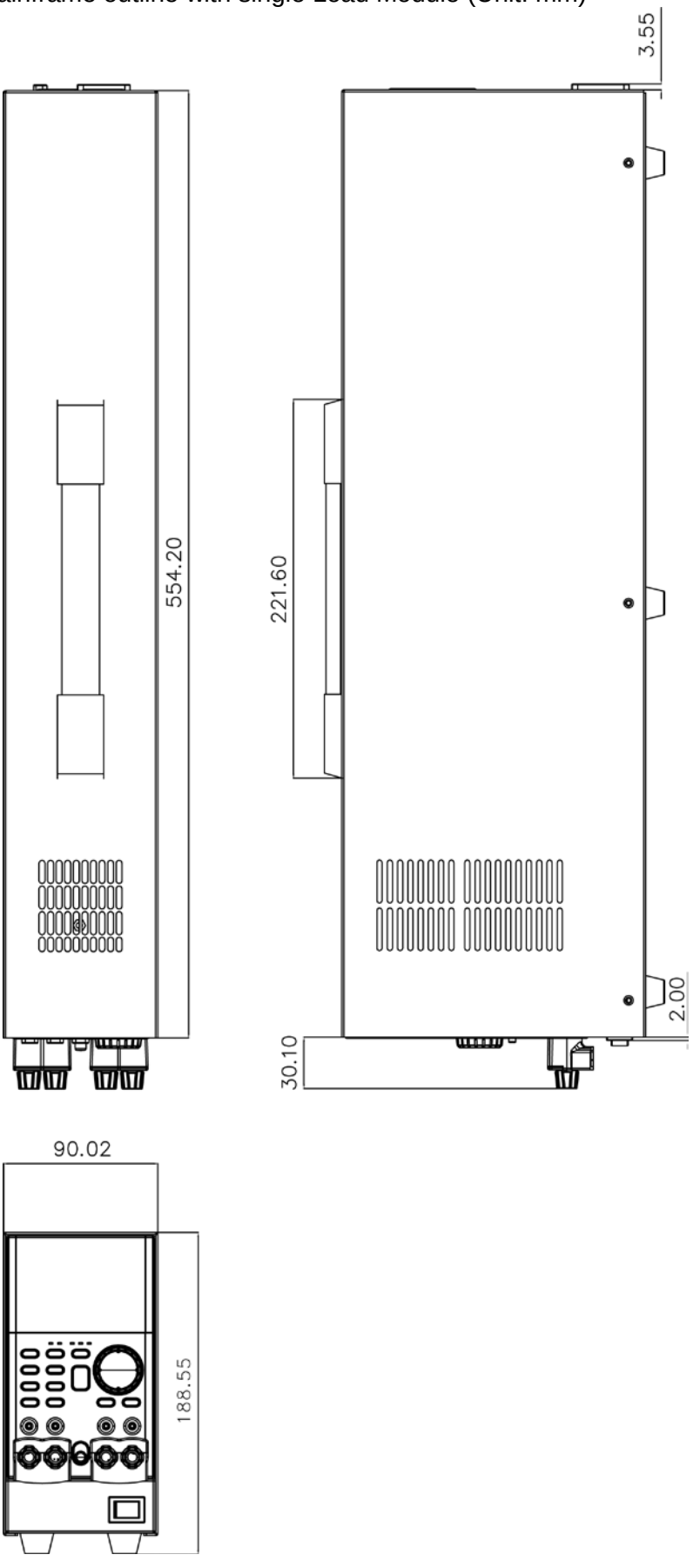
- 63601-5 Mainframe outline with 5 Load Modules (Unit: mm)



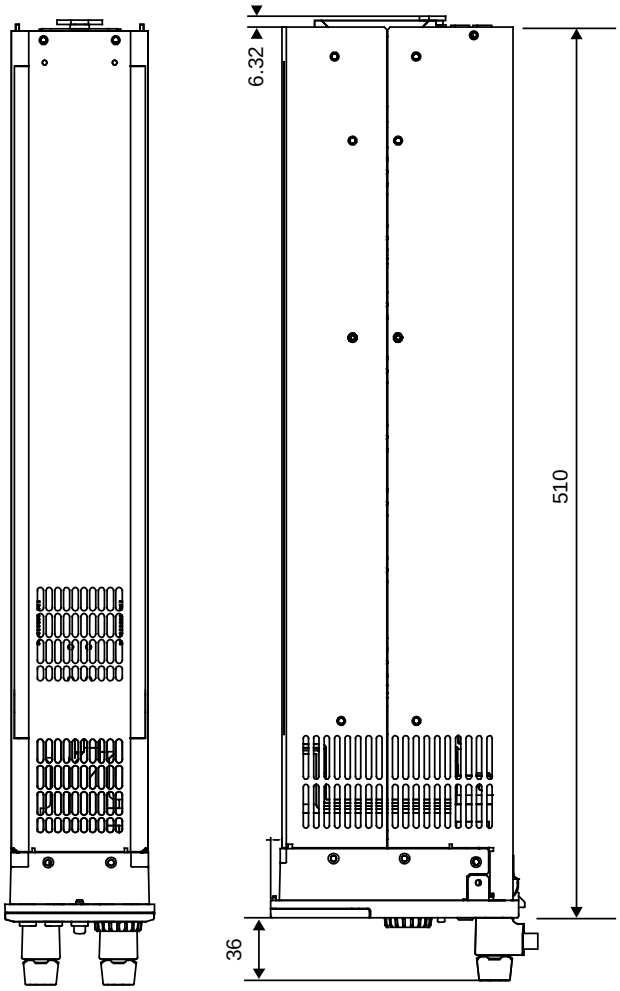
- 63600-2 Mainframe outline with 2 Load Modules (Unit: mm)



- 63600-1 Mainframe outline with single Load Module (Unit: mm)



- Module outline (Unit: mm)



63610-80-60
63610-80-80

2. Installation and Maintenance

2.1 Precautions before Installation

■ **Sensing Electricity and Electric Shock**
To prevent electric shock from occurring, it is recommended to wear insulated rubber gloves on performing any electricity related work before using this device.

■ **Handling and moving**
This electronic load has mounting ears for taking out or moving it on the table easily. When moving the device, it is recommended to move it by the body to avoid lifting directly from the mounting ear, which could result in danger due to excessive weight.

■ **Standard Warnings**

⚠WARNING

1. Be sure to use only the accessories that meet the manufacturer specifications.
2. Do not disable the grounding plug. Be sure to use a grounded power outlet.
3. Do not block any ventilation holes to prevent the device from overheating. Do not cover the vent grating during operation. Failure to do so may cause the instrument to overheat and damage the internal components.
4. The power plug should always be able to disconnect from the device, and the power outlet should be near the device and easy to access.
5. If the instrument is not utilized according to the manufacturer's specifications, it may affect the safeguard of the instrument.
6. According to IEC 60227, the European certified power cords must not be lighter than light PVC sheathed cords. The H03 VV-F or H03 VVH2-F (equipment less than 3kg) and H05 VV-F or H05 VVH2-F2 (equipment over 3kg) with at least 3G 0.75 mm² (rated current up to10 A) or 3G 1.0mm² (rated current over 10 A and up to16A) of rated cables or larger are specified. Also the power cord in use should not exceed 2 meters.

2.1.1 In Case of Emergency

■ **When Emergency Occurs**

To avoid causing greater hazard in any emergency cases like electric shock, DUT (device under test) or mainframe burnout, be sure to follow the steps below.

- Turn off the power switch first.
- Next, unplug the power cord.

2.2 Maintenance Precautions

There are no general user maintainable items in this Electronic Load (unless specified otherwise in this user's manual.)

When the Electronic Load is judged as abnormal, please contact Chroma or its agents for troubleshooting. Do not perform any maintenance by yourself to avoid unnecessary danger, and cause greater damage to the device.

2.3 Inspection

Diagram of 63600 Series Standard Package:

F30 000019
User's Manual CD

A11 001318
Quick Start Guide (English)

W38 000023
Test Wire Red & Black

W38 000276
W38 000277
Test Wire Red & Black

G55 000948
Binding Post Fixer

W33 000035
White Load Wire

W33 000033
White Load Wire

W33 000299
White Load Wire

A21 018700
Fuse
2A/250V

A21 007000
Fuse
5A/250V

W51 000047
Y-type Bare Terminal
14mm

W51 200270
Y-type Bare Terminal
10.8mm

W51 000028
Y-type Bare Terminal
13.8mm

This instrument was inspected before shipment and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing materials in case the instrument has to be returned. If damage is found, file a claim with the carrier immediately. Do not return the instrument to Chroma without prior approval.

Make sure the following items, listed by respective model, have been received:

Model No.	Item Name	Quantity
63600-1	Quick Start Guide - English	1 piece
	User's Manual CD	1 piece
	Binding post fixer	1 piece
63600-2	Quick Start Guide - English	1 piece
	Fuse 2A/250V, 5*20mm	1 piece
	User's Manual CD	1 piece
	Binding post fixer	1 piece
63600-5	Quick Start Guide - English	1 piece
	Fuse 5A/250V, 5*20mm	1 piece
	User's Manual CD	1 piece
	Binding post fixer	1 piece
63601-5	Quick Start Guide - English	1 piece
	User's Manual CD	1 piece
	Binding post fixer	1 piece
63610-80-20	White load wire (W33 00035), 75cm RNBS8-5*2+SNB8-6*2	2 pieces
	Test wire red & black (W38 000023), 77.8cm	2 pieces each
	SNB8-6, inside diameter ϕ 6.4mm, Y-type bare terminal , outside diameter ϕ 10.8mm (W51 200270)	4 pieces
63630-80-60 63640-80-80	White load wire (W33 000033)，75cm RNBS14-5+SNB14-8	1 piece
	Test wire red & black (W38 000023), 77.8cm	1 piece each
	SNB14-8, Y-type bare terminal, inside diameter 8.4mm, outside diameter 13.8mm (W51 000028)	2 pieces
63630-600-15	White load wire (W33 000299), 77cm	1 piece
	Test wire red & black (W38 000276, W38 000277), 77.5cm	1 piece
	SNB5-8, Y-type bare terminal, inside diameter 8.4mm, outside diameter 14mm (W51 000047)	2 pieces
63640-150-60	White load wire (W33 000033), 75cm RNBS14-5+SNB14-8	1 piece
	Test wire red & black (W38 000276, W38 000277), 77.5cm	1 piece each
	SNB14-8, Y-type bare terminal, inside diameter 8.4mm, outside diameter 13.8mm (W51 000028)	2 pieces

The fixed terminal wrench/fuse/white load cable/red and black test wires are consumables. If they are damaged or broken after use, be sure to replace them as soon as possible to ensure safety.

2.4 Preparing the 63600-5 for First Time Use

Refer to Figure 2-1 when using the 5 slot mainframe for the first time. Before using the 5 slot mainframe, remove the protective cover. The screw locations are shown below:

1. Three Screws on the bottom.
2. Four Screws on the two sides.
3. Protective cover.

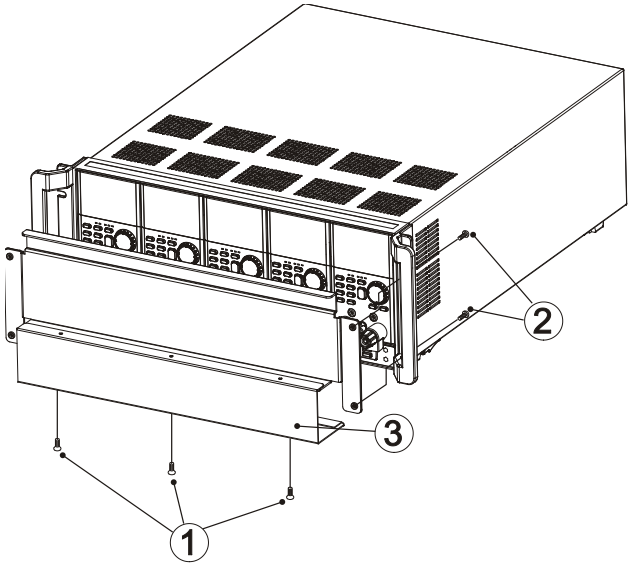


Figure 2-1

2.5 Installing the Modules

CAUTION The load module can be damaged by electrostatic discharge (static electricity). Use standard anti-static work practices when handling and installing modules. Avoid touching the connector and the circuit board.

Chroma 63600-5, 63601-5 Mainframes have room for five single-width Loads (63610-80-20, 63630-80-60, 63630-600-15, 63640-80-80, 63640-150-60). Loads can be combined in the Mainframe in any order. The module installation procedures for all Mainframes are the same. No special tools are required to install Load Modules in the Mainframe.

Procedures

1. Power off the Mainframe.
2. Remove any remaining packing materials on the Mainframe.
3. Start by installing a module into one of the open slots (see Figure 2-2).
4. Slide the load module into the Mainframe slot along the rail until it is locked and fastened.
5. Continue to install the remaining modules as described in step 4.

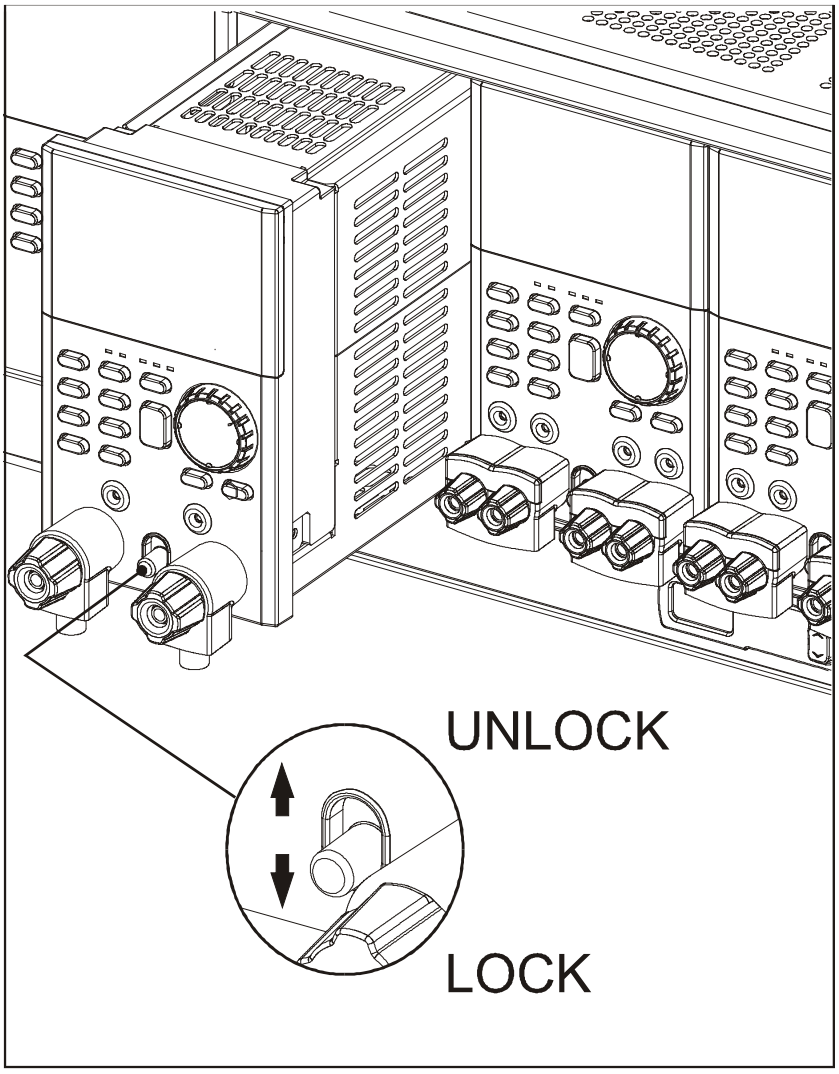


Figure 2-2 Installing Modules in the Electronic Load

⚠WARNING If any of the available slots are not filled with modules, the empty slots must be covered with the panel cover for safety and airflow.

To unplug a load module, lift up the switch between the load connectors, and then use the load connectors to help pull the module out of the mainframe.

2.5.1 Channel Number

The channel number of the Load is determined by the module location in the Mainframe, starting from the farthest left slot. As some Loads (63610-80-20) have two channels in one module, channel 1 and 2 are always on the farthest left slot of the Mainframe, and channel 9 and 10 are on the farthest right. The channel numbers are fixed on the Mainframe whether or not they are populated with a load. Figure 2-3 shows the channel assignments for a Chroma 63600-5 Mainframe containing two 63630-80-60 single channel load modules, two 63610-80-20 dual channel load modules, and one 63640-80-80 single channel load module. A channel number is automatically assigned to 1, 3, 5, 6, 7, 8, and 9. Channels 2, 4, and 10 are skipped as single modules are used in those locations.

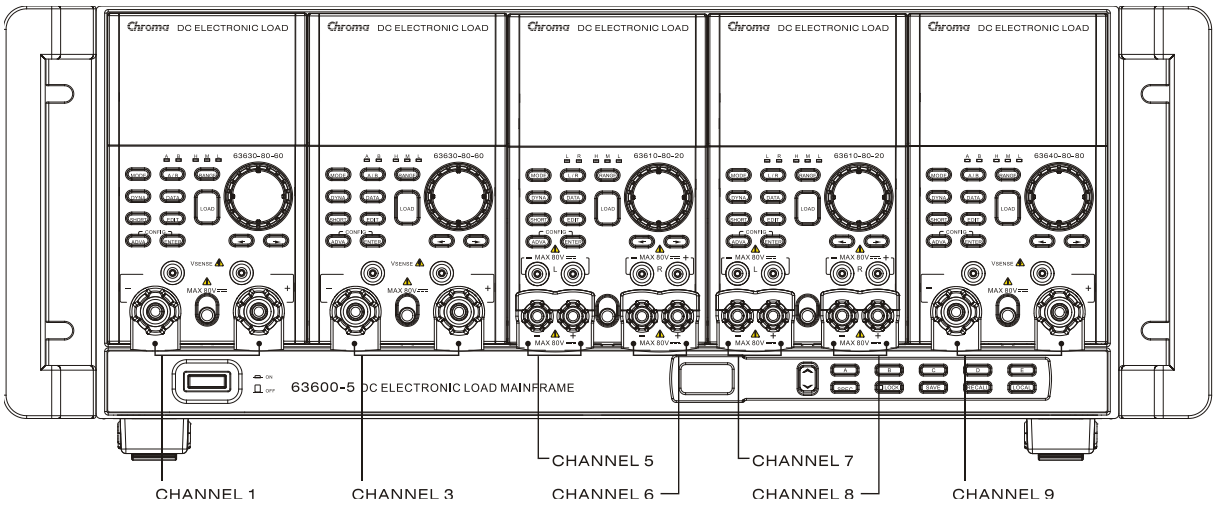


Figure 2-3 Channel Number Assignment

2.6 Installing the Mainframe

The Electronic Load should be operated within a temperature range of 0 to 40 degree C. Install the Electronic Load in an area that has enough space around the unit for adequate air flow through and escaping from the back. Leave at least 10 cm (4 inch) space above the unit for air circulation. Note that the Mainframe stock feet leave enough vertical space for air circulation when the units are stacked. The Mainframe stock feet can be removed for rack mount installation.

If any equipment is installed above the Electronic Load in a cabinet, use a filter panel above the unit to ensure adequate air circulation. A 1U (EIA standard) panel is sufficient.

2.6.1 Line Voltage

The Electronic Load can operate with a 115/230 Vac input as indicated on the rear LINE label. The detailed line voltage input range for the 63600-5 is shown in section 1.4 *Specifications*. The 63600-1 and 63600-2 mainframes also operate within 115/230 but have a voltage switch. The default setting is set to 230VAC. See Figure 3-7 for the rear of the 63600-2 or Figure 3-8 for the rear of the 63600-1. Both have a Red colored switch.

Notice Line fuses do not need to be changed when the line voltage is changed. The line fuses will protect the Electronic Load from an incorrect voltage setting.

2.6.2 Turn-On Self-Test

Check the following before turning on the Load in the mainframe:

1. The red switch is set correctly for the AC voltage. This only applies to the 63600-1 or 63600-2.
2. The power cord is connected to the AC input socket.

⚠WARNING The power cord supplies a chassis ground through the third connector. Be sure that the outlet is a three-conductor type with the correct pin connected to ground.

Power on the Load using the front panel switch on the Mainframe and observe the display. Immediately after turning on, the Electronic Load executes a self-test that checks firmware and communication. The Load Module displays

and then displays the model number as well as firmware version

63630-80-60	< --- Model Number
[636308000066]	< --- Serial Number
G_FW : 1.00	< --- F/W version
C1_FW: 1.00	< --- F/W version

If any error is found during self-test, the display will stop here. Check the Load and Mainframe connection when an error occurs. When the self-test completes, the VFD (Vacuum Fluorescent Display) will display measurement V & I. The dual channel module goes to L channel.

In case of failure, return the Mainframe or Load module to a Chroma sales or service office for repair.

2.7 Application Connection

2.7.1 Load Connections

⚠WARNING To satisfy safety requirements, load wires must be the correct gauge to not overheat while the Electronic Load is in short-circuit operation.

Notice In order to meet the factory specification for high slew rates, load wires that have higher than 2.0uH inductance must be avoided when connecting from the UUT to the Electronic Load. Load cables have been provided to meet factory specifications between UUT and the Load.

Input connections are made to the + and – terminal connectors on the front of each Load module. The major considerations for input connections are the wire size, length and polarity. The minimum wire size required to avoid overheating may not be enough to maintain good regulation. The wires should be large enough to limit the voltage drop to less than 0.5V per lead. The wires should be as short as possible, and bundled or tied together to minimize inductance and noise. Connect the wire from the PLUS (+) terminal on the module to the HIGH potential output terminal of the power supply (UUT). Connect the wire from the MINUS (–) terminal on the module to the LOW potential output terminal of the power supply (UUT). Figure 2-4 illustrates the typical setup of the Load module to the UUT. The way to connect the load wire is: First, put the Y-type terminal wire into the Load terminal from the bottom of the load terminal and verify the Y-type terminal touches the metal post. Then, turn the banana binding socket of the Load terminal by hand and use the tailor-made spanner to make the connection tight. Figure 2-5 shows the Load connection with the tailor-made spanner.

⚠WARNING Each terminal with a banana binding socket can use a banana plug to make a load connection. A banana plug can normally carry 10 to 20 Amps. Before using the banana plugs for connections, check the maximum current rating of the banana plugs and the wire. The connection between the banana plug and the banana binding socket is not a tight fit. The banana plug connection should not be used when the output voltage of the power supply (UUT) is equal to or greater than 70VDC to prevent accidental contact with hazardous voltages.

⚠WARNING When using Y-type (U-type) terminals to connect to the load terminals, do not overlap 2 (or more) terminals at the same time. The torque cannot exceed 30kgf-cm when using the Chroma terminal fixture.

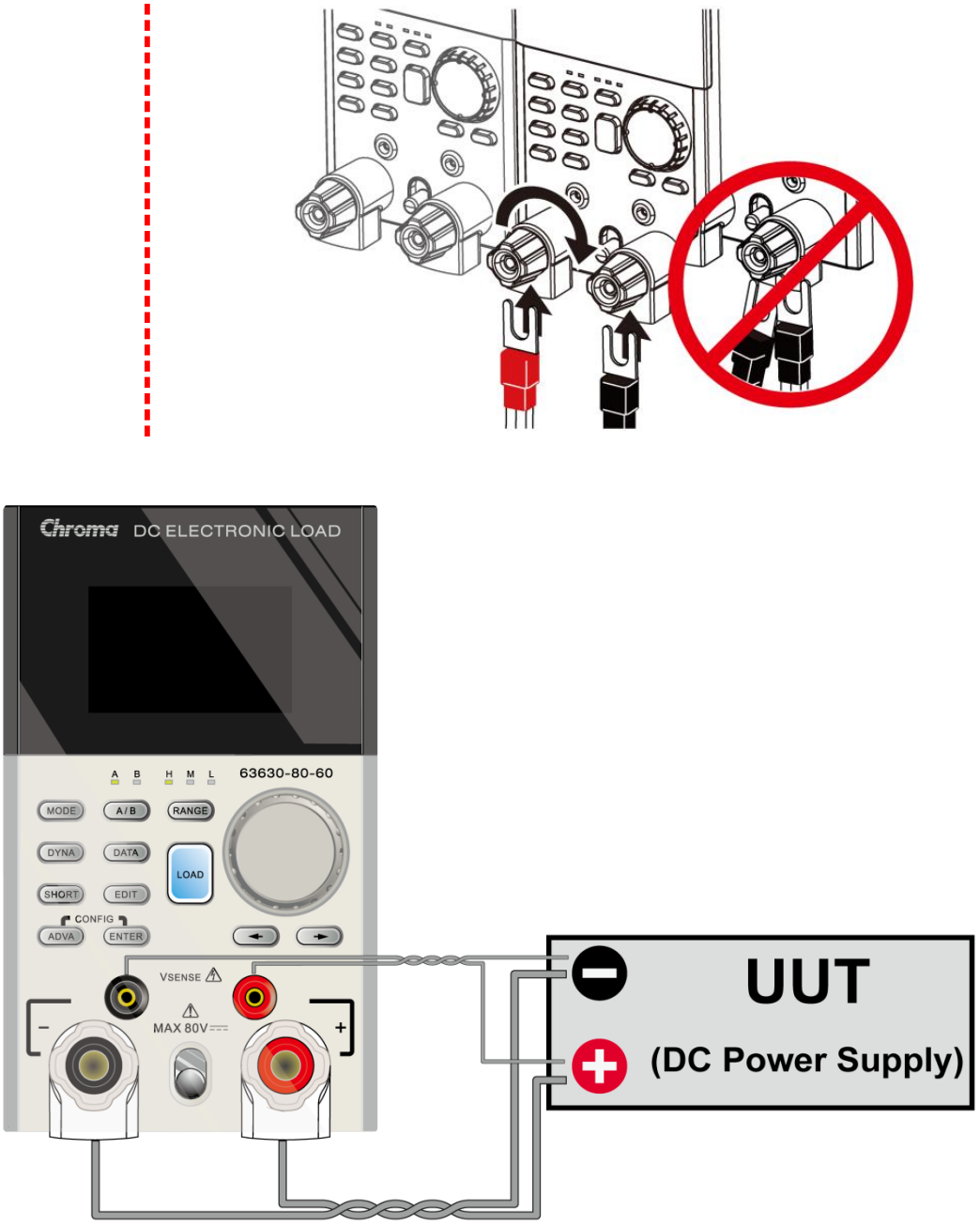
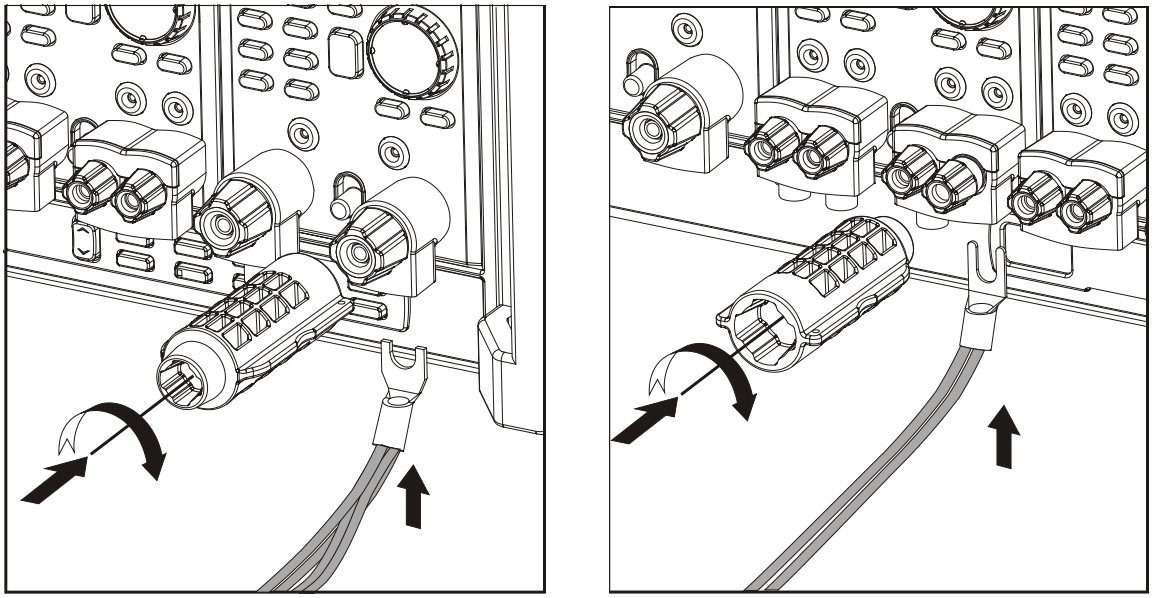


Figure 2-4 Load and Remote Sensing Connection



A. Single Channel Module B. Dual Channel Module

Figure 2-5 Load Connection with the Tailor-made Spanner

2.7.2 Remote Sensing Connections

There are two remote sensing points in the Electronic Load module. One is measured at the Load terminal and the other at Vsense. The Load module will automatically switch to Vsense when the Vsense terminals are connected to the UUT, otherwise it will measure at the Load terminals. Remote sensing compensates for the voltage drop in applications that require long lead lengths. It is useful when a module is operating in CV or CR mode, or when a precise measurement is required. Figure 2-4 illustrates a typical setup for a remote sensing operation.

Notice The potential of the Vsense red connector must be higher than that of the Vsense black connector.

Notice Due to the nature of the Load, the associated internal designs are shared for use. Follow the precautions listed below for operation.

1. The internal resistance of each Electronic Load is different and varied when connecting to a UUT. Use a professional digital power meter if more accurate voltage measurements are required.
2. Use the load UUT Vsense or Local terminal to do voltage measurements. Connect the negative ends to avoid any possible loop current that may affect the measurement result.
3. Contact Chroma technical service center if there is a need to use the UUT voltage measurement function as a power meter.

2.7.3 Parallel Connections

Figure 2-6 illustrates how modules can be paralleled to increase power dissipation. Modules can be directly paralleled in CC, CR or CP mode. Modules cannot be paralleled in CV mode. Each module will dissipate the power it has been programmed for. For example, if two modules are connected in parallel and one is programmed for 10A and another for 15A, the total current drawn from the source is 25A. Restrictions on the number of parallel modules depend only on the total modules available in the multi-mainframe environment described in the next section.

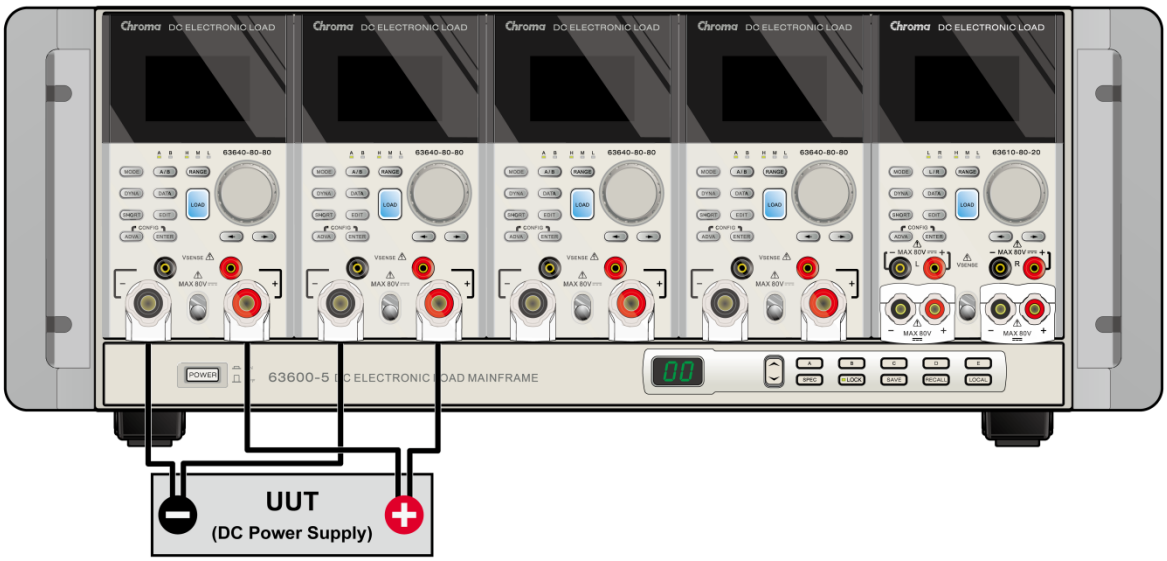


Figure 2-6 Parallel Connection

2.7.4 Multi-Mainframe Connections

The Electronic Load system offers multi-mainframe synchronized connectivity for up to 4 mainframes. The user is allowed to connect either the System Bus1 or System Bus2 port on the rear panel of a mainframe as input from a previous mainframe, and use the remainder as output to the next mainframe. For a systematic configuration, it is strongly recommended to connect 2 mainframes from System Bus1 on a mainframe to System Bus2 on the other mainframe. Figure 2-7 shows how to connect mainframe1 and mainframe2 along with extending it to mainframe3.

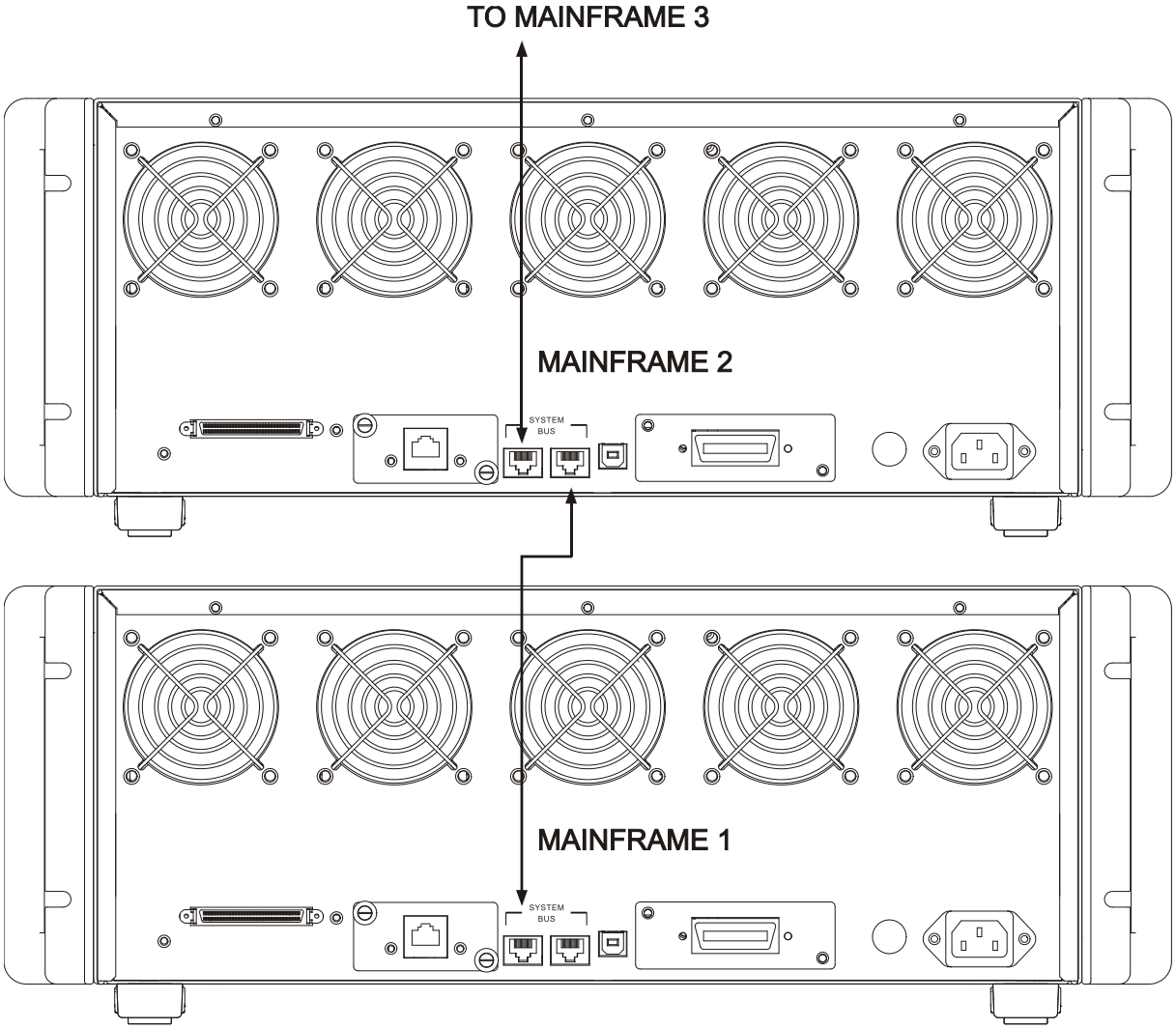


Figure 2-7 Multi-Mainframe Connections Modes

2.8 Remote Control Connection

Remote operation of a Load can be done through the GPIB, Ethernet, or USB interfaces. These connectors on the rear panel connect the Load to the controller or computer (the GPIB and Ethernet interfaces for the electronic load are optional). Connect the Remote Controller to the Electronic Load before powering it on. If this is not done, the Load will shut down, or the fuse for the remote controller in the Mainframe may open.

2.9 GPIB Card Setup

The 63600-5 and 63601-5 mainframes facilitate remote operation via the GPIB bus as an option. Setting up the GPIB card, changing the GPIB address, and its operation are described in *Chapter 5*.

2.10 Ethernet Card Setup

The 63600-2, 63600-5, and 63601-5 mainframes facilitate remote operation via the Ethernet bus as an option. Setting up the Ethernet card and its operation are described in *Chapter 5*.

3. Operation Overview

3.1 Introduction

Chroma 63600 Electronic loads and mainframes are suitable for design, manufacturing, testing, and quality assurance for electronic products. The Mainframe contains five slots for load modules. Each load module model occupies one slot except the 100W model. That model has 2 loads in one slot.

The 63600-5 and 63601-5 mainframes can dissipate up to 2,000 watts when fully loaded. They contain a processor, two System Bus ports, a USB port, a GPIB card (optional), an Ethernet card (optional), front panel keypad and display, and PASS/FAIL signals. The built-in remote control function enables the user to set and query the loads and mainframe. The SYNC function on the Mainframe is used for synchronizing load modules when operating multiple loads in either Dynamic mode or paralleling load modules in a Master/Slave configuration with multiple 5 slot mainframes. The Save/Recall feature allows the user to save up to 100 files, 10 programs, and one default setting. All of them can be saved in the mainframe EEPROM for future use.

Notice The 63601-5 model only provides commands for save and recall functions with no support for manual operation.

The Load Module has one cooling fan. The fan speed automatically increases or decreases when the module power rises or falls. This feature reduces overall noise level as the fans do not always run at maximum speed.

Each module can operate independently in constant current (CC), constant resistance (CR), constant voltage (CV), constant power (CP), and constant impedance (CZ). An individual module may have one or two channels. Each module has its own channel number with its own input connectors, and can be turned on/off or short-circuited independently. If the application requires a greater power or current capacity than one module can provide, the load modules can be connected in parallel in CC, CR, or CP mode.

Each load module can be controlled remotely via GPIB/Ethernet/USB/System Bus interface. Once a channel is selected or addressed, all subsequent commands go to that channel till another channel is selected or addressed. The operation of all modules in the Mainframe is similar in spite of power ratings; meanwhile each module has a keypad to control itself.

Each module operates independently in CC, CR, CV, CP, or CZ mode as a load and simultaneously measures current, voltage, or power level. The user is allowed to off-line edit above mentioned parameters. Beside, in any of the operation modes, when active, the on-line change of parameters changes the Electronic Loading accordingly, thus making it easy to achieve an optimized test condition and then saved for later use.

The module allows the user to enter V and I specifications for GO/NG operation. In addition, the real time measurement bars on the VFD indicates the degree of deviation from the programmed specification.

This chapter covers the interpretation of the front and rear panel description, the initial setup, and the operation of static load under different operating modes including CC, CR, CV, CP and CZ, and CC dynamic load.

3.2 Front Panel Description

The Mainframe front panel includes a 2 character 7-segment LED display and keypads.

The front panels of the 63600-5, 63601-5, 63600-2, and 63600-1 Mainframes are shown in Figure 3-1, Figure 3-2, Figure 3-3 and Figure 3-4.

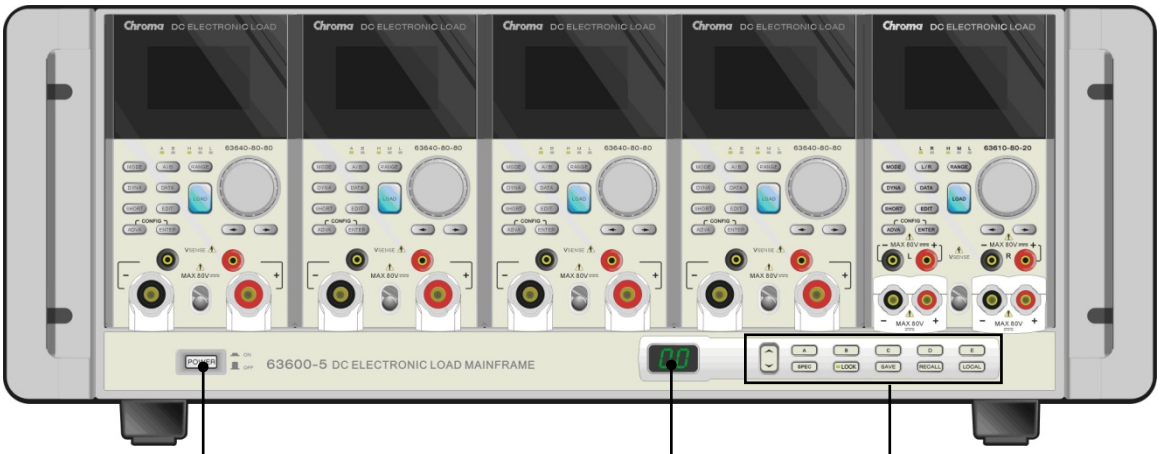


Figure 3-1 Front Panel of 63600-5

Figure 3-2 Front Panel of 63601-5

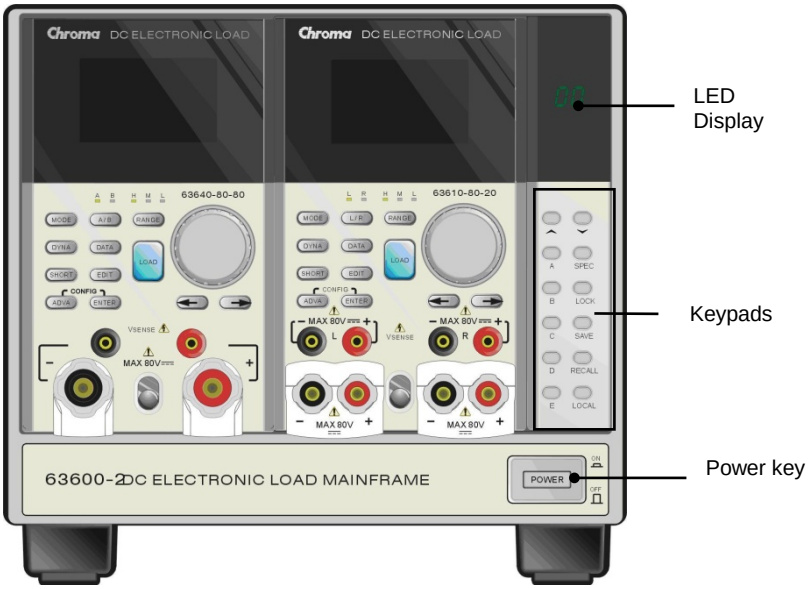


Figure 3-3 Front Panel of 63600-2

Figure 3-4 Front Panel of 63600-1

3.3 Rear Panel Description

The Mainframe rear panel includes two System Bus ports, a USB port, an optional GPIB connector, an optional Ethernet connector, a System I/O port, an AC LINE socket, a fuse holder, and five air vents for the cooling fans.

The rear panels of the 63600-5, 63601-5, 63600-2, and 63600-1 Mainframes are shown in Figure 3-5, Figure 3-6, Figure 3-7 and Figure 3-8.

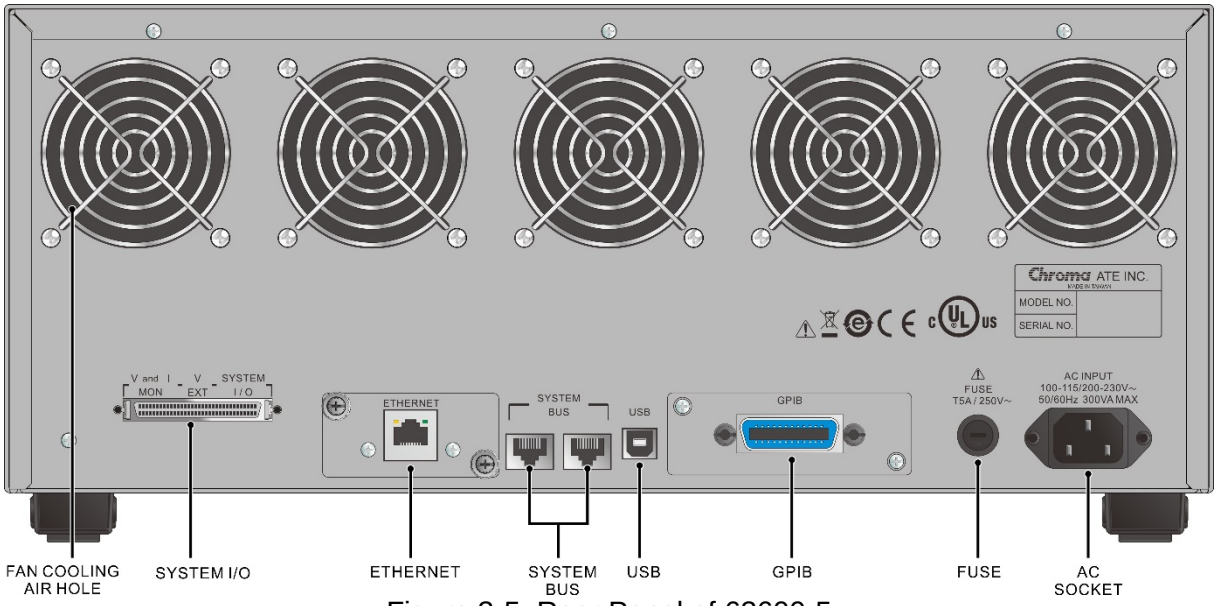


Figure 3-5 Rear Panel of 63600-5

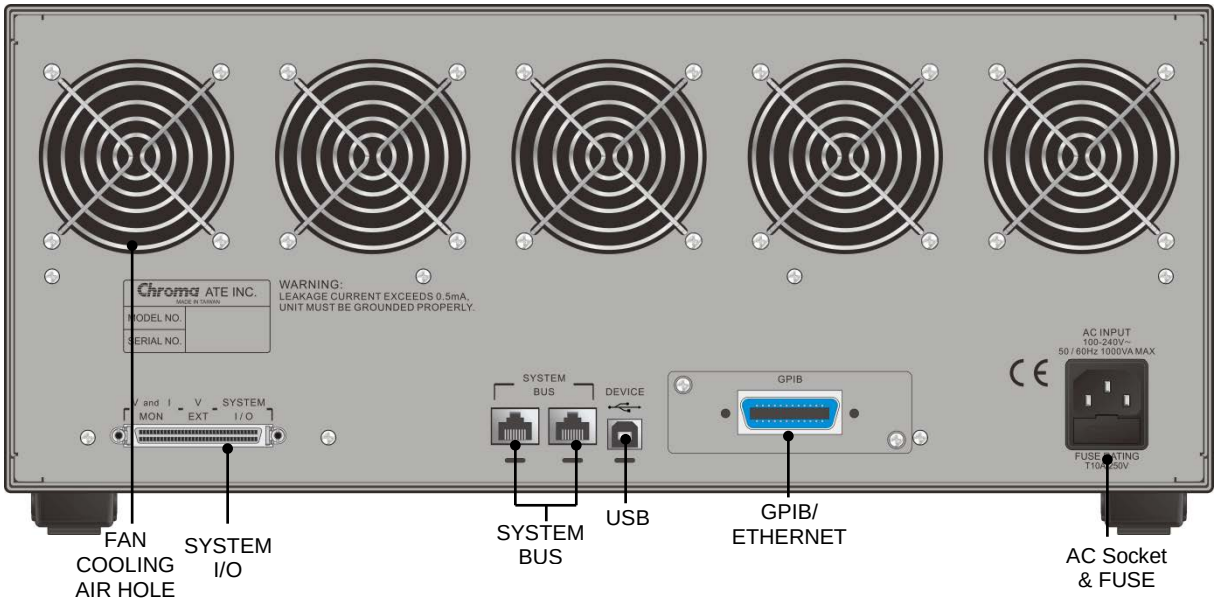


Figure 3-6 Rear Panel of 63601-5

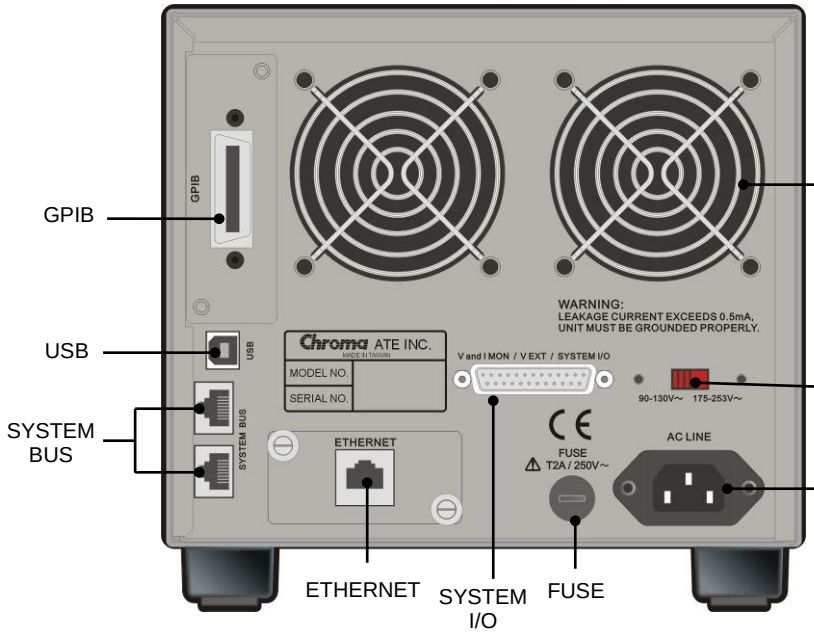


Figure 3-7 Rear Panel of 63600-2 Figure 3-8 Rear Panel of 63600-1

Table 3-1 Definitions of Rear Panel Connectors on the Mainframe

Item	Description
1	*GPIB Interface*: A GPIB interface for connecting by remote control using a computer.
2	*Ethernet Interface*: An Ethernet interface for connecting by remote control using a computer.
3	*USB Interface*: A USB interface for connecting by remote control using a computer.
4	*System Bus Interface*: Connectors to enable multi-mainframe synchronous operation, with USB/Ethernet/GPIB/MANUAL control. Also a System Bus port for connecting to a remote controller.
5	*System I/O*: Connector which includes Analog signals: voltage and current monitor and external wave input, and Digital System Input/Output signals. The Digital System Input/Output signals are TTL Compatible. The signal is connected to module with isolation.
6	*Fuse*: Safe guard against over loading.
7	*AC Line*: AC power connector that supplies power to all modules in the mainframe.
8	*Fan Cooling Air Holes*: Air vents with metal fan guards on the rear of the mainframe for air flow. Fans are on the load modules and the cooling fan speed automatically increases or decreases as load power rises or falls in each individual load module.

3.4 Local/Remote Control

Local (front panel) control is in effect immediately after the power is applied. The front panel keypad and display allow manual control of individual modules when a Load is used in bench test applications. Remote control goes into effect as soon as the Mainframe receives a command via a GPIB/Ethernet/USB/System Bus interface. When remote control is in effect, only the computer/remote controller can control the Load. The front panel keypad has no effect except the **LOCAL** key. Return to local control by pressing the **LOCAL** key.

All functions that can be done at the Load Module Front panel can be done remotely. The keypad on the Mainframe can perform simple functions, i.e., specific settings, the data lock operation, and save/recall settings.

Details on local operation are given in *Chapter 4 Local Operation*. Fundamentals of remote programming are described in *Chapter 5 Remote Operation*.

3.5 Modes of Operation

There are five modes of operation: Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), Constant Power (CP), and Constant Impedance (CZ).

When the MODE key is pressed, the load will go to the next mode. When changing from one mode to the next, the module's input is momentarily disabled but it is re-enabled after the new mode is selected. This ensures minimum overshoot during the mode change. The parameters in current, resistance, or voltage mode can be programmed easily when the mode is selected.

All data set in CC/CR/CV/CP/CZ mode will be rescaled to fit the resolution of current/voltage levels or slew rate. In local mode any value can be set from the keypad. However, if the value entered is lower or higher than the module's limit it will beep. The Load automatically selects data, which is rescaled from the programmed value, truncates and checks the high, low boundary before storing it into the memory. When the programmed data is over the boundary, the Load will set the maximum or minimum level. In remote mode the programmed value cannot be over the boundary. An error will occur when the data is over the maximum or minimum value.

3.5.1 Constant Current Mode

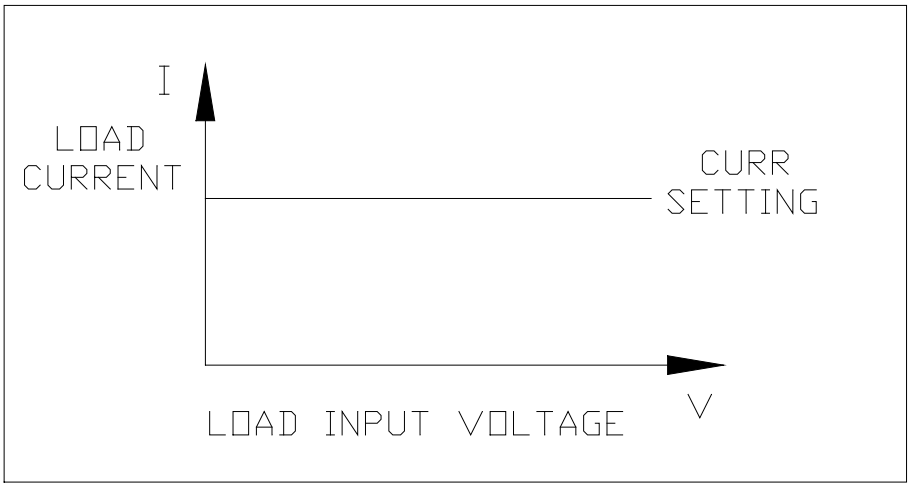


Figure 3-9 Constant Current Mode

In CC mode, the Load will sink current in accordance with the programmed value regardless of the input voltage. To enter into the CC mode, press the MODE key a few times until the VFD displays **CC** mode.

Current Ranges (Low, Middle, High)

Current can be programmed in any of the three ranges: low range, middle range, and high range. The low range provides better resolution at low current settings. If any value is over the maximum of the low range, select the middle range. When any value is over the maximum of the middle range, select the high range. To change the range, press the RANGE key a few times until the LED range indicator is active in the selected range. If you are not sure which range to use, determine the maximum power of the application.

The mode change will affect the module as will the range change. Both of them will cause the input to go through an off state. If the CC mode of the Load module is active, the new setting will change the input immediately at a rate determined by the slew rate setting.

Static Load Mode

Two operation modes, Static load and Dynamic load, are available for selection in CC mode.

The static function checks the stability of the output voltage from a power supply. In some modules (single channel module) there are two current levels (A or B) for the static function. Both A and B states use the same range. The current loading can be programmed to two different levels, A and B, and then switched manually between the two programmed states A and B using the A/B key on the module's keypad. Slew rate determines the rate of change of current over time, which may be mA/us or A/us. Figure 3-10 shows the current level of the load module after pressing the A/B key.

State A=4A, State B=2A, Rise ⎍=0.2A/μs, Fall ⎍=0.08A/μs

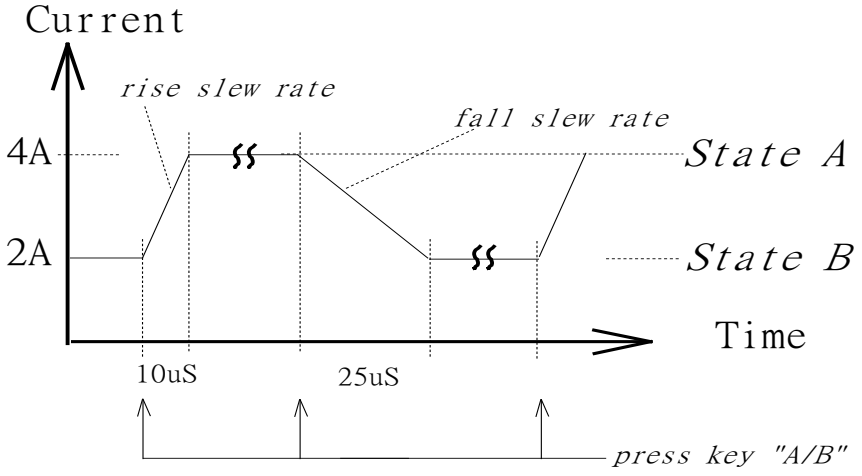


Figure 3-10 Load Level after Pressing A/B Key

Dynamic Load Mode

There are two Operation Modes for dynamic load: Dynamic load mode and Dynamic load frequency sweep mode. Press DYNA to select Dynamic load or Dynamic load frequency sweep mode.

Dynamic load operation allows the user to program 2 load levels (Load1 and Load2), load durations (T1 and T2), slew rates (Rise and Fall), and Repeat times (RT). During operation, the loading value is switched between those two load levels according to the specific setting parameters. The Dynamic Load is commonly used for testing the UUT's performance under high speed, transient loading condition.

Load1=4A, Load2=2A, Rise ⎍=0.2A/μs, Fall ⎍=0.2A/μs, T1=10ms, T2=10ms, RT=0

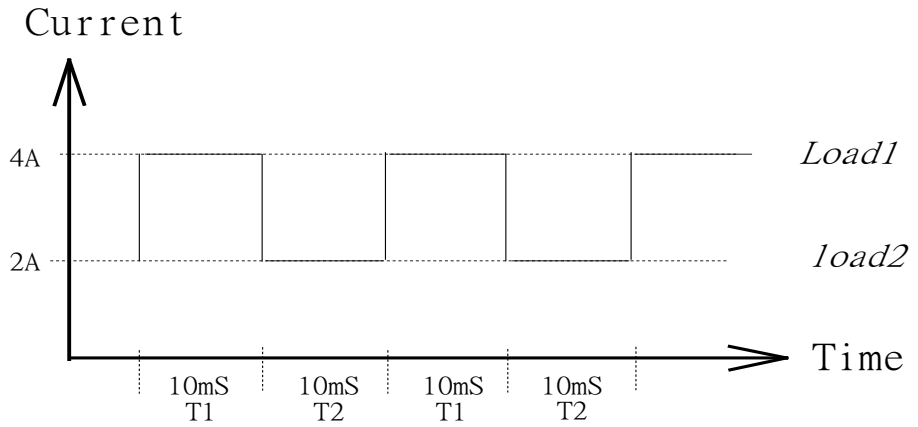


Figure 3-11 Dynamic Current Waveform

The STATic/DYNAmic functions can also be selected through the DYNA key on the Load module.

Slew Rate (Rise, Fall A/μs or mA/μs)

Slew rate determines the rate of change of current over time, which may be mA/us or A/us. There are two slew rate values: rise rate and fall rate.

Voltage Ranges (Low, Middle, High)

There are three voltage ranges for voltage measurement and Von voltage setting. The low range provides better resolution for low voltage measurements. If the value is over the maximum of the low range, select the middle range. When the value is over the maximum of the middle range, select the high range, the voltage range selection is in the configuration setting. If the voltage range is too low for the application, OVP will show on the load display.

Repeat times (times)

The Load can operate in a "for-loop" when setting an RT value. When the RT is set to a limited number of times, the Load will automatically turn off after the RT has finished. To run the Load indefinitely, set the RT to zero.

Dynamic Load Frequency Sweep Mode

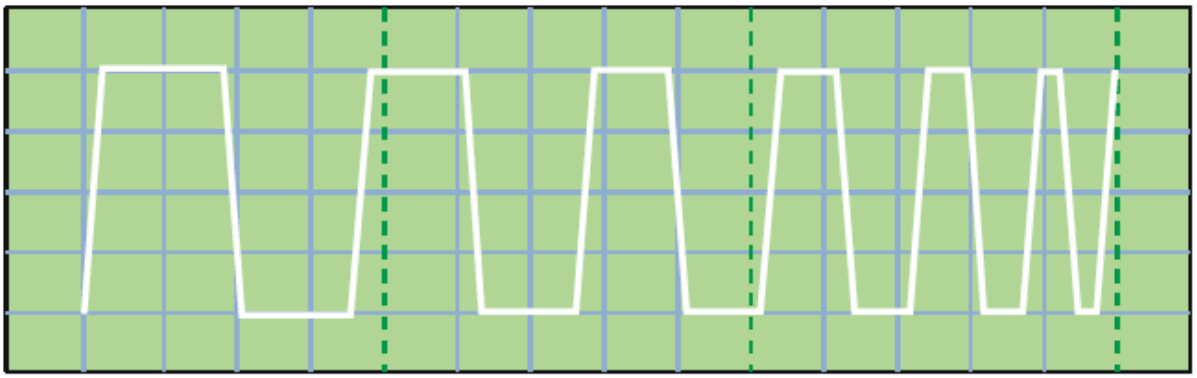


Figure 3-12 CC Dynamic Frequency Sweep Current Waveform

The Load offers a unique CC dynamic frequency sweep with variable frequency to find the worst case UUT voltage.

Frequency Sweep Function operation enables the programming of two load levels (Load1 and Load2), Start frequency, End frequency, Step frequency, Dwell time, duty, and slew rate (Rise and Fall). During operation, the loading value is switched between those two load levels according to the user specified parameters.

Frequencies (Start frequency, End frequency, Step frequency Hz)

The Frequency range can be set from 0.01Hz to 50 kHz.

Dwell time (s)

Dwell time is the elapsed time of each step frequency from Start frequency to End frequency. The Dwell time range can be set from 1ms to 100s.

Duty (%)

The duty in percentage of Load1 is for one dynamic loading cycle, expressed in %. The duty can be set from 1%-99%. The Duty setting will be limited within the transition time of the two load levels.

3.5.2 Constant Resistance Mode

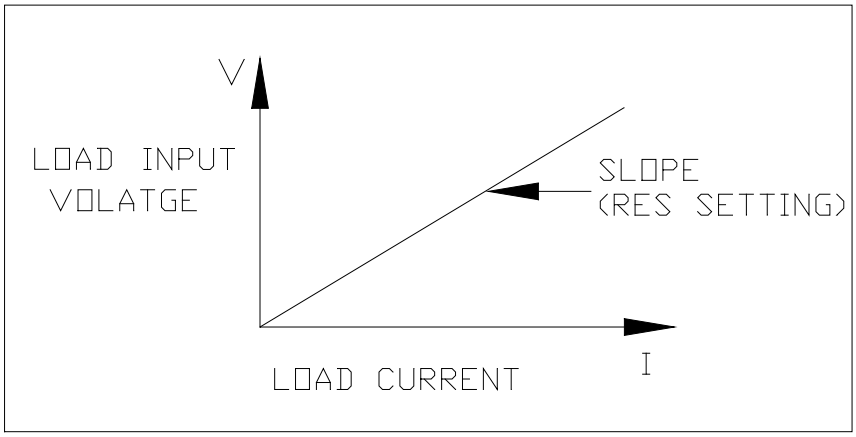


Figure 3-13 Constant Resistance Mode

In CR mode, the Load will draw current linearly and proportional to the input voltage based on the programmed resistance value. In this mode, the F/W calculates the current draw based on ohm's law. The F/W also calculates an average for the data being measured. High frequency changes will be filtered out and the minimum transient time of the loading current is 400us. To avoid unstable current variations caused by input voltage variations, the power source impedance should be as low as possible. Also, a remote sense cable must be used to compensate for voltage drop under high current, low resistance settings.

Voltage Ranges (Low, Middle, High)

Resistance can be programmed in one of three ranges: low, middle, or high. The low range is used for input voltage in the low voltage range. The middle range is used for input voltage in the middle voltage range, and the high range is for input voltage greater than the middle voltage range. CR mode only operates in the highest current range.

If the input voltage is over the maximum of the low range, select the middle range. When the input voltage is over the maximum of the middle range, select the high range. To change the range, press the RANGE key a few times until the LED range indicator is active in the desired range. In some modules (single channel modules) there are two resistance levels (A or B) for the CR function. Both A and B states use the same range. Select state A or state B through the A/B key on the module's keypad. Slew rate determines the rate at which the load level changes from one load level state to another.

Notice

The standard option refrigerant line or the cable with line sense lower than 0.5µH should be used between the UUT and Electronic Load. During low voltage/high current testing, the load voltage during loading needs to be larger than 1.8V to avoid a loading error.

3.5.3 Constant Voltage Mode

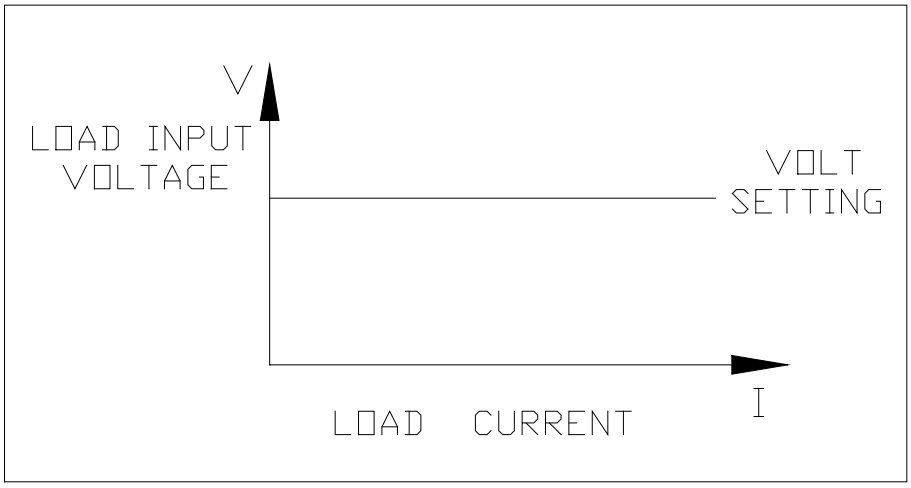


Figure 3-14 Constant Voltage Mode

In CV mode the Load will sink current to control the voltage source in programmed value. This mode is operated under the F/W calculation. That is, take the voltage setting, divide the measured output current of UUT's CC mode and get the suitable resistance as the equivalent resistance of the Cells. Then, take the voltage setting, divide the suitable resistance and get the I setting value. The F/W also calculates an average for the data being measured. High frequency changes will be filtered out and the minimum transient time of the loading current is 400us.

Voltage can be programmed in one of three ranges: low, middle, or high, using the RANGE key. The low range is used for input voltage in the low voltage range. The middle range is used for input voltage in the middle voltage range, and the high range is for input voltage greater than the middle voltage range.

In some modules (single channel modules) there are two resistance levels (A or B) for the CV function. Both A and B states use the same range. Select state A or state B through the A/B key on the module's keypad. Slew rate determines the rate at which the load level changes from one load level state to another.

Current Range (High)

CV mode only operates in the highest current range.

3.5.4 Constant Power Mode

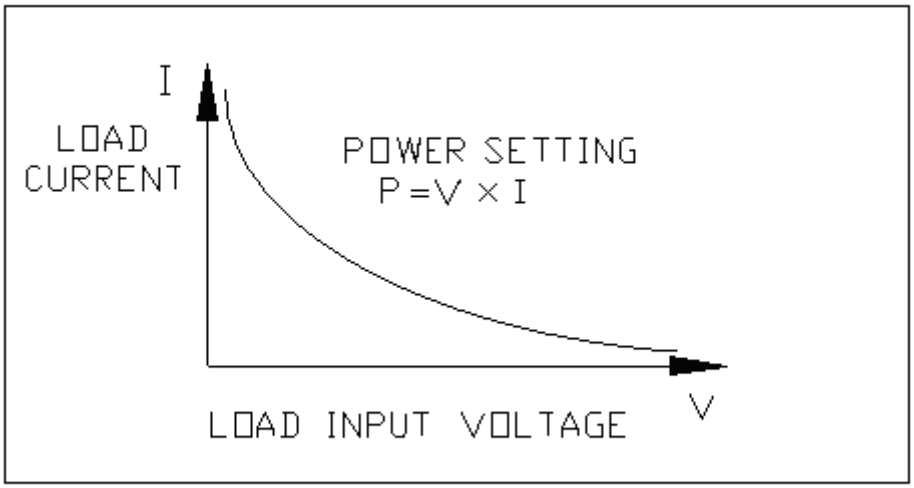


Figure 3-15 Constant Power Mode

In CP mode, the Load will sink a current according to the programmed power. This mode is operated under the F/W calculation. That is to divide the power setting by the measured V data and get the I setting value. There is a moving average calculation process for the measuring data. High frequency parts will be removed, and the minimum transient time of the loading current in this mode is 400μs.

Power can be programmed in the low, middle, or high range by the RANGE key. The low power range is operated under low current range mode. The middle power range is operated under middle current range mode while the high power range is under high current range mode.

In some modules (single channel module), there are two power levels (A or B) for CP function as other modes. Both A and B states use the same range. Select CPLA or CPLB using the A/B key. Slew rate determines the rate that the load level changes from one state to another.

3.5.5 Constant Impedance Mode

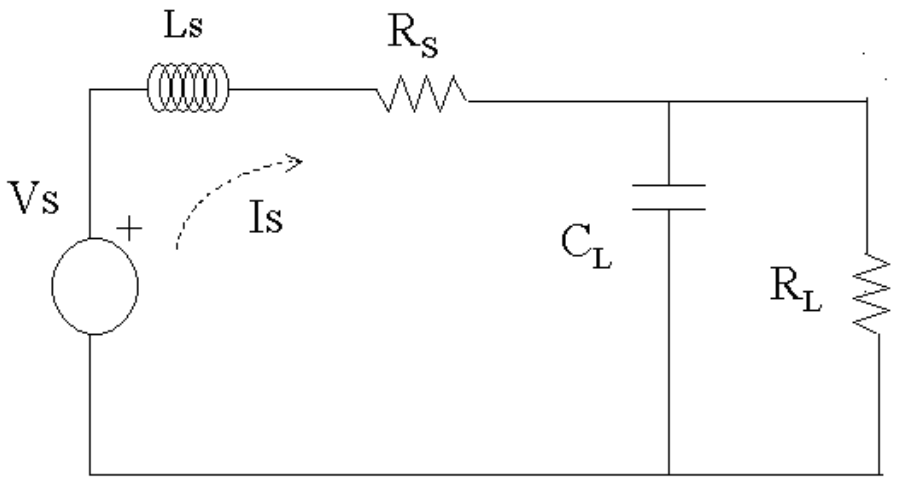


Figure 3-16 Constant Impedance Mode

In CZ mode, the Load will sink a current according to the programmed impedance. This mode is operated under the F/W calculation. That is, take the measured V data, divide the Impedance setting and get I setting value.

There is a moving average calculation process for the measuring data. High frequency parts will be removed, and the minimum transient time of the loading current in this mode is 400us.

Impedance can be programmed by set the equivalent series resistance Rs, equivalent series inductance Ls, equivalent parallel load capacitance C_L, equivalent parallel load resistance R_L and Ip (max) parameters for loading when operating in this mode. The UUT Ip (max) value needs to be set before loading and the parameter range for setting is listed in the specifications.

To avoid the load current change caused by the input voltage variation, the power source impedance should be as low as possible, and remote sensing cable must be used to sense load input voltage when high sink current (low setting resistance) is programmed.

3.6 Load ALL RUN

Chroma 63600-5 electronic load mainframes can support up to ten channels. The method each channel loads On/Off can be controlled by the ALL RUN setting. The loading of channels with the ALL RUN function turned on, can be controlled via other channels with ALL RUN settings turned on. Channels with ALL RUN turned off will load On/Off individually.

3.7 Measurements

Each load module measures the current and voltage of a UUT at a sampling rate of ~2μs with a 16-bit resolution of the full scale ratings.

3.8 Slew Rate and Minimum Transient Time

Slew rate is defined by the change in current over time. A programmable slew rate allows a controlled transition from one load setting to another to minimize the induced voltage drops on inductive power wiring and controls the induced transients on a test device. If the transient from one setting to another is large, the actual transient time can be calculated by dividing the current transition by the slew rate. The actual transition time is defined as the time required for a change of input from 10% to 90% or from 90% to 10% of the programmed excursion. If the transition from one setting to another is small, the small signal bandwidth of the Load will limit the minimum transition time for all programmable slew rates. Because of the limit, the actual transition time is longer than the expected time based on the slew rate. Therefore, both minimum transition time and slew rate must be considered when determining the actual transition time. The minimum slew rate transition time is 10μs in the CC and CC dynamic modes.

Notice To prevent a voltage transient from a UUT from damaging the Load, the electronic short function is not available in the Low and Middle current ranges for each mode.

3.9 Start/Stop Sink Current

Two critical problems are when and how the Load starts sinking current from the UUT. To simulate the transient characteristics of a load on the UUT, set the conducting voltage Von. The Load will start sinking current when the Load is ON and the input voltage of the module is over the Von voltage. The Load will stop sinking current when the Load is OFF or the input voltage is below the Von voltage. See Figure 3-17 and Figure 3-18 for start/stop sinking current.

There are two operation modes for Von control: latch and non-latch. In the latch mode, when the input voltage is greater than the Von voltage, the Load will continuously sink current even if the input voltage drops below the Von voltage. In the non-latch mode, when the input voltage drops below the Von voltage, the Load will stop sinking current. The Von voltage and its operation mode are set in the configuration.

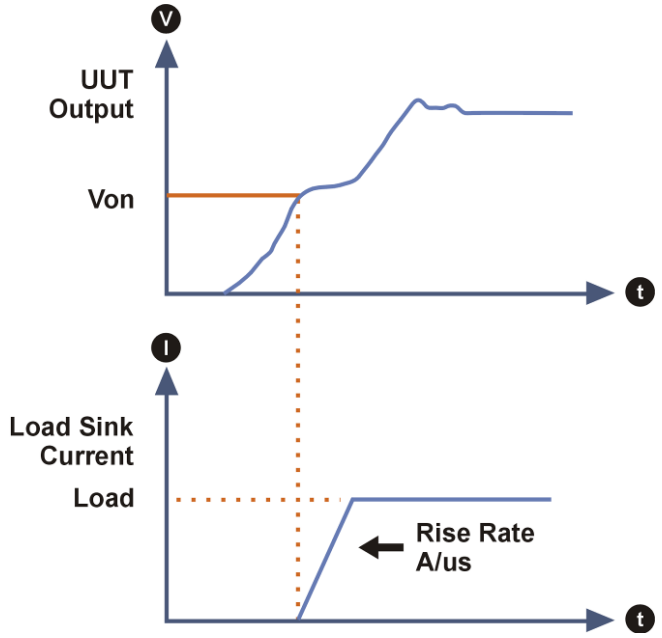


Figure 3-17 Start Sinking Current (Von Non-Latch)

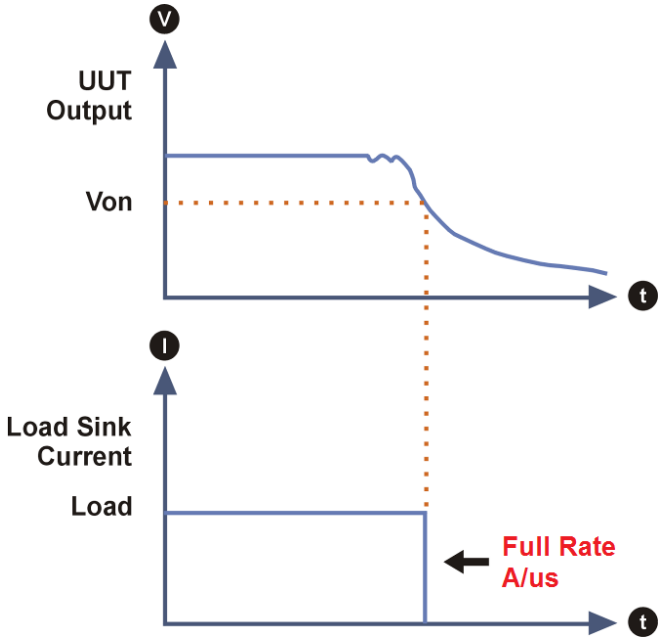


Figure 3-18 Stop Sinking Current (Von Non-Latch)

Set the conducting voltage Voff In the battery discharge timing mode to avoid repeatedly starting and stopping sinking current when the UUT output voltage fluctuates up and down near the Von voltage.

When the conducting voltage Voff is set, the Load will start sinking current when the Load is ON and the UUT output voltage reaches the Von voltage, and stop sinking current when the UUT output voltage is below the Voff voltage and the Load is OFF. It will not sink current when the UUT output voltage reaches the Von voltage again, until it is turned on.

The conducting voltage Voff is only available in the Timing mode, and to avoid a logic error, Voff should be less than or equal to Von.

Notice The delay time spec for Von is 300µs.

3.10 Short On/Off

A Load module can simulate a short circuit at the input of the UUT by turning the Load ON with full-scale current. The short circuit can be turned on/off from the front panel or via remote control. The SHORT key on the front panel operates in two modes: “toggled on/off”, or “controlled by key”. Either mode can be selected in the configuration. The SHORT key will be enabled only when the load is ON.

“Toggled on/off” means pressing the SHORT key once to enable the short circuit, and pressing it again to disable the short circuit. “Controlled by key” means pressing the SHORT key and holding it to enable the short circuit, and releasing it to return to normal operation.

The actual current value of the short depends on the limit of the maximum current range and the maximum power range the Load can supply. Turning on the short circuit does not affect the programmed setting, and the Load input will return to the previously programmed values when the short circuit is turned off.

Notice In order to simulate a real short circuit the electronic short function is not available in the Low and Middle current ranges for each mode.

3.11 Digitizing Function

The 63600 Series Loads offer a digitizing function for recording the transient voltage and current waveforms.

In the system configuration, turn the Rotary knob to change the display value to 9, and then press the ENTER key to select the Digitizing Function page.

Set the Sampling Time. Set the sampling time interval. The range is from 2µs to 40ms, and the resolution is 2µs. If the ***Sampling Point*** is 4097 to 15,000 dots, the setting range is 100µs - 40ms and the resolution is 100µs. The Sampling Time default is 40mS.

```
SAMPLING_TIME
              : 40.000ms
```

Set the Sampling Point. Set the total number of sampling points. The range is from 1 to 15,000 points. The Sampling Point default is 4,096 points.

```
SAMPLING_POINT
              : 4096
```

Set the Trigger Source. Set the Trigger Source. The Trigger source can be Load ON, Load OFF, TTL (External trigger, TRIG_DIGI signal), BUS trigger, and Manual trigger. The Trigger

Source default is Load ON.

TRIG_SOURCE : LOAD ON

Set the Trigger point. Set the Trigger point. The range is from 1 to 4,096 points. The Sampling Point default is 2,000 points.

TRIG_ POINT : 2000

The display will return to the first editing page.

Simultaneously press the ADVA and ENTER keys to leave the Digitizing Function edit page and go back to the system configuration page.

Once the configuration has been completed, press the ADVA and ENTER keys simultaneously to leave the system configuration page.

Then the display will go to the first editing page again.

3.12 Timing Measurement Function

The Load includes a unique timing function allowing precise time measurements between 0 and 100,000s. This feature allows setting the final voltage & timeout value for battery discharge testing and other similar applications.

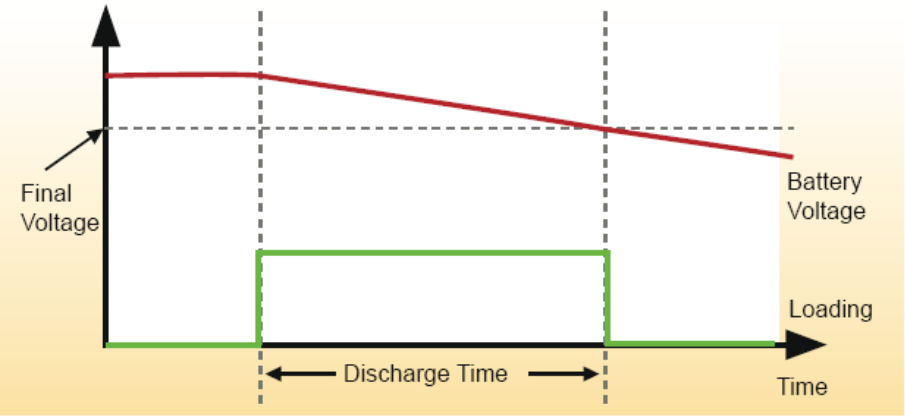


Figure 3-19 Timing Measurement Function

Press the ADVA key to select the timing measurement function. In the timing measurement function, the Load will measure the time duration from Load ON to when the UUT output voltage equals the trigger voltage setting.

The Load provides for the setting of the trigger levels of the UUT output voltage and the operation mode. Figure 3-19 shows the Timing measurement function. In this mode, the Load will automatically stop current sinking and finish the operation after the timing

measurement is taken without pressing the LOAD key.

CAUTION To protect the Electronic Load from damage during a battery discharge test, refer to *Appendix A Precautions for Loading Battery*.

3.13 Sine Wave Dynamic

The Load has a unique sine wave loading current that allows the setting of the bias loading current (I_DC), the sine wave loading current (I_AC), and the sine wave frequency (Frequency). The lowest point of the sine wave current cannot be less than 0 amperes. Figure 3-20 shows the actual loading current waveform (Ch1) and the voltage waveform of the UUT (AC component) (Ch2).

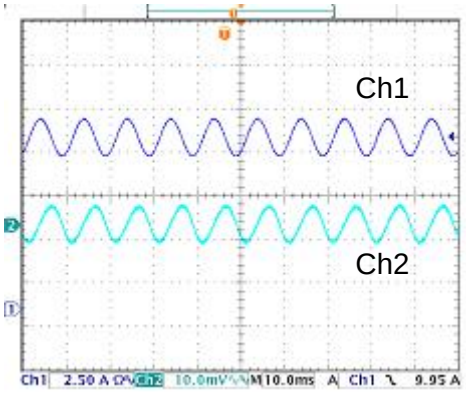


Figure 3-20

The dynamic current loading bandwidth varies with the load designed on the market and the response speed of loading slew rate varies by the bandwidth. For instance, using two loads of different brands to set the dynamic current conditions as I_{max}= 6A, I_{min}= 1A, T1= 0.1ms, T2= 0.9ms, Slew Up= 0.23A/μs and Slew Down = 0.23A/μs to test the voltage transient response character of the same power supply. The results are shown in Figure 3-21 Load of A Brand and Figure 3-22 Load of B Brand are set in the same current slew rate but with different voltage waveform. Therefore, using sine wave loading to test the dynamic load modulation rate will not cause any measurement error due to different load design and different bandwidth.

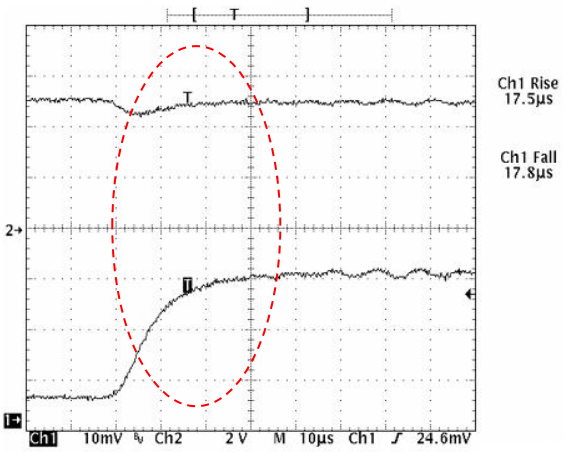


Figure 3-21 Load of A Brand

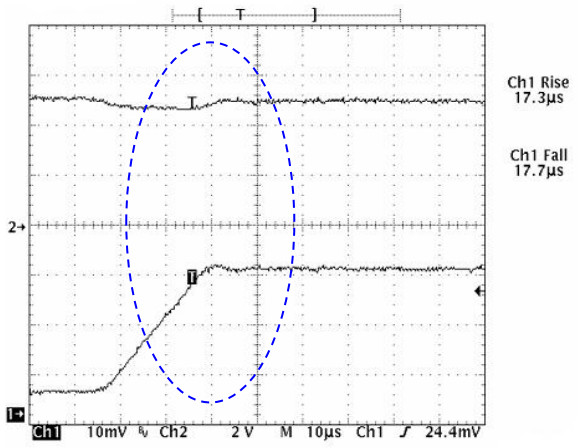


Figure 3-22 Load of B Brand

3.14 OCP Test Function

The Load provides ramped up current for the load to test the UUT voltage whether has reaches trigger voltage level to judge the OCP protection movement normally or not. This test checks the response of one UUT output under overloaded condition.

3.15 Program Sequences Function

The electronic load has 10 programs that can set up to 100 sequences maximum. For example, when program 1 is set up with 5 sequences and program 2 is set up with 8 sequences, the remaining programs from 3 to 10 can set up the remaining 87 sequences. See section 4.6.5 for setting and running the Program Sequences Function.

3.16 Load On/Off

A module's input can be toggled on/off through the LOAD key on the module, or by remote control. The on/off change for input is done according to the slew rate.

Turning off the load does not affect the programmed setting. The load will return to the previous programmed values when the Load is turned on again.

3.17 Protection Features

Each load module has the following features: Over Current Protection, Over Power Protection, Over Temperature Protection and Over Voltage, Reverse Voltage Warnings.

The appropriate bits in the Mainframe's status registers are set when any of the protection features listed above is active. The Load's buzzer will beep until the protection status is reset.

When any of the protections occur, the Load input will turn off.

- Over Voltage Warning
  The over voltage protection circuit is set at a level slightly above the voltage range specified in the Load specification. The over voltage (OV) and voltage fault (VF) status register bits are set when the OV condition occurs and will remain set until they are reset. The Load module will display OVP when over voltage protection occurs.

- Over Current Protection
  When the Load is operating in CR or CV mode, it is possible for a module to attempt to sink more current than it is rated for. The limit level of current is set at a level slightly above the current of the Load. The over current (OC) and current error (CE) status register bits are set when the OC condition occurs, and will remain set until they are reset. The Load module will display OCP when over current protection occurs.

- Over Power Protection
  The overpower protection circuit is set at a level slightly above the power range specified in the Load specifications. The over power (OP) and power error (PE) status register bits are set when the OP condition occurs, and will remain set until they are reset. The Load module will display OPP when overpower protection occurs.

- Over Temperature Protection
  Each Load has an over temperature protection circuit, which will turn off the load if the internal temperature exceeds the safety limit. The over temperature (OT) and temperature error (TE) status register bits are set when the OT condition occurs, and will remain set until they are reset. The Load module will display OTP when over temperature protection occurs.

- Reverse Voltage Warning
  The Load conducts a reverse current when the UUT polarity connection is not correct. The maximum safe reverse current is the same as the rated Load current. If the UUT reverse current is over the rated current of Load, the Load may be damaged. If a reverse voltage condition is detected, immediately turn off the power to the UUT and correct the connection. The reverse voltage (RV) and voltage fault (VF) status register bits are set when the RV condition occurs, and will remain set until they are reset. The Load module will display REV when reverse voltage protection occurs.

  The Load conducts a reverse current when the UUT polarity connection is not correct. The maximum safe reverse current is same as the Load rated current. If the UUT reverse current is over the rated current of Load, the Load may be damaged. If a reverse voltage condition is detected, you must turn off the power to UUT immediately, and correct the connection. The reverse voltage (RV) and voltage fault (VF) status register bits are set when the RV condition occurs, and will remain set till they are reset. The Load module will appear REV when reverse voltage protection occurs.

- Max sine wave current
  When the LOAD is operating under SINE WAVE DYNA function, the panel will show “MAX LIM” if the loading current caused the voltage to vary beyond the condition allowed.

All of the above protection features will latch when they are tripped. When any of the protections occur the module will turn off the load input and beep until the condition is removed. Reset the protection by pressing the ENTER key on the module.

CAUTION To protect the Electronic Load from possible damage, the input voltage must not exceed the maximum input voltage rating specification. In addition, the Load + terminal potential must be higher than the Load – terminal potential.

- LVP
  The design of LVP is to prevent the UUT from a sudden voltage drop to 0V and rise again when the Von point is set to 0V or in a current loading state at “LOAD ON” as it could cause the voltage or current to overshoot. It also could damage the UUT or Electronic Load if the UUT is connected.

  The LVP is a default protection voltage set internally. When the Electronic Load is under this voltage and in a loading mode, it does not perform current loading until the external voltage is higher than the LVP set protection voltage. Therefore, there will be no overshoot even though the Von point is set to 0V or the voltage is suddenly dropped to 0V and raised again. This prevents the overshoot from damaging the UUT and Electronic Load.

CAUTION When high voltage models are used, the “CC, CP V RANGE SELECT” is set to “HIGH” and “LVP” is set to protection. It may not be possible to operate the maximum current under minimum working voltage as the LVP default protection voltage range is about 0.02V~1.2V.

For example,

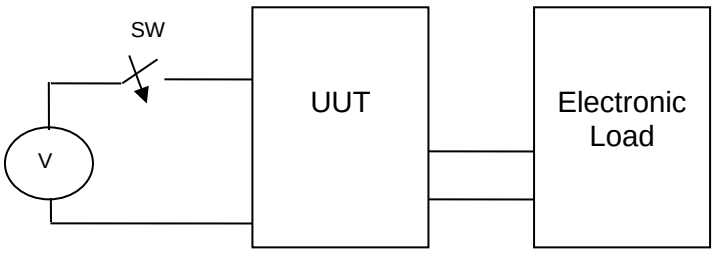


Figure 3-23 Power, UUT and Electronic Load Connecting Diagram

(1) When the Von Point is set to 0V and the LVP sets no protection during “LOAD ON”, current overshoot will occur on the Electronic Load when the Switch (SW) is off. It may damage the UUT and Electronic Load under this circumstance as shown in Figure 3-24.

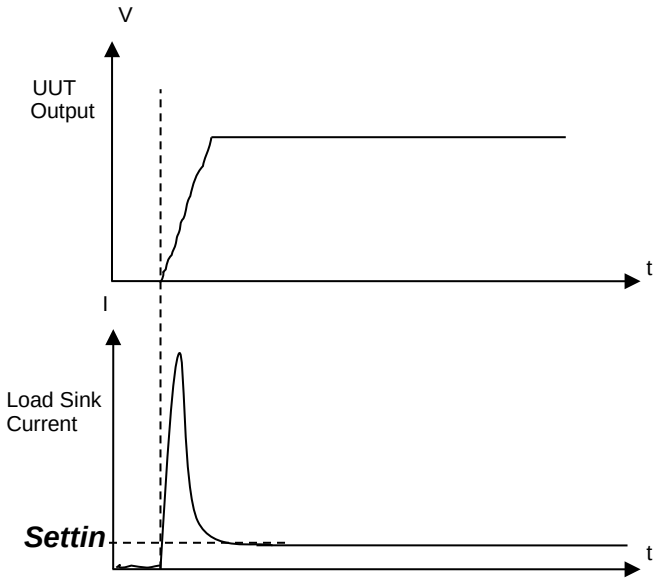


Figure 3-24 When Von Point sets to 0V without Protection

(2) When the Von Point is set to 0V and protection is selected for LVP during “LOAD ON”, the Electronic Load starts current loading when the SW is off and the external voltage is over the protection voltage. Current overshoot will not occur under this circumstance as shown in Figure 3-25.

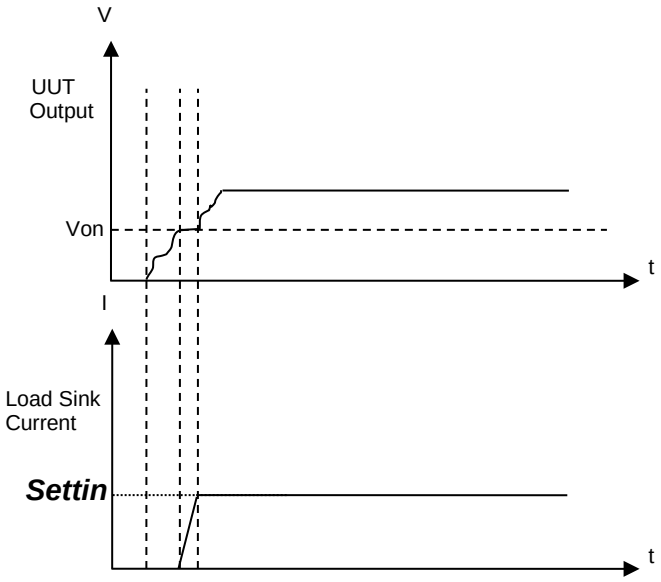


Figure 3-25 When Von Point sets to 0V with Protection

(3) When the Von Point is not set to 0V and protection is selected for LVP during “LOAD ON”, turn off the SW after it is turned off a period of time and then turn the SW off again. It will not perform current loading if the power is lower than the default protection voltage as shown in Figure 3-26. The loading state restores when the SW is off and the power is larger than the default voltage.

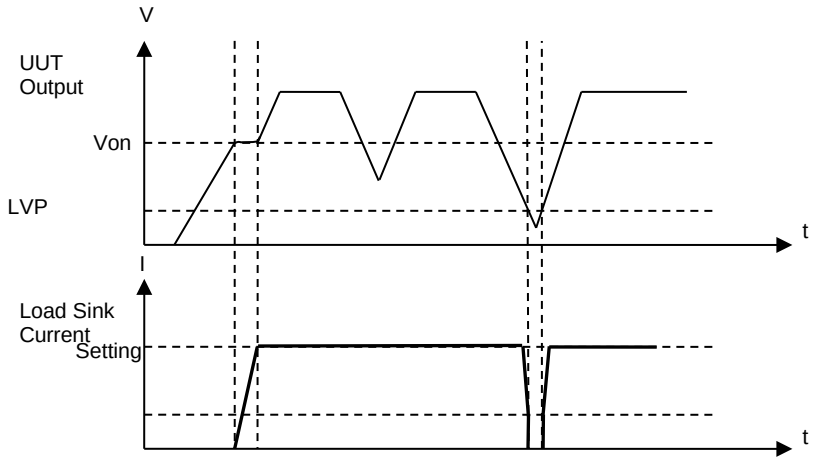


Figure 3-26 When Von Point is not set to 0V with Protection

(4) When the Von Point is not set to 0V and the LVP sets no protection during “LOAD ON”, turn off the SW after it is turned off a period of time and then turn the SW off again. Current loading continues when there is no power as shown in Figure 3-27. Current overshoot may occur when the SW is off with power input. It could damage the UUT and Electronic Load under this circumstance.

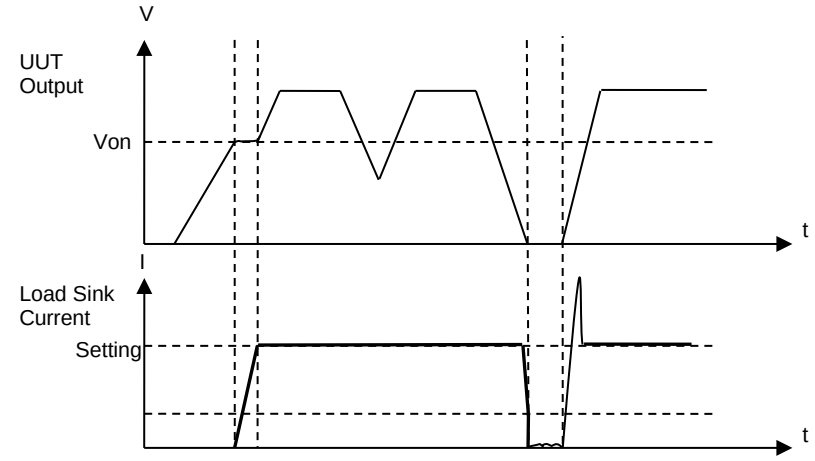


Figure 3-27 When Von Point is not set to 0V without Protection

3.18 Save/Recall Setting

The Electronic Load settings for all channels can be saved and recalled for various test setups. In the Save files (00~99), each file has the settings of Configure, CC, CR, CV, CP, CZ, CCD, CCFS, TIMING, SINE WAVE DYNAMIC, and OCP TEST without AUTO SEQUENCE. Also, there is an additional Power On setting file with the same contents as file 0 ~ 99. Once the Load is on or the Configure screen is exited during normal operation, the present settings will be saved in this file. When the SAVE key is pressed, it will not only save the settings to the user specified file, but also save them to the Power On file. To recall the saved settings (file 00~99), press the ▲or ▼ key to adjust the file number (file 00~99) set by

the 7-segment digit display on the Mainframe panel and then press **RECALL** to recall the saved settings.

3.19 External Waveform Control

The external dynamic test, operated in the CC mode, is similar to that under the Dynamic test, but the load level switching is controlled by the duty cycle of an External signal. It works the same way as the dynamic test except that the Period control signals are not generated internally, but are inputted from V EXT. Connectors are on the rear panel. A 0-to-10V external signal corresponds to the 0-to-full scale input range, so that users should apply DC offset for the external signal in the range from 0 to 10V. For the configuration of external waveform control usage, refer to section 4.7.1 for details.

3.20 Voltage and Current Monitor

Each channel of the Load has two isolated connectors to monitor load voltage and current; the output signal to I MON and V MON. Connectors are on the rear panel. A 0-to-10V output signal corresponds to the 0-to-full scale load V&I range.

4. Local Operation

4.1 Introduction

This chapter describes how to operate the electronic load from the front panel. The descriptions include: Mainframe control panel, Module control panel, and indicators.

Local operation must be in effect in order to use the front panel keys to control the electronic load. Local operation will be in effect immediately after the power is applied. When local operation is in effect, each module can be operated independently, using the display with the keypad on the Load front panel to control the Load. The input voltage/current is displayed on the module's display.

Each module operates independently in CC, CR, CV, CP or CZ mode as a load and simultaneously measures current, voltage, and power level. Each module also operates independently in the dynamic load or dynamic load frequency sweep, or the Advance functions including Timing Measurement, SINE WAVE DYNA, OCP Test, and Program Sequences. The user can off-line edit the above mentioned parameters. In any of the operation modes, when active, the on-line change of parameters changes the Electronic Loading accordingly, thus making it easy to achieve an optimized test condition and then save for later use.

The module allows the user to enter the specifications of a UUT, including V, I, and Watt, for later GO/NG checks. In addition, the real time measurement bar on the VFD display indicates the degree of deviation from the specification and guides the user in adjusting it to fulfill the specification.

This chapter covers the interpretation of the front and rear panel descriptions, the initial setup, the operation of the different load modes including CC, CR, CV, CP and CZ, the operation of the two dynamic load modes including dynamic load and dynamic load frequency sweep, and the operation of the Advance functions including Timing Measurement, SINE WAVE DYNA, OCP Test, and Program Sequences.

Notice When editing a setting, the display will blink to show which setting is to be edited or has been selected.

In remote state, the keys on the front panel have no effect. Only remote controller can program the Load. The display of module will show the present input voltage and current readings or the last display while local state is in effect. The display of the Module will show REMOTE message.

Notice When setting the load module level, the resolution of current, voltage, resistance, and slew rate will be different from the entered values. The displayed or stored value for setting is the actual value of D/A programmed in the load module. The current, voltage and slew rate setting will be degraded when low values are entered. The resistance setting will be degraded when higher values are entered.

4.2 Front Panel Keys and Indicators

4.2.1 Front Panel Keys and Indicators of the Mainframe

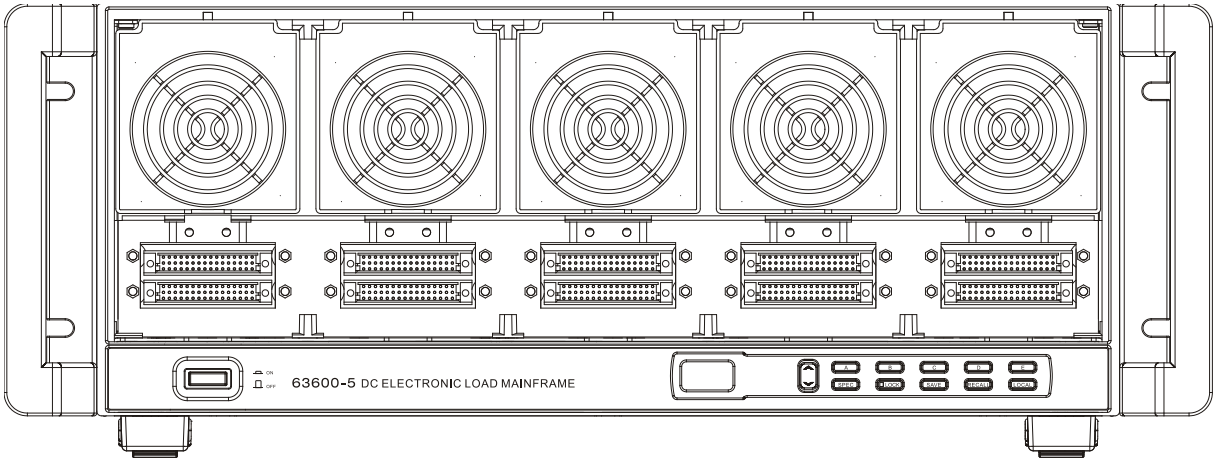


Figure 4-1 Front Panel of the 63600-5 Mainframe

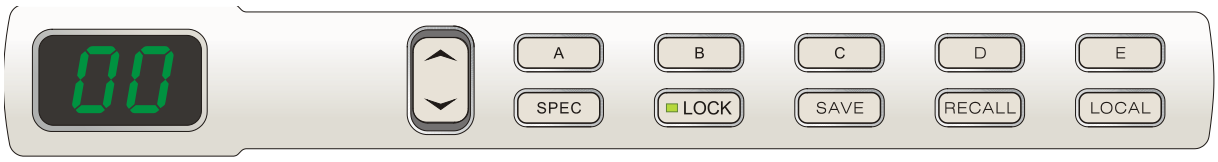


Figure 4-2 Front Panel Keys and Indicators of the 63600-5 Mainframe

- Front Panel Keys and Indicators (mainframe)

Table 4-1 Description of Front Panel for the Mainframe

Item	Name	Description
1	Spec key	The *SPEC* key enables the SPEC function for all channel's GO/NG inspection. (The electronic load allows the user to program the specifications at configuration for Voltage in CC/CR/CP/CZ/DYNA/SWP mode, Current in CC/CR/CV/CP mode, and Power in CC/CR/CV/CP.)
2	Lock key	This system provides a data lock feature to insure that the stored data will only be erasable by an authorized user. When data lock is enabled, any data entry is prohibited and the LED indicator lights up when any data key is pressed. To toggle the lock / unlock state, press and hold this key for at least 2 seconds.
3	Save key	Saves all active mode settings of all channels in the specified file (00 to 99). Saving as DEFAULT saves the status of all channels for the next time the electronic load is turned on. All saved settings are stored in EEPROM, and will not be lost when AC power is cycled. The memory channel is indicated on the LED.
4	Recall key	Recalls the saved settings from EEPROM, and all channel's settings from specified files (00 to 99). The memory channel is indicated on the LED
5	Local key	The *Local* key can recover local control of each module when the Load module is running under remote control mode.
6	Memory channel	A total of 100 memory sets are built in the Load module for

	indicator	storage of programmed setups. The user can save into (or recall from) any memory channel from 00 to 99, and a pre-programmed loading setup.
7	Up and Down keys	*Up* and *Down* keys enable the user to change the memory channel number for save and recall.
8	A/B/C/D/E Mnemonic keys	These 5 mnemonic keys allow users to define and save 5 sets of loading profile for all channels so that users can switch the load. (Press and hold the key for 3 seconds to save the profile automatically.)
9	Power Switch	*Main power switch*.

4.2.2 Front Panel Keys and Indicators of the Load Module

There are two types of panels in the Load modules: a single channel module panel and a dual channel module panel. They are almost the same and only differ by one key and the number of connectors.

The single channel module has one channel in the module. The dual channel module has two channels in one module. Each channel is isolated from the other. The module display/keypad can control both channels. The left channel is called channel L while the right one is channel R.

A. Single Channel Module B. Dual Channel Module

Figure 4-3 Front Panel of the Module

- VFD Display Symbols

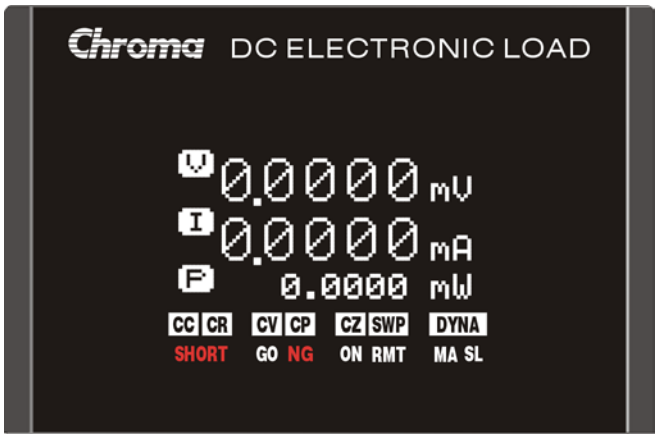


Figure 4-4 VFD Display

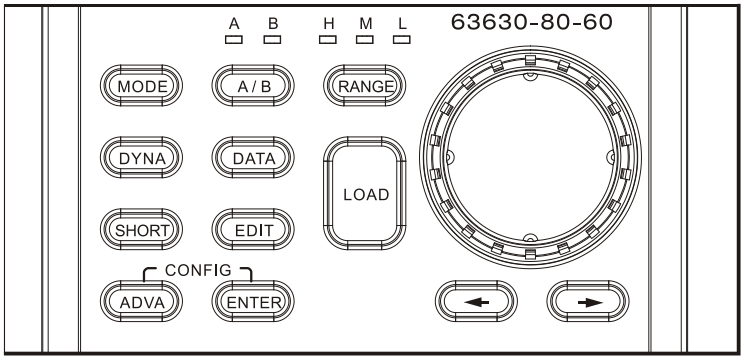
Figure 4-5 Symbols of VFD Display

Table 4-2 Definition for VFD Display Symbols on the Module

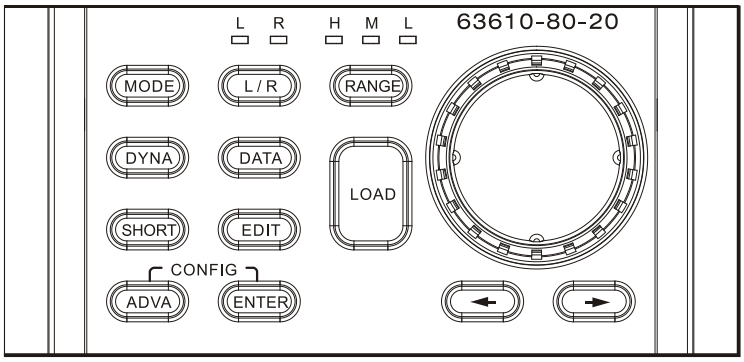
Zone	Symbol	Description
1	CC CR CV CP	Indicates active mode is one of the following: constant current (CC), constant resistance (CR), constant voltage (CV), or constant power (CP).
2	CZ	Indicates active mode for impedance load simulation.
3	SWP	Indicates the Electronic Load is in Frequency sweep mode.
4	DYNA	Indicates the Electronic Load is in Dynamic load mode.
5	SHORT	Indicates the Electronic Load is in short circuit simulation for UUT to test short protection.
6	GO	Indicates the SPEC inspection for GO (PASS).
7	NG	Indicates the SPEC inspection for NG (FAIL).
8	ON	Indicates the load module is in load ON status.
9	RMT	Indicates remote operation via USB/Ethernet/System or GPIB bus is enabled.
10	MA	Indicates the load module is in parallel control mode of MASTER unit or in Sync Dynamic mode of MASTER unit.
11	SL	Indicates the load module is in parallel control mode of SLAVE unit or in Sync Dynamic mode of SLAVE unit. (Slave module in parallel control mode will show “SLAVE” on the display.)

- Front Panel Keys (Load module)

  There are twelve keys on each of the module panels. Only one key is different between the keypads; the A/B key in the single channel module panel and the L/R key in the dual channel module panel. Figure 4-6 shows the front panel keys of the modules.



A. Single Channel Module



B. Dual Channel Module

Figure 4-6 Front Panel Keys of the Module

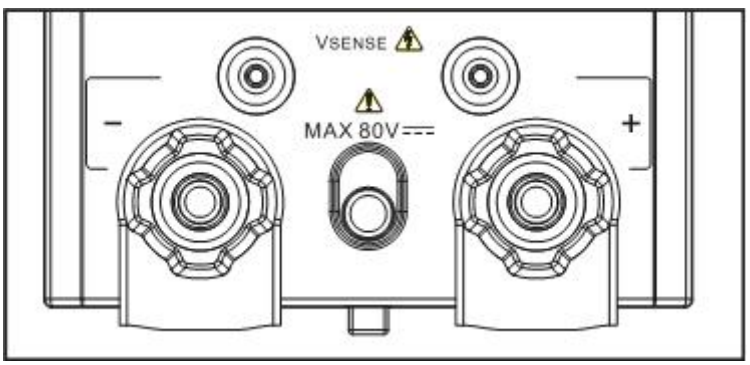
Table 4-3 Definition of Front Panel Keys on the Module

Keys	Description
MODE	The system provides CC, CR, CV, CP and CZ modes for loading simulation. This key is used to change the operation mode for power supply testing. (Pressing MODE repeatedly will switch the mode in the sequence of CC→CR→CV→CP→CZ for users to edit and test.)
DYNA	The system provides programmable dynamic loading for power supply test simulation. This key enables the system to enter into dynamic test. This dynamic mode provides two setting methods of DYNAMIC + COUNT and FREQUENCY SWEEP. (Pressing DYNA repeatedly will switch the function in the sequence of Dynamic →F_Sweep→Static for users to edit and test.) The LED is lit when this function is selected.
A/B (only exists in single channel module)	The single channel module provides two load settings of A and B for STATIC test. This key enables user to select static A or B directly.

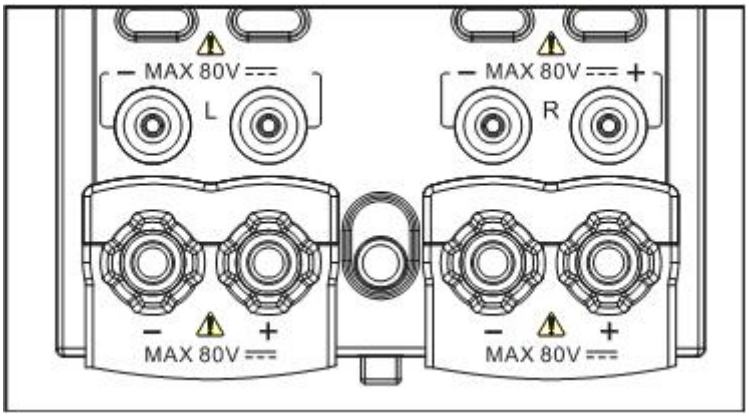
L/R (only exists in dual channel module)	This key is used to select the left channel or right channel directly for the dual channel module.
EDIT	This key is used to select the system operation mode for EDIT or to change the next parameter when the EDIT key is pressed again.
RANGE	This system provides HIGH, MIDDLE, or LOW loading range for data input. The low range offers a better accuracy than the high range. Whenever this key is pressed, the range will be alternately changed.
ADVA	The system provides other functions of TIMING, SINE WAVE DYNA, OCP TEST, AUTO_SEQUENCES for battery discharge, fuel cell and power supply testing. (Pressing ADVA repeatedly will switch the function in the sequence of TIMING -> SINE WAVE DYNA> OCP TEST -> AUTO SEQUENCES for users to edit and test. This key can define the default mode for power on. Press and hold this key for 3 seconds to save the Default of any mode.
SHORT	This key is used to trigger the short circuit function. (Active at load ON status).
LOAD	This key is used to start or stop sinking current from the power supply.
ENTER	This key is used for confirming data entry.
DATA	To select the other measurement and editing parameters.
AVDA + ENTER	To enter into the setup of system configuration.
◄ or ►	These 2 keys are used to change the cursor position of data when operating using rotary knob. Under configuration setup, use them to select the desired parameter.
Rotary Knob	Under configuration setup, this knob is used for changing options of a parameter. On data entry, it changes values of the cursor position which is moved by the above 2 arrows.

- Front Panel Connectors

  There are two Vsense connectors and two Load connectors in the single channel module panel, but there are four Vsense connectors and four Load connectors in the dual channel module panel. Figure 4-7 shows the front panel Connectors of the Module.



A. Single Channel Module



B. Dual Channel Module

Figure 4-7 Front Panel Connectors of the Module

Table 4-4 Definition of Front Panel Connectors on the Module

Connector	Description
V Sense TERMINAL	A connector for remote sensing directly at the UUT terminal eliminates any voltage drop on the connecting cable. If it is not connected, the sensing terminal switches automatically to the LOAD connectors.
LOAD TERMINAL	Input connectors of the Electronic Load for connecting to the UUT. The red one is for positive (+) and the black one is for the negative (-) pole.

4.3 Selecting the Channel for a Dual Channel Module

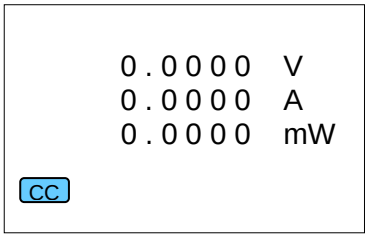
The L/R key is used to select one of the channels in a dual channel module, like the Chroma Model 63610-80-20. To edit the channel settings, first select a channel. Press the L/R key to select the left or right channel for the dual channel module, then the LED “L” or LED “R” above the key L/R lights up. If the load model is a single channel module, the L/R key does not exist, it is instead the A/B key. The Chroma Model 63630-80-60 is a single channel module, so it has the A/B key instead of the L/R key.

4.4 Setting Operation Mode of Static Load

There are five operation modes for static load: constant current (CC), constant resistance (CR), constant voltage (CV), constant power (CP), and constant impedance (CZ).

4.4.1 Setting the Operation Mode

Press the MODE key until the desired mode is displayed on the VFD. To operate in CC mode, press the MODE key until the VFD displays CC mode.



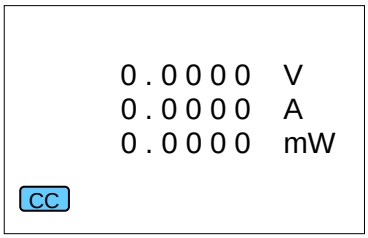
The sequence of mode selection after pressing the MODE key is as follows:

CC → CR → CV → CP → CZ goes back to CC

The load levels and slew rate are common to the CC, CR, and CP modes. CV mode sets the voltage level and current limit. There are two level settings in CC, CR, CV, and CP modes for a single channel module, like the Chroma Model 63630-80-60. They can be switched by the A/B key.

4.4.2 Setting CC Values

When operating in the CC mode, the VFD displays “CC” mode.



There are three current ranges for CC operation: high current range, middle current range, and low current range. The current levels are programmed in milliamps in the low range and in Amps in the middle and high ranges. The slew rate levels are programmed in milliamps/μs in the low range and in Amps/μs in the middle and high ranges. The timings are programmed in milliseconds. The setting buffers of the six CC modes and ranges are independent. Changing the operating range does not affect the settings of the other ranges. The following examples show how to set the CC values of a 63630-80-60 Load module.

1. Select Range

   Select the proper range by pressing the RANGE key until the LED of the desired range above the RANGE key lights up. High range should be used when higher current levels are required, and LOW range should be used when better resolution is required.

   Select the LOW range by pressing the RANGE key until the LED “L” above the RANGE key lights up.

   The sequence of range selection after pressing the RANGE key is as follows:

High range → Middle range→ Low range; goes back to High range.

2. Select state A/B for single channel module

   For a single channel module, press the A/B key to select state A or state B, then the LED “A” or LED “B” above the key A/B lights up. Select state A by pressing the A/B key to select state A, then the LED “A” above the key A/B lights up.

3. Set Current Level

   There are 15,000 discrete steps from 0 to full scale in each range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 500mA, then press the ENTER key to confirm.

500.00 mA

   Use the ◄ or ► keys to change the cursor position to a different digit of the data, then turn the rotary knob to change the value of that digit.

   If the ◄ or ► keys are not used to display the cursor, then the resolution of the value changes according to the rotary knob turning speed.

4. Set Slew Rate

   There are 500 discrete steps in each range. Press the DATA key to set slew rate of rise. Turn the Rotary knob to change the display value to 30mA/μs, and the VFD displays:

⎍ : 30.00 mA/μs

   Then press the ENTER key to confirm the setting, and the slew rate settings change to fall at the same time. Turn the Rotary knob to change the display value to 30mA/μs, and the VFD displays:

⎺_ : 30.00 mA/μs

   Then press the ENTER key to confirm the setting, and the setting page changes to Current Level at the same time.

5. Set the second Current Level for single channel module

   Press the A/B key to select the B State then the LED “B” above the key A/B lights up.

   Turn the Rotary knob to change the display value to 100.00mA, then press the ENTER key to confirm.

100.00 mA

6. Review and update the values of the setting parameters

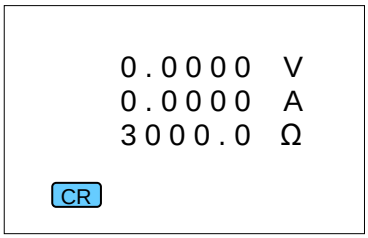
Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.

After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

7. Quit from editing mode
   Press EDIT to exit from the editing mode. The VFD display will go back to the voltage, current, and watt measurement display mode.

4.4.3 Setting CR Values

When operating in the CR mode, the VFD displays “CR: mode.



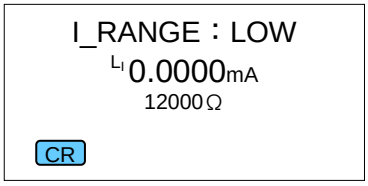
There are three resistance ranges for CR operation: high resistance range, middle resistance range, and low resistance range. The current setting of all resistance ranges can select high, middle or low 3 types of ranges. ALL resistance levels are programmed in ohms (Ω). The following examples show how to set the CR values of a 63630-80-60 Load module.

1. Select the resistance range
   Select the proper range by pressing the RANGE key until the LED of the desired range above the RANGE key lights up. High range is used when a higher resistance level is required, and LOW range is used when better resolution is required.
   Select the LOW range by pressing the RANGE key until the LED “L” above the RANGE key lights up.

   The sequence of range selection after pressing the RANGE key is as follows:

   High range → Middle range→ Low range; goes back to High range.

2. Select the current range
   Press EDIT to enter into the editing mode and press DATA to set the current parameter as shown below:



Turn the rotary knob to select the current range and press ENTER to confirm the selection; otherwise, the new data will not be written into the internal memory. Press EDIT to exit the editing mode and complete the current range setting.

3. Select state A/B for single channel module

   For a single channel module, press the A/B key to select state A or state B, then the LED “A” or LED “B” above the A/B key lights up. Select state A by pressing the A/B key to select state A, then the LED “A” above the key A/B lights up.

4. Set Resistance Level

   There are 15,000 discrete steps from 0 to full scale in each range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 2Ω, then press ENTER to confirm.

2.000 Ω

   Use the ◄ or ► keys to change the cursor position to a different digit of the data, then turn the rotary knob to change the value of that digit.

   If the ◄ or ► keys are not used to display the cursor, then resolution of the value changes according to the rotary knob turning speed.

5. Set the second Resistance Level for single channel module

   Press the A/B key to select State B; the LED “B” above the key A/B lights up. Turn the Rotary knob to change the display value to 1Ω, then press the ENTER key to confirm.

1.000 Ω

6. Review and update the values of the setting parameters

   Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.

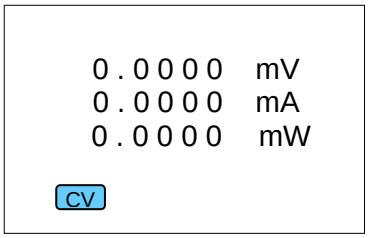
   After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

7. Quit from editing mode

   Press EDIT to exit the editing mode. The VFD display will go back to the voltage, current, and resistance display mode.

4.4.4 Setting CV Values

When operating in the CV mode, the VFD displays “CV” mode.



There are three voltage ranges for CV operation: high voltage range, middle voltage range, and low voltage range. The current is always in high range. ALL voltage levels are programmed in V. The following examples show how to set the CV values of a 63630-80-60 Load module.

1. Select Range

   Select the proper range by pressing the RANGE key until the LED of the desired range above the RANGE key lights up. High range is used when a higher voltage level is required, and LOW range is used when better resolution is required.

   Select LOW range by pressing the RANGE key until the LED “L” above the RANGE key lights up.

   The sequence of range selection after pressing the RANGE key is as follows:

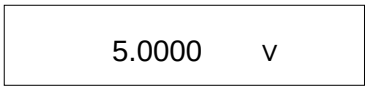
   High range → Middle range → Low range goes back to High range

2. Select state A/B for single channel module

   For a single channel module, press the A/B key to select state A or state B, then the LED “A” or LED “B” above the key A/B lights up. Select state A by pressing the A/B key to select state A, then the LED “A” above the A/B key lights up.

3. Set Voltage Level

   There are 15,000 discrete steps from 0 to full scale in each range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 5 V, then press the ENTER key to confirm.

   Use the ◄ or ► keys to change the cursor position to a different digit of the data, then turn the rotary knob to change the value of that digit.

   If the ◄ or ► keys are not used to display the cursor, the resolution of the value changes according to the rotary knob turning speed.

4. Set the second Voltage Level for single channel module

Press the A/B key to select State B; the LED "B" above the key lights up.

Turn the Rotary knob to change the display value to 6V, and then press the ENTER key to confirm.

6.0000 V

5. Set Current Limit

This function will limit the current sinking of the Load to protect the UUT in the CV mode. There are three CV modes: VOLT_PSU, CURR_PSU, and 6310A. The default setting for the current limit is the maximum Load current.

There are 15,000 discrete steps from 0 to full scale in each range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 60A, then press ENTER key to confirm.

I-LIM : 60.000 A

Use the ◄ or ► keys to change the cursor position to a different digit of the data, and then turn the rotary knob to change the value of that digit.

6. Set Response Speed

There are three response speeds for the CURR_PSU CV and 6310A mode: fast, normal, and slow, for testing different UUTs. Their response time is Fast: 3ms, Normal: 10ms, Slow: 50ms. Turn the Rotary knob to change the speed until the desired response speed is displayed on the VFD. Press the ENTER key to select the mode and confirm the testing.

RESPONSE : FAST

Fast, Normal, and Slow settings are invalid in the VOLT_PSU CV mode.

7. Review and update the values of the setting parameters

Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.

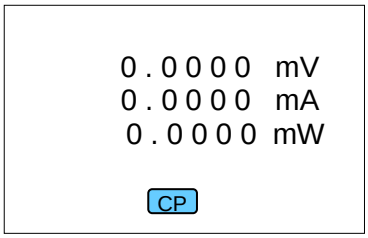
After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

8. Quit from editing mode

Press EDIT to exit from the editing mode. The VFD display will go back to the voltage, current, and watt display mode.

4.4.5 Setting CP Values

When operating in the CP mode, the VFD displays “CP” mode.



There are three power ranges for CP operation: high power range, middle power range, and low power range. ALL power levels are programmed in watts. The slew rate levels are programmed in mA/μs in the low range and in A/μs in the middle and high ranges.
The following examples show how to set the CP values of a 63630-80-60 Load module.

1. Select Range

   Select the proper range by pressing the RANGE key until the LED of the desired range above the RANGE key lights up. High range is used when a higher power level is required and the LOW range is used when better resolution is required.

   Select LOW range by pressing the RANGE key until the LED “L” above the RANGE key lights up.

   The sequence of range selection after pressing the RANGE key is as follows:

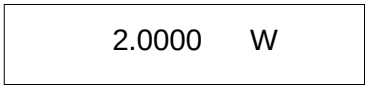
   High range → Middle range → Low range goes back to High range

2. Select state A/B for single channel module

   For a single channel module, press the A/B key to select state A or state B, then the LED “A” or LED “B” above the key A/B lights up. Select state A by pressing the A/B key to select state A, then the LED “A” above the key A/B lights up.

3. Set Power Level

   There are 15,000 discrete steps from 0 to full scale in each range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 2 watts, then press the ENTER key to confirm.

   Use the ◄ or ► keys to change the cursor position to a different digit of the data, then turn the rotary knob to change the value of that digit.

   If the ◄ or ► keys are not used to display the cursor, the resolution of the value changes according to the rotary knob turning speed

4. Set Slew Rate

   There are 500 discrete steps in each range. Press the DATA key to set the slew rate of rise. Turn the Rotary knob to change the display value to 0.03A/μs, and the VFD displays:

   ⎍ : 00.030 A/μs

   Press the ENTER key to confirm the setting and the slew rate setting changes to fall at the same time. Turn the Rotary knob to change the display value to 0.03A/μs, and the VFD displays:

   ⎍ : 00.030A/μs

   Then press ENTER key to confirm the setting, and the setting page change to Power Level at the same time.

5. Set the second Power Level for single channel module

   Press the A/B key to select State B then the LED “B” above the key A/B lights up.

   Turn the Rotary knob to change the display value to 6 watts, then press ENTER key to confirm.

   6.0000 W

6. Review and update the values of the setting parameters

   Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.

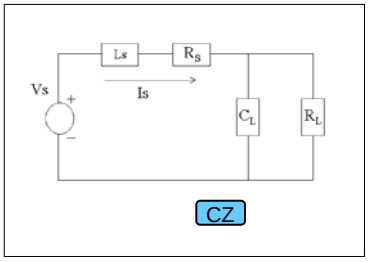
   After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

7. Quit from editing mode

   Press EDIT to exit from the editing mode. The VFD display will go back to the voltage, current, and watt measurement display mode.

4.4.6 Setting CZ Values

When operating in the CZ mode, the VFD displays “CZ” mode.



There is only one impedance range for CZ operation. The current is always in high range. ALL resistance levels are programmed in Ω. The C_L is in μF, and the Ls is in μH. The following examples show how to set the CZ values for a 63630-80-60 Load module.

1. Set the Level of the equivalent parallel load capacitance C_L
   The setting range is from 30μF to 50,000μF. There are 15,000 discrete steps in the range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 2,000μF, then press the ENTER key to confirm.

C_L : 2000 μF

   Use the ◄ or ► keys to change the cursor position to a different digit of the data, then turn the rotary knob to change the value of that digit.

   If the ◄ or ► keys are not used to display the cursor, the resolution of the value changes according to the rotary knob turning speed

2. Set the Level of the equivalent parallel load resistance R_L
   The setting range is the same as the CR mode high range of the Load model. There are 15,000 discrete steps in the range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 3Ω, then press ENTER key to confirm.

R_L : 3.0 Ω

3. Set the Level of the equivalent series inductance Ls
   The setting range is from 0.1μH to 20μH. There are 15,000 discrete steps in the range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 0.1μH, then press the ENTER key to confirm.

Ls : 0.1 μH

4. Set the Level of the equivalent series resistance Rs
   The setting range is from 30mΩ to 20Ω. There are 15,000 discrete steps in the range. Press the EDIT key to enter into the editing mode. Turn the Rotary knob to change the display value to 0.15Ω, then press the ENTER key to confirm.

   Rs : 00.15 Ω

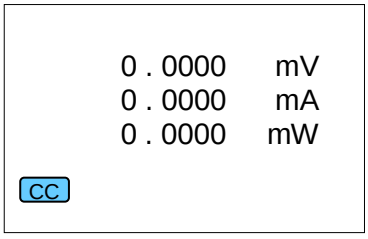
5. Review and update the values of the setting parameters
   Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.
   After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

6. Quit from editing mode
   Press EDIT to exit from the editing mode. The VFD display will go back to the voltage, current, and peak plus/minus voltage display mode.

4.5 Setting Operation Mode of Dynamic Load

4.5.1 Setting the Operation Mode to CC Mode

Dynamic load is the only operation in CC mode. Press the MODE key repeatedly until the VFD displays CC mode.

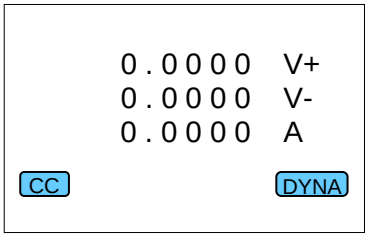


The sequence of mode selection after pressing the MODE key is as follows:

CC → CR → CV → CP → CZ goes back to CC

4.5.2 Select the Operation Mode of Dynamic Load

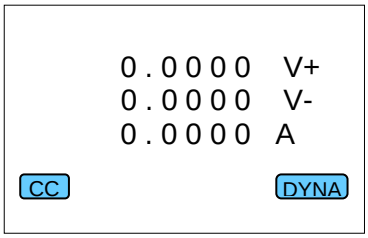
There are two Operation Modes for dynamic load: Dynamic load mode and Dynamic load frequency sweep mode. Press DYNA to select dynamic load, then the LED above the key DYNA lights up, and the VFD displays:



The sequence of mode selection after pressing the DYNA key is as follows:
Dynamic load mode→ Dynamic load frequency sweep mode→ Static load mode goes back to Dynamic mode.

4.5.3 Setting Dynamic Load Values

When operating in the CC Dynamic load mode, the VFD displays “CC” Dynamic Load mode.



There are three current ranges for CC Dynamic load operation: high current range, middle current range, and low current range. The current levels are programmed in milliamps in the low range and in Amps in the middle and high ranges. The slew rate levels are programmed in mA/μs in the low range and in A/μs in the middle and high ranges. The timings are programmed in millisecond. The setting buffers of the six CC Dynamic load modes and ranges are independent. Changing the operation range does not affect the settings of other ranges. The following examples show how to set the CC Dynamic load values for a 63630-80-60 Load module.

1. Select Range

   Select the proper range by pressing the RANGE key until the LED of the desired range above the RANGE key lights up. High range is used when a higher current level is required and the LOW range is used when better resolution is required.

   Select High range by pressing the RANGE key until the LED “H” above the RANGE key lights up.

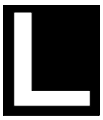
   The sequence of range selection after pressing the RANGE key is as follows:

   High range → Middle range→ Low range goes back to High range

2. Set Current Level

There are 15000 discrete steps from 0 to full scale in each range. Press the EDIT key to enter into the editing mode, and the VFD displays:

Turn the Rotary knob to change the display value to 30A for Load1 and then press the ENTER key to confirm. At the same time it changes to load level setting for Load2. The VFD displays now:



Turn the Rotary knob to change the display value to 10A for Load2 and then press the ENTER key to confirm. At the same time it changes to setting period T1 for Load1.

Use the ◄ or ► keys to change the cursor position to a different digit of the data, then turn the rotary knob to change the value of that digit.

If the ◄ or ► keys are not used to display the cursor, then the resolution of the value changes according to the rotary knob turning speed.

Notations for Load1 and Load2 are H and L respectively, values for Load1 and for Load2 have nothing to do with a comparison between them as their implied meaning is high and low.

3. Set period T1 & T2
The VFD displays:

Turn the Rotary knob to change the display value to 10.000 ms, then press the ENTER key to confirm. At the same time period setting changes to T2.

The VFD displays now:

Turn the Rotary knob to change the display value to 01.000 ms and then press the ENTER key to confirm. At the same time it changes to setting slew rate for rise.

If one of the periods T1 or T2 is larger than 50 ms, full scale switches from low to high, and resolution switches to 1ms automatically. See below for period range and resolution:

	Period	Resolution
Low	0.020ms ~10ms	1μs
High	1ms ~ 100s	1ms

4. Set Slew Rate
   The VFD displays:

   Turn the Rotary knob to change the display value to 1.000A/μs and then press the ENTER key to confirm. The slew rate settings change to fall at the same time.

   The VFD displays:

   Turn the Rotary knob to change the display value to 1.000A/μs and then press the ENTER key to confirm. At the same time it changes to setting Repeat times.

   Full scale range of slew rate switches automatically between low, middle, and high.

5. Set Repeat times
   The VFD displays:

   RT

   Turn the Rotary knob to change the display value to 0 times and then press the ENTER key to confirm. Then the display will go to the first editing page again.

6. Review and update the values of the setting parameters

   Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.

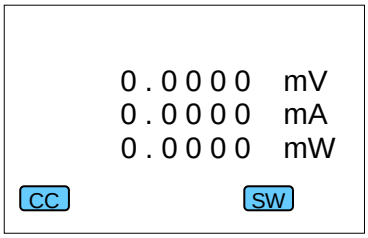
   After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

7. Quit from editing mode

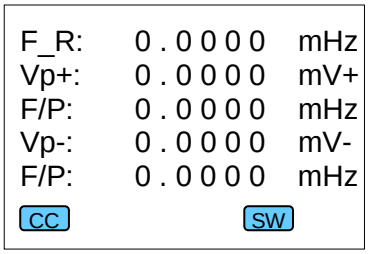
   Press EDIT to exit from the editing mode. The VFD display will go back to the voltage, current, and peak plus/minus voltage measurement display mode.

4.5.4 Setting Dynamic Load Frequency Sweep Values

When operating in the CC Dynamic Load Frequency Sweep mode, the VFD displays “CC” Dynamic load frequency sweep mode.



Press the DATA key to switch the measurement page as shown below. The F_R means the current executing frequency, the Vp+ and Vp- are the voltage positive/negative peaks measured and the F/P is the frequency under voltage positive/negative peak.



There are three current ranges for CC Dynamic load frequency sweep operation: high current range, middle current range, and low current range. The current levels are programmed in milliamps in the low range and in Amps in the middle and high ranges. The slew rate levels are programmed in mA/μs in the low range and in A/μs in the middle and high ranges. The frequencies are programmed in Hz. The Dwell time is in Seconds. Duty is in %. The following examples show how to set the CC Dynamic load frequency sweep values for a 63630-80-60 Load module.

1. Select Range

   Select the proper range by pressing the RANGE key until the LED of the desired range above the RANGE key lights up. High range is used when a higher current level is required and LOW range is used when better resolution is required.

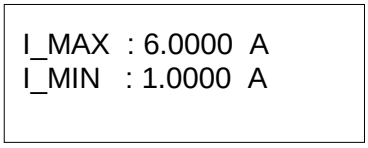
   Select the Middle range by pressing the RANGE key until the LED “M” above the RANGE key lights up.

   The sequence of range selection after pressing the RANGE key is as follows:
   High range → Middle range → Low range goes back to High range

2. Set Current Level

   There are 15,000 discrete steps from 0 to full scale in each range. Turn the Rotary knob to change the display value to 6A for Load1 and then press the ENTER key to confirm the setting. At the same time it changes to load level setting for Load2.

   Turn the Rotary knob to change the display value to 1A for Load2.
   The VFD displays:



Press the ENTER key to confirm. At the same time it changes to setting Start Frequency.

3. Set Frequencies
The setting range of the Frequencies is from 0.01Hz to 50kHz.
Turn the Rotary knob to change the display value to 100Hz for Start frequency and then press the ENTER key to confirm the setting. At the same time it changes to setting End Frequency.

Turn the Rotary knob to change the display value to 1kHz for End Frequency and then press the ENTER key to confirm. At the same time it changes to setting Step Frequency.
Turn the Rotary knob to change the display value to 100Hz for Step frequency.

The VFD displays:

```
F_STAR  :  100.00 Hz
F_END   :  1000.0 Hz
F_STEP  :  100.00 Hz
```

Press the ENTER key to confirm the setting. At the same time it changes to setting Dwell time.

4. Set Dwell time
Dwell time is the elapsed time of each step frequency setting from start frequency to End frequency. The setting range of the Dwell time is from 1ms to 100s. Turn the Rotary knob to change the display value to 0.1s.

The VFD displays:

```
DWELL   : 0.100  s
```

Press the ENTER key to confirm the setting. At the same time it changes to setting Duty.

5. Set Duty
The duty can be set from 1%-99%, but the Duty setting will be limited within the transition time of the two load levels. Turn the Rotary knob to change the display value to 50%.

The VFD displays:

```
DUTY    :  50    %
```

Press the ENTER key to confirm the setting. At the same time it changes to setting Slew Rate.

6. Set Slew Rate
   Turn the Rotary knob to change the display value to 0.600A/μs and then press the ENTER key to confirm. The slew rate settings change to fall at the same time.
   Turn the Rotary knob to change the display value to 0.600A/μs.

   ```
   SR/ : 0.600  A / μs
   SR\ : 0.600  A / μs
   ```

   Press the ENTER key to confirm. At the same time it changes and goes back to the load level setting for Load1.

   The full scale range of slew rate switches automatically between low, middle, and high.

7. Review and update the values of the setting parameters
   Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.

   After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

8. Quit from editing mode
   Press EDIT to exit from the editing mode. The VFD display will go back to the voltage, current, and peak plus/minus voltage measurement display mode.

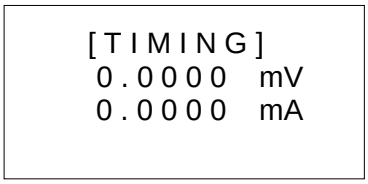
4.6 Setting the Advance Function

The Electronic Load provides useful advanced functions such as Timing Measurement, Sine Wave Dynamic, etc. To use these powerful functions, set the relevant parameters in accordance with application needs. To set the Advance function, press ADVA to enter into the Advance function; the VFD displays “ADVANCE”.

```
   [ A D V A N C E ]
1. TIMING
2. SINE WAVE DYNA
3. OCP TEST
4. AUTO SEQUENCES
```

4.6.1 Setup of Timing Measurement Function

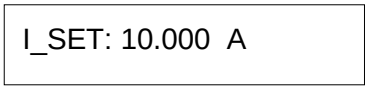
In the Advance function, turn the Rotary knob to change the display value to 1 and then press the ENTER key to select the Timing Measurement Function; the VFD displays “TIMING”.



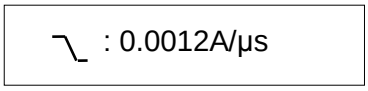
Press the EDIT key to enter into the editing mode. Then press DATA to select the parameter setting.

1. ***Select the operation mode***. There are three operation modes for the Timing Measurement Function. They are CC, CR, and CP modes. Turn the Rotary knob to change the mode until the desired mode is displayed on the VFD. Then press the ENTER key to select the mode and confirm the setting.

2. ***Set Load Level***. There are 15,000 discrete steps from 0 to full scale in each range and each mode. Turn the Rotary knob to change the display value to 10.000A and then press the ENTER key to confirm the setting.



3. ***Set Slew Rate***. Turn the Rotary knob to change the display value and then press the ENTER key to confirm the setting.



4. ***Set Trigger Mode***. There are three Trigger Modes: RISE, FALL, and HOLD_UP. Turn the Rotary knob to change the mode until the desired mode is displayed on the VFD. Press the ENTER key to select the mode and confirm the setting.

5. ***Set Trigger Voltage***. Trigger Voltage is the conduction voltage level.
TRG_S: Sets the start trigger voltage level for the measurement period.
TRG_E: Sets the end trigger voltage level for the measurement period.
The Electronic Load will measure the duration from the load “ON” to the UUT output voltage equal to the trigger voltage setting and the Load stops sinking current when the UUT output drops to the end trigger voltage. Turn the Rotary knob to change the display value and then press the ENTER key to confirm the setting.

```
TRG_S  :3.000     V
TRG_E  :5.000     V
```

6. ***Set the period of time out***. The Electronic Load will measure the duration from the load "ON" to the UUT output voltage equal to the trigger voltage setting. When the time is already over the period of the time out, but the UUT output voltage still has not reached the trigger voltage, the Load will turn "OFF" and stop counting the timing. Turn the Rotary knob to change the display value and then press the ENTER key to confirm the setting.

```
T_OUT: 600  s
```

The display will return to the first editing page.

4.6.2 Setup of Sine Wave Dynamic Function

In the Advance function, turn the Rotary knob to change the display value to 2 and then press the ENTER key to select the Sine Wave Dynamic Function.

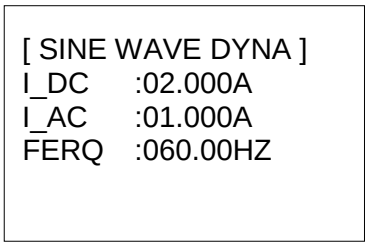
```
    [ ADVANCE ]
1.TIMING
2.SINE WAVE DYNA
3.OCP TEST
4.AUTO SEQUENCES
```

```
    [ ADVANCE ]
5. MPP TRACKER
6. USER DEF. WAVE
```

```
[ SINE WAVE DYNA ]
        0.0000 mV+
        0.0000 mV-
```

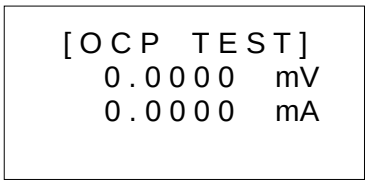
Press the DATA key in the SINE WAVE DYNA screen to set the parameters required for I_DC, I_AC, and FREQ. I_DC is the DC bias current and I_AC is the peak to peak current generated based on the I_DC. The setting range for FREQ is 0.01Hz~20000Hz.

When setting the I_DC and I_AC, be aware the minimum current cannot be lower than 0A, otherwise, the "Out Of Range!!" message will display on the panel.

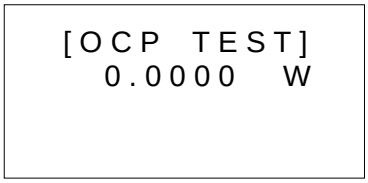


4.6.3 Setup of OCP Test Function

In the Advance function, turn the Rotary knob to change the display value to 3 and then press the ENTER key to select the OCP Test Function; the VFD displays “OCP TEST”.

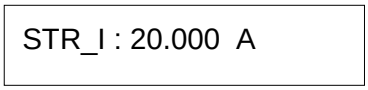


Press the DATA key to switch to the measurement page.

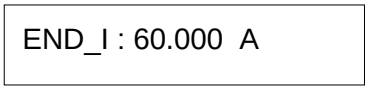


Press the EDIT key to enter into the editing mode. Press DATA to select the parameter setting.

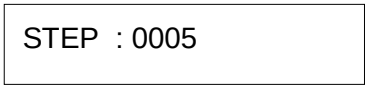
1. ***Set Start Current Level***. Set the initial Current Level. There are 15,000 discrete steps from 0 to full scale in each range. Turn the Rotary knob to change the display value to 20A and then press the ENTER key to confirm the setting.



2. ***Set End Current Level***. Set the final Current Level. There are 15,000 discrete steps from 0 to full scale in each range. Turn the Rotary knob to change the display value to 60A and then press the ENTER key to confirm the setting.



3. ***Set Current Change Step***. Set the current change step between the initial Current Level and the final Current Level. The setting range of the step is from 1 to 1,000. Turn the Rotary knob to change the display value to 5 and then press the ENTER key to confirm the setting.



4. ***Set Dwell Time***. Dwell time is the elapsed time of each Current Level setting from the initial Current Level to the final Current Level. The setting range of the Dwell time is from 10μs to 1000ms. Turn the Rotary knob to change the display value to 100ms and then press the ENTER key to confirm the setting.

DWELL: 100.00 ms

5. ***Set Trigger Voltage***. Trigger Voltage is the conduction voltage level. The Load will stop sinking current when the UUT output voltage reaches the trigger voltage. Turn the Rotary knob to change the display value to 5 V and then press the ENTER key to confirm the setting.

TRG_V : 05.000 V

6. ***Set OCP Current Specification***. There are two levels for OCP Current specification: LOW and HIGH. The LOW and HIGH levels are set by the selected value. Turn the Rotary knob to change the display value and then press the ENTER key to confirm the setting.

SPECL : 50.000 A SPECH : 55.000 A

The display will return to the first editing page.

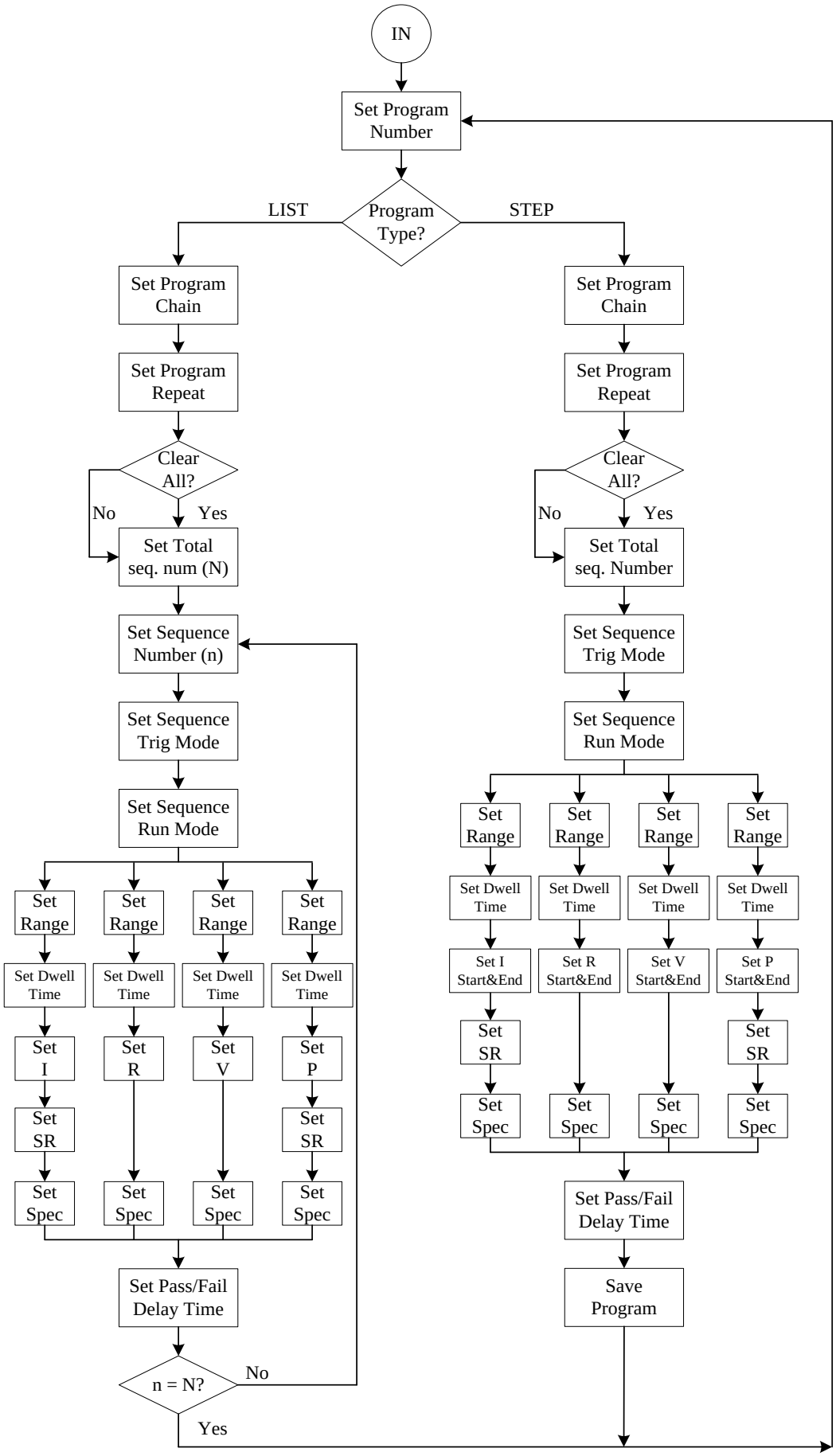
4.6.4 Setup of Program Sequences Function

The user can select customized basic tests for the Electronic Load and link them to the program for auto execution.

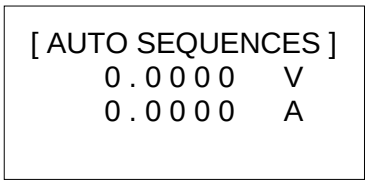
The Electronic Load has 10 programs (1-10) and they share 100 sequences. The user can use the program chain function to chain each set of programs and create various sequence combinations.

For example: If the user sets program 1 to have 5 sequences, program 2 to have 8 sequences and program 3 to have 15 sequences, there are 72 sequences remaining available for editing by programs 4 thru 10. The user can use program chain to chain the programs 1, 2, and 3 to execute in the 5→8→15 sequence order; or chain the program 2, 3 and 1 to execute in the 8→15→5 sequence order. In other words, the user can chain the programs in any way desired via the program chain function.

Following is the Operation Flow:


IN
Set Program Number
Program Type?
LIST
STEP
Set Program Chain
Set Program Repeat
Clear All?
No
Yes
Set Total seq. num (N)
Set Sequence Number (n)
Set Sequence Trig Mode
Set Sequence Run Mode
Set Range
Set Dwell Time
Set I
Set R
Set V
Set P
Set SR
Set Spec
Set Pass/Fail Delay Time
n = N?
No
Yes
Set Program Chain
Set Program Repeat
Clear All?
No
Yes
Set Total seq. Number
Set Sequence Trig Mode
Set Sequence Run Mode
Set Range
Set Dwell Time
Set I Start&End
Set R Start&End
Set V Start&End
Set P Start&End
Set SR
Set Spec
Set Pass/Fail Delay Time
Save Program

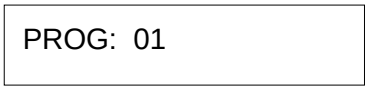
In the Advance function, turn the Rotary knob to change the display value to 4 and then press the ENTER key to select the Program Sequences Function; the VFD displays “AUTO SEQUENCES”.



Press the EDIT key to enter into the editing mode. Press DATA to select the parameter setting.

1. ***Setting the Number of Program***

There are ten programs (1-10) and up to 100 sequences can be set. Turn the Rotary knob to change the display value to 1, then press the ENTER key to confirm the setting.

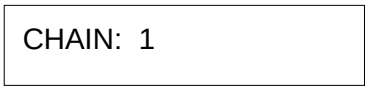


2. ***Setting Type of program***

There are two types of program: List and Step. Turn the Rotary knob to change the type until the desired type is displayed on the VFD. Press the ENTER key to select the type and confirm the setting.

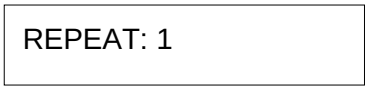
3. ***Setting the Program Chain***

The program chain function enables the chaining of programs to get more sequences for testing. Setting the program chain number to 0 means no program chain. The program chain function can chain itself for loop testing, or chain other programs. Turn the Rotary knob to change the display value to 1, then press ENTER to chain itself for loop testing. The default setting is 0.



4. ***Set Repeat Times***

Set the number of times to repeat the Program Chain. Turn the Rotary knob to set the Repeat times as desired. Press the ENTER key to confirm the setting.



5. ***Display the Remain Unsetting Sequence Amount***

The Load shows the Remaining Unused Setting Sequence amount, which is the difference between the total 100 Sequences minus the number of the total setting Sequences used.

6. ***Clear the Setting Sequence***

Clear the setting Sequences by turning the Rotary knob to change the display value to YES, then press the ENTER key to confirm the setting.

7. ***Set the Amount of the Total Setting Sequence***

Set the Amount of the Total Setting Sequences by turning the Rotary knob to change the display value and then press the ENTER key to confirm the setting.

```
REMAIN_SEQ : 98
CLEAR_SEQ  : NO
TOTAL_SEQ  : 2
```

8. ***Setting Sequence***

In the Program Sequences Function, turn the Rotary knob to change the display value to Sequence Setting and then press the ENTER key to select the Sequence Setting page of the Program Sequences Function.

```
SET_SEQ
```

a. Setting the Sequence Mode

There are four modes to control the sequence execution:

SKIP: Skip the sequence. Load will not change input status.
AUTO: When Dwell time is completed, the Load will go to the next sequence automatically.
MANUAL: Press the ENTER key to confirm the setting; the Load will go to the next sequence automatically.
External: Use the External TRIG_ SEQ signal to control Load input on/off. When the rising edge of the TRIG_ SEQ signal is active, the Load will go to the next sequence automatically.

Turn the Rotary knob to change the display value to MANUAL and then press the ENTER key to set sequence 1 to manual mode. Two or more sequence settings must be set for one program. The default setting is SKIP.

```
TRIG  : MANUAL
```

b. Select the operation mode.

There are four operation modes for the Program Sequences Function. They are CC, CR, CV, and CP modes. Turn the Rotary knob to change the mode until the desired mode is displayed on the VFD. Press the ENTER key to select the mode and confirm the setting.

```
MODE : CC
```

c. Select Range
Select the proper range by turning the Rotary knob to change the mode until the desired range is displayed.

RANGE : HIGH

d. Setting the Sequence Dwell Time
The sequence Dwell time controls the Load input Dwell when the program sequence is executed. The range of Dwell time is from 0.1ms to 30s.

DWELL: 2 s

e. Set Load Level.
There are 15,000 discrete steps from 0 to full scale in each range and each mode. Turn the Rotary knob to change the display value to 10.000A and then press the ENTER key to confirm the setting.

SET_I : 10.000 A

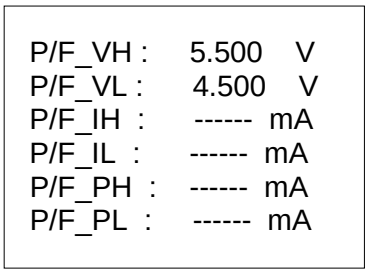
f. Set Slew Rate
The Display shows the slew rate rise and fall settings. Turn the Rotary knob to change the display value to 0.2A/μs and then press the ENTER key to confirm the setting. The slew rate settings change to fall. Turn the Rotary knob to change the display value to 0.2A/μs and then press the ENTER key to confirm the setting.

SR/ : 0.20 A / μs SR\ : 0.20 A / μs

g. Setting the Sequence P/F Specification
The Electronic Load allows the user to program the specifications of a UUT for later GO/NG verification in the Program Sequences Function. During testing, it measures the UUT's performance and compares it with the specification. The Electronic Load allows the user to program specifications for V and I.

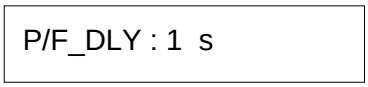
There are two levels for OCP Current specification: LOW and HIGH. The LOW and HIGH levels can be set by selecting the value. Turn the Rotary knob to change the display value and then press the ENTER key to confirm the setting.

The Display shows the specification HIGH settings. Turn the Rotary knob to change the display value to 5.5V and then press the ENTER key to confirm the setting. The specification settings change to LOW. Turn the Rotary knob to change the display value to 4.5V and then press the ENTER key to confirm the setting. The dotted line indicates the item will not be judged.



h. Setting the Sequence P/F Delay Time
The sequence Pass/Fail delay time sets the delay time for P/F checking when a load condition changes. The failure status of the sequence will latch when a program is executed. It means that any failure will be recorded even when the UUT becomes stable within the specifications later. The range of P/F delay time is from 0 to 30s.

Turn the Rotary knob to change the display value to 1 and then press ENTER to set the sequence P/F delay time for 1s. This setting value must be less than the dwell time. The default setting is 0s.



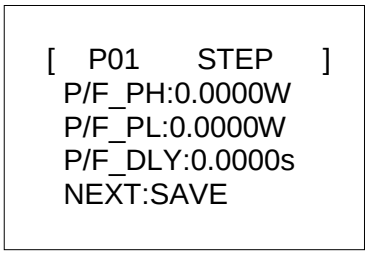
9. ***Review and update the values of the parameter settings***

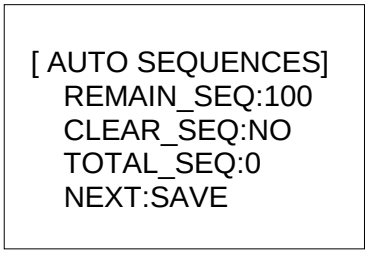
Review the values of the parameter settings by pressing the DATA key. Update them by setting new values in their setting pages.

After completion of the data edit, the ENTER key must be pressed. If the DATA key is pressed, new data will not be written into the internal memory; the previous value for the parameter is kept.

10. ***Save the Program Settings***

There are two ways to save all sequences. One is in the Auto sequences mode: press EDIT to edit the sequence and use the rotary knob under the NEXT selection to select SAVE, and then press ENTER. The other is to use select SAVE under the NEXT selection in the parameter setting screen of sequence and press ENTER.





4.6.5 Running the Program Sequences Function

Press the LOAD key ON to run the program when the program sequences function is selected. The VFD display goes to the voltage and current measurement and program sequences run display mode. The display shows the following:

```
[ 01-004 CCM RUN  ]
      4.9963V
      1.3686A
```

Once the execution of Auto sequences is done, the panel will show the items not within the specifications.

```
[  SPEC. NG  SEQ  ]
  01-001  01-002
  01-003
```

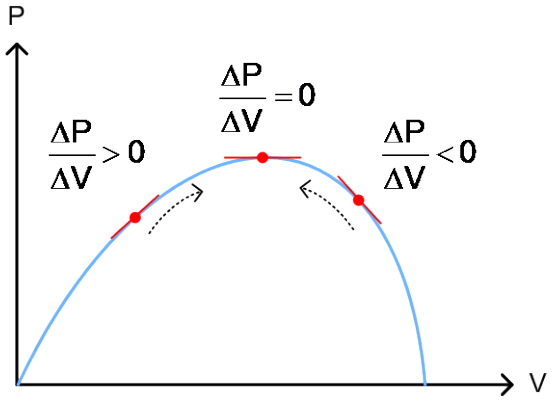
01: means Program 01.
001: means Sequence 01.
002: means Sequence 02.

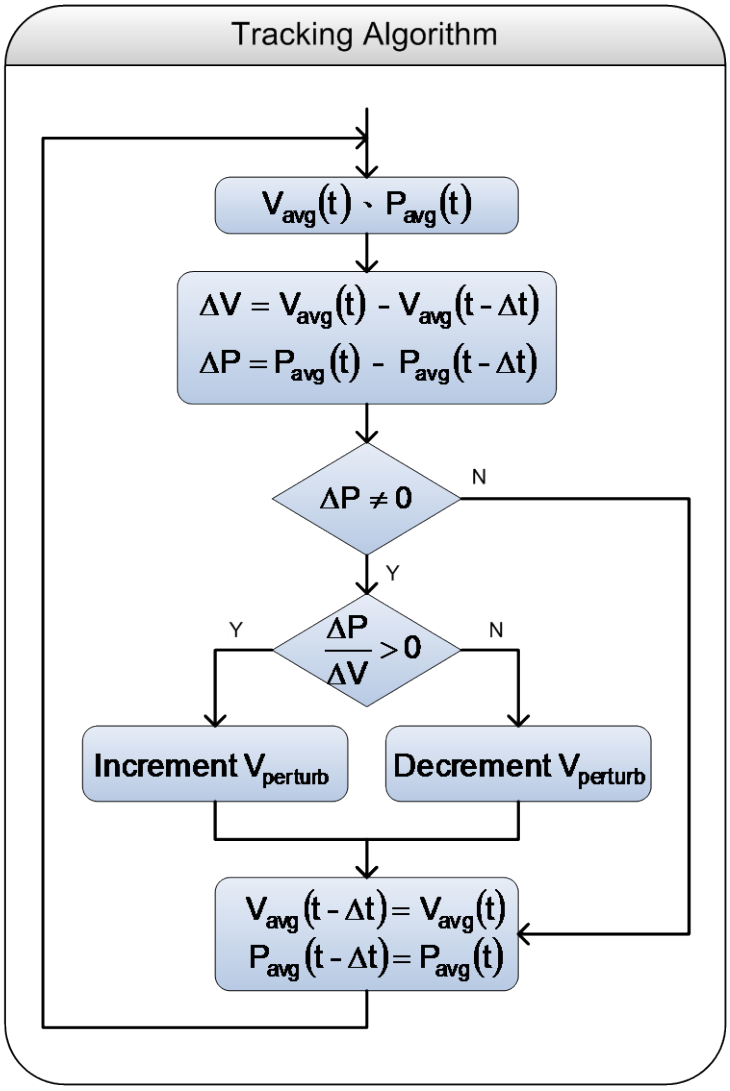
4.6.6 MPP Tracker

```
    [ ADVANCE ]
1.TIMING
2.SINE WAVE DYNA
3.OCP TEST
4.AUTO SEQUENCES
```

```
    [ ADVANCE ]
5. MPP TRACKER
6. USER DEF. WAVE
```

Press the LOAD key ON to run the MPP Tracker function.

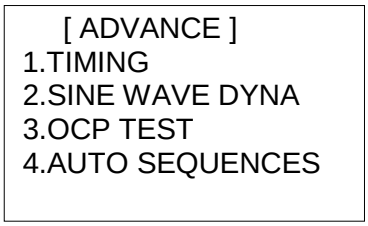

P
$\frac{\Delta P}{\Delta V} > 0$
$\frac{\Delta P}{\Delta V} = 0$
$\frac{\Delta P}{\Delta V} < 0$
V

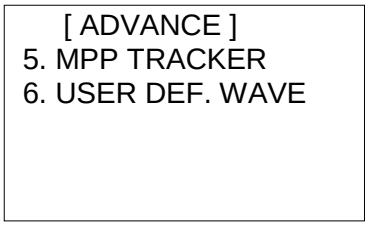

Tracking Algorithm
$V_{avg}(t)$ 、 $P_{avg}(t)$
$\Delta V = V_{avg}(t) - V_{avg}(t-\Delta t)$
$\Delta P = P_{avg}(t) - P_{avg}(t-\Delta t)$
$\Delta P \neq 0$
N
Y
Y
$\frac{\Delta P}{\Delta V} > 0$
N
Increment $V_{perturb}$
Decrement $V_{perturb}$
$V_{avg}(t-\Delta t) = V_{avg}(t)$
$P_{avg}(t-\Delta t) = P_{avg}(t)$

4.6.7 User Defined Waveform (UDW)

The function of USER DEFINED WAVEFORM can simulate the actual loading current and easily save the oscilloscope captured current waveform data or user edited current waveform to the 63600 internal memory through graphical UI. The loading of any user-defined waveforms can be performed by the electronic load as desired.

To enter into the UDW mode, press ADVA and select 6. USER DEF. WAVE, and then press Enter to enter into UDW mode.





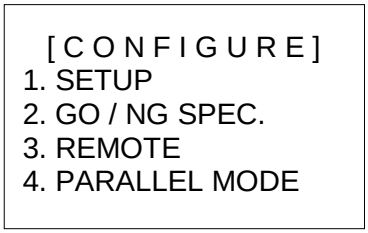
Setting parameters:

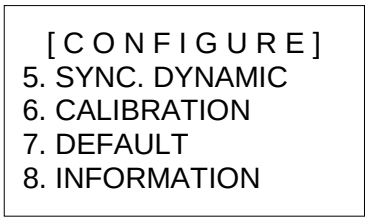
WAVE: Select the waveform number to be executed or saved (1~10).
INTERV: Set the time interval between dots. The range is 10us ~ 20s.
REPEAT: The setting range is 0 ~ 100,000 and the default is 0 indicating infinitely.
INTERP: The selection of interpolation that can set to YES or NO. The 63600 does not interpolate dots when set to NO, and the 63600 will automatically fill in the interval between dots making the loading current smooth when set to YES.
CHAIN: It sets to chain other 1 to 10 stored waveforms.

See *Appendix B Using the 63600 Soft Panel Downloaded UDW* for detail usage.

4.7 Setting the Configuration

The Electronic Load provides useful features such as Von point, Current limit, All run, etc. To use these powerful features, set the relevant parameters in accordance with application needs during the configuration setup. This procedure is only required for the initial setup. The configuration of each channel is stored separately in the EEPROM of the Mainframe. To set the configuration, press ADVA and ENTER simultaneously to enter the system configuration page. The VFD displays the Configuration Setting:



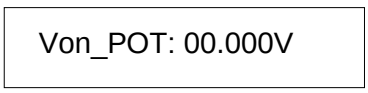


4.7.1 Setup of System Configuration

Turn the Rotary knob to change the display value to 1 and then press the ENTER key to enter the System Configuration Setup page.

Set the CC mode voltage range. There are three voltage ranges in the CC mode: High range for high voltage, middle range for middle voltage, and low range for low voltage. The default setting of Vrange is HIGH.

Set Von point. Von is the conduction voltage level when the Electronic Load starts to sink current and the UUT output reaches the Von voltage. The default setting for Von voltage is 0V.



Set Von latch. There are two operation modes for Von control. Von latch ON means the Load will sink current continuously when it reaches the Von voltage. Von latch OFF means the Load will stop sinking current when the UUT voltage is under the Von voltage. The default setting of Von latch is OFF. Figure 4-8 and Figure 4-9 show the Von LATCH ON and OFF current waveforms respectively.

CAUTION If the Von_POT is too small and it is loaded under the minimum working voltage, it will get an overshoot spike. If a UUT is connected, the overshoot may damage the UUT regardless of how small the specified Load current setting may be. It is therefore necessary to consider if it meets the minimum working voltage when setting the Von_POT to avoid an overshoot spike.

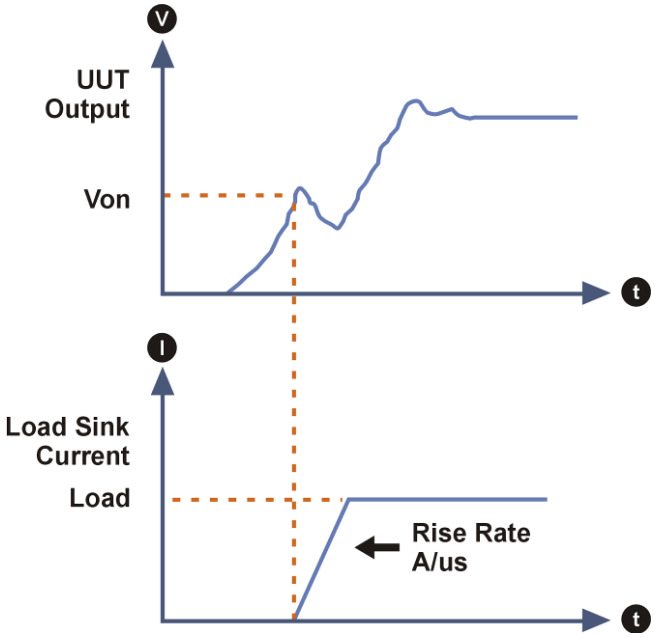


Figure 4-8 Von LATCH ON Current Waveform

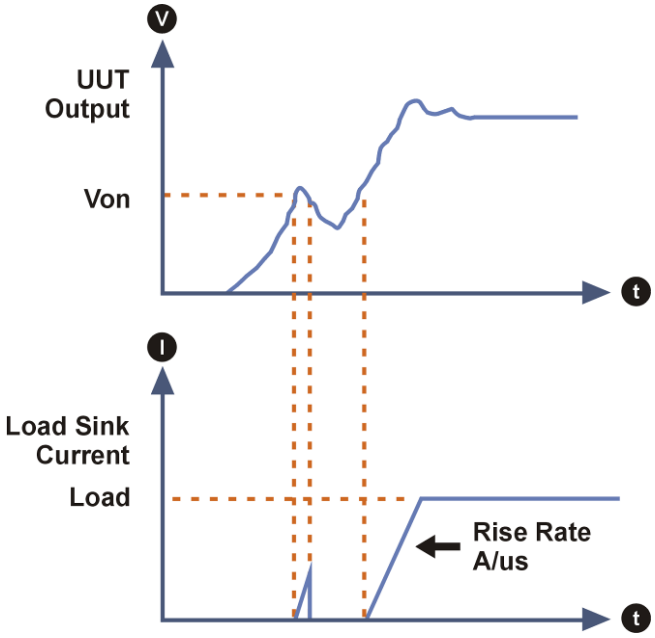


Figure 4-9 Von LATCH OFF Current Waveform

Set Voff point. Voff is the conduction voltage level and it is only available in the Timing mode. The Electronic Load stops sinking current when the UUT output drops to the Voff voltage. To avoid the logic error, the Voff should be less than or equal to Von. The default setting for Voff voltage is 0V.

Vof_POT : 00.000V

Set CV mode type. There are three operation modes in CV mode: Current PSU, Voltage PSU and 6310A. This option allows users to choose the appropriate CV movements to apply to different UUTs. CV Mode type Current PSU is for current source supplies like Chargers and Current sources. CV Mode type Voltage PSU is for Voltage source supplies like Fuel cells, Batteries, and Photovoltaic sources. The 6310A of CV mode simulates the response of

6310A series. The default setting of CV mode type is Voltage PSU.

CV_TYPE:VOLT_PSU

Set All Run mode. When All Run is set to ON, the Load on/off is controlled by any LOAD key on any module of the Mainframe. Otherwise, the Load on/off is controlled individually by the LOAD key on each module. The default setting of All Run is ON.

ALL RUN: ON

Set External wave mode. Under CC mode operation, the load module can be programmed to use internal waveform simulation or use an external driving current as a waveform generator. The default setting for the External wave mode is OFF.

EXT_WAVE: ON

CAUTION When using an external drive current as the waveform generator, the minimum drive current is 0.2mA.

Set sign of voltage for display. The Electronic Load will display a minus sign for the voltage if MINUS is selected. It will not show any sign if PLUS is selected. The default setting is PLUS. Five digits are displayed (the MINUS sign will occupy one digit).

SIGN OF V: PLUS

Set measurement sample time. This function sets the width of the sample time over which data is averaged before updating the display. The default for WINDOW_T is 0.02s and the setting range is 0.001s~10s. Use the Rotary knob to set the required parameter and press ENTER.

WINDOW_T: 10.000s

Select short key mode. Set the SHORT key mode for a load module. The SHORT key can be set to TOGGLE (press to turn ON, press again to turn OFF) or HOLD (press and hold for the duration of the short). The default setting of the SHORT mode is TOGGLE.

SHORT_KEY: TOGGLE

Select module SOUND on/off. Pressing the key on the module will produce a sound if sound = ON. The default setting of sound is ON.

SOUND : ON

Select Load module input status when it is powered ON. When ON is selected, the Load module will be active using the last setting before being turned OFF the last time. The default setting of AUTO_ON is OFF.

AUTO_ON : ON

Select LVP on/off. LVP is a default protection voltage set internally. When the Electronic Load is under this voltage and in loading mode, it does not perform current loading until the external voltage is larger than the LVP set protection voltage. The LVP default is OFF.

LVP : ON

Select ENTER status. Sets "skip to the next setting item" or "stay at its original setting item" when the ENTER key is pressed. The ENTER_KEY default is NEXT.

ENTER_KEY : NEXT

Trigger SHORT key. When the SHORT key is pressed, it enables the SHORT mode if SHORT_KEY= ENABLE. The SHORT_KEY default is ENABLE.

SHORT_KEY: ENABLE

The display will return to the first editing page.

To exit the Setup page and return to the system configuration home page, simultaneously press ADVA and ENTER.

4.7.2 Setup of Specification

The Electronic Load allows the user to program the specifications for a UUT for later GO/NG verification. During testing, it measures the UUT's performance and compares it with the specifications. The Electronic Load allows the user to program specifications for V, I, and Watt.

In the system configuration, turn the Rotary knob to change the display value to 2 and then press the ENTER key to select the GO/NG SPEC page.

Set the specifications of entry mode. The specifications for the Load can be set by VALUE or Percentage for HIGH and LOW data. The percentage values refer to the CENTER value of the specification. The default setting of the SPEC entry mode is percentage.

MODE: PERCENT

Set Voltage specification. There are three levels for Voltage specification: CENTER, HIGH and LOW. The CENTER level must be set by the value of channel input reference level. The HIGH and LOW levels can be set by the value or percentage selected in configuration SPEC. ENTRY MODE. The HIGH/LOW percentage range is from 0 to 100%. And also may choose OFF to close Voltage specification judgment. The default setting of HIGH and LOW is 100%. The CENTER value is half of the range.

```
V_CENT     : ------V
V_HIGH     : ------%
V_LOW:  ------%
```

Set Current specification. There are three levels for Current specification: CENTER, HIGH, and LOW. The CENTER level must be set by the value of channel input reference level. The HIGH and LOW levels can be set by the value or percentage selected in the SPEC MODE configuration. The HIGH/LOW percentage range is from 0 to 100%. OFF will close the Current specification judgment. The default of CENT, HIGH, and LOW is a dotted line which means there is no specification judgment.

```
I_CENT     : ------A
I_HIGH     : ------%
I_LOW      : ------%
```

Set Power specification. There are three levels for Power specification: CENTER, HIGH, and LOW. The CENTER level must be set by the value of channel input reference level. The HIGH and LOW levels can be set by the value or percentage selected in the SPEC MODE configuration. The HIGH/LOW percentage range is from 0 to 100%. OFF will close the Power specification judgment. The default of CENT, HIGH, and LOW is a dotted line which means there is no specification judgment.

```
P_CENT     : ------W
P_HIGH     : ------%
P_LOW:  ------%
```

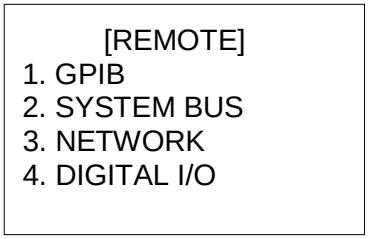
The display will return to the first editing page.

To exit the GO/NG SPEC page, simultaneously press ADVA and ENTER to return to the main system configuration page.

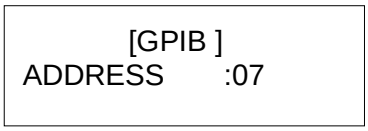
4.7.3 Setup of REMOTE

Remote operation of the Load can be done through the GPIB, USB, or Ethernet interfaces. These connectors on the rear panel connect the Load to the controller or computer. (The GPIB and Ethernet interfaces for the Electronic Load are optional.)

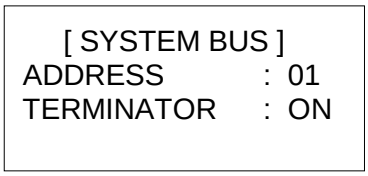
Simultaneously press ADVA and ENTER to enter into the system configuration page. Turn the Rotary knob to change the display value to 3 and then press the ENTER key to select the REMOTE edit page.



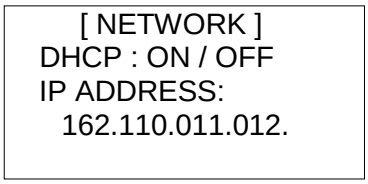
Setting the GPIB Address. Refer to *Chapter 5* for GPIB address in the system. Use this feature to check the GPIB address.

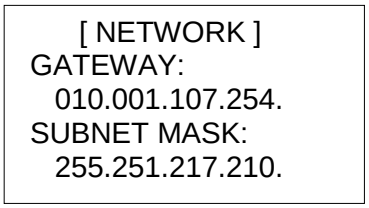


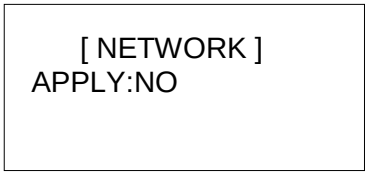
Setting the System Bus address. Refer to *Chapter 5* for System Bus address in the system. Use this feature to check the System Bus address.



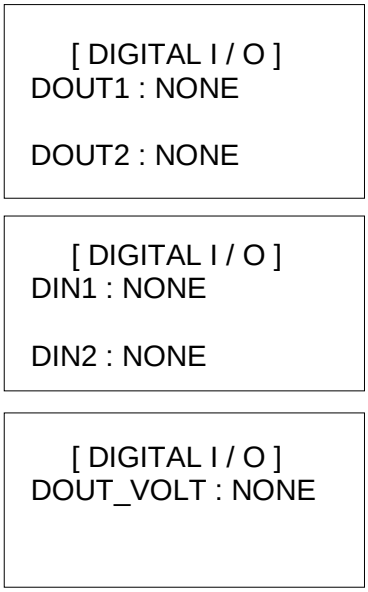
Setting the NETWORK parameters. Refer to *Chapter 5* for Ethernet LAN in the system. Set the LAN parameters including 1.DHCP on/off, 2.IP address, 3. Gateway IP address and 4.Subnet Mask.







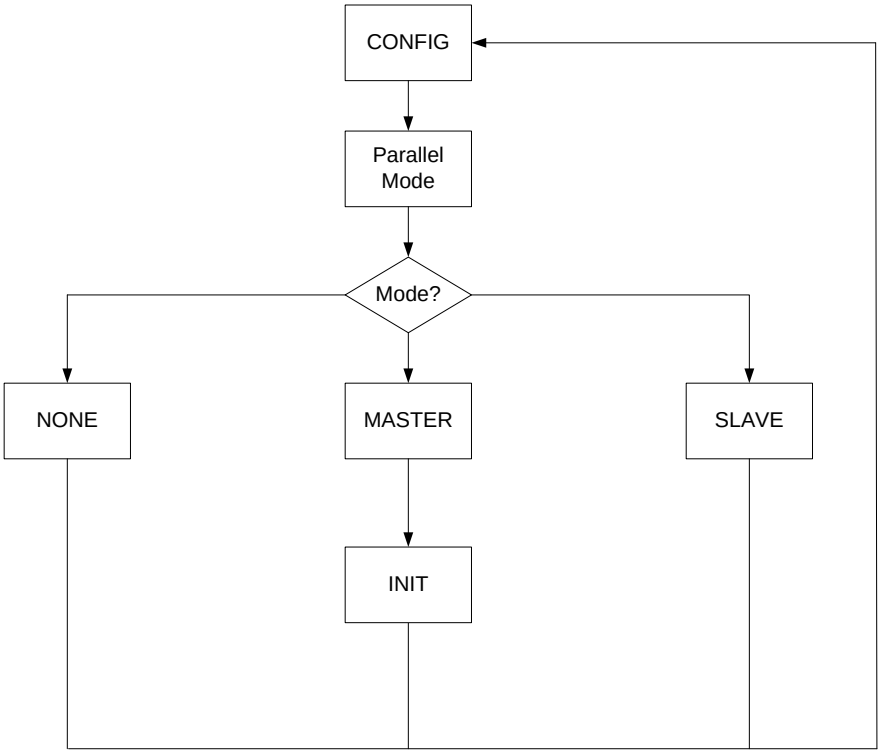
Setting the Digital I/O. Set the Digital I/O including Dout1, Dout2, Din1, Din2 and DOUT_VOLT. Digital output settings include none, OCP test pass/fail, GO/NG test pass/fail, or protection features status. Digital input settings include none or EXT. LOAD On/Off Enable/Disable.



To exit the REMOTE edit page, simultaneously press ADVA and ENTER to return to the main system configuration page.

4.7.4 Setup of Parallel

Operation Flow:



In the system configuration page, turn the Rotary knob to change the display value to 4 and then press the ENTER key to select the Parallel edit page.

Select None / Master / Slave for parallel mode. Set the specified module to none, master or slave for parallel mode.

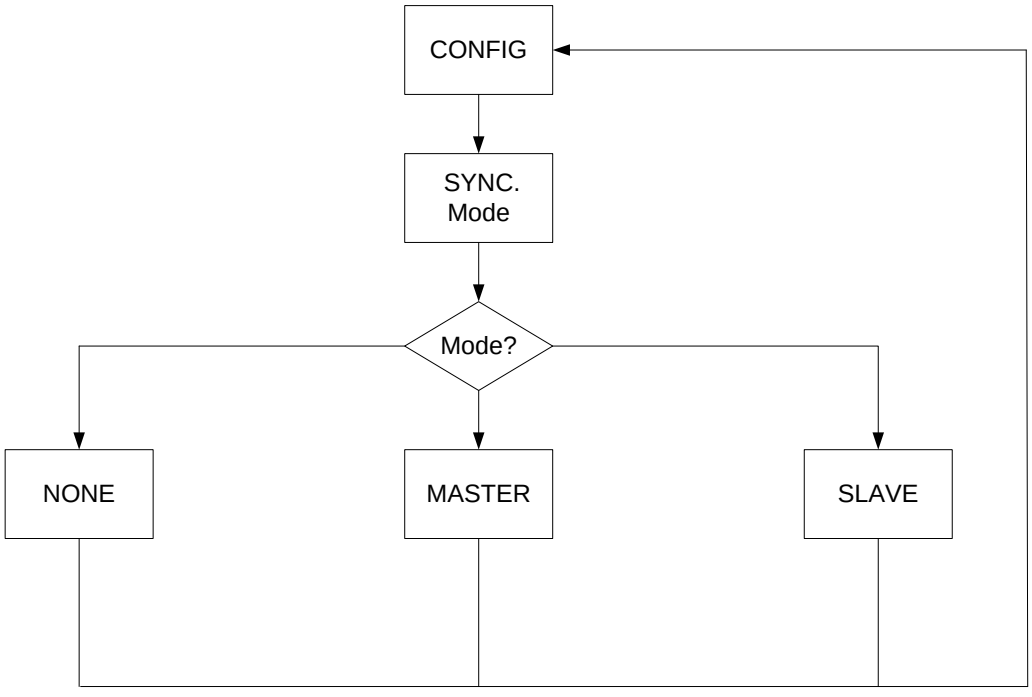
NONE: Disable the MASTER/SLAVE control function.
MASTER: Used as the master for the parallel group. This is the only one controlled by the front panel or PC in this group. Also tells the slaves how much current they should sink. Slave Model: 1 – 5 to set up the slave's model to use in parallel. NONE means does not exist.
SLAVE: Set up the load as slave.

```
 [PARALLEL MODE]
MODE        : MASTER
INITIAL     : OFF
```

To exit the Parallel edit page, simultaneously press ADVA and ENTER to return to the main system configuration page.

4.7.5 Setup of Synchronous Dynamic Mode

Operation Flow:



When Synchronous Dynamic Mode is set to ON, the Load on/off is controlled by the LOAD key on any module of the Mainframe. Otherwise, the Load on/off is individually controlled by the LOAD key on each module.

In the system configuration page, turn the Rotary knob to change the display value to 5 and then press the ENTER key to select the Synchronous Dynamic Mode page.

Select None / Master / Slave for Synchronous Dynamic Mode. Set the specified module to none, master, or slave for parallel run.

NONE: Disable the MASTER/SLAVE control function.
MASTER: Used as the master for the parallel group and this is the only one controlled by the front panel or PC in this group. Also tells the slaves how much current they should sink. Slave Model: 1 – 5 to set up the slave's model to use in parallel. NONE means does not exist.
SLAVE: Set up the load as slave.

To exit the Synchronous Dynamic mode edit page, simultaneously press ADVA and ENTER to return to the main system configuration page.

Notice

1. In the system configuration page, turn the Rotary knob to change the display value to 6 and then press the ENTER key to select the Calibration system configuration page. Only qualified service personnel should enter into this page and edit the data. This is for Chroma instruments factory or service center or standard instruments calibration centers to calibrate the programming and measurement values that are out of specification.
2. The fastest refresh time for the LOAD panel is 0.5 second. When operating in SYNC DYNA, if the T1 or T2 time is less than 0.5 second, a change in the panel reading is restricted by the panel refresh time.
3. Parallel and sync supporting modes list:

	Parallel	Sync
CC mode	O	O
CR mode	O	X
CP mode	O	X
CV mode	X	X
CCD mode	O	O
Timing Mode	X	X
Sine Wave Dynamic	O	O
OCP	O	X
CC Sweep	O	X
CZ Mode	X	X
Program	X	X
User Defined Waveform	X	X
Short	O	X

4.7.6 Recall Factory Default

In the system configuration page, turn the Rotary knob to change the display value to 7 and then press the ENTER key to select the Recall Factory Default page.

Set Recall Factory default. Choose YES and press ENTER and the Load will recall the factory default settings as shown in Table 4-5.

[DEFAULT]
RECALL FACTORY
DEFAULT : YES

To exit the Recall Factory Default page, simultaneously press ADVA and ENTER to return to the main system configuration page.

Table 4-5 Factory Default

Mode Of Operation	Range	63640-80-80	63630-80-60	63610-80-20	63630-600-15	63640-150-60
CC	H	00.005A	00.004A	00.001A	0.0000A	00.000A
	M	0.0005A	0.0004A	0.0001A	000.00mA	0.0000A
	L	000.05mA	000.04mA	000.01mA	00.000mA	000.00mA
CR	H	2900.0Ω	3000.0Ω	12000Ω	200.00kΩ	1500.0Ω
	M	720.00Ω	600.00Ω	2900.0Ω	4000.0Ω	800.00Ω
	L	020.00Ω	30.000Ω	080.00Ω	270.00Ω	60.000Ω
CV	H	80.000V	80.000V	80.000V	600.00V	150.00V
	M	16.000V	16.000V	16.000V	150.00V	80.000V
	L	6.0000V	6.0000V	6.0000V	80.000V	16.000V
CP	H	0000.4W	000.32W	0000.1W	000.00W	000.00W
	M	000.04W	00.032W	000.01W	00.000W	00.000W
	L	00.004W	0.0032W	00.001W	0.0000W	0.0000W
CZ(R_L)	H	2900.0Ω	3000.0Ω	12000Ω	200.00kΩ	1500.0Ω
	M	720.00Ω	600.00Ω	2900.0Ω	4000.0Ω	800.00Ω
	L	020.00Ω	30.000Ω	080.00Ω	270.00Ω	60.000Ω
CZ	H					
	M	C_L: 000030μF Ls: 00.0μH Rs: 10.00Ω				
	L					

Configuration list on panel: (Underline indicates factory default.)

Item1	Item2	Item3	Setting
CONFIGURE			
	1.SETUP		CC_VRANGE: HIGH
			Von_POT: 000.00V
			Von_LATCH: OFF
			Vof_POT: 000.00V
			CV_TYPE: VOLT_PSU
			ALL_RUN: ON
			EXT_WAVE: OFF
			SIGN_OF_V: PLUS
			WINDOW_T: 00.020s
			SHORT_MOD: TOGGLE
			SOUND: ON
			AUTO_ON: OFF
			LVP: ON
			ENTER_KEY: NEXT
			SHORT_KEY: ENABLE
	2.GO/NG SPEC.		MODE: PERCERT
			V_CENT: ------V
			V_HIGH: ------%
			V_LOW: ------%
			I_CENT: ------mA

		I_HIGH: ------%
		I_LOW: ------%
		P_CENT: ------W
		P_HIGH: ------%
		P_LOW: ------%
3.REMOTE	1.GPIB	ADDRESS: 07
	2.SYSTEM BUS	ADDRESS: 01 TERMINATOR: ON
	3.NETWORK	
	4.DIGITAL I/O	DOUT_1: NONE DOUT_2: NONE
4.PARALLEL MODE		MODE: NONE
5.SYNC. DYNAMIC		MODE: NONE
6.CALIBRATION		PASWORD 0.0.0.0.0
7.DEFAULT		RECALL FACTORY DEFAULT: YES
8.INFORMATION[1]		636XX-XX-XX
		G_FW: x.xx
		G_PCB: xx.xx
		G_HDL: xx.xx
		A_FW: x.xx
		A_PCB: x.xx
		A_HDL1: x.xx
		A_HDL2: x.xx
		C1_FW: x.xx
		C1_PCB: x.xx
		C1_HDL1: x.xx
		C1_HDL2: x.xx
9.DIGITIZING		SAMPLING_TIME: 40.000ms
		SAMPLING_POINT: 4096
		TRIG_SOURCE: LOAD_ON
		TRIG_POINT: 2000
		DIGI: INITIATE

Note: FW: Firmware version, PCB: PCB version; HDL: CPLD & FPGA version; G, A, C1, C2 (63610-80-20) represents the PCB name in the module respectively.

4.7.7 Display Model Information

In the system configuration page, turn the Rotary knob to change the display value to 8 and then press the ENTER key to select the Display Model Information page.

Display the Load model and serial number. Displays the model number of the Load module. It is a fixed value and cannot be selected or changed.

63630-80-60
[636308000066]

Display C board F/W version, PCB version and HDL version. Displays the firmware version, PCB version, and hardware description language version of C board. It is a fixed

value and cannot be selected or changed.

```
C_F/W  : X.XX
C_PCB  : X.XX
C_HDL1: X.XX
C_HDL2: X.XX
```

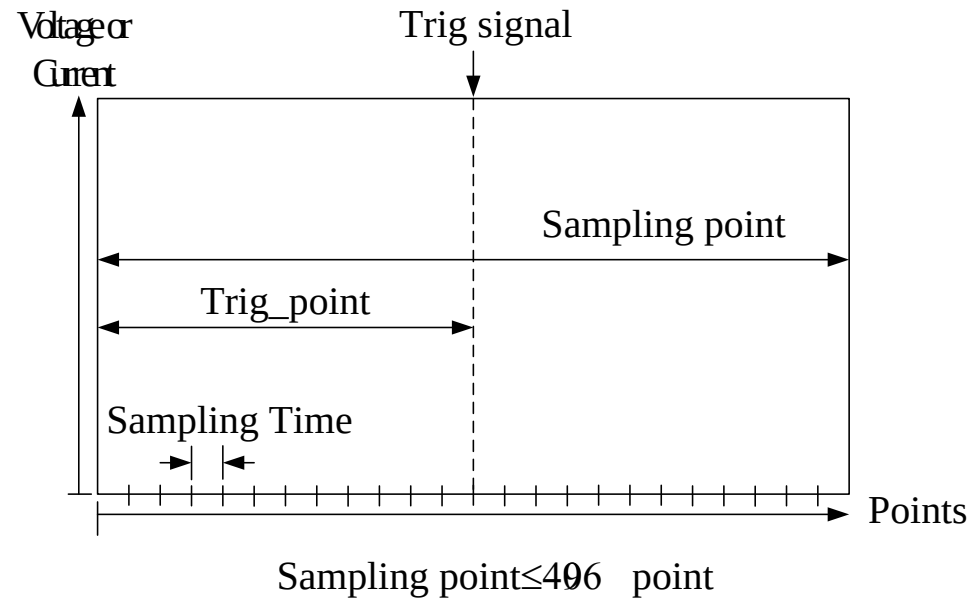
The display will return to the first editing page.

To exit the Display Model Information page, simultaneously press ADVA and ENTER to go back to the main system configuration page.

4.7.8 Setup of Digitizing Function

The 63600 series Electronic Loads offer a digitizing function for recording transient waveforms.

In the system configuration page, turn the Rotary knob to change the display value to 9 and then press the ENTER key to select the Digitizing Function edit page.



Sampling point≤4096 point

Description of Parameter Settings:

Set the Sampling Time. Set the sampling time interval. The range is from 2μs to 40ms, and the resolution is 2μs. The default setting for Sampling Time is 40ms.

Set the Sampling Point. Set the sampling points. The range is from 1 to 4,096 points. The default setting for Sampling Point is 4,096 points.

Set the Trigger point. Set the Digitizing Function Trigger point. The range is from 1 to 4,096 points. The default setting for Trigger Point is 2,000 points.

Set the Digitizing Function Trigger Source. Load ON, Load OFF, TTL (External trigger, TRIG_DIGI signal), BUS trigger, and Manual trigger can be chosen to be the Trigger Source. The default setting for Trigger Source is Load ON.

LOAD ON:	Triggers at Load on
LOAD OFF:	Triggers at Load off.
TTL:	Triggers external TTL (Pin No. 7 of the System I/O Port → TRIG_DIGI)
BUS:	Executes the command ***DIGitizing:TRIGger ON*** for trigger.
MANUAL:	Simultaneously press EDIT+ENTER on the Module front panel to trigger it.

Procedures:

STEP 1: Setting the parameters
Local operation:
SAMPLING_TIME:00.100ms
SAMPLING_POINT:3596
TRIG_SOURCE:LOAD_ON
TRIG_POINT:0500

Remote operation:
DIGitizing:SAMPling:TIME 100µs
DIGitizing:SAMPling:POINt 3596
DIGitizing:TRIGger:POINt 500
DIGitizing:TRIGger:SOURce 0

STEP 2: Initializing the Digitizing function
It is necessary to do initialization before capturing a new waveform. The initialization action will restart the Digitizing function and capture all Trigger Points to wait for the Trigger source.

Local operation:
DIGI:INITIATE

Remote operation:
DIGitizing:INITiate

STEP 3: Setting the Digitizing execution status
IDLE: Indicates the Digitizing is done.
PRE_TRIG: Indicates the Digitizing is processing Trigger Points.
WAIT_TRIG: Indicates the Digitizing is waiting for the trigger signal.
POST_TRIG: Indicates the Digitizing is processing Sampling Points.

Local operation:
It shows ***<PRE_TRIG…> & <WAIT_TRIG…>*** under the ***DIGI:INITIATE.***

Remote operation:
DIG:TRIG?

STEP 4: Executing the trigger condition
Refer to "***Set the Trigger Source of Digitizing Function*.**"

STEP 5: Downloading the waveform
(1) Execute the ***DIG:WAV:CAP?*** command to send the MODULE waveform to

the FRAME. The transmission is done when OK is returned.

(2) Execute the ***DIG:WAV:DATA? V*** command to download the voltage waveform to the PC from the FRAME.
Execute the ***DIG:WAV:DATA? I*** command to download the current waveform to the PC from the FRAME.

To exit the Digitizing Function edit page of the system configuration, simultaneously press ADVA and ENTER to return to the main system configuration page.

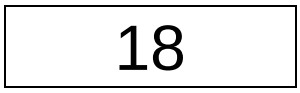
When the module configuration has been completed, simultaneously press ADVA and ENTER to return to the main menu page.

4.8 Recalling Files

Press the **RECALL** key on the mainframe to recall files from 00 to 99. Files 00 to 99 are user data. The memory channel is indicated on the LED. After a file is recalled, the display will go to mode editor to edit or view the file. Press **RECALL** to display the file No. recalled the last time. The default file is “00” when the mainframe is powered on.

To recall parameters on memory channel number 18:

1. Press ▲or ▼ key (several times if required) on the mainframe until the LED beside these 2 keys displays the channel number 18:



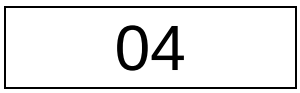
2. Press the **RECALL** key.

4.9 Saving File/Default

Saves all current mode settings of all channels in the specified files (00 to 99). All saved settings are stored in EEPROM, and will not be lost when AC power is cycled. The memory channel is indicated on the LED.

To save parameters into memory channel number 4:

1. Press the ▲ or ▼ keys (several times if required) on the mainframe until the LED beside these 2 keys displays the channel number 4:



2. Press the **SAVE** key.

4.10 Going To Local

Press the **LOCAL** key to go to local operation when the Load is in the remote state.

4.10.1 Lock Operation

The lock operation prevents any settings from being changed. The operation of the LOAD key will not be affected by the lock function. Press and hold the **LOCK** key for at least 2 seconds to enable/disable the lock function.

4.11 Universal Serial Bus (USB) Port

The Universal Serial Bus (USB) Port on the Mainframe rear panel is a 4-pin USB connector. It is available for connecting to a remote controller or a personal computer for remote control. The Universal Serial Bus (USB) signal is defined below:

Table 4-6 Universal Serial Bus (USB) Connector

Pin Number	Input/Output	Description
1	NC	USB Power
2	bidirectional	USBP-
3	bidirectional	USBP+
4	Output	GND

4.12 System Bus Port

The System Bus parameter is set in the configuration mode (refer to section 4.7.1.)
There are two System Bus ports on the Mainframe rear panel. They are 10-pin connectors (RJ-45, male connector). The System Bus connector bus signal is defined below:

Table 4-7 System Bus Connector

Pin Number	Signal	Description
8	DGND	Ground
9	SYNCW	Output Signal

Note When in Synchronous Dynamic Mode, the SYNCW will change by T1/T2. When in T1 the SYNCW output is High and when in T2 the SYNCW output is Low.

4.13 Connecting the System I/O Port

The System I/O port on the rear panel of the 63600-5 mainframe is a 68-pin connector (SCSI 68 pins, female connector). It includes 0-10VDC analog signals, voltage and current monitoring, external analog signal input, and digital I/O signals. The digital system I/O signals are TTL compatible. Definitions are shown below:

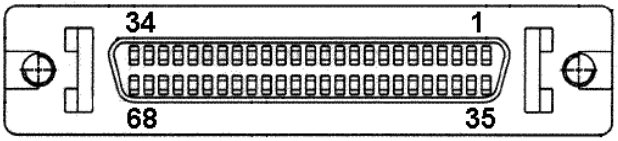


Figure 4-10 63600-5 System I/O Port Connector

Table 4-8 Pin Assignments of 63600-5 System I/O Port Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	SHORT1	**35**	SHORT2	**18**	EXT_WAVE10	**52**	AGNDC
2	SHORT3	**36**	SHORT4	**19**	EXT_WAVE9	**53**	AGNDC
3	SHORT5	**37**	SHORT6	**20**	VMON2	**54**	AGNDC
4	SHORT7	**38**	SHORT8	**21**	IMON2	**55**	VMON1
5	SHORT9	**39**	SHORT10	**22**	AGNDC	**56**	IMON1
6	TRIG_SEQ	**40**	DGNDC	**23**	VMON4	**57**	AGNDC
7	TRIG_DIGI	**41**	DGNDC	**24**	IMON4	**58**	VMON3
8	LOAD_ON	**42**	DGNDC	**25**	AGNDC	**59**	IMON3
9	DO1	**43**	DO2	**26**	VMON6	**60**	AGNDC
10	DI1	**44**	DI2	**27**	IMON6	**61**	VMON5
11	AGNDC	**45**	AGNDC	**28**	AGNDC	**62**	IMON5
12	EXT_WAVE2	**46**	AGNDC	**29**	VMON8	**63**	AGNDC
13	EXT_WAVE1	**47**	EXT_WAVE4	**30**	IMON8	**64**	VMON7
14	AGNDC	**48**	EXT_WAVE3	**31**	AGNDC	**65**	IMON7
15	EXT_WAVE6	**49**	AGNDC	**32**	VMON10	**66**	AGNDC
16	EXT_WAVE5	**50**	EXT_WAVE8	**33**	IMON10	**67**	VMON9
17	AGNDC	**51**	EXT_WAVE7	**34**	AGNDC	**68**	IMON9

Notice

1. TTL High Level Voltage is 5V.
2. SHORT [1:10]: Short ON output signal from the first channel to the tenth channel, TTL Level, Active High.
3. TRIG_ SEQ: External trigger input signal used to increment to the next sequence setting. TTL Level, falling edge, pulse width ≥1μs.
4. TRIG_DIGI: External trigger input signal used as the trigger source for the Digitizing Function. TTL Level, falling edge, pulse width ≥1μs.
5. LOAD_ON: Load ON output signal, TTL Level, Active High.
6. DI [1:2]: 2 bits of digital input signals, TTL Compatible.
   DI1 and DI2 have External Load ON/OFF function. Use this input signal to externally control the Load ON/OFF. If DI1 and DI2 are set to External Load ON/OFF, the two signals need to be HIGH to signal Load OFF and both of the signals need to be LOW to signal Load ON.
   When DI1 (or DI2) is set to Remote Inhibit and is LOW, all channels in FRAME are Load OFF and a REMOTE INHIBIT protection message will appear. Load ON will not be active if the protection message of REMOTE INHIBIT is not cleared even though DI1 (or DI2) is High.
7. DO [1:2]: 2 bits of digital output signals, High Level: 4.7kΩ resistor pull up to 1.8V/3.3V/5V selectable, Low Level <0.6V, sink current = 10mA.
   DO1 and DO2 have the following 5 functions available for selection:
   a. OCP TEST PASS-H: In OCP mode, if the test result is Pass, the DO will output HIGH level signal, or it remains at LOW level.

   b. OCP TEST FAIL-L: In OCP mode, if the test result is Fail, the DO will output LOW level signal, or it remains at HIGH level.
   c. GO/NG TOTAL PASS-H: When the SPEC is ON, if all channels pass, the DO will output a HIGH level signal, or it will remain at LOW level.
   d. GO/NG TOTAL FAIL-L: When the SPEC is ON, if all channels fail, the DO will output a LOW level signal, or it will remain at HIGH level.
   e. OTP OVP OCP OPP, REV-H: If the load has any one of the OTP, OVP, OCP, OPP, REV protection, the DO will output HIGH level signal, or it will remain at LOW level.

   The selections of DOUT_VOLT are:
   a. NONE: Sets the Dout High level to floating.
   b. 1.8V: Sets the Dout High level to 1.8V.
   c. 3.3V: Sets the Dout High level to 3.3V.
   d. 5.0V: Sets the Dout High level to 5.0V.
8. DGNDC: Digital signal ground reference.
9. EXT_WAVE [1:10]: External wave input signals from the first channel to the tenth channel; the input range is from 0 to 10V.
10. VMON [1:10]: Voltage monitor output signals from the first channel to the tenth channel; the output range is from 0 to 10V.
11. IMON [1:10]: Current monitor output signals from the first channel to the tenth channel; the output range is from 0 to 10V.
12. AGNDC: Analog signal ground reference.

The System I/O port on the 63600-2 Mainframe rear panel is a 25-pin connector (D-SUB 25pin male connector). It includes Analog signals: voltage and current monitor and external wave input, and Digital System I/O signals. The Digital System I/O signals are TTL Compatible. They are defined below:

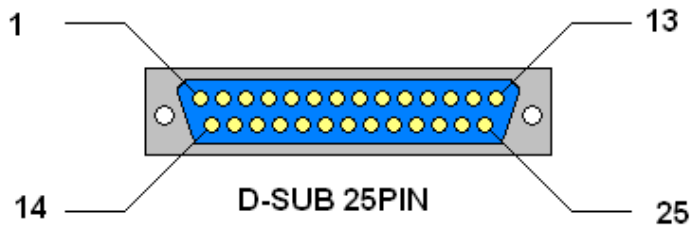


Figure 4-11 63600-2 System I/O Port Connector

Table 4-9 63600-2 Pin Assignments of the System I/O Port Connector

Pin No.	Signal	Pin No.	Signal
1	EXT_WAVE1	14	EXT_WAVE2
2	EXT_WAVE3	15	EXT_WAVE4
3	AGNDC	16	VMON1
4	VMON2	17	VMON3
5	VMON4	18	IMON1
6	IMON2	19	IMON3
7	IMON4	20	SHORT1
8	SHORT2	21	SHORT3
9	SHORT4	22	DGNDC
10	TRIG_DIGI	23	TRIG_SEQ
11	LOAD_ON	24	DO1

12	DO2	25	DI1
13	DI2		

Notice

1. TTL High Level Voltage is 5V.
2. SHORT [1-4]: Short ON output signals from the first channel to the fourth channel, TTL Level, Active High.
3. TRIG_ SEQ: External trigger input signal to go to the next sequence automatically. TTL Level, falling edge, pulse width≥1μs.
4. TRIG_DIGI: External trigger input signal used as the trigger source for the Digitizing Function. TTL Level, falling edge, pulse width ≥1μs.
5. LOAD_ON: Load ON output signal, TTL Level, Active High.
6. DI [1-2]: 2 bits of digital input signals, TTL Compatible.
   DI1 and DI2 have External Load ON/OFF function. Use this input signal to externally control the Load ON/OFF. If DI1 and DI2 are set to External Load ON/OFF, the two signals need to be HIGH to signal Load OFF and both of the signals need to be LOW to signal Load ON.
   When DI1 (or DI2) is set to Remote Inhibit and is LOW, all channels in FRAME are Load OFF and a REMOTE INHIBIT protection message will appear. Load ON will not be active if the protection message of REMOTE INHIBIT is not cleared even though DI1 (or DI2) is High.
7. DO [1-2]: 2 bits of digital output signals, High Level: 4.7kΩ resistor pull up to 1.8V/3.3V/5V selectable, Low Level <0.6V, sink current = 10mA.
   DO1 and DO2 have the following 5 functions available for selection:
   a. OCP TEST PASS-H: In OCP mode, if the test result is Pass, the DO will output HIGH level signal, or it remains at LOW level.
   b. OCP TEST FAIL-L: In OCP mode, if the test result is Fail, the DO will output LOW level signal, or it remains at HIGH level.
   c. GO/NG TOTAL PASS-H: When the SPEC is ON, if all channels pass, the DO will output HIGH level signal, or it will remain at LOW level.
   d. GO/NG TOTAL FAIL-L: When the SPEC is ON, if all channels fail, the DO will output LOW level signal, or it will remain at HIGH level.
   e. OTP OVP OCP OPP REV-H: If the load has any one of the OTP, OVP, OCP, OPP, REV protection, the DO will output a HIGH level signal, or it will remain at LOW level.
   The selections of DOUT_VOLT are:
   a. NONE: Sets the Dout High level to floating.
   b. 1.8V: Sets the Dout High level to 1.8V.
   c. 3.3V: Sets the Dout High level to 3.3V.
   d. 5.0V: Sets the Dout High level to 5.0V.
8. DGNDC: Digital signal ground reference.
9. EXT_WAVE [1-4]: External wave input signals from the first channel to the fourth channel; the input range is from 0 to 10V.
10. VMON [1-4]: Voltage monitor output signals from the first channel to the fourth channel; the output range is from 0 to 10V.
11. IMON [1-4]: Current monitor output signals from the first channel to the fourth channel; the output range is from 0 to 10V.
12. AGNDC: Analog signal reference ground.

The System I/O port on the rear panel of the 63600-1 mainframe is a 15-pin connector (D-SUB 15 pins male connector). It includes 0-10VDC analog signals to monitor voltage and current, external analog signal input, and digital I/O signals. The digital system I/O signals are TTL compatible. Definitions are shown below:

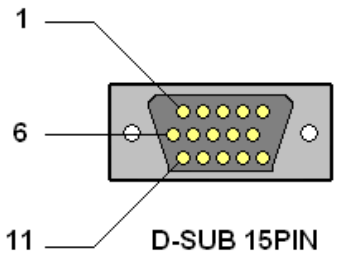


Figure 4-12 63600-1 System I/O Port Connector

Table 4-10 63600-1 Pin Assignments of the System I/O Port Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	DGNDC	6	DGNDC	11	AGNDC
2	EXT_WAVE1	7	EXT_WAVE2	12	NA
3	VMON1	8	VMON2	13	AGNDC
4	IMON1	9	IMON2	14	TRIG_SEQ
5	DGNDC	10	DGNDC	15	AGNDC

Notice

1. TTL High Level Voltage is 5V.
2. TRIG_ SEQ: External trigger input signal used to increment to the next sequence setting. TTL Level, falling edge, pulse width ≥1μs.
3. DGNDC: Digital signal reference ground.
4. EXT_WAVE [1-2]: External input signals for first or second channels. Input range is from 0 to 10V.
5. VMON [1-2]: Voltage monitor signals for the first or second channel. Output range is from 0 to 10V.
6. IMON [1-2]: Current monitor signals for the first or second channel. Output range is from 0 to 10V.
7. AGNDC: Analog signal reference ground.

4.14 Using the Synchronous Cable

The 63600 Series supports up to 4 sets of mainframe synchronous load controls (see 4.7.1 for the configuration settings). The connection between mainframes is via the System Bus connector on the rear panel. Figure 4-13 & Figure 4-14 show the internal wiring of the synchronous cable and MASTER/ SLAVE connection of the mainframe. An additional synchronous cable is required if one more SLAVE is required. Connect the MASTER port to the EXTENDED port of the previous cable and plug in the SLAVE port to the mainframe, and so forth.

The synchronous cable connection of two mainframes turns ON the terminal resistor of each mainframe. Simultaneously press ADVA and ENTER to enter into the CONFIGURE page. Select “3. REMOTE” and press ENTER to go to the REMOTE page and select “2. SYSTEM

BUS" to set the ADDRESS to 01~04 (the address of the two mainframes cannot be the same to avoid conflict) and TERMINATOR to be ON.

```
[ SYSTEM BUS ]
ADDRESS      :01
TERMINATOR   :ON
```

When more than two mainframes are using a synchronous cable connection, it is necessary to turn on the terminal resistor of the first and the last mainframe (the terminal resistors of the other mainframes need to be turned off.) Press ADVA and ENTER at the same time to enter into the CONFIGURE page. Select "3. REMOTE" and press ENTER to go to the REMOTE page and select "2. SYSTEM BUS" to set the ADDRESS to 01~04 (the address of each mainframe cannot be the same to avoid conflict.)

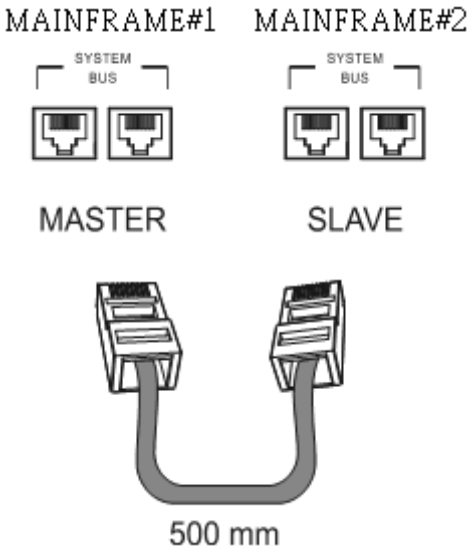


Figure 4-13 Synchronous Cable Connection of 2 Mainframes

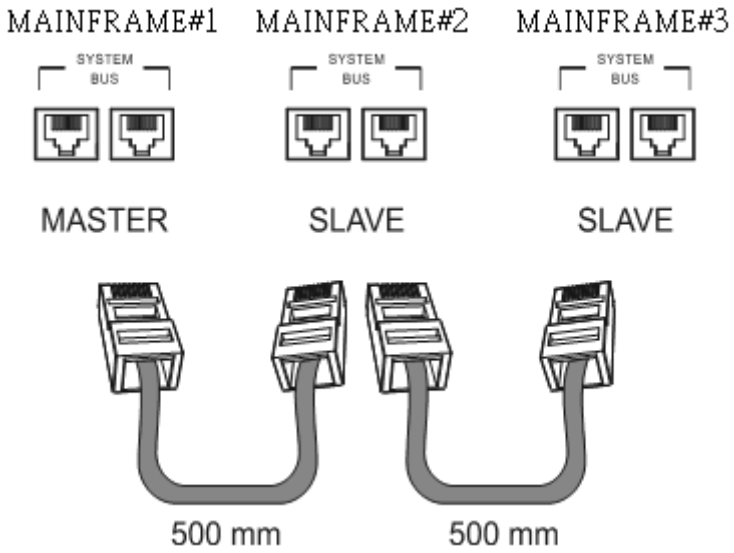


Figure 4-14 Synchronous Cable Connection of 3 Mainframes

5. Remote Operation

5.1 General Introduction

This section describes how to program the 63600 Series DC Electronic Loads remotely from a GPIB, USB, or Ethernet interface. The command set introduced here can be applied to all electronic loads of the 63600 series, including 63600-2, 63600-5 etc., equipped with optional GPIB card, Ethernet card, or USB equipment.

GPIB, USB, or Ethernet can be used one at a time. They cannot be used simultaneously. If GPIB is used first in remote control, USB and Ethernet will be disabled unless the machine is reset, and vice versa.

5.1.1 GPIB Address

Before programming the electronic load remotely via a GPIB computer, you need to know the GPIB address. Each device connected to the GPIB interface has a unique address assigned to it. Each address allows the system controller to communicate with individual devices. To set the GPIB address of an individual mainframe, go to the “REMOTE” setting in the “CONFIG” functional list menu for that Module.

5.1.2 GPIB Capability of the Electronic Load

GPIB Capability	Response	Interface Functions
Talker/Listener	All electronic load functions except the setting for GPIB address are programmable via the GPIB. The electronic load can send and receive messages through the GPIB. Status information is sent using a serial poll.	AH1, SH1, T6, L4
Service Request	The electronic load will set the SRQ line true if there is an enabled service request condition.	SR1
Remote/Local	In local mode, the electronic load is controlled by the front panel and also executes commands sent through the GPIB. The electronic load powers up in local mode and remains there until it receives a command from the GPIB. Once the electronic load is in remote mode, *RMT* will appear on the front panel of all modules. All front panel keys except LOCAL are disabled, and the load module display is in normal metering mode. Press the **LOCAL** key on the front panel at the Frame to return to local mode. Local can be disabled using local lockout, so only the controller or the power switch can return the load to local mode.	RL1
Device Clear	The electronic load responds to the Device Clear (DCL) and Selected Device Clear (SDC)	DCL, SDC

	interface commands. These two actions cause the electronic load to clear the activity that may prevent it from receiving and executing a new command. DCL and SDC do not change any programmed settings.	

5.1.3 USB in Remote Control

Supported Hardware: USB 2.0 and USB 1.1
Supported Software: USBTMC class and USB488 subclass

Installing Driver Program:
The USB Interface of the 63600 Series supports USBTMC class; therefore, if the PC's OS supports USBTMC (the PC has NI-VISA runtime 3.00 or above installed) there is no need to install other drivers. The OS will automatically search the standard USBTMC for installation.

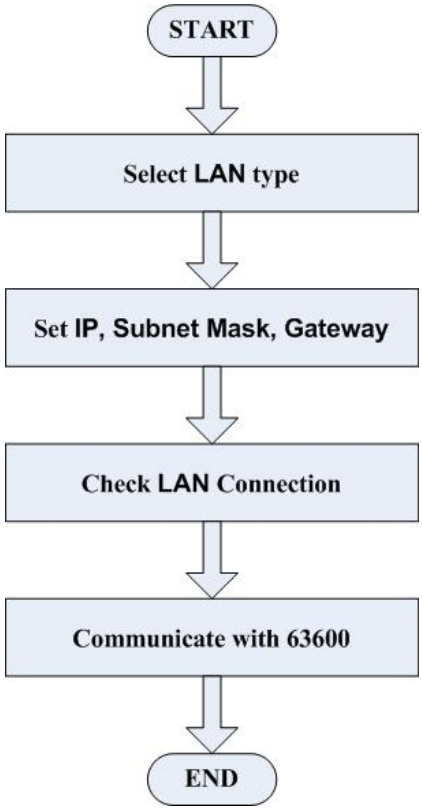
If the PC's OS does not support USBTMC, install NI-VISA runtime 3.00 or above first. The USBTMC driver will be in the OS once the NI-VISA runtime is installed. Power on the DC Electronic Load after connecting it with the PC via a USB cable and use the 63600 Series SCPI commands through **NI-VISA** to communicate with the DC Electronic Load.

5.1.4 Ethernet in Remote Control

Before programming the electronic load remotely via an Ethernet computer, you need to know the IP address, Gateway address, and Subnet mask. Each device connected to the Ethernet interface has a unique IP address assigned to it. The address allows the system controller to communicate with individual devices. To set the IP address of an individual mainframe, go to the "REMOTE" setting in the "CONFIG" functional list menu for each Module.

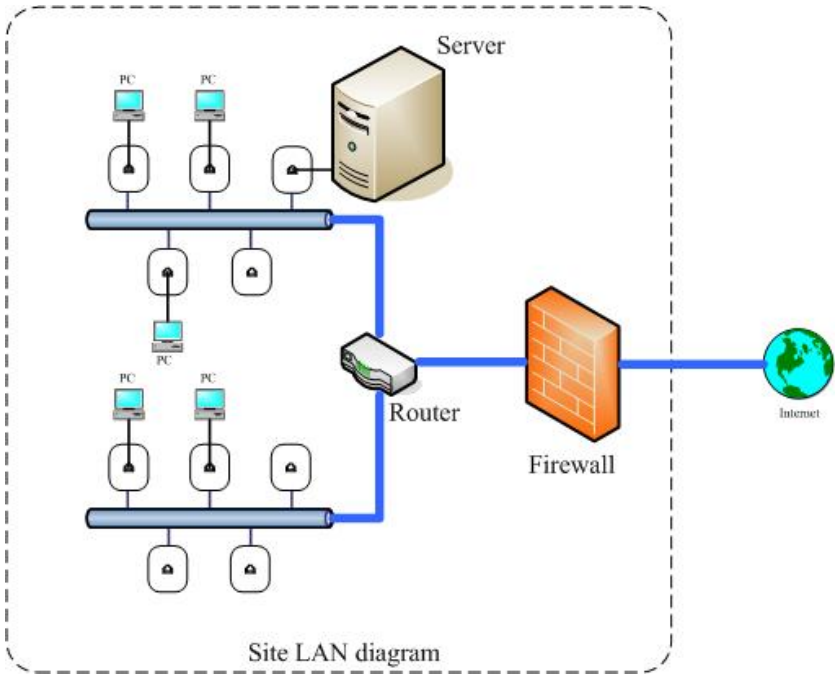
This section describes how to use a Chroma DC Load 63600 network card correctly. Read it carefully before using the 63600 network interface and ensure the network is active and is securely connected to the hardware before execution.

The configuration process is divided into four sections, as described below:



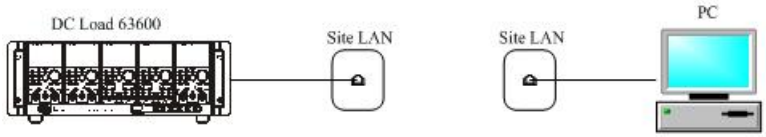
5.1.4.1 Selecting the LAN Type to be Connected

LAN is divided into Site LAN and Private LAN. Site LAN usually refers to large local area networks (such as an enterprise network, also called an Intranet) including network servers (DHCP, WINS, DNS…etc.) and terminal devices (Terminator) that are connected via Router, Firewall, and Internet as shown below.

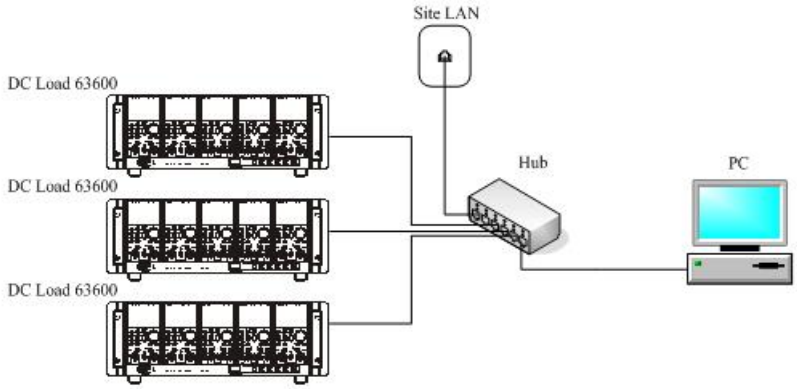


When selecting a Site LAN, use the following two ways to connect to the computer:

(1)



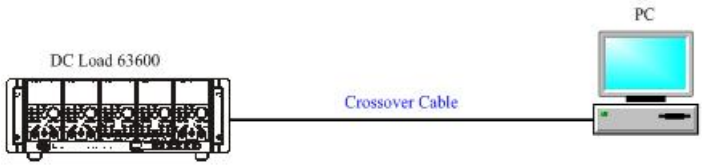
(2)



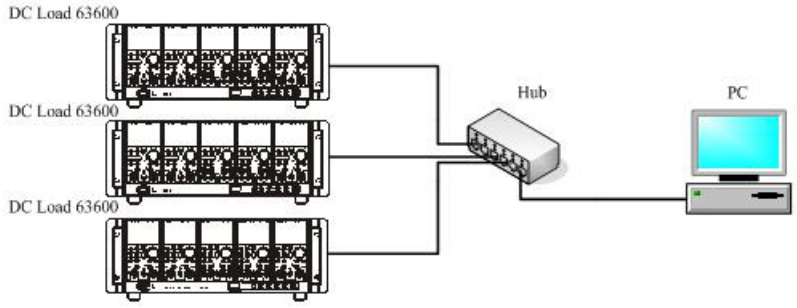
Private LAN is a smaller local area network composed of two or more terminal devices and Hub or two terminal devices via Crossover Cable connection.

When choosing a Private LAN, use the following two ways to connect to the computer:

(1)



(2)



5.1.4.2 Setting Network Parameter (IP, Subnet Mask, Gateway)

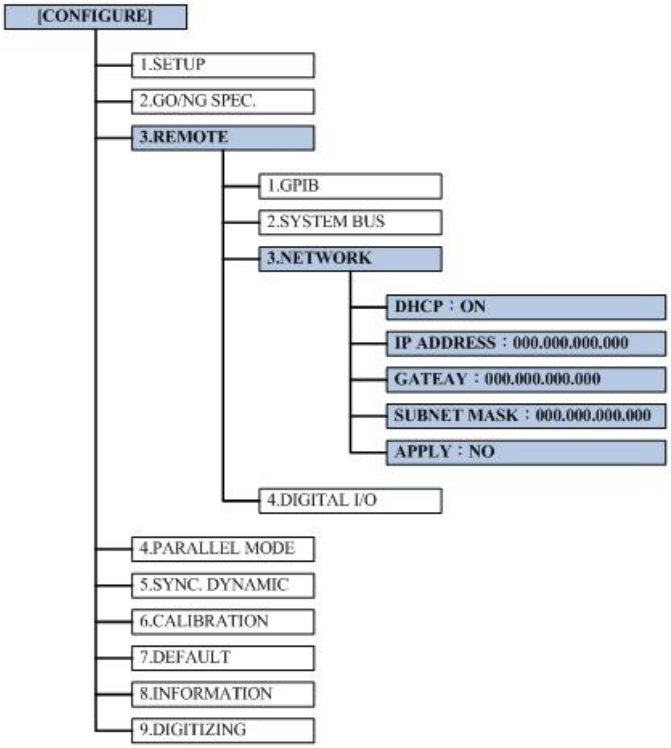
1. When in Site LAN:

The only network setting required on the 63600 is setting DHCP to ON (Server specifies the IP automatically) or OFF (specifies IP manually.)

Steps to set 63600 DHCP = ON for Chroma DC Load:

STEP 1:

Simultaneously press ADVA + ENTER on the front panel of any module to go to the CONFIG screen and follow the tree diagram shown below to locate the DHCP parameter to set it to ON.



STEP 2:

Press ENTER or DATA to go to the APPLY option and set it to YES, then confirm the setting.

STEP 3:

The screen will show the networking status setting. The status messages are shown below:

a. Initiating… : The network card is initialing.
b. Connecting… : The network card is connecting.
c. Disconnection! : It is unable to connect to the network.
d. DHCP Failure!! : It cannot find the DHCP Server and is unable to specify the IP Address via DHCP.
e. Not Properly Set : The network setting is wrong.

Once the setting is successful, the panel will automatically show the updated network setting

and clear the status message.

STEP 4:
Save the settings and exit the CONFIGURE page completely to save them correctly.

Steps to set DHCP = OFF for Chroma DC Load 63600:

STEP 1:
When DHCP=OFF, the IP, GATEWAY, and SUBNET MASK parameters need to be set. If the current Site LAN is known, the settings can be done easily.

If the current Site LAN is not known, contact the network administrator in the company to manually set the network parameters.

Notice

If the computer network setting is known, enter the SUBNET MASK and GATEWAY settings directly while setting a different IP address for the 63600. For instance, if the computer IP is 10.1.7.100, Mask is 255.255.254.0, and Gateway is 10.1.7.254, users can set the 63600 IP to 10.1.7.101, Mask to 255.255.254.0,and Gateway to 10.1.7.254 under the premise that the IP: 10.1.7.101 has not been used by any other users.

STEP 2:
Press ENTER or DATA to go to the APPLY option and set it to YES, then confirm the setting.

STEP 3:
The screen will show the networking setting status. The status messages are shown below:

a. Initiating… : The network card is initialing.
b. Connecting… : The network card is connecting.
c. Disconnection! : It is unable to connect to the network.
d. DHCP Failure!! : It cannot find the DHCP Server and is unable to specify the IP Address via DHCP.
e. Not Properly Set : The network setting is wrong.

Once the setting is successful, the panel will automatically show the updated network setting and clear the status message.

STEP 4:
Save the settings and exit the CONFIGURE page completely for 63600 to save them correctly.

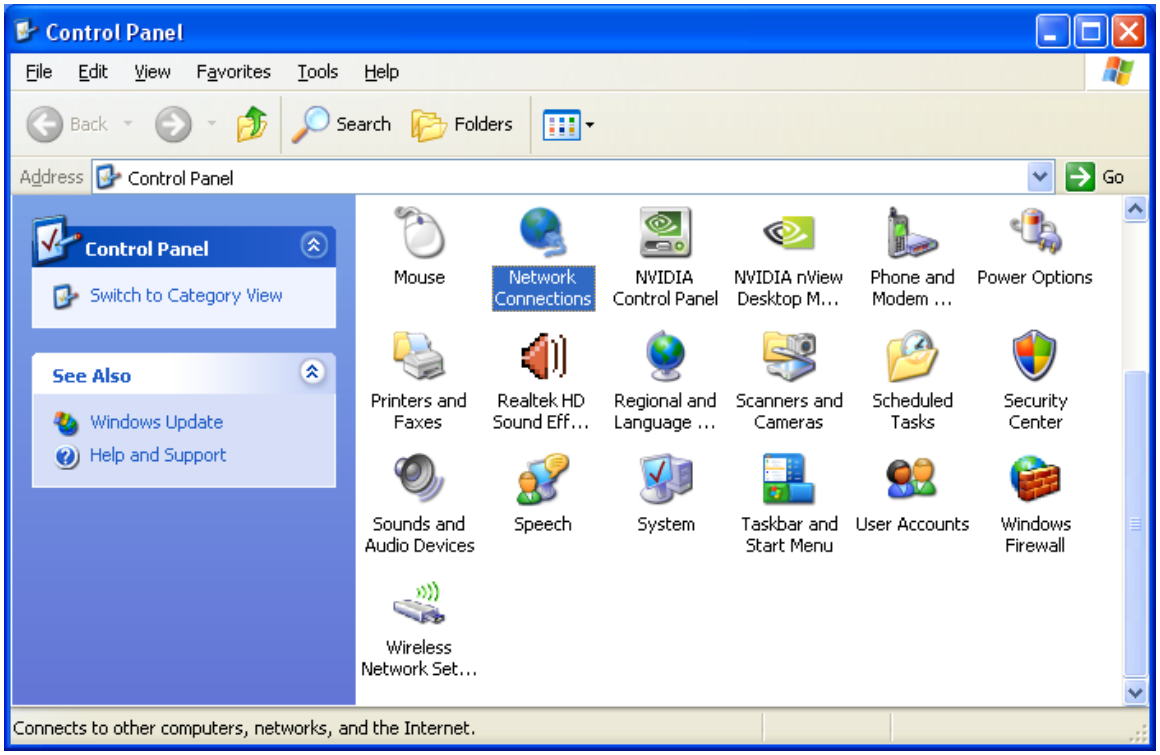
2. When in Private LAN:

In common situations, the Personal Computer (PC) does not have a DHCP Server, so this section only explains the settings when DHCP=OFF. In a Private LAN, all network devices connected need to set the IP manually. For instance, when a PC is connected to a 63600 through a Crossover Cable, the IP of both devices needs to be set manually.

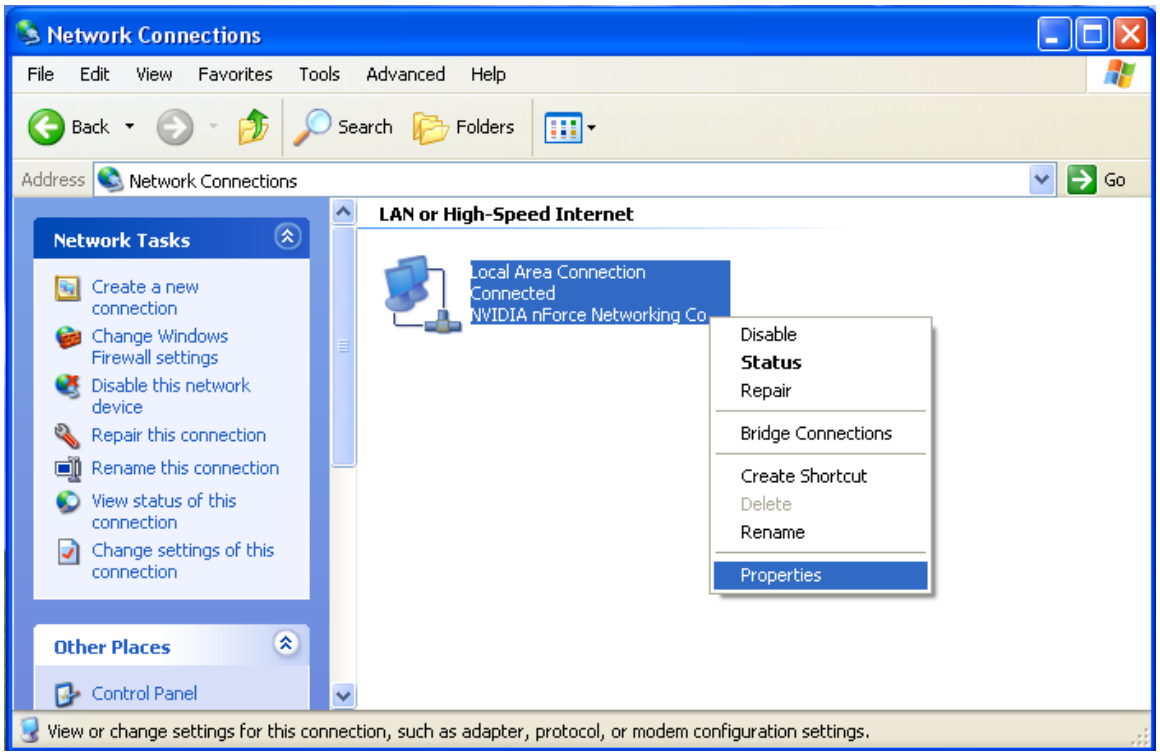
Steps to set DHCP = OFF for PC

Ensure the IP of LAN setting for user's PC is to be set manually. If not, change it to set manually for IP and complete other settings.

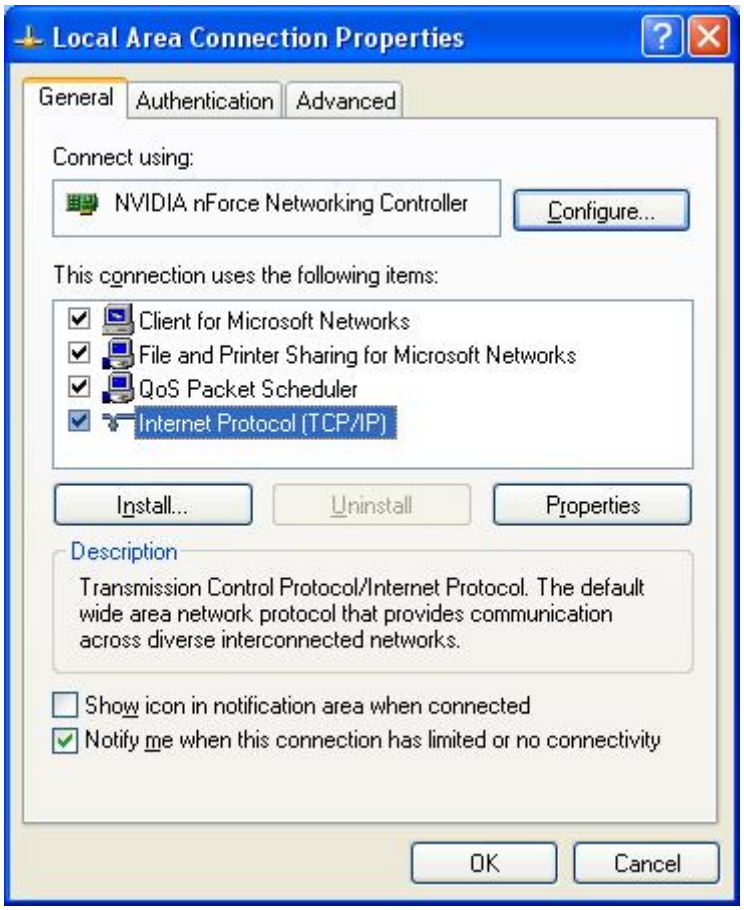
STEP 1:
Click "**Control Panel**" on the PC and double-click "**Network Connections**" to enter it.



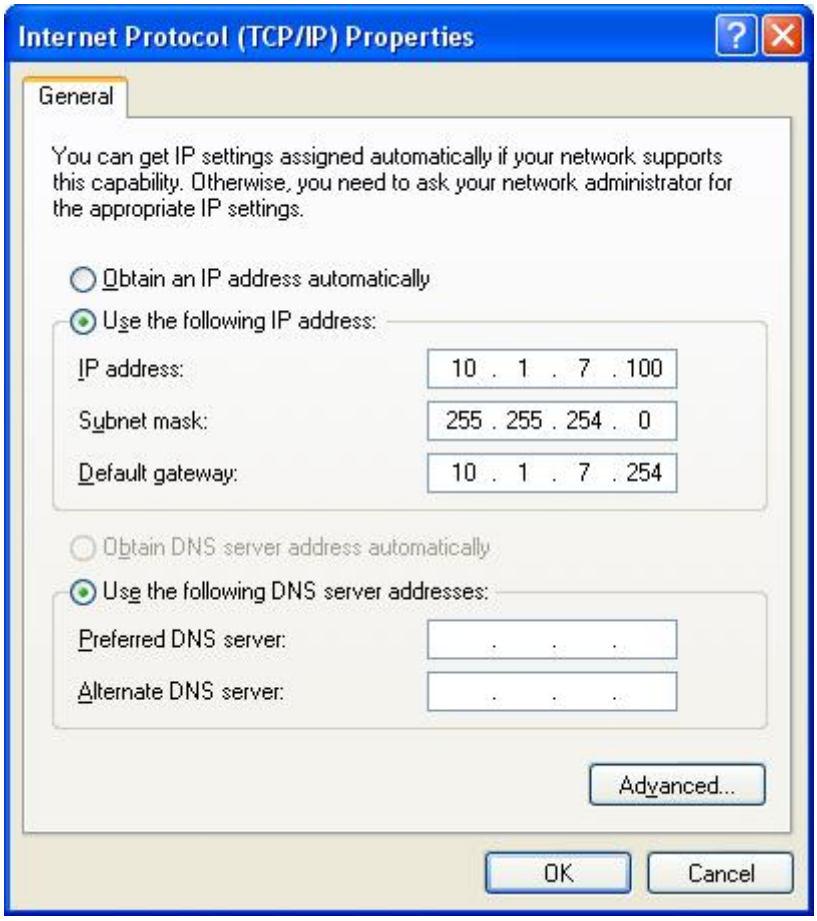
STEP 2:
Select "**Local Area Connection**" and click right mouse button to select "**Properties**."



STEP 3:
Select "**Internet Protocol (TCP/IP)**" and click "**Properties**."



STEP 4:
Select "**Use the following IP address:**" (to set the IP manually) to enter the desired local area network IP address.



STEP 5:
Once the setting is done, click **OK** to return to the previous level and click **OK** again to exit and finish the setting procedure.

Steps to set DHCP = OFF for Chroma DC Load 63600:

STEP 1:
When DHCP=OFF, the IP, GATEWAY, and SUBNET MASK parameters need to be set. If the network parameters are already set on the computer or other devices in the network, users can enter the SUBNET MASK and GATEWAY settings directly while setting a different IP address for 63600. For instance, if the computer IP is 10.1.7.100, Mask is 255.255.254.0, and Gateway is 10.1.7.254, users can set the 63600 IP to 10.1.7.101, Mask to 255.255.254.0,and Gateway to 10.1.7.254 under the premise that the IP: 10.1.7.101 has not been used by any other users.

STEP 2:
Press ENTER or DATA to go to the APPLY option and set it to YES, then confirm the setting.

STEP 3:
The screen will show the networking status setting. The status messages are shown below:
a. Initiating… : The network card is initialing.
b. Connecting… : The network card is connecting.
c. Disconnection! : It is unable to connect to the network.
d. DHCP Failure!! : It cannot find the DHCP Server and is unable to specify the IP

Address via DHCP.

e. Not Properly Set : The network setting is wrong.

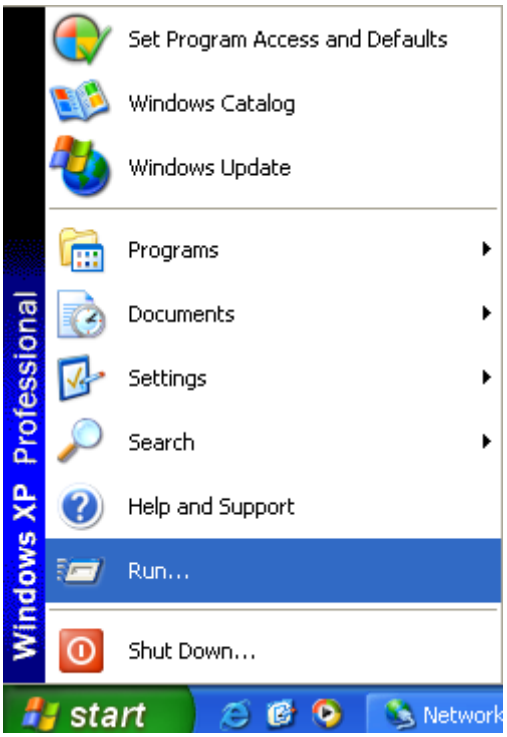
Once the setting is successful, the panel will automatically show the updated network setting and clear the status message.

STEP 4:
Save the settings and exit the CONFIGURE page completely to save them correctly.

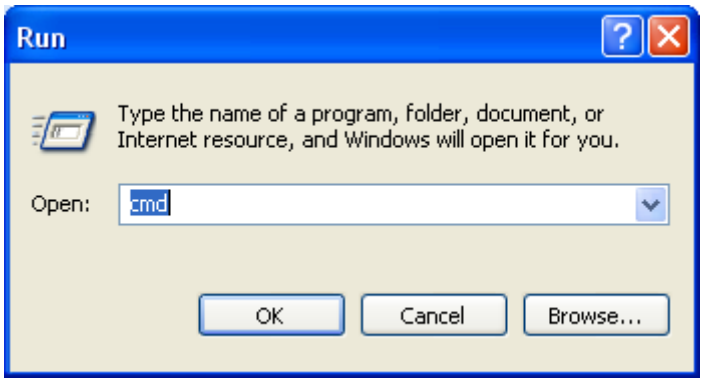
5.1.4.3 Confirming Network Connection is Successful

When the above actions have been completed, it indicates the local area network is set, including the Chroma DC Load 63600 network card. Confirm the local area network settings are correct by following the steps below for verification.

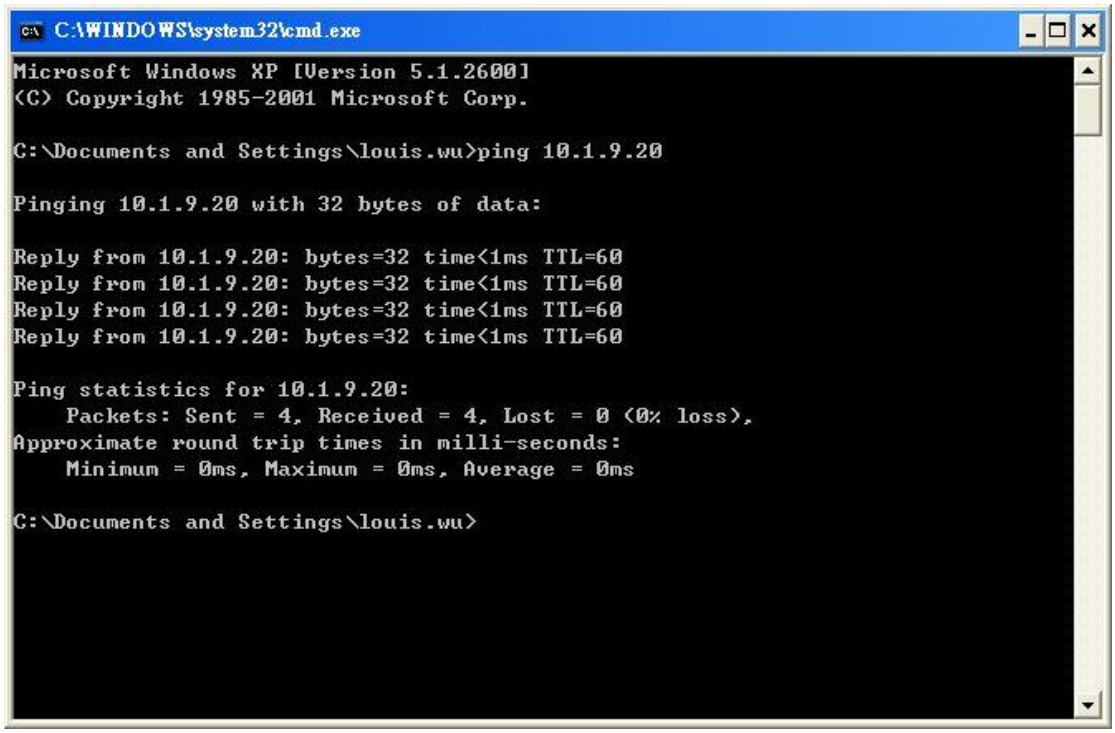
STEP 1:
Click "**start**" from the Windows desktop and click "**Run**."



STEP 2:
Input cmd and click **OK** to run the cmd program.



STEP 3:
An MS-DOS operation environment window will open. Input "**ping *IP address***" such as *ping 10.1.9.20*. If there is a response, it means the setting of the local area network was done successfully.

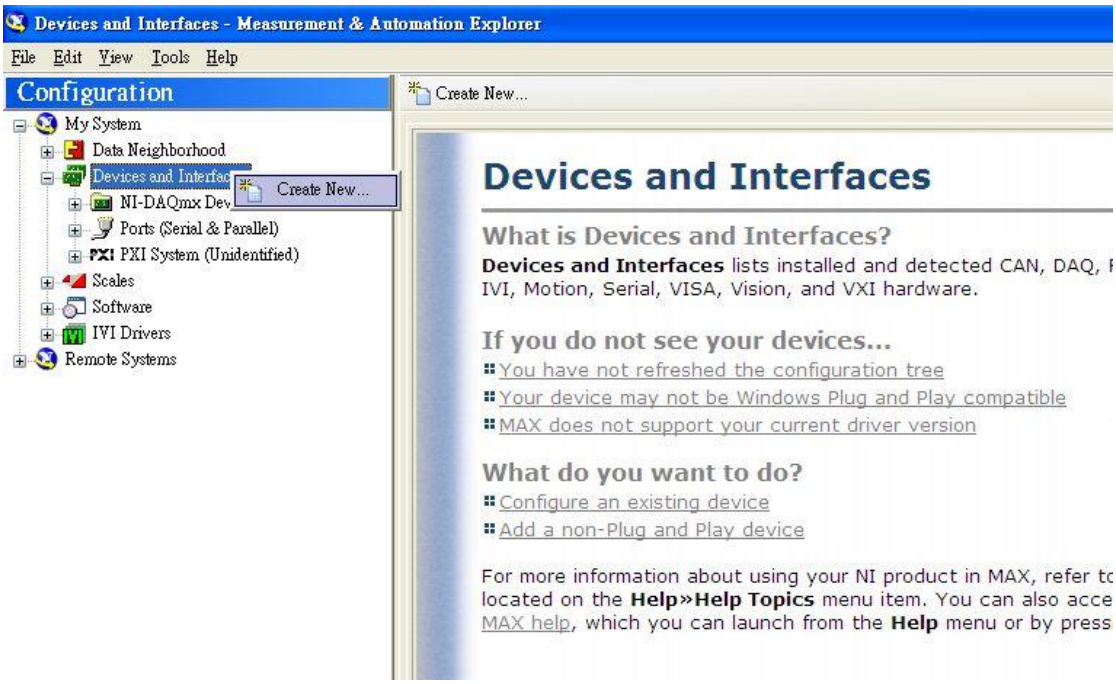


5.1.4.4 Communicating with Instruments

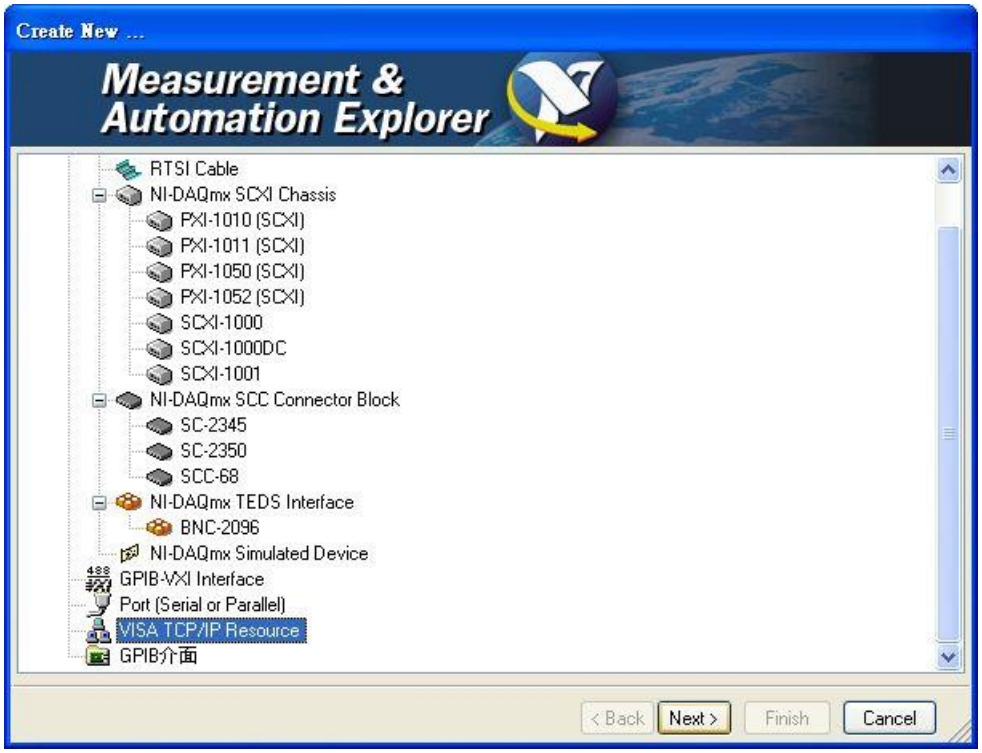
The NI-MAX (Measurement & Automation Explorer) application from National Instruments can be used to communicate with existing instruments or user developed applications. To use NI VISA, open a VISA Session Resource Name in the format of TCPIP0::<IP address>::2101::SOCKET, for example, TCPIP0::10.1.7.100:: 2101::SOCKET. Otherwise, set the TCP/IP SOCKET PORT to 2101 if not using NI VISA.

The following is an example using the NI-MAX (Measurement & Automation Explorer) application.

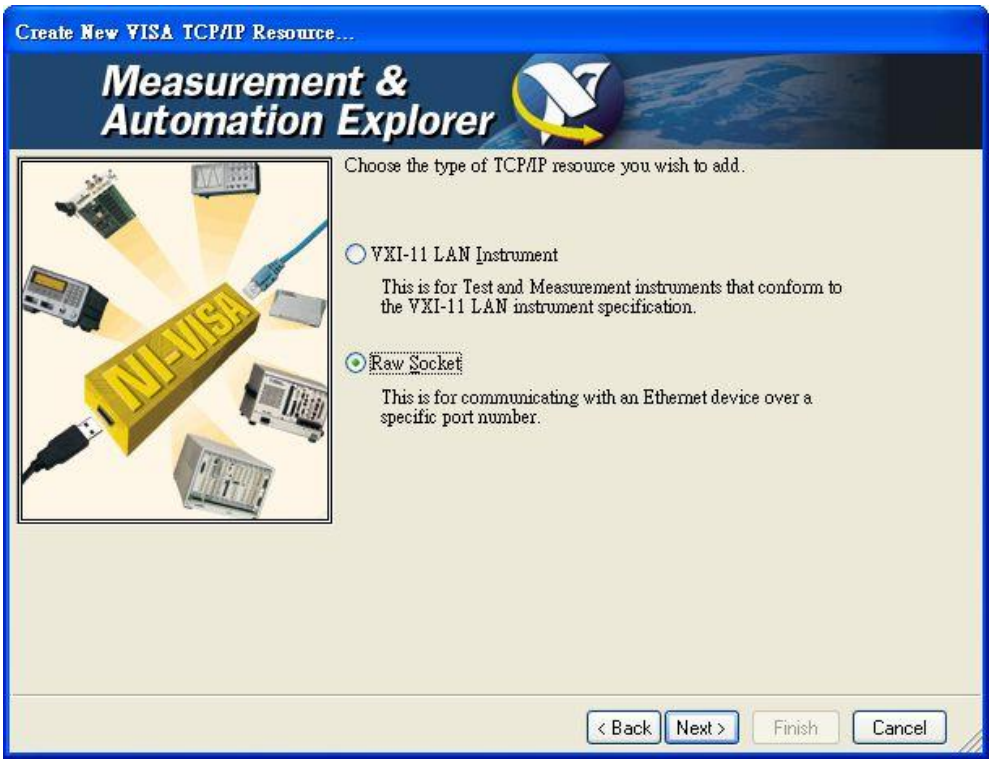
STEP 1:
Open NI-MAX (version 4.3.0F0) and select "**Devices and Interface**" then click the right mouse button to choose "**Create New. . .**".



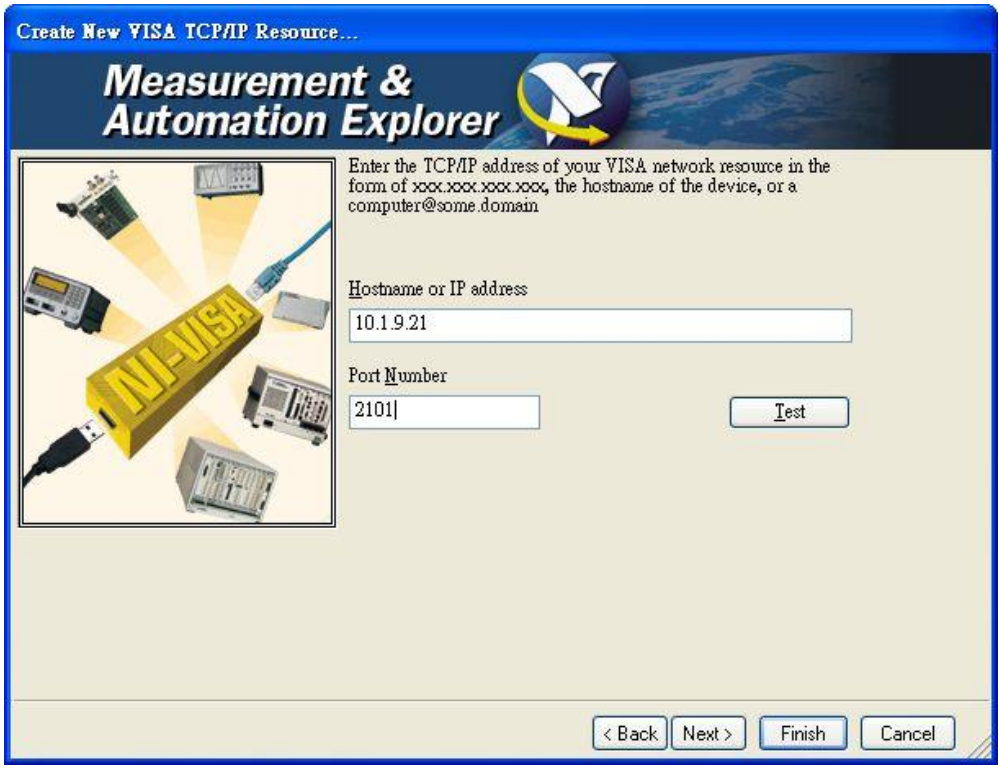
STEP 2:
Select "**VISA TCP/IP Resource**" and click **Next >**.



STEP 3:
Select "**Raw Socket**" and click **Next >**.

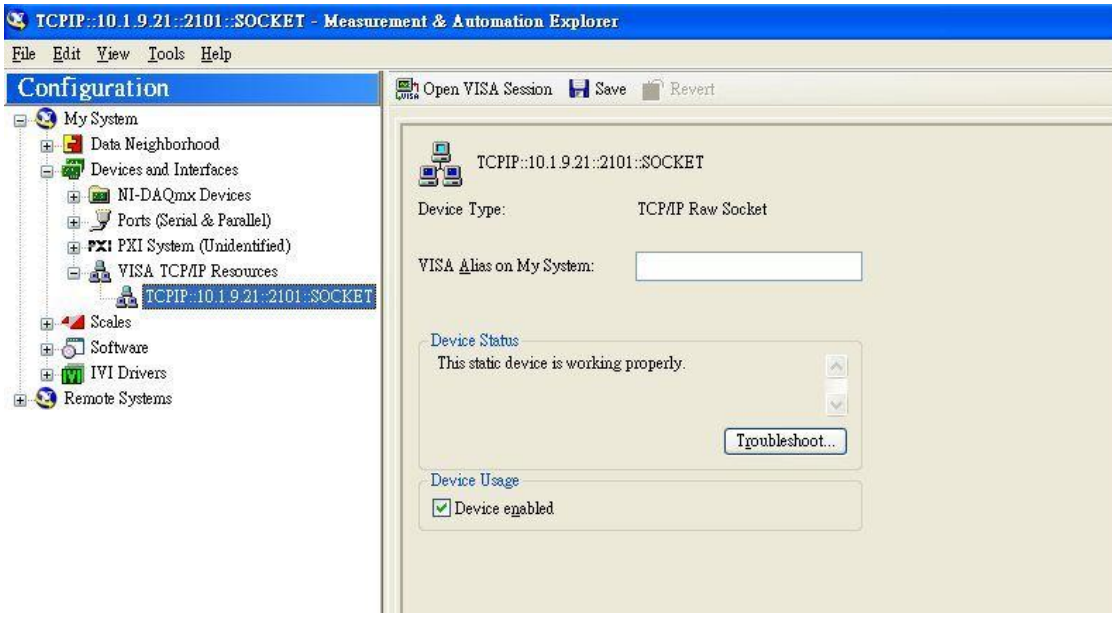


STEP 4:
Input the "**IP Address**" and "**Port Number**" (TCP/IP Port used by Chroma DC Load 63600 is 2101) and click Test.

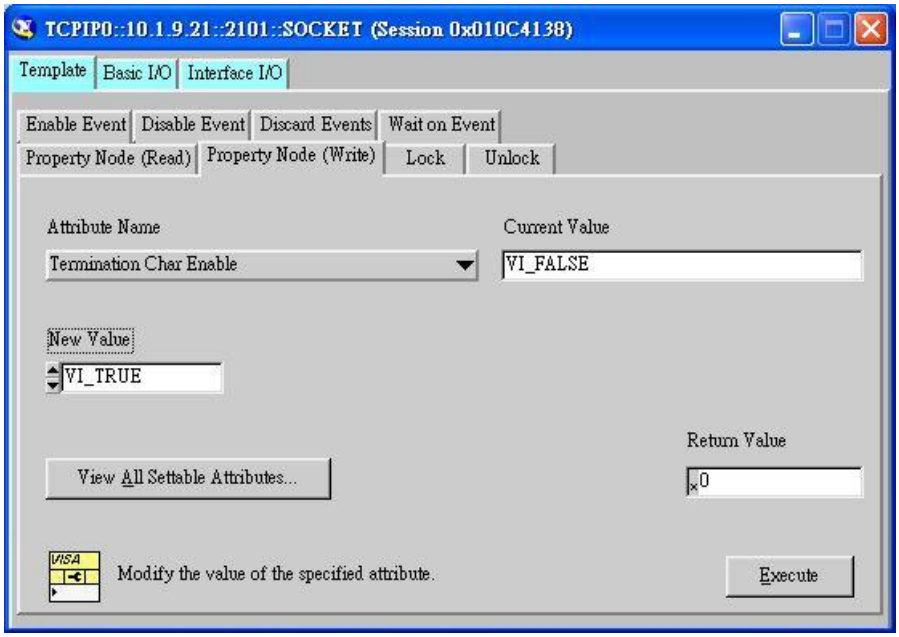


STEP 5:
The following screen will prompt if it is connected successfully. Click **OK** to close the message dialog and click **Finish** to end it.

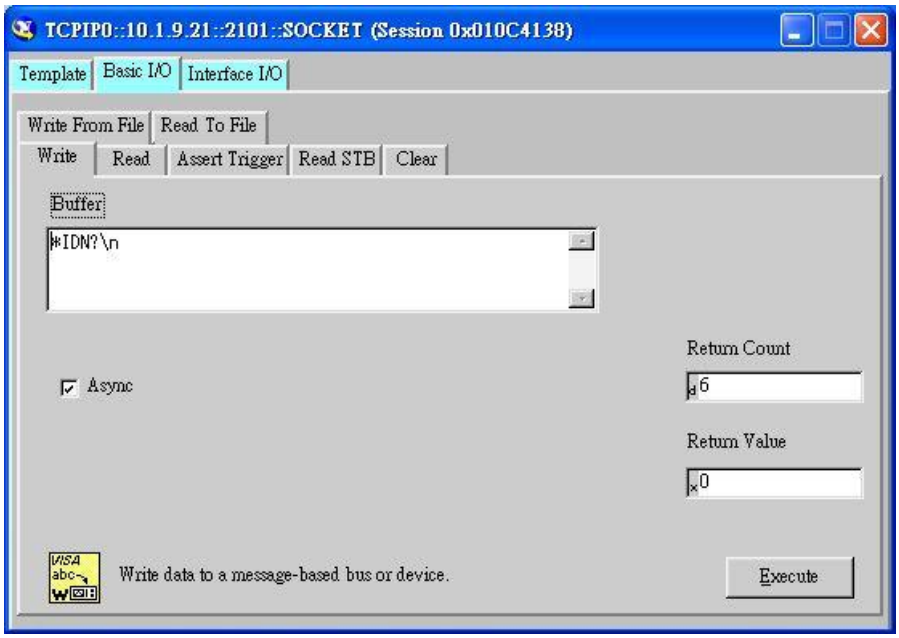
STEP 6:
VISA TCP/IP Resource will add to Devices and Interfaces. Select it and click Open VISA Session (NI VISA Ver.3.0).



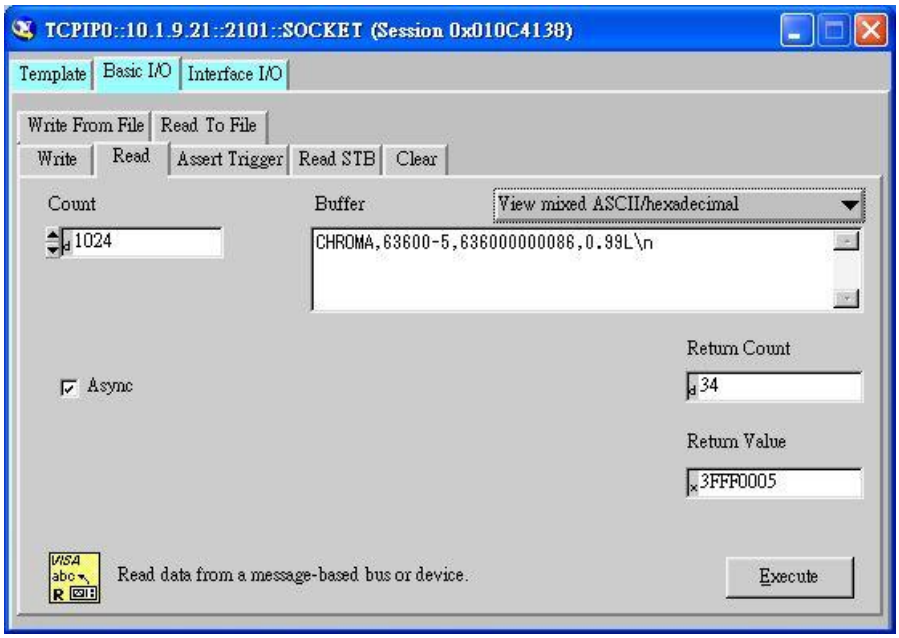
STEP 7:
Select “Termination Char Enable**”** for “Attribute Name**”** in the sub-tab “**Property Node (Write)”** under “**Template”** tab. If “Current Value” is “VI_FALSE”, set “VI_TRUE” for New Value and then click **Execute**.



STEP 8:
Select “**Basic I/O**” tab to use the “**Write**” sub-tab to give commands to 63600 (using *IDN? as the example) and then click **Execute**.



STEP 9:
Select "**Basic I/O**" tab to use the "**Read**" sub-tab to read back the status of 63600 and then click **Execute**.



5.2 Introduction to Programming

5.2.1 Basic Definition

A GPIB statement includes instrument control and query commands. A command statement sends an instruction to the electronic load, and a query command requests information from the electronic load.

Simple Command
A simple command statement consists of a command or keyword usually followed by a parameter or data:

```
        LOAD ON
or      TRIG
```

Compound Command
When two or more keywords are connected by colons (:), it creates a compound command statement. The last keyword is usually followed by a parameter or data:

```
        CURRent : STATic : L1 3
or      CONFigure : VOLTage : RANGe HIGH
```

Query Command
A simple query command consists of a keyword followed by a question mark:

```
MEASure : VOLTage?
MEASure : CURRent?
```

or CHAN?

Forms of Keywords
There are two forms for a keyword as described below.

Long-Form
The word is spelled out completely to identify its function. For instance, CURRENT, VOLTAGE, and MEASURE are long-form keywords.

Short-Form
The word contains only the first three or four letters of the long-form. For instance, CURR, VOLT, and MEAS are short-form keywords.

In keyword definitions and diagrams, the short-form part of each keyword is emphasized in UPPER CASE letters to make it easier to remember. However, the electronic load will accept Volt, volt, voltage, VOLTAGE, volTAGE, etc. regardless of what form is used. However, if the keyword is incomplete, for example, “VOL” or “curre”, it will not be recognized.

5.2.2 Numerical Data Formats

The Chroma 63600 Electronic Load accepts the numerical data types listed in Table 5-1. Numeric data may be followed by a suffix to specify the dimension of the data. A suffix may be preceded by a multiplier. The Chroma 63600 makes use of the suffixes listed in Table 5-2 and multipliers listed in Table 5-3.

Table 5-1 Numerical Data Type

Symbol	Description	Example
NR1	Digits without decimal point. The decimal point is assumed to be at the right of the least-significant digit.	123, 0123
NR2	Digits with a decimal point.	123., 12.3, 0.123, .123
NR3	Digit with a decimal point and an exponent.	1.23E+3, 1.23E-3
NRf	Flexible decimal form that includes NR1 or NR2 or NR3.	123, 12.3, 1.23E+3
NRf+	Expanded decimal form that includes NRf and MIN, MAX. MIN and MAX are the minimum and maximum limit values for the parameter.	123, 12.3, 1.23E+3, MIN, MAX

Table 5-2 Suffix Elements

Mode	Class	Preferred Suffix	Secondary Suffix	Referenced Unit
CC	Current	A		Ampere
CR	Resistance	OHM		Ohm
CV	Amplitude	V		Volt
CP	Power	W		Watt
CZ	Inductance	H		Henry
	Capacitance	F		Farad
All	Time	S		Second
All	Frequency	Hz		Hertz
All	Slew Rate	A/μS		Amperes/micro Second

Table 5-3 Suffix Multipliers

Multiplier	Mnemonic	Definition
1E6	MA	mega
1E3	K	kilo
1E-3	M	milli
1E-6	U	micro
1E-9	N	nano

5.2.3 Character Data Formats

For command statements, the <NRf+> data format permits entry of required characters. For query statements, character strings may be returned in either of the forms shown in the following table. It depends on the length of the returned string.

Symbol	Character Form
crd	Character Response Data. They permit the return of up to 12 characters.
aard	Arbitrary ASCII Response Data. They permit the return of undelimited 7-bit ASCII. This data type is an implied message terminator (refer to *Separators and Terminators*).

5.2.4 Arbitrary Block Data Format

The arbitrary block data returned by a query command may take either of the following forms:

<DLABRD> Definite Length Arbitrary Block Response Data:

The <DLABRD> is formatted as:
#<x><yy...y><byte1><byte2><byte3><byte4>…<byteN><RMT>

Where,
<x> is the number of characters in <yy…y>.
<yy…y> is the number of bytes to transfer.

For example, if <yy…y> = 01024, then <x> = 5 and <byte1><byte2><byte3>…<byte1024>

<ILABRD> Indefinite Length Arbitrary Block Response Data:

The <ILABRD> is formatted as:
#<0><byte1><byte2><byte3><byte4>…<byteN><RMT>

5.2.5 Separators and Terminators

In addition to keywords and parameters, GPIB program statements require the following:

Data Separators:
Data must be separated from the previous command keyword by a space. This is shown in examples as a space (CURR 3) and on diagrams by the letters *SP* inside a circle.

Keyword Separators:
Keywords (or headers) are separated by a colon (:), a semicolon (;), or both. For example:

- **LOAD:SHOR ON**
- **MEAS:CURR?;VOLT?**
- **CURR:STAT:L1 3;:VOLT:L1 5**

Program Line Separators:
A terminator informs the GPIB that it has reached the end of a statement. Normally, this is sent automatically by the GPIB programming statements.

The termination also occurs with other terminator codes, such as EOI. In this manual, the terminator is assumed to be at the end of each example line of code. If it needs to be indicated, it is shown by the symbol <nl>, which stands for “new line” and represents the ASCII code byte 0A hexadecimal (or 10 decimal).

Traversing the Command Tree:

- The colon “:” separates keywords from each other which represent changes in branch level to the next lower one. For example:

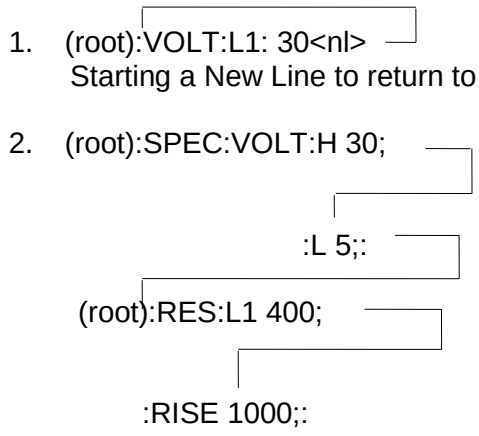
  CONF:VOLT:ON 5
  CONF is a root-level command, *VOLT* is the first branch, and *ON* is the second branch. Each “:” moves down command interpretation to the next branch.

- The semicolon “;” allows you to combine command statements into one line. It returns the command interpretation to the previous colon.

  For example: Combine the following two command statements:
  RES:RISE 100 <nl> and
  RES:L1 400 <nl>
  which can be formed into one command line as follows:
  RES:RISE 100;L1 400 <nl>

- To return to the root-level form you can
  1. Enter a new line character. This is symbolized as “<nl>” and can be linefeed “LF” or/and end of line “EOL”. Or else,
  2. Enter a semicolon followed by a colon “;:”.

Please refer to the following figure.

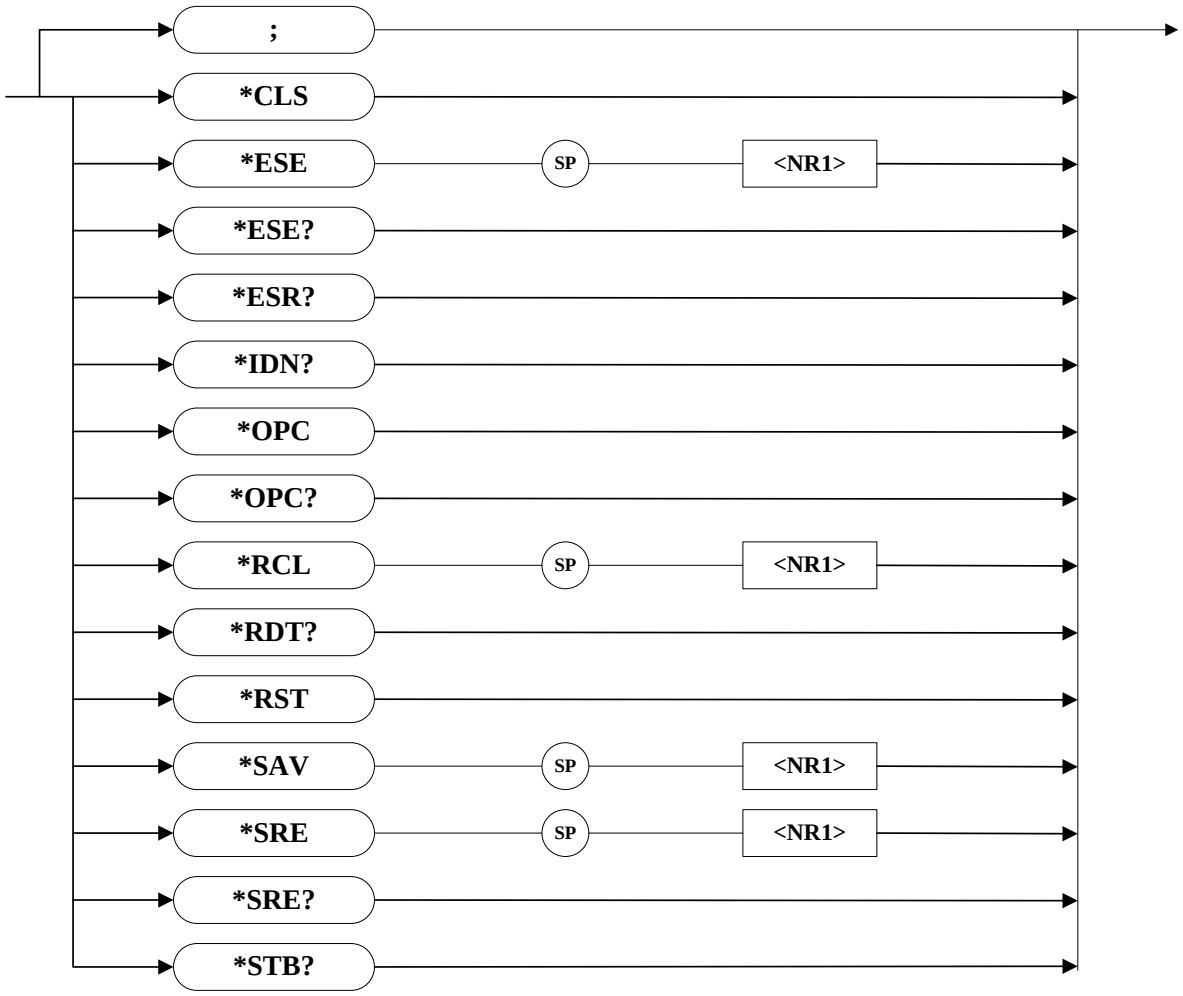


5.3 Language Dictionary

Commands for operating the 63600 Electronic Load remotely are grouped into subsystems. Each command that belongs to the same subsystem is arranged in alphabetic order. A syntax chart of the subsystem that contains the commands in the same group is included. Sub-systems are ordered alphabetically according to their names in the following sections.

5.3.1 Common Commands

The common commands defined by IEEE488.2 standard are generic commands and queries. The first part of the language dictionary covers the commands. Each of them has a leading "*".



CLS Clear Status Command

Type: Device Status

Description: The *CLS command executes the following actions:

1. Clear these registers
   - <1> Channel Status Event registers for all channels
   - <2> Channel Summary Event register
   - <3> Questionable Status Event register
   - <4> Standard Event Status Event register
   - <5> Operation Status Event register
2. Clear the Error Queue
3. If “Clear Status Command” immediately follows a program message terminator (<nl>), the “Output Queue” and the MAV bit are also cleared.

Setting Syntax: *CLS

Setting Parameter: nil

ESE Standard Event Status Enable Command/Query

Type: Device Status

Description: This command sets the condition of the Standard Event Status Enable register to determine which event (see *ESR?) is allowed to set the ESB (Event Summary Bit) for the Status Byte register. A "1" in the bit position enables the corresponding event. All of the events that enabled by Standard Event Status register are logically ORed

to cause the Status Byte register ESB (bit 5) to be set. See descriptions of these three registers in *Chapter* 6.

Setting Syntax: *ESE<space><NR1>
Setting Parameter: <NR1>, 0 ~ 255
Setting Example: *ESE 48 This command enables the CME and EXE events for the Standard Event Status register.
Query Syntax: *ESE?
Return Parameter: <NR1>
Query Example: *ESE? This query returns the current setting for "Standard Event Status Enable".

ESR? Standard Event Status Register Query

Type: Device Status
Description: This query reads the Standard Event Status register. Reading the register clears it. See detailed explanation of this register in *Chapter* 6.

Standard Event Status Event Register

Bit Position	7	6	5	4	3	2	1	0
Condition	PON	0	CME	EXE	DDE	QYE	0	0
Bit Weight	128	64	32	16	8	4	2	1

Query Syntax: *ESR?
Return Parameter: <NR1>
Query Example: *ESR? Return the Standard Event Status register readings.
Return Example: 48

IDN? Identification Query

Type: System Interface
Description: This query requests the Electronic Frame (63600) to identify itself.
Query Syntax *IDN?
Return Parameter: <aard>
Query Example: *IDN?

String	***Information***
CHROMA	Manufacture
63600-5	Model
636000000001	Serial number
1.00	Revision level of the primary interference firmware

Return Example: CHROMA,63600-5,636000000001,1.00

OPC Operation Complete Command

Type: Device Status
Description: This command causes the interface to set the OPC bit (bit 0) of the Standard Event Status register when the Electronic Frame (63600) has completed all pending operations.
Setting Syntax: *OPC
Setting Parameter: nil

OPC? Operation Complete Query

Type: Device Status
Description: This query returns an ASCII “1” when all pending operations are

completed.
Query Syntax: *OPC?
Return Parameter: <NR1>
Query Example: 1

RCL Recall Instrument State Command

Type: Device Status
Description: This command restores the electronic load to a state that was previously stored in memory with the *SAV command to the specified location (see *SAV).
Setting Syntax: *RCL<space><NR1>
Setting Parameter: <NR1>, -1 ~ 99, -1:Factory default file, 0~99:User define file
Setting Example: *RCL 50

RDT? Resource Description Transfer Query

Type: System Interface
Description: This command returns the types of Electronic Frame (63600). If channel does not exist, it returns 0. If channel exists, it returns the types like 63610-80-20, 63630-80-60, 63630-80-60, 63640-80-80...
Query Syntax: *RDT?
Return Parameter: <aard>
Query Example: 63640-80-80,63630-80-60,63630-80-60,0,63610-80-20L, 63610-80-20R,0,0.

RST Reset Command

Type: Device State
Description: This command forces an ABORt, *CLS, LOAD=PROT=CLE command.
Setting Syntax: *RST
Setting Parameter: nil

SAV Save Command

Type: Device Status
Description: This command stores the present state of the single electronic load and all channel states of multiple loads in a specified memory location.
Setting Syntax: *SAV<space><NR1>
Setting Parameter: <NR1>, 0 ~ 99
Setting Example: *SAV 50

SRE Service Request Enable Command/Query

Type: Device Status
Description: This command sets the condition of the Service Request Enable register to determine which event of the Status Byte register (see *STB) is allowed to set the MSS (Master Status Summary) bit. A "1" in the bit position is logically ORed to cause the Status Byte register Bit 6 (the Master Summary Status Bit) to be set. See details regarding the Status Byte register in *Chapter* 6.
Setting Syntax *SRE<space><NR1>
Setting Parameter: <NR1>, 0 ~ 255
Setting Example: *SRE 20 Enable the CSUM and MAV bit for Service Request.
Query Syntax: *SRE?
Return Parameter: <NR1>
Query Example: *SRE? Return current setting for "Service Request Enable".

****STB? Read Status Byte Query***

Type: Device Status

Description: This query reads the Status Byte register. Note that the MSS (Master Summary Status) bit instead of RQS bit is returned in Bit 6. This bit indicates if the electronic load has at least one reason for requesting service. *STB? does not clear the Status Byte register, which is cleared only when subsequent action has cleared all its set bits. Refer to *Chapter* 6 for more information about this register.

Status Byte Register

Bit Position	7	6	5	4	3	2	1	0
Condition	0	MSS	ESB	MAV	QUES	CSUM	0	0
Bit Weight	128	64	32	16	8	4	2	1

Query Syntax: *STB?

Return Parameter: <NR1>

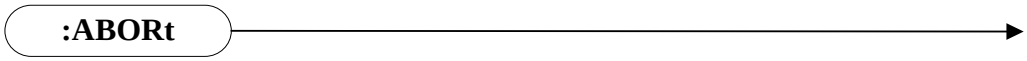
Query Example: *STB? Return the contents of "Status Byte".

Return Example: 20

5.3.2 Specific Commands

The 63600 series products are equipped with the following specific GPIB commands.

5.3.2.1 ABORT Subsystem



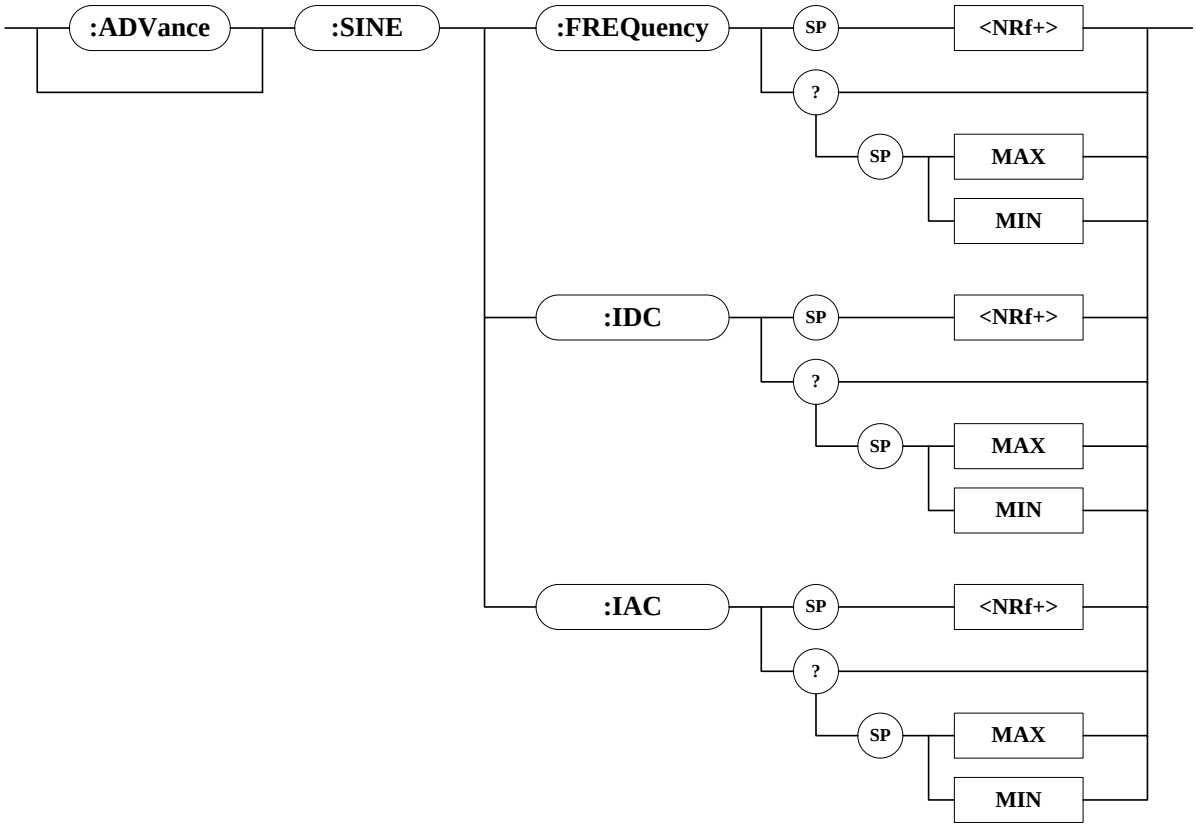
ABORt

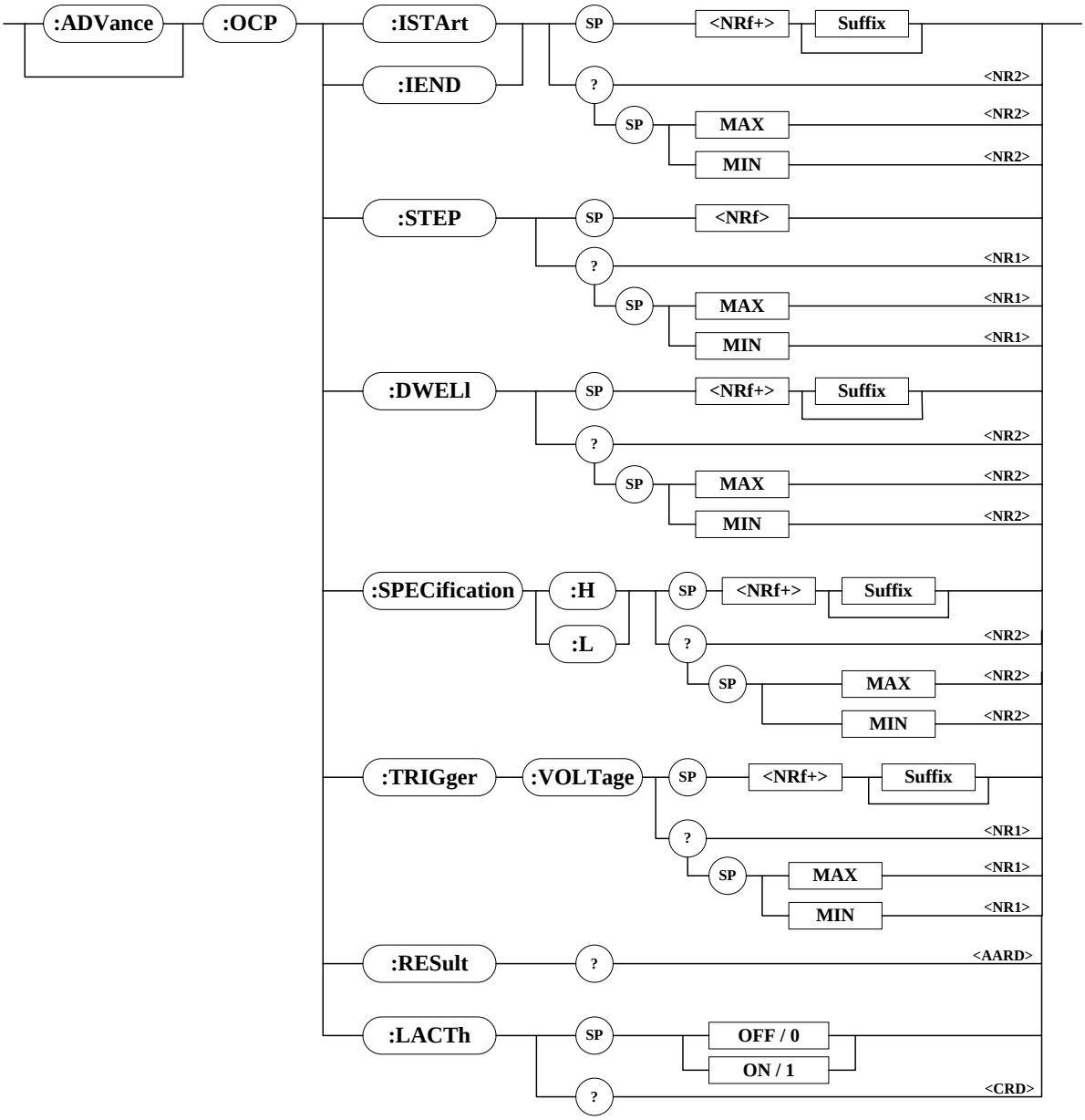
Type: All Channels

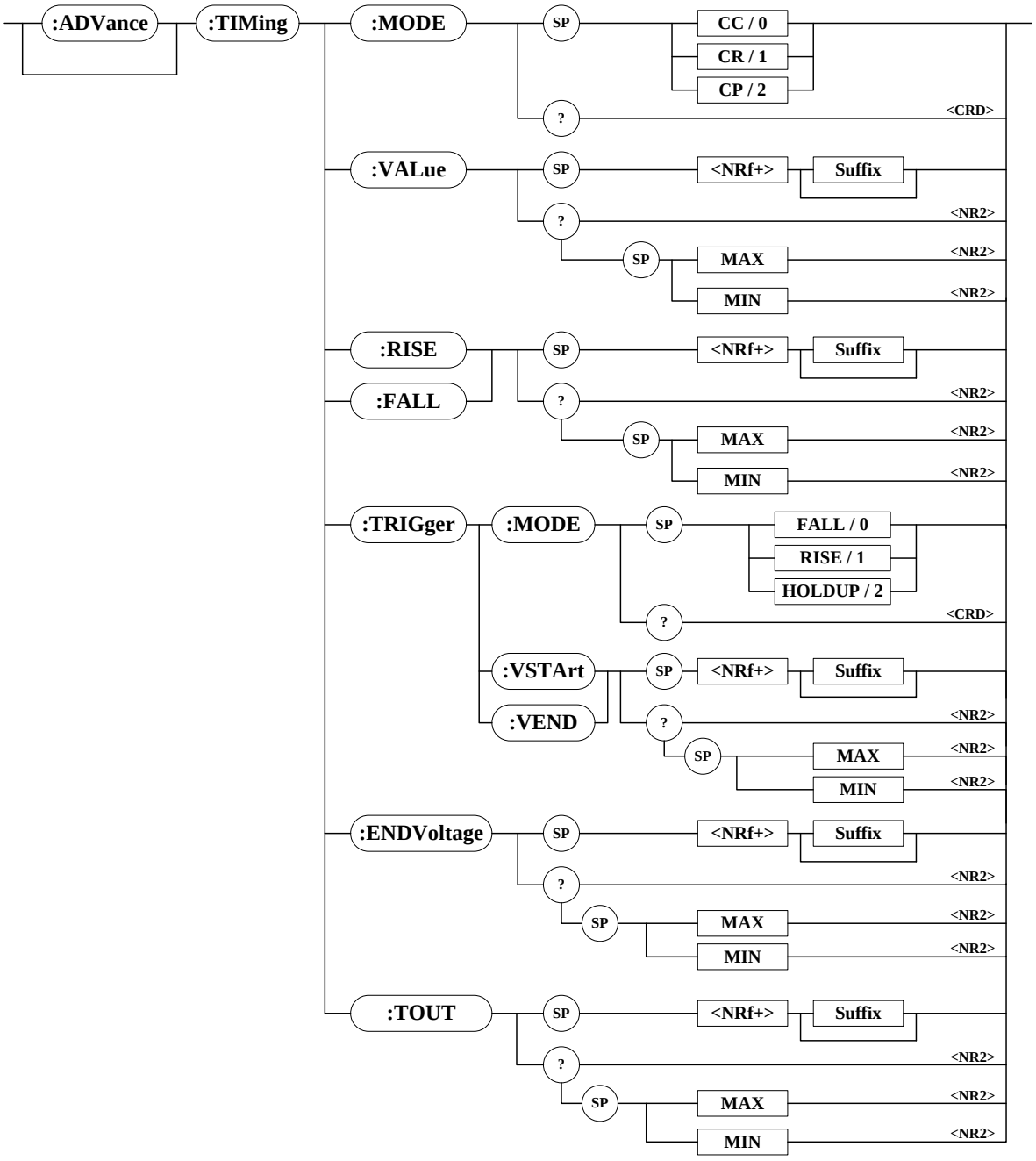
Description: Set all electronic loads as "OFF".

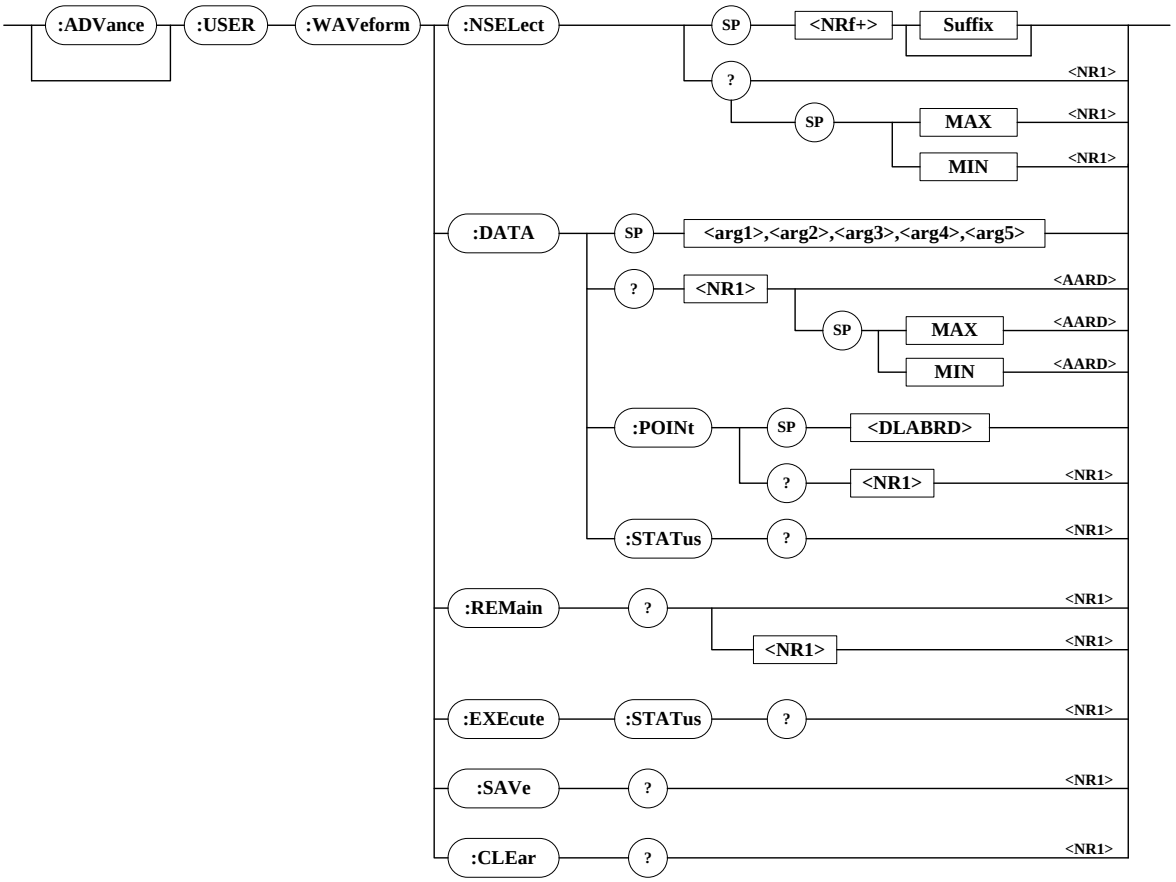
Setting Syntax: ABORt

5.3.2.2 ADVANCE Subsystem




:ADVance
:OCP
:ISTArt
:IEND
:STEP
:DWELl
:SPECification
:H
:L
:TRIGger
:VOLTage
:RESult
:LACTh
SP
?
<NRf+>
Suffix
<NRf>
MAX
MIN
OFF / 0
ON / 1
<NR1>
<NR2>
<AARD>
<CRD>


:ADVance
:TIMing
:MODE
SP
CC / 0
CR / 1
CP / 2
?
<CRD>
:VALue
SP
<NRf+>
Suffix
?
<NR2>
SP
MAX
MIN
:RISE
:FALL
:TRIGger
:MODE
FALL / 0
RISE / 1
HOLDUP / 2
:VSTArt
:VEND
:ENDVoltage
:TOUT



ADVance:SINE:FREQuency

Type: Channel-Specific
Description: Sets the frequency for the sine wave dynamic mode.
Setting Syntax: ADVance:SINE:FREQuency<space><NRf+>[suffix]
Setting Parameter: <NRf+>, 0.01Hz ~ 20000.00Hz, Resolution = 0.01Hz, Unit = Hertz
Setting Example: ADV:SINE:FREQ 1000 Set frequency = 1kHz.
ADV:SINE:FREQ 1kHz Set frequency = 1kHz.
ADV:SINE:FREQ MAX Set frequency = maximum value.
ADV:SINE:FREQ MIN Set frequency = minimum value.
Query Syntax: ADVance:SINE:FREQuency?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Hertz]
Query Example: ADV:SINE:FREQ?
ADV:SINE:FREQ? MAX
ADV:SINE:FREQ? MIN

ADVance:SINE:IAC

Type: Channel-Specific
Description: Sets the AC current for the sine wave dynamic mode.
Setting Syntax: ADVance:SINE:IAC<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: ADV:SINE:IAC 0.5 Set AC current = 0.5A.
ADV:SINE:IAC 500mA Set AC current = 0.5A.
ADV:SINE:IAC MAX Set AC current = maximum value.
ADV:SINE:IAC MIN Set AC current = minimum value.
Query Syntax: ADVance:SINE:IAC?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: ADV:SINE:IAC?

ADV:SINE:IAC? MAX
ADV:SINE:IAC? MIN

ADVance:SINE:IDC

Type: Channel-Specific
Description: Sets the DC current for the sine wave dynamic mode.
Setting Syntax: ADVance:SINE:IDC<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: ADV:SINE:IDC 0.5 Set DC current = 0.5A.
ADV:SINE:IDC 500mA Set DC current = 0.5A.
ADV:SINE:IDC MAX Set DC current = maximum value.
ADV:SINE:IDC MIN Set DC current = minimum value.
Query Syntax: ADVance:SINE:IDC?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: ADV:SINE:IDC?
ADV:SINE:IDC? MAX
ADV:SINE:IDC? MIN

ADVance:OCP:RESult?

Type: Channel-Specific
Description: Returns the results of the OCP test function.
Setting Syntax: None
Setting Parameter: None
Setting Example: None
Query Syntax: ADVance:OCP:RESult?
Return Parameter: <arg1>,<arg2>,<arg3>
<arg1>: Pass/Fail. <NR1>, 0: PASS 1: FAIL [Unit = None]
<arg2>: OCP current. <NR2>, [Unit = Ampere]
<arg3>: Maximum power. <NR2>, [Unit = Watt]
When the returns are
-1,-1,-1 denotes OCP test is stop.
-2,-2,-2 denotes OCP test is ready to execute what wait for Von or other condition.
-3,-3,-3 denotes OCP test is executed.
Query Example: ADV:OCP:RES?

ADVance:OCP:DWELl

Type: Channel-Specific
Description: Sets the dwell time for the OCP test mode.
Setting Syntax: ADVance:OCP:DWELl<space><NRf+>[suffix]
Setting Parameter: <NRf+>, 10µs ~ 1s Resolution = 10µs, Unit = Second
Setting Example: ADV:OCP:DWEL 0.5 Set off time = 0.5s.
ADV:OCP:DWEL 500msSet off time = 0.5s.
ADV:OCP:DWEL MAX Set off time = maximum value.
ADV:OCP:DWEL MIN Set off time = minimum value.
Query Syntax: ADVance:OCP:DWELl?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Second]
Query Example: ADV:OCP:DWEL?
ADV:OCP:DWEL? MAX
ADV:OCP:DWEL? MIN

ADVance:OCP:IEND

Type:	Channel-Specific	
Description:	Sets the end current for the OCP test mode.	
Setting Syntax:	ADVance:OCP:IEND<space><NRf+>[suffix]	
Setting Parameter:	Refer to the respective specification for the valid range value.	
Setting Example:	ADV:OCP:IEND 0.5	Set end current = 0.5A.
	ADV:OCP:IEND 500mA	Set end current = 0.5A.
	ADV:OCP:IEND MAX	Set end current = maximum value.
	ADV:OCP:IEND MIN	Set end current = minimum value.
Query Syntax:	ADVance:OCP:IEND?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = Ampere]	
Query Example:	ADV:OCP:IEND?	
	ADV:OCP:IEND? MAX	
	ADV:OCP:IEND? MIN	

ADVance:OCP:ISTArt

Type:	Channel-Specific	
Description:	Sets the start current for the OCP test mode.	
Setting Syntax:	ADVance:OCP:ISTArt<space><NRf+>[suffix]	
Setting Parameter:	Refer to the respective specification for the valid range value.	
Setting Example:	ADV:OCP:ISTA 0.5	Set starts current = 0.5A.
	ADV:OCP:ISTA 500mA	Set starts current = 0.5A.
	ADV:OCP:ISTA MAX	Set starts current = maximum value.
	ADV:OCP:ISTA MIN	Set starts current = minimum value.
Query Syntax:	ADVance:OCP:ISTArt?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = Ampere]	
Query Example:	ADV:OCP:ISTA?	
	ADV:OCP:ISTA? MAX	
	ADV:OCP:ISTA? MIN	

ADVance:OCP:SPECification:H

Type:	Channel-Specific	
Description:	Sets the high level current of specification for the OCP test mode.	
Setting Syntax:	ADVance:OCP:SPECification:H<space><NRf+>[suffix]	
Setting Parameter:	Refer to the respective specification for the valid range value.	
Setting Example:	ADV:OCP:SPEC:H 0.5	Set high level current = 0.5A.
	ADV:OCP:SPEC:H 500mA	Set high level current = 0.5A.
	ADV:OCP:SPEC:H MAX	Set high level current = maximum value.
	ADV:OCP:SPEC:H MIN	Set high level current = minimum value.
Query Syntax:	ADVance:OCP:SPECification:H?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = Ampere]	
Query Example:	ADV:OCP:SPEC:H?	
	ADV:OCP:SPEC:H? MAX	
	ADV:OCP:SPEC:H? MIN	

ADVance:OCP:SPECification:L

Type:	Channel-Specific	
Description:	Sets the low level current of specification for the OCP test mode.	
Setting Syntax:	ADVance:OCP:SPECification:L<space><NRf+>[suffix]	
Setting Parameter:	Refer to the respective specification for the valid range value.	
Setting Example:	ADV:OCP:SPEC:L 0.5	Set low level current = 0.5A.

ADV:OCP:SPEC:L 500mA Set low level current = 0.5A.
ADV:OCP:SPEC:L MAX Set low level current = maximum value.
ADV:OCP:SPEC:L MIN Set low level current = minimum value.
Query Syntax: ADVance:OCP:SPECification:L?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: ADV:OCP:SPEC:L?
ADV:OCP:SPEC:L? MAX
ADV:OCP:SPEC:L? MIN

ADVance:OCP:STEP

Type: Channel-Specific
Description: Sets the step count for the OCP test mode.
Setting Syntax: ADVance:OCP:STEP<space><NRf+>
Setting Parameter: <NRf+>, 1 ~ 1000, Resolution = 1, Unit = None
Setting Example: ADV:OCP:STEP 500 Set step count = 500.
ADV:OCP:STEP MAX Set step count = maximum value.
ADV:OCP:STEP MIN Set step count = minimum value.
Query Syntax: ADVance:OCP:STEP?[<space><MAX | MIN>]
Return Parameter: <NR1>, [Unit = None]
Query Example: ADV:OCP:STEP?
ADV:OCP:STEP? MAX
ADV:OCP:STEP? MIN

ADVance:OCP:TRIGger:VOLTage

Type: Channel-Specific
Description: Sets the trigger voltage for the OCP test mode.
Setting Syntax: ADVance:OCP:TRIGger:VOLTage<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: ADV:OCP:TRIG:VOLT 0.5 Set trigger voltage = 0.5V.
ADV:OCP:TRIG:VOLT 500mV Set trigger voltage = 0.5V.
ADV:OCP:TRIG:VOLT MAX Set trigger voltage = maximum value.
ADV:OCP:TRIG:VOLT MIN Set trigger voltage = minimum value.
Query Syntax: ADVance:OCP:TRIGger:VOLTage?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Volt]
Query Example: ADV:OCP:TRIG:VOLT?
ADV:OCP:TRIG:VOLT? MAX
ADV:OCP:TRIG:VOLT? MIN

ADVance:OCP:LACTh

Type: Channel-Specific
Description: Sets the load latch function for the OCP test mode.
Setting Syntax: ADVance:OCP:LATCh<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: ADV:OCP:LATC OFF Set latch = OFF
ADV:OCP:LATC 1 Set latch = ON
Query Syntax: ADVance:OCP:LATCh?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: ADV:OCP:LATC?

ADVance:TIMing:ENDVoltage

Type:	Channel-Specific
Description:	Sets the end voltage when the trigger mode is set to HOLD_UP for the Timing mode.
Setting Syntax:	ADVance:TIMing:ENDVoltage<space><NRf+>[suffix]
Setting Parameter:	Refer to the respective specification for the valid range value.
Setting Example:	ADV:TIM:ENDV 0.5 Set end voltage = 0.5V
	ADV:TIM:ENDV 500mV Set end voltage = 0.5V
	ADV:TIM:ENDV MAX Set end voltage = maximum value.
	ADV:TIM:ENDV MIN Set end voltage = minimum value.
Query Syntax:	ADVance:TIMing:ENDVoltage?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Volt]
Query Example:	ADV:TIM:ENDV?
	ADV:TIM:ENDV? MAX
	ADV:TIM:ENDV? MIN

ADVance:TIMing:FALL

Type:	Channel-Specific
Description:	Sets the falling slew rate of current in the Timing mode.
Setting Syntax:	ADVance:TIMing:FALL<space><NRf+>[suffix]
Setting Parameter:	Refer to the respective specification for the valid range value.
Setting Example:	ADV:TIM:FALL 0.1 Set slew rate = 0.1A/μs
	ADV:TIM:FALL 100mA/μs Set slew rate = 0.1A/μs
	ADV:TIM:FALL MAX Set slew rate = maximum value.
	ADV:TIM:FALL MIN Set slew rate = minimum value.
Query Syntax:	ADVance:TIMing:FALL?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = A/uS]
Query Example:	ADV:TIM:FALL?
	ADV:TIM:FALL? MAX
	ADV:TIM:FALL? MIN

ADVance:TIMing:MODE

Type:	Channel-Specific
Description:	Sets the run mode in the Timing mode.
Setting Syntax:	ADVance:TIMing:MODE<space><CRD | NR1>
Setting Parameter:	<CRD | NR1>, CC(0), CR(1), CP(2)
Setting Example:	ADV:TIM:MODE CR Set run mode = CR mode
	ADV:TIM:MODE 1 Set run mode = CR mode
Query Syntax:	ADVance:TIMing:MODE?
Return Parameter:	<CRD>, CC, CR, CP [Unit = None]
Query Example:	ADV:TIM:MODE?

ADVance:TIMing:RISE

Type:	Channel-Specific
Description:	Sets the rising slew rate of current in the Timing mode.
Setting Syntax:	ADVance:TIMing:RISE<space><NRf+>[suffix]
Setting Parameter:	Refer to the respective specification for the valid range value.
Setting Example:	ADV:TIM:RISE 0.1 Set slew rate = 0.1A/μs
	ADV:TIM:RISE 100mA/μs Set slew rate = 0.1A/μs
	ADV:TIM:RISE MAX Set slew rate = maximum value.
	ADV:TIM:RISE MIN Set slew rate = minimum value.
Query Syntax:	ADVance:TIMing:RISE?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = A/uS]

Query Example: ADV:TIM:RISE?
ADV:TIM:RISE? MAX
ADV:TIM:RISE? MIN

ADVance:TIMing:TOUT

Type: Channel-Specific
Description: Sets the timeout for the Timing mode.
Setting Syntax: ADVance:TIMing:TOUT<space><NRf+>[suffix]
Setting Parameter: <NRf+>, 0s~100000s, Resolution = 1s, Unit = Second
Setting Example: ADV:TIM:TOUT 100 Set timeout = 100s
ADV:TIM:TOUT MAX Set timeout = maximum value.
ADV:TIM:TOUT MIN Set timeout = minimum value.
Query Syntax: ADVance:TIMing:TOUT?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Second]
Query Example: ADV:TIM:TOUT?
ADV:TIM:TOUT? MAX
ADV:TIM:TOUT? MIN

ADVance:TIMing:TRIGger:MODE

Type: Channel-Specific
Description: Sets the trigger mode in the Timing mode.
Setting Syntax: ADVance:TIMing:TRIGgerMODE<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, FALL(0), RISE(1), HOLDUP(2)
Setting Example: ADV:TIM:TRIG:MODE RISE Set trigger mode = Rising edge
ADV:TIM:TRIG:MODE 1 Set trigger mode = Rising edge
Query Syntax: ADVance:TIMing:TRIGger:MODE?
Return Parameter: <CRD>, FALL, RISE, HOLDUP [Unit = None]
Query Example: ADV:TIM:TRIG:MODE?

ADVance:TIMing:TRIGger:VEND

Type: Channel-Specific
Description: Sets the end voltage of the trigger when the trigger mode is set to FALL or RISE in the Timing mode.
Setting Syntax: ADVance:TIMing:TRIGger:VEND<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: ADV:TIM:TRIG:VEND 0.5 Set end voltage = 0.5V
ADV:TIM:TRIG:VEND 500mV Set end voltage = 0.5V
ADV:TIM:TRIG:VEND MAX Set end voltage = maximum value.
ADV:TIM:TRIG:VEND MIN Set end voltage = minimum value.
Query Syntax: ADVance:TIMing:TRIG:VEND?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Volt]
Query Example: ADV:TIM:TRIG:VEND?
ADV:TIM:TRIG:VEND? MAX
ADV:TIM:TRIG:VEND? MIN

ADVance:TIMing:TRIGger:VSTArt

Type: Channel-Specific
Description: Sets the start voltage of the trigger when the trigger mode is set to FALL or RISE in the Timing mode.
Setting Syntax: ADVance:TIMing:TRIGger:VSTArt<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: ADV:TIM:TRIG:VSTA 0.5 Set start voltage = 0.5V

	ADV:TIM:TRIG:VSTA 500mV	Set start voltage = 0.5V
	ADV:TIM:TRIG:VSTA MAX	Set start voltage = maximum value.
	ADV:TIM:TRIG:VSTA MIN	Set start voltage = minimum value.

Query Syntax: ADVance:TIMing:TRIG:VSTArt?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Volt]
Query Example: ADV:TIM:TRIG:VSTA?
ADV:TIM:TRIG:VSTA? MAX
ADV:TIM:TRIG:VSTA? MIN

ADVance:TIMing:VALue

Type: Channel-Specific
Description: Sets the load value according to the run mode in the Timing mode.
Notice: every time the run mode of the Timing mode is changed this setting will be reset to zero.
Setting Syntax: ADVance:TIMing:VALue<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example:

When ADV:TIM:MODE set to CC mode, then

ADV:TIM:VAL 0.5	Set current = 0.5A
ADV:TIM:VAL 500mA	Set current = 0.5A
ADV:TIM:VAL MAX	Set current = maximum value.
ADV:TIM:VAL MIN	Set current = minimum value.

When ADV:TIM:MODE set to CR mode, then

ADV:TIM:VAL 0.5	Set resistance = 0.5Ω.
ADV:TIM:VAL 500mΩ	Set resistance = 0.5Ω.
ADV:TIM:VAL MAX	Set resistance = maximum value.
ADV:TIM:VAL MIN	Set resistance = minimum value.

When ADV:TIM:MODE set to CP mode, then

ADV:TIM:VAL 0.5	Set power = 0.5W.
ADV:TIM:VAL 500mW	Set power = 0.5W.
ADV:TIM:VAL MAX	Set power = maximum value.
ADV:TIM:VAL MIN	Set power = minimum value.

Query Syntax: ADVance:TIMing:VALue?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere | Ohm | Watt]
Query Example: ADV:TIM:VAL?
ADV:TIM:VAL? MAX
ADV:TIM:VAL? MIN

[ADVance:]USER:WAVeform:NSELect

Type: Channel-Specific
Description: Sets the active waveform to run for the user-defined waveform function.
Setting Syntax: [ADVance:]USER:WAVeform:NSELect<space><NRf+>
Setting Parameter: <NRf+>, 1 ~ 10, Resolution = 1, Unit = None
Setting Example:

USER:WAV:NSEL 5	Set active waveform = 5
USER:WAV:NSEL MAX	Set active waveform = maximum value.
ADV:USER:WAV:NSEL MIN	Set active waveform = minimum value.

Query Syntax: [ADVance:]USER:WAVeform:NSELect?[<space><MAX | MIN>]
Return Parameter: <NR1>, [Unit = None]

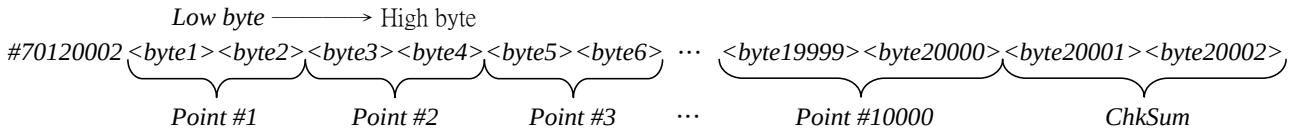
Query Example: USER:WAV:NSEL?
ADV:USER:WAV:NSEL? MAX
ADV:USER:WAV:NSEL? MIN

[ADVance:]USER:WAVeform:DATA

Type: Channel-Specific
Description: Sets the user-defined waveform parameters. (**Note:** All setting parameters in this command cannot use suffix.)
Setting Syntax:
[ADVance:]USER:WAVeform:DATA<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>
Setting Parameter:
Selects a waveform to be configured:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Set the **interval** of waveform:
Arg2: <NRf>, 0.00001s ~ 20s, Resolution = 0.00001s, Unit = Second
Set the **repeat** time of waveform:
Arg3: <NR1>, 0 ~ 100000, Resolution = 1, Unit = None.
Set the **chain** parameter of waveform:
Arg4: <NR1>, 0 ~ 10, Resolution = 1, Unit = None.
Set the **interpolation** function of waveform:
Arg5: <NRf>, NO(0), YES(1), Unit = None.
Setting Example: USER:WAV:DATA 1,0.001,1,0,YES
Query Syntax:
[ADVance:]USER:WAVeform:DATA?<space><NR1>[<space><MAX | MIN>]
Return Parameter: <aard>
Query Example: USER:WAV:DATA? 1
USER:WAV:DATA? 1 MAX
USER:WAV:DATA? 1 MIN
Return Example: 1,0.001,1,0,YES

[ADVance:]USER:WAVeform:DATA:POINt

Type: Channel-Specific
Description: This command sets the user-defined waveform data using a binary format. The waveform consists of a number of points corresponding to sampling points that the user specifies in a format of 16bits unsigned integral.



Setting Syntax: [ADVance:]USER:WAVeform:DATA:POINt<space><DLABRD>
Setting Parameter: <DLABRD>
The <DLABRD> is formatted as:
#<x><ww><yy...y><byte1><byte2><byte3><byte4>…<byteN><Chksum Low byte><Chksum High byte>

Where,
<x> is the number of characters in <ww><yy…y>.
<ww> is the waveform number.
<yy…y> is the number of bytes to transfer.

<ChkSum> is the two's complement of summary of <yy…y>.

For example, if <yy…y> = 20002 and <ww> = 01, then <x> = 7 and
<byte1><byte2><byte3>…<byte20000><Chksum Low byte><Chksum High byte>

Setting Example: ADV:USER:WAV:DATA:POIN "#70120002xxxxxxxxxxxxxx…….xxxcc"
Query Syntax: [ADVance:]USER:WAVeform:DATA:POINt?<space><NR1>
Return Parameter: <NR1>, 0 ~ 120000
Query Example: USER:WAV:DATA:POIN?

[ADVance:]USER:WAVeform:DATA:STATus?

Type: Frame-Specific
Description: This command returns the status of the waveform data download.
Setting Syntax: None
Setting Parameter: None
Query Syntax: [ADVance:]USER:WAVeform:DATA:STATus?
Return Parameter: <NR1>
0：Idle
1：Wait Processing
2：Finish
3：Data Format Error
4：Data Length Error
5：Over limit of waveform data
6：ChkSum Error
Query Example: USER:WAV:STAT?

[ADVance:]USER:WAVeform:EXEcute:STATus?

Type: Channel-Specific
Description: This command returns the status of the waveform data download.
Setting Syntax: None
Setting Parameter: None
Query Syntax: [ADVance:]USER:WAVeform:EXEcute:STATus?
Return Parameter: <NR1>,
0：Idle
1：Running
2：Finish
3：Stop
Query Example: USER:WAV:EXE:STAT?
Return Example: 1

[ADVance:]USER:WAVeform:REMain?[<space><NR1>]

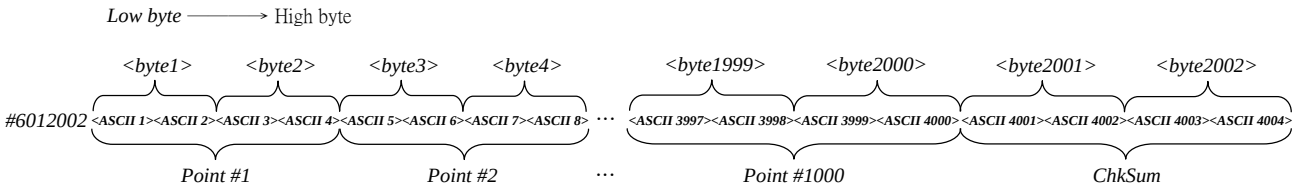
Type: Channel-Specific
Description: This command returns the remaining unused waveform data points.
Setting Syntax: None
Setting Parameter: None
Query Syntax: [ADVance:]USER:WAVeform:REMain?[<space><NR1>]
Query Parameter: <NR1>, 1 ~ 10, Resolution = 1, Unit = None, 1~10:Waveform 1~10
Return Parameter: <NR1>, 0 ~ 120000
Query Example: ADV:USER:WAV:REM? Return total remain points.
ADV:USER:WAV:REM? 1 Return waveform #1 remain points.

[ADVance:]USER:WAVeform:CLEar?

Type: Channel-Specific
Description: Clear the waveform specified.
Setting Syntax: [ADVance:]USER:WAVeform:CLEar?<space><NR1>
Setting Parameter: <NR1>, 1 ~ 10, Resolution = 1, Unit = None, 1~10:Waveform 1~10
Setting Example: ADV:USER:WAV:CLE? 3
Query Syntax: None
Return Parameter: <NR1>, 0:ok 1:error
Query Example: None

[ADVance:]USER:WAVeform:DATA:POINt:ASCii

Type: Channel-Specific
Description: This command sets the user-define waveform data with ASCII format.



Example：*Two points waveform*

Point #1：0x1A2B
Point #2：0xC3D4
ChkSum：0xFE24
ASCII-Format：#30162B1AD4C324FE
Hex-Format：23 33 30 31 36 32 42 31 41 44 34 43 33 32 34 46 45

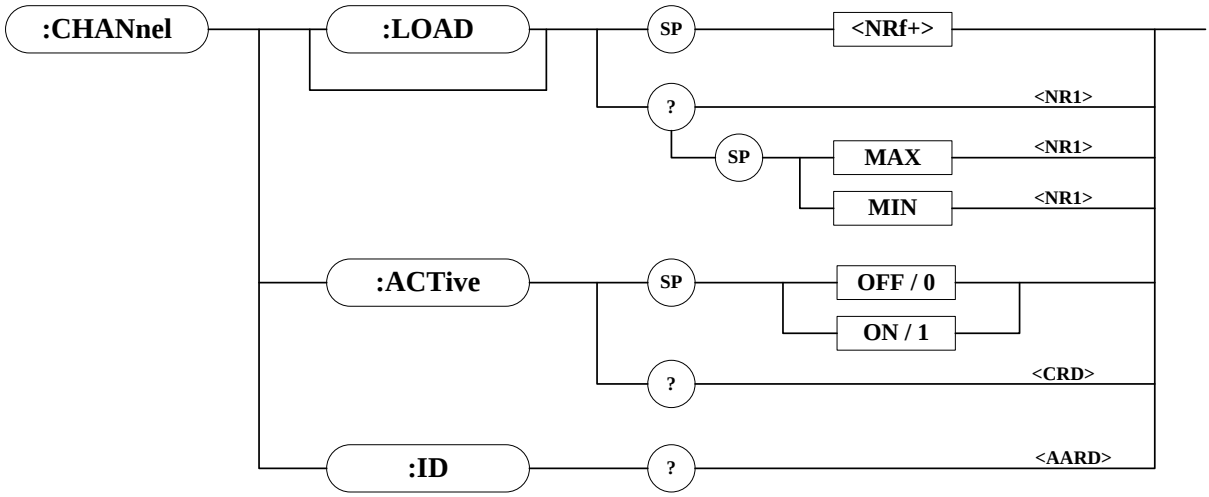
Setting Syntax: [ADVance:]USER:WAVeform:DATA:POINt:ASCii<space><aard>
Setting Parameter: <aard>
The <aard> is formatted as:
#<x><ww><yy...y><ascii1><ascii2><ascii3><ascii4>…<asciiN><Chksum Low byte ascii><Chksum High byte ascii>

Where,
<x> is the number of characters in <ww><yy…y>.
<ww> is the waveform number.
<yy…y> is the number of bytes to transfer.
<ChkSum> is the **two's complement of summary of waveform data.**

For example, if <yy…y> = 2002 and <ww> = 01, then <x> = 6 and <ascii1><ascii2><ascii3>…<ascii2000><Chksum Low byte ascii><Chksum High byte ascii>

Setting Example: ADV:USER:WAV:DATA:POIN:ASC #6012002CC01CD01….0003FE16
Query Syntax: [ADVance:]USER:WAVeform:DATA:POINt?<space><NR1>
Return Parameter: <NR1>, 0 ~ 120000
Query Example: USER:WAV:DATA:POIN?

5.3.2.3 CHANNEL Subsystem



CHANnel[:LOAD]

Type: Channel Specific
Description: Selects the channel to which the next channel-specific command will be received and executed.
Setting Syntax: CHANnel[:LOAD]<space><NRf+>
Setting Parameter: 63600-1:1 ~ 2 63600-2:1 ~ 4 63600-5:1 ~ 10
Setting Example: CHAN 1 Set the channel to "1".
CHAN MAX Set the channel to "10".
CHAN MIN Set the channel to "1".
Query Syntax: CHANnel[:LOAD]?[<space><MAX | MIN>]
Return Parameter: <NR1>, 63600-1:0 ~ 2 63600-2:0 ~ 4 63600-5:0 ~ 10
[Unit = None]
Query Example: CHAN?
CHAN? MAX
CHAN? MIN

CHANnel:ACTive

Type: Channel Specific
Description: Enables or disables the load module.
Setting Syntax: CHANnel:ACTive<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: CHAN:ACT 1 Enables the load module.
CHAN:ACT OFF Disables the load module.
Query Syntax: CHANnel:ACTive?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: CHAN:ACT?

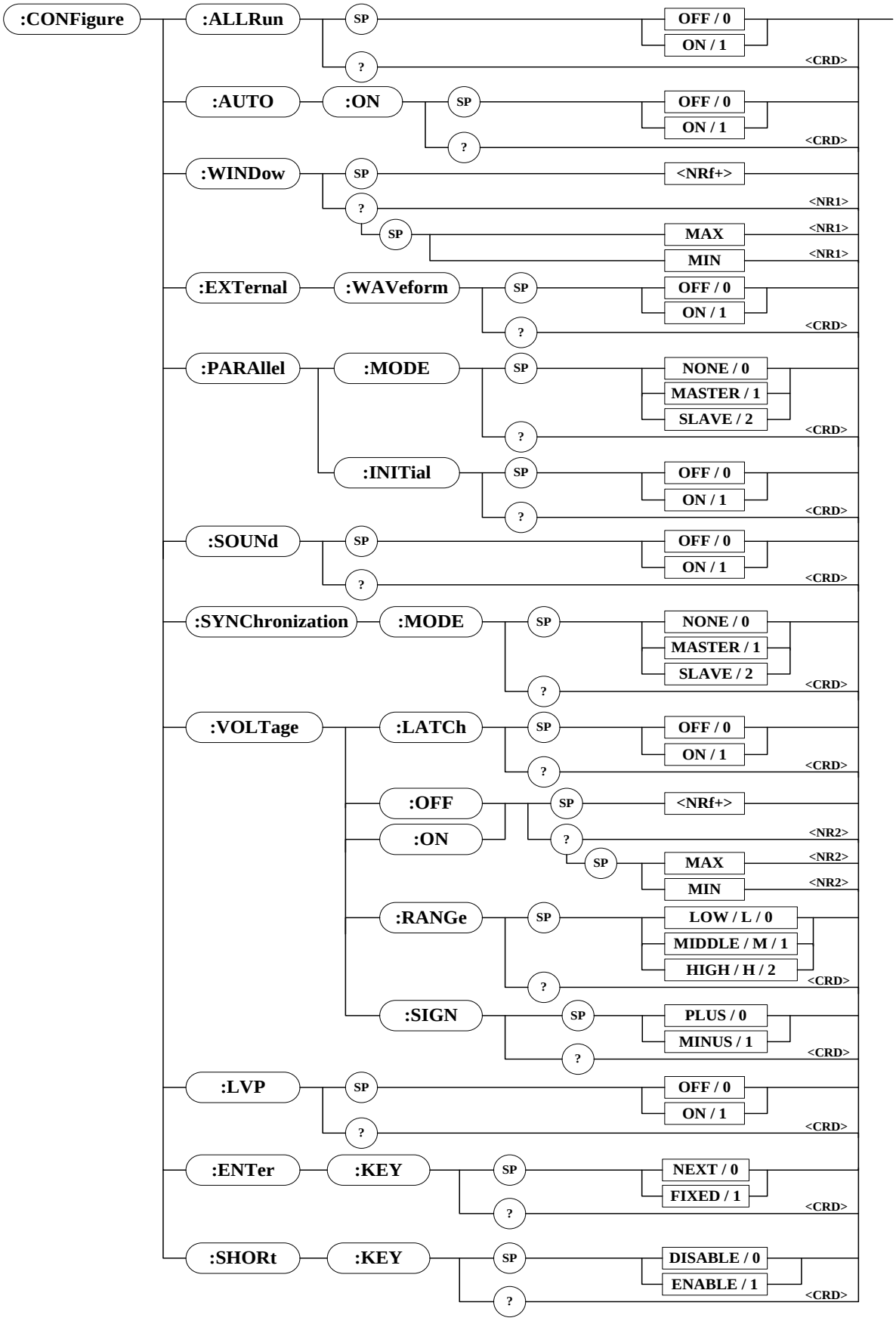
CHAN:ID?

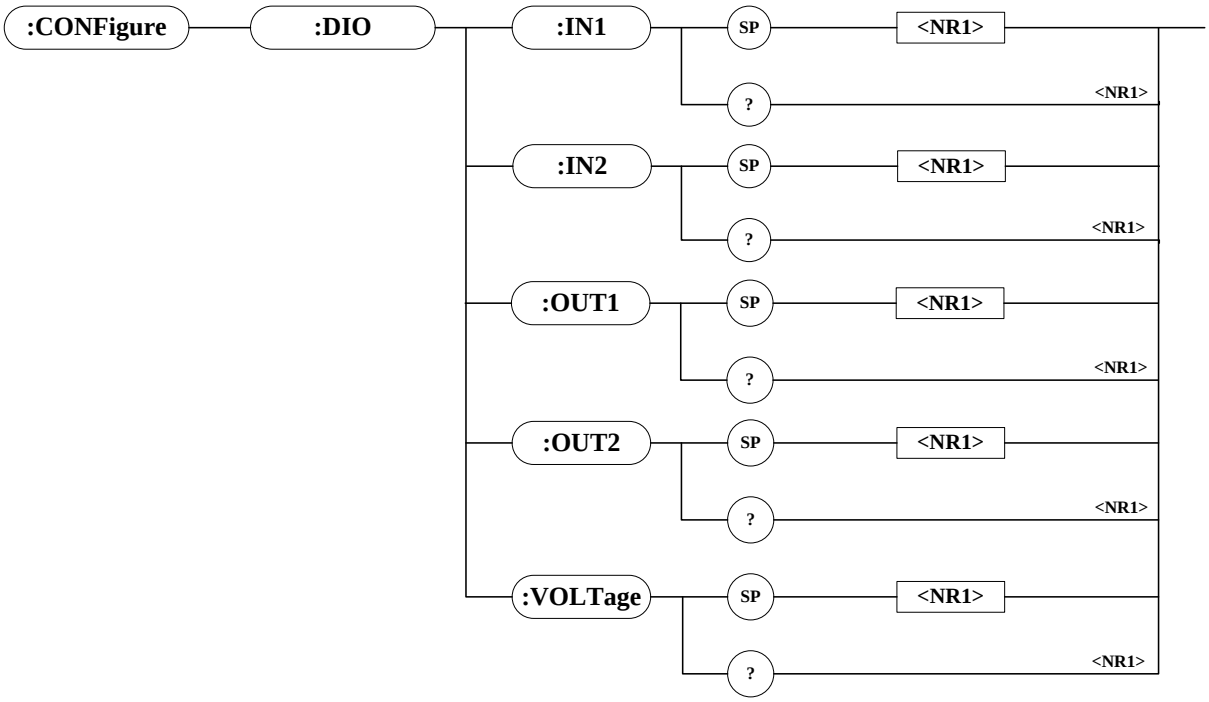
Type: Channel-Specific
Description: This query requests the module to identify itself.
Setting Syntax: None
Setting Parameter: None
Setting Example: None
Query Syntax: CHANnel:ID?
Return Parameter: <aard>,[Unit = None]
Query Example: CHAN:ID?

CHROMA,63630-80-60,636308000066,1.00,1.00

String	Description
CHROMA	Manufacturer
63630-80-60	Model name
636308000066	Serial number
xx.xxx	Version of Panel's firmware
xx.xxx	Version of Module's firmware

5.3.2.4 CONFIGURE Subsystem





CONFigure:ALLRun

Type: Channel-Specific
Description: Set the load module all run state.
Setting Syntax: CONFigure:ALLRun<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: CONF:ALLR ON Set all run state to ON.
CONF:ALLR 0 Set all run state to OFF.
Query Syntax: CONFigure:ALLRun?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: CONF:ALLRun?

CONFigure:AUTO:ON

Type: Channel-Specific
Description: Set the load module to perform auto load on during power-on.
Setting Syntax: CONFigure:AUTO:ON<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: CONF:AUTO:ON ON Set auto load on state to ON.
CONF:AUTO:ON 0 Set auto load on state to OFF.
Query Syntax: CONFigure:AUTO:ON?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: CONF:AUTO:ON?

CONFigure:EXTernal:WAVeform

Type: Channel-Specific
Description: Set the external waveform function on/off.
Setting Syntax: CONFigure:EXTernal:WAVeform<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: CONF:EXT:WAV ON Set external waveform to ON.
CONF:EXT:WAV 0 Set external waveform to OFF.
Query Syntax: CONFigure:EXTernal:WAVeform?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: CONF:EXT:WAV?

CONFigure:PARAllel:INITial

Type: All Channel
Description: Set Load into/exit parallel mode.
Setting Syntax: CONFigure:PARAllel:INITial<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: CONF:PARA:INIT ON Set Load to into parallel mode.
CONF:PARA:INIT 0 Set Load to exit parallel mode.
Query Syntax: CONFigure:PARAllel:INITial?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: CONF:PARA:INIT?

CONFigure:PARAllel:MODE

Type: Channel-Specific
Description: Set the parallel mode.
Setting Syntax: CONFigure:PARAllel:MODE<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, NONE(0), MASTER(1), SLAVE(2)
Setting Example: CONF:PARA:MODE MASTER Set parallel mode to MASTER.
CONF:PARA:MODE 0 Set parallel mode to NONE.
Query Syntax: CONFigure:PARAllel:MODE?
Return Parameter: <CRD>, NONE, MASTER, SLAVE [Unit = None]
Query Example: CONF:PARA:MODE?

CONFigure:SOUNd

Type: Channel-Specific
Description: Set the buzzer on/off in Load.
Setting Syntax: CONFigure:SOUNd<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: CONF:SOUN OFF Set buzzer to OFF.
CONF:SOUN 1 Set buzzer to ON.
Query Syntax: CONFigure:SOUNd?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: CONF:SOUN?

CONFigure: SYNChronous:MODE

Type: Channel-Specific
Description: Set the synchronization mode.
Setting Syntax: CONFigure: SYNChronous:MODE<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, NONE(0), MASTER(1), SLAVE(2)
Setting Example: CONF:SYNC:MODE MASTER Set sync. mode to MASTER.
CONF:SYNC:MODE 0 Set sync. mode to NONE.
Query Syntax: CONFigure: SYNChronous:MODE?
Return Parameter: <CRD>, NONE, MASTER, SLAVE [Unit = None]
Query Example: CONF:SYNC:MODE?

CONFigure:VOLTage:LATCh

Type: Channel-Specific
Description: Set the action type of Von.
Setting Syntax: CONFigure:VOLTage:LATCh<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0),ON(1)
Setting Example: CONF:VOLT:LATC OFF Set Von latch function to OFF.
CONF:VOLT:LATC 1 Set Von latch function to ON.
Query Syntax: CONFigure:VOLTage:LATCh?
Return Parameter: <CRD>, OFF, ON [Unit = None]

Query Example: CONF:VOLT:LATC?

CONFigure:VOLTage:LATCh:RESet

Type: Channel-Specific
Description: Resets the Von signal.
Setting Syntax: CONFigure:VOLTage:LATCh:RESet
Setting Parameter: None.
Setting Example: CONF:VOLT:LATC:RES Resets the Von Signal.

CONFigure:VOLTage:OFF

Type: Channel-Specific
Description: Set the voltage of sink current off.
Setting Syntax: CONFigure:VOLTage:OFF<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: CONF:VOLT:OFF 0.5 Set Voff = 0.5V
CONF:VOLT:OFF 500mV Set Voff = 0.5V
CONF:VOLT:OFF MAX Set Voff = maximum value.
CONF:VOLT:OFF MIN Set Voff = minimum value.
Query Syntax: CONFigure:VOLTage:OFF?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Volt]
Query Example: CONF:VOLT:OFF?
CONF:VOLT:OFF? MAX
CONF:VOLT:OFF? MIN

CONFigure:VOLTage:ON

Type: Channel-Specific
Description: Set the voltage of sink current on.
Setting Syntax: CONFigure:VOLTage:ON<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: CONF:VOLT:ON 0.5 Set Von = 0.5V
CONF:VOLT:ON 500mV Set Von = 0.5V
CONF:VOLT:ON MAX Set Von = maximum value.
CONF:VOLT:ON MIN Set Von = minimum value.
Query Syntax: CONFigure:VOLTage:ON?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Volt]
Query Example: CONF:VOLT:ON?
CONF:VOLT:ON? MAX
CONF:VOLT:ON? MIN

CONFigure:VOLTage:RANGe

Type: Channel-Specific
Description: Set the voltage measurement range in CC mode.
Setting Syntax: CONFigure:VOLTage:RANGEe<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: CONF:VOLT:RANG HIGH Set voltage range to High.
CONF:VOLT:RANG M Set voltage range to Middle.
CONF:VOLT:RANG 0 Set voltage range to Low.
Query Syntax: CONFigure:VOLTage:RANGe?
Return Parameter: <CRD>, LOW, MIDDLE, HIGH [Unit = None]
Query Example: CONF:VOLT:RANG?

CONFigure:VOLTage:SIGN

Type: Channel-Specific
Description: Set the sign of voltage measurement to Plus/Minus.
Setting Syntax: CONFigure:VOLTage:SIGN<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, PLUS(0), MINUS(1)
Setting Example: CONF:VOLT:SIGN PLUS Set sign of voltage to Plus.
CONF:VOLT:SIGN 1 Set sign of voltage to Minus.
Query Syntax: CONFigure:VOLTage:SIGN?
Return Parameter: <CRD>, PLUS, MINUS [Unit = None]
Query Example: CONF:VOLT:SIGN?

CONFigure:WINDow

Type: Channel-Specific
Description: Set the time of measure over which the window calculation is to be performed.
Setting Syntax: CONFigure:WINDow<space><NRf+>
Setting Parameter: <NRf+>, 0.001s ~ 10.000s, Resolution = 1ms, Unit = Second
Setting Example: CONF:WIND 0.5 Set times of window = 0.5s
CONF:WIND MAX Set times of window = maximum value.
CONF:WIND MIN Set times of window = minimum value.
Query Syntax: CONFigure:WINDow?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Second]
Query Example: CONF:WIND?
CONF:WIND? MAX
CONF:WIND? MIN

CONFigure:LVP

Type: Channel-Specific
Description: Set the action type of LVP.
Setting Syntax: CONFigure:LVP<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: CONF:LVP OFF Set LVP function to OFF.
CONF:LVP 1 Set LVP function to ON.
Query Syntax: CONFigure:LVP?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: CONF:LVP?

CONFigure:ENTer:KEY

Type: Channel-Specific
Description: Set the action type of ENTER key.
Setting Syntax: CONFigure:ENTer:KEY<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, NEXT(0), FIXED(1)
Setting Example: CONF:ENT:KEY NEXT Set ENTER key function to NEXT.
CONF:ENT:KEY 1 Set ENTER key function to FIXED.
Query Syntax: CONFigure:ENTer:KEY?
Return Parameter: <CRD>, NEXT, FIXED [Unit = None]
Query Example: CONF:ENT:KEY?

CONFigure:SHORt:KEY

Type: Channel-Specific
Description: Set the action enable or disable of SHORT key.
Setting Syntax: CONFigure:SHORt:KEY<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, DISABLE(0), ENABLE(1)
Setting Example: CONF:SHOR:KEY DISABLE Set SHORT key function to

disable.

CONF:SHOR:KEY 1 Set SHORT key function to enable.

Query Syntax: CONFigure:SHORt:KEY?
Return Parameter: <CRD>, DISABLE, ENABLE [Unit = None]
Query Example: CONF:SHOR:KEY?

CONFigure:DIO:IN1

Type: Frame-Specific
Description: Sets the System I/O Port pin No.10 DI1 function.
Setting Syntax: CONFigure:DIO:IN1<space><NR1>
Setting Parameter: <NR1>, 0 ~ 2
0：NONE
1：EXTERNAL LOAD ON/OFF
2：REMOTE INHIBIT
Setting Example: CONF:DIO:IN1 2 Set DI1 to REMOTE INHIBIT.
CONF:DIO:IN1 0 Set DI1 to NONE.
Query Syntax: CONFigure:DIO:IN1?
Return Parameter: <NR1>, 0 ~ 2 [Unit = None]
Query Example: CONF:DIO:IN1?

CONFigure:DIO:IN2

Type: Frame-Specific
Description: Sets the System I/O Port pin No.44 DI2 function.
Setting Syntax: CONFigure:DIO:IN2<space><NR1>
Setting Parameter: <NR1>, 0 ~ 2
0：NONE
1：EXTERNAL LOAD ON/OFF
2：REMOTE INHIBIT
Setting Example: CONF:DIO:IN2 2 Set DI2 to REMOTE INHIBIT.
CONF:DIO:IN2 0 Set DI2 to NONE.
Query Syntax: CONFigure:DIO:IN2?
Return Parameter: <NR1>, 0 ~ 2 [Unit = None]
Query Example: CONF:DIO:IN2?

CONFigure:DIO:OUT1

Type: Frame-Specific
Description: Sets the System I/O Port pin No.9 DO1 function.
Setting Syntax: CONFigure:DIO:OUT1<space><NR1>
Setting Parameter: <NR1>, 0 ~ 7
0：NONE
1：OCP TEST PASS-H
2：OCP TEST FAIL-L
3：GONG TOTAL PASS-H
4：GONG TOTAL FAIL-L
5：OTP OVP OCP OPP REV-H
6：BUS CTRL. ACT-H
7：BUS CTRL. ACT-L
Setting Example: CONF:DIO:OUT1 2 Set DO1 to OCP TEST FAIL-L.
CONF:DIO:OUT1 0 Set DO1 to NONE.
Query Syntax: CONFigure:DIO:OUT1?
Return Parameter: <NR1>, 0 ~ 7 [Unit = None]

Query Example: CONF:DIO:OUT1?

CONFigure:DIO:OUT2

Type: Frame-Specific
Description: Sets the System I/O Port pin No.43 DO2 function.
Setting Syntax: CONFigure:DIO:OUT2<space><NR1>
Setting Parameter: <NR1>, 0 ~ 7
0：NONE
1：OCP TEST PASS-H
2：OCP TEST FAIL-L
3：GONG TOTAL PASS-H
4：GONG TOTAL FAIL-L
5：OTP OVP OCP OPP REV-H
6：BUS CTRL. ACT-H
7：BUS CTRL. ACT-L
Setting Example: CONF:DIO:OUT2 1 Set DO2 to OCP TEST PASS-H.
CONF:DIO:OUT2 0 Set DO2 to NONE.
Query Syntax: CONFigure:DIO:OUT2?
Return Parameter: <NR1>, 0 ~ 7 [Unit = None]
Query Example: CONF:DIO:OUT2?

CONFigure:DIO:VOLTage

Type: Frame-Specific
Description: Sets the voltage level of the digital output pins (DO1&DO2).
Setting Syntax: CONFigure:DIO:VOLTage<space><NR1>
Setting Parameter: <NR1>, 0 ~ 3
0：NONE
1：1.8V
2：3.3V
3：5.0V
Setting Example: CONF:DIO:VOLT 2 Set output voltage is 3.3V.
CONF:DIO:VOLT 3 Set output voltage is 5.0V.
Query Syntax: CONFigure:DIO:VOLTage?
Return Parameter: <NR1>, 0 ~ 3 [Unit = None]
Query Example: CONF:DIO:VOLT?

DIO:OUT1

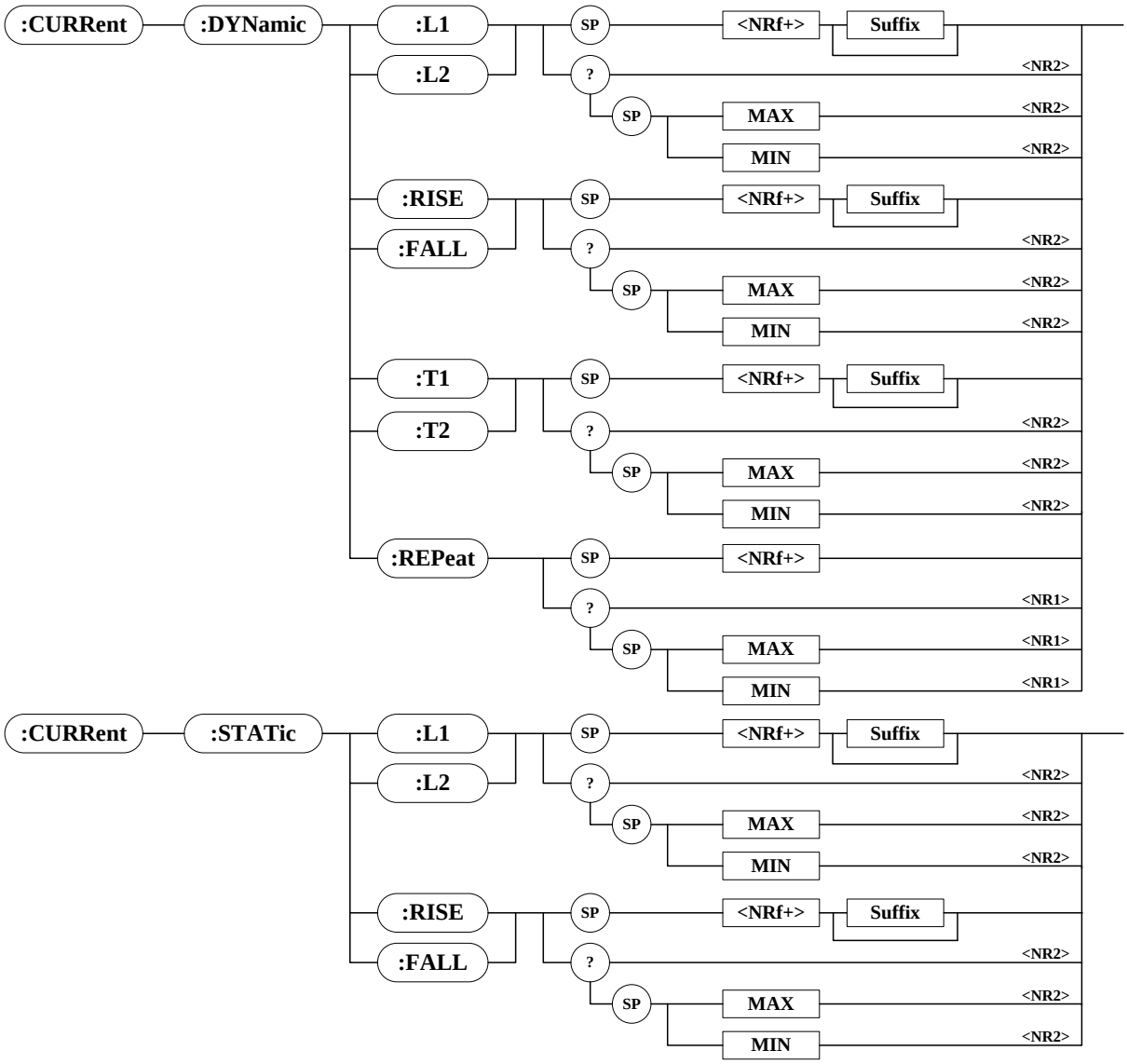
Type: Frame-Specific
Description: Sets the system I/O port pin 9 DO1 status when the BUS CTRL mode is selected for DO1.
Setting Syntax: DIO:OUT1<space><NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: DIO:OUT1 ON Set DO1 to act.
DIO:OUT1 0 Set DO1 not to act.
Query Syntax: DIO:OUT1?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: DIO:OUT1?

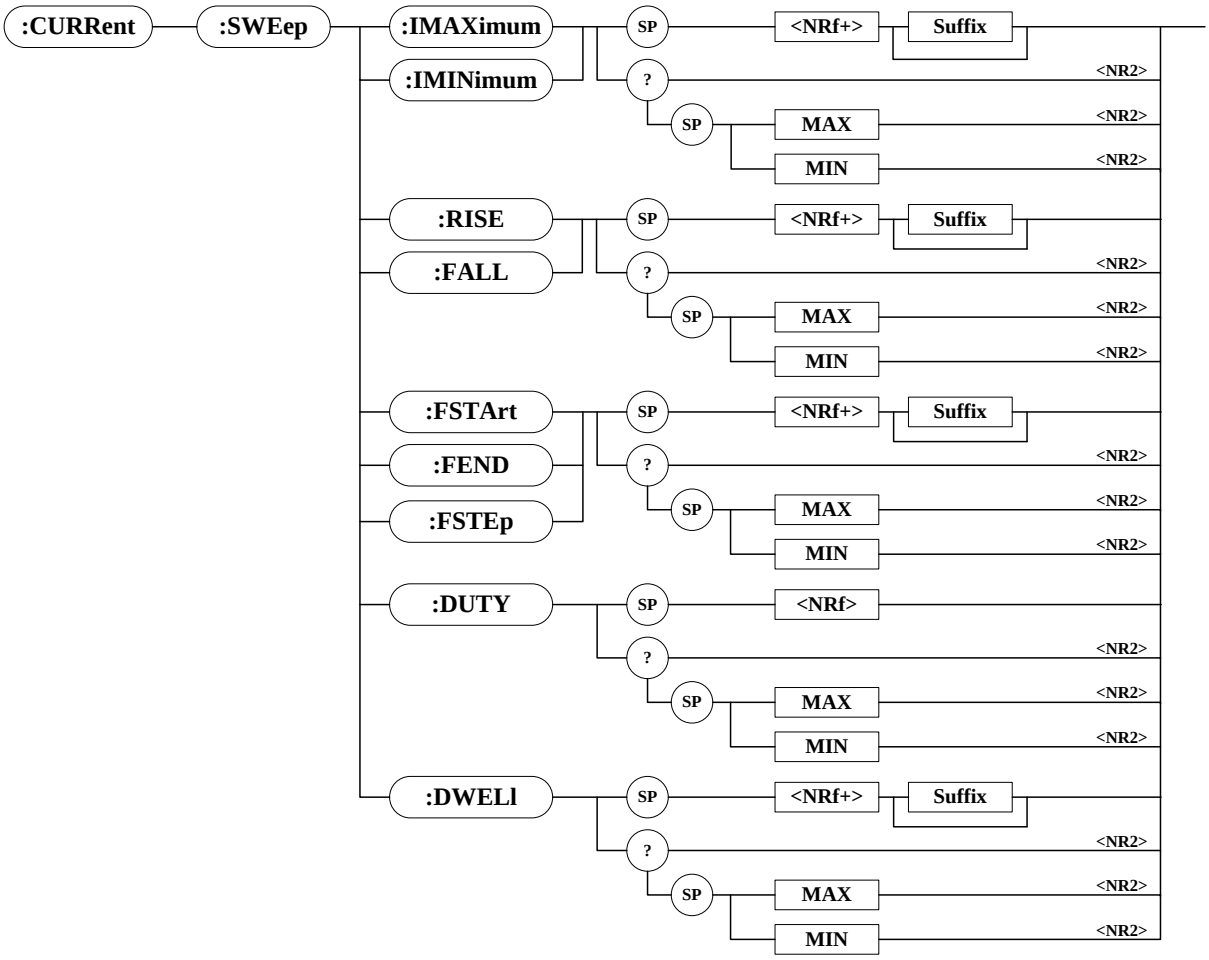
DIO:OUT2

Type: Frame-Specific
Description: Sets the system I/O port pin 43 DO2 status when the BUS CTRL mode is selected for DO2.

Setting Syntax: DIO:OUT2<space><NR1>
Setting Parameter: <CRD | NR1>, OFF(0), ON(1)
Setting Example: DIO:OUT2 ON Set DO2 to act.
DIO:OUT2 0 Set DO2 not to act.
Query Syntax: DIO:OUT2?
Return Parameter: <CRD>, OFF, ON [Unit = None]
Query Example: DIO:OUT2?

5.3.2.5 CURRENT Subsystem





CURRent:DYNamic:FALL

Type: Channel-Specific

Description: Sets the falling current slew rate in the constant current dynamic mode.

Setting Syntax: CURRent:DYNamic:FALL<space><NRf+>[suffix]

Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example:

CURR:DYN:FALL 2.5	Set falling slew rate to 2.5A/μs.
CURR:DYN:FALL 1A/μs	Set falling slew rate to 1A/μs.
CURR:DYN:FALL MAX	Set falling slew rate to the maximum value of dynamic load.
CURR:DYN:FALL MIN	Set falling slew rate to the minimum value of dynamic load.

Query Syntax: CURRent:DYNamic:FALL?[<space><MAX | MIN>]

Return Parameter: <NR2>, [Unit = A/μs]

Query Example:

CURR:DYN:FALL?

CURR:DYN:FALL? MAX

CURR:DYN:FALL? MIN

CURRent:DYNamic:L1

Type: Channel-Specific

Description: Sets the load current during the T1 period in the constant current dynamic mode.

Setting Syntax: CURRent:DYNamic:L1<space><NRf+>[suffix]

Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example: CURR:DYN:L1 20 Set the dynamic load parameter L1 = 20A.
CURR:DYN:L1 10A Set the dynamic load parameter L1 = 10A.
CURR:DYN:L1 MAX Set the dynamic load parameter L1 = maximum value.
CURR:DYN:L1 MIN Set the dynamic load parameter L1 = minimum value.
Query Syntax: CURRent:DYNamic:L1?[<space><MAX | MIN>]
Return Parameter: <NR2>,[Unit = Ampere]
Query Example: CURR:DYN:L1?
CURR:DYN:L1? MAX
CURR:DYN:L1? MIN

CURRent:DYNamic:L2

Type: Channel-Specific
Description: Sets the load current during the T2 period in the constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:L2<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: CURR:DYN:L2 20 Set the dynamic load parameter L2 = 20A.
CURR:DYN:L2 10A Set the dynamic load parameter L2 = 10A.
CURR:DYN:L2 MAX Set the dynamic load parameter L2 = maximum value.
CURR:DYN:L2 MIN Set the dynamic load parameter L2 = minimum value.
Query Syntax: CURRent:DYNamic:L2?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: CURR:DYN:L2?
CURR:DYN:L2? MAX
CURR:DYN:L2? MIN

CURRent:DYNamic:REPeat

Type: Channel-Specific
Description: Sets the repeat count in the constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:REPeat<space><NRf+>
Setting Parameter: <NRf+>, 0 ~ 65535, Resolution = 1, Unit = None
Setting Example: CURR:DYN:REP 500 Set repeat count = 500
CURR:DYN:REP MAX Set repeat count = maximum value.
CURR:DYN:REP MIN Set repeat count = minimum value.
Query Syntax: CURRent:DYNamic:REPeat?[<space><MAX | MIN>]
Return Parameter: <NR1>, [Unit = None]
Query Example: CURR:DYN:REP?
CURR:DYN:REP? MAX
CURR:DYN:REP? MIN

CURRent:DYNamic:RISE

Type: Channel-Specific
Description: Sets the rising current slew rate in the constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:RISE<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example:	CURR:DYN:RISE 2.5	Set rising slew rate to 2.5A/μs.
	CURR:DYN:RISE 1A/μs	Set rising slew rate to 1A/μs.
	CURR:DYN:RISE MAX	Set rising slew rate to the maximum value of dynamic load.
	CURR:DYN:RISE MIN	Set rising slew rate to the minimum value of dynamic load.
Query Syntax:	CURRent:DYNamic:RISE?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = A/μs]	
Query Example:	CURR:DYN:RISE?	
	CURR:DYN:RISE? MAX	
	CURR:DYN:RISE? MIN	

CURRent:DYNamic:T1

Type:	Channel-Specific	
Description:	Sets the T1 duration parameter in the constant current dynamic mode.	
Setting Syntax:	CURRent:DYNamic:T1<space><NRf+>[suffix]	
Setting Parameter:	<NRf+>, 10μs ~ 100s, Resolution = 10μs, Unit = Second	
Setting Example:	CURR:DYN:T1 10ms	Set the dynamic duration T1 = 10ms.
	CURR:DYN:T1 2	Set the dynamic duration T1 = 2s.
	CURR:DYN:T1 MAX	Set the dynamic duration T1 as maximum value.
	CURR:DYN:T1 MIN	Set the dynamic duration T1 as minimum value.
Query Syntax:	CURRent:DYNamic:T1?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = Second]	
Query Example:	CURR:DYN:T1?	
	CURR:DYN:T1? MAX	
	CURR:DYN:T1? MIN	

CURRent:DYNamic:T2

Type:	Channel-Specific	
Description:	Sets the T2 duration parameter in the constant current dynamic mode.	
Setting Syntax:	CURRent:DYNamic:T2<space><NRf+>[suffix]	
Setting Parameter:	<NRf+>, 10μs ~ 100s, Resolution = 10μs, Unit = Second	
Setting Example:	CURR:DYN:T2 10ms	Set the dynamic duration T2 = 10ms.
	CURR:DYN:T2 2	Set the dynamic duration T2 = 2s.
	CURR:DYN:T2 MAX	Set the dynamic duration T2 as maximum value.
	CURR:DYN:T2 MIN	Set the dynamic duration T2 as minimum value.
Query Syntax:	CURRent:DYNamic:T2?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = Second]	
Query Example:	CURR:DYN:T2?	
	CURR:DYN:T2? MAX	
	CURR:DYN:T2? MIN	

CURRent:STATic:FALL

Type:	Channel-Specific	
Description:	Sets the falling current slew rate in the constant current static mode.	
Setting Syntax:	CURRent:STATic:FALL<space><NRf+>[suffix]	
Setting Parameter:	Refer to the respective specification for the valid range value.	
Setting Example:	CURR:STAT:FALL 2.5	Set falling slew rate to 2.5A/μs.

	CURR:STAT:FALL 1A/μs	Set falling slew rate to 1A/μs.
	CURR:STAT:FALL MAX	Set falling slew rate to the maximum value of static load.
	CURR:STAT:FALL MIN	Set falling slew rate to the minimum value of static load.

Query Syntax: CURRent:STATic:FALL?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = A/μs]
Query Example: CURR:STAT:FALL?
CURR:STAT:FALL? MAX
CURR:STAT:FALL? MIN

CURRent:STATic:L1

Type: Channel-Specific
Description: Sets the static load current in the constant current static mode.
Setting Syntax: CURRent:STATic:L1<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example:	CURR:STAT:L1 20	Set the static load parameter L1 = 20A.
	CURR:STAT:L1 10A	Set the static load parameter L1 = 10A.
	CURR:STAT:L1 MAX	Set the static load parameter L1 = maximum value.
	CURR:STAT:L1 MIN	Set the static load parameter L1 = minimum value.

Query Syntax: CURRent:STATic:L1?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: CURR:STAT:L1?
CURR:STAT:L1? MAX
CURR:STAT:L1? MIN

CURRent:STATic:L2

Type: Channel-Specific
Description: Sets the static load current in the constant current static mode.
Setting Syntax: CURRent:STATic:L2<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example:	CURR:STAT:L2 20	Set the static load parameter L2 = 20A.
	CURR:STAT:L2 10A	Set the static load parameter L2 = 10A.
	CURR:STAT:L2 MAX	Set the static load parameter L2 = maximum value.
	CURR:STAT:L2 MIN	Set the static load parameter L2 = minimum value.

Query Syntax: CURRent:STATic:L2?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: CURR:STAT:L2?
CURR:STAT:L2? MAX
CURR:STAT:L2? MIN

CURRent:STATic:RISE

Type: Channel-Specific
Description: Sets the rising current slew rate in the constant current static mode.
Setting Syntax: CURRent:STATic:RISE<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example:	CURR:STAT:RISE 2.5	Set rising slew rate to 2.5A/μs.
	CURR:STAT:RISE 1A/μs	Set rising slew rate to 1A/μs.
	CURR:STAT:RISE MAX	Set rising slew rate to the maximum value of static load.

	CURR:STAT:RISE MIN	Set rising slew rate to the minimum value of static load.
Query Syntax:	CURRent:STATic:RISE?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = A/μs]	
Query Example:	CURR:STAT:RISE?	
	CURR:STAT:RISE? MAX	
	CURR:STAT:RISE? MIN	

CURRent:SWEep:DUTY

Type:	Channel-Specific	
Description:	Sets the duty cycle in the constant current frequency sweep mode.	
Setting Syntax:	CURRent:SWEep:DUTY<space><NRf+>	
Setting Parameter:	<NRf+>, 1% ~ 99%, Resolution = 1%	
Setting Example:	CURR:SWE:DUTY 50	Set duty cycle = 50%
	CURR:SWE:DUTY MAX	Set duty cycle = maximum value.
	CURR:SWE:DUTY MIN	Set duty cycle = minimum value.
Query Syntax:	CURRent:SWEep:DUTY?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = None]	
Query Example:	CURR:SWE:DUTY?	
	CURR:SWE:DUTY? MAX	
	CURR:SWE:DUTY? MIN	

CURRent:SWEep:DWELl

Type:	Channel-Specific	
Description:	Sets the dwell time in the constant current frequency sweep mode.	
Setting Syntax:	CURRent:SWEep:DWELl<space><NRf+>[suffix]	
Setting Parameter:	<NRf+>, 1ms ~ 100s, Resolution = 1ms, Unit = Second	
Setting Example:	CURR:SWE:DWEL 50	Set dwell time = 50s
	CURR:SWE:DWEL 500ms	Set dwell time = 0.5s
	CURR:SWE:DWEL MAX	Set dwell time = maximum value.
	CURR:SWE:DWEL MIN	Set dwell time = minimum value.
Query Syntax:	CURRent:SWEep:DWELl?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = Second]	
Query Example:	CURR:SWE:DWEL?	
	CURR:SWE:DWEL? MAX	
	CURR:SWE:DWEL? MIN	

CURRent:SWEep:FALL

Type:	Channel-Specific	
Description:	Sets the falling current slew rate in the constant current frequency sweep mode.	
Setting Syntax:	CURRent:SWEep:FALL<space><NRf+>[suffix]	
Setting Parameter:	Refer to the respective specification for the valid range value.	
Setting Example:	CURR:SWE:FALL 2.5	Set falling slew rate to 2.5A/μs.
	CURR:SWE:FALL 1A/μs	Set falling slew rate to 1A/μs.
	CURR:SWE:FALL MAX	Set falling slew rate to the maximum value of static load.
	CURR:SWE:FALL MIN	Set falling slew rate to the minimum value of static load.
Query Syntax:	CURRent:SWEep:FALL?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = A/μs]	
Query Example:	CURR:SWE:FALL?	
	CURR:SWE:FALL? MAX	
	CURR:SWE:FALL? MIN	

CURRent:SWEep:FEND

Type: Channel-Specific
Description: Sets the end frequency in the constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:FEND<space><NRf+>[suffix]
Setting Parameter: <NRf+>, 0.01Hz ~ 50kHz, Resolution = 0.01Hz, Unit = Hertz
Setting Example:
CURR:SWE:FEND 1000 Set frequency = 1kHz
CURR:SWE:FEND 1kHz Set frequency = 1kHz
CURR:SWE:FEND MAX Set frequency = maximum value.
CURR:SWE:FEND MIN Set frequency = minimum value.
Query Syntax: CURRent:SWEep:FEND?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Hertz]
Query Example:
CURR:SWE:FEND?
CURR:SWE:FEND? MAX
CURR:SWE:FEND? MIN

CURRent:SWEep:FSTArt

Type: Channel-Specific
Description: Sets the start frequency in the constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:FSTArt<space><NRf+>[suffix]
Setting Parameter: <NRf+>, 0.01Hz ~ 50kHz, Resolution = 0.01Hz, Unit = Hertz
Setting Example:
CURR:SWE:FSTA 1000 Set frequency = 1kHz
CURR:SWE:FSTA 1kHz Set frequency = 1kHz
CURR:SWE:FSTA MAX Set frequency = maximum value.
CURR:SWE:FSTA MIN Set frequency = minimum value.
Query Syntax: CURRent:SWEep:FSTA?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Hertz]
Query Example:
CURR:SWE:FSTA?
CURR:SWE:FSTA? MAX
CURR:SWE:FSTA? MIN

CURRent:SWEep:FSTEp

Type: Channel-Specific
Description: Sets the step frequency in the constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:FSTEp<space><NRf+>[suffix]
Setting Parameter: <NRf+>, 0.01Hz ~ 50kHz, Resolution = 0.01Hz, Unit = Hertz
Setting Example:
CURR:SWE:FSTE 1000 Set frequency = 1kHz
CURR:SWE:FSTE 1kHz Set frequency = 1kHz
CURR:SWE:FSTE MAX Set frequency = maximum value.
CURR:SWE:FSTE MIN Set frequency = minimum value.
Query Syntax: CURRent:SWEep:FSTE?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Hertz]
Query Example:
CURR:SWE:FSTE?
CURR:SWE:FSTE? MAX
CURR:SWE:FSTE? MIN

CURRent:SWEep:IMAXimum

Type: Channel-Specific
Description: Sets the maximum current in the constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:IMAXimum<space><NRf+>[suffix]

Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: CURR:SWE:IMAX 20 Set max current = 20A.
CURR:SWE:IMAX 10A Set max current = 10A.
CURR:SWE:IMAX MAX Set max current = maximum value.
CURR:SWE:IMAX MIN Set max current = minimum value.
Query Syntax: CURRent:SWEep:IMAXimum?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: CURR:SWE:IMAX?
CURR:SWE:IMAX? MAX
CURR:SWE:IMAX? MIN

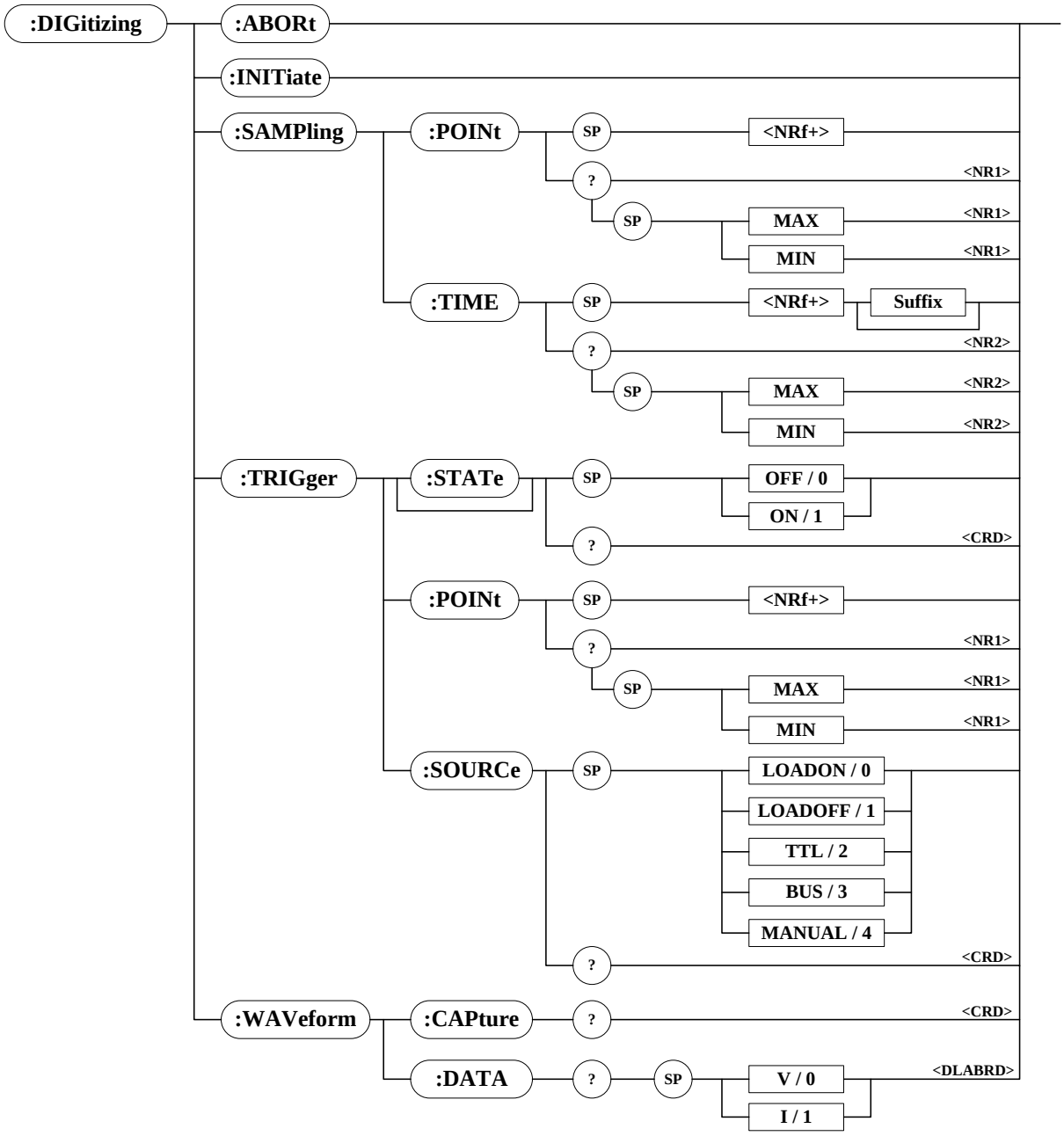
CURRent:SWEep:IMINimum

Type: Channel-Specific
Description: Sets the minimum current in the constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:IMINimum<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: CURR:SWE:IMIN 20 Set min current = 20A.
CURR:SWE:IMIN 10A Set min current = 10A.
CURR:SWE:IMIN MAX Set min current = maximum value.
CURR:SWE:IMAX MIN Set min current = minimum value.
Query Syntax: CURRent:SWEep:IMINimum?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: CURR:SWE:IMIN?
CURR:SWE:IMIN? MAX
CURR:SWE:IMIN? MIN

CURRent:SWEep:RISE

Type: Channel-Specific
Description: Sets the rising current slew rate in the constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:RISE<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: CURR:SWE:RISE 2.5 Set rising slew rate to 2.5A/μs.
CURR:SWE:RISE 1A/μsSet rising slew rate to 1A/μs.
CURR:SWE:RISE MAX Set rising slew rate to the maximum value of static load.
CURR:SWE:RISE MIN Set rising slew rate to the minimum value of static load.
Query Syntax: CURRent:SWEep:RISE?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = A/μs]
Query Example: CURR:SWE:RISE?
CURR:SWE:RISE? MAX
CURR:SWE:RISE? MIN

5.3.2.6 DIGITIZING Subsystem



DIGitizing:ABORt

Type:	Channel-Specific	
Description:	Abort the digitizing function.	
Setting Syntax	DIGitizing:ABORt	
Setting Parameter:	None	
Setting Example:	DIG:ABOR	Abort digitizing function.
Query Syntax:	None	
Return Parameter:	None	
Query Example:	None	

DIGitizing:INITiate

Type:	Channel-Specific	
Description:	Start the digitizing function to wait trigger signal.	
Setting Syntax	DIGitizing:INITiate	
Setting Parameter:	None	
Setting Example:	DIG:INIT	Initial digitizing function.
Query Syntax:	None	
Return Parameter:	None	
Query Example:	None	

DIGitizing:SAMPling:POINt

Type:	Channel-Specific	
Description:	Sets the number of sampling points in the digitizing function.	
Setting Syntax:	DIGitizing:SAMPling:POINt<space><NRf+>	
Setting Parameter:	<NRf+>, 1 ~ 15,000, Resolution = 1, Unit = None	
Setting Example:	DIG:SAMP:POIN 500	Set sampling points = 500
	DIG:SAMP:POIN MAX	Set sampling points = maximum value.
	DIG:SAMP:POIN MIN	Set sampling points = minimum value.
Query Syntax:	DIGitizing:SAMPling:POINt?[<space><MAX | MIN>]	
Return Parameter:	<NR1>, [Unit = None]	
Query Example:	DIG:SAMP:POIN?	
	DIG:SAMP:POIN? MAX	
	DIG:SAMP:POIN? MIN	

DIGitizing:SAMPling:TIME

Type:	Channel-Specific	
Description:	Sets the sampling time in the digitizing function.	
Setting Syntax:	DIGitizing:SAMPling:TIME<space><NRf+>[suffix]	
Setting Parameter:	<NRf+>, 2μs ~ 40ms, Resolution = 2μs, Unit = Second	
Setting Example:	DIG:SAMP:TIME 0.02	Set sampling time = 20ms
	DIG:SAMP:TIME 20ms	Set sampling time = 20ms
	DIG:SAMP:TIME MAX	Set sampling time = maximum value.
	DIG:SAMP:TIME MIN	Set sampling time = minimum value.
Query Syntax:	DIGitizing:SAMPling:TIME?[<space><MAX | MIN>]	
Return Parameter:	<NR2>, [Unit = Second]	
Query Example:	DIG:SAMP:TIME?	
	DIG:SAMP:TIME? MAX	
	DIG:SAMP:TIME? MIN	

DIGitizing:TRIGger[:STATe]

Type:	Channel-Specific	
Description:	Sets the software trigger state in the digitizing function.	
Setting Syntax	DIGitizing:TRIGger[:STATe]<space><CRD | NR1>	
Setting Parameter:	<CRD | NR1>, OFF(0), ON(1) [Unit = None]	
Setting Example:	DIG:TRIG ON	Set trigger state to ON.
	DIG:TRIG 0	Set trigger state to OFF.
Query Syntax:	DIGitizing:TRIGger[:STATe]?	
Return Parameter:	<CRD>, IDLE, PRE_TRIG, WAIT_TRIG, POST_TRIG	
Query Example:	DIG:TRIG?	

DIGitizing:TRIGger:POINt

Type: Channel-Specific
Description: Sets the number of trigger points in the digitizing function.
Setting Syntax: DIGitizing:TRIGger:POINt<space><NRf+>
Setting Parameter: <NRf+>, 1 ~ 15,000, Resolution = 1, Unit = None
Setting Example: DIG:TRIG:POIN 500 Set trigger points = 500
DIG:TRIG:POIN MAX Set trigger points = maximum value.
DIG:TRIG:POIN MIN Set trigger points = minimum value.
Query Syntax: DIGitizing:TRIGger:POINt?[<space><MAX | MIN>]
Return Parameter: <NR1>, [Unit = None]
Query Example: DIG:TRIG:POIN?
DIG:TRIG:POIN? MAX
DIG:TRIG:POIN? MIN

DIGitizing:TRIGger:SOURce

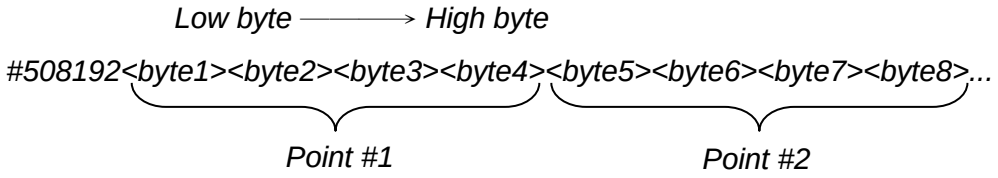
Type: Channel-Specific
Description: Sets the trigger source in the digitizing function.
Setting Syntax DIGitizing:TRIGger:SOURce<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, LOADON(0), LOADOFF(1), TTL(2), BUS(3) | MANUAL(4) [Unit = None]
Setting Example: DIG:TRIG:SOUR TTL Set trigger source to TTL.
DIG:TRIG:SOUR 3 Set trigger source to BUS.
Query Syntax: DIGitizing:TRIGger:SOURce?
Return Parameter: <CRD>, LOADON, LOADOFF, TTL, BUS, MANUAL
Query Example: DIG:TRIG:SOUR?

DIGitizing:WAVeform:CAPture?

Type: Channel-Specific
Description: Starts the waveform data transmission from the Module to the Frame.
Setting Syntax: None
Setting Parameter: None
Setting Example: None
Query Syntax: DIGitizing:WAVeform:CAPture?
Return Parameter: <CRD>, WAIT, OK, ERROR [Unit = None]
Query Example: DIG:WAV:CAP?

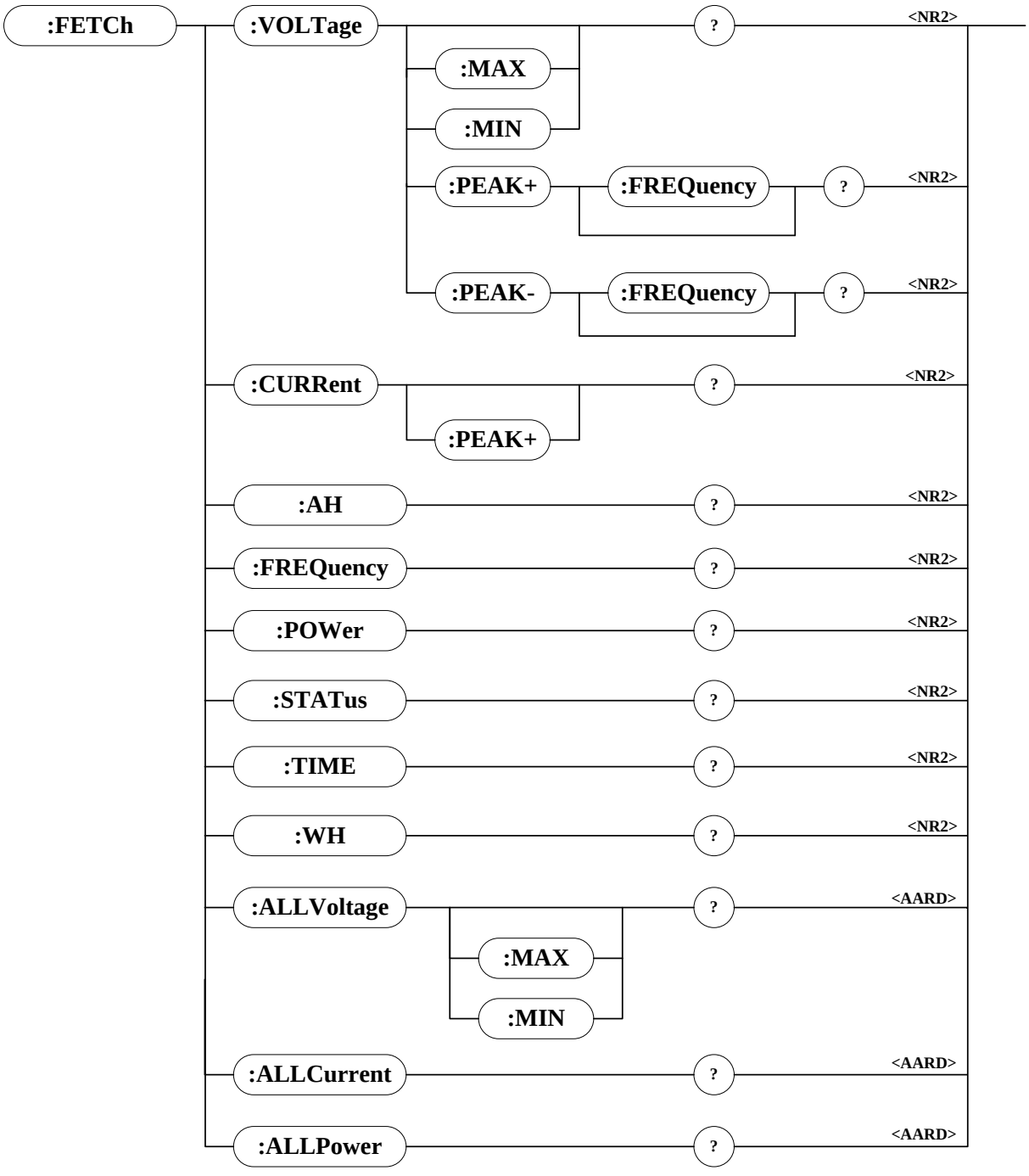
DIGitizing:WAVeform:DATA?

Type: Channel-Specific
Description: This query returns the voltage or current waveform data from the DC Electronic Load in binary format. The waveform (voltage or current) consists of number points corresponding to sampling points in a user specified format of 32bits floating point.



Setting Syntax:	None
Setting Parameter:	None
Setting Example:	None
Query Syntax:	DIGitizing:WAVeform:DATA?<space><V | I>
Return Parameter:	<DLABRD>, [Unit = None]
Query Example:	DIG:WAV:DATA? V DIG:WAV:DATA? I

5.3.2.7 FETCH Subsystem



FETCh:ALLCurrent?

Type: Channel-Independent
Description: Returns the current measured at the input of all the load modules. The return value is 0 when the channel does not exist or there is no sink current.
Query Syntax: FETCh:ALLCurrent?
Return Parameter: <aard>, [Unit = Ampere]
Query Example: FETC:ALLC?
Return Example: 0, 0, 0, 0, 5.12, 0, 12, 0

FETCh:ALLVoltage?

Type: Channel-Independent
Description: Returns the voltage measured at the input of the all load channels. The return value is 0 when the channel does not exist or no voltage input.
Query Syntax: FETCh:ALLVoltage?
Return Parameter: <aard>, [Unit = Voltage]
Query Example: FETC:ALLV?
Return Example: 1.2, 2, 0, 0, 10.2, 0, 0, 0

FETCh:ALLPower?

Type: Channel-Independent
Description: Returns the power measured at the input of the all load channels. The return value is 0 when the channel does not exist or no input.
Query Syntax: FETCh:ALLPower?
Return Parameter: <aard>, [Unit = Watt]
Query Example: FETC:ALLP?
Return Example: 1.2, 2, 0, 0, 10.2, 0, 0, 0

FETCh:AH?

Type: Channel-Specific
Description: Returns the ampere-hour measured in timing mode.
Query Syntax: FETCh:AH?
Return Parameter: <NR2>, [Unit = Ampere-hour]
Query Example: FETC:AH?
Return Example: 3.15

FETCh:CURRent?

Type: Channel-Specific
Description: Returns the current measured at electronic load input.
Query Syntax: FETCh:CURRent?
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: FETC:CURR?
Return Example: 3.15

FETCh:CURRent:PEAK+?

Type: Channel-Specific
Description: Returns the peak+ current measured at electronic load input in CZ mode.
Query Syntax: FETCh:CURRent:PEAK+?
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: FETC:CURR:PEAK+?
Return Example: 3.15

FETCh:FREQuency?

Type: Channel-Specific
Description: Returns the frequency measured in frequency sweep mode or sine wave dynamic mode.
Query Syntax: FETCh:FREQuency?
Return Parameter: <NR2>, [Unit = Hertz]
Query Example: FETC:FREQ?
Return Example: 100.0

FETCh:POWer?

Type: Channel-Specific
Description: Returns the power measured at electronic load input.
Query Syntax: FETCh:POWer?
Return Parameter: <NR2>, [Unit = Watt]
Query Example: FETC:POW?
Return Example: 3.15

FETCh:STATus?

Type: Channel-Independent
Description: Returns real time status of the load module.

Bit Position	15~9	8	7	6	5	4	3	2	1	0
Condition		**REMOTE INHIBIT**	**FAN**	**MAX LIM**	**SYNC**	**REV**	**OPP**	**OCP**	**OVP**	**OTP**
Bit Weight		256	128	64	32	16	8	4	2	1

Query Syntax: FETCh:STATus?
Return Parameter: <NR1>, [Unit = None]
Query Example: FETC:STAT?
Return Example: 4

FETCh:TIME?

Type: Channel-Specific
Description: Returns the time measured in timing mode.
Query Syntax: FETCh:TIME?
Return Parameter: <NR2>, [Unit = Second]
Query Example: FETC:TIME?
Return Example: 0.045

FETCh:WH?

Type: Channel-Specific
Description: Returns the watt-hour measured in timing mode.
Query Syntax: FETCh:WH?
Return Parameter: <NR2>, [Unit = Watt-hour]
Query Example: FETC:WH?
Return Example: 20.045

FETCh:VOLTage?

Type: Channel-Specific
Description: Returns the voltage measured at electronic load input.
Query Syntax: FETCh:VOLTage?
Return Parameter: <NR2>, [Unit = Voltage]
Query Example: FETC:VOLT?
Return Example: 8.12

FETCh:VOLTage:MAX?

Type: Channel-Specific
Description: Returns the maximum voltage measured at electronic load input in CZ mode.
Query Syntax: FETCh:VOLTage:MAX?
Return Parameter: <NR2>, [Unit = Voltage]
Query Example: FETC:VOLT:MAX?
Return Example: 8.12

FETCh:VOLTage:MIN?

Type: Channel-Specific
Description: Returns the minimum voltage measured at electronic load input in CZ mode.
Query Syntax: FETCh:VOLTage:MIN?
Return Parameter: <NR2>, [Unit = Voltage]
Query Example: FETC:VOLT:MIN?
Return Example: 8.12

FETCh:VOLTage:PEAK+?

Type: Channel-Specific
Description: Returns the peak+ voltage measured at electronic load input in CCD, CCFS and sine wave dynamic mode.
Query Syntax: FETCh:VOLTage:PEAK+?
Return Parameter: <NR2>, [Unit = Voltage]
Query Example: FETC:VOLT:PEAK+?
Return Example: 8.12

FETCh:VOLTage:PEAK+:FREQuency?

Type: Channel-Specific
Description: Returns the frequency at peak+ voltage measured in frequency sweep mode.
Query Syntax: FETCh:VOLTage:PEAK+:FREQuency?
Return Parameter: <NR2>, [Unit = Hertz]
Query Example: FETC:VOLT:PEAK+:FREQ?
Return Example: 8.12

FETCh:VOLTage:PEAK-?

Type: Channel-Specific
Description: Returns the peak- voltage measured at electronic load input in CCD, CCFS and sine wave dynamic mode.
Query Syntax: FETCh:VOLTage:PEAK-?
Return Parameter: <NR2>, [Unit = Voltage]
Query Example: FETC:VOLT:PEAK-?
Return Example: 8.12

FETCh:VOLTage:PEAK-:FREQuency?

Type: Channel-Specific
Description: Returns the frequency at peak- voltage measured in frequency sweep mode.
Query Syntax: FETCh:VOLTage:PEAK-:FREQuency?
Return Parameter: <NR2>, [Unit = Hertz]
Query Example: FETC:VOLT:PEAK-:FREQ?
Return Example: 8.12

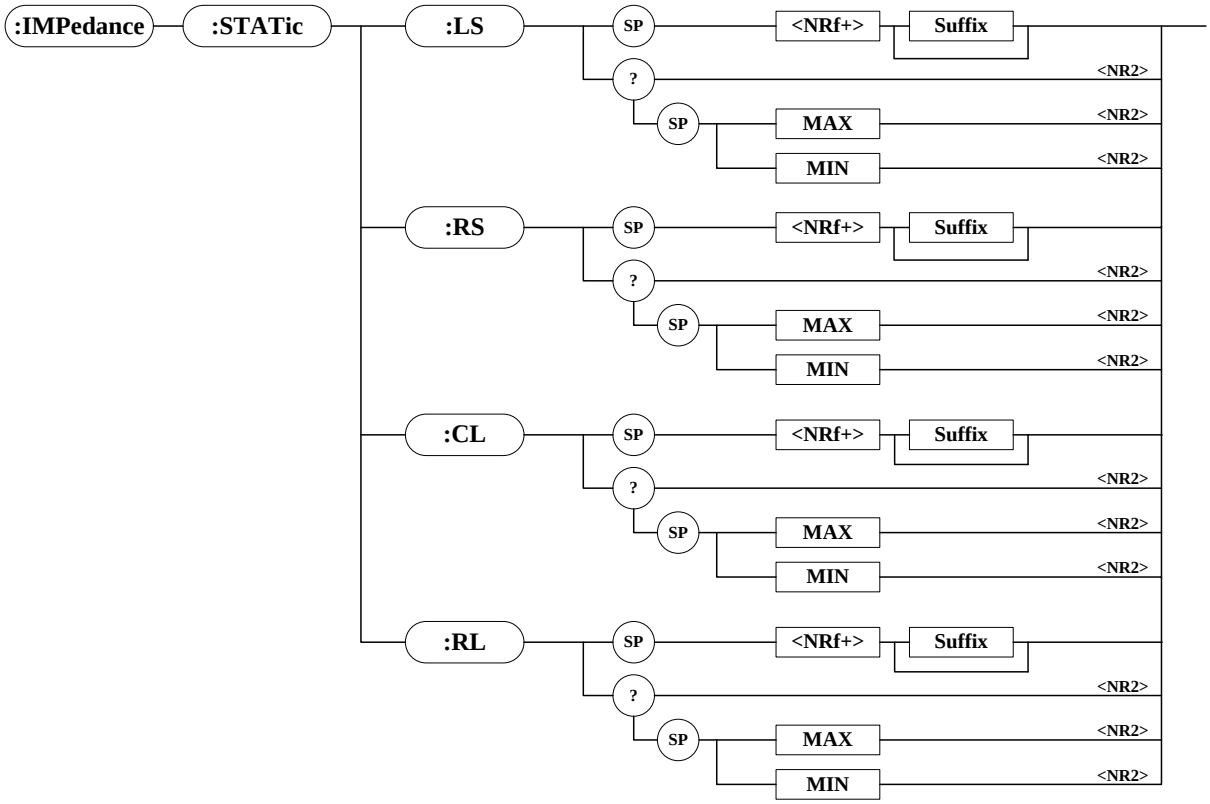
FETCh:ALLVoltage:MAX?

Type: Channel-Independent
Description: Returns the maximum voltage measured at the input of all load modules. The return value is 0 when the channel does not exist.
Query Syntax: FETCh:ALLVoltage:MAX?
Return Parameter: <aard>, [Unit = Voltage]
Query Example: FETC:ALLV:MAX?
Return Example: 0, 0, 0, 0, 0, 0, 5.12, 0, 12, 0

FETCh:ALLVoltage:MIN?

Type: Channel-Independent
Description: Returns the minimum voltage measured at the input of all load modules. The return value is 0 when the channel does not exist.
Query Syntax: FETCh:ALLVoltage:MIN?
Return Parameter: <aard>, [Unit = Voltage]
Query Example: FETC:ALLV:MIN?
Return Example: 0, 0, 0, 0, 0, 0, 5.12, 0, 12,0

5.3.2.8 IMPEDANCE Subsystem



IMPedance:STATic:CL

Type: Channel-Specific
Description: Sets the equivalent parallel load capacitance in the constant impedance mode.
Setting Syntax: IMPedance:STATic:CL<space><NRf+>[suffix]
Setting Parameter: <NRf+>, 30μF ~ 50,000μF, Resolution = 1uF, Unit = Farad
Setting Example: IMP:STAT:CL 0.02 Set capacitance = 20mF.
IMP:STAT:CL 100μF Set capacitance = 100μF.
IMP:STAT:CL MAX Set capacitance = maximum value.
IMP:STAT:CL MIN Set capacitance = minimum value.
Query Syntax: CURRent:STATic:CL?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Farad]
Query Example: CURR:STAT:CL?
CURR:STAT:CL? MAX
CURR:STAT:CL? MIN

IMPedance:STATic:LS

Type:	Channel-Specific
Description:	Sets the equivalent series inductance in the constant impedance mode.
Setting Syntax:	IMPedance:STATic:LS<space><NRf+>[suffix]
Setting Parameter:	<NRf+>, 0 ~ 20.0μH, Resolution = 0.1μH, Unit = Henry
Setting Example:	IMP:STAT:LS 0.00002 Set inductance = 20μH. IMP:STAT:LS 1μH Set inductance = 1μH. IMP:STAT:LS MAX Set inductance = maximum value. IMP:STAT:LS MIN Set inductance = minimum value.
Query Syntax:	CURRent:STATic:LS?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Henry]
Query Example:	CURR:STAT:LS? CURR:STAT:LS? MAX CURR:STAT:LS? MIN

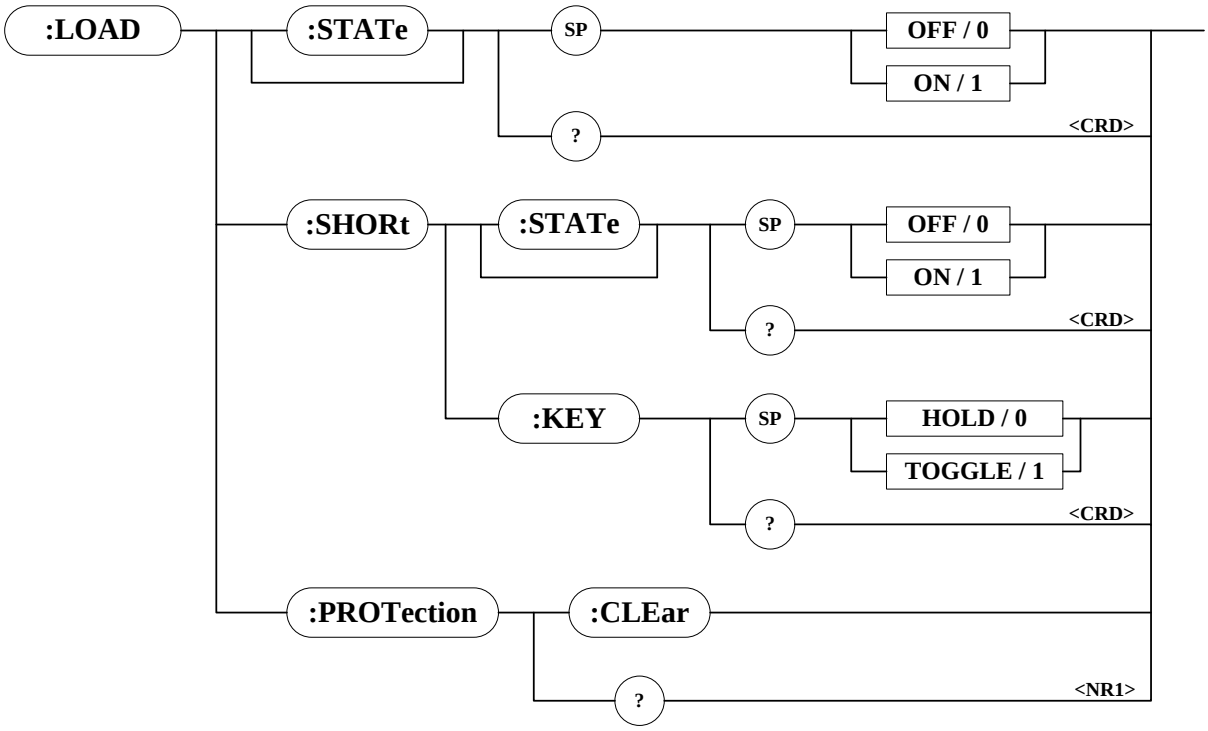
IMPedance:STATic:RS

Type:	Channel-Specific
Description:	Sets the equivalent series resistance in the constant impedance mode.
Setting Syntax:	IMPedance:STATic:RS<space><NRf+>[suffix]
Setting Parameter:	<NRf+>, 0.03Ω ~ 20.00Ω, Resolution = 0.01Ω, Unit = Ohm
Setting Example:	IMP:STAT:RS 20 Set resistance = 20Ω. IMP:STAT:RS 10 OHM Set resistance = 10Ω. IMP:STAT:RS MAX Set resistance = maximum value. IMP:STAT:RS MIN Set resistance = minimum value.
Query Syntax:	IMPedance:STATic:RS?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = OHM]
Query Example:	IMP:STAT:RS? IMP:STAT:RS? MAX IMP:STAT:RS? MIN

IMPedance:STATic:RL

Type:	Channel-Specific
Description:	Sets the equivalent parallel load resistance in the constant impedance mode.
Setting Syntax:	IMPedance:STATic:RL<space><NRf+>[suffix]
Setting Parameter:	For valid value range refer to respective specification.
Setting Example:	IMP:STAT:RL 20 Set resistance = 20Ω. IMP:STAT:RL 10 OHM Set resistance = 10Ω. IMP:STAT:RL MAX Set resistance = maximum value. IMP:STAT:RL MIN Set resistance = minimum value.
Query Syntax:	IMPedance:STATic:RL?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = OHM]
Query Example:	IMP:STAT:RL? IMP:STAT:RL? MAX IMP:STAT:RL? MIN

5.3.2.9 LOAD Subsystem



LOAD[:STATe]

Type: Channel-Specific
Description: The LOAD command sets the electronic load active/on or inactive/off.
Setting Syntax: LOAD[:STATe]<space><NRf>
Setting Parameter: <NRf>, OFF(0), ON(1)
Setting Example: LOAD ON Activates the electronic load.
LOAD 0 Inactivates the electronic load.
Query Syntax: LOAD[:STATe]?
Return Parameter:<CRD>, OFF, ON
Query Example: LOAD?

LOAD:PROTection?

Type: Channel-Specific
Description: This command returns the status of the electronic load.
Setting Syntax: None
Setting Parameter: None
Setting Example: None
Query Syntax: LOAD:PROTection?
Return Parameter:<NR1>

Bit Position	15~9	8	7	6	5	4	3	2	1	0
Condition		REMOTE INHIBIT	FAN	MAX LIM	SYNC	REV	OPP	OCP	OVP	OTP
Bit Weight		256	128	64	32	16	8	4	2	1

Query Example: LOAD:PROT?

LOAD:PROTection:CLEar

Type:	Channel-Specific
Description:	Resets the status of the electronic load.
Setting Syntax:	LOAD:PROTection:CLEar
Setting Parameter:	None
Setting Example:	LOAD:PROT:CLE
Query Syntax:	None

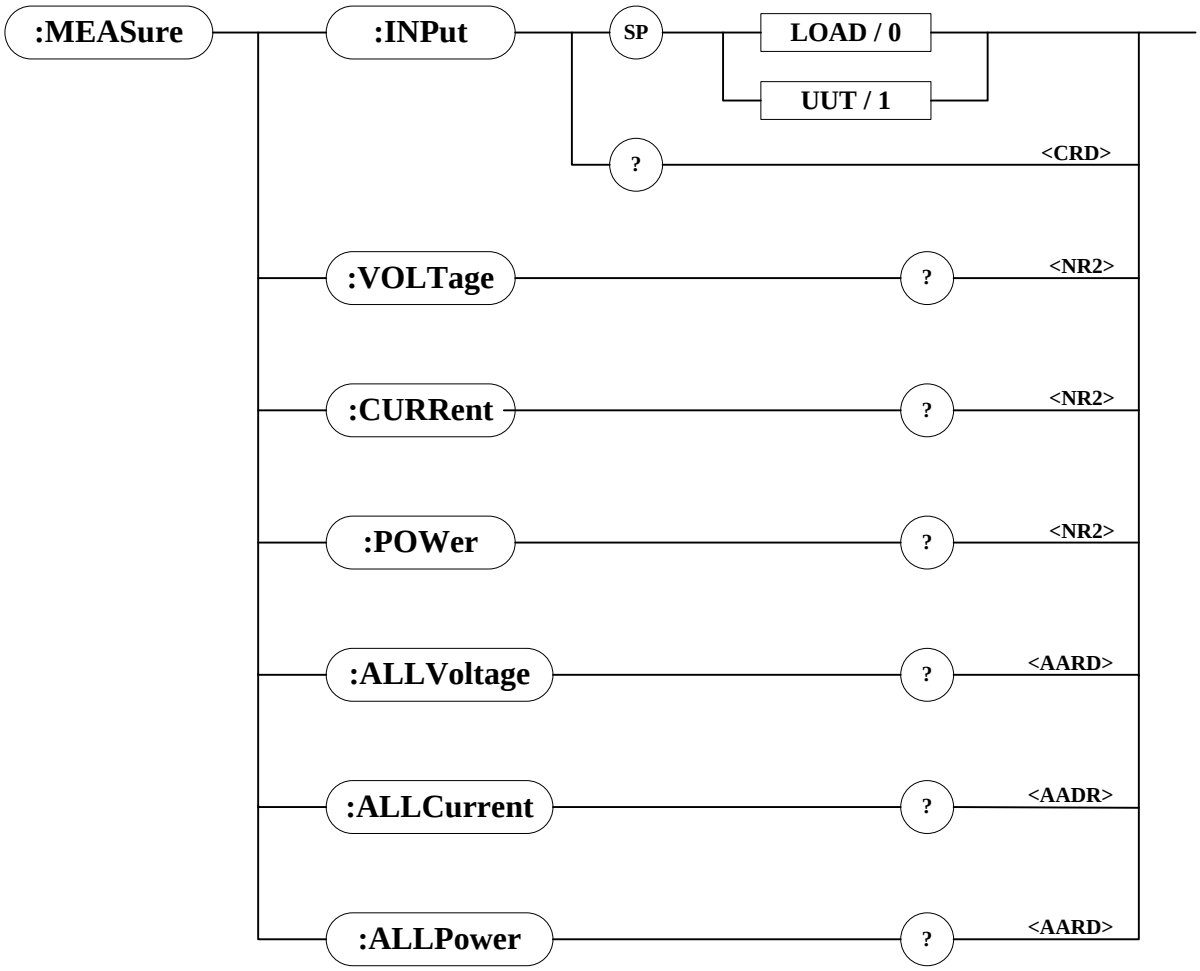
LOAD:SHORt[:STATe]

Type:	Channel-Specific	
Description:	Activates or inactivates the short-circuit simulation.	
Setting Syntax:	LOAD:SHORt[:STATe]<space><NRf>	
Setting Parameter:	<NRf>, OFF(0), ON(1)	
Setting Example:	LOAD:SHOR ON	Activates short-circuit simulation.
	LOAD:SHOR OFF	Inactivates short-circuited simulation.
Query Syntax:	LOAD:SHORt[:STATe]?	
Return Parameter:	<CRD>, OFF, ON	
Query Example:	LOAD:SHOR?	

LOAD:SHORt:KEY

Type:	Channel-Specific	
Description:	Sets the mode of the short key in the electronic load.	
Setting Syntax:	LOAD:SHORt:KEY<space><NRf>	
Setting Parameter:	<NRf>, HOLD(0), TOGGLE(1)	
Setting Example:	LOAD:SHOR:KEY TOGGLE	Sets the short key mode to Toggle.
	LOAD:SHOR:KEY HOLD	Sets the short key mode to Hold.
Query Syntax:	LOAD:SHORt:KEY?	
Return Parameter:	<CRD>, HOLD, TOGGLE	
Query Example:	LOAD:SHOR:KEY?	

5.3.2.10 MEASURE Subsystem



MEASure:ALLCurrent?

Type:	Channel-Independent
Description:	Returns the real time current measured at the input of all the load modules. The return value is 0 if the channel does not exist.
Query Syntax:	MEASure:ALLCurrent?
Return Parameter:	<aard>, [Unit = Ampere]
Query Example:	MEAS:ALLC?
Return Example:	0, 0, 0, 0, 5.12, 0, 12, 0

MEASure:ALLPower?

Type:	Channel-Independent
Description:	Returns the real time power measured at the input of all the load modules. The return value is 0 if the channel does not exist.
Query Syntax:	MEASure:ALLPower?
Return Parameter:	<aard>, [Unit = Watt]
Query Example:	MEAS:ALLP?
Return Example:	0, 0, 0, 0, 5.12, 0, 12, 0

MEASure:ALLVoltage?

Type:	All Channel
Description:	Returns real time voltage measured at the input of the all the load channels. The return value is 0 if the channel does not exist.
Query Syntax:	MEASure:ALLVoltage?
Return Parameter:	<aard>, [Unit = Volt]
Query Example:	MEAS:ALLV?
Return Example:	1.2, 2, 0, 0, 10.2, 0, 0, 0

MEASure:CURRent?

Type:	Channel-Specific
Description:	Returns the real time current measured at the load module input.
Query Syntax:	MEASure:CURRent?
Return Parameter:	<NR2>, [Unit = Ampere]
Query Example:	MEAS:CURR?
Return Example:	3.15

MEASure:INPut

Type:	Channel-Specific
Description:	Selects the input port of the electronic load to measure voltage.
Setting Syntax:	MEASure:INPut<space><NRf>
Setting Parameter:	<NRf>, LOAD(0), UUT(1)
Setting Example:	MEAS:INP LOAD MEAS:INP 1
Query Syntax:	MEASure:INPut?
Return Parameter:	<CRD>, LOAD, UUT
Query Example:	MEAS:INP?

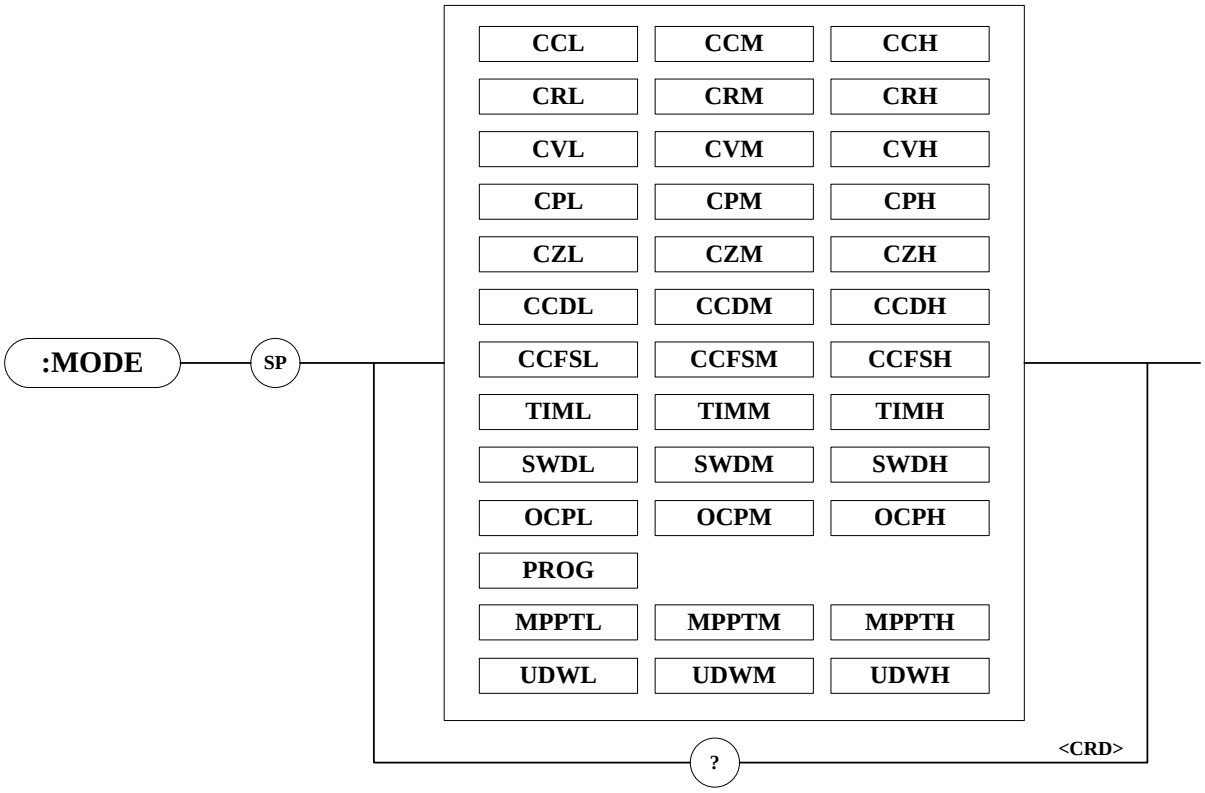
MEASure:POWer?

Type:	Channel-Specific
Description:	Returns the real time power measured at the load module input.
Query Syntax:	MEASure:POWer?
Return Parameter:	<NR2>, [Unit = Watt]
Query Example:	MEAS:POW?
Return Example:	3.15

MEASure:VOLTage?

Type:	Channel-Specific
Description:	Returns the real time voltage measured at the load module input.
Query Syntax:	MEASure:VOLTage?
Return Parameter:	<NR2>, [Unit = Volt]
Query Example:	MEAS:VOLT?
Return Example:	8.12

5.3.2.11 MODE Subsystem



MODE

Type: Channel-Specific

Description: This command sets the operational mode of the electronic load.

Setting Syntax: MODE<space><NRf>

Setting Parameter: <CRD>, CCL, CCM, CCH, CRL, CRM, CRH, CVL, CVM, CVH, CPL, CPM, CPH, CZL, CZM, CZH, CCDL, CCDM, CCDH, CCFSL, CCFSM, CCFSH, TIML, TIMM, TIMH, SWDL, SWDM, SWDH, OCPL, OCPM, OCPH, PROG, MPPTL, MPPTM, MPPTH, UDWL, UDWM, UDWH

Example:

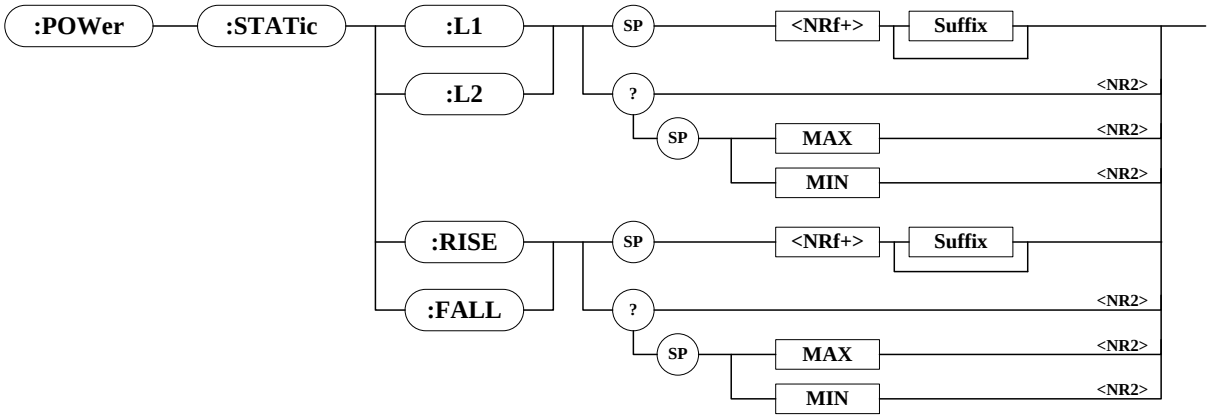
MODE CCL	Set CC mode of low range.
MODE CCH	Set CC mode of high range.
MODE CCDL	Set CC dynamic mode of low range.
MODE CCDH	Set CC dynamic mode of high range.
MODE CRL	Set CR mode of low range.
MODE CRH	Set CR mode of high range.

Query Syntax: MODE?

Return Parameter: <CRD>, CCL, CCM, CCH, CRL, CRM, CRH, CVL, CVM, CVH, CPL, CPM, CPH, CZL, CZM, CZH, CCDL, CCDM, CCDH, CCFSL, CCFSM, CCFSH, TIML, TIMM, TIMH, SWDL, SWDM, SWDH, OCPL, OCPM, OCPH, PROG, MPPTL, MPPTM, MPPTH, UDWL, UDWM, UDWH

Query Example: MODE?

5.3.2.12 POWER Subsystem



POWer:STATic:FALL

Type: Channel-Specific
Description: Sets the falling current slew rate in the constant power mode.
Setting Syntax: POWer:STATic:FALL<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example:
- POW:STAT:FALL 2.5 — Set falling slew rate to 2.5A/μs.
- POW:STAT:FALL 1A/μs — Set falling slew rate to 1A/μs.
- POW:STAT:FALL MAX — Set falling slew rate to the maximum value.
- POW:STAT:FALL MIN — Set falling slew rate to the minimum value.

Query Syntax: POWer:STATic:FALL?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = A/μs]
Query Example:
- POW:STAT:FALL?
- POW:STAT:FALL? MAX
- POW:STAT:FALL? MIN

POWer:STATic:L1

Type: Channel-Specific
Description: Sets the static load power in the constant power mode.
Setting Syntax: POWer:STATic:L1<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example:
- POW:STAT:L1 20 — Set the load parameter L1 = 20W.
- POW:STAT:L1 10W — Set the load parameter L1 = 10W.
- POW:STAT:L1 MAX — Set the load parameter L1 = maximum value.
- POW:STAT:L1 MIN — Set the load parameter L1 = minimum value.

Query Syntax: CURRent:STATic:L1?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Watt]
Query Example:
- CURR:STAT:L1?
- CURR:STAT:L1? MAX
- CURR:STAT:L1? MIN

POWer:STATic:L2

Type: Channel-Specific
Description: Sets the static load power in the constant power mode.
Setting Syntax: POWer:STATic:L2<space><NRf+>[suffix]

Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example:	POW:STAT:L2 20	Set the load parameter L2 = 20W.
	POW:STAT:L2 10W	Set the load parameter L2 = 10W.
	POW:STAT:L2 MAX	Set the load parameter L2 = maximum value.
	POW:STAT:L2 MIN	Set the load parameter L2 = minimum value.

Query Syntax: POWer:STATic:L2?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Watt]
Query Example: POW:STAT:L2?
POW:STAT:L2? MAX
POW:STAT:L2? MIN

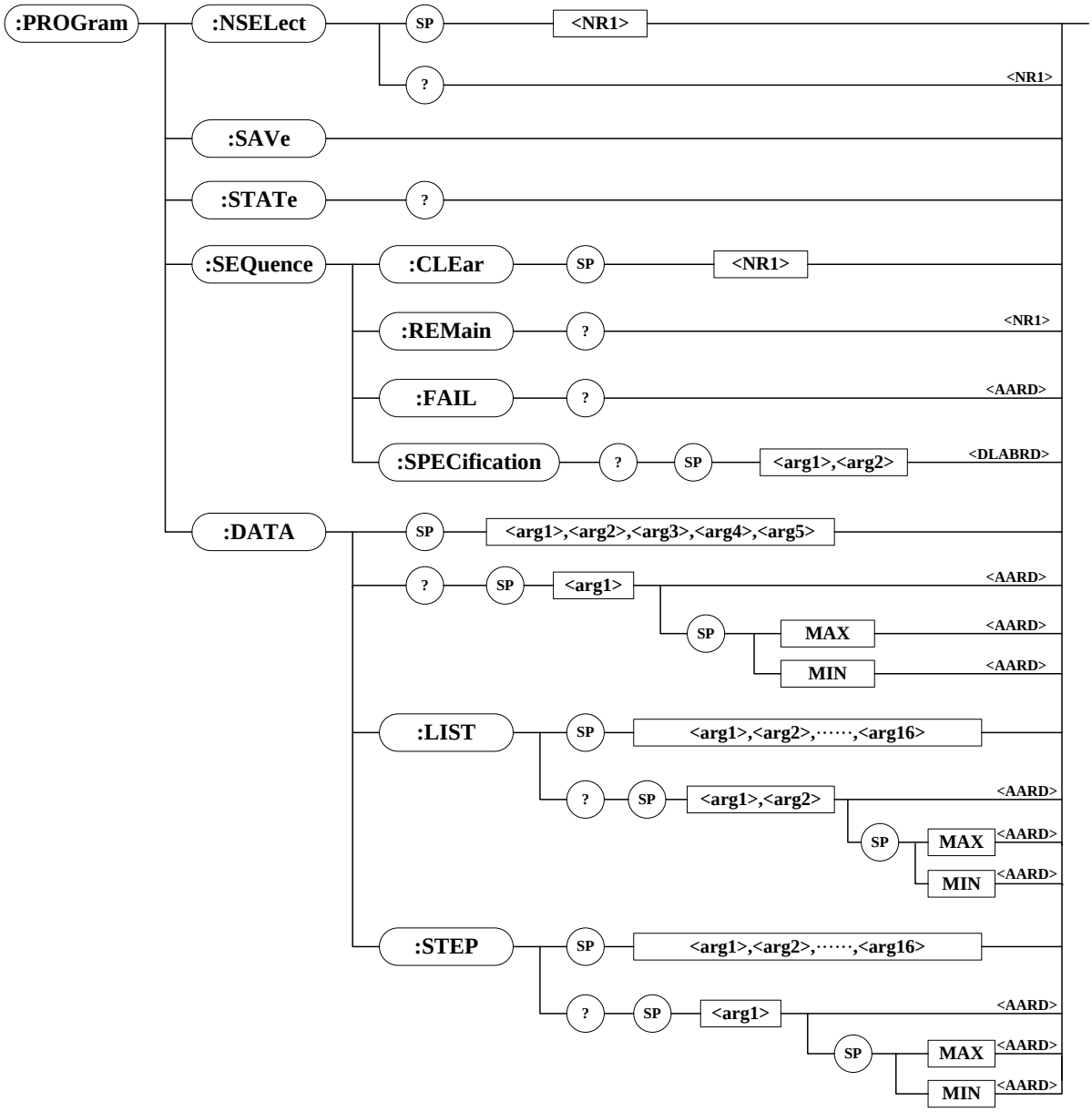
POWer:STATic:RISE

Type: Channel-Specific
Description: Sets the rising current slew rate in the constant power mode.
Setting Syntax: POWer:STATic:RISE<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.

Setting Example:	POW:STAT:RISE 2.5	Set rising slew rate to 2.5A/μs.
	POW:STAT:RISE 1A/μs	Set rising slew rate to 1A/μs .
	POW:STAT:RISE MAX	Set rising slew rate to the maximum value of load.
	POW:STAT:RISE MIN	Set rising slew rate to the minimum value of load.

Query Syntax: POWer:STATic:RISE?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = A/μs]
Query Example: POW:STAT:RISE?
POW:STAT:RISE? MAX
POW:STAT:RISE? MIN

5.3.2.13 PROGRAM Subsystem



PROGram:DATA

Type: Channel-Specific

Description: Sets the program parameters. (**Note:** All parameter settings in this command cannot use a suffix.)

Setting Syntax: PROGram:DATA<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>

Setting Parameter:

Selects a program to be set:

Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.

Sets the type of program:

Arg2: <NRf>, LIST(0), STEP(1), Unit = None.

Sets the chain parameter in program:

Arg3: <NR1>, 0 ~ 10, Resolution = 1, Unit = None.

Sets the repeat count of program:

Arg4: <NR1>, 0 ~ 9,999, Resolution = 1, Unit = None.

Sets number of sequence in program:

Arg5: <NR1>, 0 ~ 100, Resolution = 1, Unit = None.

Setting Example: PROG:DATA 1,STEP,2,0,5
Query Syntax: PROGram:DATA?<space><NR1>[<space><MAX | MIN>]
Return Parameter: <aard>
Query Example: PROG:DATA? 1
PROG:DATA? 1 MAX
PROG:DATA? 1 MIN
Return Example: 1,LIST,3,1,5

PROGram:DATA:LIST

Type: Channel-Specific
Description: Sets the list parameters in the program. (**Note:** All parameter settings in this command cannot use a suffix.)
Setting Syntax: PROGram:DATA:LIST<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>,<Arg6>,<Arg7>,<Arg8>,<Arg9>,<Arg10>,<Arg11>,<Arg12>,<Arg13>,<Arg14>,<Arg15>,<Arg16>
Setting Parameter:

Selects a program to be set:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Selects a sequence to be set:
Arg2: <NR1>, 1 ~ N, Resolution = 1, Unit = None.
Sets the trigger mode of the sequence:
Arg3: <NRf>, SKIP(0), AUTO(1), MANUAL(2), EXTERNAL(3), Unit = None.
Sets the run mode of the sequence:
Arg4: <NRf>, CC(0), CR(1), CV(2), CP(3), Unit = None.
Sets the mode's range for the sequence:
Arg5: <NRf>, LOW(0), MIDDLE(1), HIGH(2), Unit = None.
Sets the load value according to the run mode in the sequence:
Arg6: <NRf>, Refer to the respective specification for the valid range value.
Sets the falling slew rate in the sequence:
Arg7: <NRf>, Refer to the respective specification for the valid range value.
Sets the rising slew rate in the sequence:
Arg8: <NRf>, Refer to the respective specification for the valid range value.
Sets the dwell time of the sequence:
Arg9: <NRf>, 0.1ms ~ 30s, Resolution = 0.0001s, Unit = Second.
Sets the high-level voltage in the sequence:
Arg10: <NRf>, Refer to the respective specification for the valid range value.
Sets the low-level voltage in the sequence:
Arg11: <NRf>, Refer to the respective specification for the valid range value.
Sets the high-level current in the sequence:
Arg12: <NRf>, Refer to the respective specification for the valid range value.
Sets the low-level current in the sequence:
Arg13: <NRf>, Refer to the respective specification for the valid range value.
Sets the high-level power in the sequence:
Arg14: <NRf>, Refer to the respective specification for the valid

range value.
Sets the low-level power in the sequence:
Arg15: <NRf>, Refer to the respective specification for the valid range value.
Sets the delay time for Pass/Fail in the sequence:
Arg16: <NRf>, 0s ~ 30s, Resolution = 0.0001s, Unit = Second.

Setting Example: PROG:DATA:LIST 1,1,AUTO,CC,2,3.5,0.5,0.5,2,-1,-1,-1,-1,-1,-1,1

Query Syntax 1: PROGram:DATA:LIST?<space><Arg1>,<Arg2>[<space><MAX | MIN>]
Selects a program:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Selects a sequence:
Arg2: <NR1>, 1 ~ N, Resolution = 1, Unit = None.

Query Syntax 2: PROGram:DATA:LIST?<space><Arg1>,<Arg2>,<Arg3>,<Arg4><space><MAX | MIN>
Selects a program:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Selects a sequence:
Arg2: <NR1>, 1 ~ N, Resolution = 1, Unit = None.
Selects a run mode:
Arg3: <NRf>, CC(0), CR(1), CV(2), CP(3), Unit = None.
Selects the mode's range:
Arg4: <NRf>, LOW(0), MIDDLE(1), HIGH(2), Unit = None.

Return Parameter: <aard>

Query Example:
PROG:DATA:LIST? 2,1
PROG:DATA:LIST? 2,1 MAX
PROG:DATA:LIST? 2,1 MIN
PROG:DATA:LIST? 2,1,1,0 MAX
PROG:DATA:LIST? 2,1,1,0 MIN

Return Example: 2,1,AUTO,CC,HIGH,3.5,0.5,0.5,2,-1,-1,-1,-1,-1,-1,1

PROGram:DATA:STEP

Type: Channel-Specific

Description: Sets the step parameters in the program. (**Note:** All parameter settings in this command cannot use a suffix.)

Setting Syntax: PROGram:DATA:STEP<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>,<Arg6>,<Arg7>,<Arg8>,<Arg9>,<Arg10>,<Arg11>,<Arg12>,<Arg13>,<Arg14>,<Arg15>,<Arg16>

Setting Parameter:
Selects the program to be set:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Sets the trigger mode in the sequence:
Arg2: <NRf>, SKIP(0), AUTO(1), MANUAL(2), EXTERNAL(3), Unit = None.
Sets the run mode of the sequence:
Arg3: <NRf>, CC(0), CR(1), CV(2), CP(3), Unit = None.
Sets the mode's range for the sequence:
Arg4: <NRf>, LOW(0), MIDDLE(1), HIGH(2), Unit = None.
Sets the start value according to the run mode in the sequence:
Arg5: <NRf>, Refer to the respective specification for the valid range value.
Sets the end value according to the run mode in the sequence:
Arg6: <NRf>, Refer to the respective specification for the valid range value.

Sets the falling slew rate in the sequence:
Arg7: <NRf>, Refer to the respective specification for the valid range value.
Sets the rising slew rate in the sequence:
Arg8: <NRf>, Refer to the respective specification for the valid range value.
Sets the dwell time of the sequence:
Arg9: <NRf>, 0.1ms ~ 30s, Resolution = 0.0001s, Unit = Second.
Sets the high-level voltage in the sequence:
Arg10: <NRf>, Refer to the respective specification for the valid range value.
Sets the low-level voltage in the sequence:
Arg11: <NRf>, Refer to the respective specification for the valid range value.
Sets the high-level current in the sequence:
Arg12: <NRf>, Refer to the respective specification for the valid range value.
Sets the low-level current in the sequence:
Arg13: <NRf>, Refer to the respective specification for the valid range value.
Sets the high-level power in the sequence:
Arg14: <NRf>, Refer to the respective specification for the valid range value.
Sets the low-level power in the sequence:
Arg15: <NRf>, Refer to the respective specification for the valid range value.
Sets the delay time for Pass/Fail in the sequence:
Arg16: <NRf>, 0s ~ 30s, Resolution = 0.0001s, Unit = Second.

Setting Example: PROG:DATA:STEP ,AUTO,CC,2,3.5,20.0,0.5,0.5,2,-1,-1,-1,-1,-1,-1,1

Query Syntax 1: PROGram:DATA:STEP?<space><Arg1>[<space><MAX | MIN>]
Selects a program:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.

Query Syntax 2: PROGram:DATA:STEP?<space><Arg1>,<Arg2>,<Arg3><space><MAX | MIN>
Selects a program:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Selects a run mode:
Arg2: <NRf>, CC(0), CR(1), CV(2), CP(3), Unit = None.
Selects the mode's range:
Arg3: <NRf>, LOW(0), MIDDLE(1), HIGH(2), Unit = None.

Return Parameter: <aard>

Query Example: PROG:DATA:STEP? 1
PROG:DATA:STEP? 1 MAX
PROG:DATA:STEP? 1 MIN
PROG:DATA:STEP? 1,0,2 MAX
PROG:DATA:STEP? 1,0,2 MIN

Return Example: 1,AUTO,CC,HIGH,3.5,20.0,0.5,0.5,2,-1,-1,-1,-1,-1,-1,1

PROGram:NSELect

Type: Channel-Specific

Description: Selects the program number to be executed.

Setting Syntax: PROGram:NSELect<space><NRf+>

Setting Parameter: <NR1>, 1 ~ 10, Resolution = 1, Unit = None
Setting Example: PROG:NSEL 10
PROG:NSEL MAX
PROG:NSEL MIN
Query Syntax: PROGram:NSELect?[<space><MAX | MIN>]
Return Parameter: <NR1>
Query Example: PROG:NSEL?
PROG:NSEL? MAX
PROG:NSEL? MIN

PROGram:SAVe

Type: Channel-Specific
Description: Saves the program settings.
Syntax: PROGram:SAVe
Parameters: NONE
Example: PROG:SAV

PROGram:STATe?

Type: Channel-Specific
Description: Returns information on the state of the currently running program.
Setting Syntax: None
Setting Parameter: None
Query Syntax: PROGram:STATe?
Return Parameter: <aard>, x1,x2,x3,x4 which
x1 : program number.
x2 : sequence number.
x3 : load mode, 0:CCL, 1:CCM, 2:CCH, 3:CRL, 4:CRM, 4:CRH, 5:CVL, 6:CVM, 7:CVH, 8:CPL, 9:CPM, 10:CPH
x4 : execution state, 0:Idle, 1:running, 2:Wait manual trigger, 3:Wait external trigger
Query Example: PROG:STAT?
Return Example: 1,2,1,1

PROGram:SEQuence:CLEar

Type: Channel-Specific
Description: Clears all sequences in the specified program file.
Setting Syntax: PROGram:SEQuence:CLEar<space><NR1>
Setting Parameter: <NR1>, 1 ~ 10, Resolution = 1, Unit = None
Setting Example: PROG:SEQ:CLE 3
Query Syntax: None
Return Parameter: None
Query Example: None

PROGram:SEQuence:FAIL?

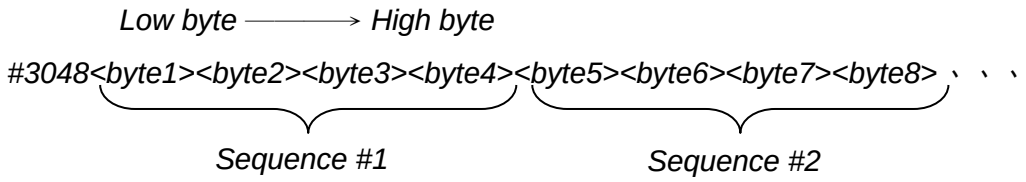
Type: Channel-Specific
Description: Returns the program number and sequence number of failed tests.
Setting Syntax: None
Setting Parameter: None
Query Syntax: PROGram:SEQuency:FAIL?
Return Parameter: <aard>, xx-xxx,xx-xxx,xx-xxx…etc., where the number before the "-" is the program number and the number after the "-" is the sequence number.
Query Example: PROG:SEQ:FAIL?
Return Example: 1-2,5-13,10-8

PROGram:SEQuence:REMain

Type: Channel-Specific
Description: Returns the number of remaining sequences.
Setting Syntax: None
Setting Parameter: None
Query Syntax: PROGram:SEQuency:REMain?
Return Parameter: <NR1>
Query Example: PROG:SEQ:REM?

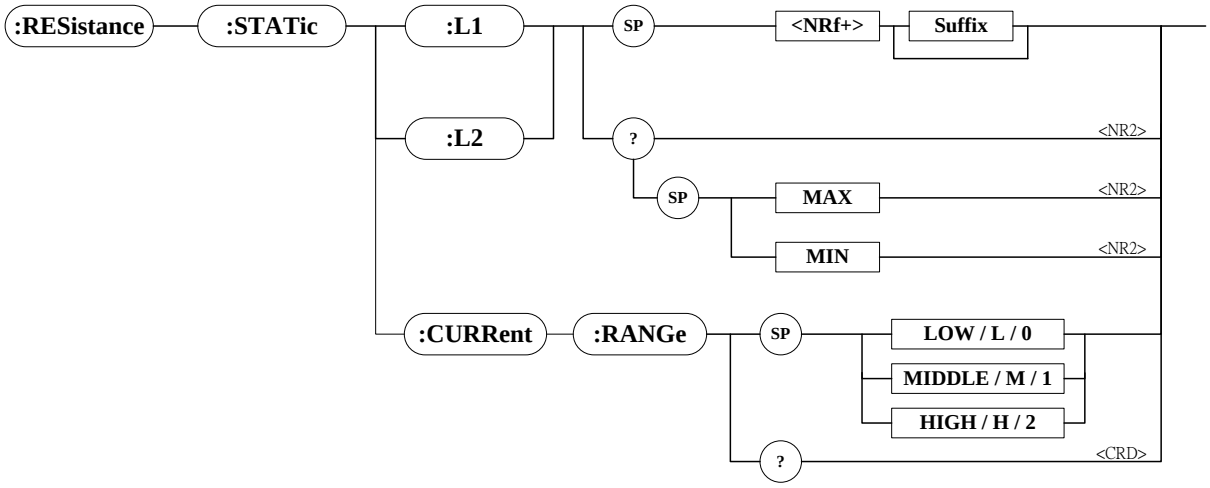
PROGram:SEQuence:SPECification?

Type: Channel-Specific
Description: This query returns the specifications of the program sequence in binary format. The specification, either voltage, current, or power, consists of the total sequences in the program file that the user specified, in 32 bit floating point format.
Setting Syntax: None
Setting Parameter: None
Query Syntax: PROGram:SEQuency:SPECification?<space><Arg1>,<Arg2>
Selects the program number:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Selects the measurement parameter:
Arg2: <NRf>, V(0), I(1), P(2), Unit = None.
Return Parameter: <DLABRD>, for example: if there are 2 sequences in program 1, the returned data will be in the format shown below:



Query Example: PROG:SEQ:SPEC? 1,V
Return Example: None

5.3.2.14 RESISTANCE Subsystem



RESistance:STATic:L1

Type: Channel-Specific
Description: Sets the static resistance level in the constant resistance mode.
Setting Syntax: RESistance:STATic:L1<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example:
- RES:STAT:L1 20 — Set constant resistance = 20Ω for Load L1.
- RES:STAT:L1 10 OHM — Set constant resistance = 10Ω for Load L1.
- RES:STAT:L1 MAX — Set constant resistance = maximum value for Load L1.
- RES:STAT:L1 MIN — Set constant resistance = minimum value for Load L1.

Query Syntax: RESistance:STATic:L1?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = OHM]
Query Example:
- RES:STAT:L1?
- RES:STAT:L1? MAX
- RES:STAT:L1? MIN

RESistance:STATic:L2

Type: Channel-Specific
Description: Sets the static resistance level in the constant resistance mode.
Setting Syntax: RESistance:STATic:L2<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example:
- RES:STAT:L2 20 — Set constant resistance = 20Ω for Load L2.
- RES:STAT:L2 10 OHM — Set constant resistance = 10Ω for Load L2.
- RES:STAT:L2 MAX — Set constant resistance = maximum value for Load L2.
- RES:STAT:L2 MIN — Set constant resistance = minimum value for Load L2.

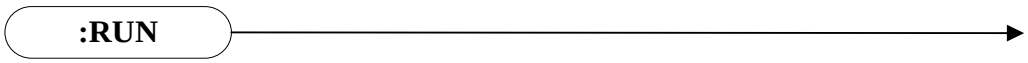
Query Syntax: RESistance:STATic:L2?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = OHM]
Query Example:
- RES:STAT:L2?
- RES:STAT:L2? MAX

RES:STAT:L2? MIN

RESistance:STATic:CURRent:RANGe

Type:	Channel-Specific	
Description:	Sets the current loading and measurement range in the constant resistance mode.	
Setting Syntax:	RESistance:STATic:CURRent:RANGe<space><CRD | NR1>	
Setting Parameter:	<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2	
Setting Example:	RES:STAT:CURR:RANG HIGH	Set current range to High.
	RES:STAT:CURR:RANG M	Set current range to Middle.
	RES:STAT:CURR:RANG 0	Set current range to Low.
Query Syntax:	RES:STAT:CURR:RANGe?	
Return Parameter:	<CRD>, LOW, MIDDLE, HIGH	[Unit = None]
Query Example:	RES:STAT:CURR:RANG?	

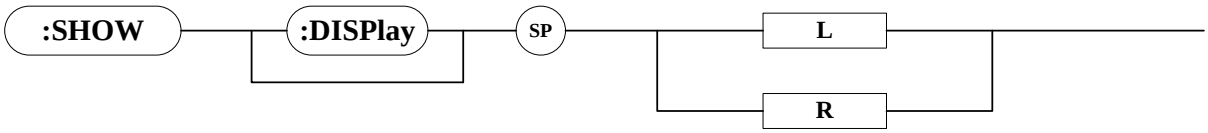
5.3.2.15 RUN Subsystem



RUN

Type:	All Channels
Description:	Sets all electronic loads to “ON”.
Setting Syntax:	RUN

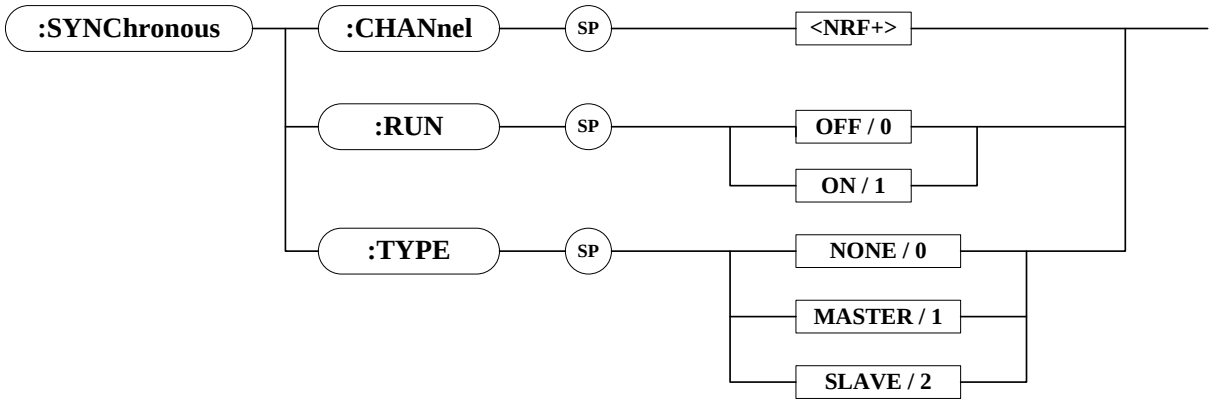
5.3.2.16 SHOW Subsystem



SHOW[:DISPlay]

Type:	Channel-Specific (Dual Channel Module Only)	
Description:	Sets the display mode for the electronic load.	
Setting Syntax:	SHOW:DISPlay<space><CRD>	
Setting Parameter:	<CRD>, L | R	
Example:	SHOW:DISP L	Display the voltage and current values of channel L.
	SHOW:DISP R	Display the voltage and current values of channel R.

5.3.2.17 SYNCHRONOUS Subsystem



SYNChronous:CHANnel

Type: All Channels
Description: Sets the specified channel to T1 & T2 in the sync dynamic mode for parallel loading.
Setting Syntax: SYNChronous:CHANnel<space><NRf+>
Setting Parameter: <NRf+>, 1 ~ 10
Setting Example: SYNC:CHAN 1 Sets the specified channel to "1".
SYNC:CHAN MAX Sets the specified channel to "10".
SYNC:CHAN MIN Sets the specified channel to "1".

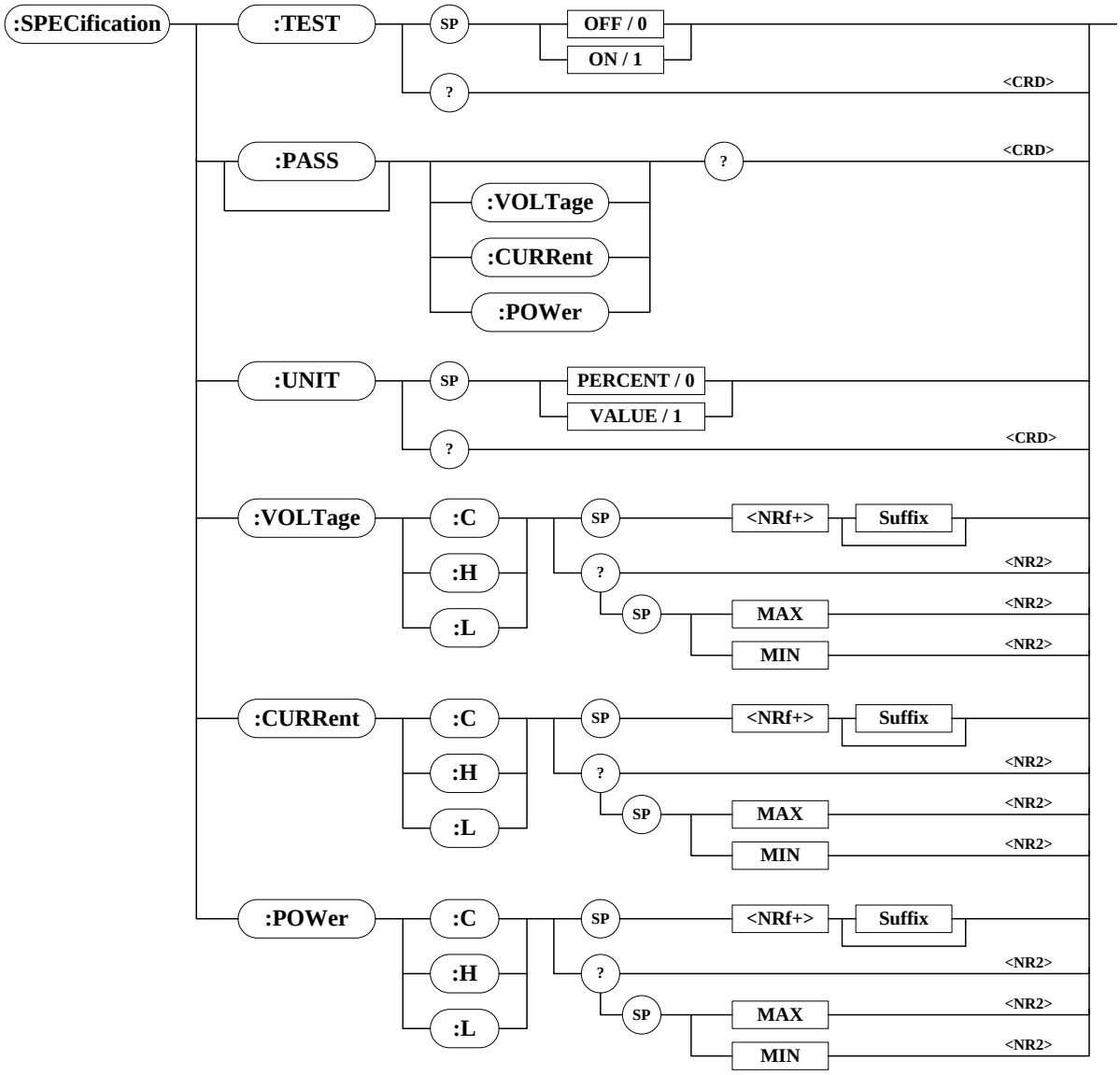
SYNChronous:RUN

Type: All Channels
Description: Sets all electronic loads to “ON” in the sync. parallel run.
Setting Syntax: SYNChronous:RUN<space><NRf>
Setting Parameter: <NRf>, OFF(0), ON(1)
Setting Example: SYNC: RUN ON Sets the load to “ON” on sync. parallel.
SYNC: RUN OFF Sets the load to “OFF” on sync. parallel.

SYNChronous:TYPE

Type: All Channels
Description: Sets the specified mainframe to master or slave for sync. in parallel run.
Setting Syntax: SYNChronous:TYPE<space><NRf>
Setting Parameter: <NRf>, NONE(0), MASTER(1), SLAVE(2)
Setting Example: SYNC:TYPE MASTER Sets the mainframe to master for sync. in parallel run.
SYNC:TYPE SLAVE Sets the mainframe to slave for sync. in parallel run.
SYNC:TYPE NONE Disables the mainframe to sync.

5.3.2.18 SPECIFICATION Subsystem



SPECification[:PASS]?

Type: All Channels
Description: Requests GO-NG results from all channels.
Query Syntax: SPECification?
Query Example: SPEC? Return all channels GO-NG results.
Return Parameter: <CRD>, IDLE, GO, NG

SPECification[:PASS]:CURRent?

Type: Channel-Specific
Description: Requests the GO-NG result of the current test.
Query Syntax: SPECification[:PASS]:CURRent?
Query Example: SPEC:CURR?
Return Parameter: <CRD>, IDLE, GO, NG

SPECification[:PASS]:POWer?

Type: Channel-Specific
Description: Requests the GO-NG result of the power test.
Query Syntax: SPECification[:PASS]:POWer?
Query Example: SPEC:POW?
Return Parameter: <CRD>, IDLE, GO, NG

SPECification[:PASS]:VOLTage?

Type: Channel-Specific
Description: Requests the GO-NG result of the voltage test.
Query Syntax: SPECification[:PASS]:VOLTage?
Query Example: SPEC:VOLT?
Return Parameter: <CRD>, IDLE, GO, NG

SPECification:CURRent:C

Type: Channel-Specific
Description: Sets the center-level current value. -1 means 'ignore'.
Setting Syntax: SPECification:CURRent:C<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: SPEC:CURR:C 10
SPEC:CURR:C 10mA
Query Syntax: SPECification:CURRent:C?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: SPEC:CURR:C?
SPEC:CURR:C? MAX
SPEC:CURR:C? MIN

SPECification:CURRent:H

Type: Channel-Specific
Description: Sets the high-level current value. -1 means 'ignore'.
Setting Syntax: SPECification:CURRent:H<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: SPEC:CURR:H 10
SPEC:CURR:H 10mA
Query Syntax: SPECification:CURRent:H?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: SPEC:CURR:H?
SPEC:CURR:H? MAX
SPEC:CURR:H? MIN

SPECification:CURRent:L

Type: Channel-Specific
Description: Sets the low-level current value. -1 means 'ignore'.
Setting Syntax: SPECification:CURRent:L<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: SPEC:CURR:L 10
SPEC:CURR:L 10mA
Query Syntax: SPECification:CURRent:H?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: SPEC:CURR:L?
SPEC:CURR:L? MAX
SPEC:CURR:L? MIN

SPECification:POWer:C

Type:	Channel-Specific
Description:	Sets the center-level power value. -1 means ‘ignore’.
Setting Syntax:	SPECification:POWer:C<space><NRf+>[suffix]
Setting Parameter:	Refer to the respective specification for the valid range value.
Setting Example:	SPEC:POW:C 10
	SPEC:POW:C 10mW
Query Syntax:	SPECification:POWer:C?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Watt]
Query Example:	SPEC:POW:C?
	SPEC:POW:C? MAX
	SPEC:POW:C? MIN

SPECification:POWer:H

Type:	Channel-Specific
Description:	Sets the high-level power value. -1 means ‘ignore’.
Setting Syntax:	SPECification:POWer:H<space><NRf+>[suffix]
Setting Parameter:	Refer to the respective specification for the valid range value.
Setting Example:	SPEC:POW:H 10
	SPEC:CURR:H 10mW
Query Syntax:	SPECification:POWer:H?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Watt]
Query Example:	SPEC:POW:H?
	SPEC:POW:H? MAX
	SPEC:POW:H? MIN

SPECification:POWer:L

Type:	Channel-Specific
Description:	Sets the low-level power value. -1 means ‘ignore’.
Setting Syntax:	SPECification:POWer:L<space><NRf+>[suffix]
Setting Parameter:	Refer to the respective specification for the valid range value.
Setting Example:	SPEC:POW:L 10
	SPEC:POW:L 10mW
Query Syntax:	SPECification:POWer:H?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Watt]
Query Example:	SPEC:POW:L?
	SPEC:POW:L? MAX
	SPEC:POW:L? MIN

SPECification:TEST

Type:	All Channels
Description:	Starts or stops the all channel specification test.
Setting Syntax:	SPECification:TEST<space><NRf>
Setting Parameter:	<NRf>, OFF(0), ON(1)
Setting Example:	SPEC:TEST ON
	SPEC:TEST 0
Query Syntax:	SPECification:TEST?
Query Example:	SPEC:TEST?
Return Parameter:	<CRD>, OFF, ON

SPECification:UNIT

Type:	Channel-Specific
Description:	Sets the specific entry mode.
Setting Syntax:	SPECification:UNIT<space><NRf>
Setting Parameter:	<NRf>, VALUE(1), PERCENT(0)
Setting Example:	SPEC:UNIT VALUE
	SPEC: UNIT 0
Query Syntax:	SPECification:UNIT?
Return Parameter:	<CRD>, VALUE, PERCENT
Query Example:	SPEC:UNIT?

SPECification:VOLTage:C

Type:	Channel-Specific
Description:	Sets the center-level voltage value. -1 means ‘ignore’.
Setting Syntax:	SPECification:VOLTage:C<space><NRf+>[suffix]
Parameters:	Refer to the respective specification for the valid range value.
Setting Example:	SPEC:VOLT:C 20
	SPEC:VOLT:C 20mV
Query Syntax:	SPECification:VOLTage:C?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Volt]
Query Example:	SPEC:VOLT:C?
	SPEC:VOLT:C? MAX
	SPEC:VOLT:C? MIN

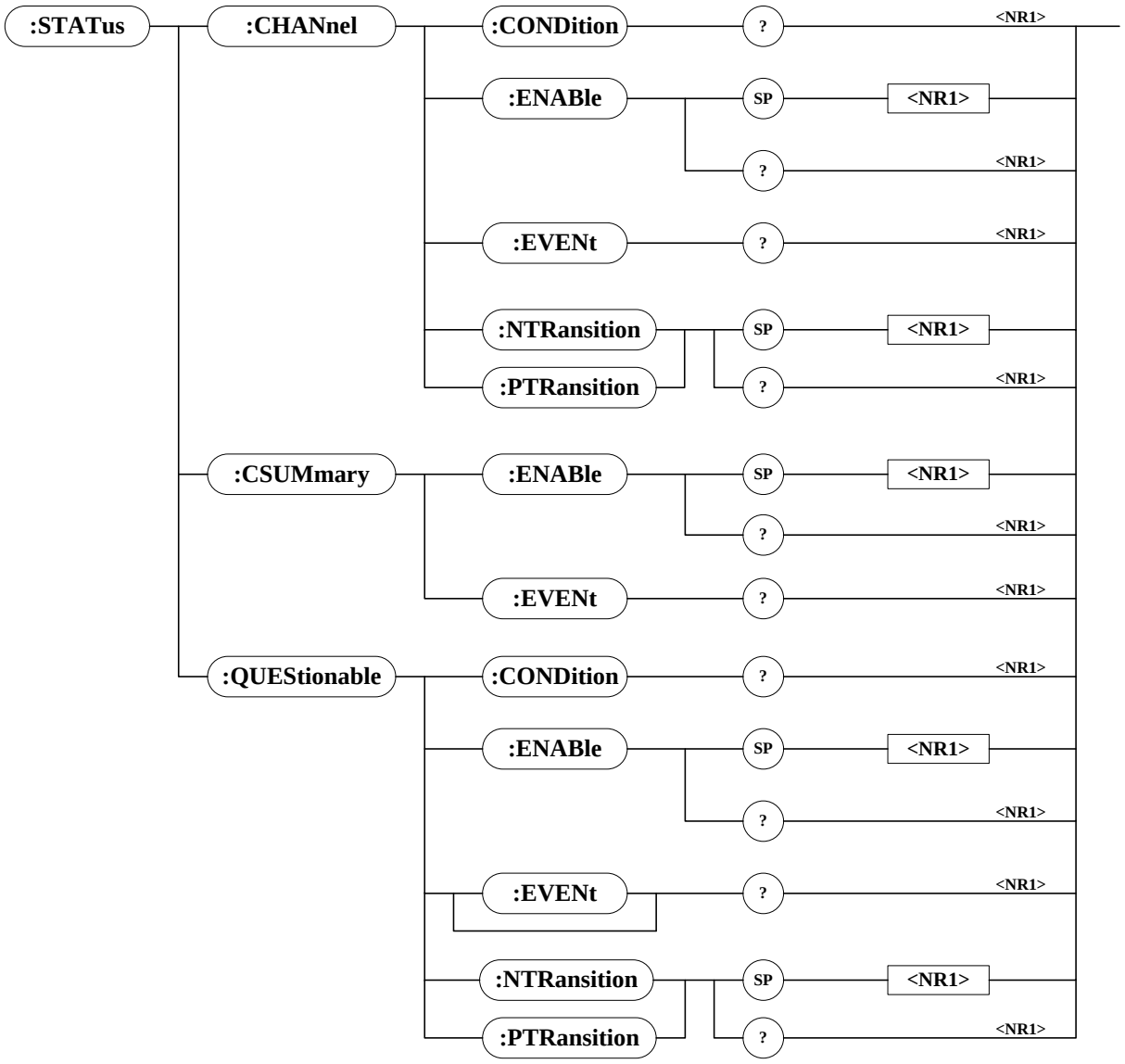
SPECification:VOLTage:H

Type:	Channel-Specific
Description:	Sets the high-level voltage value. -1 means ‘ignore’.
Setting Syntax:	SPECification:VOLTage:H<space><NRf+>[suffix]
Parameters:	Refer to the respective specification for the valid range value.
Setting Example:	SPEC:VOLT:H 20
	SPEC:VOLT:H 20mV
Query Syntax:	SPECification:VOLTage:H?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Volt]
Query Example:	SPEC:VOLT:H?
	SPEC:VOLT:H? MAX
	SPEC:VOLT:H? MIN

SPECification:VOLTage:L

Type:	Channel-Specific
Description:	Sets the low-level voltage value. -1 means ‘ignore’.
Setting Syntax:	SPECification:VOLTage:L<space><NRf+>[suffix]
Parameters:	Refer to the respective specification for the valid range value.
Setting Example:	SPEC:VOLT:L 20
	SPEC:VOLT:L 20mV
Query Syntax:	SPECification:VOLTage:L?[<space><MAX | MIN>]
Return Parameter:	<NR2>, [Unit = Volt]
Query Example:	SPEC:VOLT:L?
	SPEC:VOLT:L? MAX
	SPEC:VOLT:L? MIN

5.3.2.19 STATUS Subsystem



STATus:CHANnel:CONDition?

Type: Channel-Specific
Description: Returns the real time channel status.
Query Syntax: STATus:CHANnel:CONDition?
Return Parameter: <NR1>

Bit Configuration of Channel Status Register

Bit Position	15~9	8	7	6	5	4	3	2	1	0
Condition		REMOTE INHIBIT	FAN	MAX LIM	SYNC	REV	OPP	OCP	OVP	OTP
Bit Weight		256	128	64	32	16	8	4	2	1

Query Example: STAT:CHAN:COND? Return the status of the electronic load.
Return Example: 2048

STATus:CHANnel:ENABle

Type: Channel-Specific
Description: Mask to select which bit in the Event register is allowed to be summed into the corresponding channel bit for the Channel Summary Event register.
Setting Syntax: STATus:CHANnel:ENABle<space><NR1>
Setting Parameter: <NR1>, 0 ~ 65535, Unit = None
Setting Example: STAT:CHAN:ENABl 24
Query Syntax: STATus:CHANnel:ENABle?
Return Parameter: <NR1>
Query Example: STAT:CHAN:ENAB? Return the contents of the Status Channel Enable register.
Return Example: 24

STATus:CHANnel:EVENt?

Type: Channel-Specific
Description: Record all channel events that have occurred since last time the register was read, and reset the Channel Event register.
Query Syntax: STATus:CHANnel:EVENt?
Return Parameter: <NR1>
Query Example: STAT:CHAN:EVEN? Read and reset the Channel Event register.
Return Example: 24

STATus:CHANnel:PTRansition

Type: Channel-Specific
Description: Programmable filters that determine 0-to-1 transition in the Condition register will set the corresponding bit of the Event register.
Setting Syntax: STATus:CHANnel:PTRansition<space><NR1>
Setting Parameter: <NR1>, 0 ~ 65535, Unit = None
Setting Example: STAT:CHAN:PTR 4 Set over current bit 2 from 0-to-1.
Query Syntax: STATus:CHANnel:PTRansition?
Return Parameter: <NR1>
Query Example: STAT:CHAN:PTR?
Return Example: 4

STATus:CHANnel:NTRansition

Type: Channel-Specific
Description: Programmable filters that determine 1-to-0 transition in the Condition register will set the corresponding bit of the Event register.
Setting Syntax: STATus:CHANnel:NTRansition<space><NR1>
Setting Parameter: <NR1>, 0 ~ 65535, Unit = None
Setting Example: STAT:CHAN:NTR 4 Set over current bit 2 from 1-to-0.
Query Syntax: STATus:CHANnel:NTRansition?
Return Parameter: <NR1>
Query Example: STAT:CHAN:NTR?
Return Example: 4

STATus:CSUMmary:ENABle

Type: Channel-Specific
Description: Mask to select which bit in the Channel Event register is allowed to be summed into the CSUM (Channel Summary) bit for the Status Byte register.
Setting Syntax: STATus:CSUMmary:ENABle<space><NR1>

Setting Parameter: <NR1>, 0 ~ 1023, Unit = None

Bit Configuration of Channel Summary Register

Bit Position	9	8	7	6	5	4	3	2	1	0
Channel	10	9	8	7	6	5	4	3	2	1
Bit Weight	512	256	128	64	32	16	8	4	2	1

Setting Example: STAT:CSUM:ENAB 3
Query Syntax: STATus:CSUMmary:ENABle?
Return Parameter: <NR1>
Query Example: STAT:CSUM:ENAB? Return the setting of Channel Summary Enable register.
Return Example: 3

STATus:CSUMmary:EVENt?

Type: Channel-Specific
Description: Indicates all channels for which an enabled STAT:CHAN Event has occurred since the last time the register was read.
Query Syntax: STATus:CSUMmary:EVENt?
Return Parameter: <NR1>
Query Example: STAT:CSUM:EVEN? Return the value of the Channel Summary Event register.
Return Example: 3

STATus:QUEStionable:CONDition?

Type: Channel-Specific
Description: Real-time ("live") recording of Questionable data.
Query Syntax: STATus:QUEStionable:CONDition?
Return Parameter: <NR1>
Query Example: STAT:QUES:COND? Return the channel status.
Return Example: 6

STATus:QUEStionable:ENABle

Type: Channel-Specific
Description: Mask to select which bit on the Event register is allowed to be summed into the QUES bit for the Status Byte register.
Setting Syntax: STATus:QUEStionable:ENABle<space><NR1>
Setting Parameter:

Bit Configuration of Questionable Status Register

Bit Position	15~9	8	7	6	5	4	3	2	1	0
Condition		**REMOTE INHIBIT**	**FAN**	**MAX LIM**	**SYNC**	**REV**	**OPP**	**OCP**	**OVP**	**OTP**
Bit Weight		256	128	64	32	16	8	4	2	1

Setting Example: STAT:QUES:ENAB 24
Query Syntax: STATus:QUEStionable:ENABle?
Return Parameter: <NR1>, 0 ~ 65535, Unit = None
Query Example: STAT:QUES:ENAB Return the setting of the Status Questionable Enable register.
Return Example: 24

STATus:QUEStionable:EVENt?

Type:	Channel-Specific	
Description:	Records all Questionable conditions that have occurred since the last time the register was read.	
Query Syntax:	STATus:QUEStionable:EVENt?	
Return Parameter:	<NR1>	
Query Example:	STAT:QUES:EVEN?	Return the contents of the Questionable Event register.
Return Example:	24	

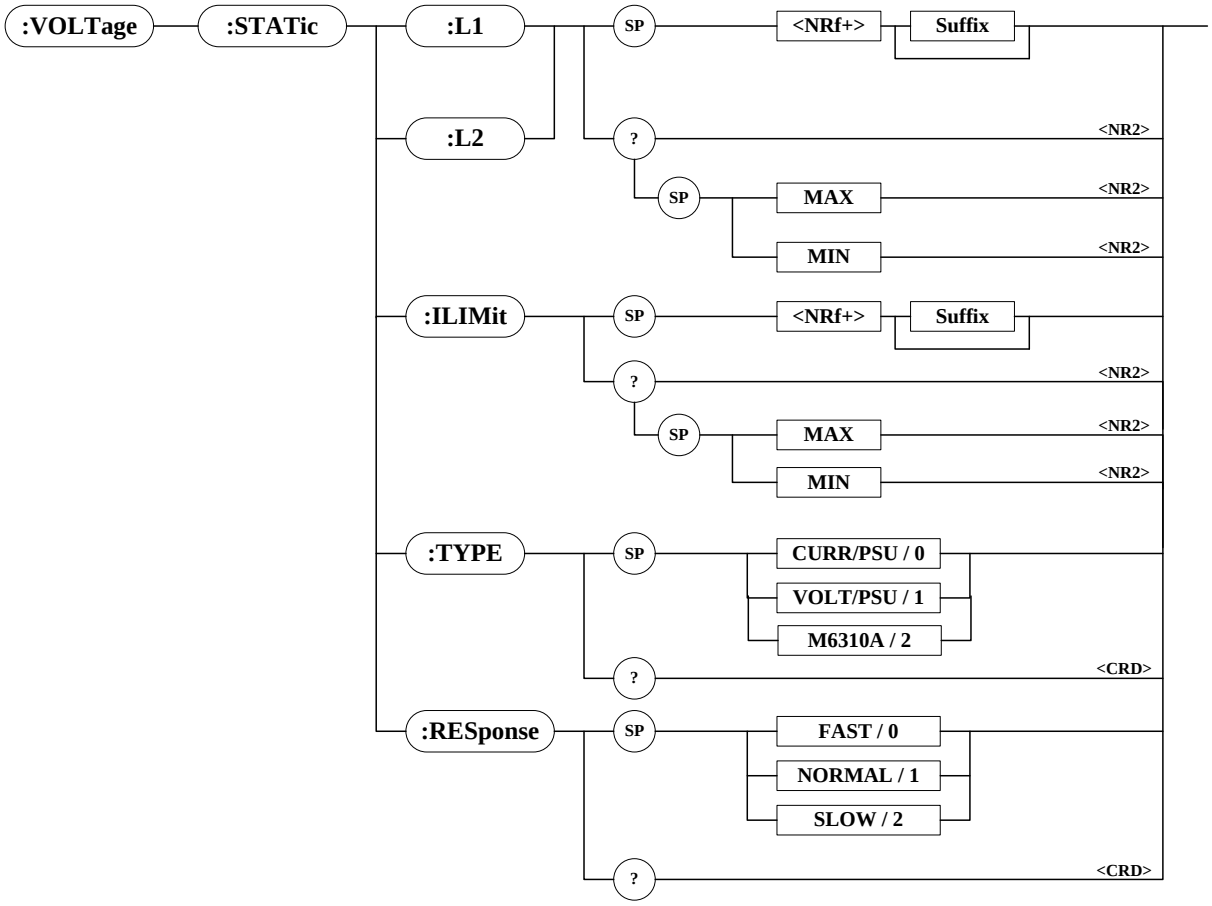
STATus:QUEStionable:PTRansition

Type:	Channel-Specific	
Description:	Programmable filters determine the 0-to-1 transition in the Condition register and set the corresponding bit of the Event register.	
Setting Syntax:	STATus:QUEStionable:PTRansition<space><NR1>	
Setting Parameter:	<NR1>, 0 ~ 65535, Unit = None	
Setting Example:	STAT:QUES:PTR 4	Set over current bit 2 as 0-to-1.
Query Syntax:	STATus:QUEStionable:PTRansition?	
Return Parameter:	<NR1>	
Query Example:	STAT:QUES:PTR?	
Return Example:	4	

STATus:QUEStionable:NTRansition

Type:	Channel-Specific	
Description:	Programmable filters determine the 1-to-0 transition in the Condition register and set the corresponding bit of the Event register.	
Setting Syntax:	STATus:QUEStionable:NTRansition<space><NR1>	
Setting Parameter:	<NR1>, 0 ~ 65535, Unit = None	
Setting Example:	STAT:QUES:NTR 4	Set over current bit 2 as 1-to-0.
Query Syntax:	STATus:QUEStionable:PTRansition?	
Return Parameter:	<NR1>	
Query Example:	STAT:QUES:NTR?	
Return Example:	4	

5.3.2.20 VOLTAGE Subsystem



VOLTage:STAT:ILIMit

Type: Channel-Specific
Description: Sets the current limit in the constant voltage mode.
Setting Syntax: VOLTage:STATic:ILIMit<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example:

VOLT:STAT:ILIM 3	Set the current limit to 3A in constant voltage mode.
VOLT:STAT:ILIM MAX	Set the current limit to the maximum value in constant voltage mode.
VOLT:STAT:ILIM MIN	Set the current limit to the minimum value in constant voltage mode.

Query Syntax: VOLTage:STATic:ILIMit?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Ampere]
Query Example: VOLT:STAT:ILIM?
VOLT:STAT:ILIM? MAX
VOLT:STAT:ILIM? MIN

VOLTage:STATic:L1

Type: Channel-Specific
Description: Sets the static load voltage in the constant voltage mode.
Setting Syntax: VOLTage:STATic:L1<space><NRf+>[suffix]

Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: VOLT:STAT:L1 8 Set voltage of load L1 as 8V.
VOLT:STAT:L1 24V Set voltage of load L1 as 24V.
VOLT:STAT:L1 MAX Set voltage of load L1 as the maximum value.
VOLT:STAT:L1 MIN Set voltage of load L1 as the minimum value.
Query Syntax: VOLTage:STATic:L1?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Volt]
Query Example: VOLT:STAT:L1?
VOLT:STAT:L1? MAX
VOLT:STAT:L1? MIN

VOLTage:STATic:L2

Type: Channel-Specific
Description: Sets the static load voltage in the constant voltage mode.
Setting Syntax: VOLTage:STATic:L2<space><NRf+>[suffix]
Setting Parameter: Refer to the respective specification for the valid range value.
Setting Example: VOLT:STAT:L2 8 Set voltage of load L2 as 8V.
VOLT:STAT:L2 24V Set voltage of load L2 as 24V.
VOLT:STAT:L2 MAX Set voltage of load L2 as the maximum value.
VOLT:STAT:L2 MIN Set voltage of load L2 as the minimum value.
Query Syntax: VOLTage:STATic:L2?[<space><MAX | MIN>]
Return Parameter: <NR2>, [Unit = Volt]
Query Example: VOLT:STAT:L2?
VOLT:STAT:L2? MAX
VOLT:STAT:L2? MIN

VOLTage:STATic:TYPE

Type: Channel-Specific
Description: Sets the execution type in the constant voltage mode.
Setting Syntax: VOLTage:STATic:TYPE<space><NRf>
Setting Parameter: <NRf>, CURR/PSU(0), VOLT/PSU(1), M6310A(2)
Example: VOLT:STAT:TYPE CURR/PSU
VOLT:STAT:TYPE 1
Query Syntax: VOLTage:STATic:TYPE?
Return Parameter: <CRD>, CURR/PSU, VOLT/PSU, M6310A
Query Example: VOLT:STAT:TYPE?

VOLTage:STATic:RESponse

Type: Channel-Specific
Description: Sets the response speed in the constant voltage mode.
Setting Syntax: VOLTage:STATic:RESponose<space><NRf>
Setting Parameter: <NRf>, FAST(0), NORMAL(1), SLOW(2)
Example: VOLT:STAT:RES FAST
VOLT:STAT:RES SLOW
Query Syntax: VOLTage:STATic:RESponse?
Return Parameter: <CRD>, FAST, NORMAL, SLOW
Query Example: VOLT:STAT:RES?

5.3.2.21 SYSTEM Subsystem

SYSTem:ERRor?

Type: All Channels
Description: Queries the error string of the command parser.
Setting Syntax: None
Setting Parameter: None
Query Syntax: SYSTem:ERRor?.
Return Parameter: <ACCRD>, 0,"No Error",
1,Data Format Error",
2,Data Range Error",
3,Command Error",
4,Execution Error",
5,Too Many Errors"
Query Example: SYST:ERR?

SYSTem:REMote

Type: All Channels
Description: This command can only be used when the load is controlled by the USB or Ethernet interface. If SYST:REM is programmed, the 63600 will be set in the REMOTE state, and the front panel of the frame will be disabled except for the <LOCAL>key.
Setting Syntax: SYSTem:REMote
Setting Parameter: None
Setting Example: SYST:REM

SYSTem:LOCal

Type: All Channels
Description: This command can only be used when the load is controlled by the USB or Ethernet interface. If SYST:LOC is programmed, the 63600 will be set in the LOCAL state, and the front panel will work.
Setting Syntax: SYSTem:LOCal
Setting Parameter: None
Setting Example: SYST:LOC

M

Type: All Channels
Description: Sets the load mode in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: M<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR1>, 0: do not change, 1: CCL, 2: CCM, 3: CCH, 4: CRL, 5: CRM, 6: CRH, 7: CVL, 8: CVM, 9: CVH, 10: CPL, 11: CPM, 12: CPH, 13: CZL, 14: CZM, 15: CZH, 16: CCDL, 17: CCDM, 18: CCDH, 19: CCFSL, 20: CCFSM, 21: CCFSH, 22: TIML, 23: TIMM, 24: TIMH, 25: SWDL, 26: SWDM, 27: SWDH, 28: OCPL, 29: OCPM, 30: OCPH, 31: PROG, 34: MPPTL, 35: MPPTM, 36: MPPTH, 37: UDWL, 38: UDWM, 39: UDWH
Example: M “1,1,2,2,2,2,5,5,0,0”
M ”2,2,2,2,2,2”

AC

Type: All Channels
Description: Sets the CC mode current level 1(L1) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.

Setting Syntax: AC<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Ampere]
Example: AC “1.0,1,2.5,5.0,10.5,4.5,2.0,2.0,0,0”

AR

Type: All Channels
Description: Sets the CR mode resistance level 1(L1) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: AR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=OHM]
Example: AR “1.0,0.1,0.2,0.5,0.15,0.4,0.2,0.2,0,0”

AV

Type: All Channels
Description: Sets the CV mode voltage level 1(L1) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: AV<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Volt]
Example: AV “5.0,5.5,3.3,5.1,12.0,5.5,5.0,5.2,0,0”

AP

Type: All Channels
Description: Sets the CP mode power level 1(L1) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: AP<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Watt]
Example: AP “50.0,100.0,30,5.1,12.0,5.5,5.0,5.2,0,0”

CCR

Type: All Channels
Description: Sets the CC mode rising slew rate in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CCR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/μs]
Example: CCR “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

CCF

Type: All Channels
Description: Sets the CC mode falling slew rate in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CCF<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/μs]
Example: CCF “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

CPR

Type: All Channels
Description: Sets the CP mode rising slew rate in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CPR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/μs]
Example: CPR “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

CPF

Type: All Channels

Description: Sets the CP mode falling slew rate in the ten channels in one frame. The frame will ignore the setting when the channel does not exist.
Setting Syntax: CPF<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/μs]
Example: CPF “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

LAT

Type: All Channels
Description: Sets the Von action type in the ten channels in one frame. The frame will ignore the setting when the channel does not exist.
Setting Syntax: LAT<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR1>, 0: OFF, 1: ON
Example: LAT “0,1,1,1,0,1,0,1,0,0”

GO

Type: All Channels
Description: Starts/stops the current sinking in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: GO<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR1>, 0: OFF, 1: ON, Other Value: no action
Example: GO “0,1,1,1,0,1,0,1,0,0”

VRB

Type: All Channels
Description: Sets the CC mode voltage range in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: VRB<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR1>, 0: LOW range, 1: MIDDLE range, 2: HIGH range, Other Value: no action
Example: VRB “0,1,1,1,0,1,0,2,0,0”

VR

Type: All Channels
Description: Sets the CC mode voltage range in the ten channels in one frame. The frame will ignore the setting when the channel does not exist. The setting value unit is the volt. (Refer to the measurement section in the Specification table.)
Setting Syntax: VR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Volt]
Example: VR “1,1,2,16,80,10,80,16,0,0”

VON

Type: All Channels
Description: Sets Von voltage in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: VON<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Volt]
Example: VON “1.23,1.23,0,0,5,5,12,12,0,0”

CCSR

Type: All Channels
Description: Sets the CC mode rising and falling slew rates in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.

Setting Syntax: CCSR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/μs]
Example: CCSR “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

CPSR

Type: All Channels
Description: Sets the CP mode rising and the falling slew rates in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CPSR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/μs]
Example: CRSR “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

CDL1

Type: All Channels
Description: Sets the CCDL/CCDM/CCDH mode current level 1(L1) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CDL1<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Ampere]
Example: CDL1 “1.0,1,2.5,5.0,10.5,4.5,2.0,2.0,0,0”

CDL2

Type: All Channels
Description: Sets the CCDL/CCDM/CCDH mode current level 2(L2) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CDL2<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Ampere]
Example: CDL2 “1.0,1,2.5,5.0,10.5,4.5,2.0,2.0,0,0”

CDT1

Type: All Channels
Description: Sets the CCDL/CCDM/CCDH mode active time T1 for the current level 1(L1) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CDT1<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Second]
Example: CDT1 “1.0,1,2.5,5.0,10.5,4.5,2.0,2.0,0,0”

CDT2

Type: All Channels
Description: Sets the CCDL/CCDM/CCDH mode active time T2 for the current level 2(L2) in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CDT2<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=Second]
Example: CDT2 “1.0,1,2.5,5.0,10.5,4.5,2.0,2.0,0,0”

CDR

Type: All Channels
Description: Sets the CCDL/CCDM/CCDH mode rising slew rate in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.

Setting Syntax: CDR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/μs]
Example: CDR “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

CDF

Type: All Channels
Description: Sets the CCDL/CCDM/CCDH mode falling slew rate in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CDF<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2>, [Unit=A/us]
Example: CDF “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

CDRT

Type: All Channels
Description: Sets the CCDL/CCDM/CCDH mode repeat count in the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: CDRT<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR1>, 0 ~ 65535
Example: CDRT “1,2,2,10,2,5,5,5,0,0”

L

Type: All Channels
Description: Sets the load level according to the mode setting for the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: L<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR2> [Unit=Ampere(CCL/CCM/CCH)]
[Unit=OHM(CRL/CRM/CRH)]
[Unit=Volt(CVL/CVM/CVH)]
[Unit=Watt(CPL/CPM/CPH)]
Example: L “1.0,2.5,2.5,10,2.0,5.0,5.0,5.0,0,0”

SRA

Type: All Channels
Description: Resets the Von control signal to the initial state for the ten channels in one frame. The frame will ignore the setting if the channel does not exist.
Setting Syntax: SRA<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameter: <NR1>, 1: RESET, Other Value: no action
Example: SRA “0,0,1,1,1,1,1,0,0,0”

5.3.2.22 COMMUNICATE Subsystem

COMMunicate:ADDRess:SBUS

Type: Chassis-specific
Description: It sets the System Bus address.
Setting Syntax: COMMunicate:ADDRess:SBUS<space><NR1>
Setting Parameter: <NR1>, 1 ~ 4, Unit = None
Setting Example: COMM:ADDR:SBUS 3 Set System Bus address to 3.
COMM:ADDR:SBUS 4 Set System Bus address to 4.

Query Syntax: COMMunicate:ADDRess:SBUS?[<space><MAX | MIN>]
Return Parameter: <NR1>, 1 ~ 4, [Unit = None]
Query Example: COMM:ADDR:SBUS?
COMM:ADDR:SBUS? MAX
COMM:ADDR:SBUS? MIN

COMMunicate:TERMinator:SBUS

Type: 特定機框
Description: It sets the System Bus terminator's state.
Setting Syntax: COMMunicate:TERMinator:SBUS<space><CRD | NR1>
Setting Parameter: <CRD | NR1>, OFF | 0, ON | 1, Unit = None
Setting Example: COMM:TERM:SBUS 0 Set System Bus terminator to OFF.
COMM:TERM:SBUS ON Set System Bus terminator to ON.
Query Syntax: COMMunicate:TERMinator:SBUS?
Return Parameter: <CRD>, OFF, ON, [Unit = None]
Query Example: COMM:TERM:SBUS?

6. Status Reporting

6.1 Introduction

This chapter describes the status data structure of the Chroma 63600 Series Electronic Load as shown in Figure 6-1 (on the next page). The standard registers, such as the Event Status register group, the Output Queue, the Status Byte, and the Service Request Enable registers, perform the standard GPIB functions and are defined in IEEE-488.2 Standard Digital Interface for Programmable Instrumentation. Other status register groups implement the specific status reporting requirements for the electronic load. The Channel Status and Channel Summary groups are used by multiple channel electronic loads to enable the status information that will be kept in its own Status register for each channel.

6.2 Register Information in Common

■ ***Condition register***

The condition register represents the present status of electronic load signals. Reading the condition register does not change the state of its bits. Only changes in electronic load conditions affect the contents of this register.

■ ***PTR/NTR Filter, Event register***

The Event register captures changes in conditions corresponding to condition bits in a condition register, or to a specific condition in the electronic load. An event becomes true when the associated condition makes one of the following electronic load-defined transitions:

Positive TRansition (0 - to - 1)
Negative TRansition (1 - to - 0)
Positive or Negative TRansition (0-to-1 or 1-to-0)

The PTR/NTR filters determine what type of condition transitions set the bits in the Event register. Channel Status, Questionable Status allow transitions to be programmed. Other register groups, i.e. Channel Summary, Standard Event Status register group use an implied Rise (0-to-1) condition transition to set bits in the Event register. Reading an Event register clears it (all bits set to zero).

■ ***Enable register***

The Enable register can be programmed to enable the bit that the corresponding Event register is logically ORed with into the Channel Summary.

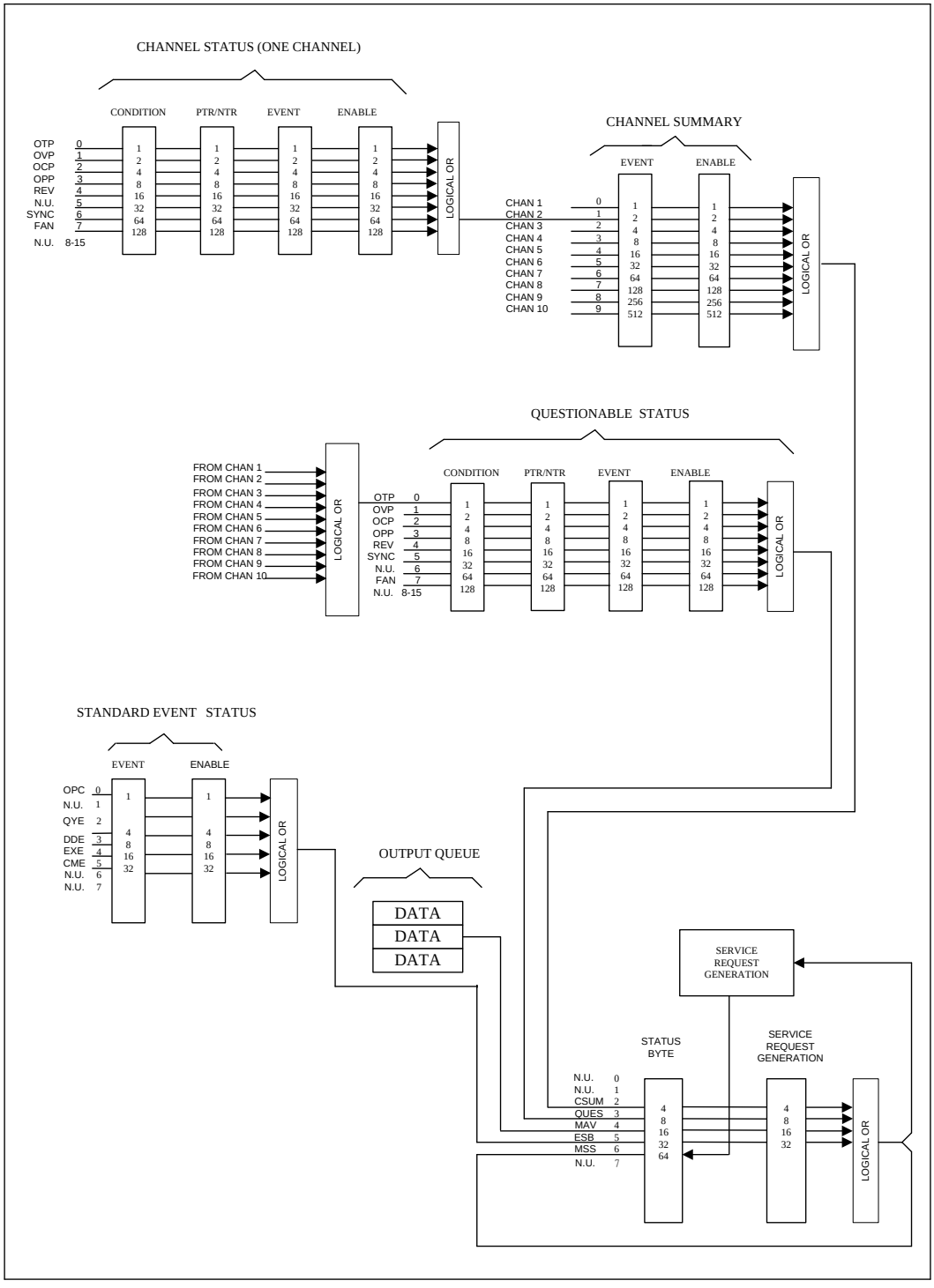


Figure 6-1 Status Registers of Electronic Load

6.2.1 Channel Status

- The Channel Status register informs you of one or more channel status conditions, which indicate certain errors or faults have occurred on a specific channel. Table 6-1 explains the channel status conditions that are applied to the electronic load.
- When the bits of the Channel Status Condition register are set, the corresponding condition is true.
- Program the PTR/NTR filter to select the kind of condition transition in the Channel Status Condition register that will be set in the Event registers.
- Reading the Channel Status Event register resets itself to zero.
- The Channel Status Enable register can be programmed to specify the channel status event bit that is logically ORed to become the corresponding channel bit in Channel Summary Event register.

Table 6-1 Bit Description of Channel Status

Mnemonic	Bit	Value	Meaning
OTP	0	1	*Over temperature*. When an over temperature condition has occurred on a channel, Bit 0 is set and the channel is turned off. It remains set until the channel has cooled down below the over temperature trip point and LOAD:PROT:CLE is programmed.
OVP	1	2	*Over voltage*. When an over voltage condition has occurred on a channel, Bit 1 is set and remains set until the over voltage condition is removed and LOAD:PROT:CLE is programmed.
OCP	2	4	*Over current*. When an over current condition has occurred on a channel, Bit 2 is set and remains set until the over current condition is removed and LOAD:PROT:CLE is programmed.
OPP	3	8	*Over power* When an over power condition has occurred on a channel, Bit 3 is set and remains set until the over power condition is removed and LOAD:PROT:CLE is programmed.
REV	4	16	*Reverse voltage on input*. When a channel has a reverse voltage applied to it, Bit 4 is set. It remains set until the reverse voltage is removed and LOAD:PROT:CLE is programmed.
SYNC	5	32	*Synchronize timeout*. When a synchronize timeout condition has occurred on a channel, Bit 5 is set and remains set until the synchronize timeout condition is removed and LOAD:PROT:CLE is programmed.
MAX LIM	6	64	*Maximum sine wave current limit*. When this condition has occurred on a channel, Bit 6 is set and remains set until the condition is removed and LOAD:PROT:CLE is programmed.
FAN	7	128	*FAN fail*. When a FAN failure condition has occurred on a channel, Bit 7 is set and remains set until the fan failure condition is removed and LOAD:PROT:CLE is programmed.
REMOTE INHIBIT	8	256	*Remote inhibit*. When a Remote inhibit condition has occurred on a Frame, Bit 8 is set and remains set until the remote inhibit condition is removed and LOAD:PROT:CLE is programmed.

6.2.2 Channel Summary

- The Channel Summary registers summarize the channel status conditions up to 10 channels.
- When an enabled bit in the Channel Status Event register is set, it causes the corresponding channel bit in the Channel Summary Event register to be set.
- Reading the Event register will reset it to zero.
- The Channel Summary Enable register can be programmed to specify the channel summary event bit from the existing channels that is logically ORed to become Bit 2 (CSUM bit) in the Status Byte register.

6.2.3 Questionable Status

- The Questionable Status registers inform you of one or more questionable status conditions which indicate certain errors or faults have occurred to at least one channel. Table 6-2 lists the questionable status conditions that are applied to the electronic load. These conditions are the same as the channel status conditions. Refer to Table 6-1 for a complete description.
- When a corresponding bit of the Questionable Status Condition register is set, it indicates the condition is true.
- Program the PTR/NTR filter to select the kind of condition transition in the Questionable Status Condition register that will be set in the Event registers.
- Reading the Questionable Status Event register will reset it to zero.
- The Questionable status Enable register can be programmed to specify the questionable status event bit that is logically ORed to become Bit 3 (QUES bit) in the Status Byte register.

Table 6-2 Bit Description of Questionable Status

Mnemonic	Bit	Value	Meaning
TE/OT	0	1	*Temperature Error (Over temperature)*.
OV	1	2	*Over voltage*.
CE/OC	2	4	*Current Error (Over current)*.
PE/OP	3	8	*Power Error (Over power)*.
RV	4	16	*Reverse voltage on input*.
SYNC	5	32	*Synchronize timeout.*
MAX LIM	6	64	*Maximum sine wave current limit*
FAN	7	128	*FAN fail.*
REMOTE INHIBIT	8	256	*Remote inhibit*

6.2.4 Output Queue

- The Output Queue stores output messages until they are read from the electronic load.
- The Output Queue stores messages sequentially on a FIFO (First-In, First-Out) basis.
- It sets bit 4 (MAV bit) in the Status Byte register when there are data in the queue.

6.2.5 Standard Event Status

- All programming errors that have occurred will set one or more error bits in the Standard Event Status register. Table 6-3 describes the standard events that apply to the electronic load.
- Reading the Standard Event Status register will reset it to zero.
- The Standard Event Enable register can be programmed to specify the standard event bit that is logically ORed to become Bit 5 (ESB bit) in the Status Byte register.

Table 6-3 Bit Description of Standard Event Status

Mnemonic	Bit	Value	Meaning
OPC	0	1	*Operation Complete.* This event bit is responding to the *OPC command. It indicates that the device has completed all of the selected pending operations.
QYE	2	4	*Query Error*. The output queue was read when no data were present or the data in the queue were lost.
DDE	3	8	*Device Dependent Error*. Memory was lost, or self-test failed.
EXE	4	16	*Execution Error*. A command parameter was out of the legal range or inconsistent with the electronic load's operation, or the command could not be executed due to some operating conditions.
CME	5	32	*Command Error*. A syntax or semantic error has occurred, or the electronic load has received a <GET> message from a program.

6.2.6 Status Byte Register

- The Status Byte register summarizes all of the status events for all status registers. Table 6-4 describes the status events that are applied to the electronic load.
- The Status Byte register can be read with a serial of pull or *STB? query.
- The RQS bit is the only bit that is automatically cleared after a serial of pull.
- When the Status Byte register is read with a *STB? query, Bit 6 of the Status Byte register will contain the MSS bit. The MSS bit indicates that the load has at least one reason for requesting service. *STB? does not affect the status byte.
- The Status Byte register is cleared by *CLS command.

Table 6-4 Bit Description of Status Byte

Mnemonic	Bit	Value	Meaning
CSUM	2	4	*Channel Summary*. It indicates if an enabled channel event has occurred. It is affected by Channel Condition, Channel Event and Channel Summary Event registers.
QUES	3	8	*Questionable*. It indicates if an enabled questionable event has occurred.
MAV	4	16	*Message Available.* It indicates if the Output Queue contains data.
ESB	5	32	*Event Status Bit*. It indicates if an enabled standard event has occurred.
RQS/MSS	6	64	*Request Service/Master Summary Status*. During a serial of pull, RQS is returned and cleared. For a *STB? query, MSS is returned without being cleared.

6.2.7 Service Request Enable Register

- The Service Request Enable register can be programmed to specify the bit in the Status Byte register that will generate the service requests.

7. Verification

7.1 Introduction

This chapter contains test procedures for checking the operation and specifications of the Chroma 63600 Series load. The tests are performed using the 63600 Series models and other required test equipment (the required test equipment is listed in Table 7-1). Refer to the Performance Tests section for connecting the equipment and running the test procedures. Use the verification tables included in the Verification Test Records section for checking the specifications. The performance tests should verify the Chroma 63600 Series load meets the published specifications. For detailed information on operation and programming, refer to *Chapter 3, Chapter 4 and Chapter 5.*

If any of the 63600 Series models requires service, refer to the list of Chroma Sales and Support Offices at the web site http://www.chromaate.com/english/contact/default.asp. The calibration period suggested for this series of models is once a year.

7.2 Equipment Required

The following table lists the required equipment, or its equivalent, for verification.

Table 7-1 Equipment Suggested for Verification

Equipment	Characteristics	Recommended Model
Voltmeter	5 1/2 digits or more	HP 34401A, HP 3458A
Current Shunt	0.05% accuracy	PRODIGIT 7550
	10 Ω@20mA	VALHALLA 2572A
	0.1 Ω@2A	
	0.01 Ω@20A	
	0.001 Ω@250A/100A	
	0.05 mΩ@1000A	
DC Source	8V/220A, 600V/8A	HP 6671A, Chroma 62012P-600-8
Oscilloscope	100MHz	Tektronics TDS340
Mainframe		Chroma 63600-5, 63600-2, 63600-1

7.3 Performance Tests

7.3.1 CC Mode Verification

This test verifies if the current programming and readings displayed on the front panel are within specifications when the module is operating in CC mode. For each DMM reading, the front panel display of current should be identical.

The reading of the Load in amps = Shunt current ± inaccuracy.

DMM (V): means DMM dc voltage of voltage measurement
DMM (I): means DMM dc voltage of current shunt measurement

DMM (DC): means DMM in dc voltage measurement
Shunt current (DMM Ai): means DMM (I) voltage/shunt resistor

7.3.1.1 Checking High Current Range

A. Connect the Load, DC source, DMM, and current shunt, as shown in Figure 7-1. Use DMM (I) to measure the voltage that passes through the shunt resistor measurement port, and get the load current.

B. Select the right range for the current shunt resistor. Press MODE until VFD shows **CC** and press RANGE to turn on the H range LED indicator.

C. Press EDIT to enter into CC Mode for setting. Use the rotary knob and ◀ or ▶ to program the current listed in Table 7-2 .

D. Turn on the DC source and set the output voltage to 5V. Set the current limit of the DC source larger than the current setting of Table 7-2. Press LOAD to enable the load and wait for 30 seconds. Then record the shunt current and the front panel displayed readings. The current of the load can be recorded from current shunt = DMM (I) voltage/current shunt resistor.

Table 7-2

Model	CCH Current Setting	Shunt Current		Front Panel Display Reading
		Max.	Min.	
63630-600-15	15.0 A	15.03A	14.97A	DMM Ai ±15mA
	15mA	30mA	0.02mA	DMM Ai ±7.5mA
63640-150-60	60A	60.048A	59.952A	DMM Ai ±48mA
	1A	1.0244A	0.9756A	DMM Ai ±24.4mA
63630-80-60	60.0 A	60.12A	59.88A	DMM Ai ±60mA
	0.2A	0.26A	0.14A	DMM Ai ±30mA
63610-80-20	20.0 A	20.04A	19.96A	DMM Ai ±20mA
	0.05A	0.07A	0.03A	DMM Ai ±10mA
63640-80-80	80.0 A	80.16A	79.84A	DMM Ai ±80mA
	0.2A	0.2802	0.1198A	DMM Ai ±40mA

E. Set the output voltage of the DC source and CCH current listed in Table 7-3 for the model being tested. Press LOAD to enable the load and slowly decrease the DC source voltage until DMM (V) display reaches the minimal operation voltage listed in Table 7-3 for the model being tested. The load current can be recorded from current shunt = DMM (I) voltage/current shunt resistor.

Table 7-3

Model	Output Voltage for DC Source Setting	Minimal Operation Voltage	CCH Current Setting	Shunt Current	
				Max.	Max.
63630-600-15	3V	2V	15A	15.03A	14.97A
63640-150-60	3V	1.8V	60A	60.048A	59.952A
63630-80-60	2V	0.5V	60A	60.12A	59.88A
63610-80-20	2V	0.5V	20A	20.04A	19.96A
63640-80-80	2V	0.4V	80A	80.16A	79.84A

7.3.1.2 Checking Medium Current Range

A. Connect the Load, DC source, DMM, and current shunt, as shown in Figure 7-1. Use DMM (I) to measure the voltage that passes through the shunt resistor measurement port and get the load current.

B. Select the right range for the current shunt resistor. Press MODE until VFD shows **CC** and press RANGE to turn on the M range LED indicator.

C. Press EDIT to enter into CC Mode for setting. Use the rotary knob and ◀ or ▶ to program the current listed in Table 7-4 .

D. Turn on the DC source and set output voltage to 5V. Set the current limit of the DC source larger than the current setting of Table 7-4. Press LOAD to enable the load and wait for 30 seconds. Then record the shunt current and the front panel displayed readings. The current of the load can be recorded from current shunt = DMM (I) voltage/current shunt resistor.

Table 7-4

Model	CCM Current Setting	Shunt Current		Front Panel Display Reading
		Max.	Min.	
63630-600-15	1.5 A	1.503A	1.497A	DMM Ai ±1.5mA
	1.5mA	3mA	2uA	DMM Ai ±0.75mA
63640-150-60	6A	6.0048A	5.9952A	DMM Ai ±4.8mA
	0.1A	0.10244A	0.09756A	DMM Ai ±2.44mA
63630-80-60	6.0 A	6.012A	5.988A	DMM Ai ±6mA
	0.02A	0.026A	0.014A	DMM Ai ±3mA
63610-80-20	2.0 A	2.004A	1.996A	DMM Ai ±2mA
	5mA	7mA	3mA	DMM Ai ±1mA
63640-80-80	8.0 A	8.016A	7.984A	DMM Ai ±8mA
	0.02A	0.028A	0.012A	DMM Ai ±4mA

E. Set the output voltage of the DC source and CCM current listed in Table 7-5 for the model being tested. Press LOAD to enable the load and slowly decrease the DC source voltage until the DMM (V) display reaches the minimal operation voltage from Table 7-5 for the model being tested. The current of the load can be recorded from current shunt = DMM (I) voltage/current shunt resistor.

Table 7-5

Model	Output Voltage for DC Source Setting	Minimal Operation Voltage	CCM Current Setting	Shunt Current	
				Max.	Max.
63630-600-15	3V	2V	1.5A	1.503A	1.497A
63640-150-60	3V	1.8V	6A	6.0048A	5.9952A
63630-80-60	2V	0.5V	6.0A	6.012A	5.988A
63610-80-20	2V	0.5V	2.0A	2.004A	1.996A
63640-80-80	2V	0.4V	8.0A	8.016A	7.984A

7.3.1.3 Checking Low Current Range

A. Connect the Load, DC source, DMM, and current shunt, as shown in Figure 7-1. Use DMM (I) to measure the voltage that passes through the shunt resistor measurement port, and get the load current.

B. Select the right range for the current shunt resistor. Press MODE until VFD shows **CC** and press RANGE to turn on the L range LED indicator.

C. Press EDIT to enter into CC Mode for setting. Use the rotary knob and ◀ or ▶ to program the current listed in Table 7-6.

D. Turn on the DC source and set the output voltage to 5V. Set the current limit of the DC source larger than the current setting of Table 7-6. Press LOAD to enable the load and wait for 30 seconds. Then record the shunt current and the front panel displayed readings. The current of the load can be recorded from current shunt = DMM (I) voltage/current shunt resistor.

Table 7-6

Model	CCL Current Setting	Shunt Current		Front Panel Display Reading
		Max.	Min.	
63630-600-15	0.15 A	0.1503A	0.1497A	DMM Ai ±0.15mA
	0.15mA	0.3mA	0.2μA	DMM Ai ±0.075mA
63640-150-60	1A	1.0008A	0.9992A	DMM Ai ±0.8mA
	10mA	10.404mA	9.596mA	DMM Ai ±0.404mA
63630-80-60	0.6 A	0.6012A	0.5988A	DMM Ai ±0.6mA
	2mA	2.6mA	1.4mA	DMM Ai ±0.3mA
63610-80-20	0.2 A	0.2004A	0.1996A	DMM Ai ±0.2mA
	2mA	2.2mA	1.8mA	DMM Ai ±0.1mA
63640-80-80	0.8 A	0.8016A	0.7984A	DMM Ai ±0.8mA
	2mA	2.8mA	1.2mA	DMM Ai ±0.4mA

E. Set the output voltage of the DC source and CCL current listed in Table 7-7 for the model being tested. Press LOAD to enable the load and slowly decrease the DC source voltage until the DMM (V) display reaches the minimal operation voltage from Table 7-7 for the model being tested. The current of the load can be recorded from current shunt = DMM (I) voltage/current shunt resistor.

Table 7-7

Model	Output Voltage for DC Source Setting	Minimal Operation Voltage	CCL Current Setting	Shunt Current	
				Max.	Min.
63630-600-15	3V	2V	0.15A	0.1503A	0.1497A
63640-150-60	2V	0.3V	1A	1.0008A	0.9992A
63630-80-60	2V	0.5V	0.6A	0.6012A	0.5988A
63610-80-20	2V	0.5V	0.2A	0.2004A	0.1996A
63640-80-80	2V	0.4V	0.8A	0.8016A	0.7984A

7.3.2 CR Mode Verification

This test verifies if the resistance programming is within specifications when the module is operating in the CR mode. The programmed resistance is calculated from the voltage divided by the current. The voltage (DMM (V)) passes through the module's input terminal or measurement terminal. The voltage (DMM (I)) passes through the current shunt, shunt current = DMM (I) voltage/shunt resistor. If the voltage output and/or current limit in the DC source are/is incorrectly set, the load module protection circuits OPP or OCP may be triggered. Press ENTER to close the warning screen and reset the resistance.

The Electronic Load modules implement constant resistance mode using CC circuits to regulate the input. The input voltage of the load is regarded as a reference for current control.

The formula is I/V = 1/R.

V: input voltage as reference of D/A.
I: controlled parameter to determine the resistance.
1/R: conductance, reciprocal of resistance.

The specifications of CR mode accuracy are specified as conductance. The effect on the programmed resistance value is not linear over the resistance range, because the resistance is a reciprocal conductance. The electronic load is designed for high current applications in the CR mode. Therefore, when large resistance is required, reading the voltage and current from the load, calculating the actual resistance, and adjusting the set value can improve accuracy. To calculate the accuracy of a programmed value error, the programmed value must be reciprocated first. The error is then applied to the programmed value (conductance), and the result is once again reciprocated. The following example illustrates the worst case error in CR mode:

Example 1: 0.133Ω to 270Ω range (Model 63630-600-15, CRL)

The accuracy for this range is specified as 0.1% + 0.02S,

If 0.1Ω is programmed, the actual resistance will be

Conductance:	10+(10×0.1%+0.02)	to	10−(10×0.1%+0.02)
Resistance:	0.0997Ω	to	0.1003Ω

If 0.05Ω is programmed, the actual resistance will be

Conductance:		20+(20×0.1%+0.02)	to	20−(20×0.1%+0.02)
	=	20.04S	to	19.96S
Resistance:		0.0499Ω	to	0.0501Ω

Connect the load module, DC source, DMM, and current shunt, as shown in Figure 7-3 . Use the DMM (V) to measure the voltage passing through the module's input terminal and the DMM (I) that passes through the shunt resistor measurement port. Be careful in making connections so that the contact resistance voltage drop will not affect the readings, or use remote sensing to sense the UUT voltage. Load resistance = DMM (V)/shunt current.

7.3.2.1 Checking High ohm Range

A. Press MODE until VFD shows **CR** and press RANGE to turn on the H range LED

indicator.

B. The current shunt range is 250A. Press EDIT to input the resistance listed in Table 7-8. Press LOAD to enable the load and use the value of DMM (V) to adjust the value of the DC source to the setting for that model in the table, wait for 30 seconds, record the voltage that passes through the load input terminals DMM (V) and the shunt current reading DMM (I). Calculate the values of the resistance via DMM (V)/DMM (I). Check the values to see if they match the specification.

Table 7-8

Model Name	Resistance Setting	Input Value of DC Source	Appropriate Conductance (S)	
			Max.	Min.
63630-600-15	200kΩ	600V	0.000305S	0S
	208Ω	200V	0.005113S	0.004503S
63640-150-60	1500Ω	150V	0.002667S	0S
	6.25Ω	50V	0.18S	0.14S
63630-80-60	3kΩ	80V	0.010334S	0S
	1.5Ω	20V	0.677333S	0.656S
63610-80-20	12kΩ	80V	0.003833S	0S
	5.76Ω	20V	0.177535S	0.169688S
63640-80-80	2.9kΩ	80V	0.014095S	0S
	1.45Ω	20V	0.704095S	0.675216S

7.3.2.2 Checking Medium ohm Range

A. Press MODE until VFD shows **CR** and press RANGE to turn on the M range LED indicator.

B. The current shunt range is 250A. Press EDIT to input the resistance listed in Table 7-9. Press LOAD to enable the load, and use the value of DMM (V) to adjust the value of the DC source to the setting for that model in the table, and wait for 30 seconds, record the voltage that passes through the load input terminals DMM (V) and the shunt current reading DMM (I). Calculate the values of the resistance via DMM (V)/DMM (I). Check the values to fit the specification.

Table 7-9

Model Name	Resistance Setting	Input Value of DC Source	Appropriate Conductance (S)	
			Max.	Min.
63630-600-15	4kΩ	150V	0.00075S	0S
	1.92Ω	20V	0.521854S	0.519813S
63640-150-60	800Ω	80V	0.0075S	0S
	0.64Ω	8V	1.57S	1.555S
63630-80-60	600Ω	16V	0.031668S	0S
	0.3Ω	8V	3.36667S	3.3S
63610-80-20	2.9kΩ	16V	0.355172S	0.334483S
	1.44Ω	8V	0.705139S	0.68375S
63640-80-80	720Ω	16V	0.03789S	0S
	0.36Ω	8V	2.817056S	2.7385S

7.3.2.3 Checking Low ohm Range

A. Press MODE until VFD shows **CR** and press RANGE to turn on the L range LED indicator.

B. The current shunt range is 250A. Press EDIT to input the resistance listed in Table 7-10 . Press LOAD to enable the load and use the value of DMM (V) to adjust the value of the DC source to the setting for that model in the table, wait for 30 seconds, and then record the voltage that passes through the load input terminals DMM (V) and the shunt current reading DMM (I). Calculate the values of the resistance via DMM (V)/DMM (I). Check the values to insure they meet the specification.

Table 7-10

Model Name	Resistance Setting	Input Value of DC Source	Appropriate Conductance (S)	
			Max.	Min.
63630-600-15	270Ω	80V	0.02371S	0S
	0.133Ω	2V	7.546316S	7.491278S
63640-150-60	60Ω	12V	0.067S	0S
	0.2Ω	8V	5.072S	4.928S
63630-80-60	30Ω	6V	0.233367S	0S
	0.015Ω	0.8V	66.9333S	66.4S
63610-80-20	80Ω	6V	0.087513S	0S
	0.04Ω	0.8V	25.1S	24.9S
63640-80-80	20Ω	6V	0.32505S	0 S
	0.01Ω	0.8V	100.375S	99.625S

7.3.3 CV Mode Verification

This test verifies if the voltage programming and reading value on the front panel display are within specifications when the module is operating in CV mode. For each DMM (V) reading, the front panel display of voltage should be equivalent to:

Load module reading in volts = DMM (V) reading in volts ± inaccuracy.

7.3.3.1 Checking High Voltage Range

A. Connect the Load module, DC source, DMM, and current shunt, as shown in Figure 7-1. Use DMM (V) to measure the voltage passing through the module's input terminal. Be careful in making connections so that contact resistance voltage drop will not affect the readings.

B. Press MODE until VFD shows **CV** and press RANGE to turn on the H range LED indicator.

C. Press EDIT to set load voltage and press DATA to set limit current. The DC Source voltage output and limit current settings are based on the voltage/current values listed in Table 7-11.

D. Next, press LOAD to enable the load and wait for 30 seconds to record the voltage passing through the negative input terminal.

Table 7-11

Model	Load Voltage Setting/Limit Current	DC Source Voltage/Limit Current	DMM(V)		Front Panel Display Reading
			Max.	Min.	
63630-600-15	595V/0.5A	600V/0.2A	595.8975V	594.1025V	DMM (V)±0.21V
	0.8V/0.5A	5V/0.2A	1.4004V	0.1996V	DMM (V)±0.150031V
63640-150-60	140V/1A	150V/0.5A	140.0725V	139.9275V	DMM (V)±0.05V
	1V/1A	150V/0.5A	1.03775V	0.96225V	DMM (V)±0.01525V
63630-80-60	75V/1A	80V/0.5A	75.1175V	74.8825V	DMM (V)±0.028V
	1V/1A	80V/0.5A	1.0805V	0.9195V	DMM (V)±0.02002V
63610-80-20	75V/1A	80V/0.5A	75.1175V	74.8825V	DMM (V)±0.028V
	1V/1A	80V/0.5A	1.0805V	0.9195V	DMM (V)±0.02002V
63640-80-80	75V/1A	80V/0.5A	75.1175V	74.8825V	DMM (V)±0.028V
	1V/1A	80V/0.5A	1.0805V	0.9195V	DMM (V)±0.02002V

*If the voltage is incapable of loading as the value set, it can add load limit current or lower down the limit current of DC Source.

7.3.3.2 Checking Medium Voltage Range

A. Connect the Load module, DC source, DMM, and current shunt as shown in Figure 7-1. Use DMM (V) to measure the voltage passing through the module's input terminal. Be careful in making connections so that contact resistance voltage drop will not affect the readings.

B. Press MODE until VFD shows **CV** and press RANGE to turn on the M range LED indicator.

C. Press EDIT to set load voltage and press DATA to set limit current. The DC Source voltage output and limit current settings are based on the voltage/current values listed in Table 7-12.

D. Next, press LOAD to enable the load and wait for 30 seconds to record the voltage passing through the negative input terminal.

Table 7-12

Model	Load Voltage Setting/Limit Current	DC Source Voltage/Limit Current	DMM(V)		Front Panel Display Reading
			Max.	Min.	
63630-600-15	145V/1A	150V/0.5A	145.2225V	144.7775V	DMM (V)±0.05125V
	2V/1A	6V/0.5A	2.151V	1.849V	DMM (V)±0.0155V
63640-150-60	70V/1A	80V/0.5A	70.0375V	69.9625V	DMM (V)±0.0255V
	1V/1A	80V/0.5A	1.02025V	0.97975V	DMM (V)±0.00825V
63630-80-60	15V/1A	16V/0.5A	15.0235V	14.9765V	DMM (V)±0.00535V
	1V/1A	16V/0.5A	1.0165V	0.9835V	DMM (V)±0.00185V
63610-80-20	15V/1A	16V/0.5A	15.0235V	14.9765V	DMM (V)±0.00535V
	1V/1A	16V/0.5A	1.0165V	0.9835V	DMM (V)±0.00185V
63640-80-80	15V/1A	16V/0.5A	15.0235V	14.9765V	DMM (V)±0.00535V
	1V/1A	16V/0.5A	1.0165V	0.9835V	DMM (V)±0.00185V

*If the voltage is incapable of loading as the value set, it can add load limit current or lower down the limit current of DC Source.

7.3.3.3 Checking Low Voltage Range

A. Connect the Load module, DC source, DMM, and current shunt, as shown in Figure 7-1. Use DMM (V) to measure the voltage passing through the module's input terminal. Be careful in making connections so that contact resistance voltage drop will not affect the readings.

B. Press MODE until VFD shows **CV** and press RANGE to turn on the L range LED indicator.

C. Press EDIT to set load voltage and press DATA to set limit current. The DC Source voltage output and limit current settings are based on the voltage/current values listed in Table 7-13.

D. Next, press LOAD to enable the load and wait for 30 seconds to record the voltage passing through the negative input terminal.

Table 7-13

Model	Load Voltage Setting/Limit Current	DC Source Voltage/Limit Current	DMM(V)		Front Panel Display Reading
			Max.	Min.	
63630-600-15	75V/1A	80V/0.5A	75.1175V	74.8825V	DMM (V)±0.02675V
	2V/1A	5V/0.5A	2.081V	1.919V	DMM (V)±0.0085V
63640-150-60	15V/1A	16V/0.5A	15.00775V	14.99225V	DMM (V)±0.00535V
	1V/1A	16V/0.5A	1.00425V	0.99575V	DMM (V)±0.00185V
63630-80-60	5V/1A	6V/0.5A	5.0085V	4.9915V	DMM (V)±0.00185V
	1V/1A	6V/0.5A	1.0065V	0.9935V	DMM (V)±0.00085V
63610-80-20	5V/1A	6V/0.5A	5.0085V	4.9915V	DMM (V)±0.00185V
	1V/1A	6V/0.5A	1.0065V	0.9935V	DMM (V)±0.00085V
63640-80-80	5V/1A	6V/0.5A	5.0085V	4.9915V	DMM (V)±0.00185V
	1V/1A	6V/0.5A	1.0065V	0.9935V	DMM (V)±0.00085V

*If the voltage is incapable of loading as the value set, it can add load limit current or lower down the limit current of DC Source.

7.3.4 CP Mode Verification

This test verifies if the current programming and reading value on the front panel display are within specifications when the module is operating in CP mode. For each DMM reading, the current displayed on the front panel should be the same. The voltage (DMM (V)) passes through the input or measurement terminal of the module as well as the current shunt. Shunt current = DMM (I) voltage/shunt resistance. If the voltage output of the DC Source and/or limit current setting is wrong, OPP or OCP of the load module may be triggered. Press ENTER to close the alarm screen and reset the power value.

DMM (W) load reading power = DMM (V) reading volt × DMM (I) current shunt ± inaccuracy
DMM (V): It means the voltage measurement of DMM dc voltage.
DMM (I): It means the current shunt measurement of DMM dc voltage.

Example: Use the Table 7-14 below to analyze the example. Select model 63640-80-80 and operate in high power range. The power accuracy is 0.3%Set + 0.3%F.S. and the panel reading accuracy is 0.1%Set + 0.1%F.S from the specifications list, where the Vrange F.S. should be 80V, Irange F.S. should be 80A, and the power F.S. should be Vrange F.S. ×

Irange F.S.= 80×80 =6400W.

When the power is set to 400W, the power specification range is shown as follows:
DMM (W) maximum value: 400 + (0.3%×400 + 0.3%×6400) = 420.4W
DMM (W) minimum value: 400 - (0.3%×400 + 0.3%×6400) = 379.6W
Panel power reading range: DMM(W)±(0.1%×400 + 0.1%×6400)= DMM(W)±6.8W

7.3.4.1 Checking High Power Range

A. Connect the load module, DC Source, DMM, and Current Shunt, as shown in Figure 7-1. Use DMM (W) to measure the voltage passing through the module's input terminal. Be careful in making connections so that contact resistance voltage drop will not affect the readings.

B. Press MODE until VFD shows **CP** press RANGE to turn on the H range LED indicator.

C. Press EDIT to set load voltage and press DATA to set limit current. The DC Source voltage output and limit current settings are based on the voltage/current values listed in Table 7-14.

D. Next, press LOAD to enable the load and wait for 30 seconds to record the voltage passing through the negative input terminal.

Table 7-14

Model	Load Power Setting	DC Source Voltage/ Limit Current	DMM(W)		Front Panel Display Reading (W)
			Max.	Min.	
63630-600-15	300W	20V/17A	327.9W	272.1W	DMM (W)± 9.3W
	16W	40V/0.5A	43.048W	0W	DMM (W)± 9.016W
63640-150-60	400W	8V/60A	402.4W	397.6W	DMM (W)± 0.8W
	10W	8V/1.25A	11.23W	8.77W	DMM (W)± 0.41W
63630-80-60	300W	6V/60A	309W	271W	DMM (W)± 5.1W
	16W	40V/0.5A	16.48W	15.52W	DMM (W)± 4.816W
63610-80-20	100W	6V/20A	105.1W	94.9W	DMM (W)± 1.7W
	4W	40V/0.2A	8.812W	0W	DMM (W)± 1.604W
63640-80-80	400W	6V/60A	420.4W	379.6W	DMM (W)± 6.8W
	16W	40V/0.5A	35.248W	0W	DMM (W)± 6.416W

7.3.4.2 Checking Medium Power Range

A. Connect the load module, DC Source, DMM, and Current Shunt, as shown in Figure 7-1. Use DMM (W) to measure the voltage passing through the module's input terminal. Be careful in making connections so that contact resistance voltage drop will not affect the readings.

B. Press MODE until VFD shows **CP** press RANGE to turn on the M range LED indicator.

C. Press EDIT to set load voltage and press DATA to set limit current. The DC Source voltage output and limit current settings are based on the voltage/current values listed in Table 7-15.

D. Next, press LOAD to enable the load and wait for 30 seconds to record the voltage passing through the negative input terminal.

Table 7-15

Model	Load Power Setting	DC Source Voltage/ Limit Current	DMM(W)		Front Panel Display Reading (W)
			Max.	Min.	
63630-600-15	30W	20V/3A	32.79W	27.21W	DMM (W)± 0.93W
	1.6W	40V/0.5A	4.3048W	0W	DMM (W)± 0.9016W
63640-150-60	40W	8V/6A	40.24W	39.76W	DMM (W)± 0.08W
	1W	8V/6A	1.123W	0.877W	DMM (W)± 0.041W
63630-80-60	30W	6V/8A	30.9W	29.1W	DMM (W)± 0.51W
	1.6W	40V/0.5A	1.648W	1.552W	DMM (W)± 0.4816W
63610-80-20	10W	6V/3A	10.51W	9.49W	DMM (W)± 0.17W
	0.4W	40V/0.5A	0.8812W	0W	DMM (W)± 0.1604W
63640-80-80	40W	5V/10A	42.04W	37.96W	DMM (W)± 0.68W
	1.6W	40V/0.5A	3.5248W	0W	DMM (W)± 0.6416W

7.3.4.3 Checking Low Power Range

A. Connect the load module, DC Source, DMM, and Current Shunt, as shown in Figure 7-1. Use the DMM (W) to measure the voltage passing through the module's input terminal. Be careful in making connections so that any contact resistance voltage drop will not affect the readings.

B. Press MODE until VFD shows **CP.** Press RANGE to turn on the L range LED indicator.

C. Press EDIT to set the load voltage and press DATA to set the current limit. The DC Source voltage output and current limit settings are based on the voltage/current values listed in Table 7-16.

D. Press LOAD to enable the load and wait for 30 seconds to record the voltage passing through the negative input terminal.

Table 7-16

Model	Load Power Setting	DC Source Voltage/ Limit Current	DMM(W)		Front Panel Display Reading (W)
			Max.	Min.	
63630-600-15	6W	40V/1A	6.288W	5.712W	DMM (W)± 0.096W
	0.16W	40V/0.5A	0.43048W	0W	DMM (W)± 0.09016W
63640-150-60	8W	8V/2A	8.048W	7.952W	DMM (W)± 0.016W
	0.2W	8V/2A	0.2246W	0.1754W	DMM (W)± 0.0082W
63630-80-60	6W	11V/1A	6.18W	5.82W	DMM (W)± 0.054W
	0.16W	40V/0.5A	0.1648W	0.1552W	DMM (W)± 0.04816W
63610-80-20	2W	11V/1A	2.054W	1.946w	DMM (W)± 0.018W
	0.04W	40V/0.5A	0.08812W	0W	DMM (W)± 0.01604W
63640-80-80	8W	11V/1A	8.216W	7.784W	DMM (W)± 0.072W
	0.16W	40V/0.5A	0.35248W	0W	DMM (W)± 0.06416W

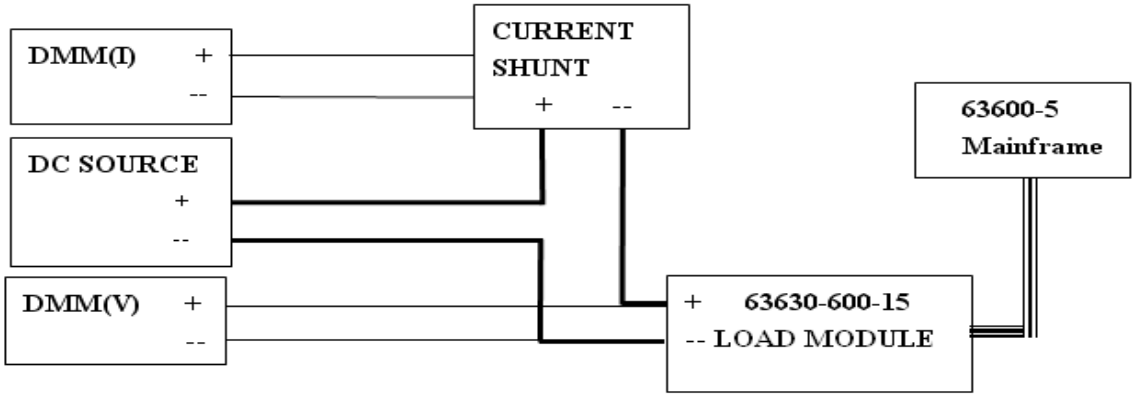


Figure 7-1

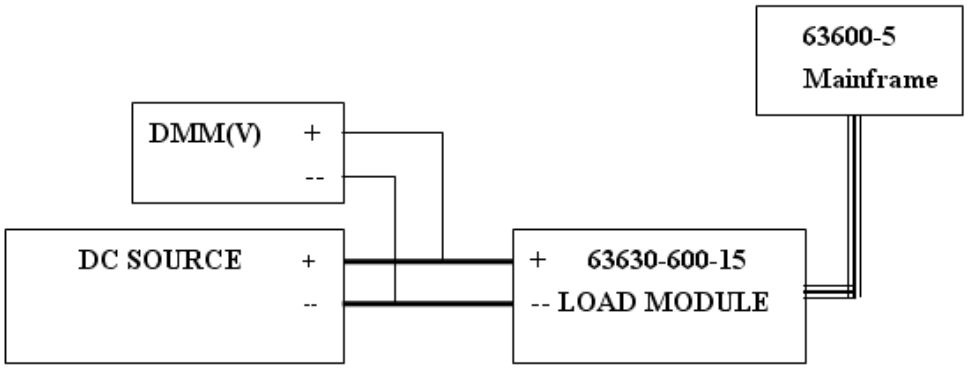


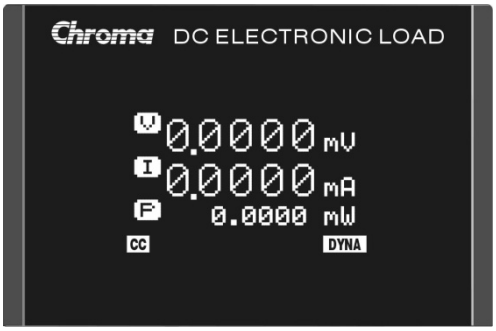
Figure 7-2

7.3.5 Dynamic and Slew Rate Circuit Test

This test verifies the slew rate circuit operation and the dynamic current waveform period specifications when the module is operating in CC mode.

Connect the Load module, DC source, oscilloscope, and probe, as shown in Figure 7-3. Use the oscilloscope to measure the waveform of current probe. To reduce the current waveform overshoot caused by cable inductance, make the cables as short as possible. Adjust the oscilloscope for a rise/fall time display. The rise time is measured from 10% to 90%, and the fall time is measured from 90% to 10%.

Press DYNA on the front panel of the Electronic Load to display **DYNA,** as shown in the figure below:



7.3.5.1 Checking Dynamic Constant Current High Range

A. Press MODE until VFD shows CC and press RANGE to turn on the H range LED indicator.

B. Press EDIT to enter into the Dynamic Constant Current setting. The settings are listed in Table 7-17 and Table 7-18.

C. Set the DC Source output voltage to 5V (hint: Set to 7V for Model 63630-600-15). The limit current needs to be higher than the highest level set for the dynamic constant current. (EX: When the 63630-600-15 H level is set to 15A, the DC Source limit current can set to 17A.)

Notice When the 63640-150-60 is providing dynamic loading, the minimum working voltage should be greater than 2.5V

Table 7-17

Model	H	L	T1	T2	SR/	SR\
63630-600-15	15A	0A	10ms	10ms	1.5 A/μs	1.5 A/μs
63640-150-60	60A	0A	10ms	10ms	6 A/μs	6 A/μs
63630-80-60	60A	0A	10ms	10ms	6 A/μs	6 A/μs
63610-80-20	20A	0A	10ms	10ms	2 A/μs	2 A/μs
63640-80-80	80A	0A	10ms	10ms	8 A/μs	8 A/μs

Table 7-18

	T1(ms)		T2(ms)		Rise time(μs)		Fall time(μs)	
Model	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
63630-600-15	10.002	9.998	10.002	9.998	31	0	31	0
63640-150-60	10.002	9.998	10.002	9.998	31	0	31	0
63630-80-60	10.002	9.998	10.002	9.998	31	0	31	0
63610-80-20	10.002	9.998	10.002	9.998	31	0	31	0
63640-80-80	10.002	9.998	10.002	9.998	31	0	31	0

7.3.5.2 Checking Dynamic Constant Current Medium Range

A. Press MODE until VFD shows CC and press RANGE to turn on the M range LED indicator.

B. Press EDIT to enter into the Dynamic Constant Current setting. The settings are listed in Table 7-19 and Table 7-20.

C. Set the DC Source output voltage to 5V. The current limit needs to be higher than the highest level set by the dynamic constant current. (EX: When the 63630-600-15 H level is set to 1.5A, the DC Source current limit can set to 2A.)

Table 7-19

Model	H	L	T1	T2	SR/	SR\
63630-600-15	1.5A	0A	10ms	10ms	0.15 A/μs	0.15 A/μs
63640-150-60	6A	0A	10ms	10ms	0.6 A/μs	0.6 A/μs
63630-80-60	6A	0A	10ms	10ms	0.6 A/μs	0.6 A/μs
63610-80-20	2A	0A	10ms	10ms	0.2 A/μs	0.2 A/μs
63640-80-80	8A	0A	10ms	10ms	0.8 A/μs	0.8 A/μs

Table 7-20

	T1(ms)		T2(ms)		Rise time(μs)		Fall time(μs)	
Model	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
63630-600-15	10.002	9.998	10.002	9.998	31	0	31	0
63640-150-60	10.002	9.998	10.002	9.998	31	0	31	0
63630-80-60	10.002	9.998	10.002	9.998	31	0	31	0
63610-80-20	10.002	9.998	10.002	9.998	31	0	31	0
63640-80-80	10.002	9.998	10.002	9.998	31	0	31	0

7.3.5.3 Checking Dynamic Constant Current Low Range

A. Press MODE until VFD shows **CC** and press RANGE to turn on the L range LED indicator.

B. Press EDIT to enter into the Dynamic Constant Current setting. The settings are listed in Table 7-21 and Table 7-22.

C. Set the DC Source output voltage to 5V. The current limit needs to be higher than the highest level set by the dynamic constant current. (EX: When the 63630-600-15 H level is set to 0.15A, the DC Source current limit can set to 0.5A.)

Table 7-21

Model	H	L	T1	T2	SR/	SR\
63630-600-15	150mA	0A	10ms	10ms	15m A/μs	15m A/μs
63640-150-60	0.6A	0A	10ms	10ms	0.06 A/μs	0.06 A/μs
63630-80-60	0.6A	0A	10ms	10ms	0.06 A/μs	0.06 A/μs
63610-80-20	0.2A	0A	10ms	10ms	0.02 A/μs	0.02 A/μs
63640-80-80	0.8A	0A	10ms	10ms	0.08 A/μs	0.08 A/μs

Table 7-22

	T1(ms)		T2(ms)		Rise time(μs)		Fall time(μs)	
Model	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
63630-600-15	10.002	9.998	10.002	9.998	31	0	31	0
63640-150-60	10.002	9.998	10.002	9.998	31	0	31	0
63630-80-60	10.002	9.998	10.002	9.998	31	0	31	0
63610-80-20	10.002	9.998	10.002	9.998	31	0	31	0
63640-80-80	10.002	9.998	10.002	9.998	31	0	31	0

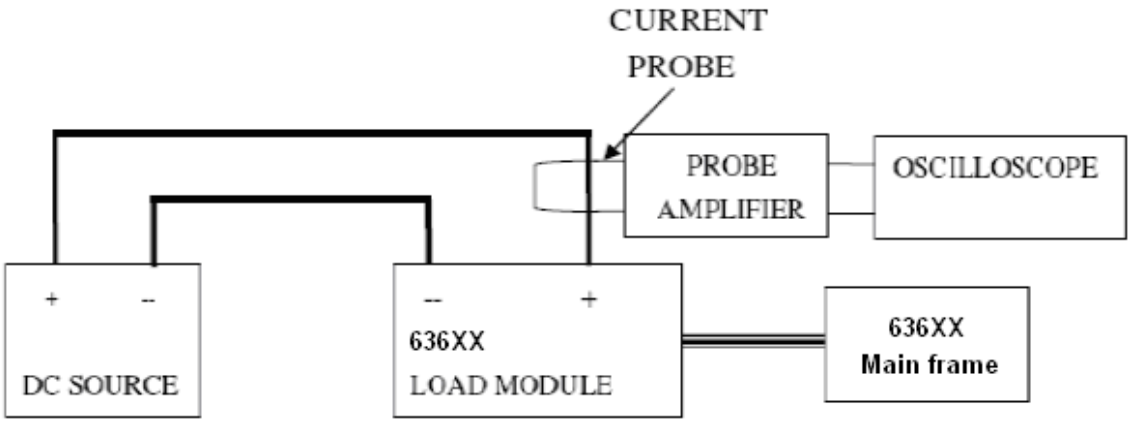

CURRENT
PROBE
PROBE
AMPLIFIER
OSCILLOSCOPE
+
--
DC SOURCE
--
+
636XX
LOAD MODULE
636XX
Main frame

Figure 7-3

Appendix A Precautions for Loading Battery

Due to the Electric Vehicle industry, high power battery test applications have become more common. As a result, it is necessary to pay more attention to safety since the testing involves batteries with high power and voltage.

Based on equipment repair data, the most commonly damaged part in large power, high voltage Electronic Loads is the output MOSFET, and the most probable cause is over voltage between the connection of the MOSFET and the UUT. It may be just a transient, but it could cause the MOSFET to be damaged by little energy if it exceeds the maximum voltage.

Common battery applications often form high voltages by connecting multiple batteries in series to avoid the transmission loss caused by low voltage and high current. As a switch is used to directly connect the battery and load, the study shows it is the main cause of Load damage. Figure A-1 shows the wire connection between the Electronic Load and Battery. When the switch is closed (same as inputting a pulse signal), the effect caused by the stray elements in the circuit (series inductance and parallel capacitance resonance) will generate a transient high voltage that damages the MOSFET and may cause a short circuit as the simulation shows in Figure A-2. It can be seen that it will generate a spike exceeding the previous voltage setting when the switch closes and it may be beyond the IC maximum withstand voltage.

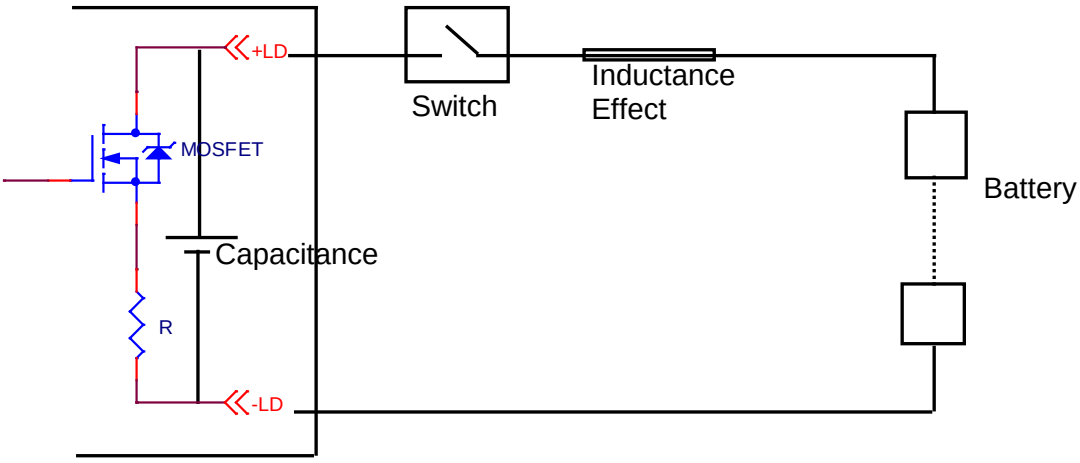


Figure A-1 Wire Connection of Electronic Load & Battery

The figure below shows the simulated circuit diagram of the application that causes damage.

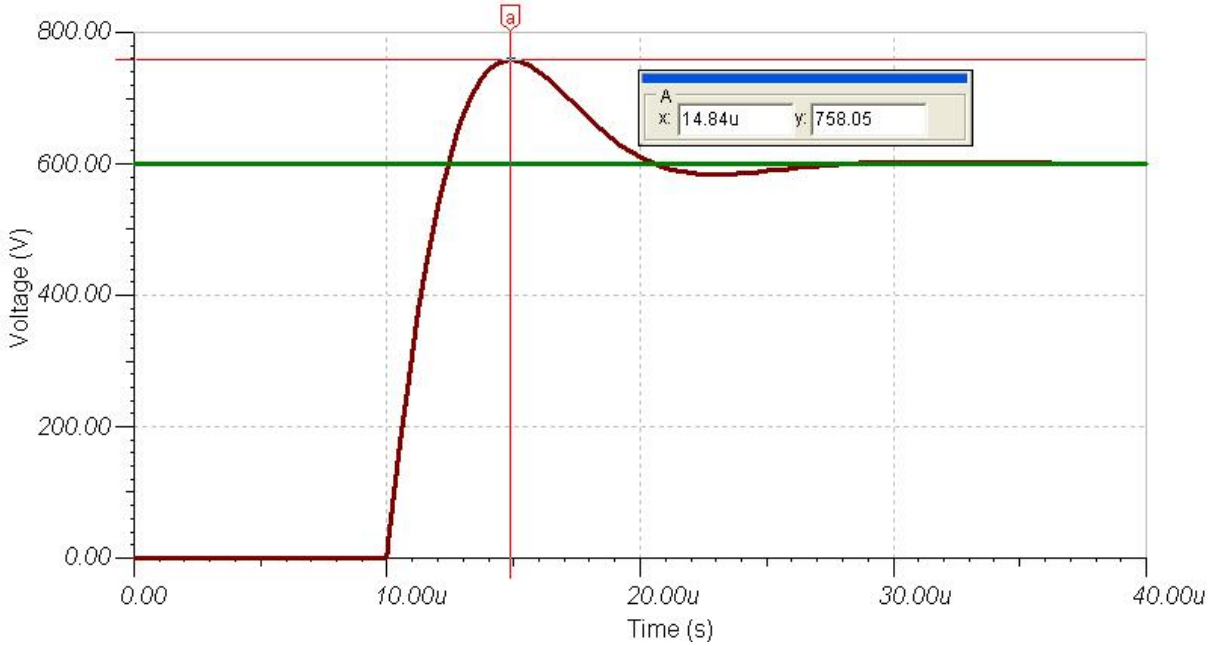


Figure A-2 Simulation of Surge Chart when Switching between Electronic Load & Battery

During the test procedure, if the entire circuit is shorted due to MOSFET breakdown by high voltage, and if the energy source is a battery or other source that can provide high power, continuous high current will pass internally through the Electronic Load due to the short circuit. The load and the battery should be disconnected immediately. If the load is not disconnected, the high energy of the battery output may cause the Electronic Load to burn out or create an even more severe situation. To prevent this from happening, a mechanism of over current protection is required.

To prevent the situation described above and avoid damaging the equipment, do not connect the battery and Electronic Load directly using only a switch.

A.1 Measures for Improvement

A.1.1 Additional Protection Switch

To prevent damage that may spread due to a shorted MOSFET and continuous energy release from the battery caused by the previously described conditions, connect the wires as shown in Figure A-3 below when doing the battery charge/discharge tests to prevent problems from happening and to ensure the safety of the Electronic Load.

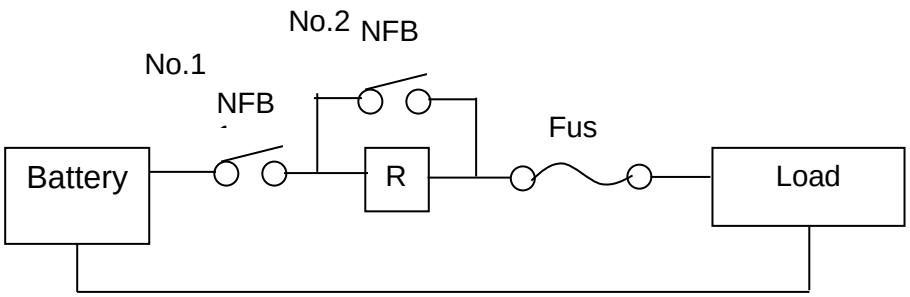


Figure A-3 Wire Connecting Diagram of LOAD & Battery

NFB (No-Fuse Breaker): The breaker capacity (current limit) should be less than the maximum current of the load and it should be able to switch off in time if there is an internal short circuit.

R: Install a resistor of 100kΩ or above to avoid applying a large voltage to the Electronic Load in a short period of time.

Fuse: Calculate the power to be discharged and select a proper fuse.

Note If two or more Electronic Loads are paralleled for the discharge test, the front terminal of each Load must add a fuse for protection.

A.1.2 Operation

Before applying voltage to the Electronic Load, close switch NFB No.1 to make the current go through resistor 'R' to prevent damaging or aging the MOSFET from high voltage sent to the Electronic Load in a short period of time.

Close switch NFB No.2 after 5 seconds and then start battery discharge testing.

To stop the discharge test, first press Load OFF on the Electronic Load and then switch NFB No.2 to OFF and then switch NFB No.1 to OFF. The discharge test stops and the battery is isolated from the Electronic Load.

For example:

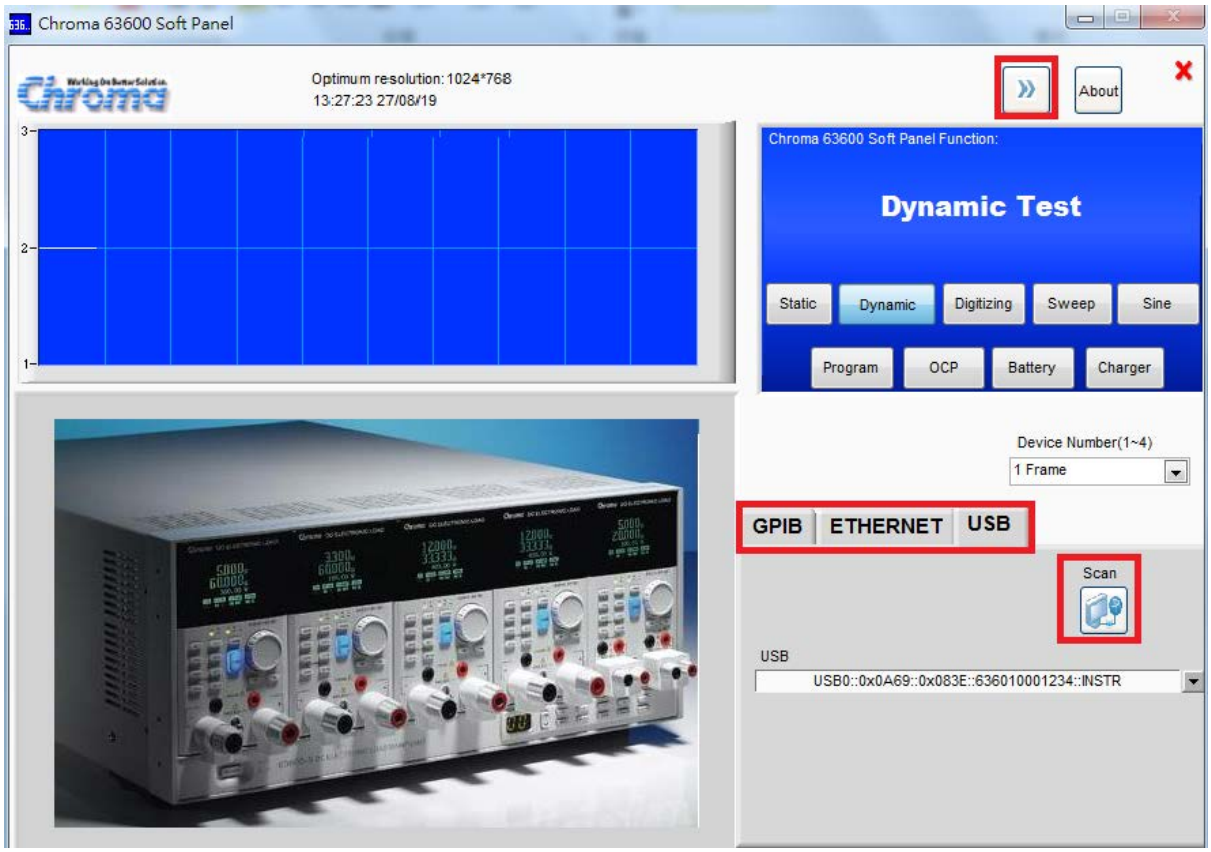
How to install the wire to discharge 2kW when using 300V (maximum battery current is 100A) for battery discharge?
(I = P / V = 2000W / 300V = 6.6A)

- When selecting an NFB, since the battery maximum current is 100A, the NFB should be less than 100A; an NFB of 20A would be appropriate.
- When R is selected, a resistor of 1W, 100kΩ would be appropriate.
- When a Fuse is selected, it must be rated larger than the loading discharge current. In this case, the discharge current is 6.6A and a fuse of 10A would be appropriate.

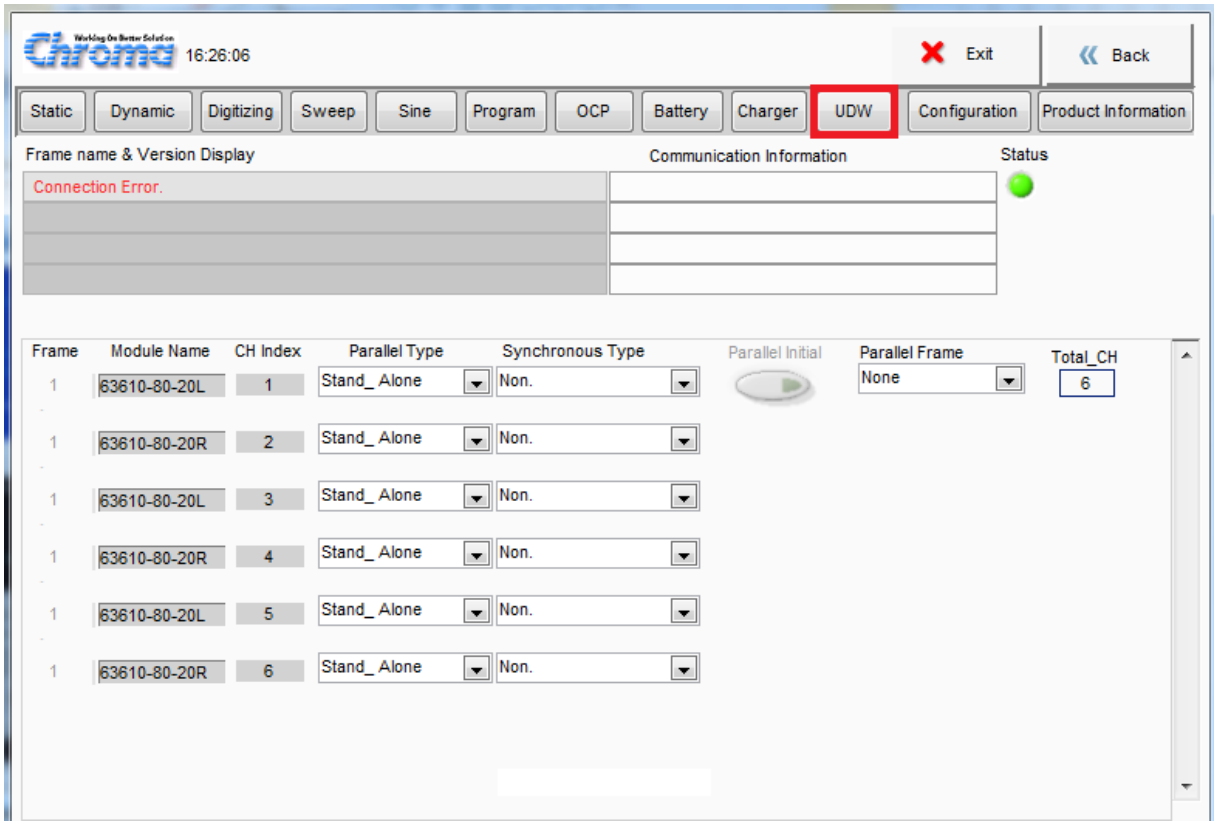
Appendix B Using the 63600 Soft Panel Downloaded UDW

Following lists the procedures when using 63600 Soft Panel for testing.

A. Select a communication interface. The 63600 supports GPIB, ETHERNET and USB interfaces. Click Scan when one of them is selected to search the connected device and go to next step.

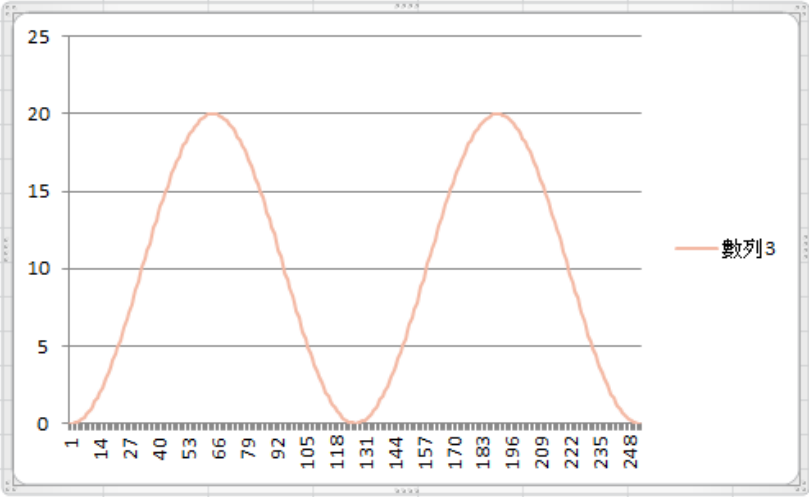


B. Select the UDW control interface:

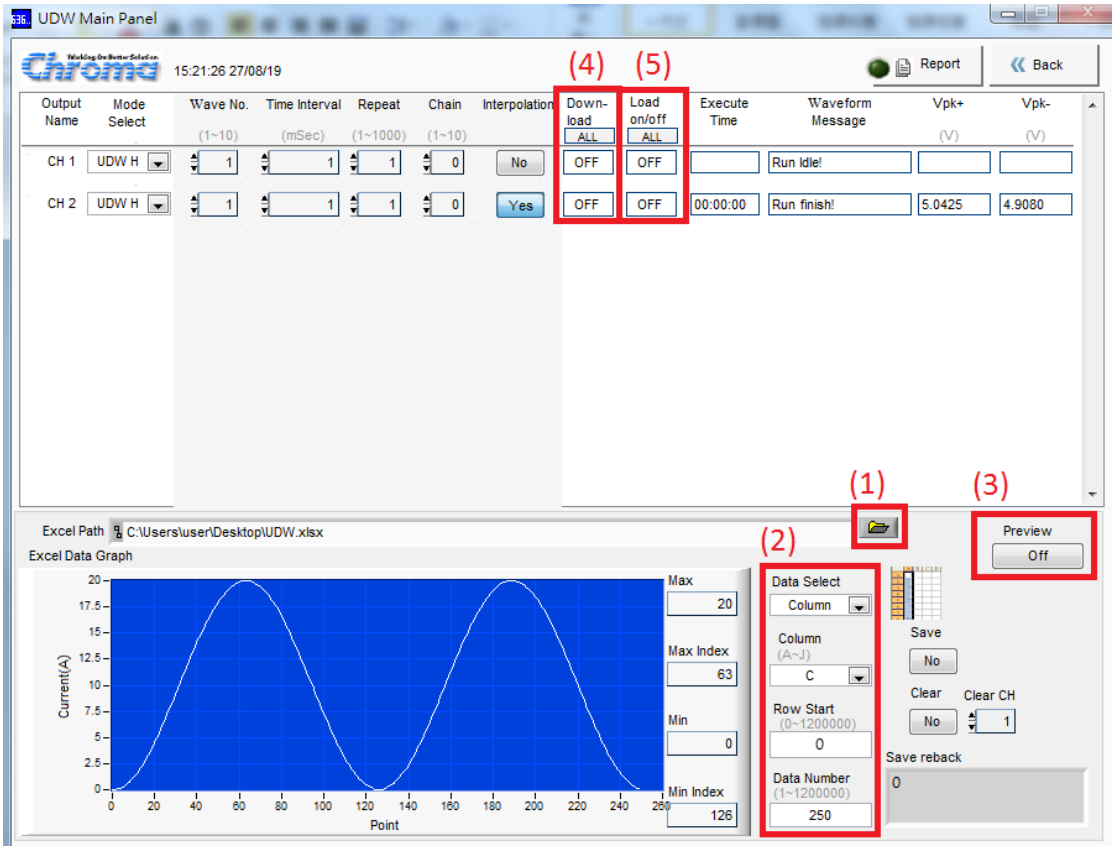


C. Use Excel to create the desired loading waveform.

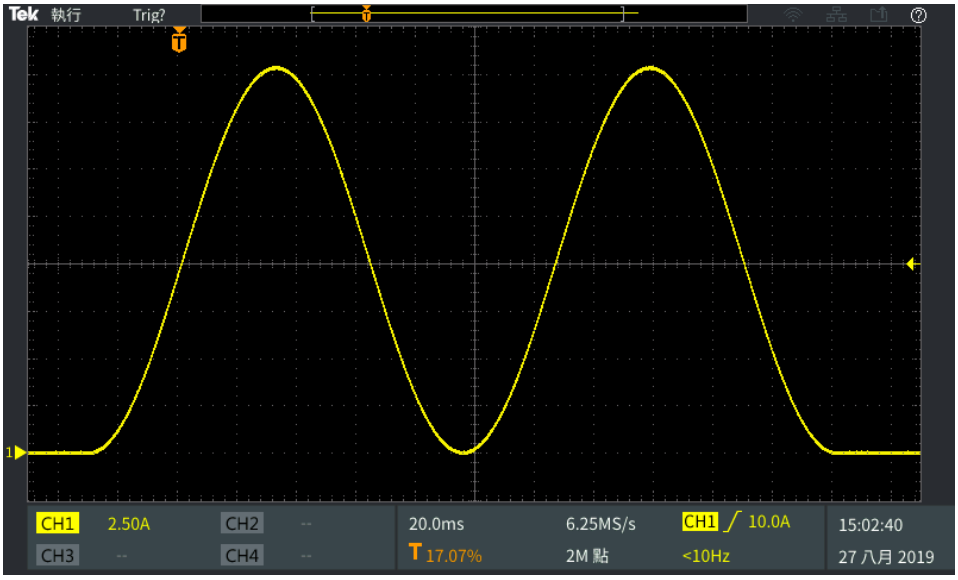
	A	B	C
1	4.7	-9.99923	0.000767
2	4.75	-9.99293	0.007072
3	4.8	-9.96165	0.038354
4	4.85	-9.90547	0.094535
5	4.9	-9.82453	0.175474
6	4.95	-9.71903	0.280969
7	5	-9.58924	0.410757
8	5.05	-9.43549	0.564513
9	5.1	-9.25815	0.741853
10	5.15	-9.05767	0.942334
11	5.2	-8.83455	1.165453
12	5.25	-8.58934	1.410655
13	5.3	-8.32267	1.677326
14	5.35	-8.0352	1.964798
15	5.4	-7.72764	2.272355
16	5.45	-7.40077	2.599227
17	5.5	-7.0554	2.944597
18	5.55	-6.6924	3.307601
19	5.6	-6.31267	3.687334
20	5.65	-5.91716	4.082844
21	5.7	-5.50686	4.493145
22	5.75	-5.08279	4.917209



D. (1) Load the created Excel file, (2) select column, row, start and loading amount, (3) click Preview to see the preview screen, (4) Click Download to download the waveforms to 636XX modules, (5) click Load on to start loading the waveform.



E. Example of actual loading waveform:



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