Chroma

Programmable DC Electronic Load

63600 Series

Operation & Programming Manual

Programmable DC Electronic Load
63600 Series
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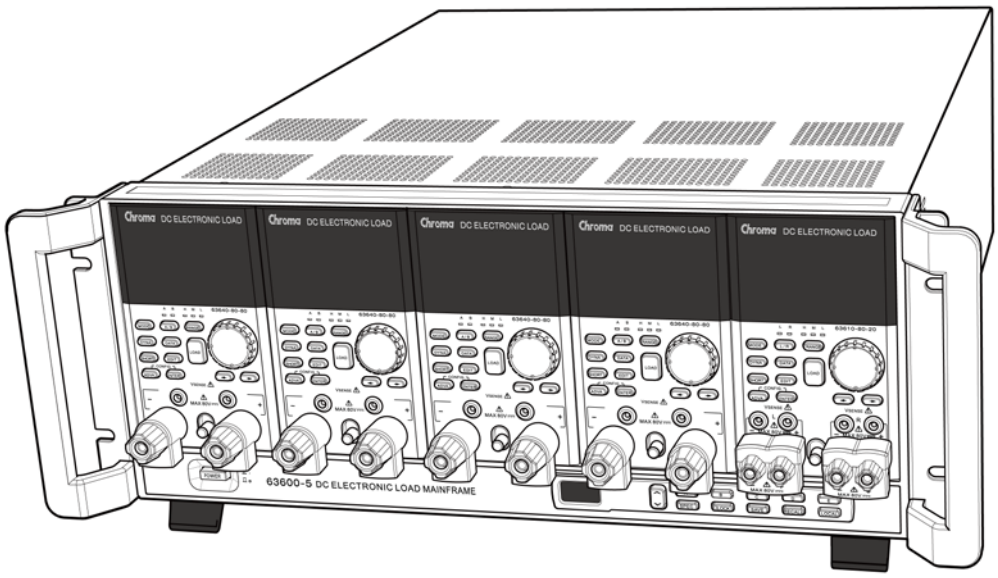

Version 2.2
July 2017

Legal Notices

The information in this document is subject to change without notice.

Chroma ATE INC. makes no warranty of any kind with regard to this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Chroma ATE INC. shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

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

Warranty

All of Chroma's instruments are warranted against defects in material and workmanship for a period of one year from date of shipment. Chroma agrees to repair or replace any assembly or component found to be defective, under normal use during this period. Chroma's obligation under this warranty is limited solely to repairing any such instrument, which in Chroma's sole opinion proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Purchaser is responsible for the shipping and cost of the service item to Chroma factory or service center. Shipment should not be made without prior authorization by Chroma.

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Chroma assumes no responsibility for its product being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. High voltage used in some instruments may be dangerous if misused. Special disclaimers apply to these instruments. Chroma assumes no liability for secondary charges or consequential damages and in any event, Chroma's liability for breach of warranty under any contract or otherwise, shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.

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CHROMA ATE INC.
66 Huaya 1st Road, Guishan,
Taoyuan 33383, Taiwan
Tel: 886-3-327-9999
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 and EU Directive 2011/65/EU.

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

Remarks: The CE marking on product is a declaration of product compliance with EU Directive 2011/65/EU.

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 and EU Directive 2011/65/EU..

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

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.

(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)

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.

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

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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)

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)

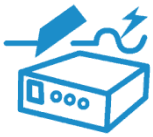
Warning:
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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.

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.

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

The Electronic Load, composed of any of a mainframe plugged-in with at least any of a module, offers stand-alone operation mode. In addition, the mainframe 63600-5, 63601-5 can be controlled via A636000 GPIB or A636001 Ethernet or USB bus by a remote computer (see *Chapter 5 Remote Operation*), or via System Bus by the remote controller.

The functions of 63610-80-20, 63630-80-60, 63630-600-15, 63640-80-80, 63640-150-60…etc. are all the same except the variations on input voltage, load current, and power ratings. An individual module may have one or two channels. Each channel has its own channel number, load & 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.…etc.

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 specifications of Electronic Load modules that apply to the Chroma 63600-5, 63601-5 Electronic Load mainframes, as well as key features concerning 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)

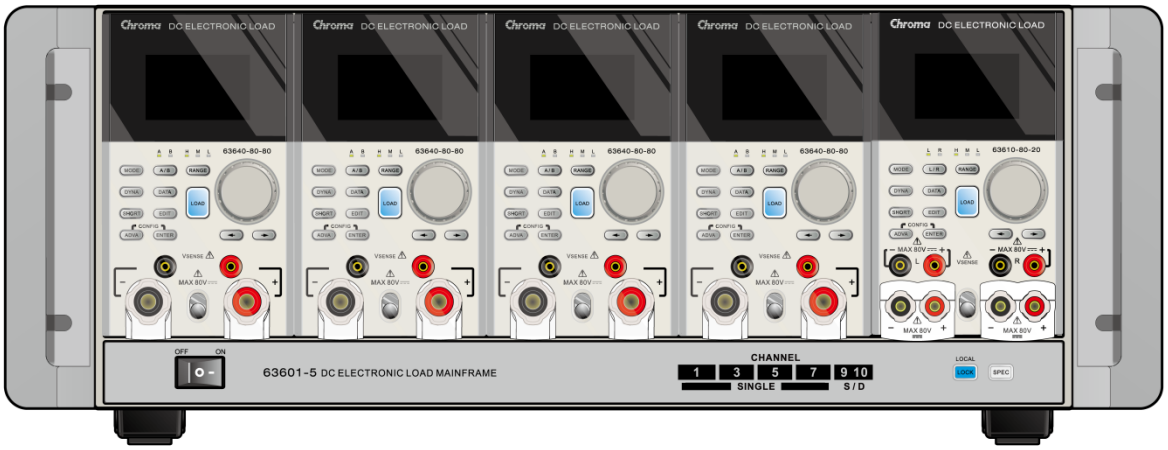


Figure 1-2 63601-5 Mainframe (Mounted with 5 Load Modules)

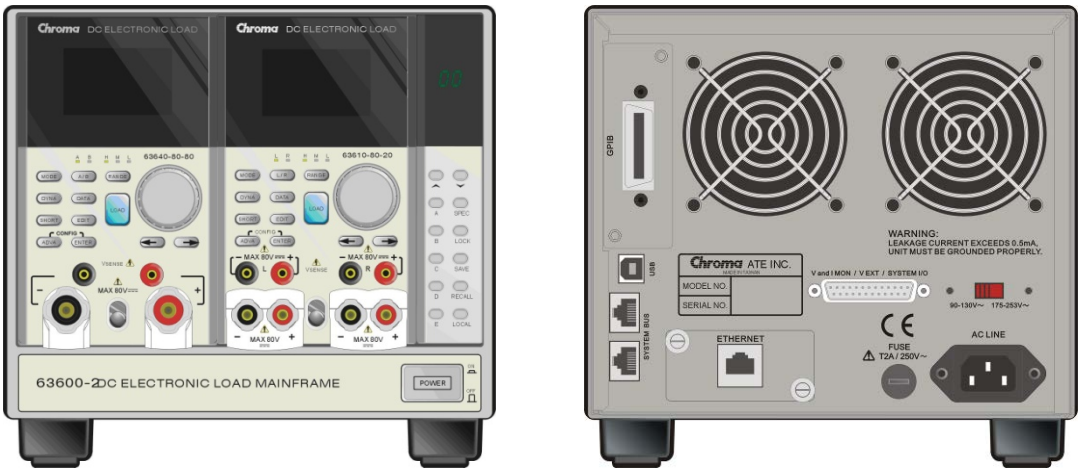


Figure 1-3 63600-2 Mainframe (Mounted with 2 Load Modules)

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 to mainframes.
- 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 for 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 50kHz. (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, allow synchronous load control under static and dynamic loading mode
- Automatic GO/NG inspection to examine if UUT 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
Frequency:	47 to 63 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 altitude up to 2,000 meters is allowed to use the equipment.
3. All specifications are tested under 20°C ~ 30°C except otherwise stated.
4. The range of operation temperature is 0°C ~ 40°C.
5. The relative humidity is from 10% to 90%. When in high humidity

environment, the hardware device should be standby for half an hour to exhaust the humidity before loading the current.

6. The specifications of DC current accuracy are tested after the input is applied for 30 seconds.
7. The pollution degree of the equipment is 2.
8. The power of the 63600 series load module is supplied by the mainframe.
9. The module is not allowed to hot swap 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		
Frequency	100Hz~50kHz/0.01Hz~1kHz			100Hz~50kHz/0.01Hz~1kHz		
Duty	1~99% (Min. Rise Time Dominated)			1~99% (Min. Rise Time Dominated)		
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		
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		
Frequency	100Hz~50kHz/0.01Hz~1kHz			100Hz~50kHz/0.01Hz~1kHz		
Duty	1~99% (Min. Rise Time Dominated)			1~99% (Min. Rise Time Dominated)		
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		
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		

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		
Frequency	100Hz~50kHz/0.01Hz~1kHz		
Duty	1~99% (Min. Rise Time Dominated)		
Accuracy	1μs/1ms+100ppm		
	0.2A/ms~	1.2A/ms~	12A/ms~
Slew rate	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		

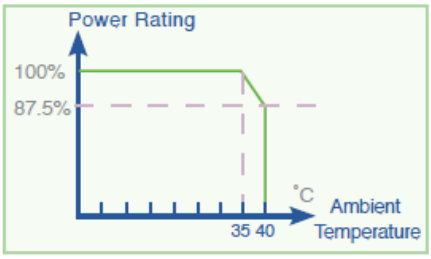
Range	0~16V	0~80V	0~150V
Output	0~10V		
Accuracy	0.5%F.S.		
Current Monitor			
Bandwidth	20 kHz		
Range	0~1A	0~6A	0~60A
Output	0~10V		
Accuracy	0.5%F.S.		
Protection			
Over Power	Yes		
Over Current	Yes		
Over Voltage Alarm *[8]	Yes		
Over Temperature	Yes		
Reverse	Yes		
Interface			
USB	Standard		
Remote 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		
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} Auto Range / 47~63Hz	1φ 100~240VAC ±10%V_{LN} 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 specified at an ambient temperature of 35℃, please 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: Power F.S.=Vrange F.S. x Irange F.S.
NOTE*5: The DC level measurements are made over a period of 20ms, and does not measure any transient signals 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 specified performance at temperature range of 25±5℃.
NOTE*8: If the operating voltage exceeds the rated voltage for 1.1 times, it would cause permanent damage to the device.
NOTE*9: Please refer to user's manual for detail specifications, and 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: It is the minimum voltage of load measured by Oscilloscope.
NOTE*12: It is 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: When loading 60A continuously within 1 minute, the minimum working voltage can drop to 1.6V.
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

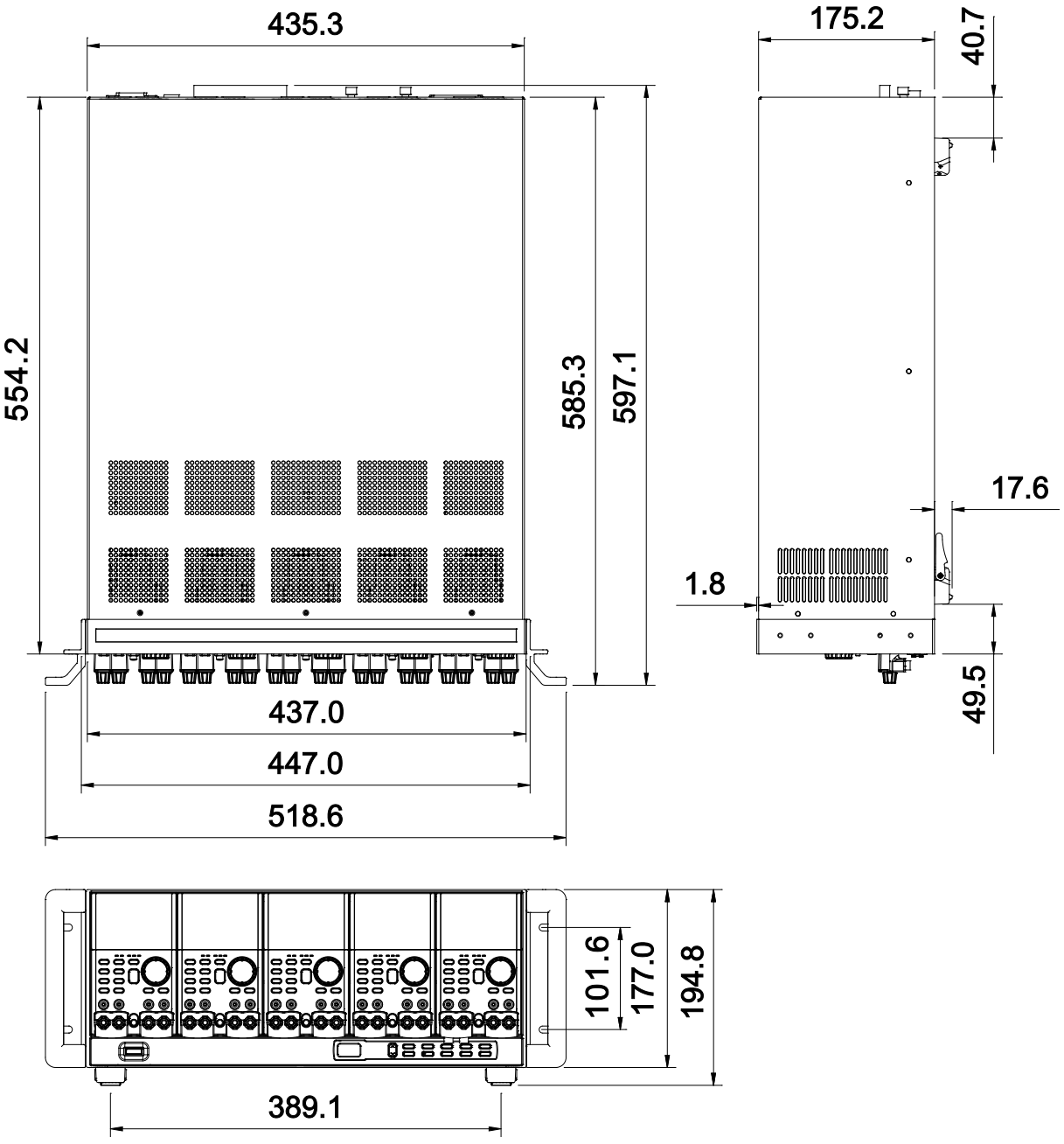
	63610-80-20	63630-80-60	63640-80-80	63630-600-15	63640-150-60
CRH (unit: S)	0.32879m / V_{sense}	0.98638m / V_{sense}	1.32206m / V_{sense}	0.2661m / V_{sense}	1m/V_{sense}
CRM (unit: S)					
CRL (unit: S)					

Table 2

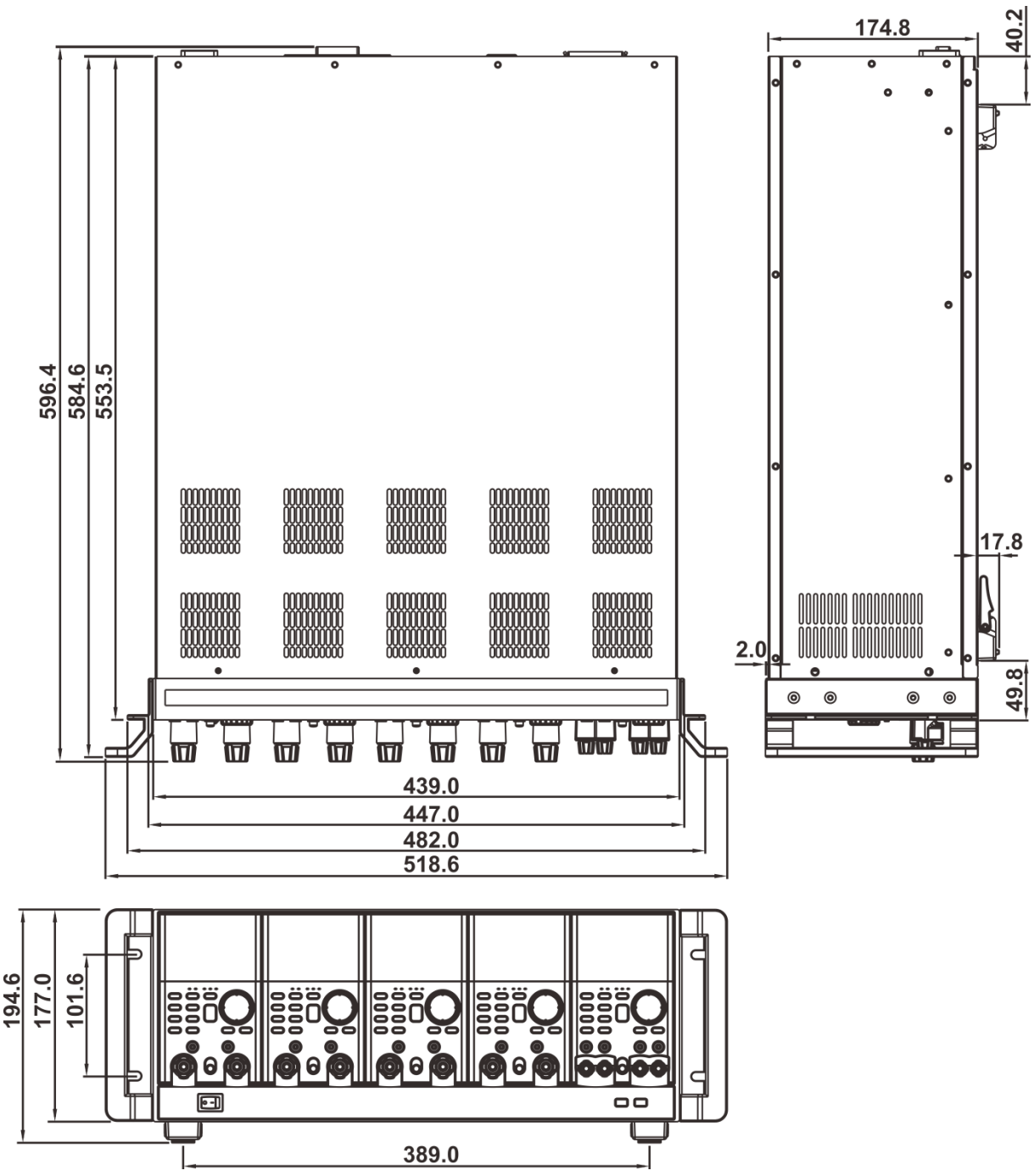
	63610-80-20	63630-80-60	63640-80-80	63630-600-15	63640-150-60
CPH (unit: W)	0.32879m x V_{sense}	0.98638m x V_{sense}	1.32206m x V_{sense}	0.2661m x V_{sense}	1m x V_{sense}
CPM (unit: W)	0.03285m x V_{sense}	0.09861m x V_{sense}	0.131517m x V_{sense}	0.026m x V_{sense}	0.1m x V_{sense}
CPL (unit: W)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

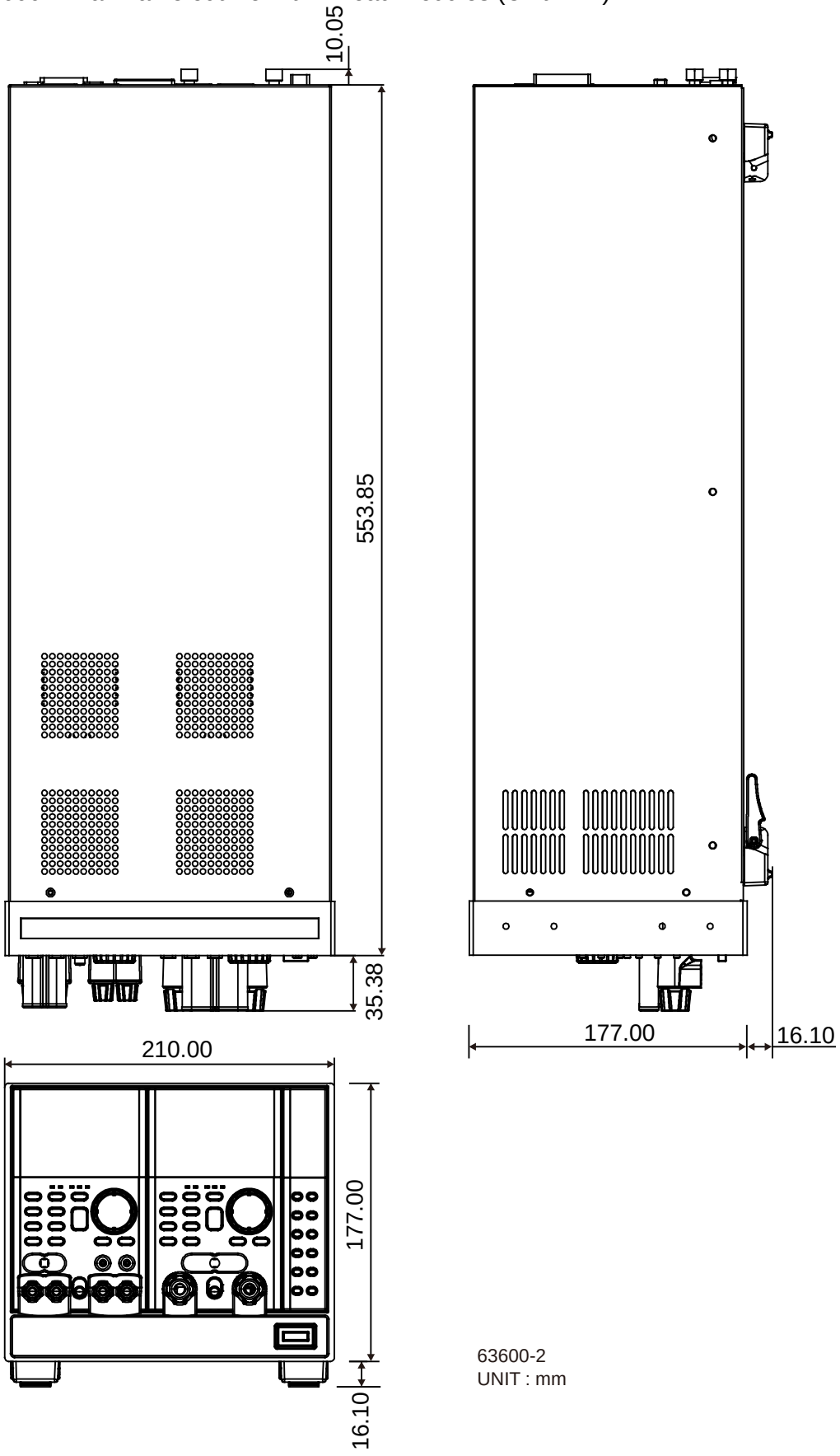
- 63600-5 Mainframe outline with 5 Load Modules (Unit: mm)



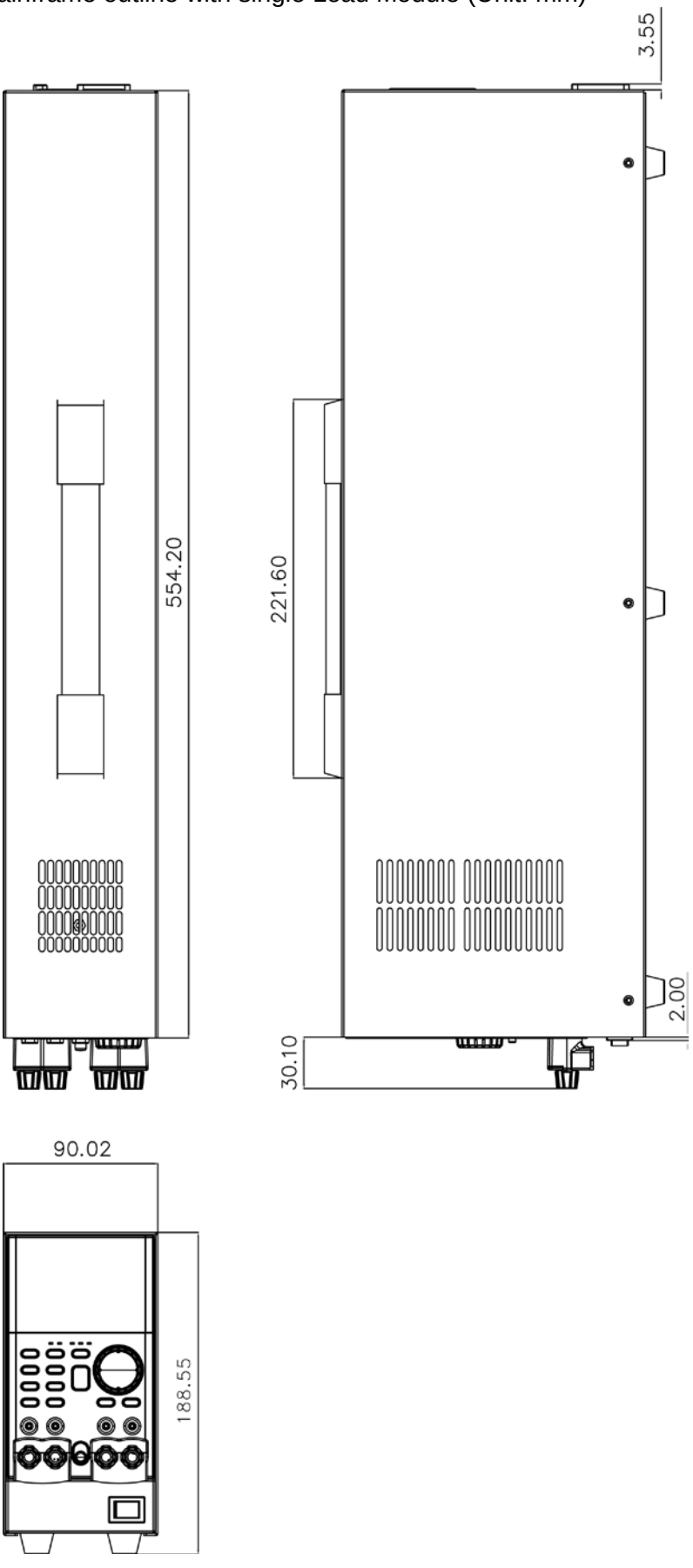
- 63601-5 Mainframe outline with 5 Load Modules (Unit: mm)



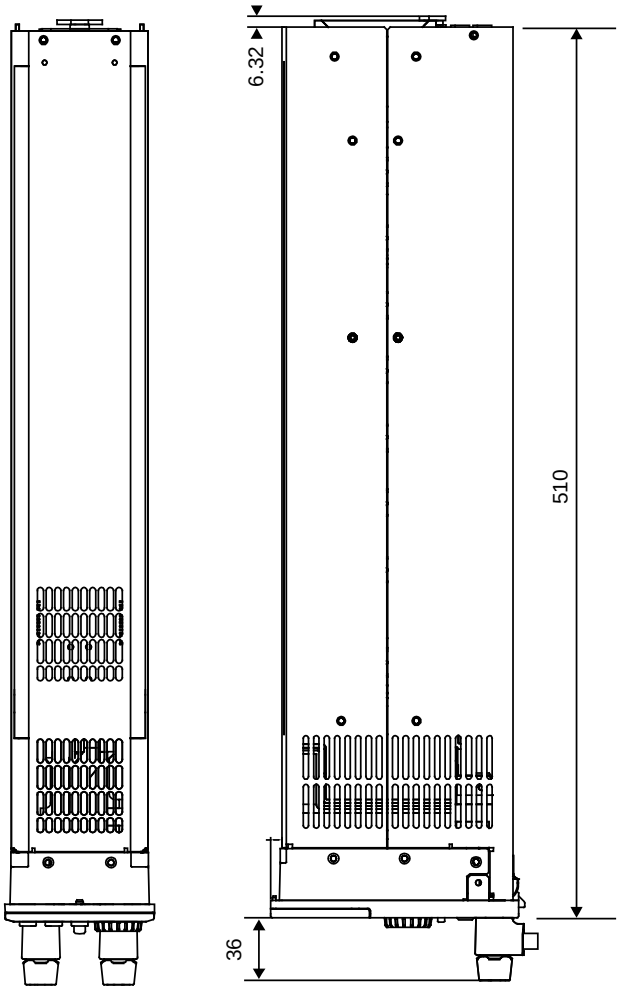
- 63600-2 Mainframe outline with 2 Load Modules (Unit: mm)



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



- Module outline (Unit: mm)



63610-80-60
63610-80-80

2. Installation

2.1 Introduction

This chapter discusses how to install the 63600. It also discusses turn-on check procedure and application considerations as well.

2.2 Inspection

Diagram of 63600 Series Standard Package:

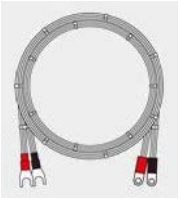
W51 200270
Y-type Bare Terminal 10.8mm

User's Manual CD

Quick Start Guide (English)

W38 000023
Test Wire
Red & Black

G32 341000
Binding Post Fixer



W33 000033
White Load Wire

W33 000035
White Load Wire

Fuse
2A/250V

Fuse
5A/250V

W51 000028
Y-type Bare Terminal 13.8mm

Y-type Bare Terminal 14mm

As soon as the instrument is unpacked, inspect any damage that might have occurred in shipping. Keep all packing materials in case that the instrument has to be returned. If any damage is found, please file a claim to the carrier immediately. Do not return the instrument to Chroma without prior approval.

Be sure that the following items listed by respective model are received completely.

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	2 pieces
	Test wire red & black	2 pieces each
	Y-type bare terminal, exradius ψ10.8mm	4 pieces
63630-80-60 63640-80-80	White load wire (W33 00033), 75cm	1 piece
	Test wire red & black	1 piece each
	Y-type bare terminal, exradius ψ13.8mm	2 pieces
63630-600-15	White load wire (W33 00033), 75cm	1 piece
	Test wire red & black	1 piece
	Y-type bare terminal, exradius ψ14mm	2 pieces
63640-150-60	White load wire (W33 00033), 75cm	1 piece
	Test wire red & black	1 piece each
	Y-type bare terminal, exradius ψ13.8mm	2 pieces

2.3 Explanation of Taking Apart

Please refer to Figure 2-1 when taking the instrument apart. Before using, please remove the protective plate, and then plug the power cord so as to avoid short circuit. The sequences of taking apart are as follows:

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

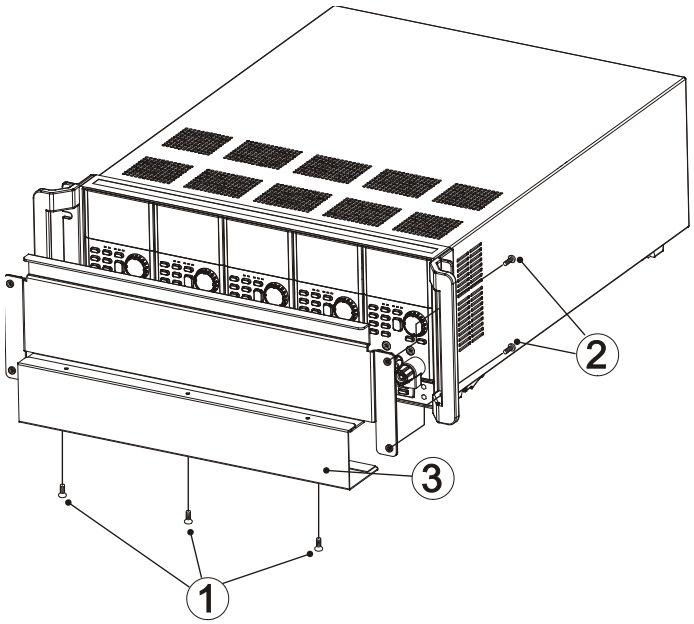


Figure 2-1

2.4 Installing the Modules

CAUTION Load module can be damaged by electronic discharge (static electricity). Use standard anti-static work practices when you handle and install modules. Avoid touching the connector and the circuit board.

Chroma 63600-5, 63601-5 Mainframe has 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 Module to Mainframe.

Procedures

1. Power off the Mainframe and disconnect the power cord.
2. Remove any packing materials on the Mainframe.
3. Start to install the modules in the slot (see Figure 2-2).
4. Plugging and sliding the load module into the Mainframe slot along the rail until it locked and fastened.
5. Install each additional module in the next slot likewise.

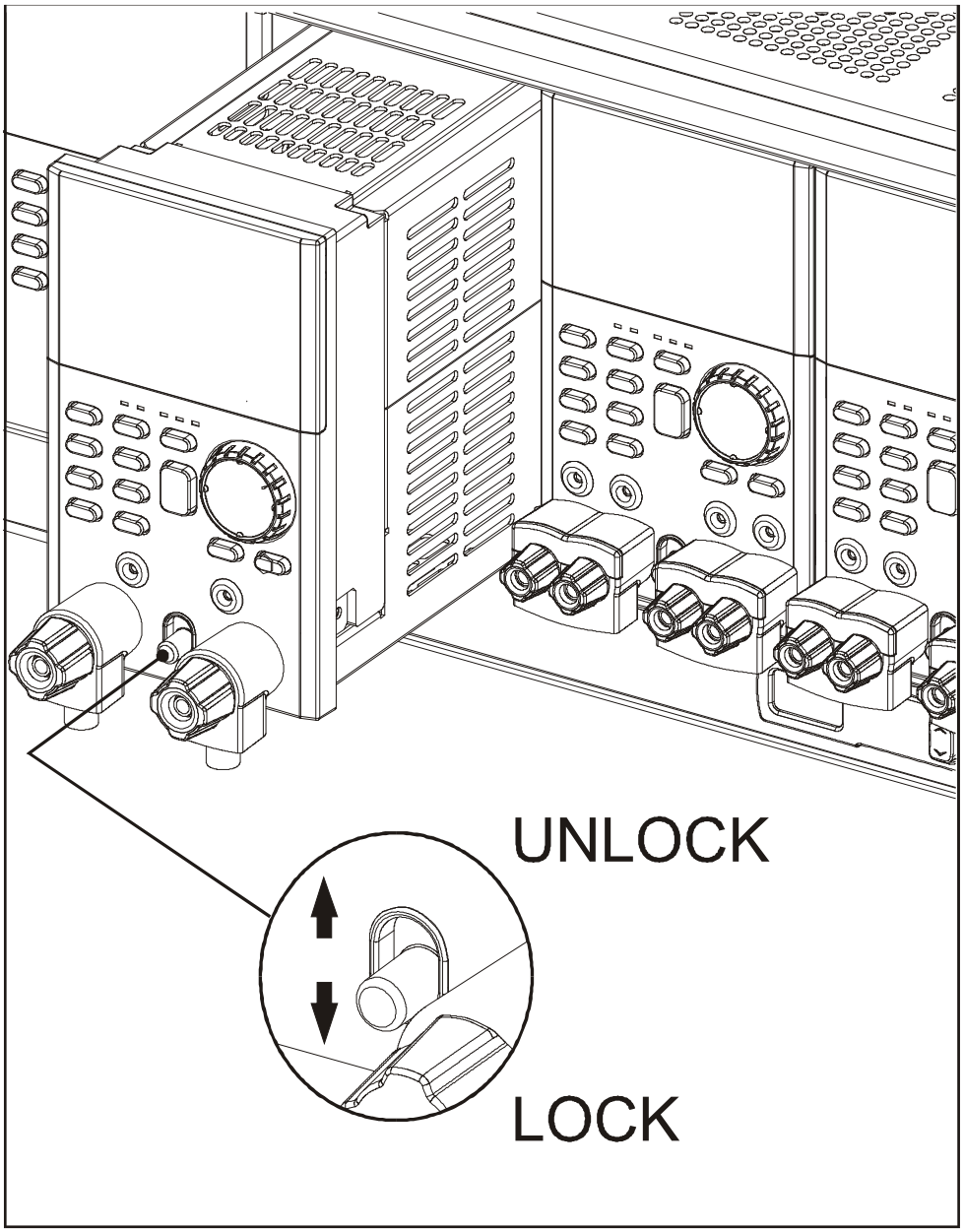


Figure 2-2 Installing Modules in the Electronic Load

⚠WARNING If the Mainframe is not installed with all modules, the empty slot must be covered with the panel cover for safety and airflow.

To unplug it, lift up the switch between the load connectors, using load connectors to help you draw the module out of the mainframe.

2.4.1 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 Load (63610-80-20) has two channels in one module, channel 1 and 2 are always on the farthest left slot of the Mainframe, and channel 9 and 10 on the farthest right. The channel number is fixed for Mainframe even the Load module is empty. Figure 2-3 shows the channel assignments for a Chroma 63600-5 Mainframe containing two Loads of 63630-80-60 single channel module, and two Loads of 63610-80-20 dual channel module. Channel number is automatically assigned to 1, 3, 5, 6, 7, and 8. Channel 2 and 4 are skipped as single module is applied.

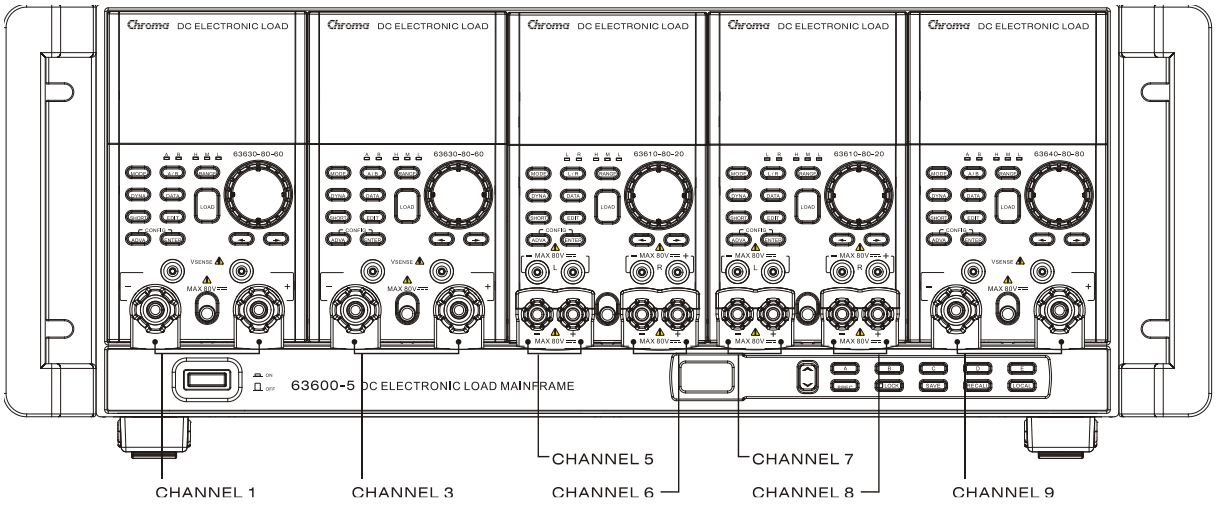


Figure 2-3 Example of Channel Number

2.5 Installing the Mainframe

The Electronic Load can operate well within temperature range from 0 to 40 degree C. However, you must install the Electronic Load in an area that has enough space around for adequate air flowing through and escaping from the back. You must leave at least 10 cm (4 inch) space above the unit for air circulation. Note that the unit foot stock has enough vertical space for air circulation when it is stacked. The Mainframe foot stock can be removed for rack mount.

If you install the equipment on top of your Electronic Load in a cabinet, you must use a filter panel above the unit to ensure adequate air circulation. A 1U (EIA standard) panel is sufficient.

2.5.1 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 is shown in section 1.4 *Specifications*. The Electronic Load can automatically switch correct line voltage range to correspond to your nominal line voltage, when you connect the power cord to correct line voltage and turn on the Electronic Load.

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

2.5.2 Turn-On Self-Test

Check the following before turning on the Load.

1. The nominal line voltage of the AC input socket is in the range of 100-120/200-240 Vac.
2. The power cord is connected to the AC input socket.

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

Power on the Load by the front panel switch on 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 will display measurement V & I. The dual channel module goes to L channel.

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

2.6 Application Connection

2.6.1 Load Connections

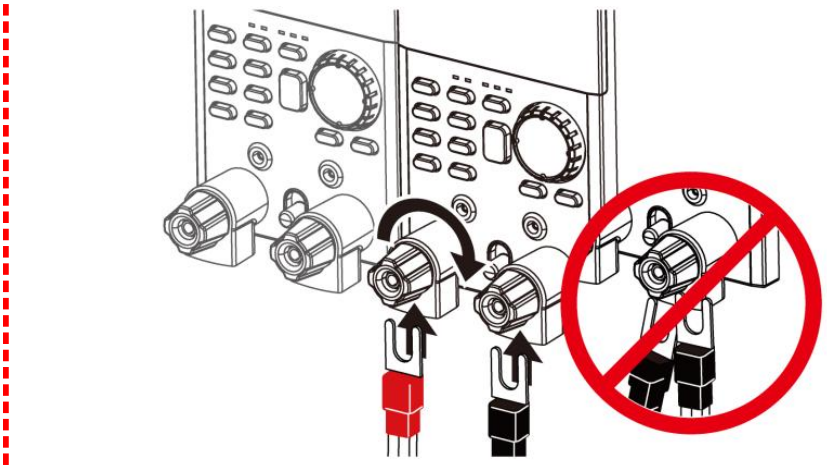
⚠WARNING To satisfy safety requirements, load wires must be heavy enough not to overheat while carrying the short-circuit output current of the device connected to the Electronic Load.

Notice To satisfy our higher slew rate load spec requirement and performance, load wires which have over 2.0μH inductance must be avoided from the UUT to our load. We have made the adaptable Load Cables along with the Load. They are better for application connection being the interface 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 connecting way is: First Put the Y-type terminal wire into Load terminal from the bottom of the load terminal, and let Y-type terminal touch the metal post of the load terminal tightly. Then, turn the banana binding socket of the Load terminal for connection by your hands, and finally use a tailor-made spanner to make the connection tightly. Figure 2-5 shows the Load connection with the tailor-made spanner.

⚠WARNING Each terminal with banana binding socket can easily use the banana plug to make load connection. It is the other way for load connection. But normally the banana plug can carry only 20 or 10 Amps at most. Before you use the banana plugs for connections, you must check the maximum current rating of the banana plugs and the wire. The connection with the banana plug isn't fixed in the banana binding socket tightly. So, when the output voltage of the power supply (UUT) is equal to or over 70VDC, to prevent accidental contact with hazardous voltage, the banana plugging connection can't be used.

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



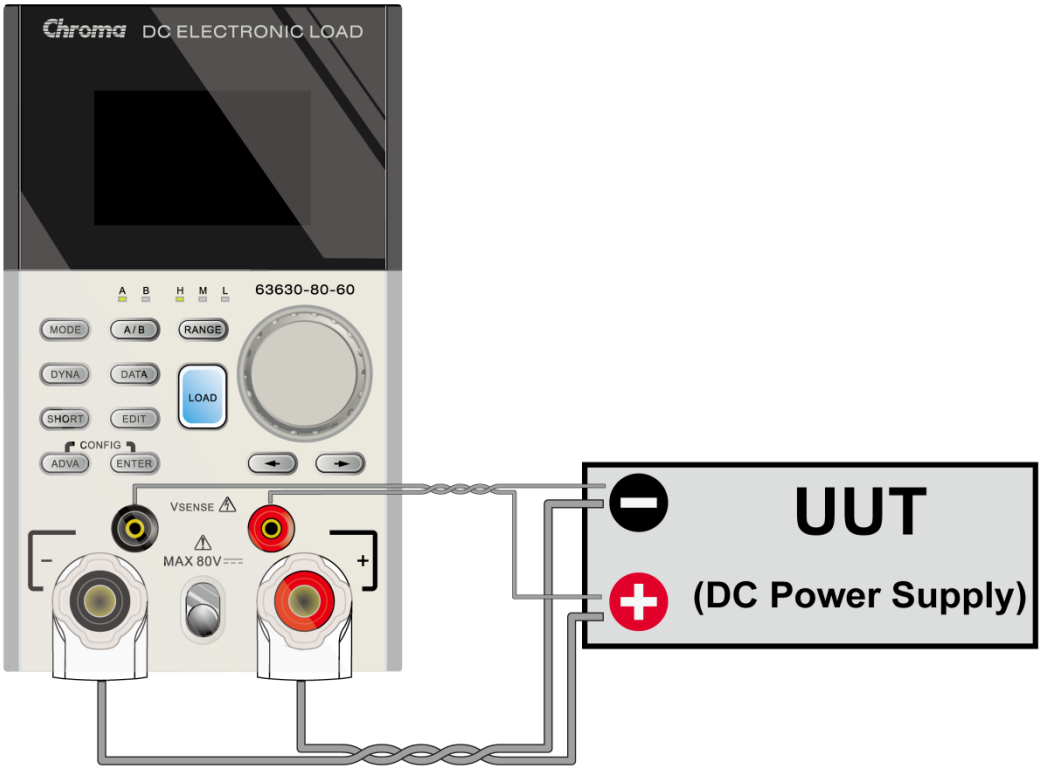
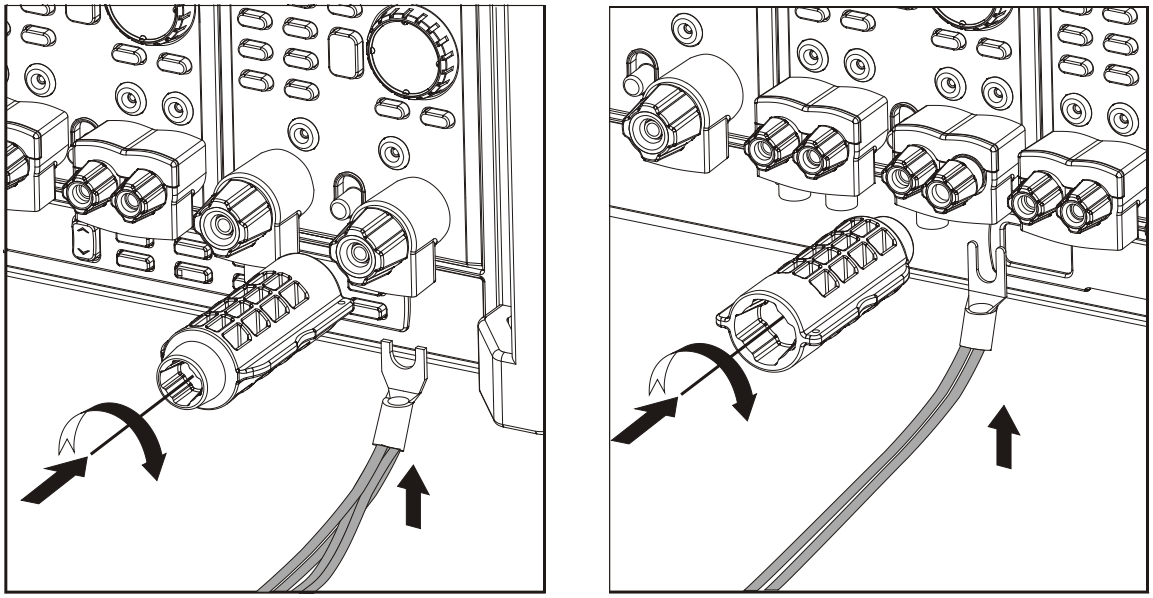


Figure 2-4 Load & Remote Sensing Connection



A. Single Channel Module B. Dual Channel Module

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

2.6.2 Remote Sensing Connections

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

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

Notice Due the nature of load, the associate 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 measurement is required.
2. Use the load UUT Vsense or Local terminal to do voltage measurement. Connect the negative ends is suggested 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.

2.6.3 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 example, if two modules are connected in parallel, one is programmed 10A, and another is 15A, the total current drawn from the source is 25A. Restriction on number of parallel modules depends only on total modules available in the multi-mainframe environment described in the next section.

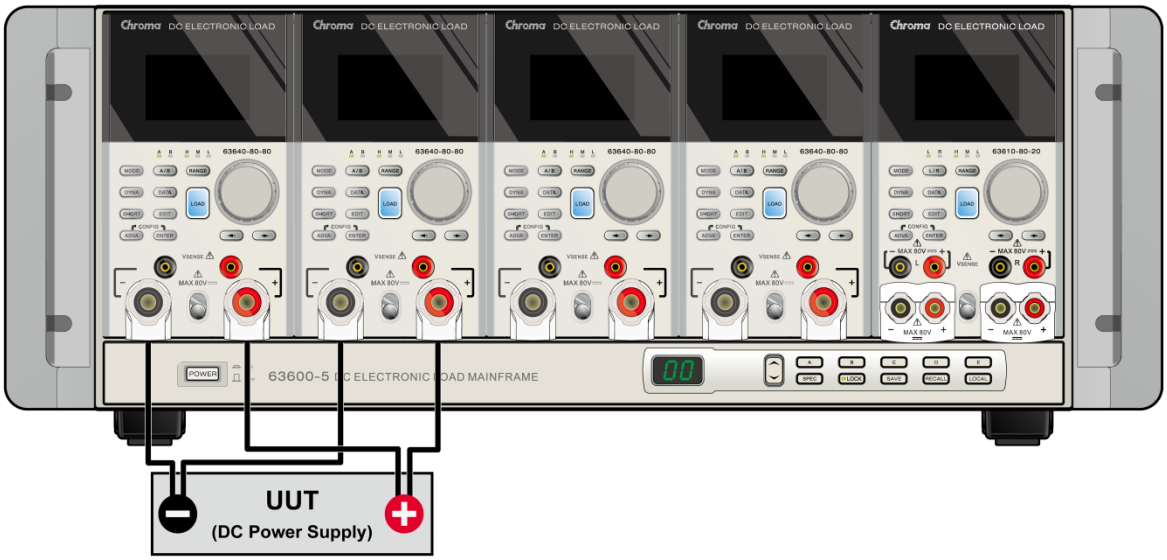


Figure 2-6 Parallel Connection

2.6.4 Multi-Mainframe Connections

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

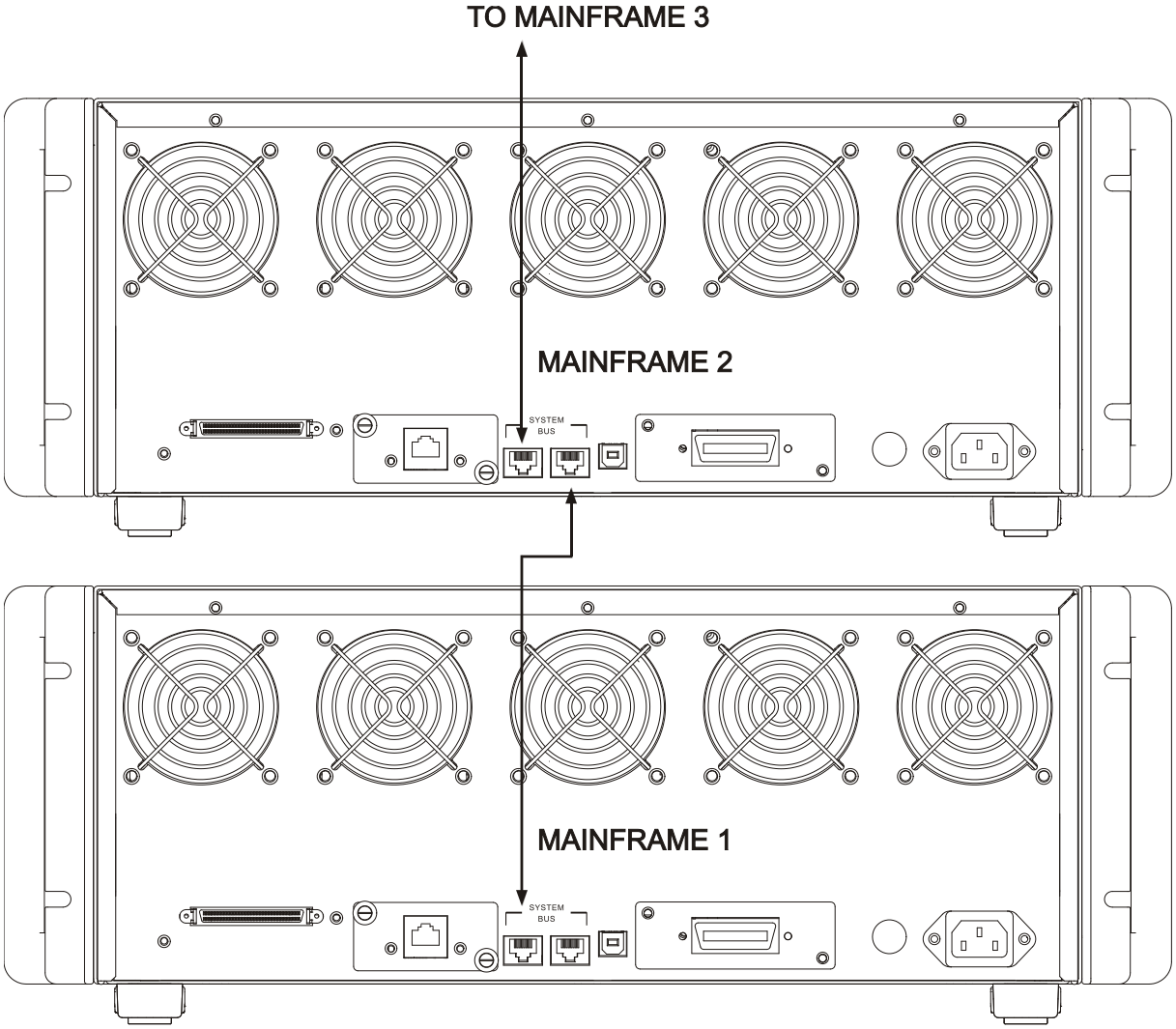


Figure 2-7 Multi-Mainframe Connections Modes

2.7 Remote Control Connection

The remote operation of Load can be done through GPIB, Ethernet, or USB interface. These connectors on the rear panel connect the Load to the controller or computer. The GPIB and Ethernet interface of the electronic load is optional. Connect the Remote Controller to the Electronic Load before powering it on. If you have not done this, Load will shut down, or the fuse for remote controller in Mainframe will be broken.

2.8 GPIB Card Setup

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

2.9 Ethernet Card Setup

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

3. Operation Overview

3.1 Introduction

Chroma 63600-5, 63601-5 multiple electronic load mainframes are suitable for design, manufacturing, testing and quality assurance for electronic products. The Mainframe contains five slots of load modules. Each Load module occupies one slot depending on the power rating of the module.

The Mainframe 63600-5, 63601-5 can dissipate up to 2,000 watts when it is full loaded. It contains 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 you to control and read back the current, voltage and status. The SYNC function on the Mainframe synchronizes each module when the module current/ voltage level changes. The Save/Recall feature allows you to save up to 100 files, 10 programs, and one default setting. All of them can be saved in module EEPROM for future use.

Notice The Model 63601-5 only provides commands for save and recall functions with no support of 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)…etc. An individual module may have one or two channels. Each of them has its own channel number with its own input connectors, and can be turned on/off or short-circuited independently. If your application requires a greater power or current capacity than one module can provide, you have to connect load modules in parallel in CC, CR, or CP mode.

Each load module can be controlled any 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 specification of a UUT including V and I for later GO/NG check. In addition, the real time measurement bar on the VFD display indicates the degree of deviation from specification and guides the users in adjusting to fulfill spec.

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 characters 7-segment LED display, and keypads.

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

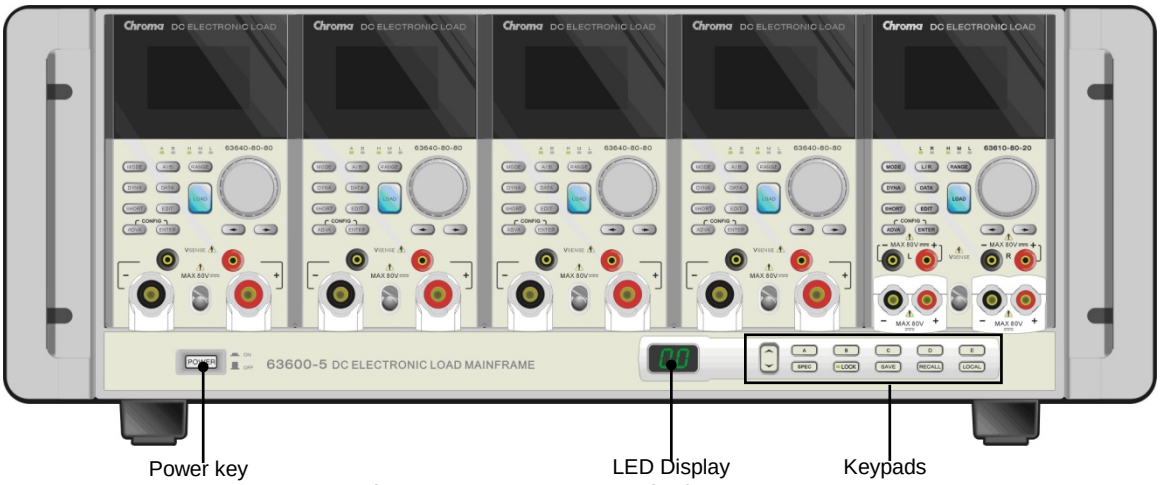


Figure 3-1 Front Panel of 63600-5

Figure 3-2 Front Panel of 63601-5

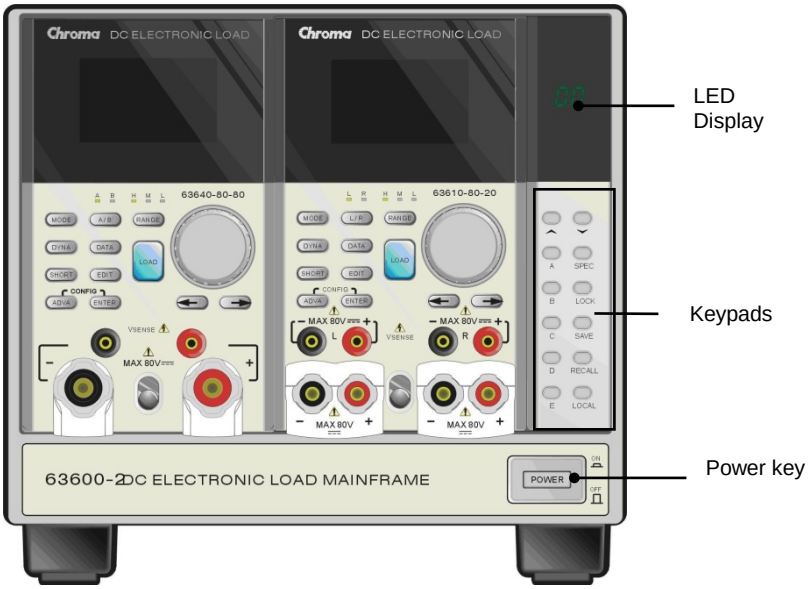


Figure 3-3 Front Panel of 63600-2

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 holes of the fan cooling.

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

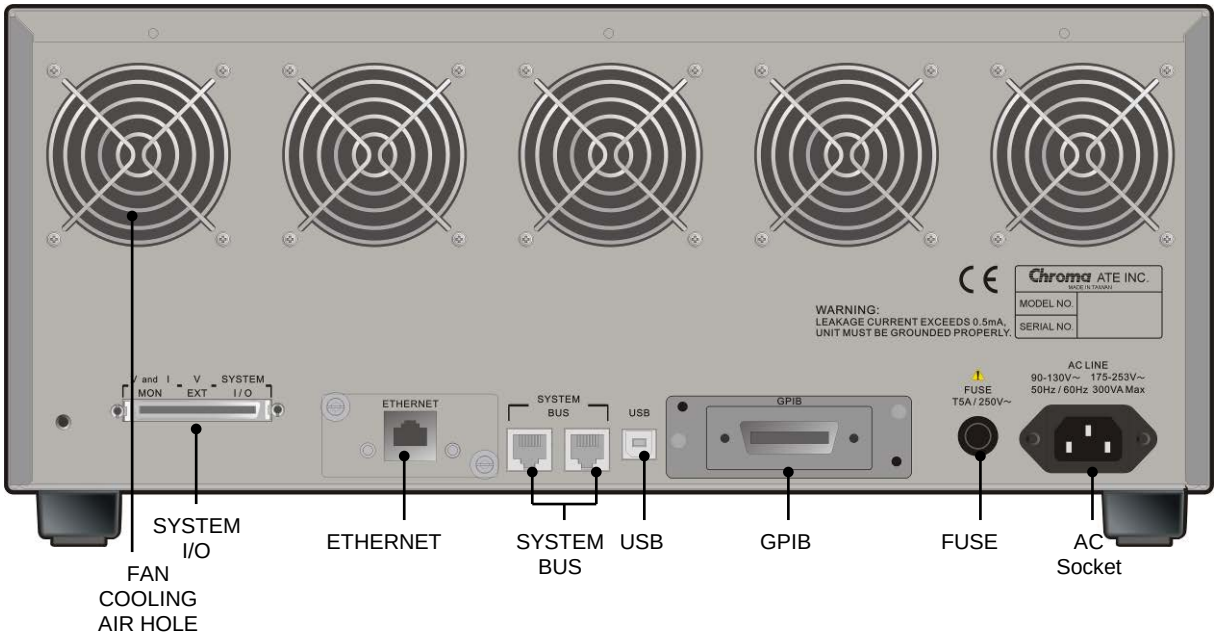


Figure 3-5 Rear Panel of 63600-5

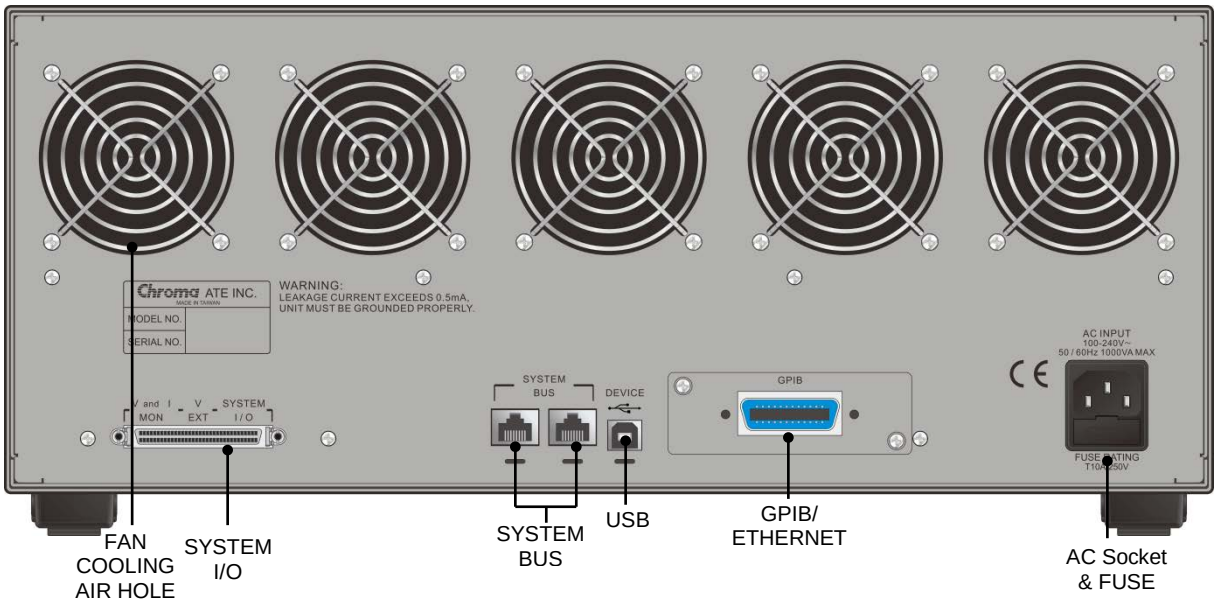


Figure 3-6 Rear Panel of 63601-5

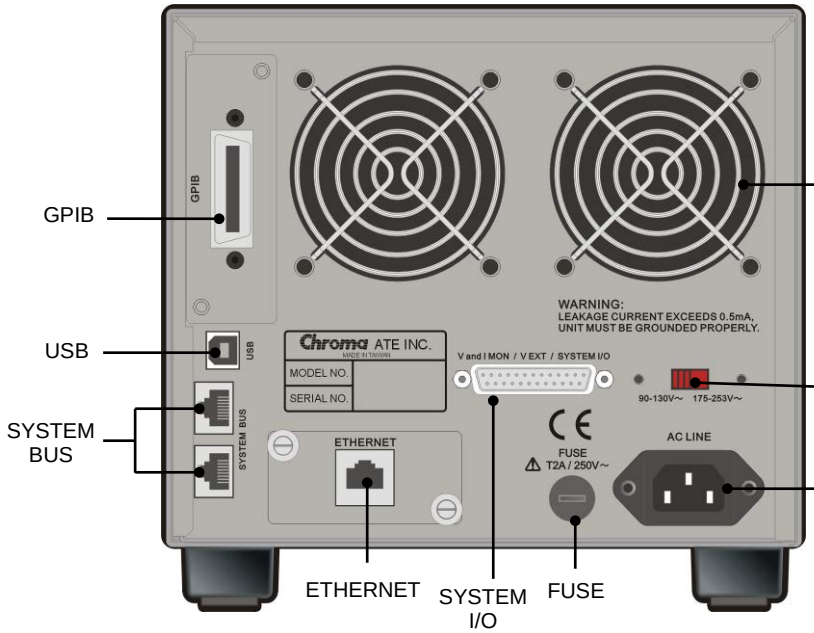


Figure 3-7 Rear Panel of 63600-2

Figure 3-8 Rear Panel of 63600-1

Table 3-1 Definition for Rear Panel Connectors on the Mainframe

Item	Description
1	*GPIB Interface*: A GPIB interface for connecting remote controller using a computer.
2	*Ethernet Interface*: An Ethernet interface for connecting remote controller using a computer.
3	*USB Interface*: An USB interface for connecting remote controller using a computer.
4	*System Bus Interface*: Connectors to enable multi-mainframe synchronous operation, with USB/Ethernet/GPIB/MANUAL control. A System Bus port also for connecting remote controller.
5	*System I/O*: Connector with 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 holes with metal fan guard on the rear of the mainframe for air flow. Fan is on the module 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 module when Load is used in bench test applications. Remote control goes into effect as soon as the Mainframe receives a command via GPIB / Ethernet / USB / System Bus interface. When the 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. You can return to local control by pressing **LOCAL** key.

Most of the functions that perform remotely can be done locally too at the Load Module front panel. The keypads on the Mainframe can perform simple functions like specific setting, data lock operation, save/recall setting.

Details of 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 you press MODE key to program a mode, the module will change to a new mode. In change of modes the module's input is momentarily disabled before a new mode is enabled. This ensures the minimum overshoots during 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. But, if there is no upper and lower limit that would cause an error. The Load automatically selects data, which is rescaled from the programmed value, truncates and checks high, low boundary before fitting 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 boundary. An error will occur when the data is over the maximum or minimum value.

3.5.1 Constant Current Mode

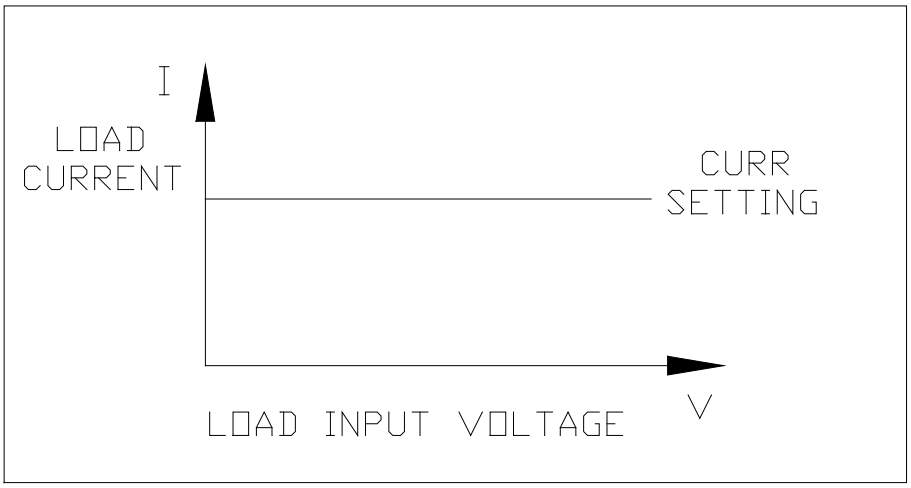


Figure 3-9 Constant Current Mode

In CC mode, the Load will sink a 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 setting. If any value is over the maximum of low range, you must select the middle range. When any value is over the maximum of middle range, you must select the high range. To change the range, press the RANGE key few times until the LED range indicator is active at you want to select.

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

Static Load Mode

In CC mode two operation modes Static load and Dynamic load are available for selection.

Static function checks the stability of output voltage from a power supply. In some modules (single channel module) there are two current levels (A or B) for static function. Both A and B states use the same range. You can program the current loading to two different levels, A and B, and then switches manually between two programmed states A and B using the A/B key on the module's keypad. Slew rate determines the rate at which Load level changes from one load level state to another. Figure 3-10 shows the current level of load module after pressing A/B key.

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

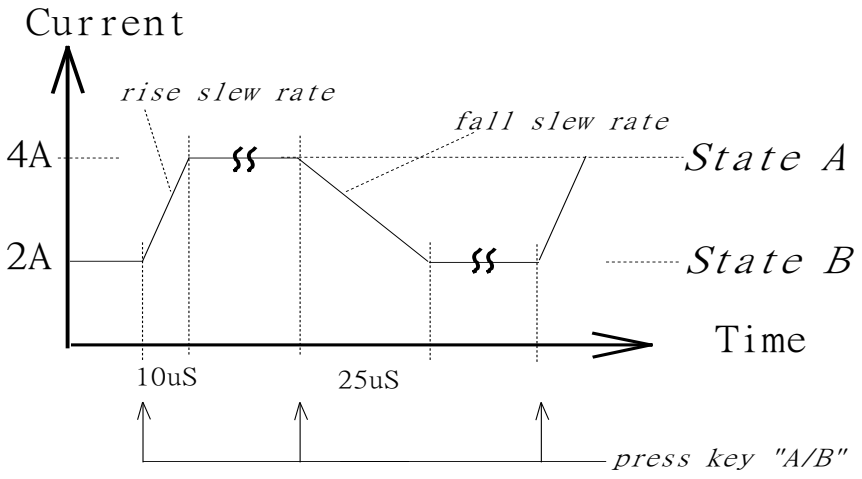


Figure 3-10 Load Level after Pressing A/B Key

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 offers 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 your 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

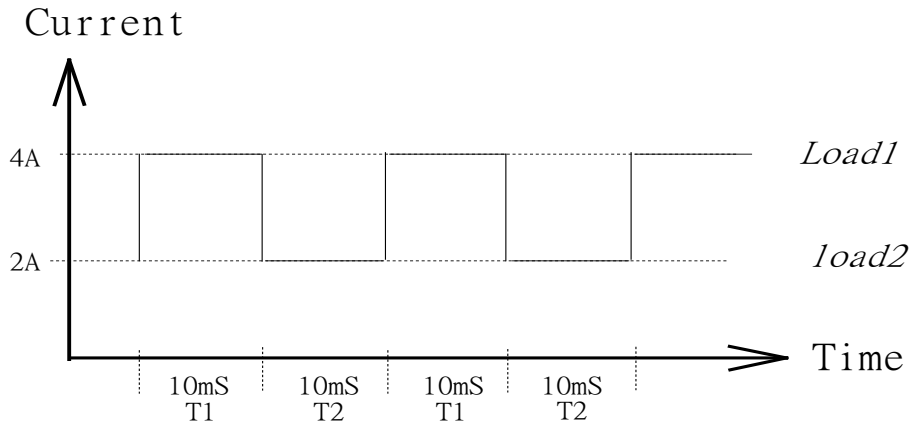


Figure 3-11 Dynamic Current Waveform

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

Slew Rate (Rise, Fall A/μs or mA/μs)

Slew rate determines the rate at which the current input of a module change to a newly programmed value. There are two slew rate values, which are 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 at low voltage measurements. If the value is over the maximum of low range, you must select the middle range. When the value is over the maximum of middle range, you must select the high range. The CC mode voltage range selection is in configuration setting.

Repeat times (times)

The Load provides a unique simulation capability, which allows users to set the number of the period times. When the times is set a limited period times, the load is automatically off till the period time is over. If you want to continue the load with unlimited times, just to set the value to be zero.

Dynamic Load Frequency Sweep Mode

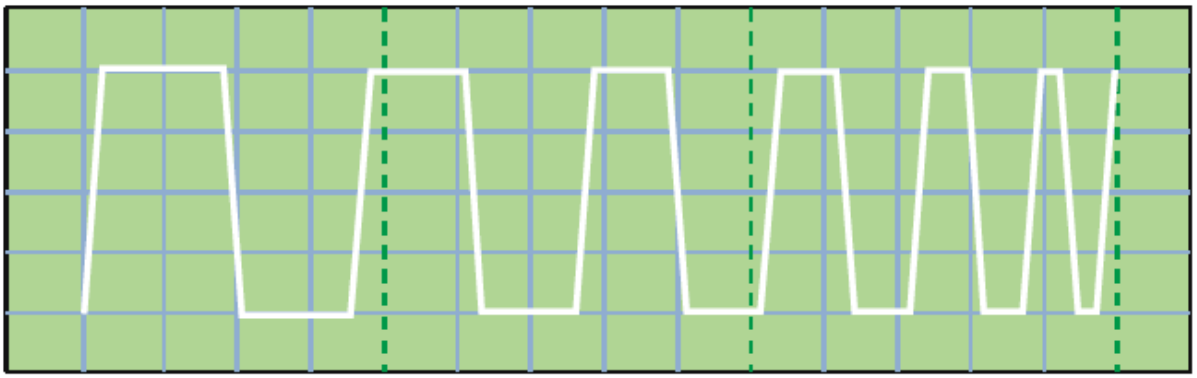


Figure 3-12 CC dynamic Frequency Sweep Current Waveform

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

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

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

The setting range of the Frequencies is from 0.01Hz to 50kHz.

Dwell time (s)

Dwell time is the elapse time of each setting step frequencies from start frequency to End frequency. The setting range of the Dwell time is from 1ms to 100s.

Duty (%)

The duty in percentage of Load1 is in one dynamic loading cycle, and it is expressed by %. 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

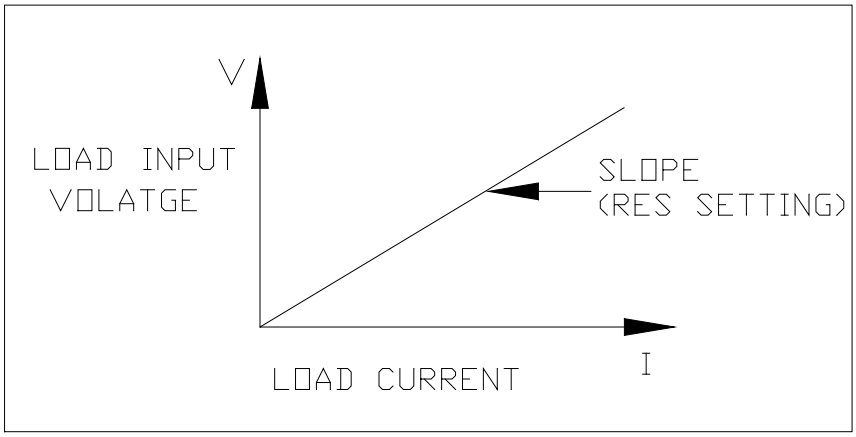


Figure 3-13 Constant Resistance Mode

In CR mode, the Load will sink a current linearly proportional to the input voltage in accordance with the programmed resistance. This mode is operated under the F/W calculation. That is, take the measured V data, divide the resistance setting 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 400us. 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.

Voltage Ranges (Low, Middle, High)

Resistance can be programmed in any of low, middle, or high range. The low range is used for input voltage in low voltage range. The middle range is used for input voltage in middle voltage range while the high range is for input voltage over middle voltage range. The current range in CR mode is high range.

If input voltage is over the maximum of low range, you must select the middle range. When input voltage is over the maximum of middle range, you must select the high range. To change the range, press the RANGE key few times until the LED range indicator is active at you want to select. In some modules (single channel module) there are two resistance levels (A or B) for CR function. Both A and B states use the same range. You can select state A or state B through the A/B key on the module's keypad. Slew rate determines the rate at which 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. When doing low voltage and large current testing, the load voltage during loading needs to be larger than 1.8V to avoid loading error.

3.5.3 Constant Voltage Mode

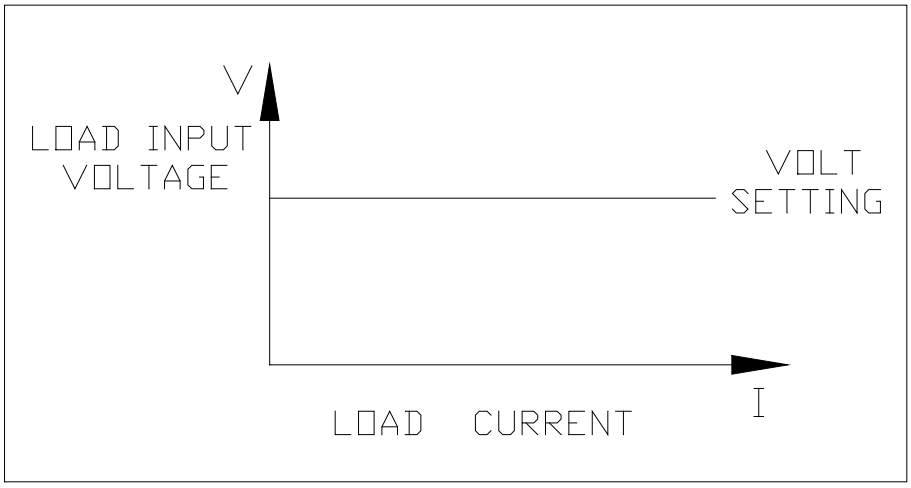


Figure 3-14 Constant Voltage Mode

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. 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.

Voltage can be programmed in any of low range, middle, or high range by the RANGE key. The low range is used for input voltage in low voltage range. The middle range is used for input voltage in middle voltage range while the high range is for the input voltage over middle voltage range.

In some modules (single channel module), there are two voltage levels (A or B) for CV function. You can select state A or state B using A/B key. Both A and B states use the same range.

Current Range (High)

The current range in CV mode is high range.

3.5.4 Constant Power Mode

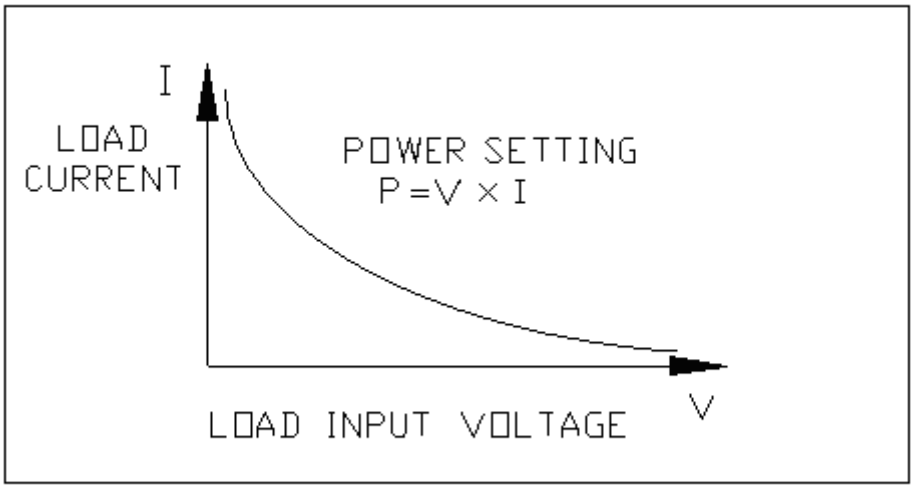


Figure 3-15 Constant Power Mode

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 any of low range, 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. You can select CPLA or CPLB using A/B key. Slew rate determines the rate that the load level changes from one state to another.

3.5.5 Constant Impedance Mode

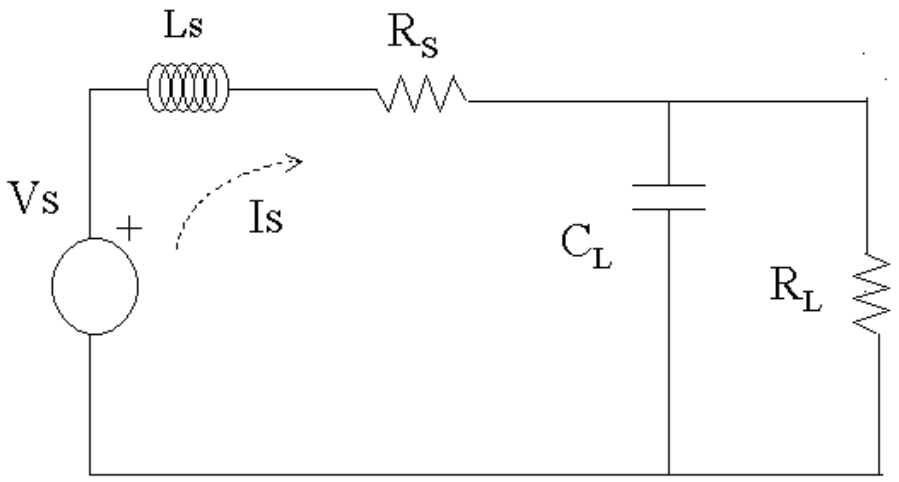


Figure 3-16 Constant Impedance Mode

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 multiple electronic load mainframes can have at most 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 module measures current and voltage of a UUT. The sampling rate is about 2μs. Voltage and current measurements are performed with a 16-bit resolution of full scale ratings.

3.8 Slew Rate & 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, or control 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 the 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 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 transition time is from 10μs in the CC mode and CC dynamic mode slew rate setting.

Notice In order to prevent the voltage transient of UUT from damaging the Load, the electronic short function is not available in each mode for Low and Middle current range.

3.9 Start/Stop Sink Current

To simulate the transient characteristics of load to UUT, the critical problems are when and how the Load starts sinking current from UUT. You may set the conducting voltage Von to solve the problems. The Load will start or stop sinking current when the UUT output voltage reaches the Von voltage. You can start sinking current when the load is ON and the input voltage of the module is over Von voltage, but stop sinking when load is OFF or the input voltage is below 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. Latch means that when voltage is over Von voltage, Load will start sinking current continuously in spite of input voltage drop is below Von voltage. Non-latch means that when input voltage is below Von voltage, Load will stop sinking current. The Von voltage and its operation mode are set in configuration.

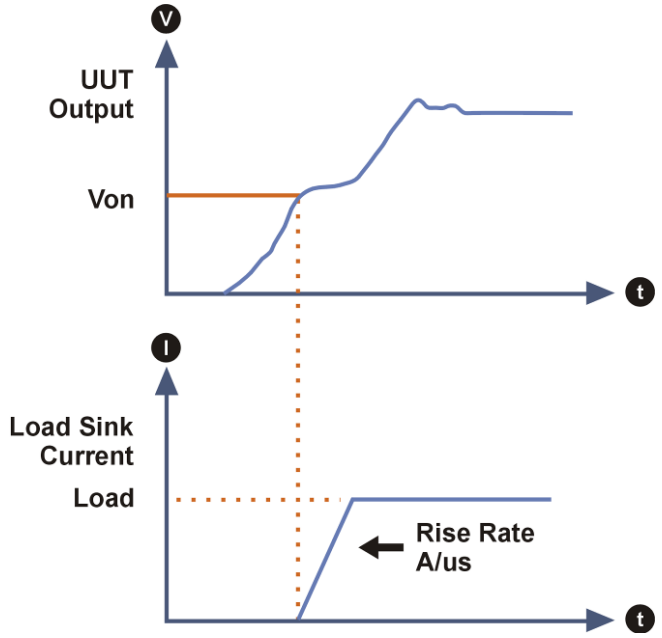


Figure 3-17 Start Sinking Current (Von Non-Latch)

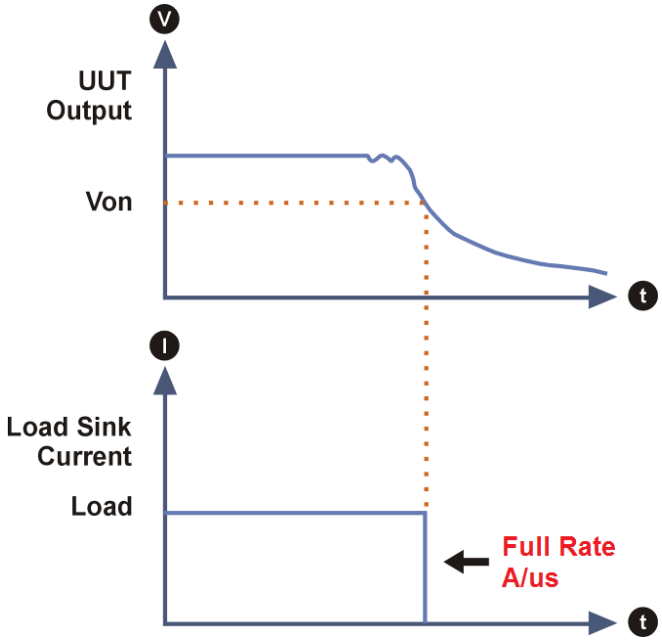


Figure 3-18 Stop Sinking Current (Von Non-Latch)

In the battery discharge timing measuring mode, you may set the conducting voltage Voff to avoid repeatedly start sinking and stop sinking current when the UUT output voltage is repeatedly up and down near the Von voltage.

When you set the conducting voltage Voff, 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. Then, the load is OFF. It will not sink current when the UUT output voltage reaches the Von voltage again, until you turn it on.

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

Notice The delay time spec for Von is 300µs.

3.10 Short On/Off

Load module can simulate a short circuit at input by setting the load on with full-scale current. The short circuit can be on/off from the front panel or via remote control. There are two operations for SHORT key on the front panel. One is toggled on/off, and the other is controlled by key. They are selected in configuration. The SHORT key will be enabled only when Load is ON.

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

The actual value of electronic short depends on the limit is 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 Load input will return to the previous programmed values when the short circuit is turned off.

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

3.11 Digitizing Function

To record the transient voltage and current waveforms, the 63600 series offer a digitizing function for recording the transient waveforms. It is very convenient to record the information via this function.

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

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

```
SAMPLING_TIME
              : 40.000ms
```

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

```
SAMPLING_POINT
              : 4096
```

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

TRIG_SOURCE : LOAD ON

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

TRIG_ POINT : 2000

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

To leave out of the Digitizing Function edit page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration

When Setting the Configuration is over, to leave out of the page of system configuration, you need to press ADVA and ENTER simultaneously to quit the Setting page of system configuration.

3.12 Timing Measurement Function

The Load includes unique timing function allowing precise time measurements in the range of 0s to 100,000s. This feature allows users to set the final voltage & timeout value for battery discharge testing and other similar applications.

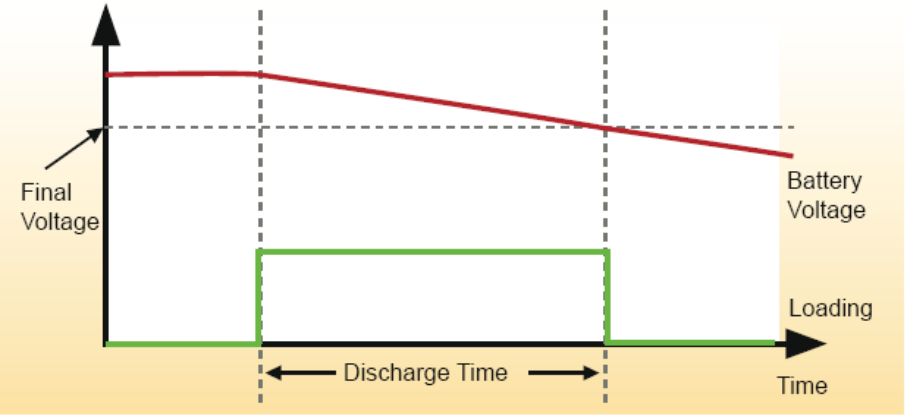


Figure 3-19 Timing Measurement Function

Press ADVA key to select the timing measurement operation. In timing measurement function, the Load will measure the duration from the load on to the UUT output voltage equal to the setting trigger voltage.

The Load allow user to specify measuring 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 sink current and finish the operation after the timing measurement is taken without pressing the LOAD key.

CAUTION For battery discharge test, to protect the Electronic Load from damage, please refer to Appendix A Precautions for Loading Battery.

3.13 Sine Wave Dynamic

If the load has a unique sine wave loading current that allows the user to set the loading current bias (I_DC), the loading sine wave (I_AC) and sine wave frequency (Frequency). The lowest point of sine wave cannot be smaller than 0 ampere. As Figure 3-20 shows Ch1 is the actual loading current waveform and Ch2 is the voltage waveform of the UUT (AC component.)

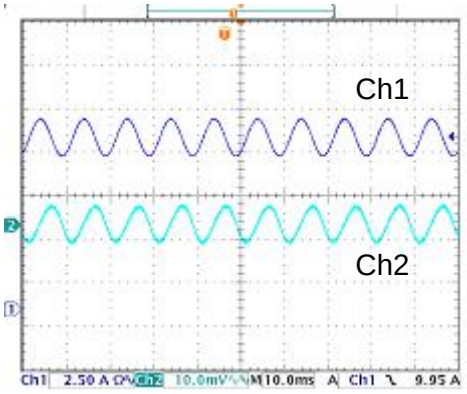


Figure 3-20

The dynamic current loading bandwidth varies with the load designed on the market and the response speed of loading slow rate is different 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 result shows 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. It will make the test more perfect.

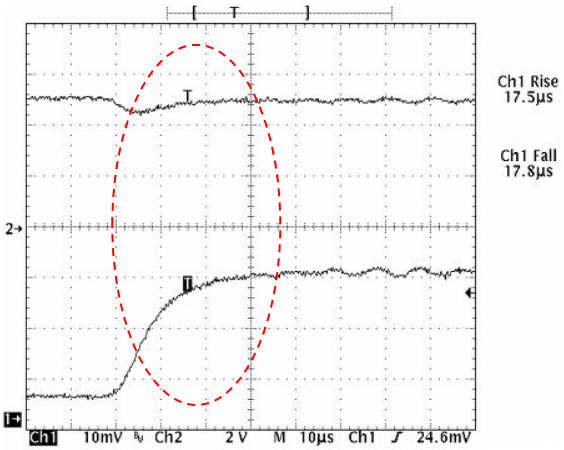


Figure 3-21 Load of A Brand

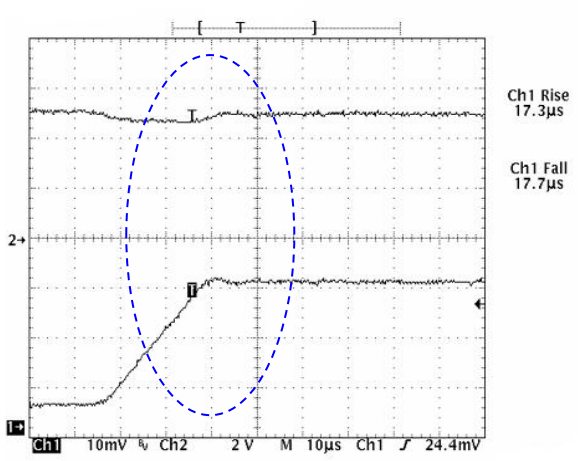


Figure 3-22 Load of B Brand

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 Program Sequences Function feature is very powerful. The electronic load has 10 programs that can set up 100 sequences maximum. For instance, when program 1 is set up with 5 sequences and program 2 is set up with 8 sequences, the rest programs from 3 to 10 can set up the remaining 87 sequences. Please 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 module, or the 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 to inform you till the protection status is reset. When any of the protections occurs, 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 till they are reset. The Load module will appear 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 current more 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 till they are reset. The Load module will appear 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 till they are reset. The Load module will appear OPP when overpower protection occurs.

- Over Temperature Protection
  Each Load has an over temperature protection circuit, which will turn off the load if 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 till they are reset. The Load module will appear 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 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" once the loading current caused the voltage to change exceedingly beyond the condition allowed.

All of the above protection features will latch when they are tripped. When any of the protections occurs the module will turn off the load input, and beep till you remove the condition and reset the protection by pressing 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 – terminal potential.

- LVP

The design of LVP is mainly to prevent the UUT from sudden voltage drop to 0V and rise again when the Von point is set to 0V or in current loading state at “LOAD ON” as it could cause the voltage or current to overshoot. Also it 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 loading mode, it does not perform current loading until the external voltage is larger 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 way is to prevent the overshoot to damage the UUT and Electronic Load.

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

For example,

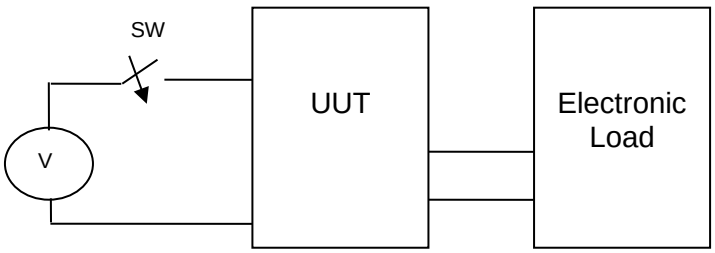


Figure 3-23 Power, UUT & Electronic Load Connecting Diagram

(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.

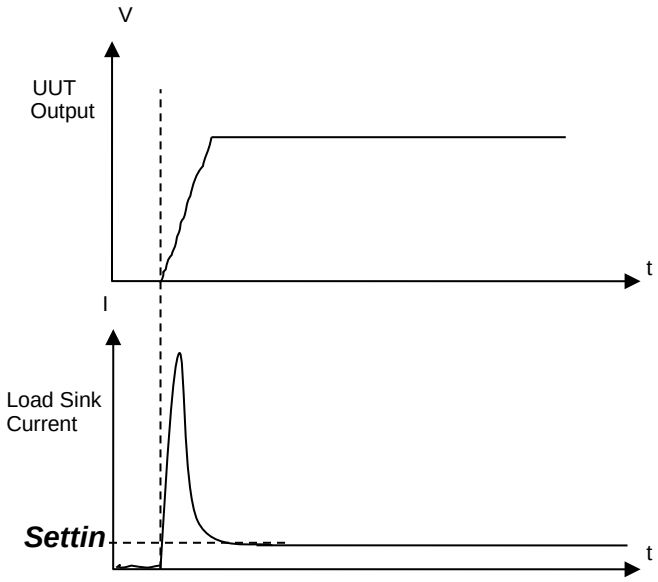


Figure 3-24 When Von Point sets to 0V without Protection

(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 .

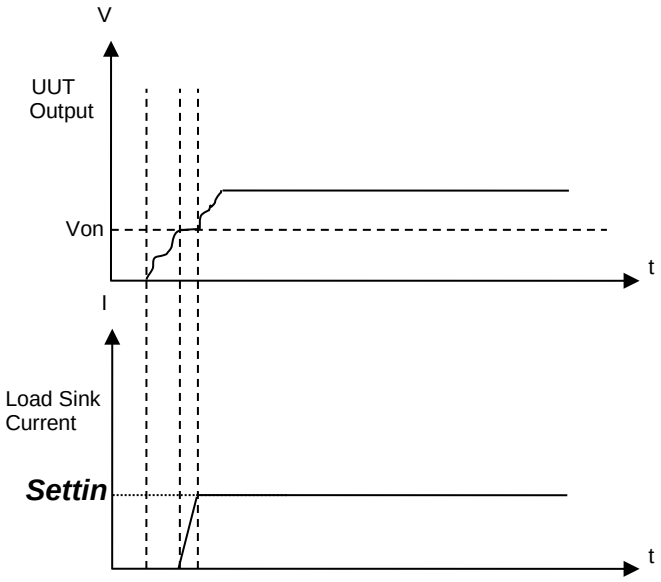


Figure 3-25 When Von Point sets to 0V with Protection

(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.

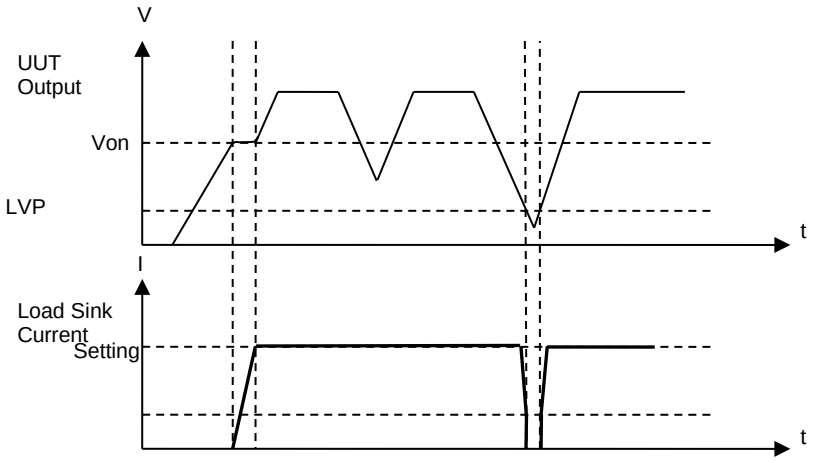


Figure 3-26 When Von Point is not set to 0V with Protection

(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.

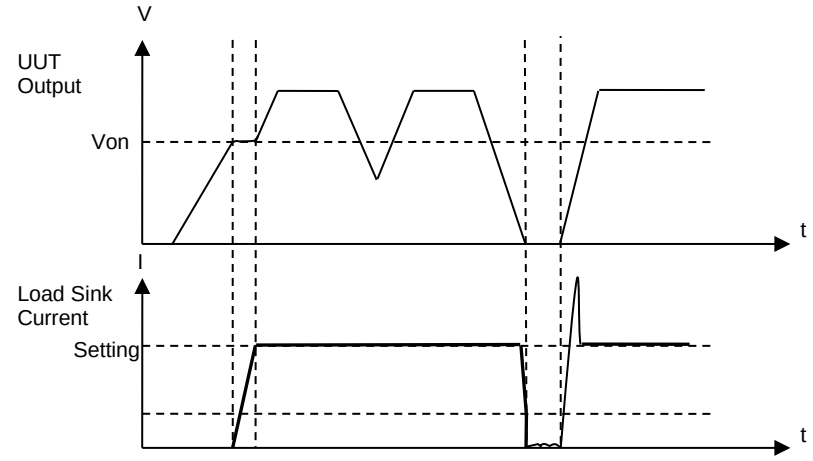


Figure 3-27 When Von Point is not set to 0V without Protection

3.18 Save/Recall Setting

The Electronic Load setting for all channels can be saved and recalled for various test setup use. In the Save file 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. Moreover, there is an addition file for power on setting file which the contents are the same as File 0 ~ 99. Once there is a Load on or it is exited from Configure screen 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 file user specified but also save them to the Power On file. To recall the saved settings (file 00~99), press ▲or ▼ key to adjust the file number (file

00~99) set by the 7-segament 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 & 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 local panel in details. The descriptions include: Mainframe panel control, Module panel control and indicators.

In order to use the front panel keys to control the electronic load, local operation must be in effect. Immediately after the power is applied, local operation will be in effect. When local operation is in effect, you can operate each module independently, and use the display with 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 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 specification of a UUT including V, I, Watt for later GO/NG check. In addition, the real time measurement bar on the VFD display indicates the degree of deviation from spec. and guides the users in adjusting to fulfill spec.

This chapter covers the interpretation of the front and rear panel description, 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 you edit the setting, the display will blink to let you know 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 & Indicators

4.2.1 Front Panel Keys & Indicators of the Mainframe

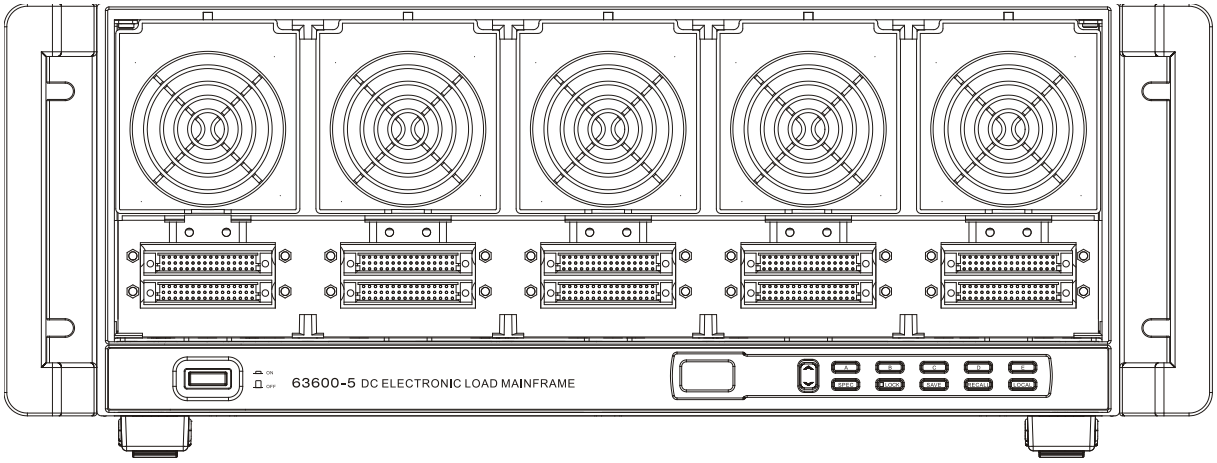


Figure 4-1 Front Panel of the 63600-5 Mainframe

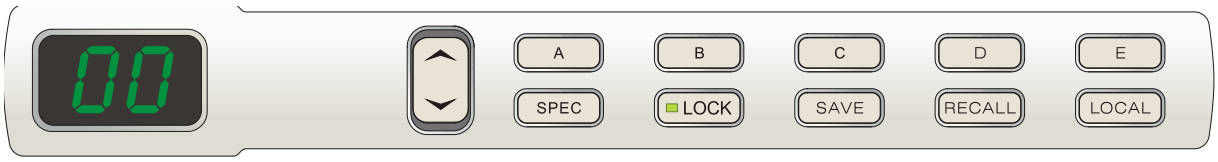


Figure 4-2 Front Panel Keys and Indicators of the 63600-5 Mainframe

- Front Panel Keys and Indicators (mainframe)

Table 4-1 Description of Front Panel for the Mainframe

Item	Name	Description
1	Spec key	*SPEC* key enables the SPEC function for all channel's GO/NG inspection. PS: The electronic load allows the user to program specification at configuration for Voltage in CC/CR/CP/CZ/DYNA/SWP mode, and Current in CC/CR/CV/CP mode, and Power in CC/CR/CV/CP.
2	Lock key	This system provides data lock feature in order that the stored data will only be erasable by authorized user. When data lock is enabled, any data enter is prohibited and this LED indicator lights up when any data key is pressed. To change lock or unlock state, the user must press and hold this key for at least 2 seconds.
3	Save key	To save the entire present mode settings of all channels in the specified files (00 to 99). Saving DEFAULT is to save 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 lose when ac power is cycled. The memory channel indicated on the LED.
4	Recall key	To recall the saved settings from EEPROM, and all channel's settings from specified files (00 to 99). The memory channel indicated on the LED
5	Local key	*Local* key can recover local control of each module when the Load module is running under remote control mode.

6	Memory channel indicator	A total of 100 sets of memory are built in the Load module for storage of programmed setup. The user can save into (or recall from) any memory channel from 00 to 99, a pre-programmed loading setup.
7	Up and Down keys	*Up and Down* keys enables the user change 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 can 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 Load module, single channel module panel and dual channel module panel. They are almost the same, but only different from one key and the amount of the connectors.

The single channel module means there is one channel in one module. The dual channel module means there are 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

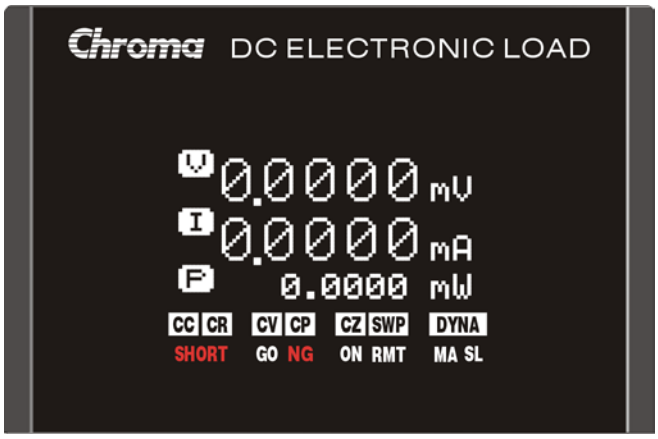


Figure 4-4 VFD Display

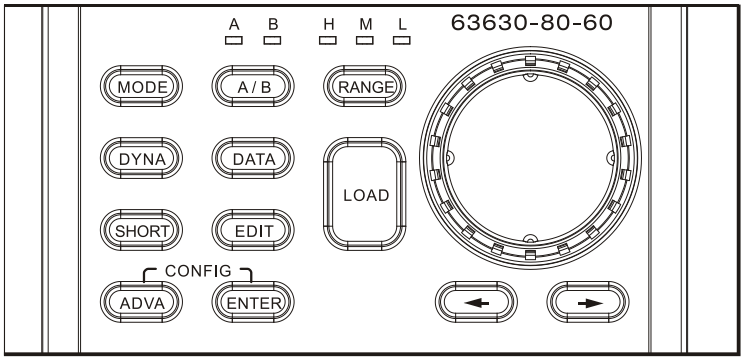
Figure 4-5 Symbols of VFD Display

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

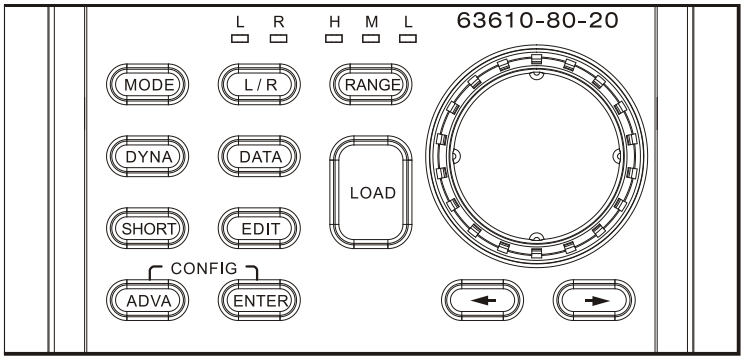
Zone	Symbol	Description
1	CC CR CV CP	Indicates acting mode is at one of the followings: constant current (CC), constant resistance (CR), constant voltage (CV), or constant power (CP).
2	CZ	Indicates acting mode of impedance load simulation.
3	SWP	Indicates the Electronic Load is in Frequency sweep in operation.
4	DYNA	Indicates the Electronic Load is in Dynamic load operation.
5	SHORT	Indicates the Electronic Load is in short circuit simulation for UUT to test short protection.
6	GO	This indicates the SPEC inspection for GO (PASS).
7	NG	This indicates the SPEC inspection for NG (FAIL).
8	ON	Indicates the load module is in load ON status.
9	RMT	Indicates the 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 for each of the module panel. Only one key is different from the keypads, which is A/B key in the single channel module panel and L/R key in the dual channel module panel. Figure 4-6 shows the front panel Keys of the Module.



A. Single Channel Module



B. Dual Channel Module

Figure 4-6 Front Panel Keys of the Module

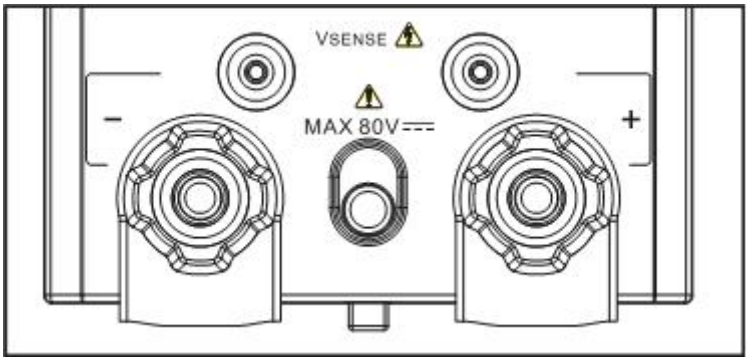
Table 4-3 Definition for Front Panel Keys on the Module

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. (Press MODE repeatedly will switch the mode in the sequence of CC → CR → CV →CP →CZ accordingly 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 method of DYNAMIC + COUNT and FREQUENCY SWEEP. (Press DYNA repeatedly will switch the function in the sequence of Dynamic → F_Sweep→Static accordingly for users to edit and test.) The LED lit when users enable this function.
A/B only exists in single channel module	The system of 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.

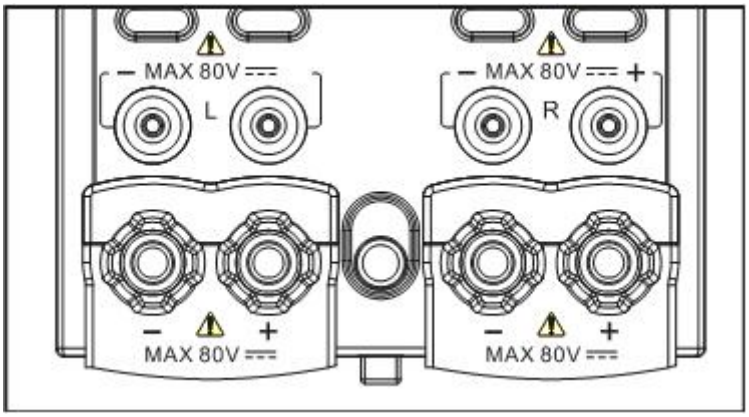
L/R only exists in dual channel module	This key is used to select the left channel or right channel directly for the dual channel module.
EDIT	This key is used to select the system operation mode for EDIT or changed the next parameter when press EDIT key again.
RANGE	This system provides HIGH, MIDDLE or LOW loading range for data input. The low range offers a better accuracy than that of 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. (Press ADVA repeatedly will switch the function in the sequence of TIMING → SINE WAVE DYNA→ OCP TEST → AUTO SEQUENCES accordingly 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 is 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. Or, 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 for 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

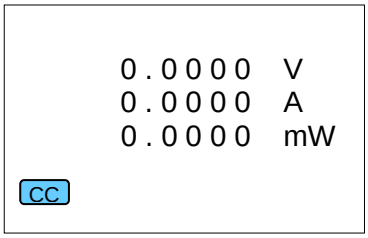
The L/R key is used to select one of the channels for a dual channel module, like the model Chroma 63610-80-20. To edit the channel settings, you must select a channel first. Press the L/R key to select left channel or right channel for the dual channel module, then the LED “L” or LED “R” above the key L/R lights up. If the load model is a single channel module, the L/R key does not exist, it is instead of A/B key. The model Chroma 63630-80-60 is a single channel module, so it has the A/B key, without 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. So, when operate in CC mode, press the MODE key until the VFD displays CC mode.



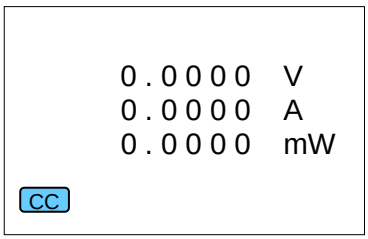
The sequence of mode selection after pressing MODE key is as follows:

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

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

4.4.2 Setting CC Values

When operate in 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 at low range and in Amps at middle range and high range. The slew rate levels are programmed in milliamps/μs at low range and in Amps/μs at middle range and high range. The timings are programmed in millisecond. The setting buffers of six CC modes and ranges are independent. Changing the operation range doesn't affect the settings of other ranges. The following examples show how to set the CC values of Load module for model 63630-80-60.

1. Select Range

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

   Select LOW range, by pressing RANGE key, until the LED "L" above the RANGE key lights up.

   The sequence of range selection after pressing 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 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 ENTER key to confirm.

500.00 mA

   The user may use ◄ or ► key to change the cursor position to different digit of data, then turn the rotary knob to change the value of that digit.

   If the user does not use ◄ or ► key to display the cursor, then 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 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 ENTER key to confirm the setting, and the setting page change to Current Level at the same time.

5. Set the second Current 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 100.00mA, then press ENTER key to confirm.

100.00 mA

6. Review and update the values of the setting parameters

   Review the values of the setting parameters by pressing DATA key. Update them by

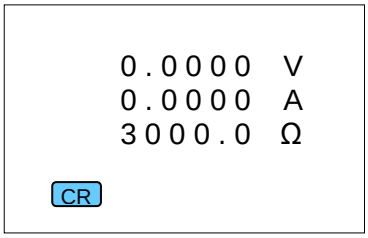
set new value in their setting pages.

After completion of the data edit, ENTER key must be pressed. Otherwise, pressing the DATA key, 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 quit from editing mode. Then, the VFD display will go back to the voltage, current, and watt measurement display mode.

4.4.3 Setting CR Values

When operate in CR mode, the VFD displays CR mode.



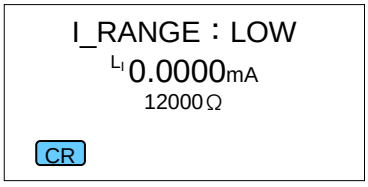
There are three resistance ranges for CR operation: high resistance range, middle resistance range, and low resistance range. The current setting of all resistance ranges can select high, middle or low 3 types of ranges. ALL resistance levels are programmed in ohms (Ω). The following examples show how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

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

   The sequence of range selection after pressing 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 again to set the current parameter as the figure shown below:



   Turn the rotary to select the current range and press ENTER to confirm the selection;

otherwise, the new data won't be written into the internal memory. At last, press EDIT to exit the editing mode and complete the current range setting.

3. Select state A/B for single channel module

   For 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.

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 key to confirm.

2.000 Ω

   The user may use ◄ or ► key to change the cursor position to different digit of data, then turn the rotary knob to change the value of that digit.

   If the user does not use ◄ or ► key 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 then the LED "B" above the key A/B lights up.

   Turn the Rotary knob to change the display value to 1Ω, then press ENTER key to confirm.

1.000 Ω

6. Review and update the values of the setting parameters

   Review the values of the setting parameters by pressing DATA key. Update them by set new value in their setting pages.

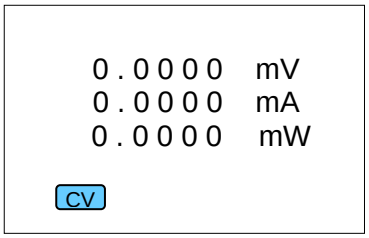
   After completion of the data edit, ENTER key must be pressed. Otherwise, pressing the DATA key, new data will not be written into the internal memory, the previous value for the parameter is kept.

7. Quit from editing mode

   Press EDIT to quit from editing mode. Then, the VFD display will go back to the voltage, current, and resistance display mode.

4.4.4 Setting CV Values

When operate in 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 Load module for model 63630-80-60.

1. Select Range

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

   Select LOW range, by pressing RANGE key, until the LED "L" above the RANGE key lights up.

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

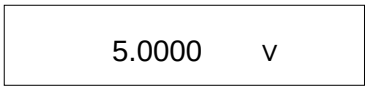
   High range → Middle range → Low range goes back to High range

2. Select state A/B for single channel module

   For 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 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 ENTER key to confirm.

   The user may use ◄ or ► key to change the cursor position to different digit of data, then turn the rotary knob to change the value of that digit.

   If the user does not use ◄ or ► key to display the cursor, then 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 then the LED "B" above the key lights up.

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

6.0000 V

5. Set Current Limit
This function will limit the current sinking of Load to protect the UUT in CV mode. There are two CV modes: VOLT_PSU and CURR_PSU. The default setting of current limit is the maximum Load current.

There are 15,000 discrete steps from 0 to full scale in each range. Press 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

Users may use ← or → key to change the cursor position to different digit of data, and then turn the rotary knob to change the value of that digit.

6. Set Response Speed
There are three response speeds for CV mode (CURR_PSU), fast, normal and slow for different UUTs testing. 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. Then, press ENTER key to select mode and confirm the testing.

RESPONSE : FAST

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

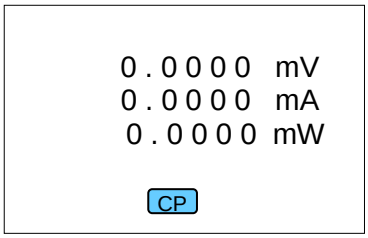
7. Review and update the values of the setting parameters
Review the values of the setting parameters by pressing DATA key. Update them by set new value in their setting pages.

After completion of the data edit, ENTER key must be pressed. Otherwise, pressing the DATA key, 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 quit from editing mode. Then, the VFD display will go back to the voltage, current, and watt display mode.

4.4.5 Setting CP Values

When operate in 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 at low range and in A/μs at middle range and high range.
The following examples show how to set the CP values of Load module for model 63630-80-60.

1. Select Range

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

   Select LOW range, by pressing RANGE key, until the LED "L" above the RANGE key lights up.

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

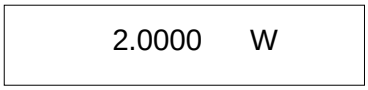
   High range → Middle range → Low range goes back to High range

2. Select state A/B for single channel module

   For 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 ENTER key to confirm.

   The user may use ◄ or ► key to change the cursor position to different digit of data, then turn the rotary knob to change the value of that digit.

   If the user does not use ◄ or ► key to display the cursor, then 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 0.03A/μs, and the VFD displays:

   ```
   _/‾ : 00.030 A/μs
   ```

   Then press 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 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 setting parameters by pressing DATA key. Update them by set new value in their setting pages.

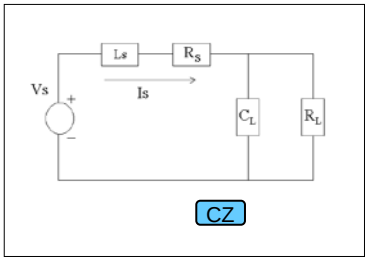
   After completion of the data edit, ENTER key must be pressed. Otherwise, pressing the DATA key, new data will not be written into the internal memory, the previous value for the parameter is kept.

7. Quit from editing mode

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

4.4.6 Setting CZ Values

When operate in 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 of Load module for model 63630-80-60.

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 ENTER key to confirm.

C_L : 2000 μF

   The user may use ◄ or ► key to change the cursor position to different digit of data, then turn the rotary knob to change the value of that digit.

   If the user does not use ◄ or ► key to display the cursor, then 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 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 ENTER key to confirm.

   Rs : 00.15 Ω

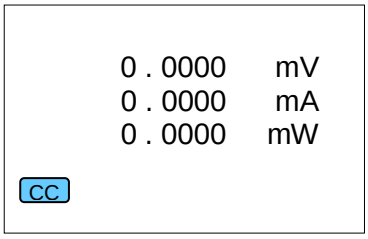
5. Review and update the values of the setting parameters
   Review the values of the setting parameters by pressing DATA key. Update them by set new value in their setting pages.
   After completion of the data edit, ENTER key must be pressed. Otherwise, pressing the DATA key, new data will not be written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

6. Quit from editing mode
   Press EDIT to quit from editing mode. Then, 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 only operation in CC mode. Press the MODE key repeatedly until the VFD displays CC mode.

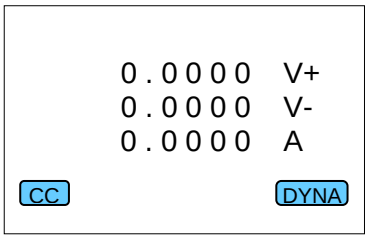


The sequence of mode selection after pressing MODE key is as follows:

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

4.5.2 Select the Operation Mode of Dynamic Load

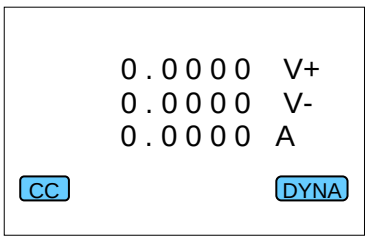
There are two Operation Modes for dynamic load: Dynamic load mode and Dynamic load frequency sweep mode. Press DYNA to select dynamic load, then the LED above the key DYNA lights up, and the VFD displays:



The sequence of mode selection after pressing 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 operate in 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 at low range and in Amps at middle range and high range. The slew rate levels are programmed in mA/μs at low range and in A/μs at middle range and high range. The timings are programmed in millisecond. The setting buffers of six CC Dynamic load modes and ranges are independent. Changing the operation range doesn't affect the settings of other ranges. The following examples show how to set the CC Dynamic load values of Load module for model 63630-80-60.

1. Select Range

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

   Select High range, by pressing RANGE key, until the LED "H" above the RANGE key lights up.

   The sequence of range selection after pressing 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, then press 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, then press ENTER key to confirm. At the same time it changes to setting period T1 for Load1.

The user may use ◄ or ► key to change the cursor position to different digit of data, then turn the rotary knob to change the value of that digit.

If the user does not use ◄ or ► key to display the cursor, then 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 comparison between them as their implied meaning 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 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, then press ENTER key to confirm. At the same time it changes to setting slew rate for rise.

If one of the periods T1 and T2 is larger than 50 ms, full scale switches from low to high, and resolution switches to 1ms automatically. Period range and resolution see following:

	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, then press 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, then press ENTER key to confirm. At the same time it changes to setting Repeat times.

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

5. Set Repeat times
   The VFD displays:

   RT

   Turn the Rotary knob to change the display value to 0 times, then press 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 setting parameters by pressing DATA key. Update them by set new value in their setting pages.

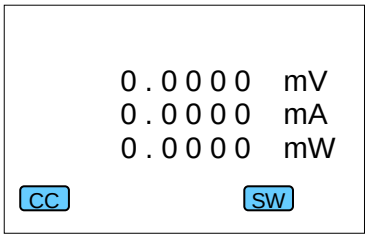
   After completion of the data edit, ENTER key must be pressed. Otherwise, pressing the DATA key, new data will not be written into the internal memory, the previous value for the parameter is kept.

7. Quit from editing mode

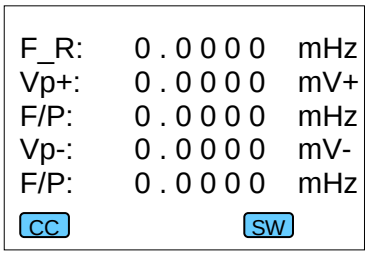
   Press EDIT to quit from editing mode. Then, the VFD display will go back to the voltage, current, and peak plus/minus voltage measurement display mode.

4.5.4 Setting Dynamic Load Frequency Sweep Values

When operate in CC Dynamic load frequency sweep mode, the VFD displays CC Dynamic load frequency sweep mode.



Press DATA key to switch the measurement page as shown below. The F_R means the executing frequency at present, 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 at low range and in Amps at middle range and high range. The slew rate levels are programmed in mA/μs at low range and in A/μs at middle range and high range. The frequencies are programmed in Hz. The Dwell time is in Second. Duty is in %. The following examples show how to set the CC Dynamic load frequency sweep values of Load module for model 63630-80-60.

1. Select Range

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

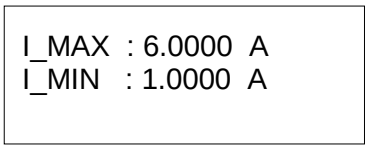
   Select Middle range, by pressing RANGE key, until the LED “M” above the RANGE key lights up.

   The sequence of range selection after pressing 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, then press 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:

   Then, press 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, then press 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, then press 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
```

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

4. Set Dwell time
Dwell time is the elapse time of each setting step frequencies 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
```

Then press 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. Dwell time is the elapse time of each setting step frequencies from start frequency to End frequency. Turn the Rotary knob to change the display value to 50%.
The VFD displays:

```
DUTY    :  50    %
```

Then press 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, then press 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
```

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

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

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

   After completion of the data edit, ENTER key must be pressed. Otherwise, pressing the DATA key, 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 quit from editing mode. Then, 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 advance functions such as Timing Measurement, Sine Wave Dynamic, etc. To use these powerful functions, you must set relevant parameters in accordance with application needs. To set the Advance function you need to press ADVA to enter into the page of Advance function, the VFD displays Advance function.

```
[ 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

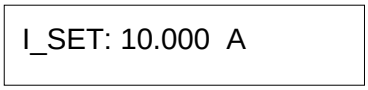
In the page of Advance function, turn the Rotary knob to change the display value to 1, then press ENTER key into the page of Timing Measurement Function, the VFD displays Timing Measurement Function.

```
[ T I M I N G ]
 0 . 0 0 0 0   mV
 0 . 0 0 0 0   mA
```

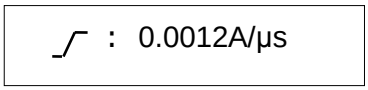
Press the EDIT key to enter into the editing mode. Then, press DATA to select the setting parameter.

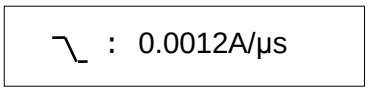
1. ***Select the operation mode***. There are three operation modes for Timing Measurement Function. They are CC, CR and CP modes. Turn the Rotary knob to change the mode until the desired mode is displayed on the VFD. Then, press ENTER key to select mode and confirm the setting.

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, then press ENTER key to confirm.



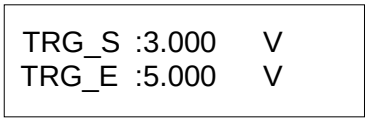
3. ***Set Slew Rate***. Setting the rising and falling slew rate. Turn the Rotary knob to change the display value, then press ENTER key to confirm.



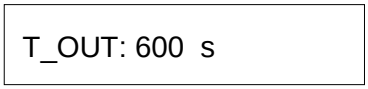


4. ***Set Trigger Mode***. There are three Trigger Modes and they are RISE , FALL and HOLD_UP. Turn the Rotary knob to change the mode until the desired mode is displayed on the VFD. Then, press ENTER key to select mode and confirm the setting.

5. ***Set Trigger Voltage***. Trigger Voltage is the conduction voltage level.
TRG_S: It sets the start trigger voltage level for measurement time.
TRG_E: It sets the end trigger voltage level for measurement time.
The Electronic Load will measure the duration from the load on to the UUT output voltage equal to the setting trigger voltage, and the Load stops sinking current when the UUT output down to reach the voltage. Turn the Rotary knob to change the display value, then press ENTER key to confirm.



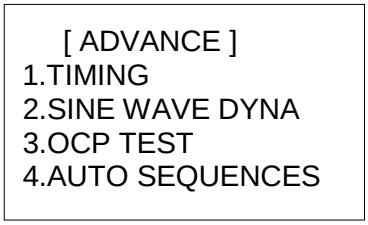
6. ***Set the period of time out***. The Electronic Load will measure the duration from the load on to the UUT output voltage equal to the setting trigger voltage. When the time is already over the period of time out, but the UUT output voltage still isn't achieve to the trigger voltage, the Load will load off and stop counting the timing. Turn the Rotary knob to change the display value, then press ENTER key to confirm.

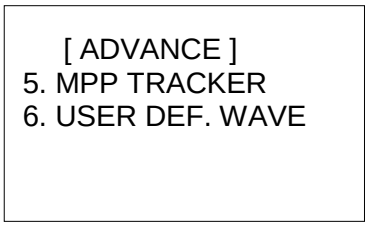


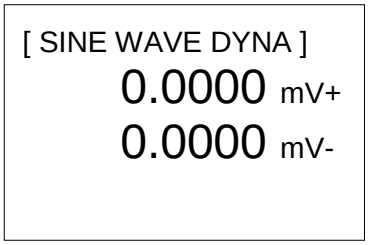
Then the display will go to the first editing page again.

4.6.2 Setup of Sine Wave Dynamic Function

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

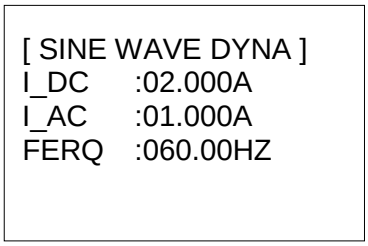






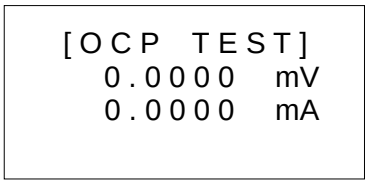
Press DATA key in SINE WAVE DYNA screen can set the parameters required for I_DC, I_AC and FREQ. I_DC is the DC bias current and I_AC is the peak to peak current generated based on the I_DC. The setting range of FREQ is 0.01Hz~20000Hz.

When setting the I_DC and I_AC, beware the minimum current cannot be lower than 0A otherwise the “Out Of Range!!” message will prompt on the panel.

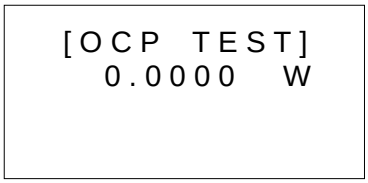


4.6.3 Setup of OCP Test Function

In the page of Advance function, turn the Rotary knob to change the display value to 3, then press ENTER key into the page of OCP Test Function, the VFD displays OCP test Function.

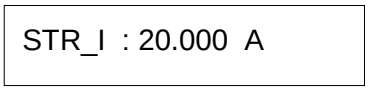


Press DATA key to switch the measurement page.

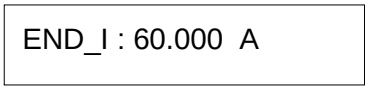


Press the EDIT key to enter into the editing mode. Then, press DATA to select the setting parameter.

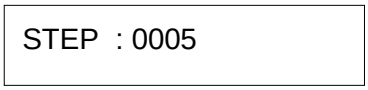
1. ***Set Start Current Level***. Set the initial Current Level. There are 15,000 discrete steps from 0 to full scale in each range. Turn the Rotary knob to change the display value to 20A, then press ENTER key to confirm the setting.



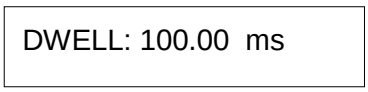
2. ***Set End Current Level***. Set the final Current Level. There are 15,000 discrete steps from 0 to full scale in each range. Turn the Rotary knob to change the display value to 60A, then press ENTER key to confirm the setting.



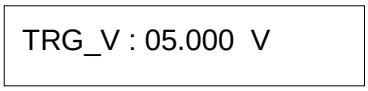
3. ***Set Step of Current Change***. Set the step of current change between initial Current Level and final Current Level. The setting range of the step is from 1 to 1,000. Turn the Rotary knob to change the display value to 5, then press ENTER key to confirm the setting.



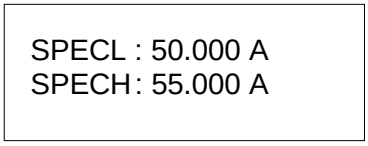
4. ***Set Dwell Time***. Dwell time is the elapse time of each setting Current Level from initial Current Level to final Current Level. The setting range of the Dwell time is from 10μs to 1000ms. Turn the Rotary knob to change the display value to 100ms, then press ENTER key to confirm the setting.



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, then press ENTER key to confirm.



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



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

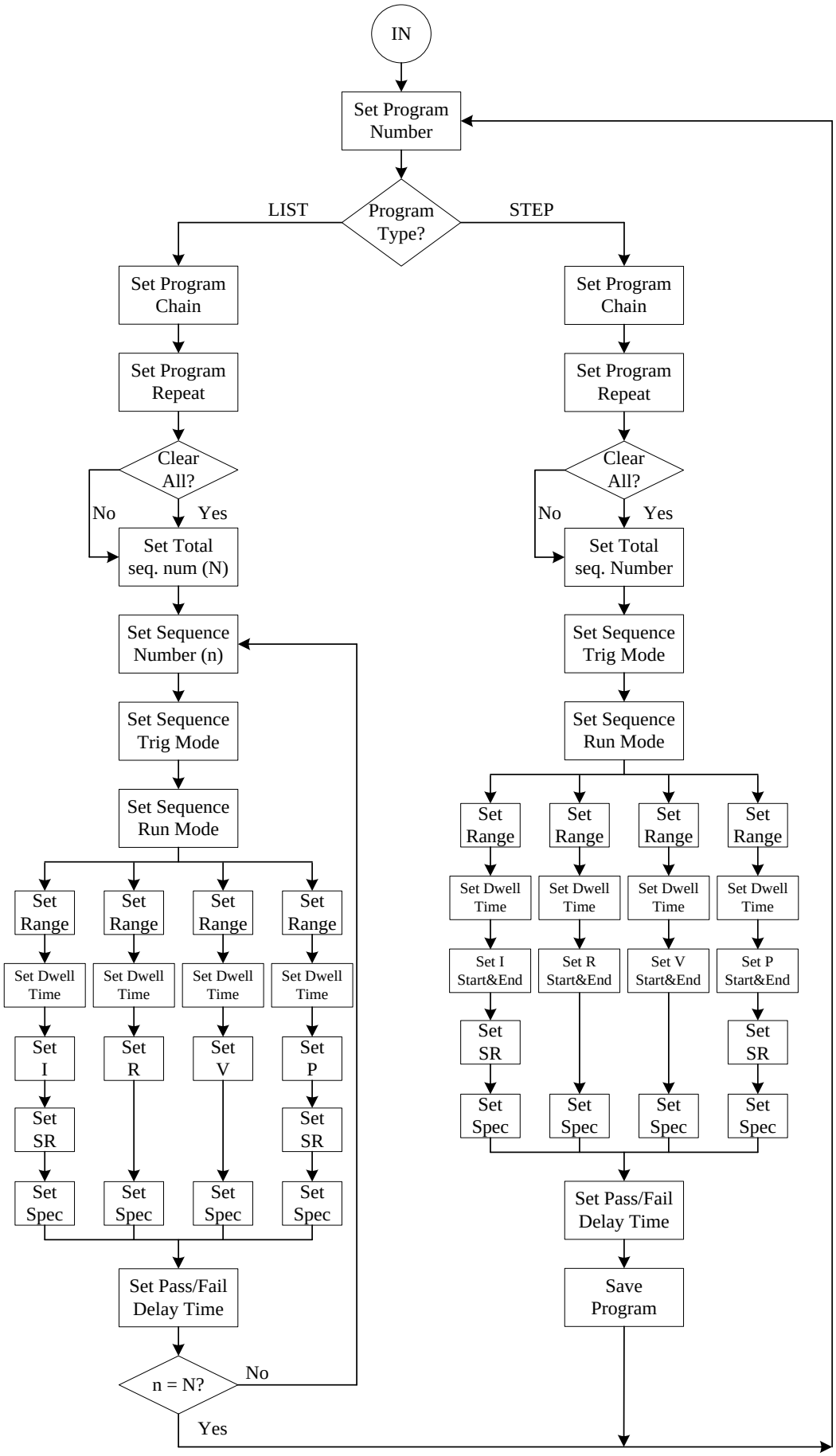
4.6.4 Setup of Program Sequences Function

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

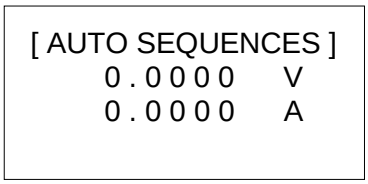
The Electronic Load has 10 programs (1-10) and they share 100 sequences. The user can use the program chain function to chain each set of program and create various sequences combinations.

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 program 4 to program 10. The user can use program chain to chain the program 1, 2 and 3 to execute in the 5→7→15 sequence order; or chain the program 2, 3 and 1 to execute in the 7→15→5 sequence order. In other words, the user can chain the program in any way desired via the program chain function.

Following is the Operation Flow:

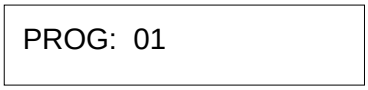

IN
Set Program Number
Program Type?
LIST
STEP
Set Program Chain
Set Program Repeat
Clear All?
No
Yes
Set Total seq. num (N)
Set Sequence Number (n)
Set Sequence Trig Mode
Set Sequence Run Mode
Set Range
Set Dwell Time
Set I
Set R
Set V
Set P
Set SR
Set Spec
Set Pass/Fail Delay Time
n = N?
No
Yes
Set 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 page of Advance function, turn the Rotary knob to change the display value to 4, then press ENTER key into the page of Program Sequences Function, the VFD displays Program Sequences Function.



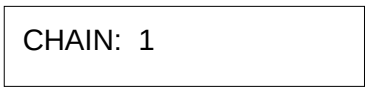
Press the EDIT key to enter into the editing mode. Then, press DATA to select the setting parameter.

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 ENTER key to confirm the setting.

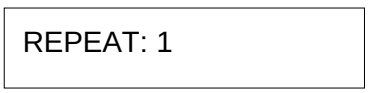


2. ***Setting Type of program***.
There are two types of program: List and Step. Turn the Rotary knob to change the type until the desired type is displayed on the VFD. Then, press ENTER key to select type and confirm the setting.

3. ***Setting the Program Chain***
The chain function of program enables you to chain program so as to get more sequences for testing. Set program chain number to 0 means no program chain. Program chain function can chain itself for loop test, or chain other programs. Turn the Rotary knob to change the display value to 1, then press ENTER to set chain itself for loop test. The default setting is 0.



4. ***Set Repeat Times***.
Set the repeat times of the Program Chain. Turn the LOAD Rotary to change the Repeat times as desired. Then, press ENTER key to confirm the setting.



5. ***Display the Remain Unsetting Sequence Amount***.
The Load shows the Remain Unsetting Sequence amount, which is from total 100 Sequences subtracting the amount of the total setting Sequences.

6. ***Clear the Setting Sequence.***
Clear the setting Sequences by turn the Rotary knob to change the display value to YES, then press ENTER key to confirm.

7. ***Set the Amount of the Total Setting Sequence.***
Set the Amount of the Total Setting Sequence by turn the Rotary knob to change the display value, then press ENTER key to confirm the setting.

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

8. ***Setting Sequence.***

In the page of Program Sequences Function, turn the Rotary knob to change the display value to Sequence Setting, then press ENTER key into Sequence Setting page of 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 passes, the Load will get to the next sequence automatically.
MANUAL: Press ENTER key to confirm, then the Load will get to the next sequence automatically.
External: Use External signal of TRIG_ SEQ to control Load input on/off. When the rising edge of the TRIG_ SEQ signal is action, the Load will get to the next sequence automatically.

Turn the Rotary knob to change the display value to MANUAL, and then press ENTER keys to set sequence 1 to manual mode. You must set more two sequence settings for one program. The default setting is SKIP.

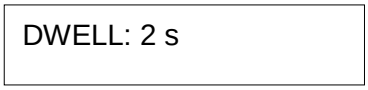
```
TRIG  : MANUAL
```

b. Select the operation mode.
There are four operation modes for 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. Then, press ENTER key to select mode and confirm the setting.

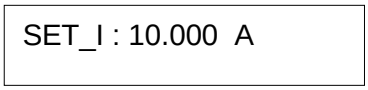
```
MODE : CC
```

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

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.

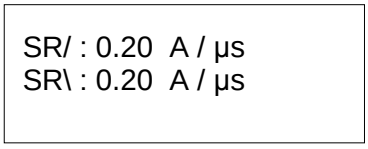


e. Set Load Level.
There are 15,000 discrete steps from 0 to full scale in each range and each mode. Turn the Rotary knob to change the display value to 10.000A, then press ENTER key to confirm.



f. Set Slew Rate

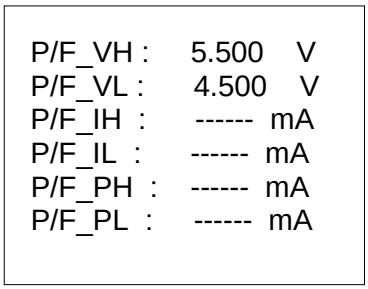
The Display shows the rise slew rate settings. Turn the Rotary knob to change the display value to 0.2A/μs, then press ENTER key to confirm. The slew rate settings change to fall. Turn the Rotary knob to change the display value to 0.2A/μs, then press ENTER key to confirm.



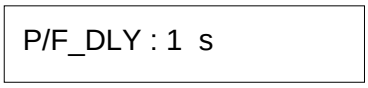
g. Setting the Sequence P/F Specification
The Electronic Load allows the user to program specification of a UUT for later GO/NG verification in Program Sequences Function. During testing, it measures the UUT's performance and compares it with the spec. The Electronic Load allows the user to program spec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

There are two levels for OCP Current specification: LOW and HIGH. The LOW and HIGH levels can be set by the value. Turn the Rotary knob to change the display value, then press 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, then press ENTER key to confirm. The specification settings change to LOW. Turn the Rotary knob to change the display value to 4.5V, then press ENTER key to confirm. The dot line indicates the item will not be judged.



h. Setting the Sequence P/F Delay Time
The sequence Pass/Failure delay time let you set the delay time for P/F checking when load condition changes. The failure status of the sequence will latch when a program is executed. It means that any failure will be memorized 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, then press ENTER to set the sequence P/F delay time for 1s. This setting value must be less than dwell time. The default setting is 0s.



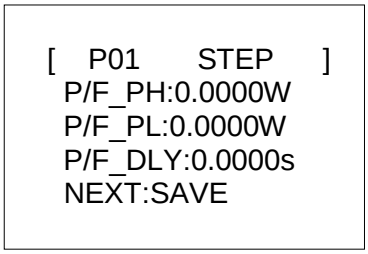
9. ***Review and update the values of the setting parameters***

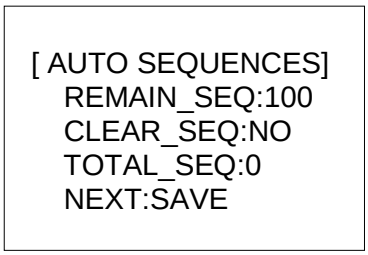
Review the values of the setting parameters by pressing DATA key. Update them by set new value in their setting pages.

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

10. ***Save the setting Program***

There are two ways to save all sequences. One is in Auto sequences mode, press EDIT to edit the sequence and use the rotary 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 program when program sequences function is selected. The VFD display goes to the voltage and current measurement, and program sequences run display mode. The display shows as follows.

```
[ 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
```

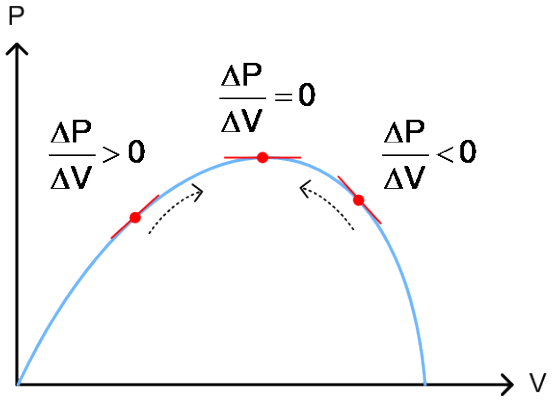
01: It means Program 01.
001: It means Sequence 01.
002: It means Sequence 02.

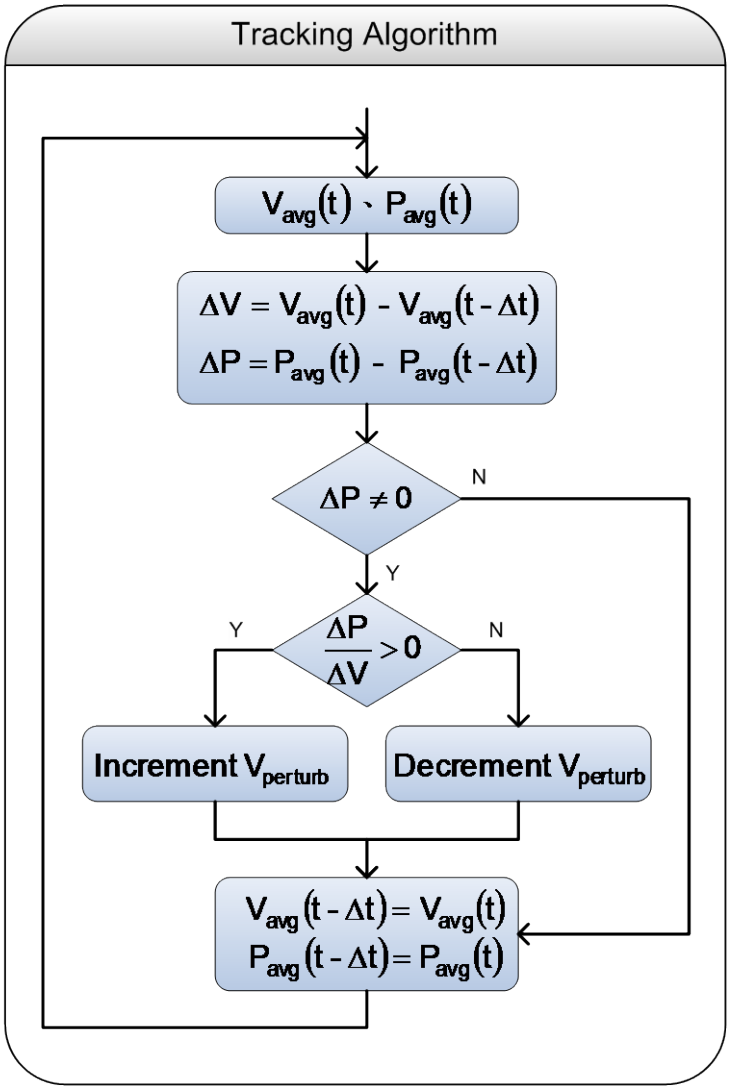
4.6.6 MPP Tracker

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

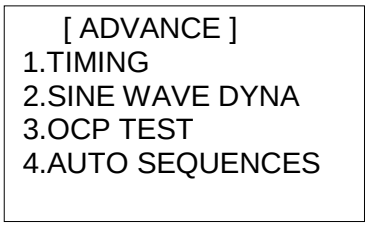
```
    [ ADVANCE ]
5. MPP TRACKER
6. USER DEF. WAVE
```

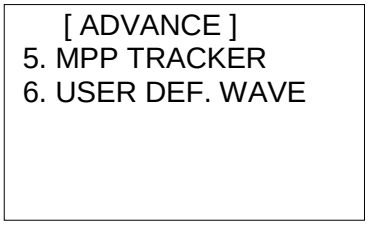
Press the LOAD key ON to run MPP Tracker function.


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 $V_{perturb}$
$V_{avg}(t-\Delta t) = V_{avg}(t)$
$P_{avg}(t-\Delta t) = P_{avg}(t)$

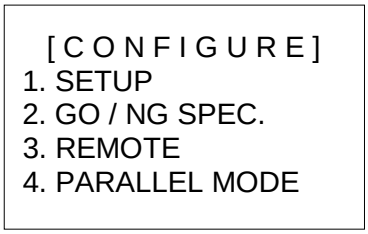
4.6.7 User Defined Waveform

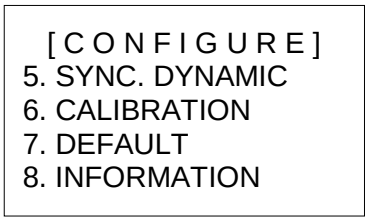




4.7 Setting the Configuration

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





4.7.1 Setup of System Configuration

Turn the Rotary knob to change the display value to 1, then press [ENTER] key into Setup page of system configuration.

Set the voltage range of CC mode. There are three voltage ranges for CC mode. High range is for high voltage, middle range is for middle voltage, and low range for low voltage so as to get better voltage resolution. The default setting of Vrange is HIGH.

CC_VRANGE: 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.

Von_POT: 00.000V

Set Von latch. There are two operation modes for Von control. Von latch ON means the Load will sink current continuously when it reaches Von voltage. Von latch OFF means the Load will stop sinking current when UUT voltage is under 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 waveform respectively.

Von_LATCH: OFF

CAUTION If the Von_POT is too small and it is loading under the minimum working voltage, it will get overshoot spike. If a UUT is applied, the overshoot may damage the UUT regardless of how small setting the Load current specified. So it is necessary to consider if it meets the minimum working voltage when setting the Von_POT to avoid having exceeding overshoot spike.

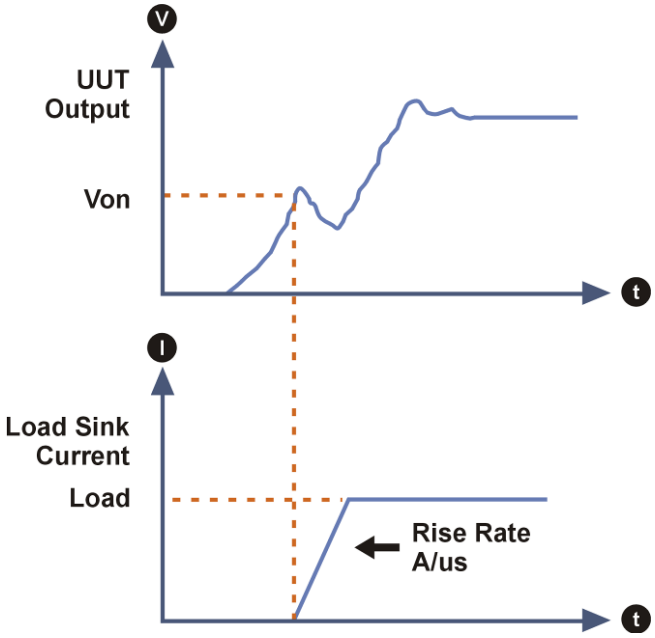


Figure 4-8 Von LATCH ON Current Waveform

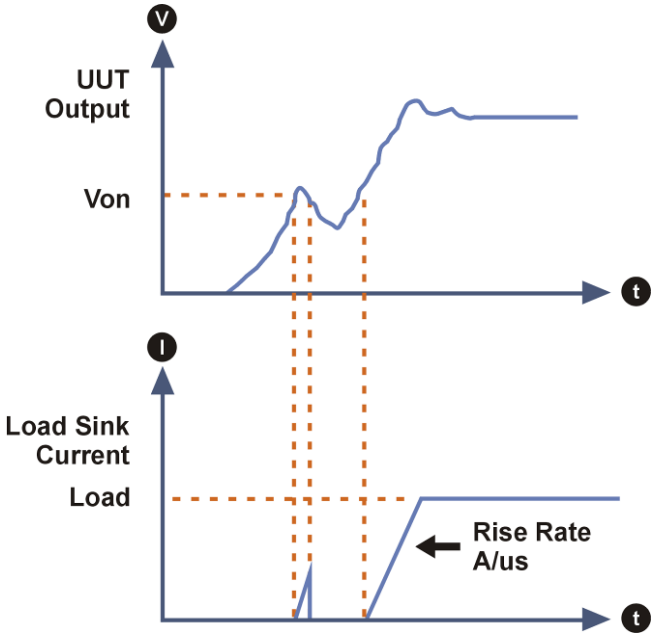


Figure 4-9 Von LATCH OFF Current Waveform

Set Voff point. Voff is the conduction voltage level, and it is only available in Timing mode. The Electronic Load stops sinking current when the UUT output down to reach 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 two operation modes in CV mode: Current PSU and Voltage PSU. This option is for users to choose appropriate CV movement to apply to different UUT. CV Mode type of Current PSU is for Current source supplies like Charger and Current source. CV Mode type of Voltage PSU is for Voltage source supplies like Fuel cell, Battery, Photovoltaics source. 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 LOAD key on the any module of the Mainframe. Under other circumstances the Load on/off is individually and simply controlled by LOAD key on the 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 waveform generator. The default setting of 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 show minus sign for the voltage if you select MINUS. It will not show any sign if you select PLUS. The default setting is PLUS. The displayed digits are five, but select MINUS of SIGN OF VOLT. will occupy one digit.

SIGN OF V: PLUS

Set measurement average samples. This function will take some measurement data samples that you set to average and then update on the display. The default of WINDOW_T is 0.02s and the setting range is 0.001s~10s. The user can use the Rotary knob to set the required parameter and press ENTER.

WINDOW_T: 10.000s

Select short key mode. Set SHORT key mode for Load module. The SHORT key can be set for toggle on/off mode, or active by pressing (HOLD mode). The default setting of SHORT mode is TOGGLE.

SHORT_KEY: TOGGLE

Select module SOUND on/off. When you press the key on the module, it 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 turned OFF 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. It sets if skip to the next setting item or stay at its original setting item when ENTER is pressed. The ENTER_KEY default is NEXT.

ENTER_KEY : NEXT

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

SHORT_KEY: ENABLE

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

To leave out of the Setup page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration.

4.7.2 Setup of Specification

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

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

Set the specifications of entry mode. The specifications of Load can be set by VALUE or Percentage for HIGH and LOW data. The percentage values refer to the CENTER value of specification. The default setting of 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 configuration SPEC MODE. The HIGH/LOW percentage range is from 0 to 100%. And also may choose OFF to close Current specification judgment. The default of CENT, HIGH and LOW is dot 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 configuration SPEC MODE. The HIGH/LOW percentage range is from 0 to 100%. And also may choose OFF to close Power specification judgment. The default of CENT, HIGH and LOW is dot line which means there is no specification judgment.

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

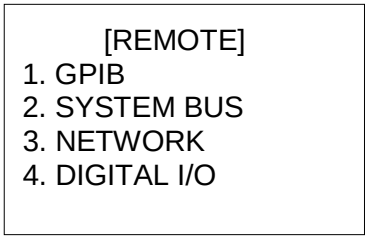
Then the display will go to the first editing page again.

To leave out of the GO/NG SPEC page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration.

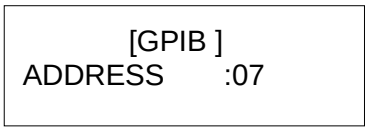
4.7.3 Setup of REMOTE

The remote operation of Load can be done through GPIB, USB or Ethernet. These connectors on the rear panel connect the Load to the controller or computer. The GPIB and Ethernet interface of the Electronic Load is optional.

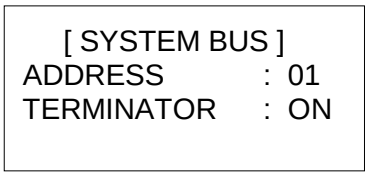
Press ADVA and ENTER at the same time to enter into the system configuration page and turn the Rotary knob to change the display value to 3, then press ENTER key into REMOTE edit page of system configuration.



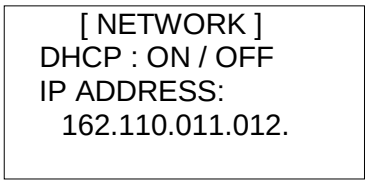
Setting the GPIB Address. Please refer to *Chapter* 5 for GPIB address in the system. You can use this feature to check the GPIB address.

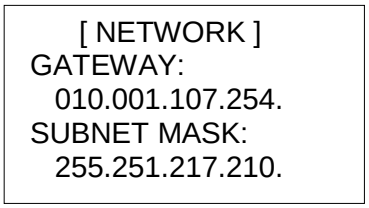


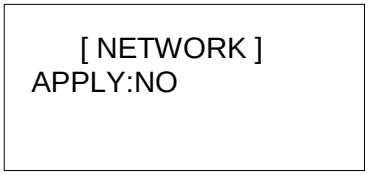
Setting the System Bus address. Please refer to *Chapter* 5 for System Bus address in the system. You can use this feature to check the System Bus address.



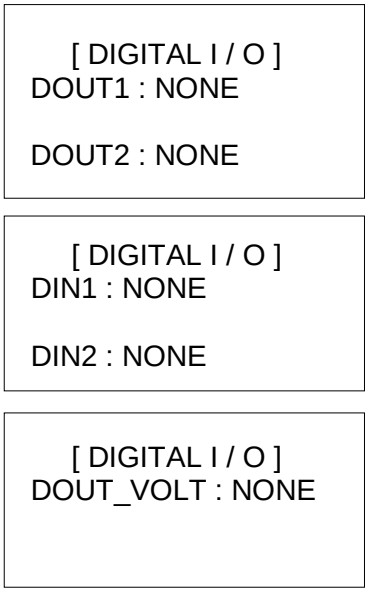
Setting the NETWORK parameters. Please refer to *Chapter* 5 for Ethernet LAN in the system. You can set the LAN parameters including 1.DHCP on/off, 2.IP address, 3. Gateway IP address and 4.Subnet Mask.







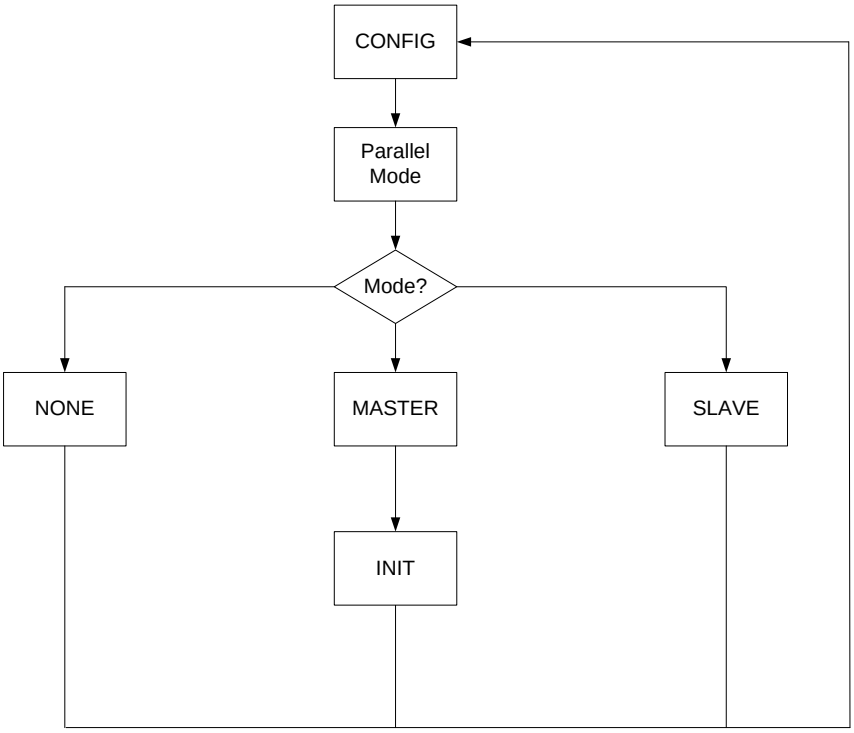
Setting the Digital I/O. You can set the Digital I/O including Dout1, Dout2, Din1, Din2 and DOUT_VOLT. There are none, OCP test pass/fail, GO/NG test pass/fail, or protection features status for Digital output; and none or EXT. LOAD On/Off Enable/Disable for Digital input.



To leave out of the REMOTE edit page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration.

4.7.4 Setup of Parallel

The following is Operation Flow:



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

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

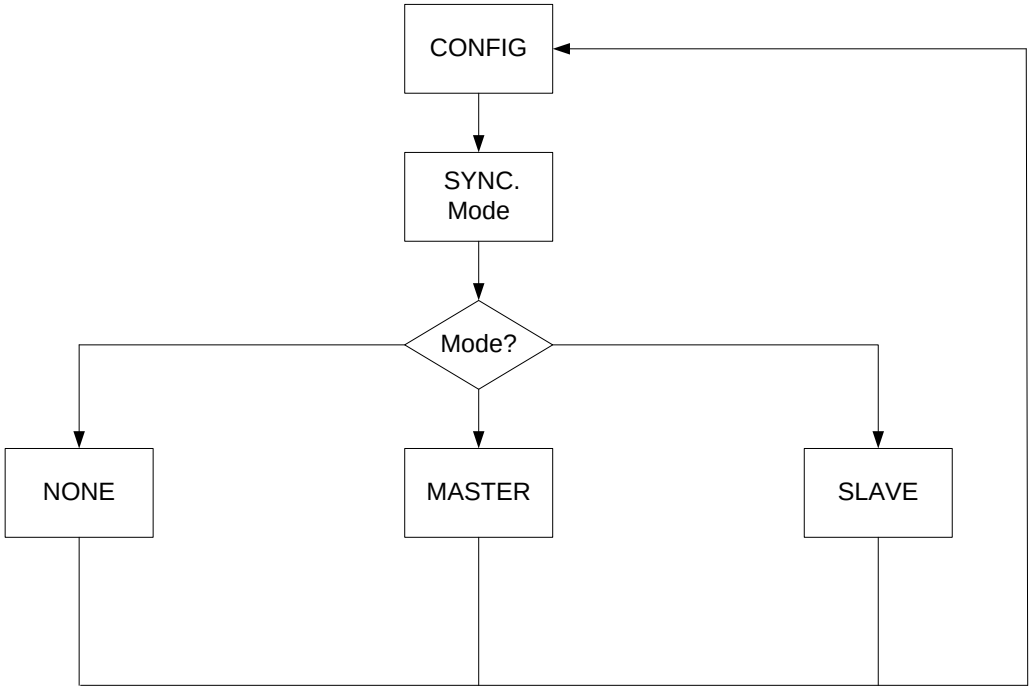
NONE: Disable the MASTER/SLAVE control function.
MASTER: Used as the master for the parallel group and this is the only one controlled by front panel or PC in this group. Also tell the slaves how many current they should sink. Slave Model: 1 – 5 to setup the slave's model to use in parallel. NONE means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

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

To leave out of the Parallel edit page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration.

4.7.5 Setup of Synchronous Dynamic Mode

The following is Operation Flow:



When Synchronous Dynamic Mode is set to ON, the Load on/off is controlled by LOAD key on the any module of the Mainframe. Under other circumstances the Load on/off is individually and simply controlled by LOAD key on the module.

In the page of system configuration, turn the Rotary knob to change the display value to 5, then press ENTER key into Synchronous Dynamic Mode page of system configuration.
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 front panel or PC in this group. Also tell the slaves how many current they should sink. Slave Model: 1 – 5 to setup the slave's model to use in parallel. NONE means not exist.
SLAVE: Setup the load as slave.

To leave out of the Synchronous Dynamic mode edit page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration.

Notice

1. In the page of system configuration, turn the Rotary knob to change the display value to 6, then press ENTER key into Calibration page of system configuration. Normally, we recommend that normal users don't enter into this page and edit the data. This is for Chroma instruments factory or service center or standard instruments calibration center to calibrate the programming and measurement values that are out of accuracy of specifications.
2. The fastest refresh time for LOAD panel is 0.5 second. When operating in SYNC DYNA, if the T1 or T2 time is less than 0.5 second, the change of panel reading is restricted by the panel refresh time. Thus it may not seem to be synchronized but it dose in actual loading.

4.7.6 Recall Factory Default

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

Set Recall the load Factory default When you choose YES and press ENTER, the Load will recall the factory default setting as Table 4-5 shows.

```
[ DEFAULT ]
RECALL FACTORY
DEFAULT :  YES
```

To leave out of the Recall Factory Default page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration.

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

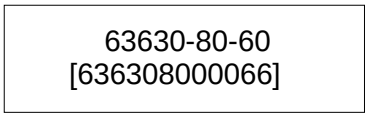
8.INFORMATION[1]	636XX-XX-XX
	G_FW: x.xx
	G_PCB: xx.xx
	G_HDL: xx.xx
	A_FW: x.xx
	A_PCB: x.xx
	A_HDL1: x.xx
	A_HDL2: x.xx
	C1_FW: x.xx
	C1_PCB: x.xx
	C1_HDL1: x.xx
	C1_HDL2: x.xx
9.DIGITIZING	SAMPLING_TIME: 40.000ms
	SAMPLING_POINT: 4096
	TRIG_SOURCE: LOAD_ON
	TRIG_POINT: 2000
	DIGI: INITIATE

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.

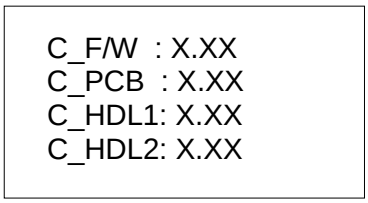
4.7.7 Display Model Information

In the page of system configuration, turn the Rotary knob to change the display value to 8, then press (ENTER) key into Display Model Information page of system configuration.

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



Display C board F/W version, PCB version and HDL version. Display firmware version, PCB version and hardware description language version of C board. It is a fixed value and cannot be selected or changed.



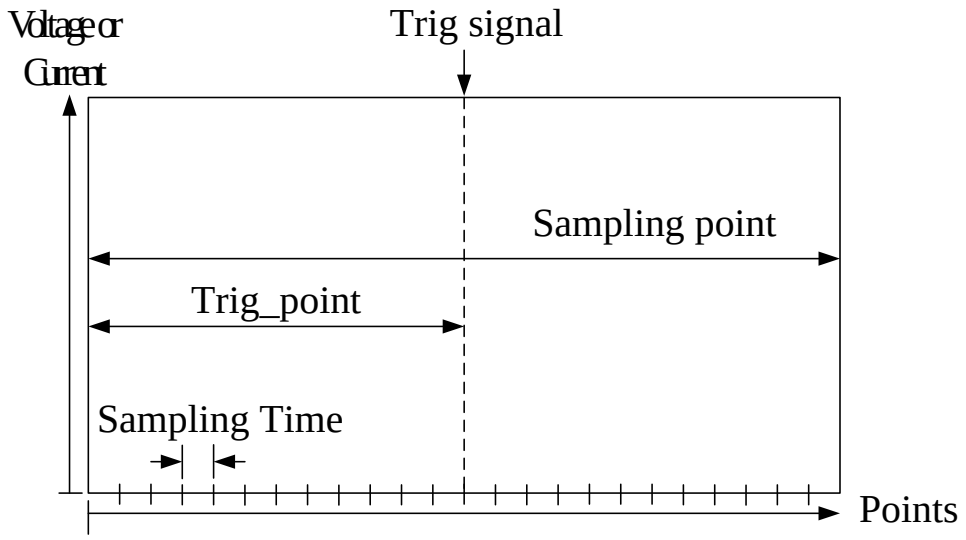
Then the display will go to the first editing page again.

To leave out of the Display Model Information page of system configuration, you need to press (ADVA) and (ENTER) simultaneously to go back to the page of system configuration.

4.7.8 Setup of Digitizing Function

To record the transient voltage and current waveforms, the 63600 series offer a digitizing function for recording the transient waveforms. It is very convenient to record the information via this function.

In the page of system configuration, turn the Rotary knob to change the display value to 9, then press [ENTER] key into Digitizing Function edit page of system configuration.



Sampling point≤4096 point

Description of Parameter Setting:

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

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

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

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

LOAD ON:	It triggers at Load on
LOAD OFF:	It triggers at Load off.
TTL:	It triggers external TTL (Pin No. 7 of the System I/O Port → TRIG_DIGI)
BUS:	It executes the command ***DIGitizing:TRIGger ON*** for trigger.
MANUAL:	Press EDIT+ENTER on the Module front panel at the same time 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 function of Digitizing
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 execution status of Digitizing
IDLE: It indicates the Digitizing is done.
PRE_TRIG: It indicates the Digitizing is processing Trigger Points.
WAIT_TRIG: It indicates the Digitizing is waiting for the trigger signal.
POST_TRIG: It 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 ***DIG:WAV:CAP?*** Command to send the MODULE waveform to FRAME. The transmission is done when OK is returned.
(2) Execute ***DIG:WAV:DATA? V*** command to download the voltage waveform to PC from FRAME.
Execute ***DIG:WAV:DATA? I*** command to download the current waveform to PC from FRAME.

To leave out of the Digitizing Function edit page of system configuration, you need to press ADVA and ENTER simultaneously to go back to the page of system configuration

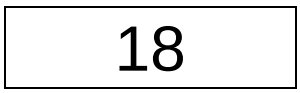
When Setting the Configuration is over, to leave out of the page of system configuration, you need to press ADVA and ENTER simultaneously to quit the Setting page of system configuration.

4.8 Recalling Files

Press **RECALL** key on the mainframe to recall files from 00 to 99. Files 00 to 99 are user data. The memory channel indicated on the LED. After a file is recalled, the display will go to mode editor for you to edit or view the file. Press **RECALL** the display will show the file No. recalled 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 like this:



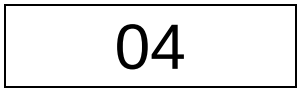
2. Press the **RECALL** key.

4.9 Saving File/Default

To save the entire present 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 indicated on the LED.

To save parameters into memory channel number 4:

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



2. Press the **SAVE** key.

4.10 Going To Local

You can press **LOCAL** key to go to local operation when Load is in remote state.

4.10.1 Lock Operation

The lock operation disables all settings for change. When the data is locked, all settings cannot be changed. The operation of LOAD key will not be affected by lock function. Press and hold **LOCK** key for at least 2 seconds to enable/disable 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 USB connecting to a remote controller or a personal computer for remote control. The Universal Serial Bus (USB) signal is defined as follows.

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 parameter of System Bus is set in the configuration remote. Please refer to 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 as follows.

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 monitor, external analog signal input and digital I/O signals. The digital system I/O signals are TTL compatible. Definitions as follows:

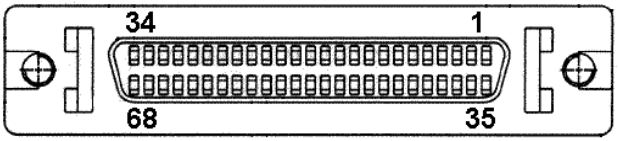


Figure 4-10 63600-5 System I/O Port Connector

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 signals from the first channel to the tenth channel, TTL Level, Active High.
3. TRIG_ SEQ: External trigger input signal used to increment get to the next sequence setting. TTL Level, falling edge, pulse width ≥1μs.
4. TRIG_DIGI: External trigger input signal to be the trigger Source of 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. The user can use this input signal to control the Load ON/OFF externally. If DI1 and DI2 are set to External Load ON/OFF, the two signals need to be HIGH to become Load OFF and vice versa both of the signals need to be LOW to become 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 the 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. GONG TOTAL PASS-H: When the SPEC is ON, if all channels are determined as Good, the DO will output HIGH level signal, or it will remain at LOW level.
   d. GONG TOTAL FAIL-L: When the SPEC is ON, if all channels are determined as No Good, 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 HIGH level signal, or it will remain at LOW level.

   The selections of DOUT_VOLT are:
   a. NONE: It sets the Dout High level to floating.
   b. 1.8V: It sets the Dout High level to 1.8V.
   c. 3.3V: It sets the Dout High level to 3.3V.

d. 5.0V: It sets the Dout High level to 5.0V.

8. DGNDC: Digital signal reference ground.
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 reference ground.

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 as follows.

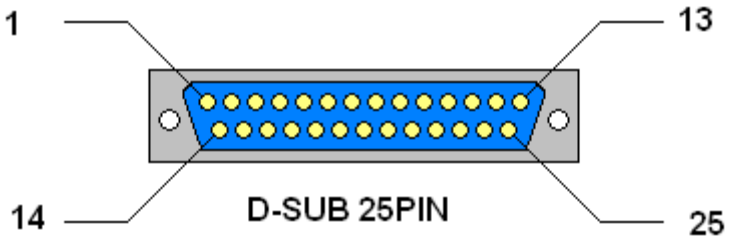


Figure 4-11 63600-2 System I/O Port Connector

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 get to the next sequence automatically. TTL Level, falling edge, pulse width≥1μs.
4. TRIG_DIGI: External trigger input signal to be the trigger Source of 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. The user can use this input signal to control the Load ON/OFF externally. If DI1

and DI2 are set to External Load ON/OFF, the two signals need to be HIGH to become Load OFF and vice versa both of the signals need to be LOW to become 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 the 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. GONG TOTAL PASS-H: When the SPEC is ON, if all channels are determined as Good, the DO will output HIGH level signal, or it will remain at LOW level.
   d. GONG TOTAL FAIL-L: When the SPEC is ON, if all channels are determined as No Good, 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 HIGH level signal, or it will remain at LOW level.

   The selections of DOUT_VOLT are:
   a. NONE: It sets the Dout High level to floating.
   b. 1.8V: It sets the Dout High level to 1.8V.
   c. 3.3V: It sets the Dout High level to 3.3V.
   d. 5.0V: It sets the Dout High level to 5.0V.
8. DGNDC: Digital signal reference ground.
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 as follows:

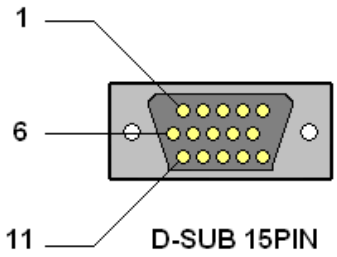


Figure 4-12 63600-1 System I/O Port Connector

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 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

63600 Series supports up to 4 sets of mainframe synchronous load control, see 4.7.1 for the configuration setting. The connection between mainframe is via the System Bus connector on the rear panel. Figure 4-13 & Figure 4-14 show the internal wiring of synchronous cable and MASTER/ SLAVE connection of mainframe. It requires another synchronous cable if one more SLAVE is desired. Be sure to connect the MASTER port to the EXTENDED port of previous cable and plug in the SLAVE port to mainframe, and so forth.

The synchronous cable connection of two mainframes is to turn on the terminal resistor of each mainframe and press ADVA and ENTER together to enter into the CONFIGURE page. Select 3.REMOTE and press ENTER to go to REMOTE page and select 2.SYSTEM BUS to set the ADDRESS to be 01~04 (the address of the two mainframes cannot be the same to avoid confliction) and TERMINATOR to be ON.

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

When more than two mainframes are doing synchronous cable connection, it is necessary to turn on the terminal resistor of the first and the last mainframe (the terminal resistors of the rest 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 REMOTE page and select 2.SYSTEM BUS to set the ADDRESS to be 01~04 (the address of each mainframe cannot be the same to avoid confliction.)

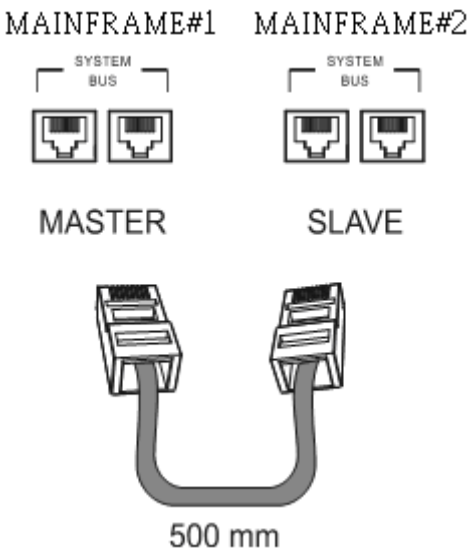


Figure 4-13 Synchronous Cable Connection of 2 MAINFRAMES

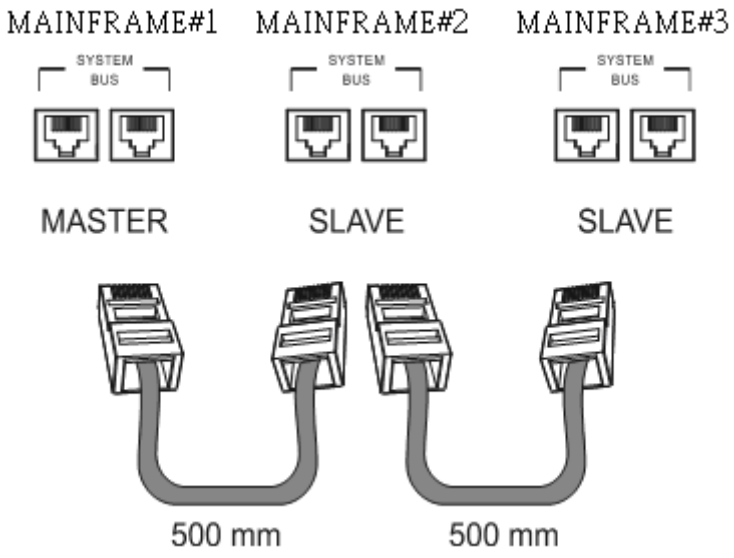


Figure 4-14 Synchronous Cable Connection of 3 MAINFRAMES

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. The command set introduced here can be applied to all electronic loads of 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. Such address allows the system controller to communicate with individual devices. To set the GPIB address of an individual mainframe, Chroma 63600 series, it is done by the "REMOTE" setting in the "CONFIG" functional list menu only at each Modules.

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 pull.	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 to GPIB. The electronic load powers up in local mode and remains there until it receives a command from GPIB. Once the electronic load is in remote mode, *RMT* will appear on the front panel at all modules. All front panel keys except LOCAL are disabled, and the load module display is in normal metering mode. Press **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 to local mode.	RL1
Device Clear	The electronic load responds to the Device Clear (DCL) and Selected Device Clear (SDC) interface commands. These two actions cause	DCL, SDC

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

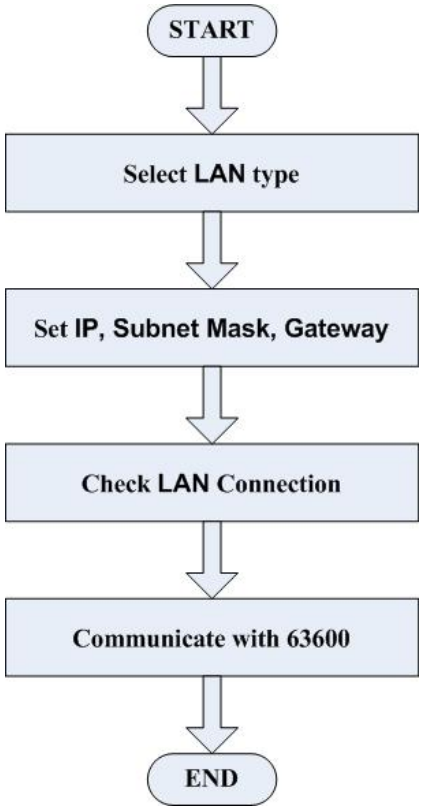
If the PC's OS does not support USBTMC, it is suggested to install NI-VISA runtime 3.00 or above first. The USBTMC driver will be in the OS once the NI-VISA runtime is installed. Power on the DC Electronic Load after connected it with the PC via USB cable and the user can use the 63600 Series SCPI commands 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. Such address allows the system controller to communicate with individual devices. To set the IP address of an individual mainframe, Chroma 63600 series, it is done by the "REMOTE" setting in the "CONFIG" functional list menu only at each Modules.

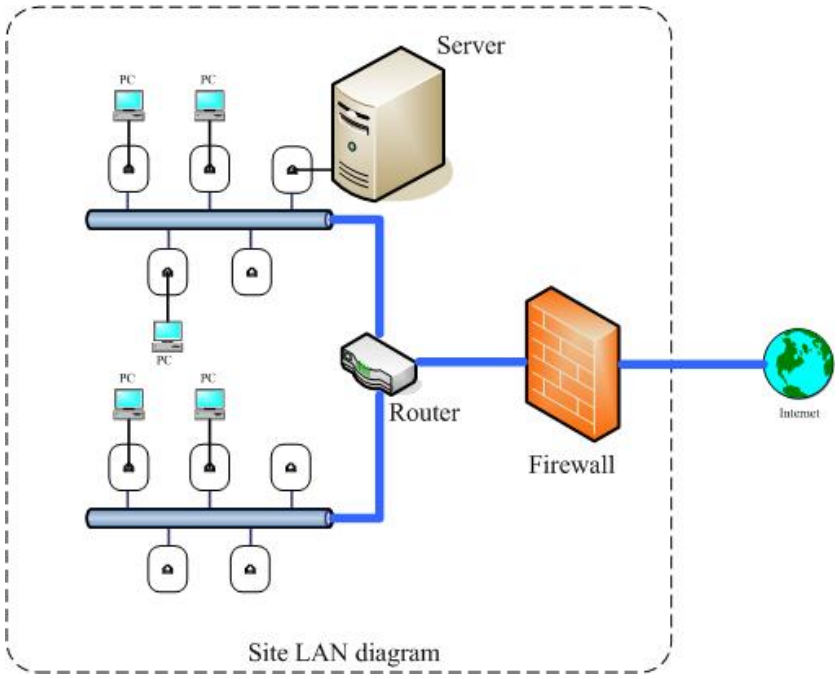
This section describes how to use Chroma DC Load 63600 network card rapidly and correctly. Please read it carefully before using the 63600 network interface and ensure the network is active and connected to hardware securely before execution.

The setting process is divided into four sections for as described below:



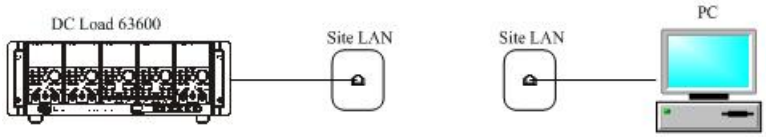
5.1.4.1 Selecting the LAN Type to be Connected

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

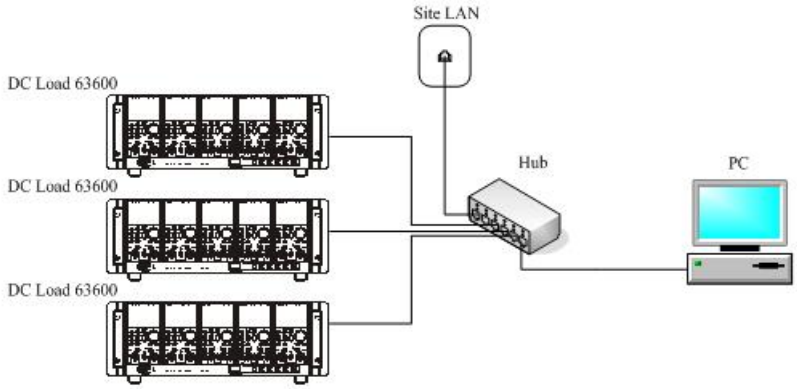


When selecting Site LAN, users can use the following two ways to connect to computer.

(1)



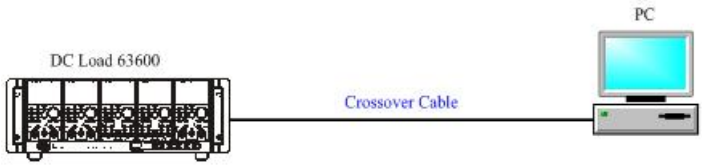
(2)



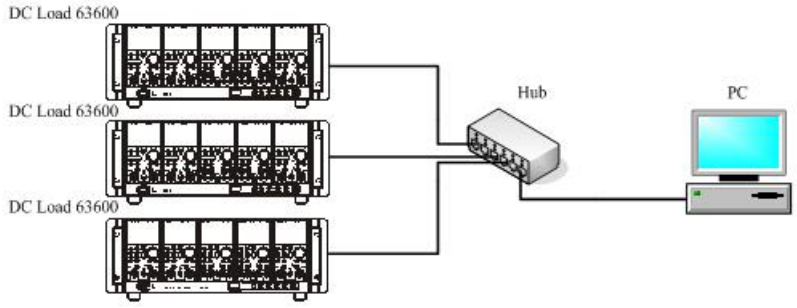
Private LAN is a smaller local area network composed of two or more terminal devices and Hub or two terminal devices via Crossover Cable connection.

When choosing Private LAN, users can use the following two ways to connect the computer.

(1)



(2)



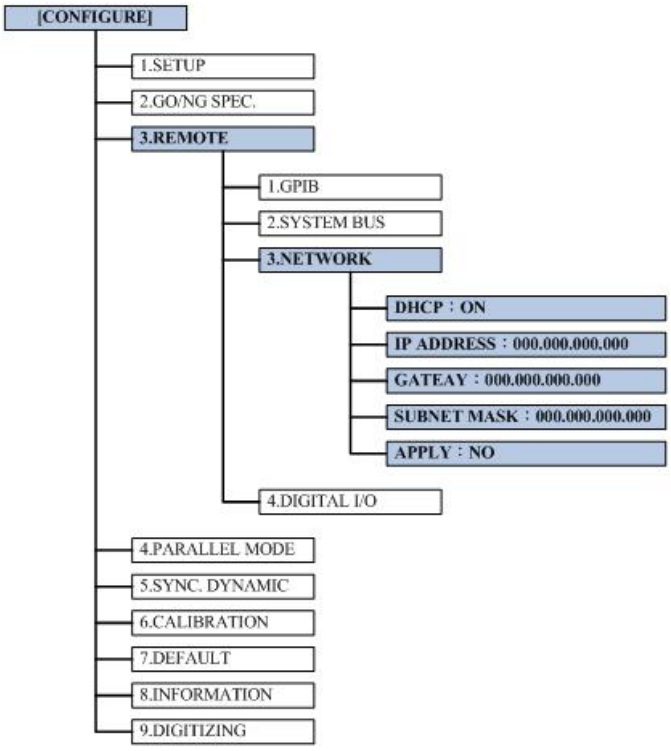
5.1.4.2 Setting Network Parameter (IP, Subnet Mask, Gateway)

1. When in Site LAN:

Only network setting is required on 63600 by 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:
Press ADVA + ENTER on the front panel of any module to go to 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 directly to go to 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 network.
d. DHCP Failure!! : It cannot find 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 show the updated network setting automatically and clear the status message.

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

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

STEP 1:
When DHCP=OFF, it also needs to set IP, GATEWAY and SUBNET MASK parameters. Thus if users know the Site LAN they are in at present, the settings can be done easily.

If users are not aware of the Site LAN they are in at present, please contact the network administrator in the company for setting the network parameters manually.

Notice

If users know the computer network setting at present, they can enter the SUBNET MASK, GATEWAY settings to 63600 directly while setting a different IP address for 63600. For instance 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 directly to go to 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 network.
d. DHCP Failure!! : It cannot find 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 show the updated network setting automatically and clear the status message.

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

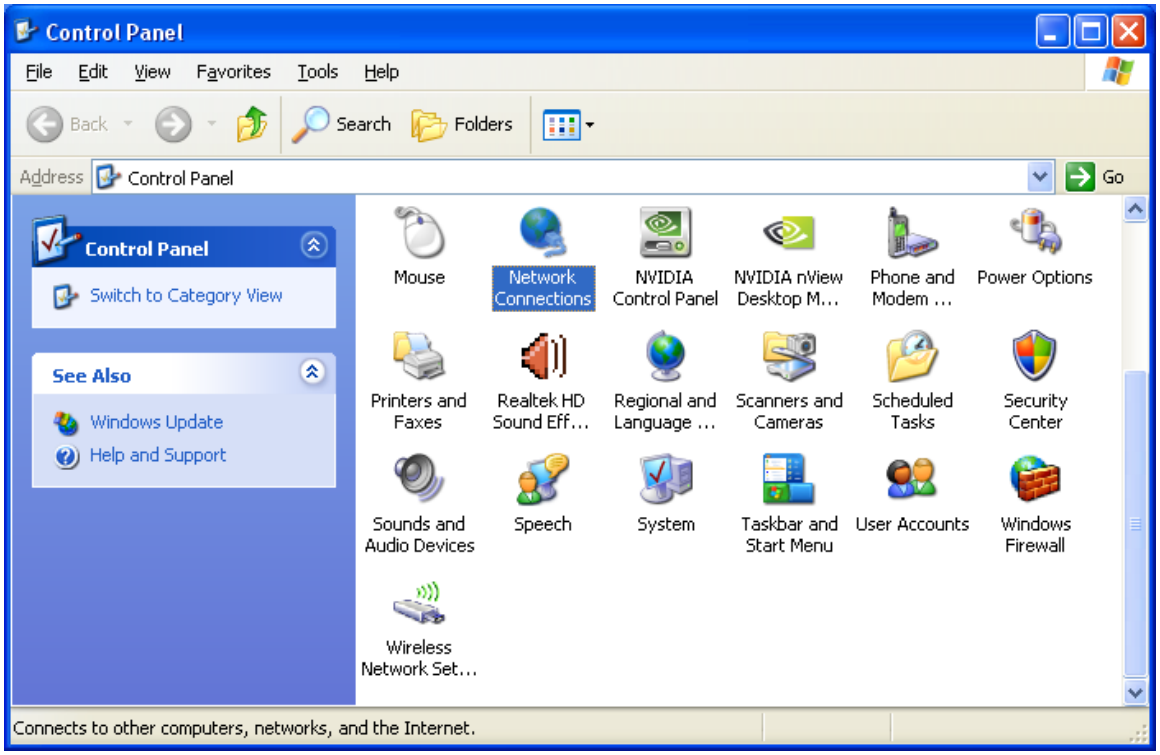
2. When in Private LAN:

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

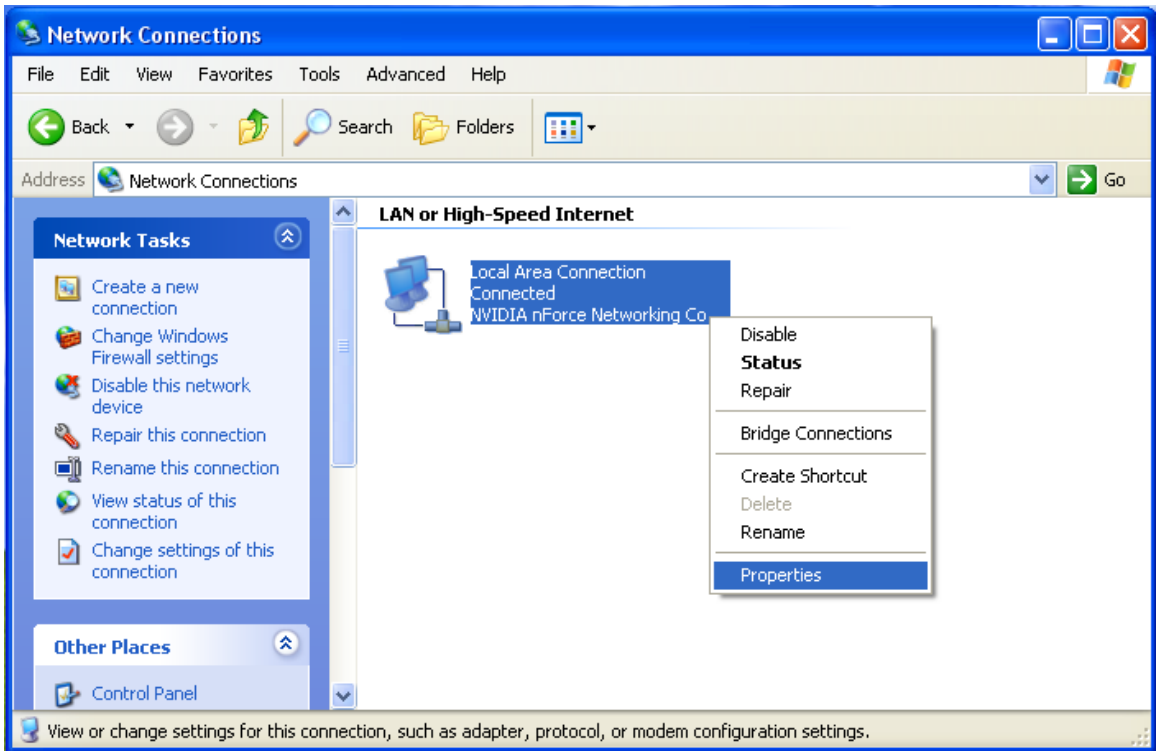
Steps to set DHCP = OFF for PC

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.

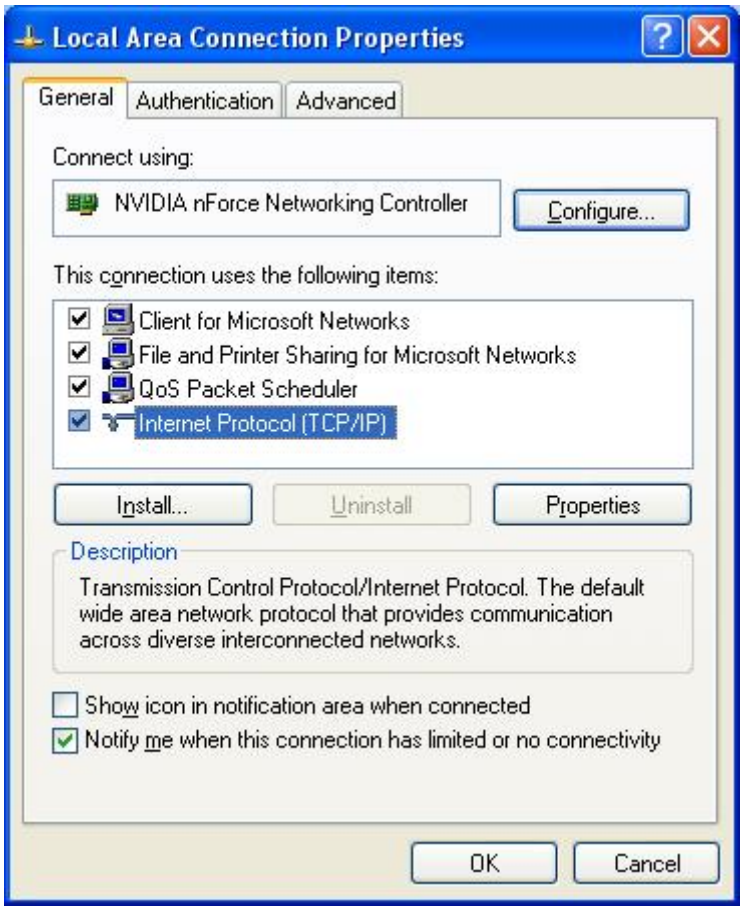
STEP 1:
Click "**Control Panel**" on the PC and double-click "**Network Connections**" to enter it.



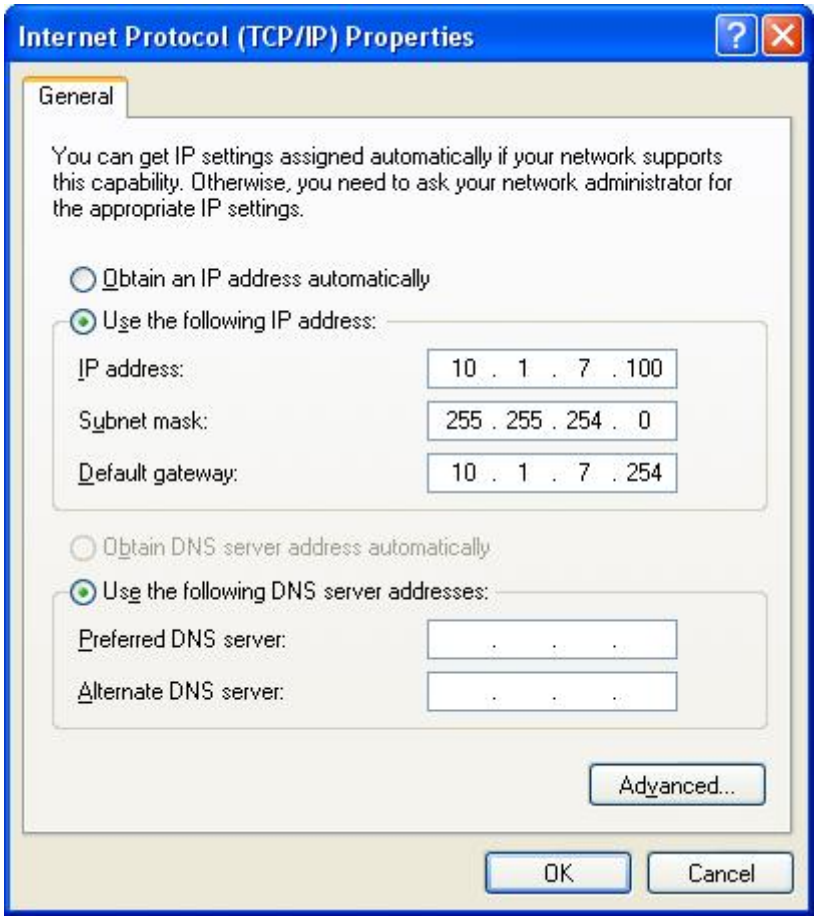
STEP 2:
Select "**Local Area Connection**" and click right mouse button to select "**Properties**."



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



STEP 4:
Select "**Use the following IP address:**" (that is 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 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, it also needs to set IP, GATEWAY and SUBNET MASK parameters. If the network parameters are already set on user's computer or other devices in the network, users can enter SUBNET MASK, GATEWAY settings to 63600 directly while setting a different IP address for 63600. For instance the computer IP is 10.1.7.100, Mask is 255.255.254.0 and Gateway is 10.1.7.254, then users can set the IP to 10.1.7.101, Mask to 255.255.254.0 and Gateway to 10.1.7.254 for 63600 under the premise that the IP: 10.1.7.101 has not been used by any other users.

STEP 2:
Press ENTER or DATA directly to go to 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 network.
d. DHCP Failure!! : It cannot find DHCP Server and is unable to specify the IP

Address via DHCP.

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

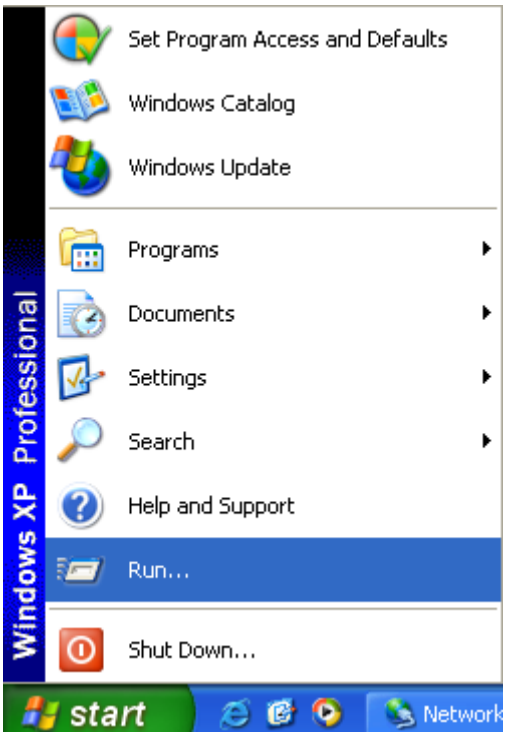
Once the setting is successful, the panel will show the updated network setting automatically and clear the status message.

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

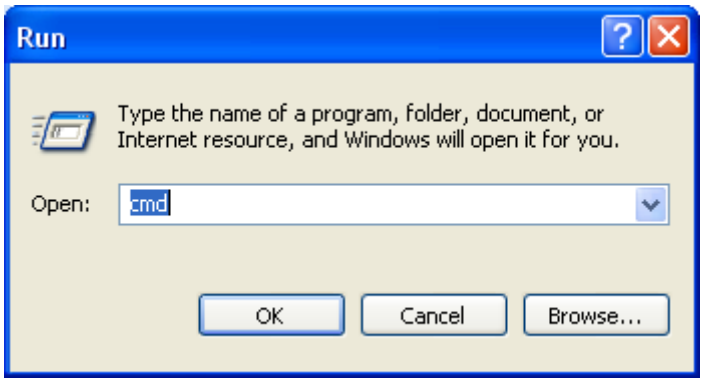
5.1.4.3 Confirming Network Connection is Successful

When the above actions are done, it indicates the local area network is set including the Chroma DC Load 63600 network card. Now, users need to confirm the set local area network is correct. Follow the steps below for verification.

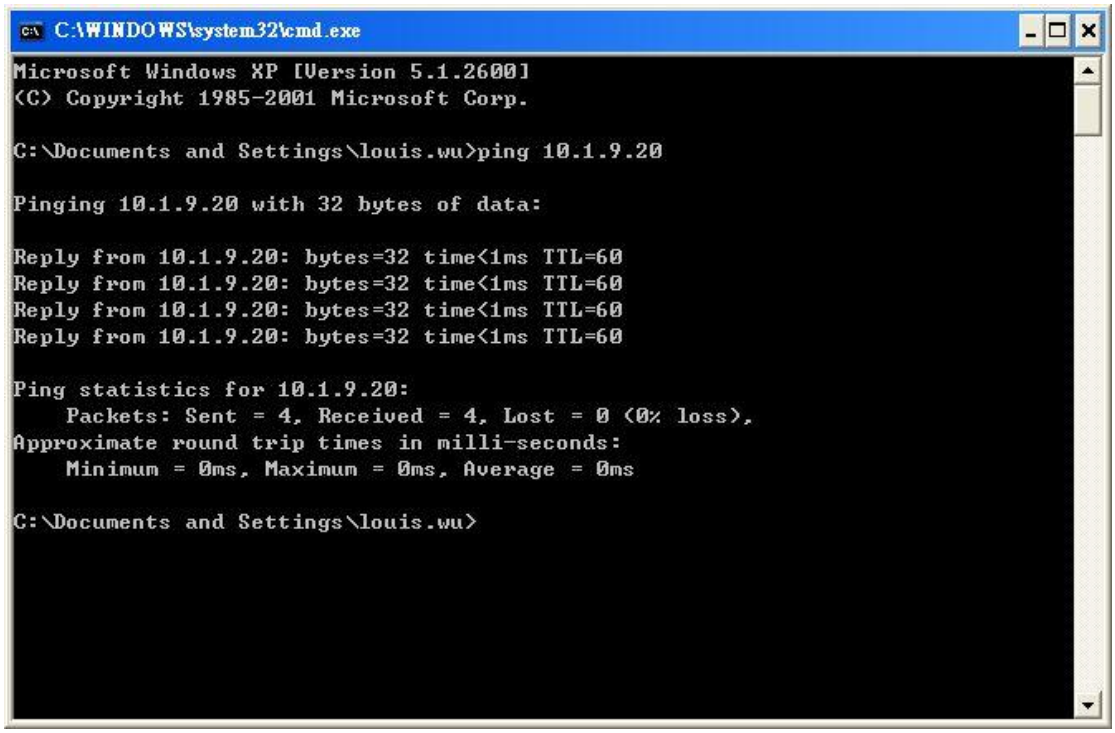
STEP 1:
Click "**start**" from the Windows desktop and click "**Run**."



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



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

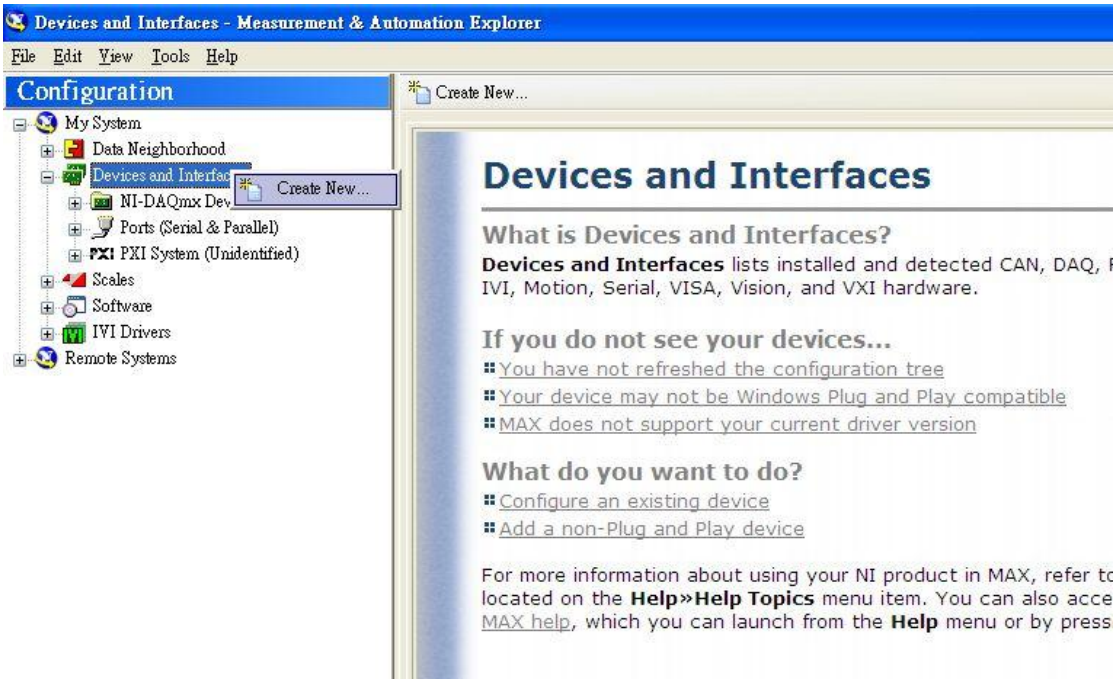


5.1.4.4 Communicating with Instruments

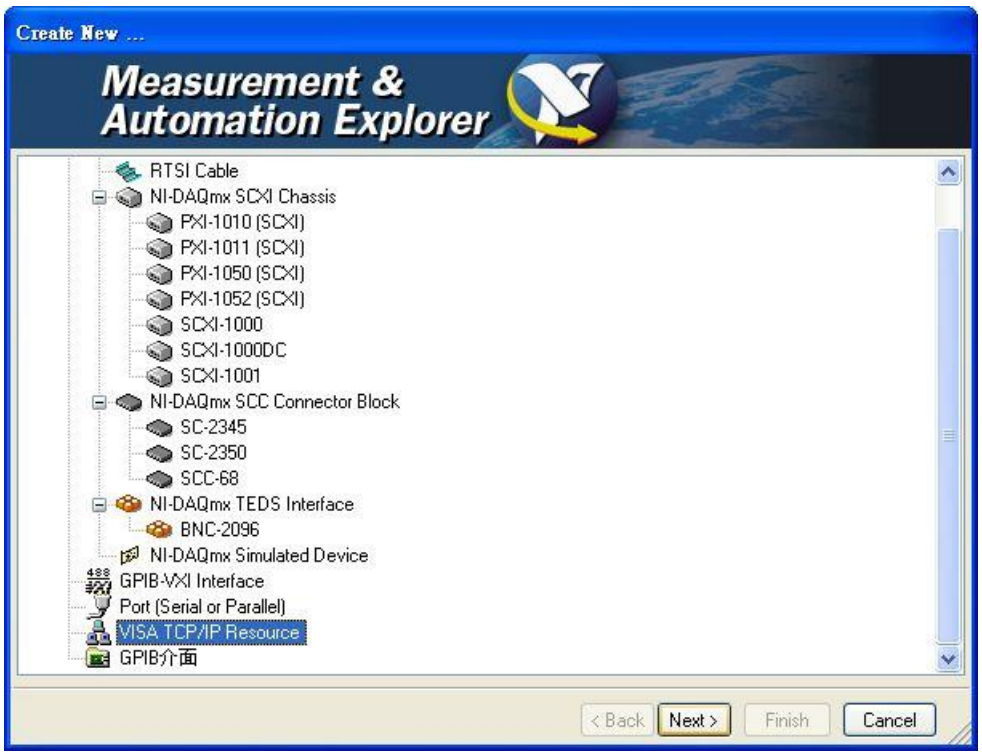
Users can use the application NI-MAX (Measurement & Automation Explorer) of National Instruments to communicate the existing instruments or user developed application. To use NI VISA, users need to open VISA Session Resource Name in the format of TCPIP0::<IP address>::2101::SOCKET, for example, TCPIP0::10.1.7.100::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

Following is the example of using NI-MAX (Measurement & Automation Explorer) application.

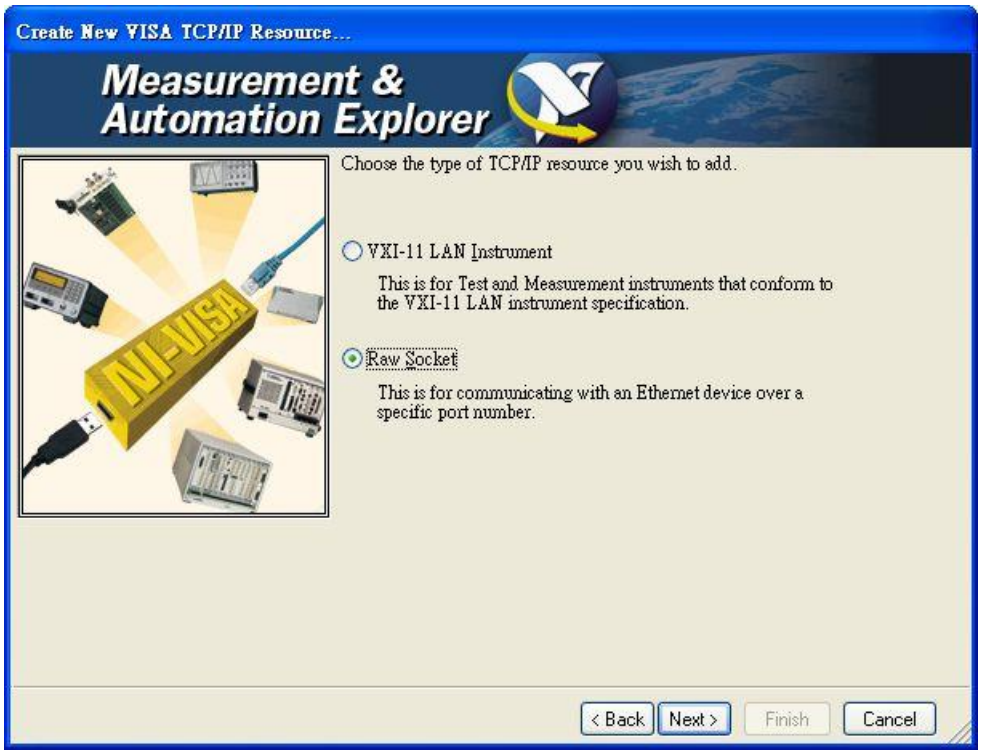
STEP 1:
Open NI-MAX (version 4.3.0F0) and select "**Devices and Interface**" then click the right mouse button to choose "**Create New. . .**".



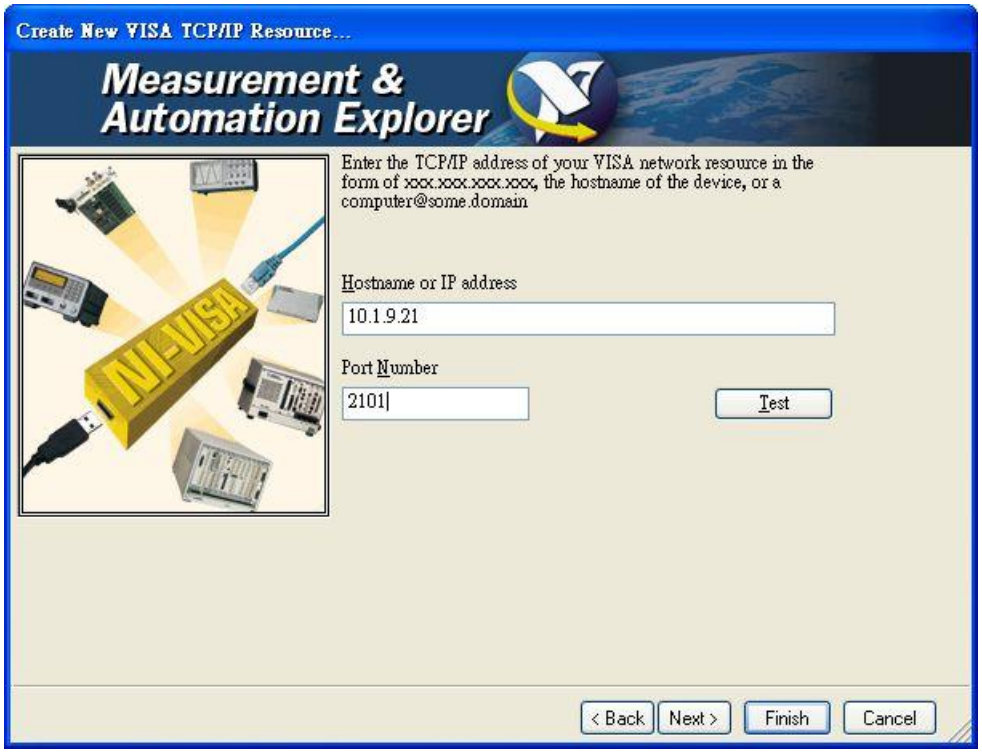
STEP 2:
Select "**VISA TCP/IP Resource"** and click **Next >**.



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



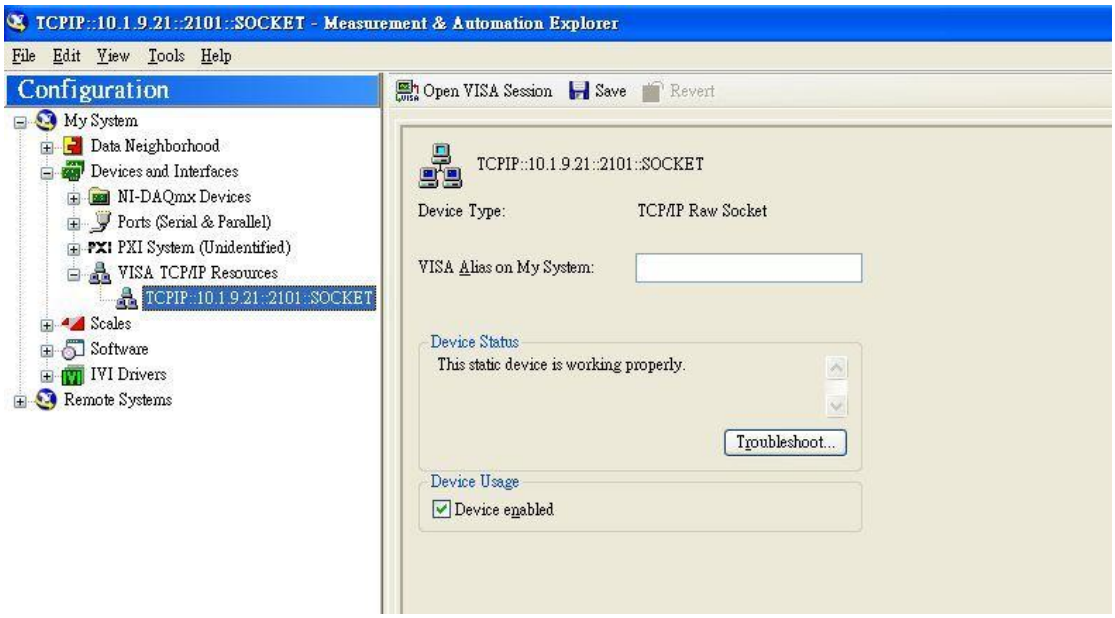
STEP 4:
Input the "**IP Address**" and "**Port Number**" (TCP/IP Port used by Chroma DC Load 63600 is 2101) and click Test.



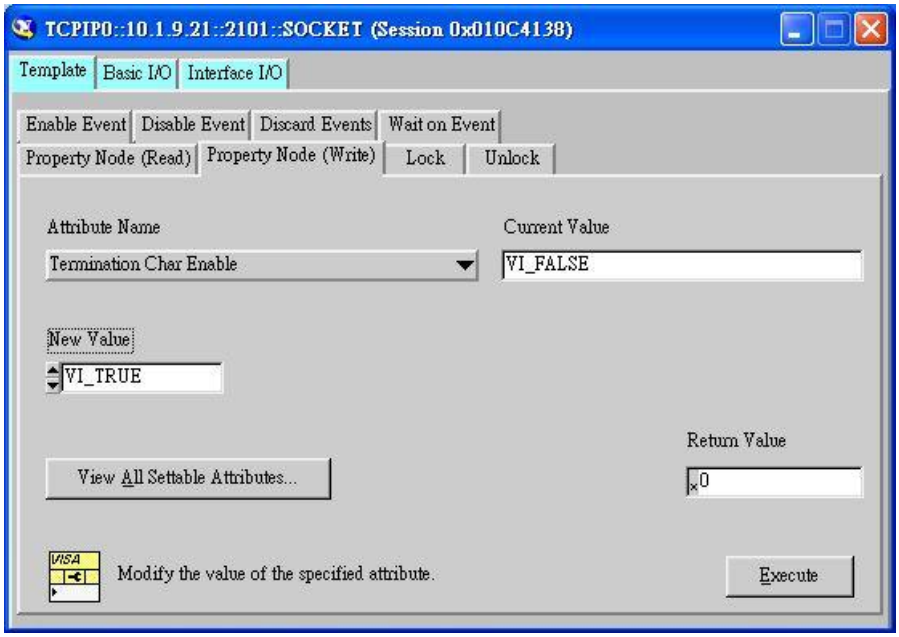
STEP 5:

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

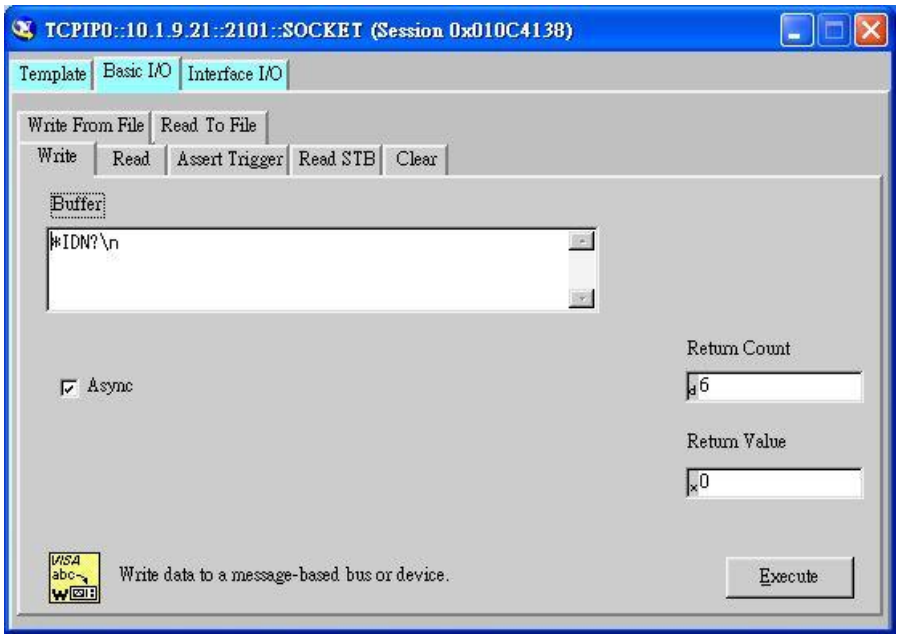
STEP 6:
VISA TCP/IP Resource will add to Devices and Interfaces. Select it and click Open VISA Session (NI VISA Ver.3.0).



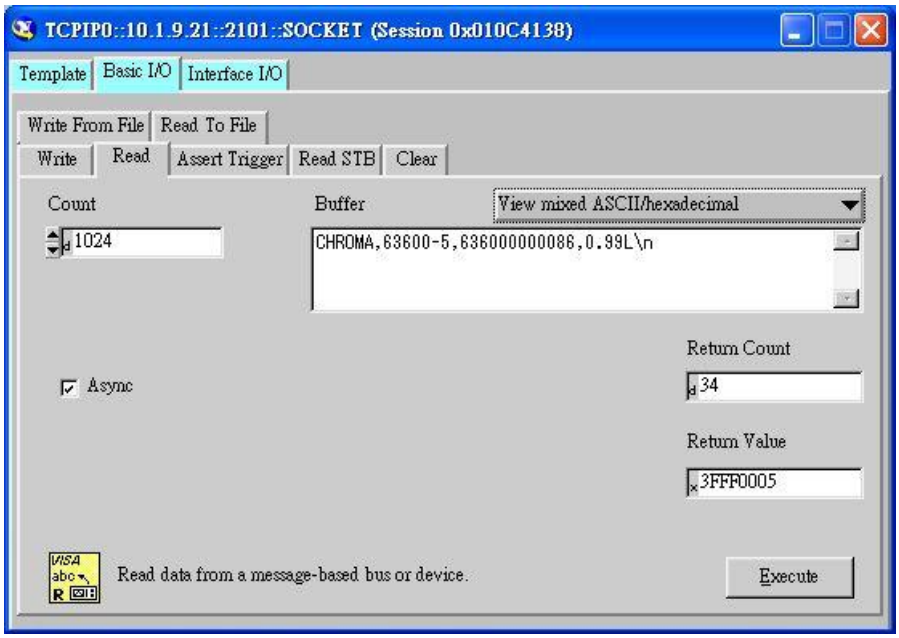
STEP 7:
Select “Termination Char Enable**”** for “Attribute Name**”** in the sub-tab “**Property Node (Write)”** under “**Template”** tab. If “Current Value” is “VI_FALSE”, set “VI_TRUE” for New Value and then click **Execute**.



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

GPIB statement includes instrument control and query commands. A command statement sends an instruction to the electronic load, and a query command to request 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 usually is 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 help you remember it. However, the electronic load will accept Volt, volt, voltage, VOLTAGE, volTAGE, etc. regardless of what form you have applied. However, if the keyword is incomplete, for example, “VOL” or “curre”, it will not be recognized.

5.2.2 Numerical Data Formats

Chroma 63600 Electronic Load accepts the numerical data type 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. 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 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 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 GPIB that it has reached the end of a statement. Normally, this is sent automatically by your GPIB programming statements.

The termination also occurs with other terminator codes, such as EOI. In this guide, the terminator is assumed 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.

1. (root):VOLT:L1: 30<nl>
   Starting a New Line to return to the Root.

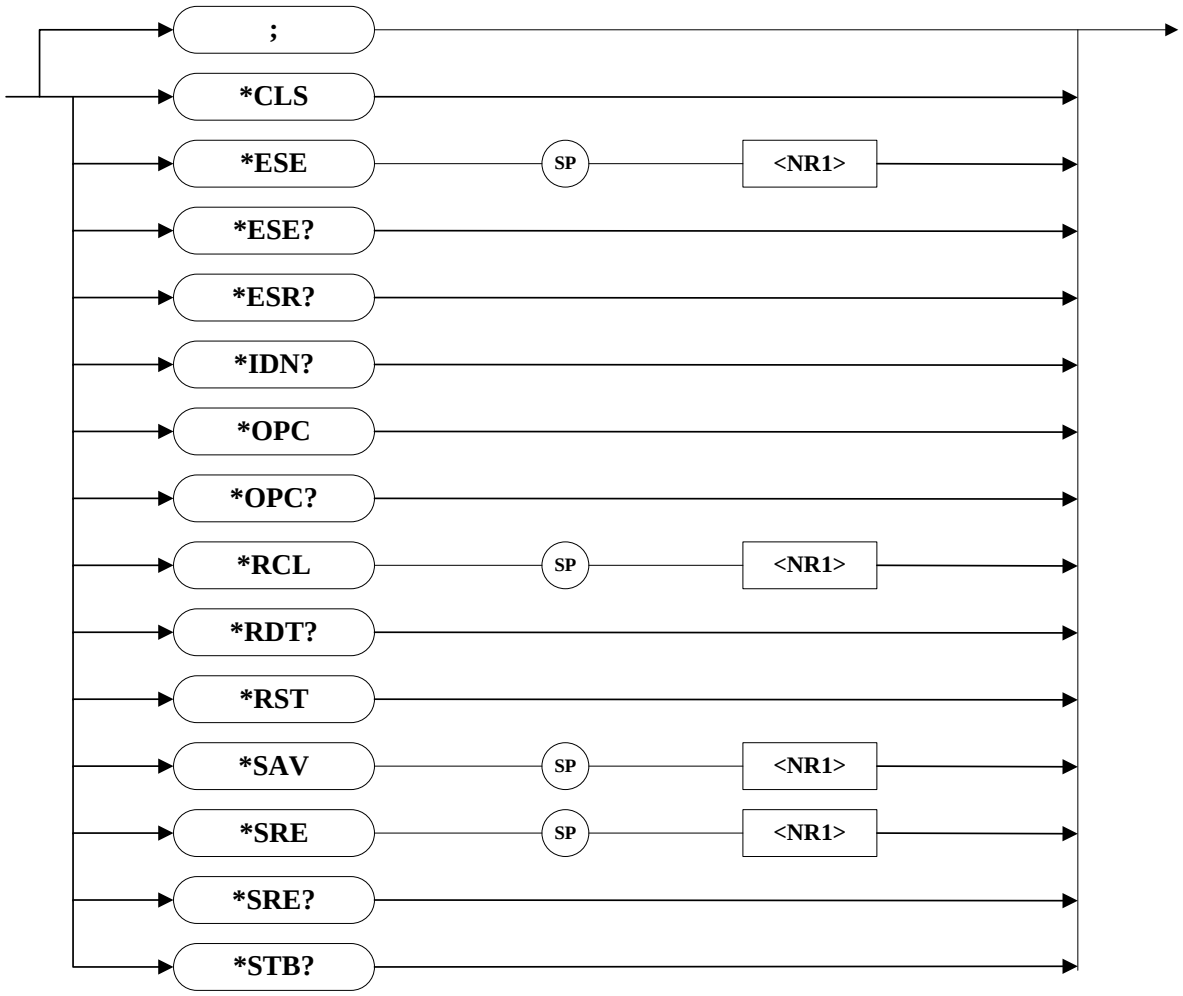
2. (root):SPEC:VOLT:H 30;
   :L 5;:
   (root):RES:L1 400;
   :RISE 1000;:

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 Parameters: 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 Parameters: <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 Parameters: <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 Parameters: <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 Parameters:<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 Parameters: 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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters: 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 Parameters:<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 Parameters:<NR1>, 0 ~ 255
Setting Example: *SRE 20 Enable the CSUM and MAV bit for Service Request.
Query Syntax: *SRE?
Return Parameters:<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 Parameters:<NR1>

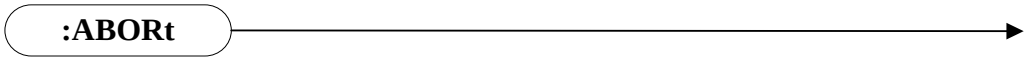
Query Example: *STB? Return the contents of "Status Byte".

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



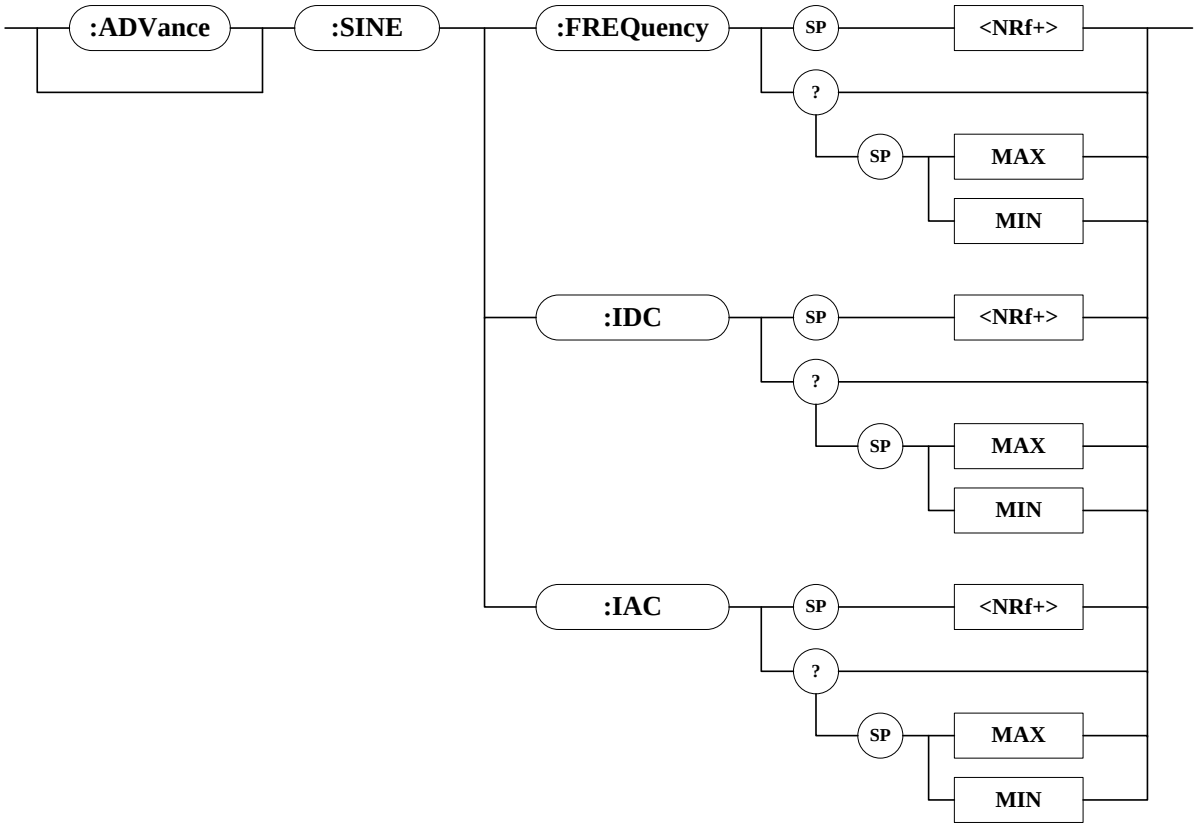
ABORt

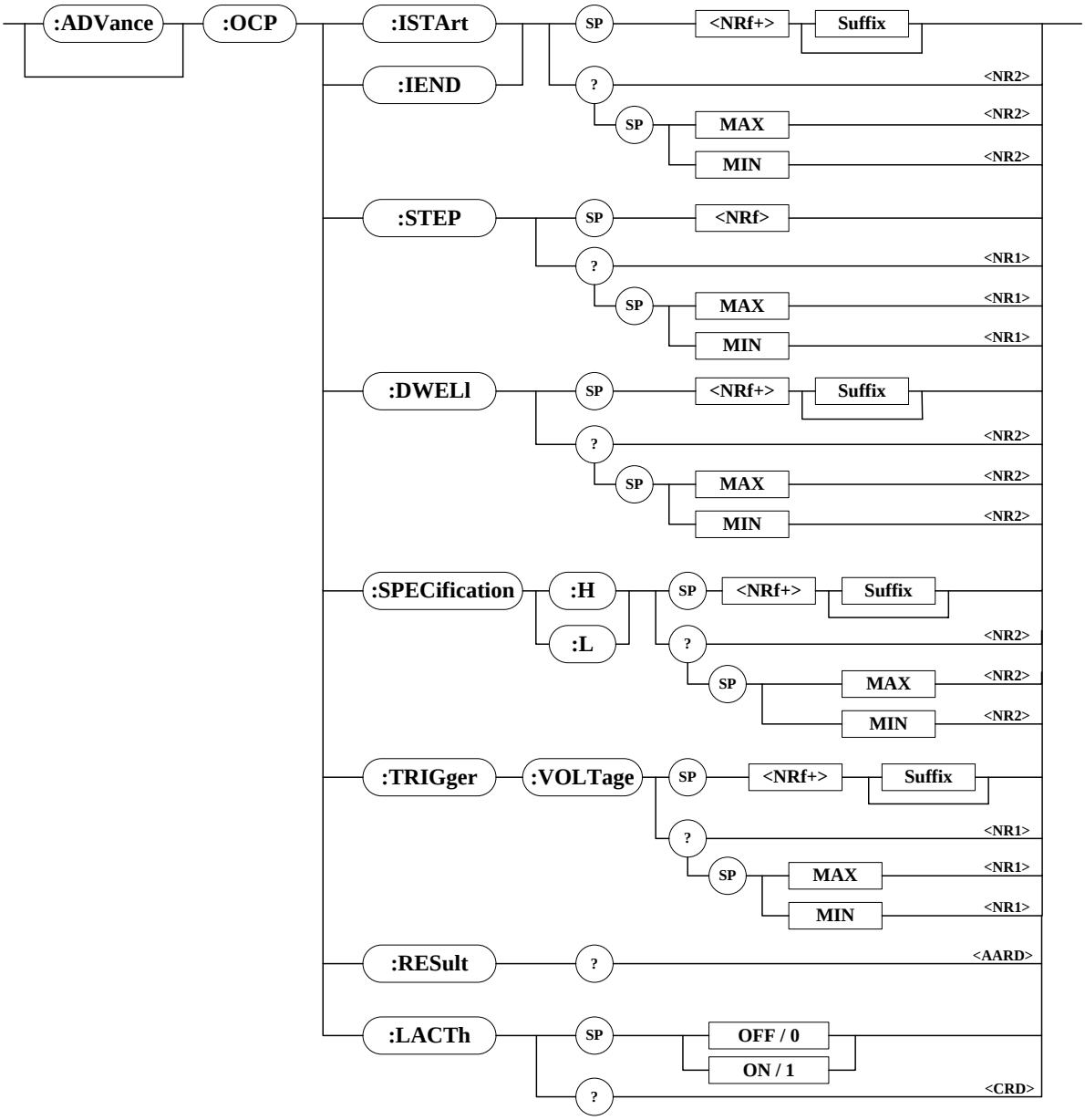
Type: All Channels

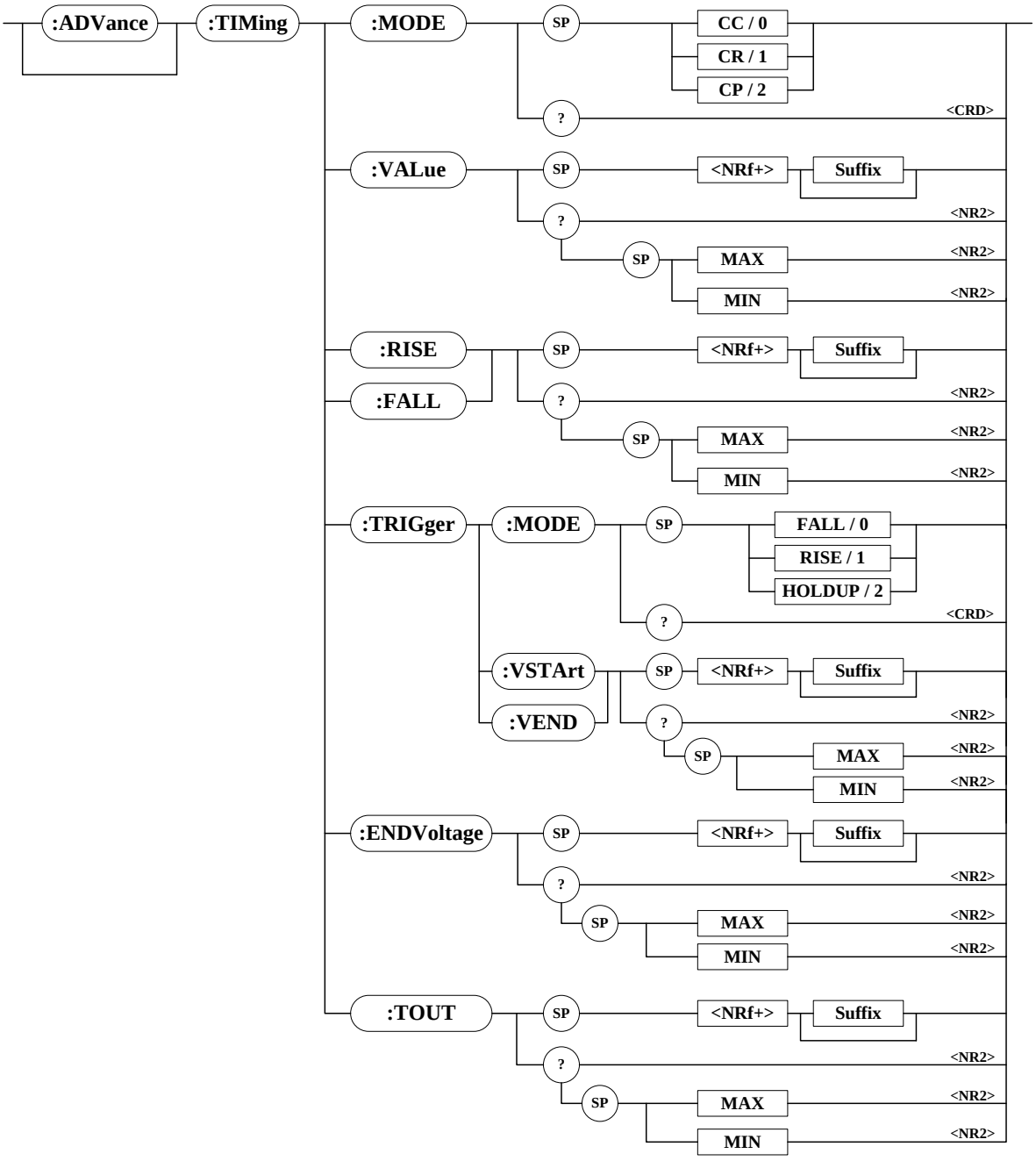
Description: Set all electronic loads as "OFF".

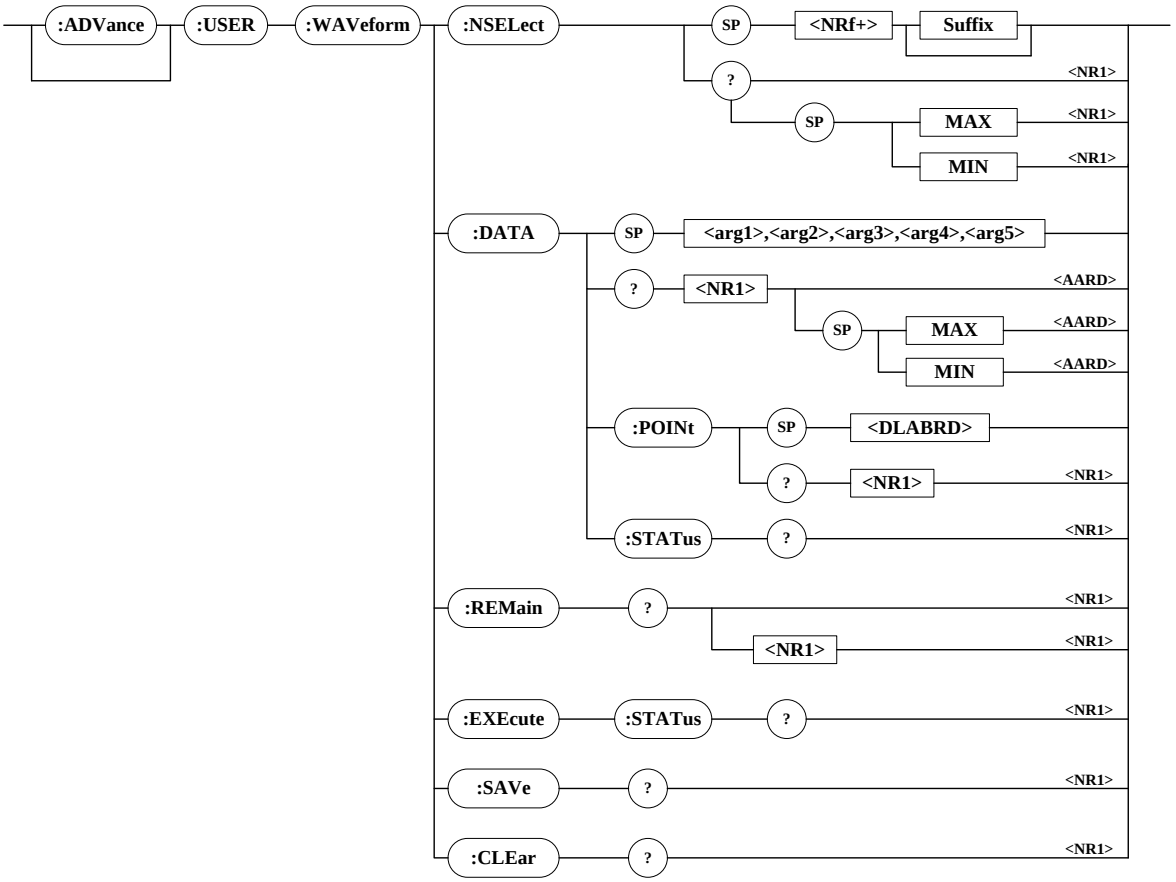
Setting Syntax: ABORt

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: Set frequency for sine wave dynamic mode.
Setting Syntax: ADVance:SINE:FREQuency<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Hertz]
Query Example: ADV:SINE:FREQ?
ADV:SINE:FREQ? MAX
ADV:SINE:FREQ? MIN

ADVance:SINE:IAC

Type: Channel-Specific
Description: Set AC current for sine wave dynamic mode.
Setting Syntax: ADVance:SINE:IAC<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Ampere]
Query Example: ADV:SINE:IAC?

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

ADVance:SINE:IDC

Type: Channel-Specific
Description: Set DC current for sine wave dynamic mode.
Setting Syntax: ADVance:SINE:IDC<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<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 result of OCP test function.
Setting Syntax: None
Setting Parameters:None
Setting Example: None
Query Syntax: ADVance:OCP:RESult?
Return Parameters:<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 execute.
Query Example: ADV:OCP:RES?

ADVance:OCP:DWELl

Type: Channel-Specific
Description: Set dwell time for OCP test mode.
Setting Syntax: ADVance:OCP:DWELl<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Second]
Query Example: ADV:OCP:DWEL?
ADV:OCP:DWEL? MAX
ADV:OCP:DWEL? MIN

ADVance:OCP:IEND

Type: Channel-Specific
Description: Set end current for OCP test mode.
Setting Syntax: ADVance:OCP:IEND<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = Ampere]
Query Example:
ADV:OCP:IEND?
ADV:OCP:IEND? MAX
ADV:OCP:IEND? MIN

ADVance:OCP:ISTArt

Type: Channel-Specific
Description: Set starts current for OCP test mode.
Setting Syntax: ADVance:OCP:ISTArt<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = Ampere]
Query Example:
ADV:OCP:ISTA?
ADV:OCP:ISTA? MAX
ADV:OCP:ISTA? MIN

ADVance:OCP:SPECification:H

Type: Channel-Specific
Description: Set high level current of specification for OCP test mode.
Setting Syntax: ADVance:OCP:SPECification:H<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <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: Set low level current of specification for OCP test mode.
Setting Syntax: ADVance:OCP:SPECification:L<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters:<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: Set step count for OCP test mode.
Setting Syntax: ADVance:OCP:STEP<space><NRf+>
Setting Parameters:<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 Parameters:<NR1>, [Unit = None]
Query Example: ADV:OCP:STEP?
ADV:OCP:STEP? MAX
ADV:OCP:STEP? MIN

ADVance:OCP:TRIGger:VOLTage

Type: Channel-Specific
Description: Set trigger voltage for OCP test mode.
Setting Syntax: ADVance:OCP:TRIGger:VOLTage<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<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: Set load latch function for OCP test mode.
Setting Syntax: ADVance:OCP:LATCh<space><CRD | NR1>
Setting Parameters:<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 Parameters:<CRD>, OFF, ON [Unit = None]
Query Example: ADV:OCP:LATC?

ADVance:TIMing:ENDVoltage

Type: Channel-Specific
Description: Set end voltage when trigger mode set to HOLD_UP for Timing mode.
Setting Syntax: ADVance:TIMing:ENDVoltage<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Volt]
Query Example: ADV:TIM:ENDV?
ADV:TIM:ENDV? MAX
ADV:TIM:ENDV? MIN

ADVance:TIMing:FALL

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

ADVance:TIMing:MODE

Type: Channel-Specific
Description: Set run mode in Timing mode.
Setting Syntax: ADVance:TIMing:MODE<space><CRD | NR1>
Setting Parameters:<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 Parameters:<CRD>, CC, CR, CP [Unit = None]
Query Example: ADV:TIM:MODE?

ADVance:TIMing:RISE

Type: Channel-Specific
Description: Set rising slew rate of current in Timing mode.
Setting Syntax: ADVance:TIMing:RISE<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = A/uS]

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

ADVance:TIMing:TOUT

Type: Channel-Specific
Description: Set timeout for Timing mode.
Setting Syntax: ADVance:TIMing:TOUT<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Second]
Query Example: ADV:TIM:TOUT?
ADV:TIM:TOUT? MAX
ADV:TIM:TOUT? MIN

ADVance:TIMing:TRIGger:MODE

Type: Channel-Specific
Description: Set trigger mode in Timing mode.
Setting Syntax: ADVance:TIMing:TRIGgerMODE<space><CRD | NR1>
Setting Parameters:<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 Parameters:<CRD>, FALL, RISE, HOLDUP [Unit = None]
Query Example: ADV:TIM:TRIG:MODE?

ADVance:TIMing:TRIGger:VEND

Type: Channel-Specific
Description: Set end voltage of trigger when trigger mode set to FALL or RISE in Timing mode.
Setting Syntax: ADVance:TIMing:TRIGger:VEND<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<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: Set start voltage of trigger when trigger mode set to FALL or RISE in Timing mode.
Setting Syntax: ADVance:TIMing:TRIGger:VSTArt<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<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: Set load value according to the run mode in Timing mode. Notice every time when the run mode of timing is changed this setting will be reset to zero.
Setting Syntax: ADVance:TIMing:VALue<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<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: Set the active waveform to run for user-define waveform function.
Setting Syntax: [ADVance:]USER:WAVeform:NSELect<space><NRf+>
Setting Parameters:<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 Parameters:<NR1>, [Unit = None]
Query Example: USER:WAV:NSEL?

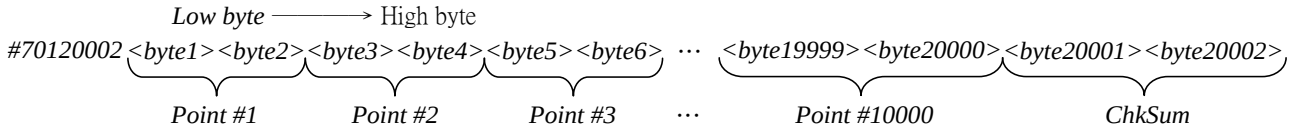
ADV:USER:WAV:NSEL? MAX
ADV:USER:WAV:NSEL? MIN

[ADVance:]USER:WAVeform:DATA

Type: Channel-Specific
Description: Set the user-define waveform parameters. (Note: All setting parameters in this command can't use suffix.)
Setting Syntax:
[ADVance:]USER:WAVeform:DATA<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>
Setting Parameters:
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 Parameters:<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-define waveform data with binary format. The waveform is consist of number points correspond to sampling points that user specified in format of 16bits unsigned integral.



Setting Syntax: [ADVance:]USER:WAVeform:DATA:POINt<space><DLABRD>
Setting Parameters: <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 Parameters: <NR1>, 0 ~ 120000
Query Example: USER:WAV:DATA:POIN?

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

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

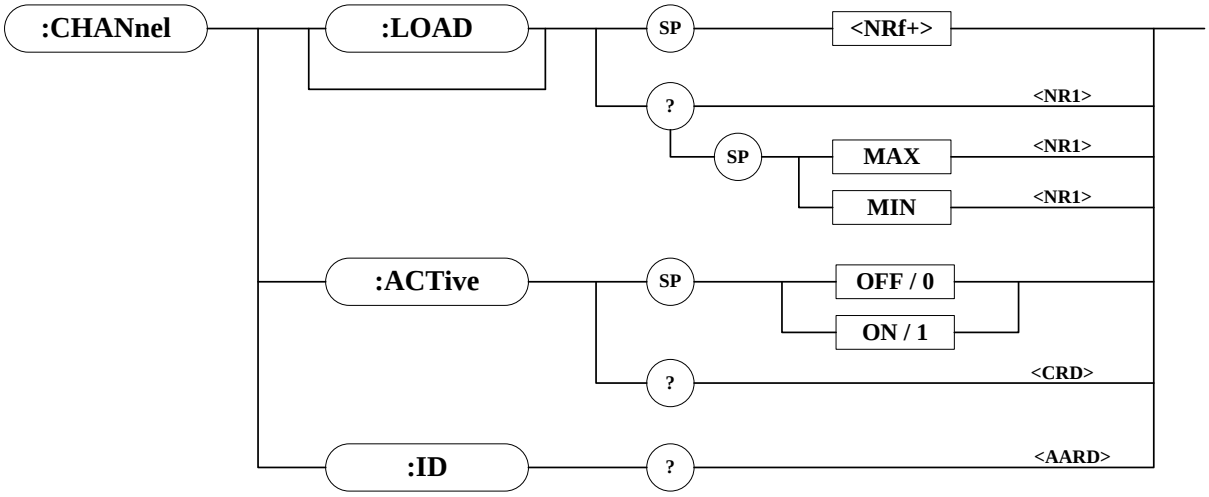
[ADVance:]USER:WAVeform:REMain?[<space><NR1>]

Type: Channel-Specific
Description: This command returns the remains waveform data of unused.
Setting Syntax: None
Setting Parameters:None
Query Syntax: [ADVance:]USER:WAVeform:REMain?[<space><NR1>]
Query Parameters: <NR1>, 1 ~ 10, Resolution = 1, Unit = None, 1~10:Waveform 1~10
Return Parameters:<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 Parameters:<NR1>, 1 ~ 10, Resolution = 1, Unit = None, 1~10:Waveform 1~10
Setting Example: ADV:USER:WAV:CLE? 3
Query Syntax: None
Return Parameters:<NR1>, 0:ok 1:error
Query Example: None

5.3.2.3 CHANNEL Subsystem



CHANnel[:LOAD]

Type: Channel Specific
Description: Selects a channel of which the coming channel-specific command will be received and executed.
Setting Syntax: CHANnel[:LOAD]<space><NRf+>
Setting Parameters: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 Parameters:<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 Parameters:<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 Parameters:<CRD>, OFF, ON [Unit = None]

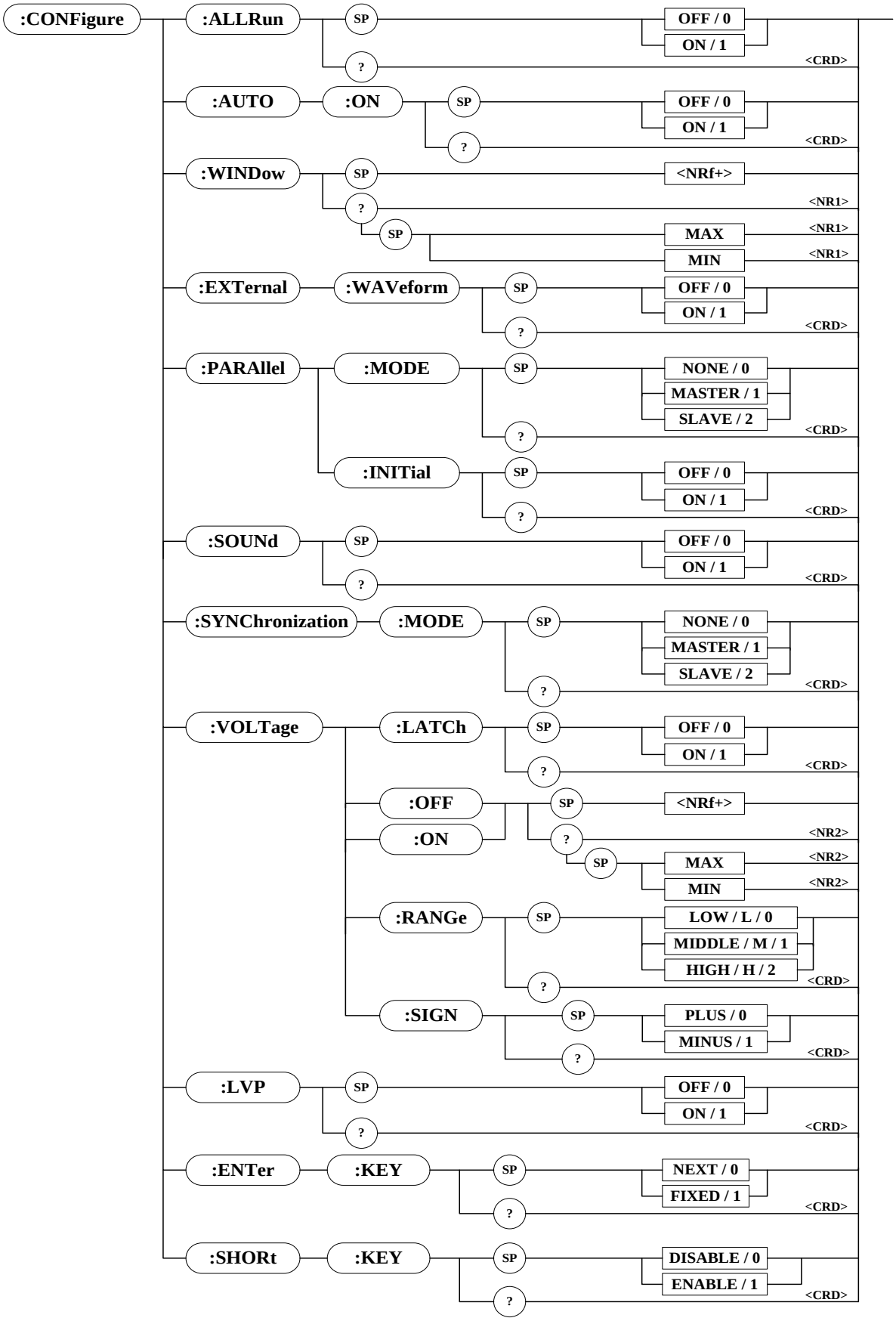
Query Example: CHAN:ACT?

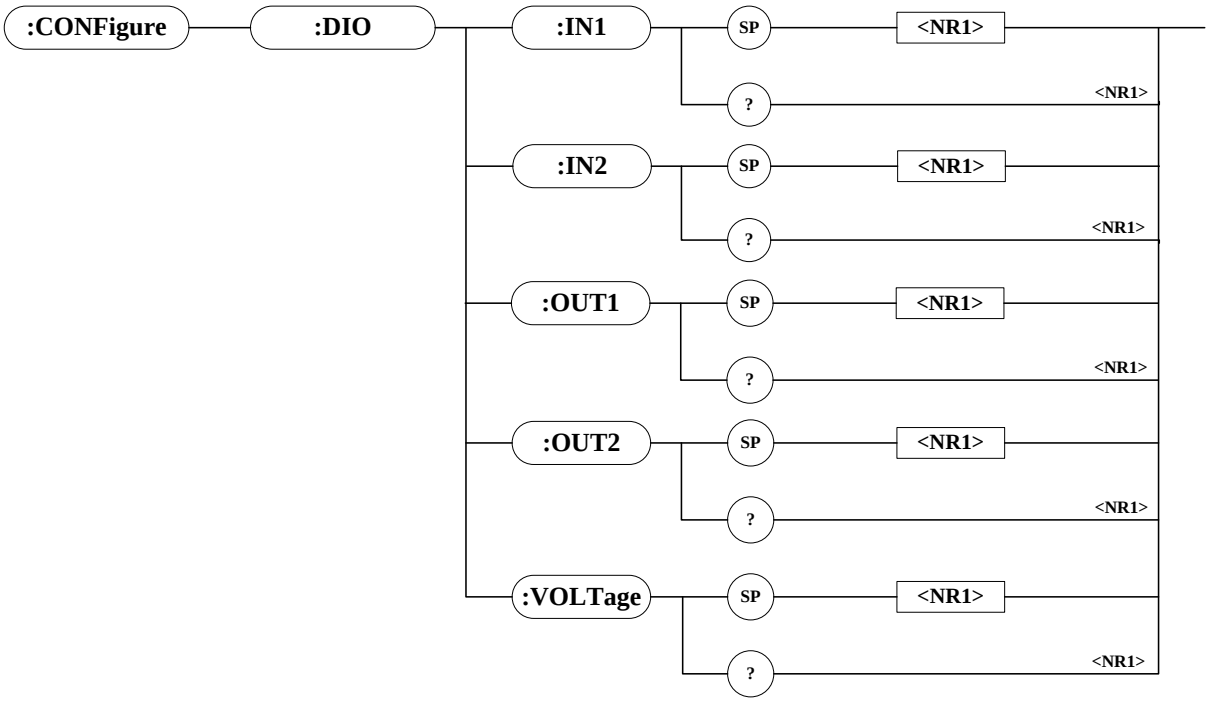
CHAN:ID?

Type: Channel-Specific
Description: This query requests the module to identify itself.
Setting Syntax: None
Setting Parameters: None
Setting Example: None
Query Syntax: CHANnel:ID?
Return Parameters: <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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters: <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 Parameters:<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 Parameters: <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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters: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 Parameters:Refer to respective specification for valid value range.
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 Parameters:<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 Parameters:Refer to respective specification for valid value range.
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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters: <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 Parameters: <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 Parameters: <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 Parameters: <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 Parameters: <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 Parameters: <CRD>, DISABLE, ENABLE [Unit = None]
Query Example: CONF:SHOR:KEY?

CONFigure:DIO:IN1

Type: Frame-Specific
Description: Set the DI1 type the pin No.10 in System I/O Port.
Setting Syntax: CONFigure:DIO:IN1<space><NR1>
Setting Parameters: <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 Parameters: <NR1>, 0 ~ 2 [Unit = None]
Query Example: CONF:DIO:IN1?

CONFigure:DIO:IN2

Type: Frame-Specific
Description: Set the DI2 type the pin No.44 in System I/O Port.
Setting Syntax: CONFigure:DIO:IN2<space><NR1>
Setting Parameters: <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 Parameters: <NR1>, 0 ~ 2 [Unit = None]
Query Example: CONF:DIO:IN2?

CONFigure:DIO:OUT1

Type: Frame-Specific
Description: Set the DO1 type the pin No.9 in System I/O Port.
Setting Syntax: CONFigure:DIO:OUT1<space><NR1>
Setting Parameters: <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 Parameters: <NR1>, 0 ~ 7 [Unit = None]

Query Example: CONF:DIO:OUT1?

CONFigure:DIO:OUT2

Type: Frame-Specific
Description: Set the DO2 type the pin No.43 in System I/O Port.
Setting Syntax: CONFigure:DIO:OUT2<space><NR1>
Setting Parameters: <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 Parameters: <NR1>, 0 ~ 7 [Unit = None]
Query Example: CONF:DIO:OUT2?

CONFigure:DIO:VOLTage

Type: Frame-Specific
Description: Set the voltage level of digital output pins (DO1&DO2).
Setting Syntax: CONFigure:DIO:VOLTage<space><NR1>
Setting Parameters: <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 Parameters: <NR1>, 0 ~ 3 [Unit = None]
Query Example: CONF:DIO:VOLT?

DIO:OUT1

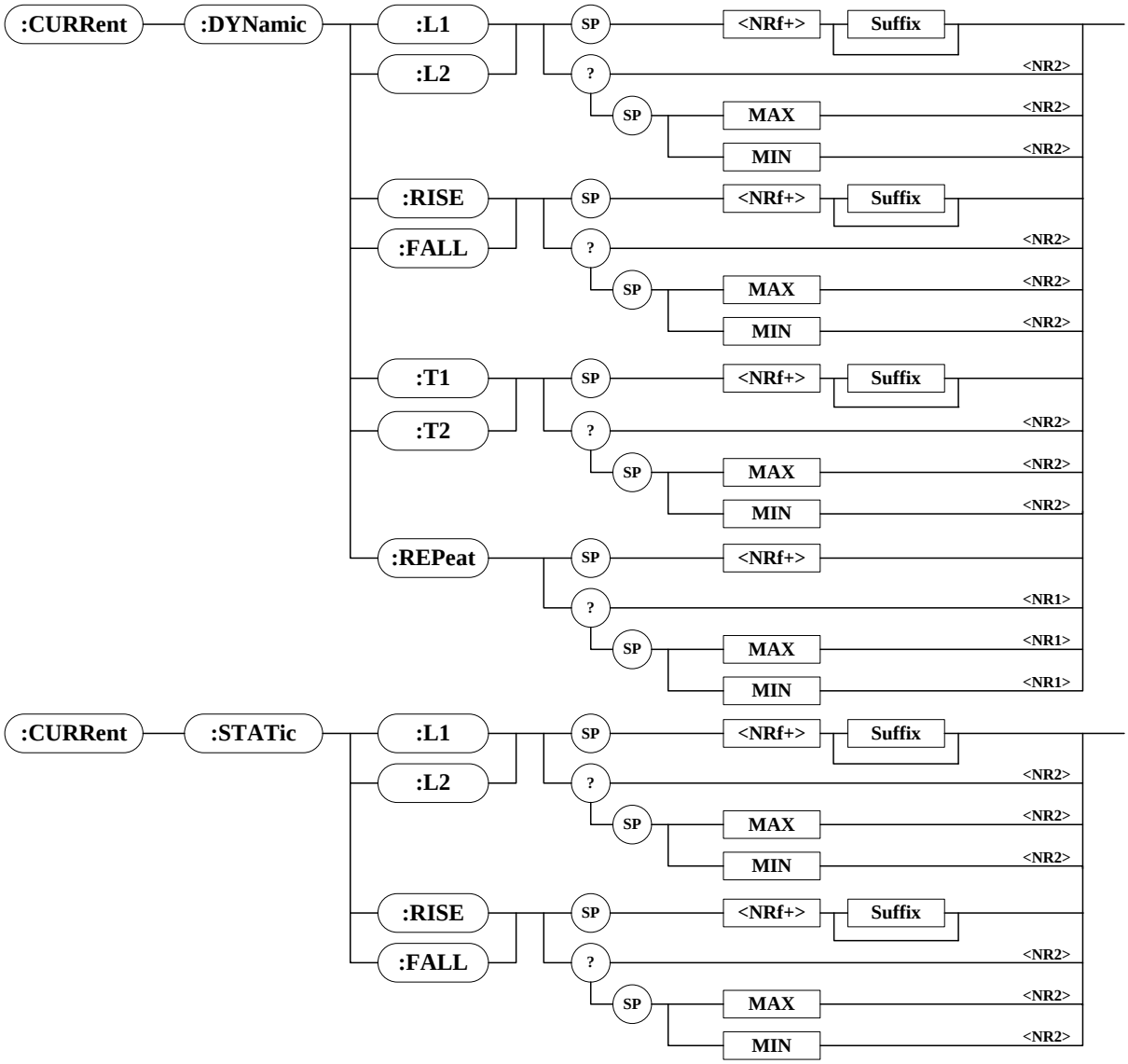
Type: Frame-Specific
Description: It sets t the system I/O port pin 9 DO1 status when the BUS CTRL. mode is selected for DO1.
Setting Syntax: DIO:OUT1<space><NR1>
Setting Parameters: <CRD | NR1>, OFF(0), ON(1)
Setting Example: DIO:OUT1 ON Set DO1 to act.
DIO:OUT1 0 Set DO1 not to act.
Query Syntax: DIO:OUT1?
Return Parameters: <CRD>, OFF, ON [Unit = None]
Query Example: DIO:OUT1?

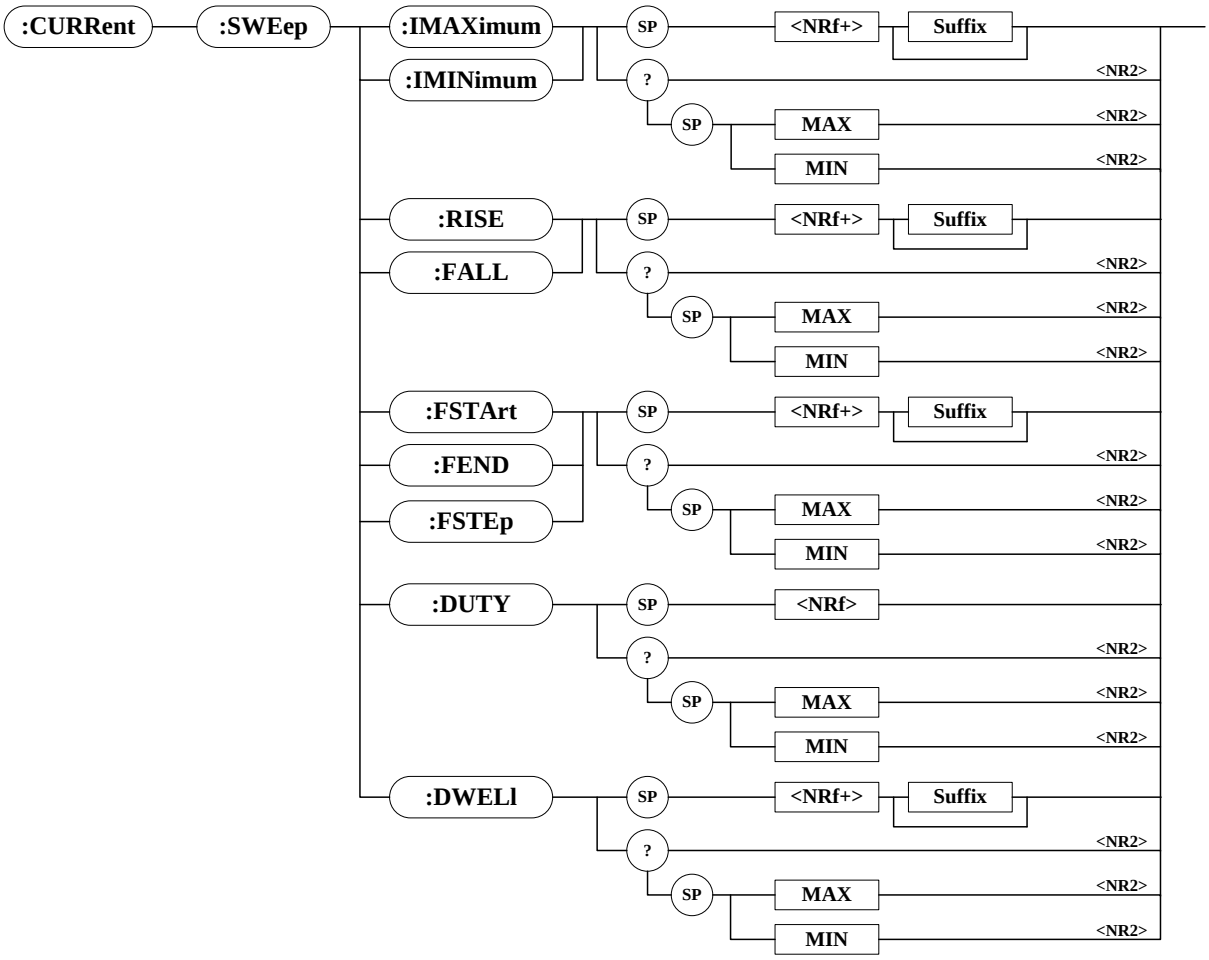
DIO:OUT2

Type: Frame-Specific
Description: It sets t 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 Parameters: <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 Parameters: <CRD>, OFF, ON [Unit = None]
Query Example: DIO:OUT2?

5.3.2.5 CURRENT Subsystem





CURRent:DYNamic:FALL

Type: Channel-Specific

Description: Set the falling slew rate of current for constant current dynamic mode.

Setting Syntax: CURRent:DYNamic:FALL<space><NRf+>[suffix]

Setting Parameters: Refer to respective specification for valid value range.

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 Parameters: <NR2>, [Unit = A/μs]

Query Example:

CURR:DYN:FALL?

CURR:DYN:FALL? MAX

CURR:DYN:FALL? MIN

CURRent:DYNamic:L1

Type: Channel-Specific

Description: Set the load current during T1 period for constant current dynamic mode.

Setting Syntax: CURRent:DYNamic:L1<space><NRf+>[suffix]

Setting Parameters: Refer to respective specification for valid value range.

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 Parameters:<NR2>,[Unit = Ampere]
Query Example: CURR:DYN:L1?
CURR:DYN:L1? MAX
CURR:DYN:L1? MIN

CURRent:DYNamic:L2

Type: Channel-Specific
Description: Set the load current during T2 period for constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:L2<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Ampere]
Query Example: CURR:DYN:L2?
CURR:DYN:L2? MAX
CURR:DYN:L2? MIN

CURRent:DYNamic:REPeat

Type: Channel-Specific
Description: Set the repeat count for constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:REPeat<space><NRf+>
Setting Parameters:<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 Parameters:<NR1>, [Unit = None]
Query Example: CURR:DYN:REP?
CURR:DYN:REP? MAX
CURR:DYN:REP? MIN

CURRent:DYNamic:RISE

Type: Channel-Specific
Description: Set the rising slew rate of current for constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:RISE<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.

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 Parameters:<NR2>, [Unit = A/μs]
Query Example: CURR:DYN:RISE?
CURR:DYN:RISE? MAX
CURR:DYN:RISE? MIN

CURRent:DYNamic:T1

Type: Channel-Specific
Description: Set duration parameter T1 for constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:T1<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Second]
Query Example: CURR:DYN:T1?
CURR:DYN:T1? MAX
CURR:DYN:T1? MIN

CURRent:DYNamic:T2

Type: Channel-Specific
Description: Set duration parameter T2 for constant current dynamic mode.
Setting Syntax: CURRent:DYNamic:T2<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Second]
Query Example: CURR:DYN:T2?
CURR:DYN:T2? MAX
CURR:DYN:T2? MIN

CURRent:STATic:FALL

Type: Channel-Specific
Description: Set the falling slew rate of current for constant current static mode.
Setting Syntax: CURRent:STATic:FALL<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = A/μs]
Query Example: CURR:STAT:FALL?
CURR:STAT:FALL? MAX
CURR:STAT:FALL? MIN

CURRent:STATic:L1

Type: Channel-Specific
Description: Set the static load current for constant current static mode.
Setting Syntax: CURRent:STATic:L1<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = Ampere]
Query Example: CURR:STAT:L1?
CURR:STAT:L1? MAX
CURR:STAT:L1? MIN

CURRent:STATic:L2

Type: Channel-Specific
Description: Set the static load current for constant current static mode.
Setting Syntax: CURRent:STATic:L2<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = Ampere]
Query Example: CURR:STAT:L2?
CURR:STAT:L2? MAX
CURR:STAT:L2? MIN

CURRent:STATic:RISE

Type: Channel-Specific
Description: Set the rising slew rate of current for constant current static mode.
Setting Syntax: CURRent:STATic:RISE<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = A/μs]
Query Example: CURR:STAT:RISE?
CURR:STAT:RISE? MAX
CURR:STAT:RISE? MIN

CURRent:SWEep:DUTY

Type: Channel-Specific
Description: Set the duty cycle for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:DUTY<space><NRf+>
Setting Parameters:<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 Parameters:<NR2>, [Unit = None]
Query Example: CURR:SWE:DUTY?
CURR:SWE:DUTY? MAX
CURR:SWE:DUTY? MIN

CURRent:SWEep:DWELl

Type: Channel-Specific
Description: Set the dwell time for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:DWELl<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Second]
Query Example: CURR:SWE:DWEL?
CURR:SWE:DWEL? MAX
CURR:SWE:DWEL? MIN

CURRent:SWEep:FALL

Type: Channel-Specific
Description: Set the falling slew rate of current for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:FALL<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = A/μs]
Query Example: CURR:SWE:FALL?
CURR:SWE:FALL? MAX
CURR:SWE:FALL? MIN

CURRent:SWEep:FEND

Type: Channel-Specific
Description: Set the end of frequency for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:FEND<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Hertz]
Query Example: CURR:SWE:FEND?
CURR:SWE:FEND? MAX
CURR:SWE:FEND? MIN

CURRent:SWEep:FSTArt

Type: Channel-Specific
Description: Set the start of frequency for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:FSTArt<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Hertz]
Query Example: CURR:SWE:FSTA?
CURR:SWE:FSTA? MAX
CURR:SWE:FSTA? MIN

CURRent:SWEep:FSTEp

Type: Channel-Specific
Description: Set the step of frequency for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:FSTEp<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Hertz]
Query Example: CURR:SWE:FSTE?
CURR:SWE:FSTE? MAX
CURR:SWE:FSTE? MIN

CURRent:SWEep:IMAXimum

Type: Channel-Specific
Description: Set the maximum current for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:IMAXimum<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Ampere]
Query Example: CURR:SWE:IMAX?
CURR:SWE:IMAX? MAX
CURR:SWE:IMAX? MIN

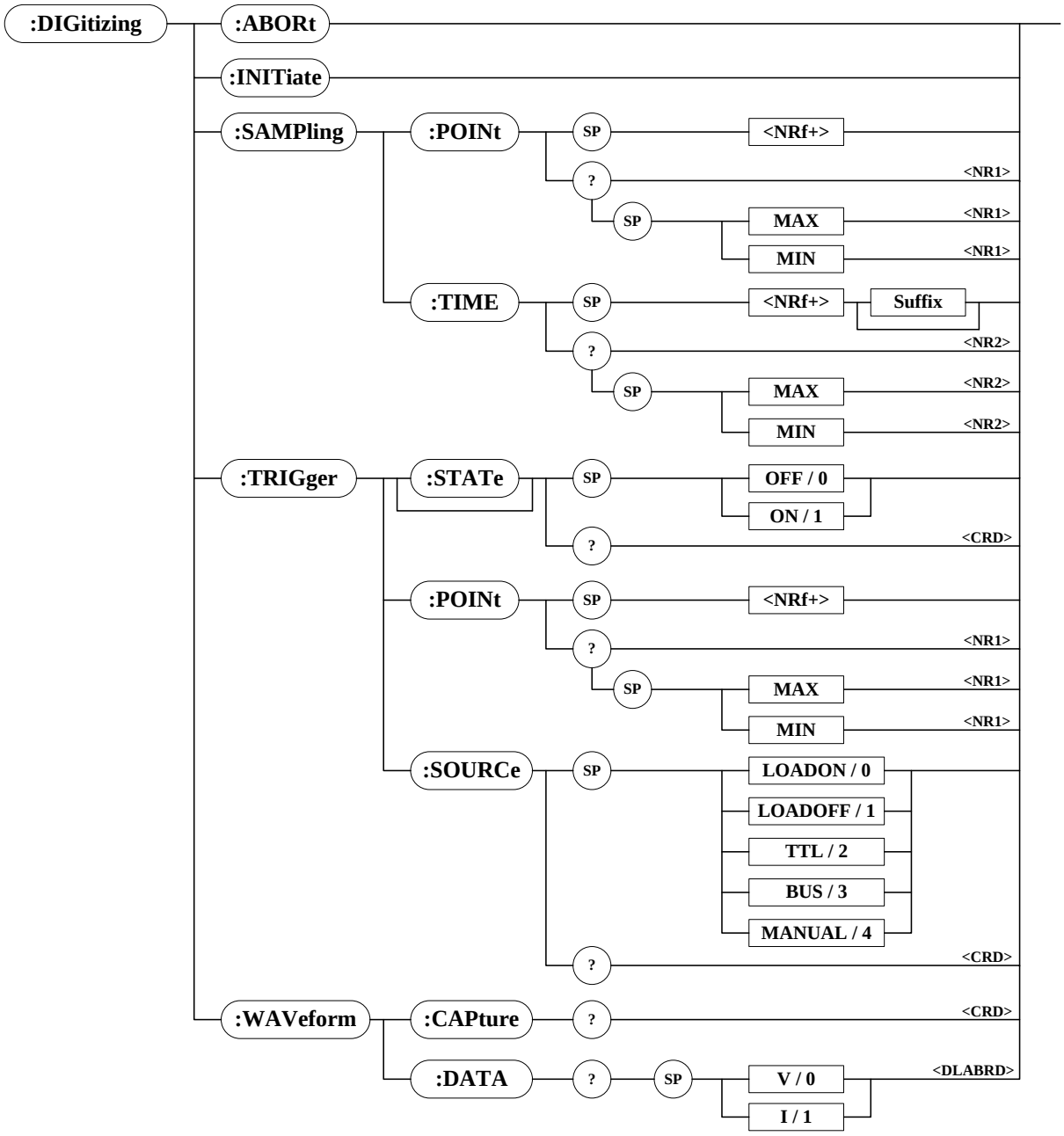
CURRent:SWEep:IMINimum

Type: Channel-Specific
Description: Set the minimum current for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:IMINimum<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Ampere]
Query Example: CURR:SWE:IMIN?
CURR:SWE:IMIN? MAX
CURR:SWE:IMIN? MIN

CURRent:SWEep:RISE

Type: Channel-Specific
Description: Set the rising slew rate of current for constant current frequency sweep mode.
Setting Syntax: CURRent:SWEep:RISE<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<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 Parameters:None
Setting Example: DIG:ABOR Abort digitizing function.
Query Syntax: None
Return Parameters:None
Query Example: None

DIGitizing:INITiate

Type: Channel-Specific
Description: Start the digitizing function to wait trigger signal.
Setting Syntax DIGitizing:INITiate
Setting Parameters: None
Setting Example: DIG:INIT Initial digitizing function.
Query Syntax: None
Return Parameters:None
Query Example: None

DIGitizing:SAMPling:POINt

Type: Channel-Specific
Description: Set the sampling points for digitizing function.
Setting Syntax: DIGitizing:SAMPling:POINt<space><NRf+>
Setting Parameters:<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 Parameters:<NR1>, [Unit = None]
Query Example: DIG:SAMP:POIN?
DIG:SAMP:POIN? MAX
DIG:SAMP:POIN? MIN

DIGitizing:SAMPling:TIME

Type: Channel-Specific
Description: Set the sampling time for digitizing function.
Setting Syntax: DIGitizing:SAMPling:TIME<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Second]
Query Example: DIG:SAMP:TIME?
DIG:SAMP:TIME? MAX
DIG:SAMP:TIME? MIN

DIGitizing:TRIGger[:STATe]

Type: Channel-Specific
Description: Set the software trigger for digitizing function.
Setting Syntax DIGitizing:TRIGger[:STATe]<space><CRD | NR1>
Setting Parameters: <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 Parameters:<CRD>, IDLE, PRE_TRIG, WAIT_TRIG, POST_TRIG
Query Example: DIG:TRIG?

DIGitizing:TRIGger:POINt

Type: Channel-Specific
Description: Set the trigger points for digitizing function.
Setting Syntax: DIGitizing:TRIGger:POINt<space><NRf+>
Setting Parameters:<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 Parameters:<NR1>, [Unit = None]
Query Example: DIG:TRIG:POIN?
DIG:TRIG:POIN? MAX
DIG:TRIG:POIN? MIN

DIGitizing:TRIGger:SOURce

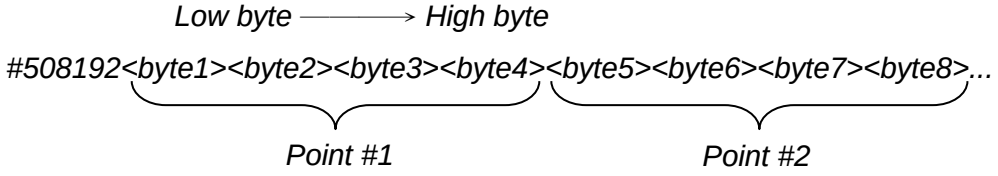
Type: Channel-Specific
Description: Set the trigger source for digitizing function.
Setting Syntax DIGitizing:TRIGger:SOURce<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOADON(0), LOADOFF(1), TTL(2), BUS(3) | MANUAL(4) [Unit = None]
Setting Example: DIG:TRIG:SOUR TTL Set trigger source to TTL.
DIG:TRIG:SOUR 3 Set trigger source to BUS.
Query Syntax: DIGitizing:TRIGger:SOURce?
Return Parameters:<CRD>, LOADON, LOADOFF, TTL, BUS, MANUAL
Query Example: DIG:TRIG:SOUR?

DIGitizing:WAVeform:CAPture?

Type: Channel-Specific
Description: Start waveform data transmit from Module to Frame.
Setting Syntax: None
Setting Parameters:None
Setting Example: None
Query Syntax: DIGitizing:WAVeform:CAPture?
Return Parameters:<CRD>, WAIT, OK, ERROR [Unit = None]
Query Example: DIG:WAV:CAP?

DIGitizing:WAVeform:DATA?

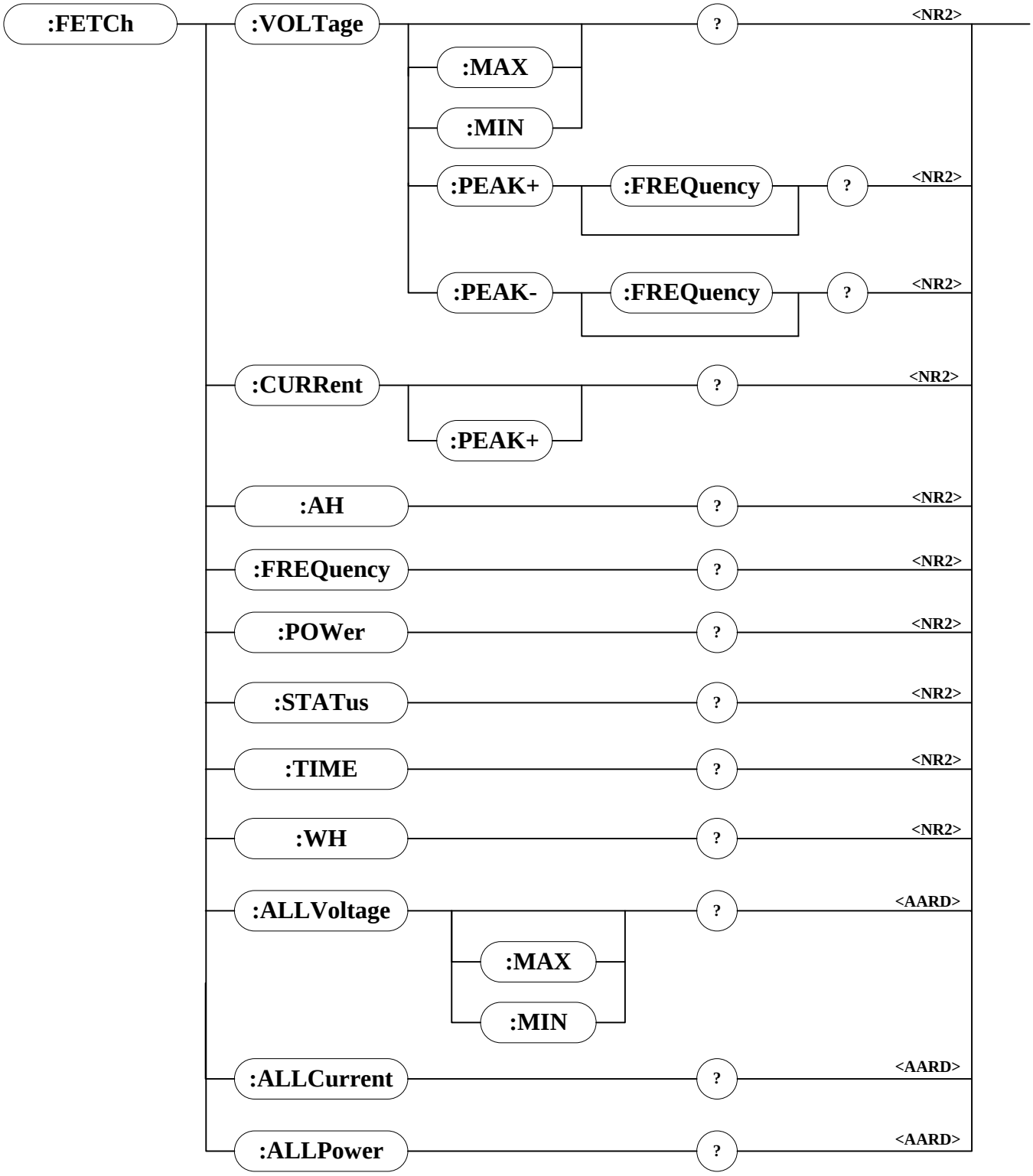
Type: Channel-Specific
Description: This query returns voltage or current waveform data from the DC Electronic Load in binary format. The waveform either voltage or current are consist of number points correspond to sampling points that user specified in format of 32bits float point.



Setting Syntax: None

Setting Parameters:None
Setting Example: None
Query Syntax: DIGitizing:WAVeform:DATA?<space><V | I>
Return Parameters:<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 the all load modules.

The return value is 0 when the channel does not exist or no sink current.
Query Syntax: FETCh:ALLCurrent?
Return Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters: <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 Parameters: <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 Parameters: <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 Parameters: <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 Parameters: <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 Parameters: <NR2>, [Unit = Hertz]
Query Example: FETC:VOLT:PEAK-:FREQ?
Return Example: 8.12

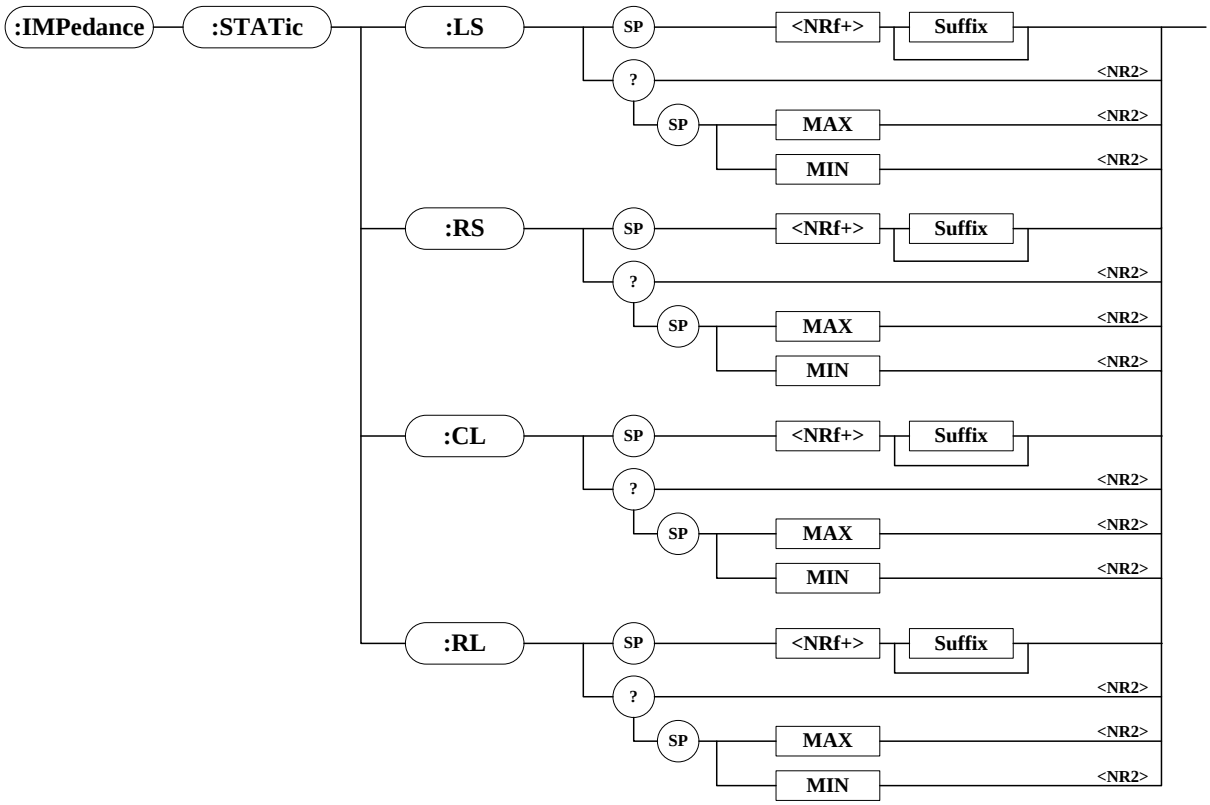
FETCh:ALLVoltage:MAX?

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 Parameters:<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 Parameters:<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: Set the equivalent parallel load capacitance for constant impedance mode.
Setting Syntax: IMPedance:STATic:CL<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Farad]
Query Example: CURR:STAT:CL?
CURR:STAT:CL? MAX
CURR:STAT:CL? MIN

IMPedance:STATic:LS

Type: Channel-Specific
Description: Set the equivalent series inductance for constant impedance mode.
Setting Syntax: IMPedance:STATic:LS<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = Henry]
Query Example: CURR:STAT:LS?
CURR:STAT:LS? MAX
CURR:STAT:LS? MIN

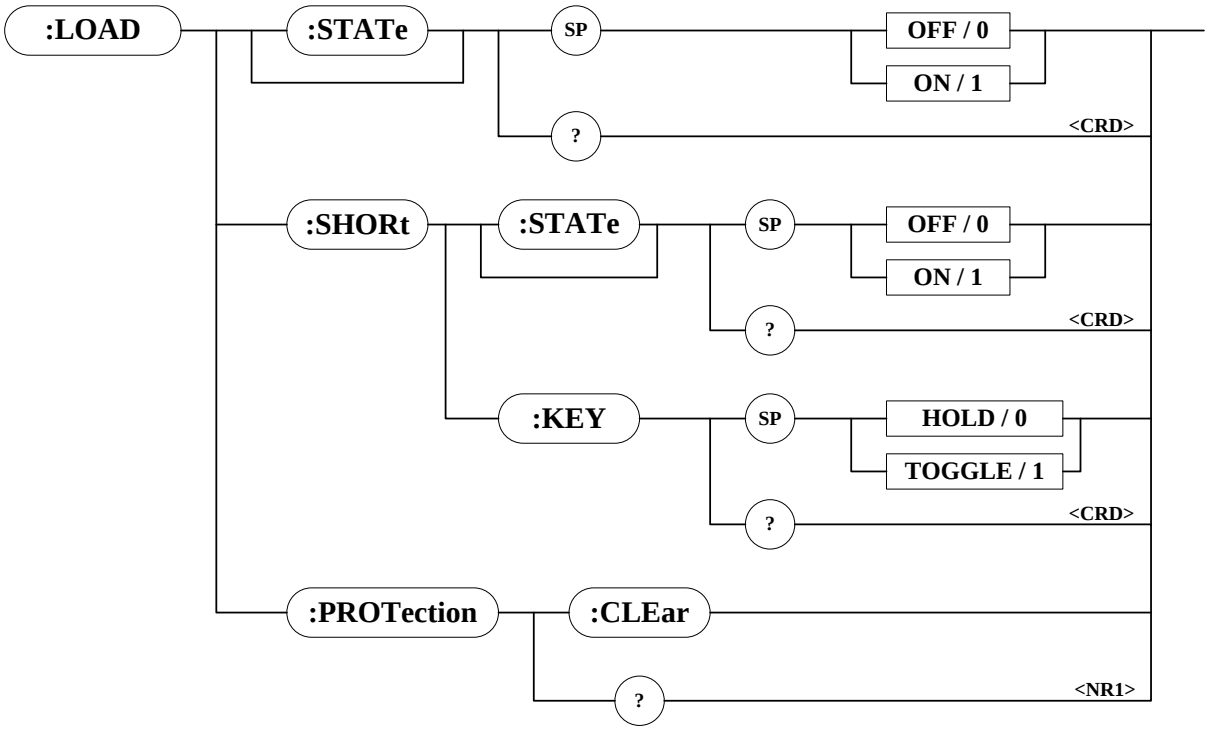
IMPedance:STATic:RS

Type: Channel-Specific
Description: Set the equivalent series resistance for constant impedance mode.
Setting Syntax: IMPedance:STATic:RS<space><NRf+>[suffix]
Setting Parameters:<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 Parameters:<NR2>, [Unit = OHM]
Query Example: IMP:STAT:RS?
IMP:STAT:RS? MAX
IMP:STAT:RS? MIN

IMPedance:STATic:RL

Type: Channel-Specific
Description: Set the equivalent parallel load resistance for constant impedance mode.
Setting Syntax: IMPedance:STATic:RL<space><NRf+>[suffix]
Setting Parameters: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 Parameters:<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 makes the electronic load active/on or inactive/off.
Setting Syntax: LOAD[:STATe]<space><NRf>
Setting Parameters:<NRf>, OFF(0), ON(1)
Setting Example: LOAD ON Activate the electronic load.
LOAD 0 Inactivate the electronic load.
Query Syntax: LOAD[:STATe]?
Return Parameters:<CRD>, OFF, ON
Query Example: LOAD?

LOAD:PROTection?

Type: Channel-Specific
Description: This command returns the status of electronic load.
Setting Syntax: None
Setting Parameters:None
Setting Example: None
Query Syntax: LOAD:PROTection?
Return Parameters:<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: This command resets the status of electronic load.
Setting Syntax: LOAD:PROTection:CLEar
Setting Parameters:None
Setting Example: LOAD:PROT:CLE
Query Syntax: None

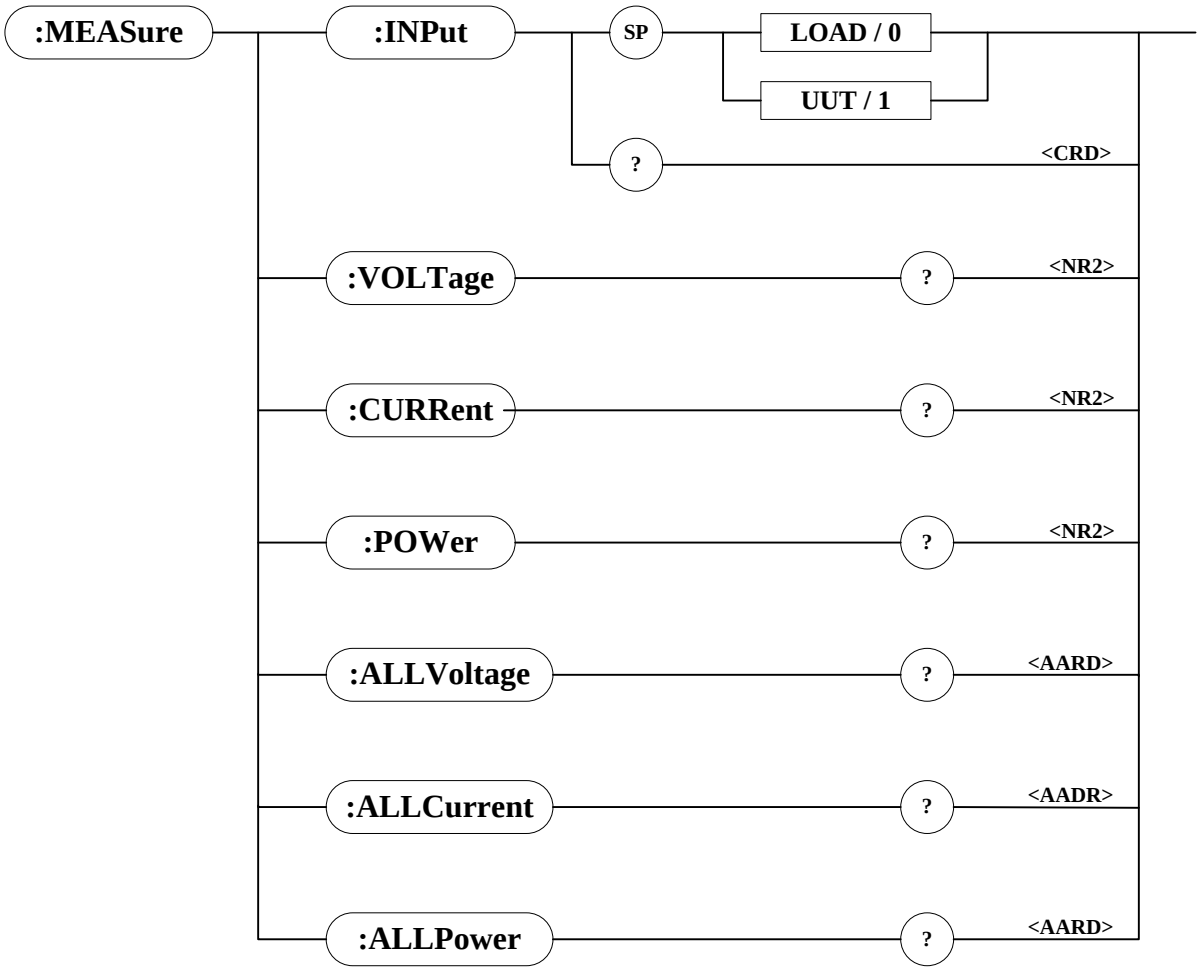
LOAD:SHORt[:STATe]

Type: Channel-Specific
Description: Activate or inactivate short-circuited simulation.
Setting Syntax: LOAD:SHORt[:STATe]<space><NRf>
Setting Parameters:<NRf>, OFF(0), ON(1)
Setting Example: LOAD:SHOR ON Activate short-circuited simulation.
LOAD:SHOR OFF Inactivates short-circuited simulation.
Query Syntax: LOAD:SHORt[:STATe]?
Return Parameters:<CRD>, OFF, ON
Query Example: LOAD:SHOR?

LOAD:SHORt:KEY

Type: Channel-Specific
Description: Set the mode of short key in the electronic load.
Setting Syntax: LOAD:SHORt:KEY<space><NRf>
Setting Parameters:<NRf>, HOLD(0), TOGGLE(1)
Setting Example: LOAD:SHOR:KEY TOGGLE Set the short key mode to Toggle.
LOAD:SHOR:KEY HOLD Set the short key mode to Hold.
Query Syntax: LOAD:SHORt:KEY?
Return Parameters:<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 load modules. The return value is 0 when the channel does not exist.
Query Syntax: MEASure:ALLCurrent?
Return Parameters:<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 load modules. The return value is 0 when the channel does not exist.
Query Syntax: MEASure:ALLPower?
Return Parameters:<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 load channel. The return value is 0 when the channel is not existed.
Query Syntax: MEASure:ALLVoltage?
Return Parameters:<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 Parameters:<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 Parameters:<NRf>, LOAD(0), UUT(1)
Setting Example: MEAS:INP LOAD
MEAS:INP 1
Query Syntax: MEASure:INPut?
Return Parameters: <CRD>, LOAD, UUT
Query Example: MEAS:INP?

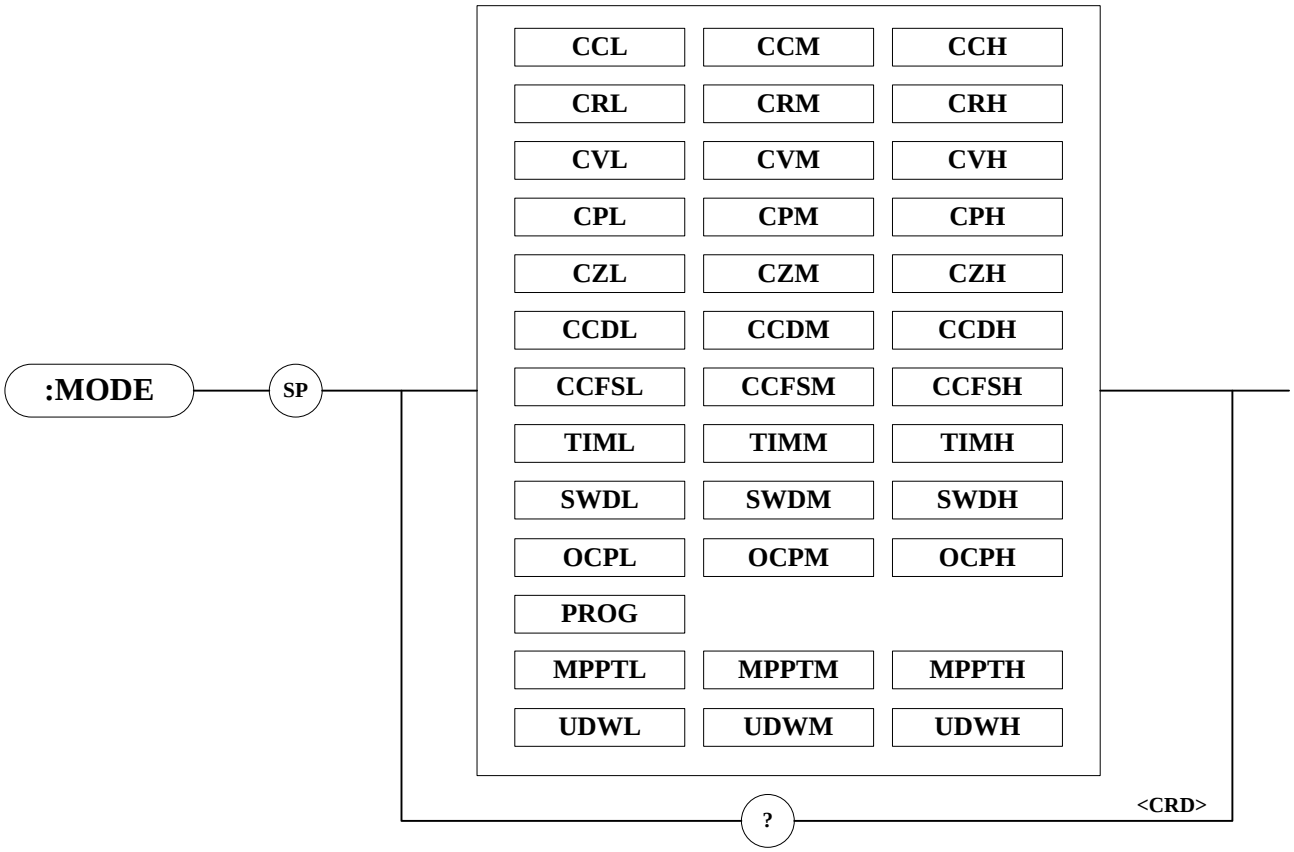
MEASure:POWer?

Type: Channel-Specific
Description: Returns the real time power measured at the load module input.
Query Syntax: MEASure:POWer?
Return Parameters:<NR2>, [Unit = Watt]
Query Example: MEAS:POW?
Return Example: 3.15

MEASure:VOLTage?

Type: Channel-Specific
Description: Returns the real time voltage measured at load module input.
Query Syntax: MEASure:VOLTage?
Return Parameters:<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 for the electronic load.

Setting Syntax: MODE<space><NRf>

Setting Parameters: <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:

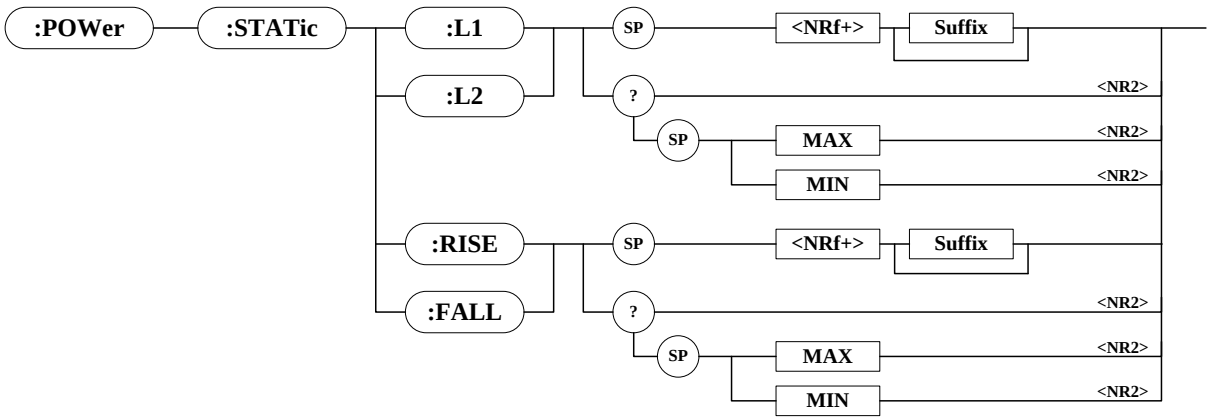
MODE CCL	Set CC mode of low range.
MODE CCH	Set CC mode of high range.
MODE CCDL	Set CC dynamic mode of low range.
MODE CCDH	Set CC dynamic mode of high range.
MODE CRL	Set CR mode of low range.
MODE CRH	Set CR mode of high range.

Query Syntax: MODE?

Return Parameters: <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: Set the falling slew rate of current for constant power mode.
Setting Syntax: POWer:STATic:FALL<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = A/μs]
Query Example:
POW:STAT:FALL?
POW:STAT:FALL? MAX
POW:STAT:FALL? MIN

POWer:STATic:L1

Type: Channel-Specific
Description: Set the static load power for constant power mode.
Setting Syntax: POWer:STATic:L1<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = Watt]
Query Example:
CURR:STAT:L1?
CURR:STAT:L1? MAX
CURR:STAT:L1? MIN

POWer:STATic:L2

Type: Channel-Specific
Description: Set the static load power for constant power mode.
Setting Syntax: POWer:STATic:L2<space><NRf+>[suffix]

Setting Parameters:Refer to respective specification for valid value range.

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 Parameters:<NR2>, [Unit = Watt]

Query Example:	POW:STAT:L2?
	POW:STAT:L2? MAX
	POW:STAT:L2? MIN

POWer:STATic:RISE

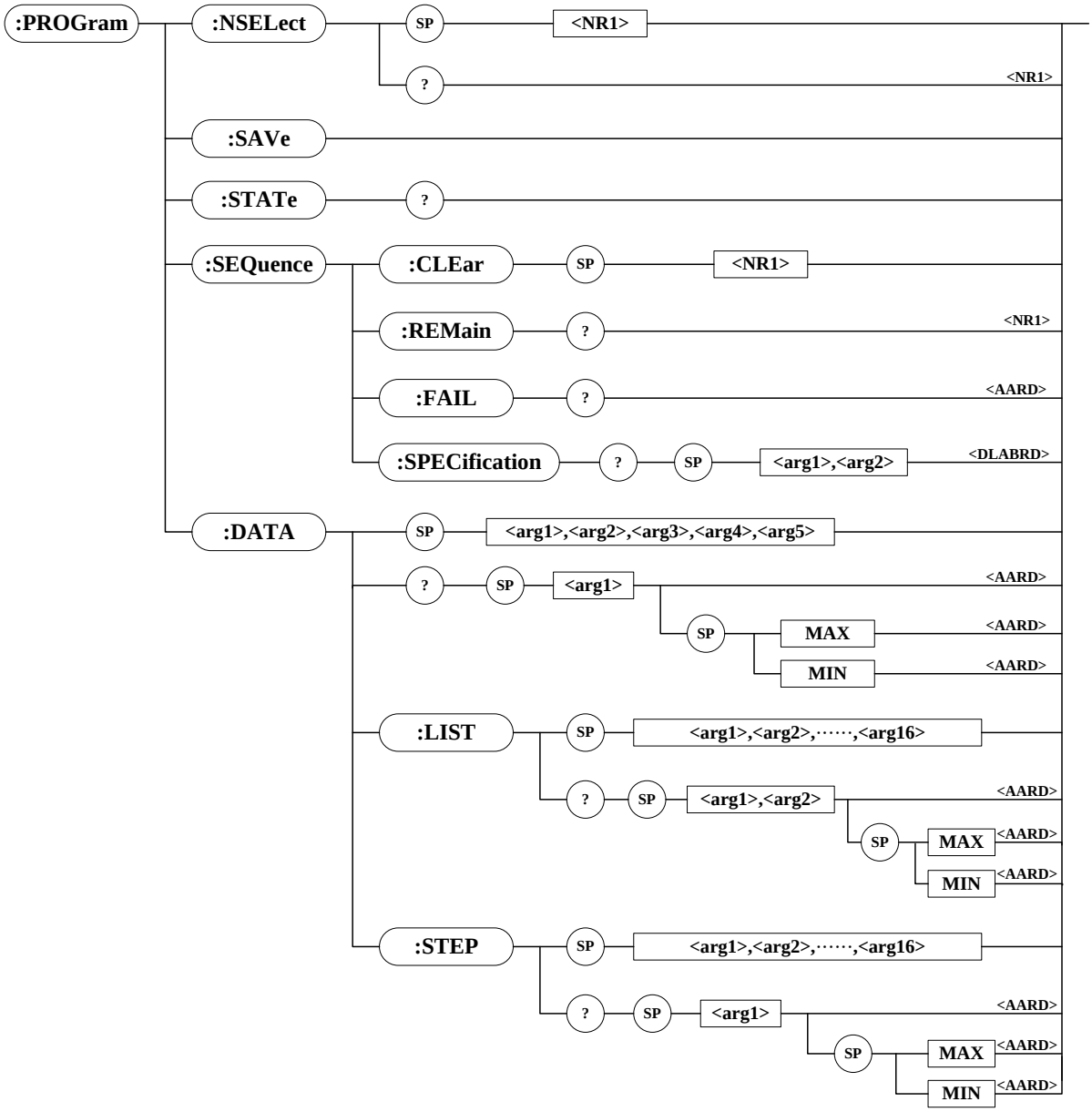
Type: Channel-Specific
Description: Set the rising slew rate of current for constant power mode.
Setting Syntax: POWer:STATic:RISE<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.

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 Parameters:<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: Set the program parameters. (**Note:** All setting parameters in this command can't use suffix.)

Setting Syntax: PROGram:DATA<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>

Setting Parameters:

Selects a program to be set:

Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.

Set the type of program:

Arg2: <NRf>, LIST(0), STEP(1), Unit = None.

Set the chain parameter in program:

Arg3: <NR1>, 0 ~ 10, Resolution = 1, Unit = None.

Set the repeat count of program:

Arg4: <NR1>, 0 ~ 9,999, Resolution = 1, Unit = None.

Set 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 Parameters:<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: Set the list parameters in program. (**Note:** All setting parameters in this command can't use suffix.)
Setting Syntax: PROGram:DATA:LIST<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>,<Arg6>,<Arg7>,<Arg8>,<Arg9>,<Arg10>,<Arg11>,<Arg12>,<Arg13>,<Arg14>,<Arg15>,<Arg16>
Setting Parameters:

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.
Set the trigger mode of sequence:
Arg3: <NRf>, SKIP(0), AUTO(1), MANUAL(2), EXTERNAL(3), Unit = None.
Set the run mode of sequence:
Arg4: <NRf>, CC(0), CR(1), CV(2), CP(3), Unit = None.
Set the mode's range of sequence:
Arg5: <NRf>, LOW(0), MIDDLE(1), HIGH(2), Unit = None.
Set the load value according to run mode in sequence:
Arg6: <NRf>, Refer to respective specification for valid value range.
Set the falling of slew rate in sequence:
Arg7: <NRf>, Refer to respective specification for valid value range.
Set the rising of slew rate in sequence:
Arg8: <NRf>, Refer to respective specification for valid value range.
Set the dwell time of sequence:
Arg9: <NRf>, 0.1ms ~ 30s, Resolution = 0.0001s, Unit = Second.
Set the high-level of voltage specific in sequence:
Arg10: <NRf>, Refer to respective specification for valid value range.
Set the low-level of voltage specific in sequence:
Arg11: <NRf>, Refer to respective specification for valid value range.
Set the high-level of current specific in sequence:
Arg12: <NRf>, Refer to respective specification for valid value range.
Set the low-level of current specific in sequence:
Arg13: <NRf>, Refer to respective specification for valid value range.
Set the high-level of power specific in sequence:
Arg14: <NRf>, Refer to respective specification for valid value

range.
Set the low-level of power specific in sequence:
Arg15: <NRf>, Refer to respective specification for valid value range.
Set the delay time of Pass/Fail in 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 Parameters: <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: Set the step parameters in program. (**Note:** All setting parameters in this command can't use suffix.)

Setting Syntax: PROGram:DATA:STEP<space><Arg1>,<Arg2>,<Arg3>,<Arg4>,<Arg5>,<Arg6>,<Arg7>,<Arg8>,<Arg9>,<Arg10>,<Arg11>,<Arg12>,<Arg13>,<Arg14>,<Arg15>,<Arg16>

Setting Parameters:
Selects a program to be set:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Set the trigger mode of sequence:
Arg2: <NRf>, SKIP(0), AUTO(1), MANUAL(2), EXTERNAL(3), Unit = None.
Set the run mode of sequence:
Arg3: <NRf>, CC(0), CR(1), CV(2), CP(3), Unit = None.
Set the mode's range of sequence:
Arg4: <NRf>, LOW(0), MIDDLE(1), HIGH(2), Unit = None.
Set the start value according to run mode in sequence:
Arg5: <NRf>, Refer to respective specification for valid value range.
Set the end value according to run mode in sequence:
Arg6: <NRf>, Refer to respective specification for valid value range.

Set the falling of slew rate in sequence:
Arg7: <NRf>, Refer to respective specification for valid value range.
Set the rising of slew rate in sequence:
Arg8: <NRf>, Refer to respective specification for valid value range.
Set the dwell time of sequence:
Arg9: <NRf>, 0.1ms ~ 30s, Resolution = 0.0001s, Unit = Second.
Set the high-level of voltage specific in sequence:
Arg10: <NRf>, Refer to respective specification for valid value range.
Set the low-level of voltage specific in sequence:
Arg11: <NRf>, Refer to respective specification for valid value range.
Set the high-level of current specific in sequence:
Arg12: <NRf>, Refer to respective specification for valid value range.
Set the low-level of current specific in sequence:
Arg13: <NRf>, Refer to respective specification for valid value range.
Set the high-level of power specific in sequence:
Arg14: <NRf>, Refer to respective specification for valid value range.
Set the low-level of power specific in sequence:
Arg15: <NRf>, Refer to respective specification for valid value range.
Set the delay time of Pass/Fail in 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 Parameters:<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 which to be executed.
Setting Syntax: PROGram:NSELect<space><NRf+>

Setting Parameters:<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 Parameters:<NR1>
Query Example: PROG:NSEL?
PROG:NSEL? MAX
PROG:NSEL? MIN

PROGram:SAVe

Type: Channel-Specific
Description: Save the program settings.
Syntax: PROGram:SAVe
Parameters: NONE
Example: PROG:SAV

PROGram:STATe?

Type: Channel-Specific
Description: This command returns the information of program running.
Setting Syntax: None
Setting Parameters:None
Query Syntax: PROGram:STATe?
Return Parameters:<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: Clear all sequence in program file what specified.
Setting Syntax: PROGram:SEQuence:CLEar<space><NR1>
Setting Parameters:<NR1>, 1 ~ 10, Resolution = 1, Unit = None
Setting Example: PROG:SEQ:CLE 3
Query Syntax: None
Return Parameters:None
Query Example: None

PROGram:SEQuence:FAIL?

Type: Channel-Specific
Description: This command returns the fail of sequence in specification.
Setting Syntax: None
Setting Parameters:None
Query Syntax: PROGram:SEQuency:FAIL?
Return Parameters:<aard>, xx-xxx,xx-xxx,xx-xxx…etc, which front of "-" is the program number and rear of "-" is the sequence number.
Query Example: PROG:SEQ:FAIL?
Return Example: 1-2,5-13,10-8

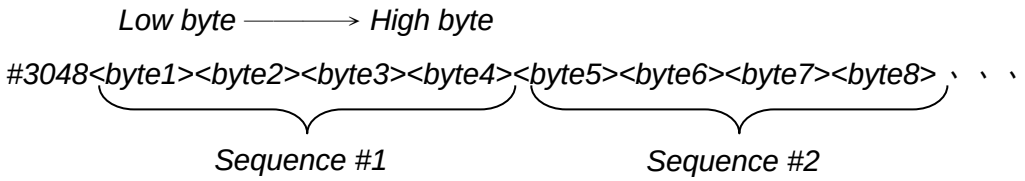
PROGram:SEQuence:REMain

Type: Channel-Specific
Description: This command returns the remains sequence of unused.
Setting Syntax: None
Setting Parameters:None
Query Syntax: PROGram:SEQuency:REMain?
Return Parameters:<NR1>
Query Example: PROG:SEQ:REM?

PROGram:SEQuence:SPECification?

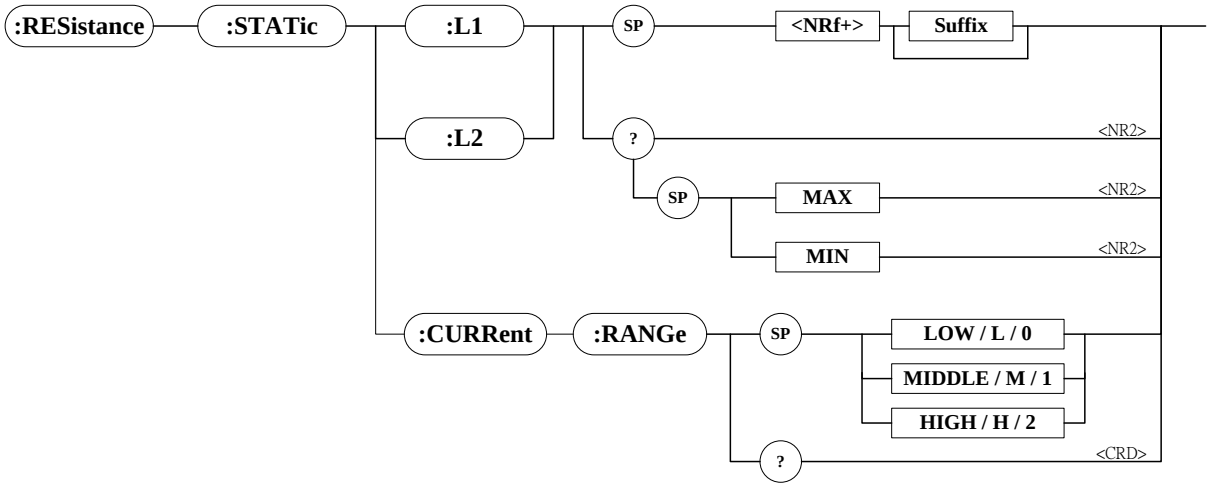
Type: Channel-Specific
Description: This query returns the specification of program sequence from the DC Electronic Load in binary format. The specification either voltage、current or power are consist of total sequences in program file that user specified in format of 32bits float point.
Setting Syntax: None
Setting Parameters:None
Query Syntax: PROGram:SEQuency:SPECification?<space><Arg1>,<Arg2>
Selects a program:
Arg1: <NR1>, 1 ~ 10, Resolution = 1, Unit = None.
Selects a parameter of measurement:
Arg2: <NRf>, V(0), I(1), P(2), Unit = None.

Return Parameters: <DLABRD>, for example: when the 12 sequences in program 1, than the return will be the format show in below.



Query Example: PROG:SEQ:SPEC? 1,V
Return Example: None

5.3.2.14 RESISTANCE Subsystem



RESistance:STATic:L1

Type: Channel-Specific
Description: Set static resistance level for constant resistance mode.
Setting Syntax: RESistance:STATic:L1<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = OHM]
Query Example:
RES:STAT:L1?
RES:STAT:L1? MAX
RES:STAT:L1? MIN

RESistance:STATic:L2

Type: Channel-Specific
Description: Set static resistance level for constant resistance mode.
Setting Syntax: RESistance:STATic:L2<space><NRf+>[suffix]
Setting Parameters: Refer to respective specification for valid value range.
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 Parameters: <NR2>, [Unit = OHM]
Query Example:
RES:STAT:L2?
RES:STAT:L2? MAX

RES:STAT:L2? MIN

RESistance:STATic:CURRent:RANGe

Type: Channel-Specific

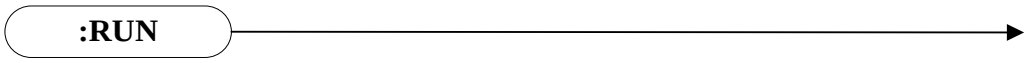
Description: Set the current loading and measurement range constant resistance mode

Setting Syntax: RESistance:STATic:CURRent:RANGe<space><CRD | NR1>

Setting Parameters: <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 Parameters:	<CRD>, LOW, MIDDLE, HIGH	[Unit = None]
Query Example:	RES:STAT:CURR:RANG?	

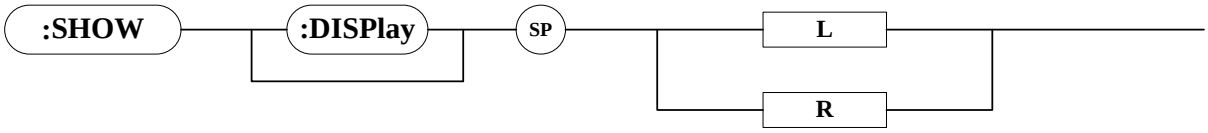
5.3.2.15 RUN Subsystem



RUN

Type: All Channels
Description: Set all electronic loads to “ON”.
Setting Syntax: RUN

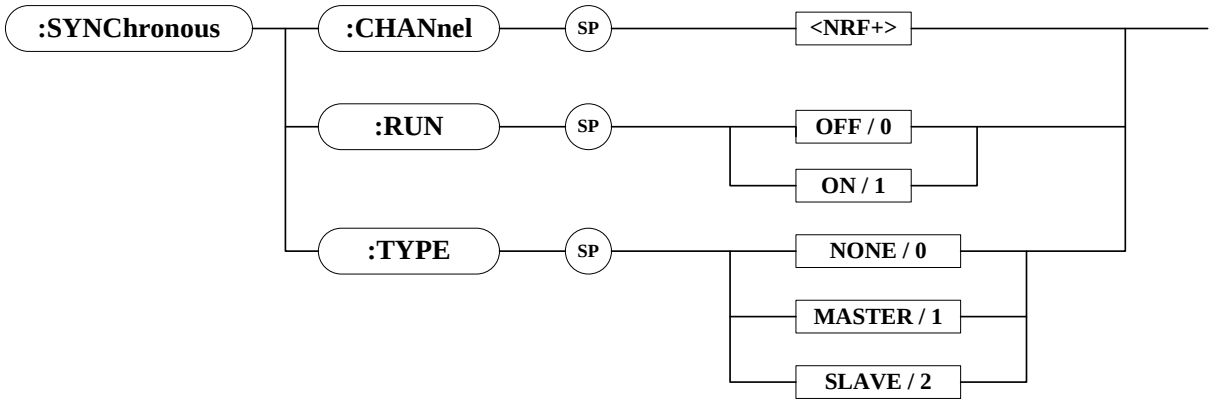
5.3.2.16 SHOW Subsystem



SHOW[:DISPlay]

Type: Channel-Specific (Dual Channel Module Only)
Description: Set the display mode for the electronic load.
Setting Syntax: SHOW:DISPlay<space><CRD>
Setting Parameters:<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: Set the specified channel to T1 & T2 in sync dynamic mode for parallel loading.
Setting Syntax: SYNChronous:CHANnel<space><NRf+>
Setting Parameters:<NRf+>, 1 ~ 10
Setting Example: SYNC:CHAN 1 Set the specified channel to "1".
SYNC:CHAN MAX Set the specified channel to "10".
SYNC:CHAN MIN Set the specified channel to "1".

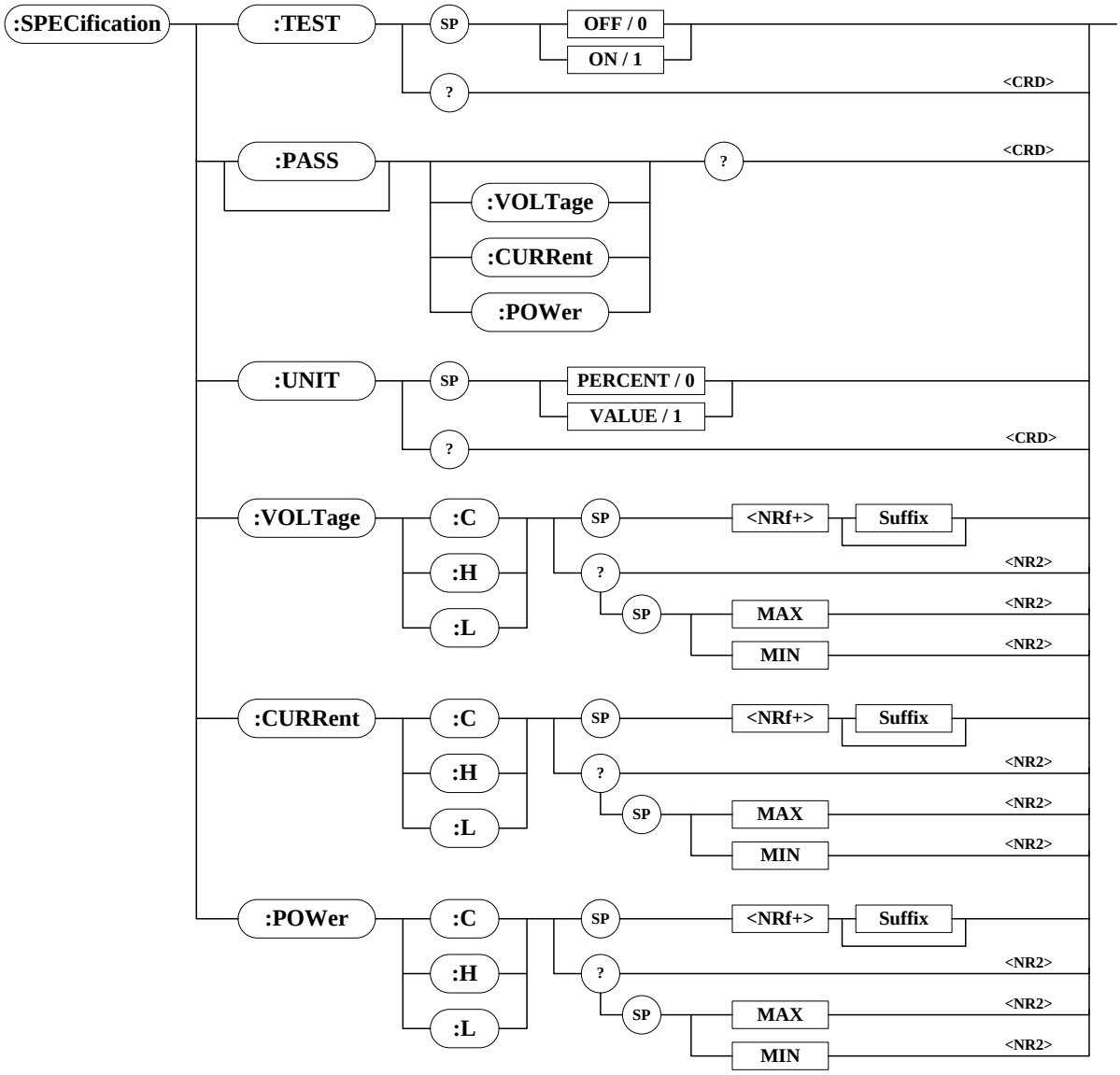
SYNChronous:RUN

Type: All Channels
Description: Set all electronic loads to “ON” in sync. parallel run.
Setting Syntax: SYNChronous:RUN<space><NRf>
Setting Parameters:<NRf>, OFF(0), ON(1)
Setting Example: SYNC: RUN ON Set the load to “ON” on sync. parallel.
SYNC: RUN OFF Set the load to “OFF” on sync. parallel.

SYNChronous:TYPE

Type: All Channels
Description: Set the specified mainframe to master or slave for sync. in parallel run.
Setting Syntax: SYNChronous:TYPE<space><NRf>
Setting Parameters:<NRf>, NONE(0), MASTER(1), SLAVE(2)
Setting Example: SYNC:TYPE MASTER Set the mainframe to master for sync. in parallel run.
SYNC:TYPE SLAVE Set 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: Request GO-NG result reference to all channels specifications.
Query Syntax: SPECification?
Query Example: SPEC? Return all channels GO-NG results.
Return Parameters:<CRD>, IDLE, GO, NG

SPECification[:PASS]:CURRent?

Type: Channel-Specific
Description: Request GO-NG result reference to current specification.
Query Syntax: SPECification[:PASS]:CURRent?
Query Example: SPEC:CURR?
Return Parameters:<CRD>, IDLE, GO, NG

SPECification[:PASS]:POWer?

Type: Channel-Specific
Description: Request GO-NG result reference to power specification.
Query Syntax: SPECification[:PASS]:POWer?
Query Example: SPEC:POW?
Return Parameters:<CRD>, IDLE, GO, NG

SPECification[:PASS]:VOLTage?

Type: Channel-Specific
Description: Request GO-NG result reference to voltage specification.
Query Syntax: SPECification[:PASS]:VOLTage?
Query Example: SPEC:VOLT?
Return Parameters:<CRD>, IDLE, GO, NG

SPECification:CURRent:C

Type: Channel-Specific
Description: Set the center-level current specification. The -1 mean don't care.
Setting Syntax: SPECification:CURRent:C<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: SPEC:CURR:C 10
SPEC:CURR:C 10mA
Query Syntax: SPECification:CURRent:C?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: SPEC:CURR:C?
SPEC:CURR:C? MAX
SPEC:CURR:C? MIN

SPECification:CURRent:H

Type: Channel-Specific
Description: Set the high-level current specification. The -1 mean don't care.
Setting Syntax: SPECification:CURRent:H<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: SPEC:CURR:H 10
SPEC:CURR:H 10mA
Query Syntax: SPECification:CURRent:H?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: SPEC:CURR:H?
SPEC:CURR:H? MAX
SPEC:CURR:H? MIN

SPECification:CURRent:L

Type: Channel-Specific
Description: Set the low-level current specification. The -1 mean don't care.
Setting Syntax: SPECification:CURRent:L<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: SPEC:CURR:L 10
SPEC:CURR:L 10mA
Query Syntax: SPECification:CURRent:H?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: SPEC:CURR:L?
SPEC:CURR:L? MAX
SPEC:CURR:L? MIN

SPECification:POWer:C

Type: Channel-Specific
Description: Set the center-level power specification. The -1 mean don't care.
Setting Syntax: SPECification:POWer:C<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: SPEC:POW:C 10
SPEC:POW:C 10mW
Query Syntax: SPECification:POWer:C?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: SPEC:POW:C?
SPEC:POW:C? MAX
SPEC:POW:C? MIN

SPECification:POWer:H

Type: Channel-Specific
Description: Set the high-level power specification. The -1 mean don't care.
Setting Syntax: SPECification:POWer:H<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: SPEC:POW:H 10
SPEC:CURR:H 10mW
Query Syntax: SPECification:POWer:H?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: SPEC:POW:H?
SPEC:POW:H? MAX
SPEC:POW:H? MIN

SPECification:POWer:L

Type: Channel-Specific
Description: Set the low-level power specification. The -1 mean don't care.
Setting Syntax: SPECification:POWer:L<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: SPEC:POW:L 10
SPEC:POW:L 10mW
Query Syntax: SPECification:POWer:H?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: SPEC:POW:L?
SPEC:POW:L? MAX
SPEC:POW:L? MIN

SPECification:TEST

Type: All Channels
Description: Start or close the all channel specification test.
Setting Syntax: SPECification:TEST<space><NRf>
Setting Parameters:<NRf>, OFF(0), ON(1)
Setting Example: SPEC:TEST ON
SPEC:TEST 0
Query Syntax: SPECification:TEST?
Query Example: SPEC:TEST?
Return Parameters:<CRD>, OFF, ON

SPECification:UNIT

Type: Channel-Specific
Description: Set the specific entry mode.
Setting Syntax: SPECification:UNIT<space><NRf>
Setting Parameters:<NRf>, VALUE(1), PERCENT(0)
Setting Example: SPEC:UNIT VALUE
SPEC: UNIT 0
Query Syntax: SPECification:UNIT?
Return Parameters:<CRD>, VALUE, PERCENT
Query Example: SPEC:UNIT?

SPECification:VOLTage:C

Type: Channel-Specific
Description: Set the center-level voltage specification. The -1 mean don't care.
Setting Syntax: SPECification:VOLTage:C<space><NRf+>[suffix]
Parameters: Refer to respective specification for valid value range.
Setting Example: SPEC:VOLT:C 20
SPEC:VOLT:C 20mV
Query Syntax: SPECification:VOLTage:C?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Volt]
Query Example: SPEC:VOLT:C?
SPEC:VOLT:C? MAX
SPEC:VOLT:C? MIN

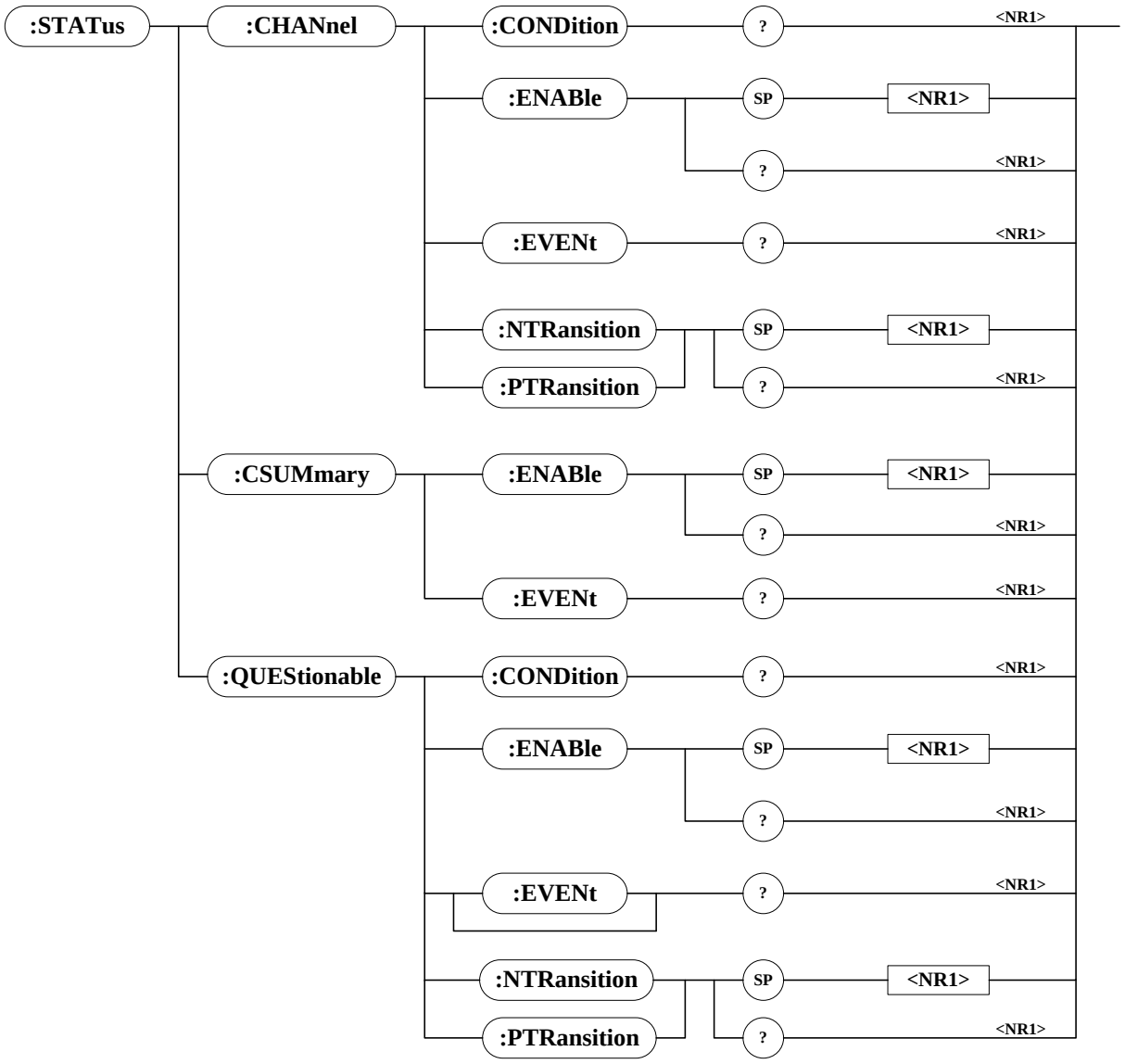
SPECification:VOLTage:H

Type: Channel-Specific
Description: Set the high-level voltage specification. The -1 mean don't care.
Setting Syntax: SPECification:VOLTage:H<space><NRf+>[suffix]
Parameters: Refer to respective specification for valid value range.
Setting Example: SPEC:VOLT:H 20
SPEC:VOLT:H 20mV
Query Syntax: SPECification:VOLTage:H?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Volt]
Query Example: SPEC:VOLT:H?
SPEC:VOLT:H? MAX
SPEC:VOLT:H? MIN

SPECification:VOLTage:L

Type: Channel-Specific
Description: Set the low-level voltage specification. The -1 mean don't care.
Setting Syntax: SPECification:VOLTage:L<space><NRf+>[suffix]
Parameters: Refer to respective specification for valid value range.
Setting Example: SPEC:VOLT:L 20
SPEC:VOLT:L 20mV
Query Syntax: SPECification:VOLTage:L?[<space><MAX | MIN>]
Return Parameters:<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 Parameters:<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 Parameters:<NR1>, 0 ~ 65535, Unit = None
Setting Example: STAT:CHAN:ENABl 24
Query Syntax: STATus:CHANnel:ENABle?
Return Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters:<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 Parameters: <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 Parameters:<NR1>
Query Example: STAT:CSUM:ENAB? Return the setting of Channel Summary Enable register.
Return Example: 3

STATus:CSUMmary:EVENt?

Type: Channel-Specific
Description: Indicate all channels of which an enabled STAT:CHAN Event has occurred since last time the register was read.
Query Syntax: STATus:CSUMmary:EVENt?
Return Parameters:<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 Parameters:<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 Parameters:

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 Parameters:<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: Record all Questionable conditions that have occurred since last time the register was read.
Query Syntax: STATus:QUEStionable:EVENt?
Return Parameters:<NR1>
Query Example: STAT:QUES:EVEN? Return the contents of the Questionable Event register.
Return Example: 24

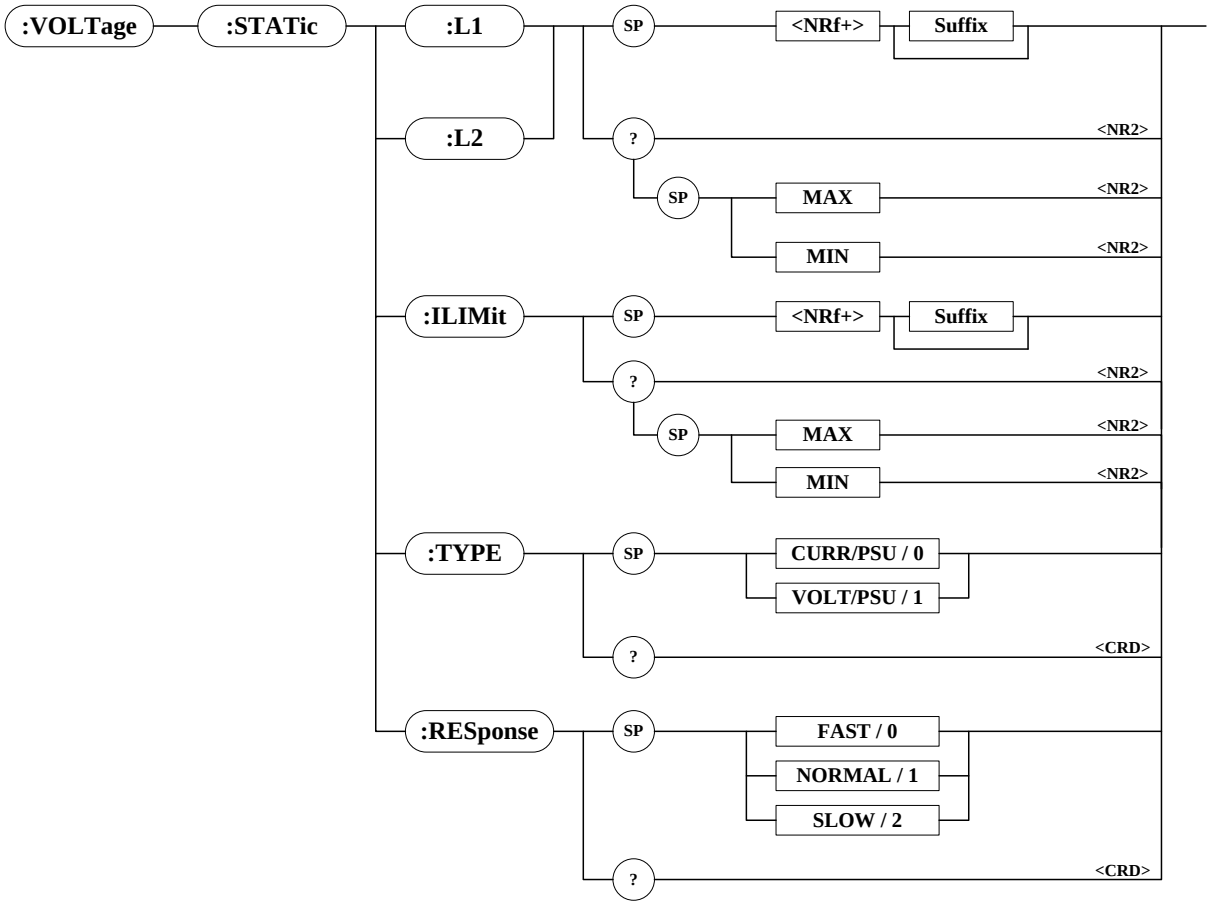
STATus:QUEStionable:PTRansition

Type: Channel-Specific
Description: Programmable filters determine 0-to-1 transition in the Condition register will set the corresponding bit of the Event register.
Setting Syntax: STATus:QUEStionable:PTRansition<space><NR1>
Setting Parameters:<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 Parameters:<NR1>
Query Example: STAT:QUES:PTR?
Return Example: 4

STATus:QUEStionable:NTRansition

Type: Channel-Specific
Description: Programmable filters determine 1-to-0 transition in the Condition register will set the corresponding bit of the Event register.
Setting Syntax: STATus:QUEStionable:NTRansition<space><NR1>
Setting Parameters:<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 Parameters:<NR1>
Query Example: STAT:QUES:NTR?
Return Example: 4

5.3.2.20 VOLTAGE Subsystem



VOLTage:STAT:ILIMit

Type: Channel-Specific
Description: Set the current limit for constant voltage mode.
Setting Syntax: VOLTage:STATic:ILIMit<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Ampere]
Query Example: VOLT:STAT:ILIM?
VOLT:STAT:ILIM? MAX
VOLT:STAT:ILIM? MIN

VOLTage:STATic:L1

Type: Channel-Specific
Description: Set the static load voltage in constant voltage mode.
Setting Syntax: VOLTage:STATic:L1<space><NRf+>[suffix]

Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Volt]
Query Example: VOLT:STAT:L1?
VOLT:STAT:L1? MAX
VOLT:STAT:L1? MIN

VOLTage:STATic:L2

Type: Channel-Specific
Description: Set the static load voltage in constant voltage mode.
Setting Syntax: VOLTage:STATic:L2<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
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 Parameters:<NR2>, [Unit = Volt]
Query Example: VOLT:STAT:L2?
VOLT:STAT:L2? MAX
VOLT:STAT:L2? MIN

VOLTage:STATic:TYPE

Type: Channel-Specific
Description: Set the execution type in constant voltage mode.
Setting Syntax: VOLTage:STATic:TYPE<space><NRf>
Setting Parameters:<NRf>, CURR/PSU(0), VOLT/PSU(1)
Example: VOLT:STAT:TYPE CURR/PSU
VOLT:STAT:TYPE 1
Query Syntax: VOLTage:STATic:TYPE?
Return Parameters:<CRD>, CURR/PSU, VOLT/PSU
Query Example: VOLT:STAT:TYPE?

VOLTage:STATic:RESponse

Type: Channel-Specific
Description: Set the response speed in constant voltage mode.
Setting Syntax: VOLTage:STATic:RESponose<space><NRf>
Setting Parameters:<NRf>, FAST(0), NORMAL(1), SLOW(2)
Example: VOLT:STAT:RES FAST
VOLT:STAT:RES SLOW
Query Syntax: VOLTage:STATic:RESponse?
Return Parameters:<CRD>, FAST, NORMAL, SLOW
Query Example: VOLT:STAT:RES?

5.3.2.21 SYSTEM Subsystem

SYSTem:ERRor?

Type: All Channels
Description: This command queries the error string of the command parser.
Setting Syntax: None
Setting Parameters: None
Query Syntax: SYSTem:ERRor?.
Return Parameters: <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 under control of USB and Ethernet. If SYST:REM is programmed, the 63600 will be set in the REMOTE state, and the front panel of frame will be disabled except the <LOCAL>key pressed.
Setting Syntax: SYSTem:REMote
Setting Parameters: None
Setting Example: SYST:REM

SYSTem:LOCal

Type: All Channels
Description: This command can only be used under control of USB and Ethernet. 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 Parameters: None
Setting Example: SYST:LOC

M

Type: All Channels
Description: Set the load mode to 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 Parameters: <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: Set the current level 1(L1) of CC mode to 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 Parameters: <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: Set the resistance level 1(L1) of CR mode to 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 Parameters: <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: Set the voltage level 1(L1) of CV mode to 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 Parameters: <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: Set the power level 1(L1) of CP mode to 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 Parameters: <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: Set the rising slew rate of CC mode to 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 Parameters: <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: Set the falling slew rate of CC mode to 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 Parameters: <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: Set the rising slew rate of CP mode to 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 Parameters: <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: Set the falling slew rate of CP mode to 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 Parameters: <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: Set the action type of Von to 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 Parameters: <NR1>, 0: OFF, 1: ON
Example: LAT “0,1,1,1,0,1,0,1,0,0”

GO

Type: All Channels
Description: This command starts/stops current sinking of 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 Parameters: <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: This command sets the voltage range of CC mode to 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 Parameters: <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: This command sets the voltage range of CC mode to the ten channels in one frame. The frame will ignore the setting when the channel does not exist. The unit of the setting value is volt. Please refer to measurement section in the Specification table.
Setting Syntax: VR<space>“n,n,n,n,n,n,n,n,n,n”
Setting Parameters: <NR2>, [Unit=Volt]
Example: VR “1,1,2,16,80,10,80,16,0,0”

VON

Type: All Channels
Description: This command sets Von voltage to 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 Parameters: <NR2>, [Unit=Volt]
Example: VON “1.23,1.23,0,0,5,5,12,12,0,0”

CCSR

Type: All Channels
Description: Set both of the rising and the falling slew rate of CC mode to 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 Parameters: <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: Set both of the rising and the falling slew rate of CP mode to 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 Parameters: <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: Set the current level 1(L1) of CCDL/CCDM/CCDH mode to 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 Parameters: <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: Set the current level 2(L2) of CCDL/CCDM/CCDH mode to 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 Parameters: <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: Set the active time T1 of current level 1(L1) of CCDL/CCDM/CCDH mode to 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 Parameters: <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: Set the active time T2 of current level 2(L2) of CCDL/CCDM/CCDH mode to 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 Parameters: <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: Set the rising slew rate of CCDL/CCDM/CCDH mode to 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 Parameters: <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: Set the falling slew rate of CCDL/CCDM/CCDH mode to 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 Parameters: <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: Set the repeat count of CCDL/CCDM/CCDH mode to 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 Parameters: <NR1>, 0 ~ 65535
Example: CDRT “1,2,2,10,2,5,5,5,0,0”

L

Type: All Channels
Description: Set the load level according to 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 Parameters: <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: This command resets the Von control signal to 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 Parameters: <NR1>, 1: RESET, Other Value: no action
Example: SRA “0,0,1,1,1,1,1,0,0,0”

6. Status Reporting

6.1 Introduction

This chapter explains the status data structure of 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 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 at 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 into the Channel Summary.

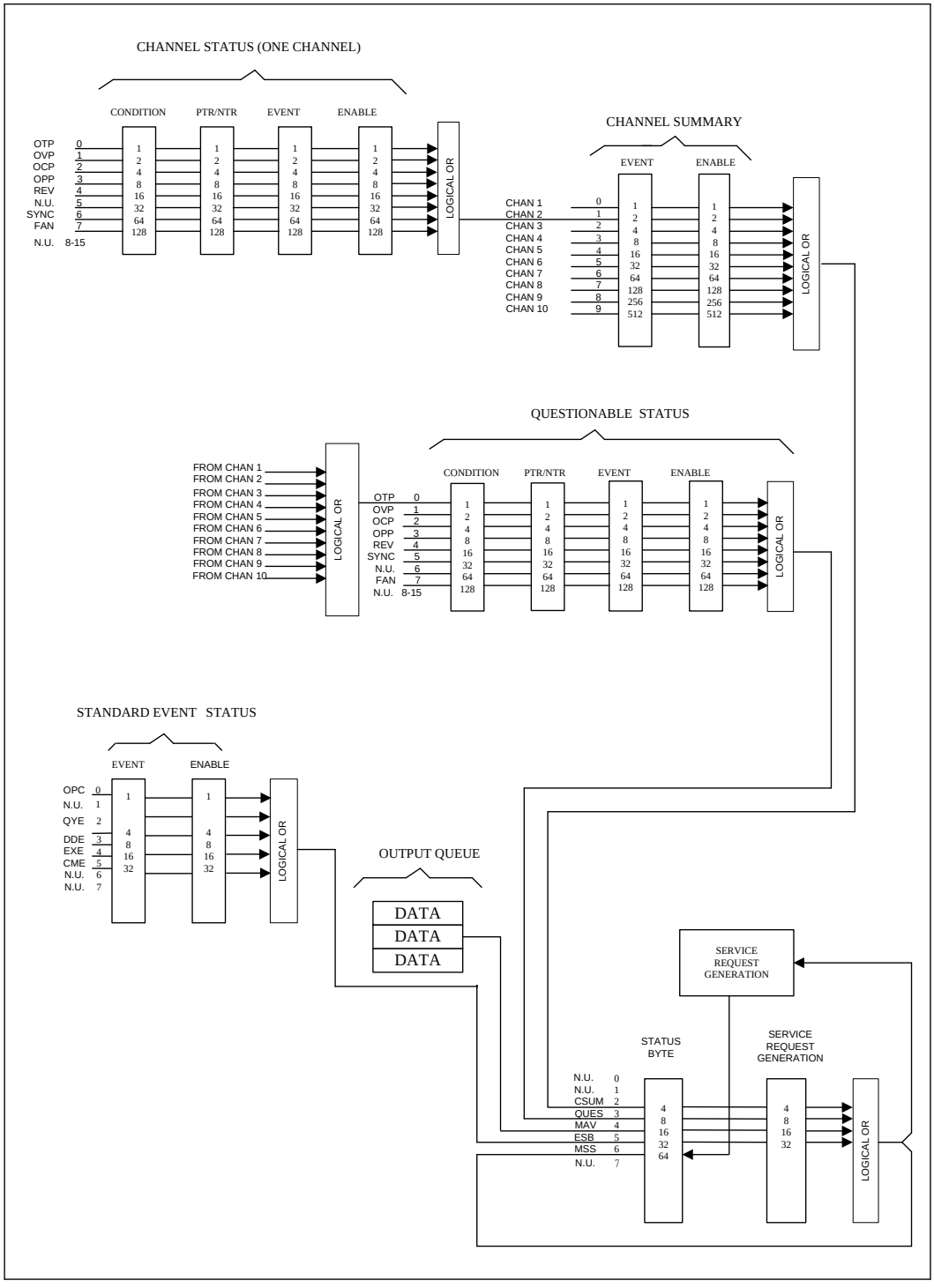


Figure 6-1 Status Registers of Electronic Load

6.2.1 Channel Status

- The Channel Status register informs you one or more channel status conditions, which indicate certain errors or faults have occurred to 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 way 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 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*. An overpower 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 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 same as the channel status conditions. Refer to Table 6-1 for a complete description.
- When a corresponding bit of Questionable Status Condition register is set, it indicates the condition is true.
- Program the PTR/NTR filter to select the way 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 to 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 generated 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 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 specification of Chroma 63600 Series. The tests are performed using the 63600 Series models and some required equipment. The required test equipment is listed in Table 7-1. Please refer the Performance Tests section for equipment connecting and test procedure. The user can use verification tables included at Verification Test Records section for checking the specification. The performance tests confirm Chroma 63600 Series meet the published specifications. For the detailed information of operation and programming please refer to the *Chapter 1, Chapter 1 and Chapter 1.*

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 every 1 year.

7.2 Equipment Required

The following table lists the equipment or its equivalent required 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, current shunt as Figure 7-1 shows. 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 till VFD shows **CC** and press RANGE to light up the H range LED indicator.

C. Press EDIT to enter into CC Mode for setting. Use rotary knob and ◀ or ▶ to program the current listed in Table 7-2 .

D. Turn on the DC source and set output voltage to 5V. Set current limit of DC source larger than the set current 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 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. To set output voltage of DC source and CCH current listed in Table 7-3 for testing model. Press LOAD to enable the load and slowly decrease the dc source voltage until DMM(V) display reaches minimal operation voltage listed in Table 7-3 for testing model. The current of load 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, current shunt as Figure 7-1 shows. 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 till VFD shows **CC** and press RANGE to light up the M range LED indicator.

C. Press EDIT to enter into CC Mode for setting. Use 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 current limit of DC source larger than the set current 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 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. To set output voltage of DC source and CCM current listed in Table 7-5 for testing model. Press LOAD to enable the load and slowly decrease the dc source voltage until DMM(V) display reached minimal operation voltage of the Table 7-5 for testing model. The current of 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, current shunt as Figure 7-1 shows. 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 till VFD shows **CC** and press RANGE to light up the L range LED indicator.

C. Press EDIT to enter into CC Mode for setting. Use rotary knob and ◀ or ▶ to program the current listed in Table 7-6.

D. Turn on the DC source and set output voltage to 5V. Set current limit of DC source larger than the set current 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 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. To set output voltage of DC source and CCL current listed in Table 7-7 for testing model. Press LOAD to enable the load and slowly decrease the dc source voltage until DMM(V) display reached minimal operation voltage of the Table 7-7 for testing model. The current of 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 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 wrongly set, the load module protection circuit of 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 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 of 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 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 of 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 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 till VFD shows **CR** and press RANGE to light up 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 see the value of DMM(V) to adjust value of DC source same as setting value for testing model before, and waited 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 7-8

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 till VFD shows **CR** and press RANGE to light up the M 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 load, and see value of DMM(V) to adjust the value of DC source same as the setting value for testing model before, and waited 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 till VFD shows **CR** and press RANGE to light up 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 load, and see value of DMM(V) to adjust the value of DC source same as the setting value for testing model before, and waited 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 7-10

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 Figure 7-1 shows. 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 till VFD shows **CV** and press RANGE to light up 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 Figure 7-1 shows. 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 till VFD shows **CV** and press RANGE to light up 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 Figure 7-1 shows. 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 till VFD shows **CV** and press RANGE to light up 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 totally the same. The voltage (DMM (V)) passes through the input or measurement terminal of module as well as the current shunt. Shunt current = DMM (I) voltage/shunt resistance. If the voltage output of DC Source and/or limit current setting is wrong, OPP or OCP of load module may be triggered. Press ENTER can 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 Figure 7-1 shows. 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 till VFD shows **CP** press RANGE to light up 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 Figure 7-1 shows. 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 till VFD shows **CP** press RANGE to light up 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 Figure 7-1 shows. 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 till VFD shows **CP** press RANGE to light up 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 7-16.

D. Next, press LOAD to enable the load and wait for 30 seconds to record the voltage passing through the negative input terminal.

Table 7-16

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

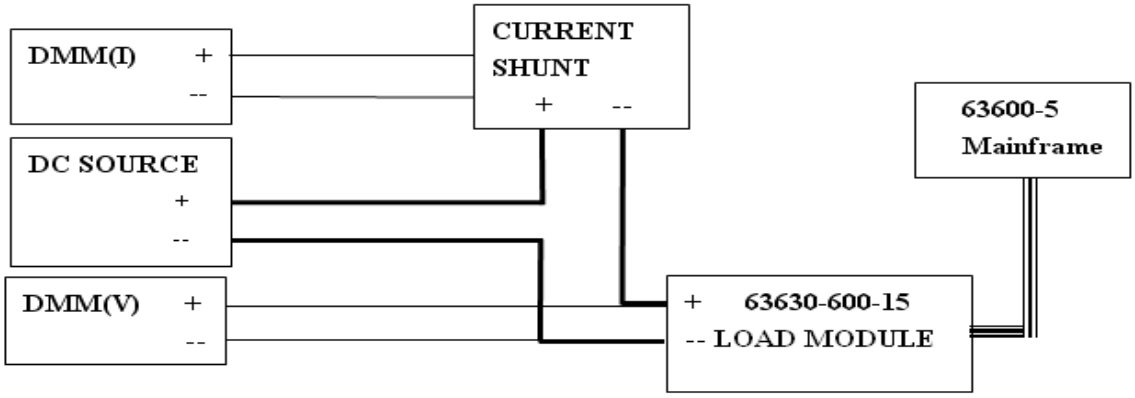


Figure 7-1

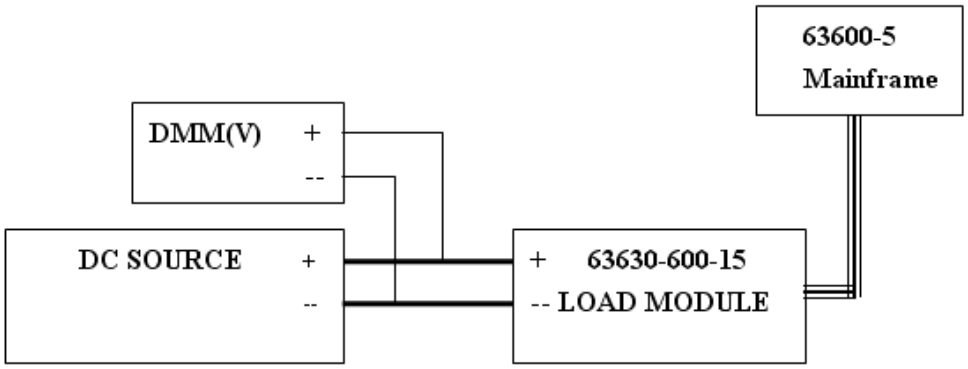


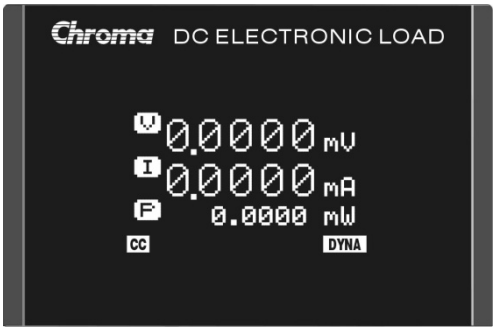
Figure 7-2

7.3.5 Dynamic & Slew Rate Circuit Test

This test verifies the slew rate circuit operation and the dynamic current waveform period specifications when the module dynamic is operating in CC mode.

Connect the Load module, DC source, oscilloscope, and current shunt as Figure 7-3 shows. Use oscilloscope to measure the waveform that passes through the shunt resistor measurement port. To reduce the current waveform overshoot caused by cable inductance, make the cables as short as possible. Adjust the oscilloscope for rise or fall time display. The rise time measured from 10% to 90% and the fall time from 90% to 10%.

Press DYNA on the front panel of Electronic Load to show **DYNA** as the figure appeared below.



7.3.5.1 Checking Dynamic Constant Current High Range

A. First, press MODE till VFD shows CC and press RANGE to light up the H range LED indicator.

B. Press EDIT to enter into Dynamic Constant Current setting. The settings are listed in Table 7-17.

C. Set the DC Source output voltage to 5V (hint: Set to 7V for Model 63630-600-15), the limit current needs to be larger than the highest level set by 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 doing dynamic loading, the minimum working voltage should be larger 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	1A	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

7.3.5.2 Checking Dynamic Constant Current Medium Range

A. First, press MODE till VFD shows CC and press RANGE to light up the M range LED indicator.

B. Press EDIT to enter into Dynamic Constant Current setting. The settings are listed in Table 7-18.

C. Set the DC Source output voltage to 5V and the limit current needs to be larger than the highest level set by dynamic constant current. (EX: When the 63630-600-15 H level is set to 1.5A, the DC Source limit current can set to 2A.)

Table 7-18

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

7.3.5.3 Checking Dynamic Constant Current Low Range

A. First, press MODE till VFD shows **CC** and press RANGE to light up the L range LED indicator.

B. Press EDIT to enter into Dynamic Constant Current setting. The settings are listed in Table 7-19.

C. Set the DC Source output voltage to 5V and the limit current needs to be larger than the highest level set by dynamic constant current. (EX: When the 63630-600-15 H level is set to 0.15A, the DC Source limit current can set to 0.5A.)

Table 7-19

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

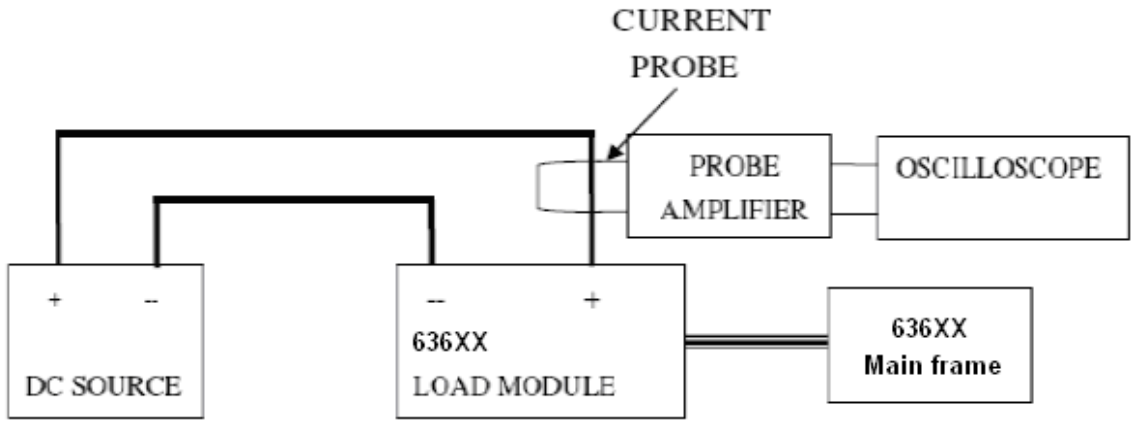


Figure 7-3

Appendix A Precautions for Loading Battery

In regard of the blooming EV, the test application for high power battery has become more and more. However, since it is to test the battery with high power and voltage, it is necessary to pay more attention to the application safety.

According to the RMA data, the damage part is MOSFET mainly for large power, high voltage Electronic Load to be repaired in general and the most possible cause is over voltage between the connection of MOSFET and UUT. It may be just a transient, but it could cause the MOSFET to be damaged by a little energy if it exceeds the maximum voltage.

Common battery application often forms high voltage by paralleling multiple batteries to avoid the transmission lost caused by low voltage high current. As the switch is uses directly to connect the battery and applied object, the study shows it is the main cause of LOAD damage. Figure A-1 shows the wire connection of Electronic Load & Battery. When the switch is shorted same as inputting a pulse signal, the effect caused by the stray element on the circuit (series inductance and parallel capacitance resonance) will generate a transient high voltage to damage the MOSFET and cause short circuit explosion as the simulation shows in Figure A-2. It can be seen that it will generate the Spike exceeding the previous setting when the switch effects and it may beyond the IC maximum withstand voltage.

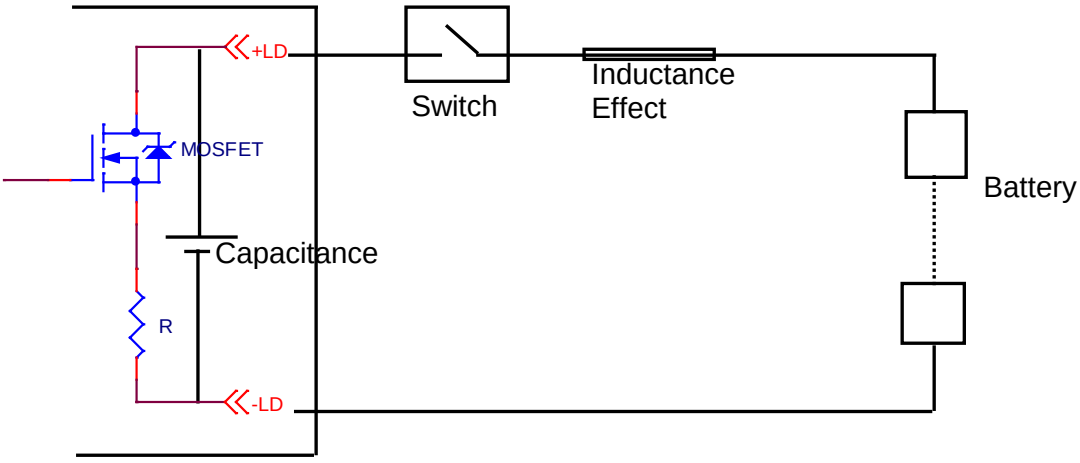


Figure A-1 Wire Connection of Electronic Load & Battery

The figure below shows the simulated circuit diagram of the application that causes damage.

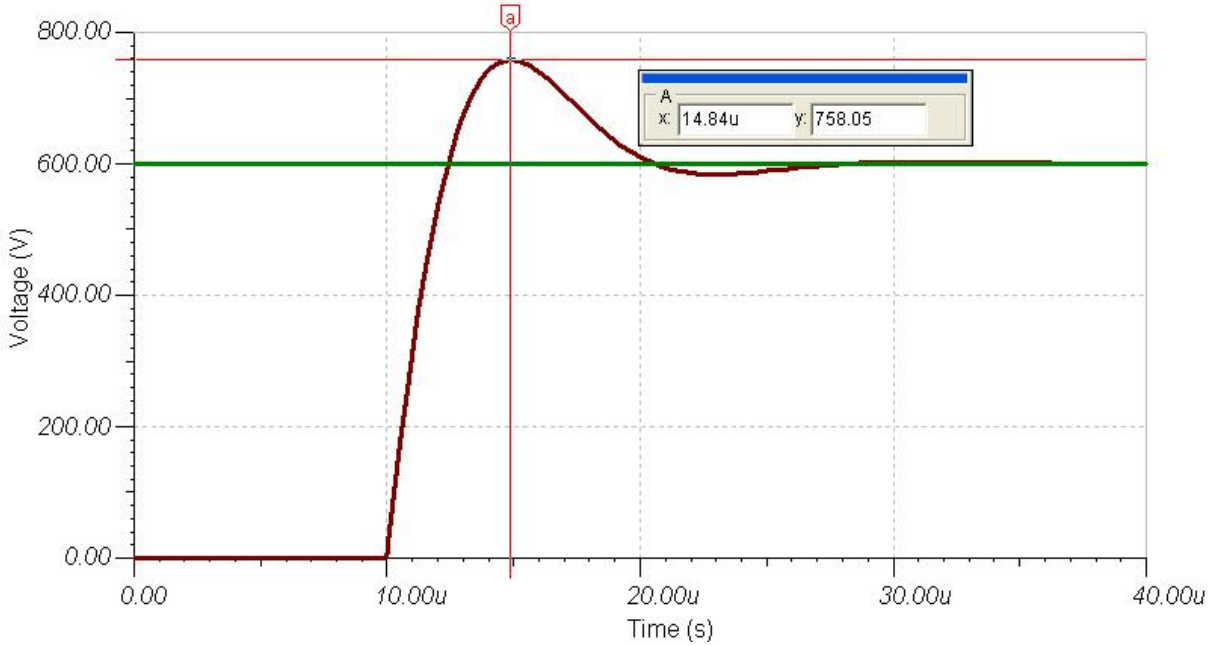


Figure A-2 Simulation of Surge Chart when Switching between Electronic Load & Battery

During the test procedure if the entire circuit is shorted due to MOSFET breakdown by high voltage and if the energy source is battery or other source that can provide high power, continuous high current will pass through Electronic Load internal due to short circuit. The load and the battery should be disconnected immediately. If unable to do so, the huge energy of battery output may cause the Electronic Load to burnout or even more severe situation. To prevent this from happening, a mechanism of over current protection is required.

For the above situation, it is suggested not to connect the battery and Electronic Load directly using a switch only to avoid damaging the equipment.

A.1 Measures for Improvement

A.1.1 Additional Protection Switch

As the burnout may expand due to the MOSFET damage and continuous energy release from battery that caused by the conditions described previously, it is suggested to connect the wires as Figure A-3 shows below when doing the battery charge/discharge tests to prevent problems from happening and to ensure the safety of using Electronic Load.

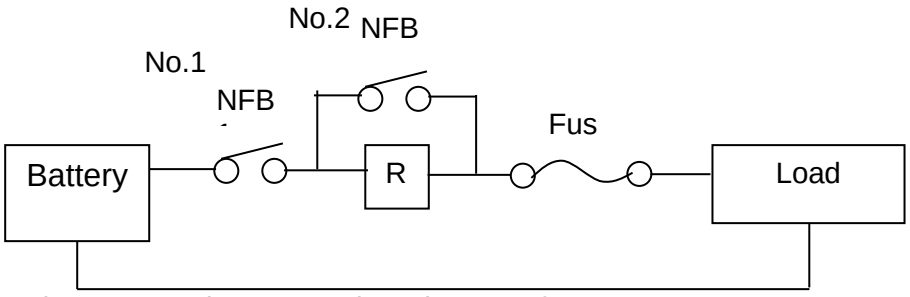


Figure A-3 Wire Connecting Diagram of LOAD & Battery

NFB(No-Fuse Breaker): The capacity (current amount) should be smaller than maximum

current to facilitate load and it should be able to cutoff in time when the internal is aging short circuited.

R: It is suggested to install the resistor of 100kΩ or above to avoid giving Electronic Load huge voltage in a sudden.

Fuse: First calculate the kW for discharge and select a proper fuse.

Note If two or more Electronic Loads are paralleled for discharge test, the front terminal of each Load has to add a fuse for protection.

A.1.2 Operation

Before inputting voltage to Electronic Load, switch to No.1 NFB to make the current go through R resistor to prevent damaging or aging the MOSFET from high voltage sent to Electronic Load internal in a sudden.

Switch to No.2 NFB after 5 seconds and then start battery discharge testing.

To stop discharge test, first press Load OFF on the Electronic Load and then switch No.2 NFB to OFF and last switch No.1 NFB to OFF. The whole discharge test stops and the battery is cutoff from Electronic Load.

For example:

How to install the wire to discharge 2kW when using 300V (maximum current is 100A) for battery discharge?
(I = P / V = 2000W / 300V = 6.6A)

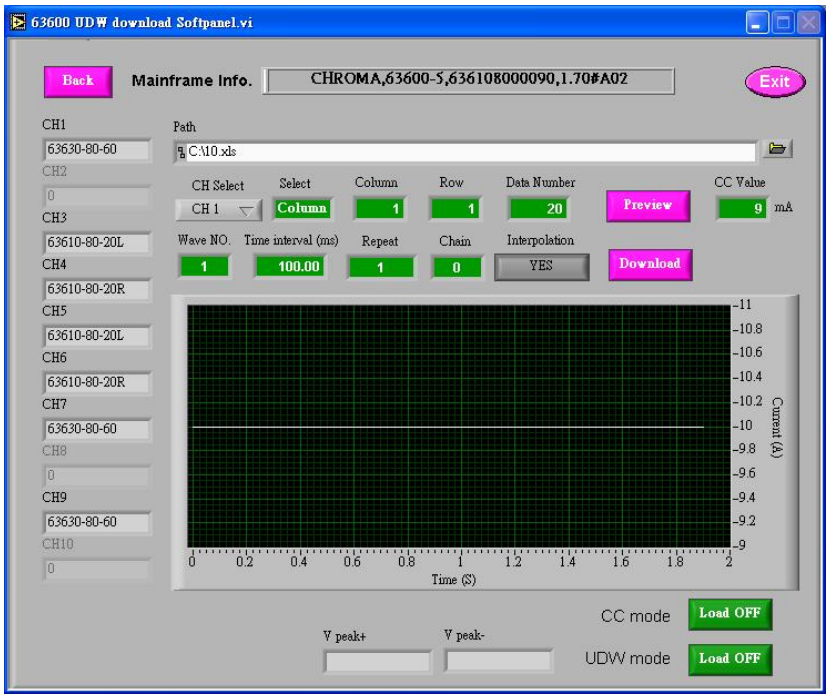
- When NFB is selected, since the battery maximum current is 100A, the NFB should be smaller than 100A; therefore it is suggested to use NFB of 20A.
- When R is selected, it is suggested to use the resistor of 1W, 100kΩ
- When Fuse is selected, it has to be larger than loading discharge current. In this case, the discharge current is 6.6A; therefore it should use fuse of 10A.

Appendix B How to Use 63600 UDW to Download Soft Panel

Operating Procedure:

Step 1: Select the user interface and click **Set OK**.

Step 2: If a device name appears on the Mainframe Info. it indicates the hardware is connected successfully.



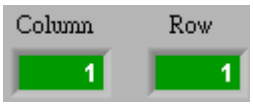
Step 3: Click  next to Path to select the .CSV or .XLS file for recall.

Step 4: Click 

to select the channel for download.

Step 5: Select 

to set the column or row of read file.

Step 6: Select 

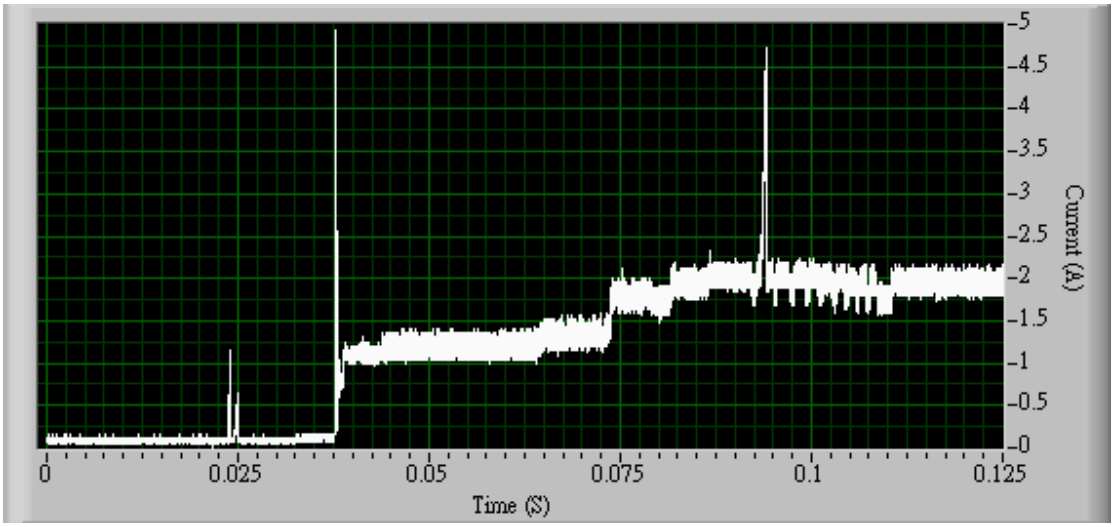
to set the column and row of the first data entry.

Step 7: Select 

to set the total entries of data to recall.

Step 8：Click 

to check if the data is correct.



Step 9: Select 

to set the Waveform No. to be saved to 63600.

Step 10: Select 

to set the time interval between data.

Step 11: Select 

to set the times to repeat the waveform.

Step 12: Select 

to set waveform to be chained.

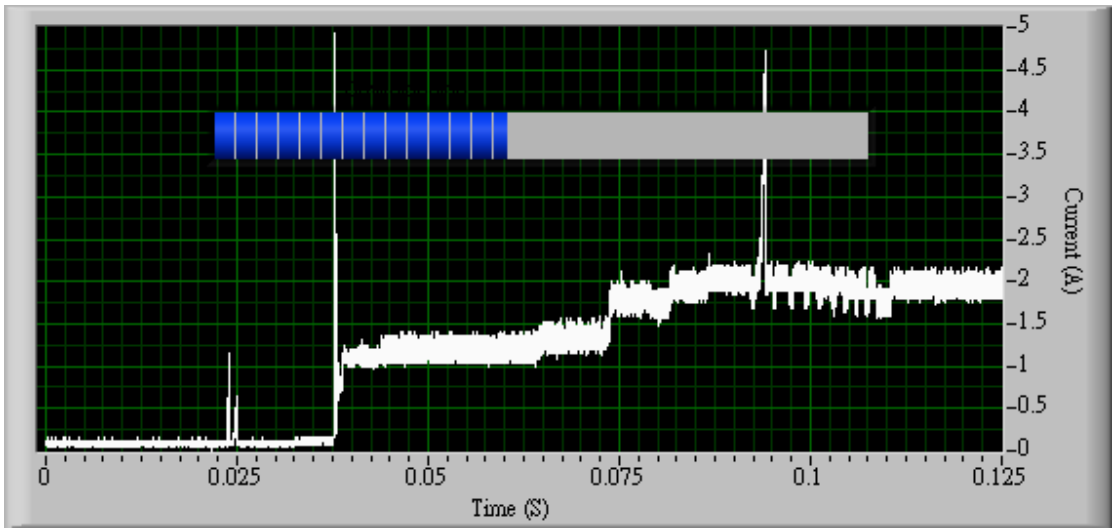
Step 13: Click 

to confirm if doing interpolation.

Step 14: Click 

when the settings are done and the data will be downloaded to 63600.

Step 15: A progress bar will appear when downloading the data to 63600.



Step 16: Select 

to set the small current pre-loading value (9mA - 1000mA) before executing UDW.

Step 17: Measure the V+ and V- for the channel selected in Step 4.

Once the loading is done, it will show in 

and click 

will turn it to Load ON.

Step 18: Click 

to perform small current loading and the button will change to 

.

Step 19: Click 

to perform UDW loading and the button will change to 

.

Notice

There is no need to click 

if not doing small current loading. It is OK to click 

only.

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CHROMA ATE INC.

致茂電子股份有限公司

66 Huaya 1st Road, Guishan,

Taoyuan 33383, Taiwan

台灣桃園市 33383 龜山區

華亞一路 66 號

T +886-3-327-9999

F +886-3-327-8898

Mail: info@chromaate.com

http://www.chromaate.com