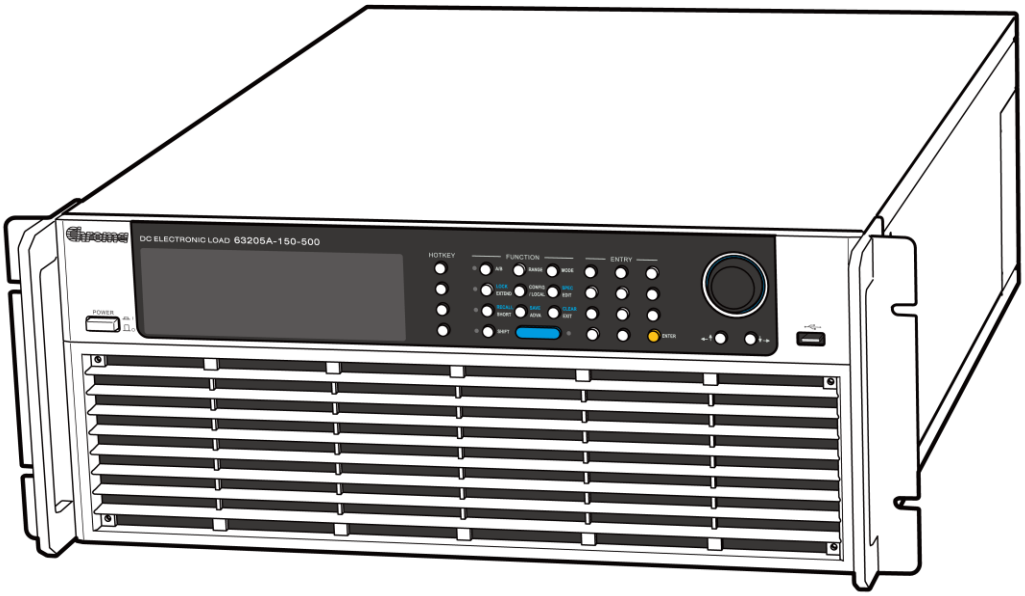
Chroma

High Power Electronic Load

63200A Series

Operation & Programming Manual

High Power Electronic Load
63200A Series
Operation & Programming Manual



Version 1.0
March 2015

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.

This warranty does not apply to any products repaired or altered by persons not authorized by Chroma, or not in accordance with instructions furnished by Chroma. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

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.

Any recommendations made by Chroma regarding the use of its products are based upon tests believed to be reliable; Chroma makes no warranty of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Chroma any liability in connection with the sale of our products other than set forth herein.

CHROMA ATE INC.
66 Huaya 1st Road, Guishan,
Taoyuan 33383, Taiwan
Tel: 886-3-327-9999
Fax: 886-3-327-2886
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
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
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 2005/618/EC.

“×” indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

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 a new one, the retailer is legally obligated to take back your old appliances for disposal free of charge.

<Table 2>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
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 2005/618/EC.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

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 a new one, the retailer is legally obligated to take back your old appliances for disposal free of charge.

www.chromaate.com

Declaration of Conformity

For the following equipment :

Programmable DC Electronic Load

(Product Name/ Trade Name)

63206A-150-600, 63205A-150-500, 63204A-150-400

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

66, Hwaya 1st Rd., Kueishan Hwaya Technology Park, Taoyuan County 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 (2004/108/EC) and Low Voltage Directive (2006/95/EC). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2013, EN 61326-2-2:2013

CISPR11:2009+A1:2010,Group1,Class A, EN61000-3-2:2006+A1:2009+A2:2009,Class A,

EN61000-3-3:2013, IEC 61000-4-2:2008 ED2.0, IEC 61000-4-3:2010 ED3.2,

IEC 61000-4-4:2012 ED3.0, IEC 61000-4-5:2005 ED2.0, IEC 61000-4-6:2013 ED4.0,

IEC 61000-4-8:2009 ED2.0, IEC 61000-4-11:2004 ED2.0

EN 61010-1:2010(Third Edition)

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

CHROMA ATE INC.

(Company Name)

66, Hwaya 1st Rd., Kueishan Hwaya Technology Park, Taoyuan County 33383, Taiwan

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Deputy Director

(Position/Title)

Taiwan	**2015.03.05**	Vincent Wu
(Place)	(Date)	(Legal Signature)

Safety Summary

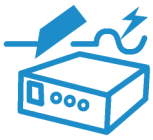
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the 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
Mar. 2015	1.0	Complete this manual.

Table of Contents

1. Overview

1.1 Introduction

This manual describes the specifications, installation, and programming of 63200A Series High Power Electronic Loads.

1.2 Description

The functions of 63200A Series Electronic Loads are the same except the input voltage, load current and operable power. All models can be operated under basic and advanced loading modes.

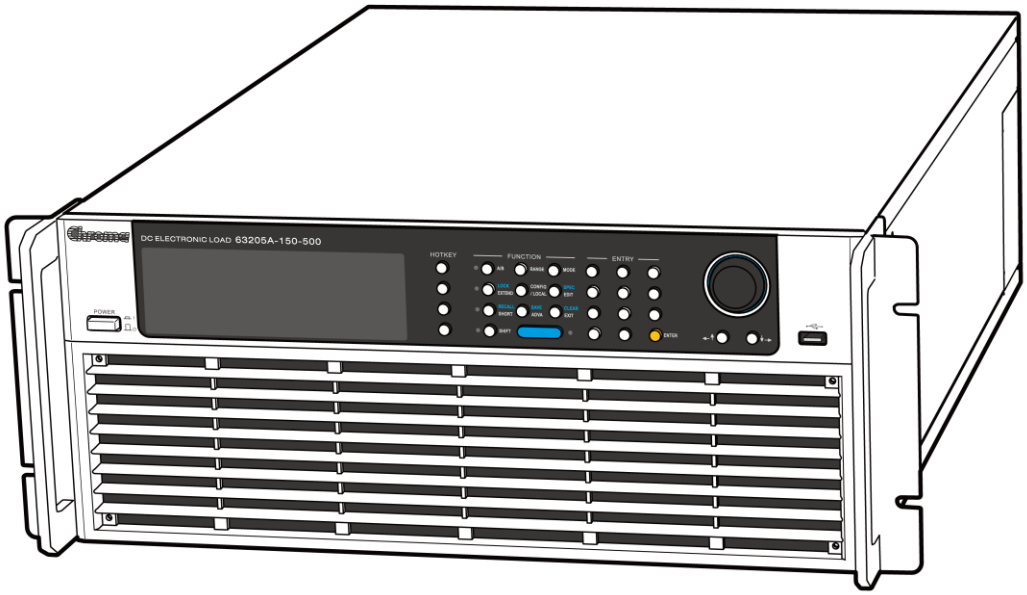


Figure 1-1 63205A-150-500 DC Electronic Load

1.3 Features

- CC (Constant Current), CR (Constant Resistance), CV (Constant Voltage), CP (Constant Power), CCD (Constant Current Dynamic) and CRD (Constant Resistance Dynamic) operating 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 (see SPEC.)
- Selective voltage and current ranges.
- Remote sensing capability.
- 256 sets of memories to save/recall user-definable setups.

- 10 sets of programs to link files for automatic test.
- 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 the UUT is within spec.
- Protection for over voltage, over current, overpower and over temperature along with reverse polarity warning.
- Front panel keys for local operation.
- Smart fan with temperature control to reduce the noise.
- Remote PC control via GPIB or USB.
- Isolated voltage and current to monitor the waveform output.
- Isolated external Vdc reference input to control the Load current.

1.4 Specifications

Electronic Load

Model	**63205A-150-500**			**63206A-150-600**		
Configuration[*2]	5,000W			6,000W		
Voltage[*3]	0-150V			0-150V		
Current	0-50A	0-250A	0-500A	0-60A	0-300A	0-600A
Power	0-5,000W			0-6,000W		
Min. operating voltage (DC)	0.15V @ 50A	0.75V @ 250A	1.5V @ 500A	0.18V @ 60A	0.9V @300A	1.8V @ 600A
CC mode						
Range	0-50A	0-250A	0-500A	0-60A	0-300A	0-600A
Resolution	0.5mA	2mA	5mA	0.5mA	2mA	5mA
Accuracy	0.05%+0.05%F.S.			0.05%+0.05%F.S.		
Accuracy[*1]	0.1% F.S.(under 0.2% Low Range)			0.1% F.S. (under 0.2% Low Range)		
CR mode						
Range	0.005Ω-50Ω (16V/5kW) 0.020Ω-200Ω (80V/5kW) 0.5Ω-1000Ω (150V/5kW)			0.005Ω-50Ω (16V/6kW) 0.020Ω-200Ω (80V/6kW) 0.5Ω-1000Ω (150V/6kW)		
Resolution[*4]	5mA/Vsense			5mA/Vsense		
Accuracy	Vin/Rset*(0.2%)+0.2% IF.S.			Vin/Rset*(0.2%)+0.2% IF.S.		
CV mode						
Range	0-16V	0-80V	0-150V	0-16V	0-80V	0-150V
Resolution	0.1mV	0.5mV	1mV	0.1mV	0.5mV	1mV
Accuracy	0.025%+0.025%F.S.			0.025%+0.025%F.S.		
CP mode						
Range	0-500W	0-2,500W	0-5,000W	0-600W	0-3,000W	0-6,000W
Resolution	5mW	50mW	100mW	10mW	50mW	100mW
Accuracy[*5]	0.2%+0.2%F.S.			0.2%+0.2%F.S.		
CZ mode						
Range	C_L: 30μF-50,000μF R_L: as CR L_s: 0.1μH-20μH R_s: 30mΩ-20Ω					

Resolution	C_L: 1μF / L_s: 0.1μH / R_s: AS CR /R_L: as CR					
CC+CV	Refer to CC & CV specifications.					
CV+CR	Refer to CV & CR specifications.					
CR+CC	Refer to CR & CC specifications.					
Auto	Refer to CV&CR & CC & CP specifications.					
Dynamic mode						
T1 & T2	0.020-99.999ms/100ms-99999ms			0.020-99.999ms/100ms-99999ms		
Resolution	1μs/1ms			1μs/1ms		
Accuracy	1us+100ppm			1us+100ppm		
Slew rate	0.5mA/μs-5A/μs	2mA/μs-25A/μs	5mA/μs-50A/μs	0.5mA/μs-6A/μs	2mA/μs-30A/μs	5mA/μs-60A/μs
Resolution	0.5mA/μs	1mA/μs	5mA/μs	0.5mA/μs	2mA/μs	5mA/μs
Accuracy	5% ± 10μs			5% ± 10μs		
Min. rise time[*6]	10μs (Typical)			10μs (Typical)		
Other						
Input Damping R+C	12uF+0.14Ω(15W)			12uF+0.14Ω(15W)		

Measurement Spec.

Model	**63205A-150-500**			**63206A-150-600**		
Voltage read back						
Range	0-16V	0-80V	0-150V	0-16V	0-80V	0-150V
Resolution	0.1mV	0.5mV	1mV	0.1mV	0.5mV	1mV
Accuracy	0.015%+0.015%F.S.			0.015%+0.015%F.S.		
Input Resistance	800kΩ(Typical)			800kΩ(Typical)		
Current read back						
Range	0-50A	0-250A	0-500A	0-60A	0-300A	0-600A
Resolution	0.5mA	2mA	5mA	0.5mA	2mA	5mA
Accuracy	0.04%+0.04%F.S.			0.04%+0.04%F.S.		
Power read back						
Range	0-5,000W			0-6,000W		
Accuracy[*5]	0.1%+0.1%F.S.			0.1%+0.1%F.S.		

System Spec.

Battery Discharge	
Range	1s-100,000s
Resolution	1s
End Trigger	Voltage level
Accuracy	0.01%
Presentation	Elapse : s Charge :AH Energy : WH
Program mode	
Sequence No.	256 / Program
Dwell / SEQ	0.1ms - 30s (Resolution:0.1ms)
Spec Check	Voltage / Current / Power
Ext Wave	
Mode	CC, CR, CV

Range	as mode range		
Level	0 - 10V		
Accuracy	0.4%F.S.		
CC mode BW	20kHz		
Input impedance	10kΩ		
Resolution	4mV		
Monitor			
Voltage Range	0~L_range F.S	0~M_range F.S	0~H_range F.S
Current Range	0~L_range F.S	0~M_range F.S	0~H_range F.S
Output	0-10V		
Bandwidth	20kHz		
Accuracy	0.5%F.S.		
Output impedance	10kΩ		
Resolution	4mV		
Protection			
Over Current	Yes (Settable)		
Over Power	Yes (Settable)		
Over Temperature	Yes		
Over Voltage Alarm	Yes		
Reverse Alarm	Yes		
Short[*8]			
Mode	CC, CR, CV, CP		
Other			
Operating Temp	0-40°C		
Storage Temp	-20-80°C		
Temperature Coefficient	100ppm/°C (Typical)		
EMC & Safety	CE		

Input Power & Dimensions

Model	**63205A-150-500**	**63206A-150-600**
AC Input Range	100-240VAC / 47-63Hz	
Maximum VA	200VA(max)	200VA(max)
Fuse	2.5A	2.5A
Weight	35kg / 77.2lbs	35kg / 77.2lbs
HxWxD*	177 x 428 x 647 mm / 6.97 x 16.85 x 25.47 inch	
Noise[*7]	78.5 dB(max)	78.5 dB(max)

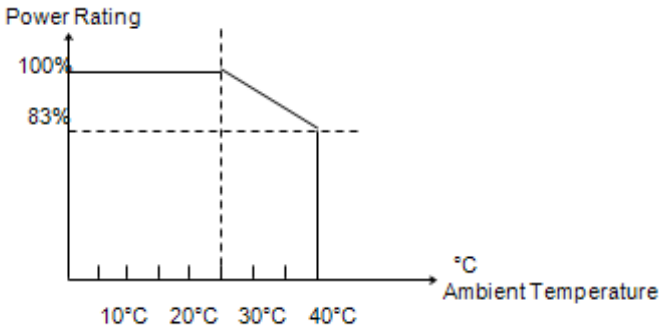
*This value is the maximum noise measured 1 meter in front of the load frame when the Electronic Load is full power at 40°C.

*The height indicated here does not include the stand 17.8mm/0.7 inch and the depth does not include the protective cover 63.41mm/2.5 inch.

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

Notice

1. The specifications are guaranteed to meet specified performance at temperature range of 25±5°C.
2. The power rating specifications at ambient temperature = 25°C and see the diagram below for power derating.



3. If the operating voltage exceeds the rated voltage for 1.1 times, it would cause permanent damage to the device.
4. Please refer to user's manual for detail specifications, and S (siemens) is the SI unit of conductance, equal to one reciprocal ohm
5. Power F.S. = Vrange F.S. × Irang F.S.
6. The specification is valid only for loading current >20A.
7. The measured maximum noise is tested under the condition of 40°C ambient temperature with full power for 5 minutes and 1 meter away from the frame.
8. The short circuit function is to simulate full power loading and is unable to do mechanical short circuit.

1.5 Dimensions of 63200A Series Electronic Loads

- 63200A Series (Unit: mm)

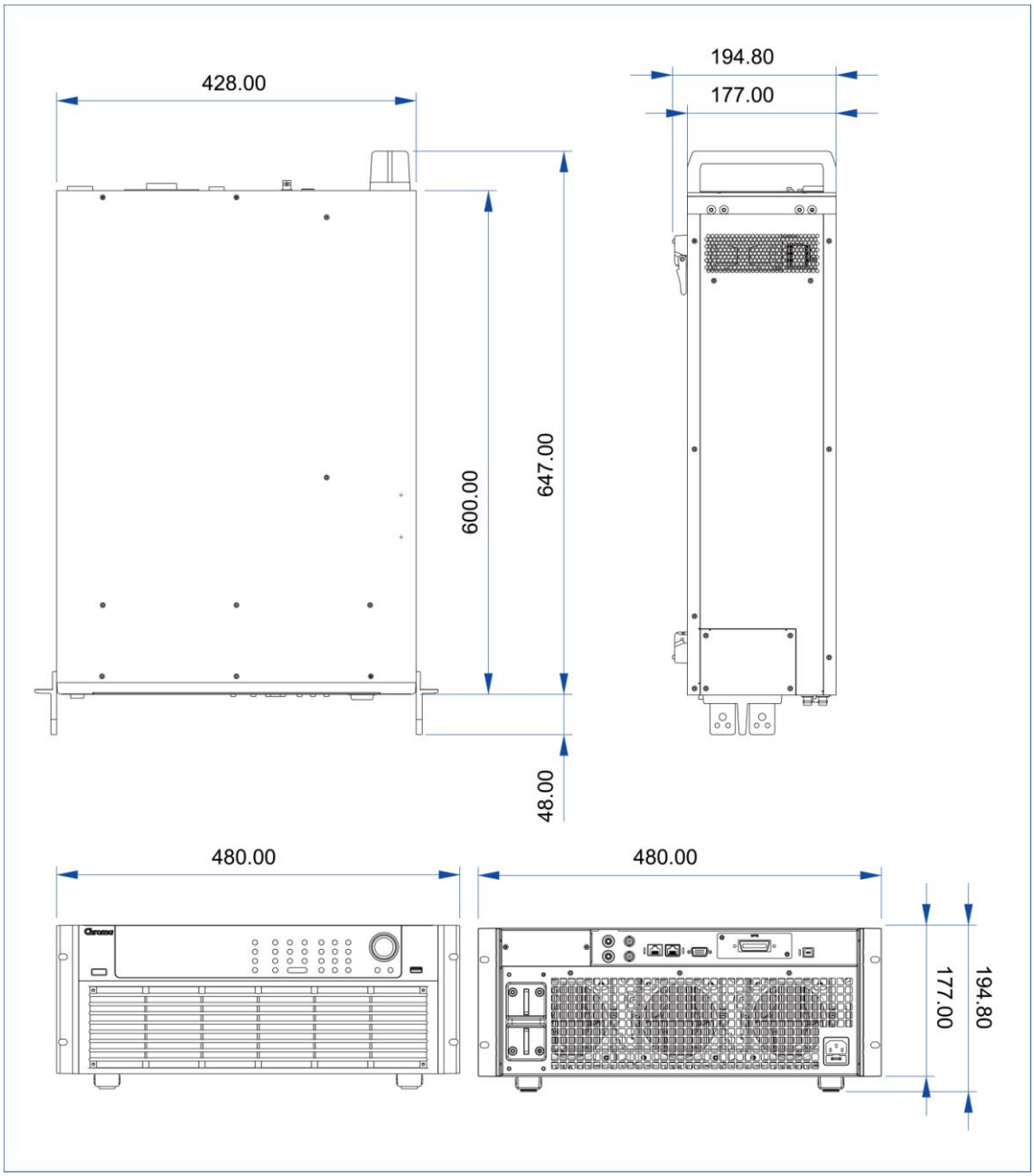


Figure 1-2 Dimension of 63200A without Protection Cover

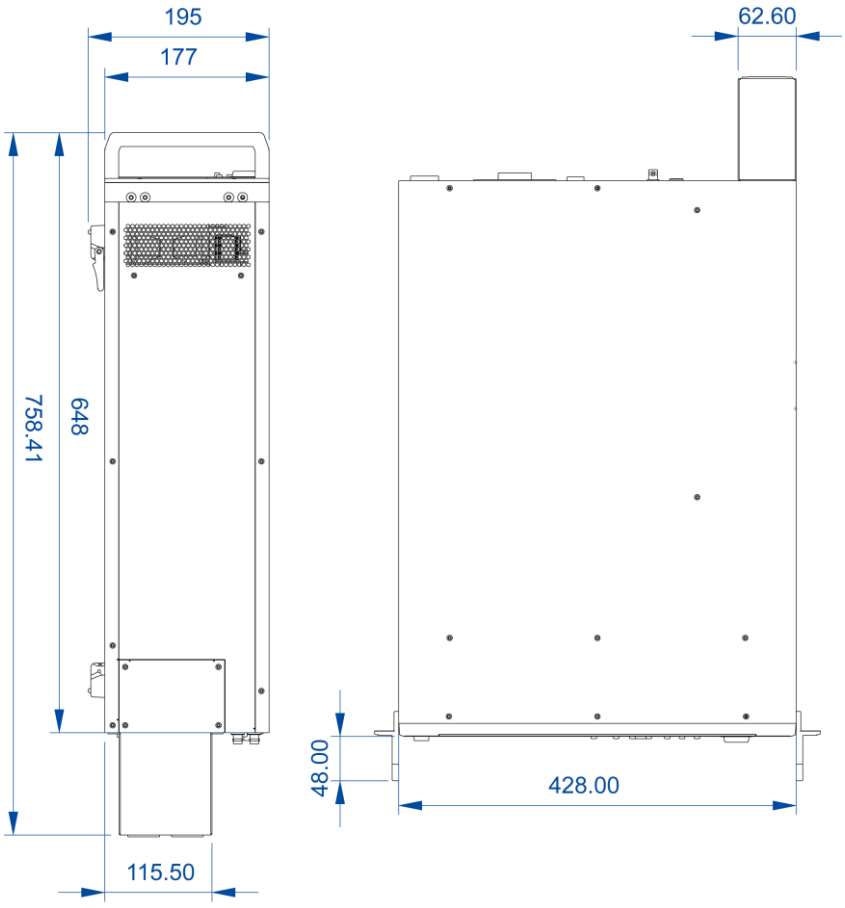


Figure 1-3 Dimension of 63200A with Protection Cover

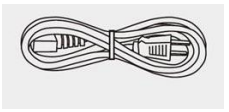
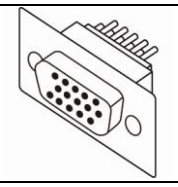
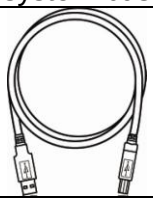
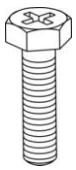
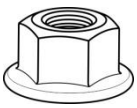
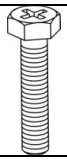
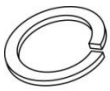
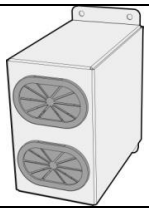
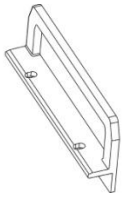
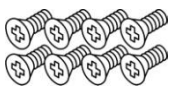
2. Installation

2.1 Introduction

This chapter discusses how to install the 63200A Series Electronic Loads. It also discusses turn-on check procedure and application considerations as well.

2.2 Inspection

Diagram of 63200A Series Standard Package:

				
User's manual CD	Network cable system bus	Red/Black test wire	Power cord 110V	D-SUB 3 rows 15P
				
BNC	USB	Screw M6x20L	Flange nut M4x0.7	Flange nut M6
				
Cross recessed hexagon bolt	Flat washer 4.3*10*0.9-NI	Spring washer M4	Flat washer M6	Spring washer M6
				
Mounting bracket (USB)	Mounting bracket (RJ45)	Output protective cover	Protective cover Screw M4*8L	Handle (4U)
				
Handle Screws M4x10L				

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.

Item	Name	Standard Accessories per Model	
		63205A	63206A
1.	User's manual CD	1	1
2.	Network cable system bus	2	2
3.	Red/Black test wire	1	1
4.	Power cord 110V	1	1
5.	D-SUB 3 rows 15P	2	2
6.	BNC	2	2
7.	USB	1	1
8.	Screw M6x20L	2	2
9.	Flange nut M4x0.7	2	2
10.	Flange nut M6	2	2
11.	Phillips hex head screw	4	4
12.	Flat washer 4.3*10*0.9-NI	4	4
13.	Spring washer M4	2	2
14.	Flat washer M6	4	4
15.	Spring washer M6	2	2
16.	Mounting bracket (USB)	1	1
17.	Mounting bracket (RJ45)	2	2
18.	Output protective cover	1	1
19.	Protective cover screw M4*8L	4	4
20.	Handle (4U)	2	2
21.	Handle screw M4x10L	8	8

2.3 Installing the Communication Interface Expansion Slot

The 63200A Series Electronic Load uses GPIB bus (option) to do remote control. The installation of GPIB card and change of its address as well as the operations are described in Chapter 4.

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.

2.3.1 Line Voltage

The Electronic Load can operate with a 100-240 Vac input as indicated on the rear LINE label. The detailed line voltage input range is shown in section 1.4. 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.

2.3.2 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 100-240 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 and observe the display. Immediately after turning on, the Electronic Load executes a self-test that checks firmware and communication. The Load Module displays the model no. and firmware version.

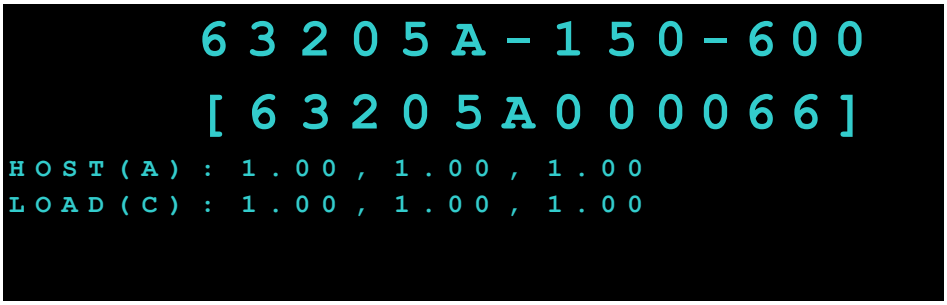


Figure 2-1

2.4 Application Connection

2.4.1 Load Connections

Input connections are made to the + and – terminal connectors on the rear panel of each load. 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. 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 to the HIGH potential output terminal of the power supply (UUT) and the MINUS (–) terminal the LOW potential output terminal of the power supply (UUT). Figure 2-2 illustrates the typical setup of the Electronic Load to the UUT.

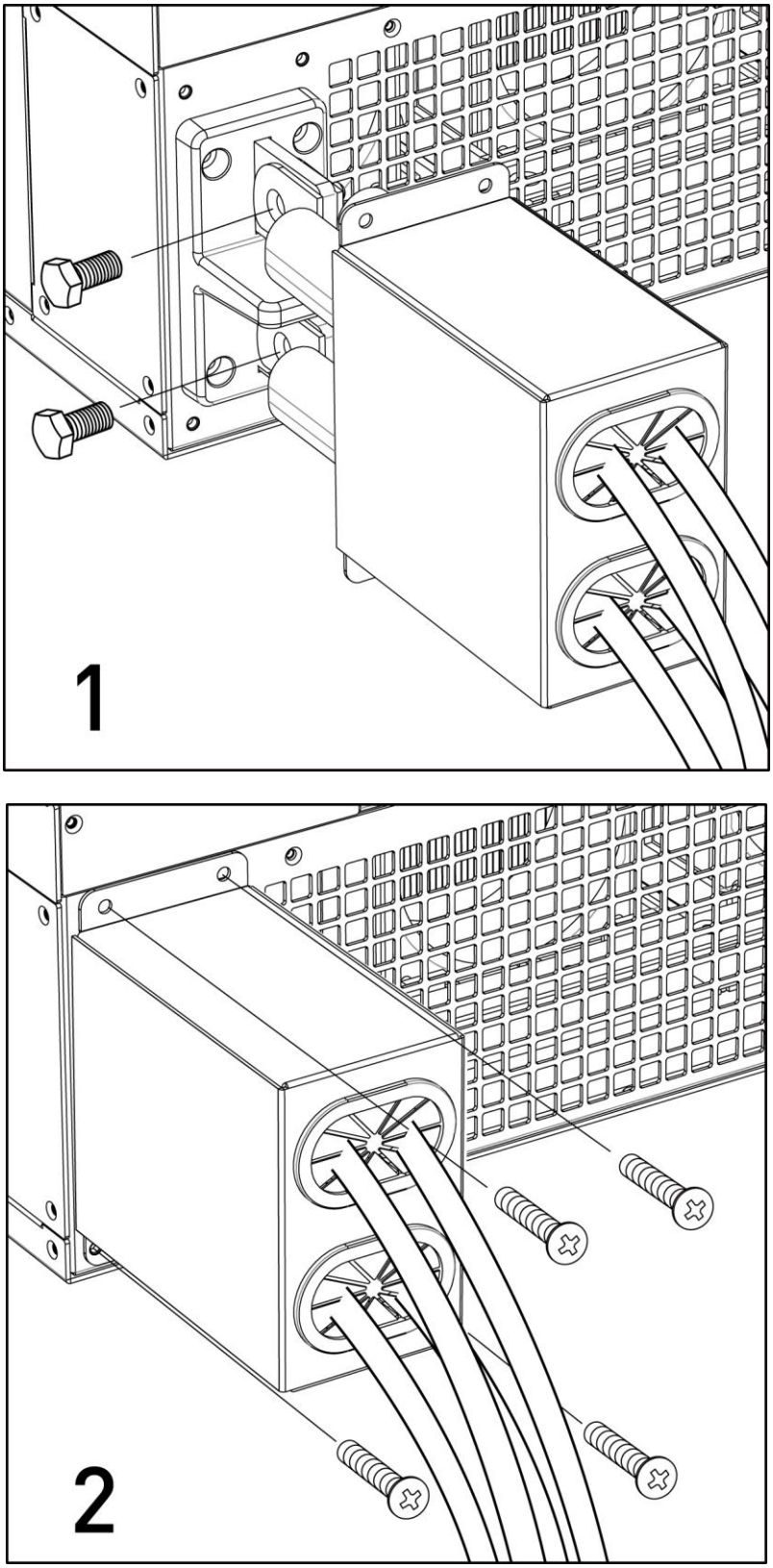


Figure 2-2

CAUTION The Electronic Load should be operated in an environment with good heat dissipation. Also, if the load is installed in a rack, a well-ventilated rack should be used to avoid poor heat sink.

Notice To satisfy our higher slew rate load spec requirement and performance, load wires from the UUT to our load must be high inductive. 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.

⚠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. Polarity + and – are marked on the Load connector and the + terminal potential should be higher than the – terminal.

⚠WARNING If errors occurred when using the Electronic Load, it could be short-circuited if the condition is severe which may cause the UUT current to input continuously and cannot be stopped. The user should consider adding an external circuit for protection. To prevent the error input caused by reverse connection, an external forward-conducting component can be added.

2.4.2 Vsense Remote Sensing Connections

There are two sensing points in the Electronic Load. One is measurement at Load terminal, and another is at Vsense. The Load 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 operating in CV or CR mode or precise measurement is needed. Figure 2-3 illustrates a typical setup for remote sensing operation.

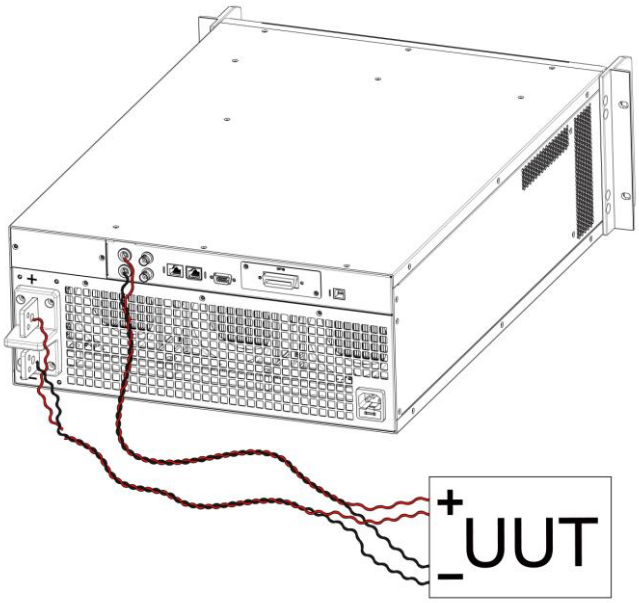


Figure 2-3

⚡CAUTION When using remote sensing, the Vsense red connector should connect to the UUT high potential output side while the black connector should connect to the UUT low potential output side. When using the Electronic Load UUT Vsense for voltage measurement, the V-sense must connect to the negative terminal.

2.4.3 Parallel Connection

Figure 2-4 illustrates how Electronic Load can be paralleled to increase power dissipation. Electronic Loads can be directly paralleled in CC, CR, CV or CP mode.

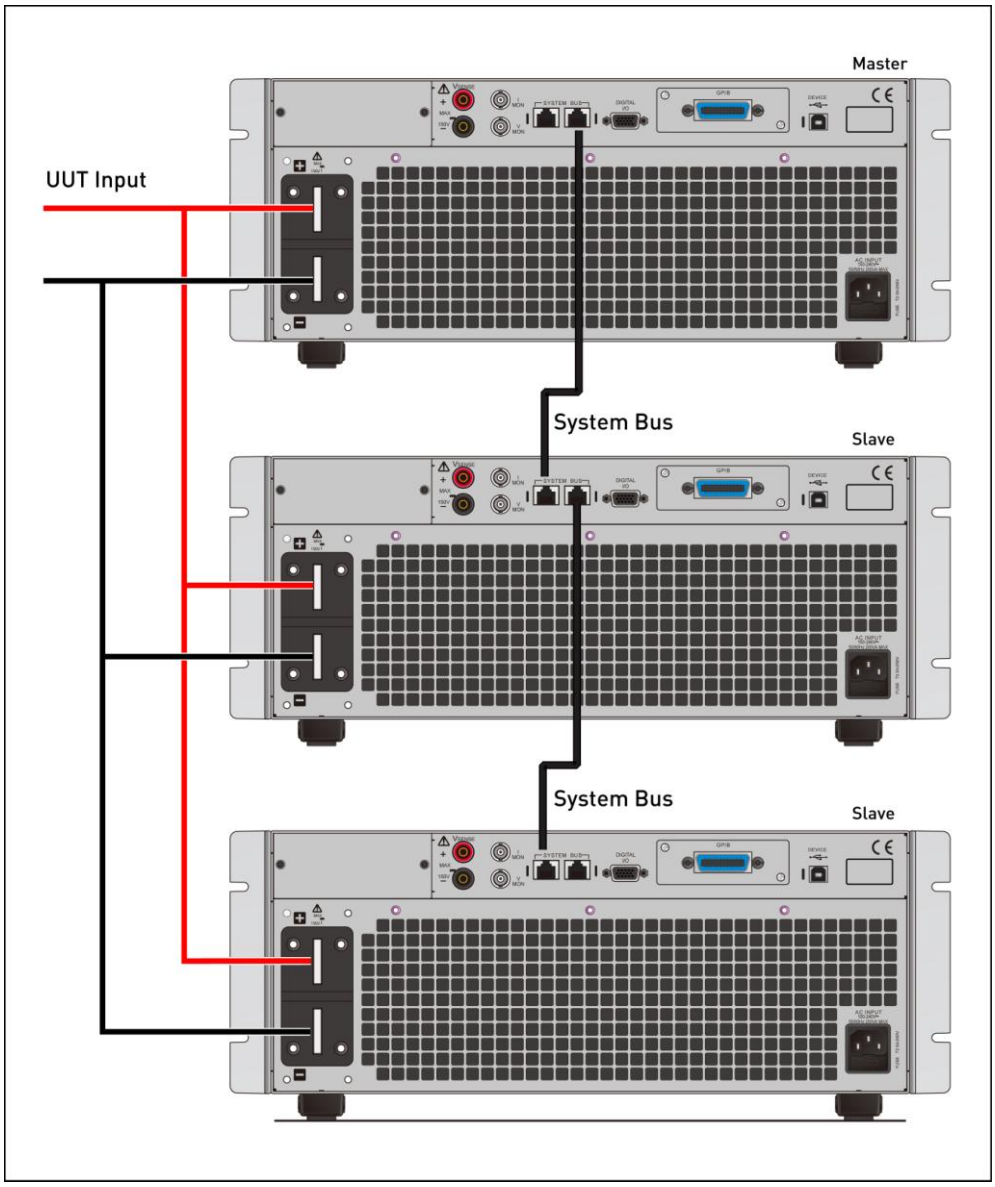


Figure 2-4 Parallel Connection

2.5 Remote Control Connection

The remote operation of Load can be done through GPIB or USB interface. These connectors on the rear panel connect the Load to computer. Connect the Remote Controller to the Electronic Load before powering it on.

Notice The GPIB interface of Electronic Load is an option for purchase.

2.6 Maintenance & Cleaning

Unplug the power cord of the hardware device first before cleaning. Use a brush to clean the dust on it. Use volatile liquid (such as Cleaning Naphtha) to clean the stain on the chassis if it cannot be brushed off. Do not wipe the chassis with any corrosive liquid to avoid damaging the case. Please use a slightly damp cloth to clean the front panel display. For internal cleaning, please use a low-pressure air gun to clean the dust inside the device or send it back to the distributors or agents of Chroma for cleaning.

*It is recommended to clean the device regularly once a year.

2.7 Calibration & Verification

Be sure to verify the device accuracy half a year on a regular basis. The verification procedures are described in Chapter 6. If repair service is required for the 63200A or out of specification, be sure to contact the sales distributors and service location worldwide listed in Chroma's web page http://www.chromaate.com/english/contact/default.asp.

3. Operation Overview

3.1 Introduction

The Chroma 63200A Series Electronic Loads are suitable for design, manufacturing, testing and quality assurance for electronic products. The load contains a set front panel keypad, a VFD, two system bus ports, two USB ports and an optional GPIB card (to be purchased). The user is able to use the built-in remote control functions to readback the current, voltage and other status. The store and recall functions can save up to 256 files, 10 programs and a group of default settings, and all data can be saved in the FLASH memory of Electronic Load for later use.

The Electronic Load is equipped with heat sink fans that can control the temperature intelligently to reduce overall noise level when the Load temperature rises or falls.

A load can operate independently in CC, CR, CV and CP mode. If your application requires the power or current capacity more than an Electronic Load can provide, multiple Electronic Loads can be used by connecting in parallel.

The Electronic Load allows the user to input the UUT spec including V and I for GO/NG check. Moreover, the VFD shows the measurements and deviation of specifications in real time to lead the user to adjust the setting parameters.

This chapter covers the descriptions of front and rear panels, initial settings and load operations in different modes.

3.2 Front Panel

The front panel contains a power switch, a VFD, hot keys, function keys, numeric keys, arrow keys, a push button rotary and a USB HOST connector as the model 63205A-150-500 shown in Figure 3-1.

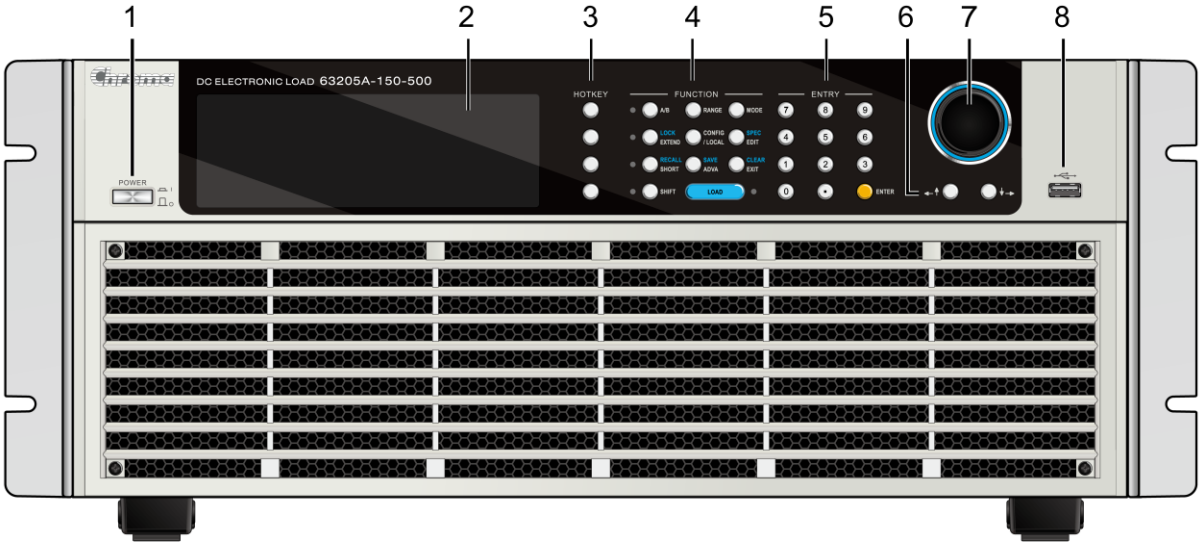


Figure 3-1 Front Panel of Model 63205A-150-500

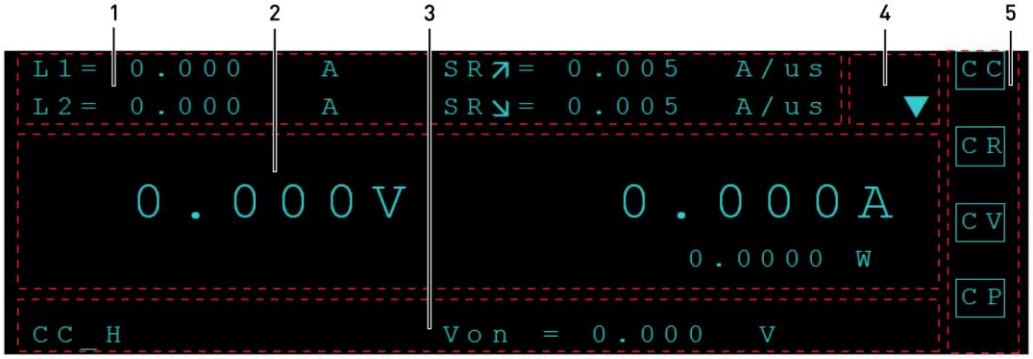
Table 3-1 Front Panel Description

Item	Name	Description	Refer to
1	Power switch	The AC power switch of Electronic Load.	
2	VFD	The display shows the setting information.	3.2.1
3	HOTKEY	The shortcut keys for switching loading modes.	3.2.2
4	FUNCTION keys	There are A/B, RANGE, MODE, EXTEND, LOCK, Config/Local, EDIT, SPEC, Short, Recall, Adva, Save and Clear keys.	3.2.3
5	Entry keys	The numeric keys and ENTER key.	
6	Arrow keys	These two keys are used to change the setting page and select the desired form. They are also used to move the cursor to the desired position when editing parameters.	3.2.4
7	Push Button Rotary	Press down the push button rotary to enter into the parameter setting page. When the settings are done, press the push button rotary again to confirm the setting.	3.2.4
8	USB HOST	USB HOST (not fully support yet).	

3.2.1 VFD

The loading mode is displayed as below:

1. Parameter setting lines: The setting parameters of each mode.
2. Reading display: It displays the measured voltage (V) & current (I) & power (W).
3. Status line: It shows the mode, range, Load ON, Short ON and Von status.
4. Up & down scroll: When a down arrow appears, it means there are parameters in the next page for setting.
5. HOTKEY: The shortcut for entering the mapped loading mode.



HOTKEY
There are 4 HOTKEYS that can switch the loading mode rapidly. When in a loading mode (such as basic or Advance mode), simply press a HOTKEY can switch to the mode indicated.

3.2.2 HOTKEY

Changing the HOTKEY

Press the HOTKEY for 2~3 seconds to switch the HOTKEY to the current loading mode and the HOTKEY display will change as well.

Notice It can set the frequently used mode as a HOTKEY to facilitate operation.

3.2.3 Function Keys

Table 3-2 Function Keys Description

Name	Description
A/B	It switches the load to A and B two types. A yellow indicator is located on the left of the function key.
RANGE	It switches the loading mode range through the cycle of H/M/L.
MODE	The menu for basic loading modes.
EXTEND	It is used when working with extended load. A green indicator is located on the left of the function key.
CONFIG/ LOCAL	It configures the function by setting up the parameters. It can also return to local control when in remote mode.
EDIT	The parameter editing function.
SHORT	It simulates the short circuit function. A red indicator is located on the left of the function key.
ADVA	The menu for advanced functions.
EXIT	It returns to the setup in previous level and exits the parameter input status.
SHIFT	It can execute the SHIFT composite function keys. A blue indicator is located on the left of the function key.
LOAD	The loading and unloading function key. The key has a blue indicator located on the right.

To enable the SHIFT composite function, press SHIFT first and the mapping function key.

Table 3-3 SHIFT Composite Function Keys

Name	Description
LOCK	It locks and unlocks the function. Any input is prohibited when lock is enabled.

SPEC	It provides GO/NG to test loading specification when enabled.
SAVE	It saves the settings of all modes to a specified file (1 to 10).
RECALL	It recalls the settings from the specified file (1 to 10).
CLEAR	It clears the input parameters.

3.2.4 Arrow Keys & Push Button Rotary

The arrow keys can be used to change the parameters and select the menu. When entering numeric values, pressing the “Left/Up” arrow key can be treated as backspace.

The push button rotary has push-down function. Pressing down the rotary can enter into the parameter setting page. Use the arrow keys to move the cursor to the desired parameter and then use the push button rotary to tune the setting value. When the parameter setting is done, press the push button rotary again to confirm it.

Notice

1. When entering numeric values, pressing the “Left/Up” arrow key can be treated as backspace.
2. The push button rotary has push-down function that can perform editing and confirmation functions.

3.3 Rear Panel

The rear panel has 2 System Bus ports, 1 USB port, 1 extended communication interface slot, 1 system I/O port, 1 AC LINE socket , 1 fuse holder and ventilation holes.

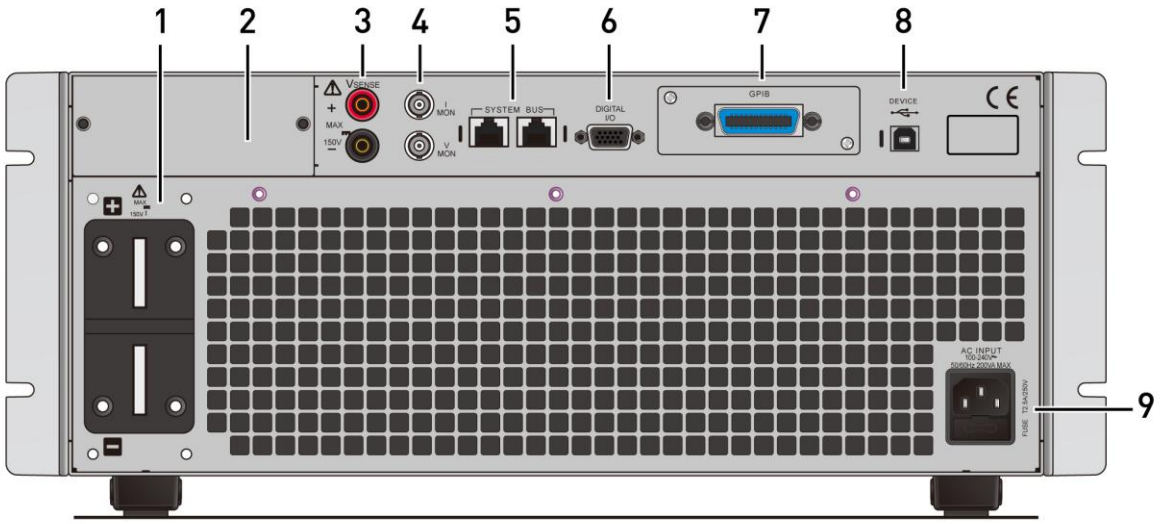


Figure 3-2 Rear Panel of 63205A-150-500 High Power Electronic Load

Item	Description	Refer to
1	The DC Load positive and negative terminals.	2.4.1
2	Optional extended slot.	
3	Vsense terminal: When the Vsense terminal connects to UUT, the Electronic Load will automatically switch to Vsense; otherwise, it will use	2.4.2

	the load terminal to perform the measurement.	
4	V/I Mon: Two separate BNC connector to simulate the load voltage and current. VMON is 0~10V that map to 0V~full scale voltage while IMON is 0~10V that map to 0A~full scale current.	3.3.1
5	System Bus: The connectors for connecting multiple 63200A Series Load in parallel or series.	3.3.2
6	DIGITIAL I/O: The connector for external waveform input and digital system input/output signals. The digital system input/output signals are TTL compatible.	3.3.3
7	Extended communication interface: GPIB interface for extension.	3.3.4
8	USB Device: It connects the PC and remote controller.	3.3.5
9	The power fuse.	

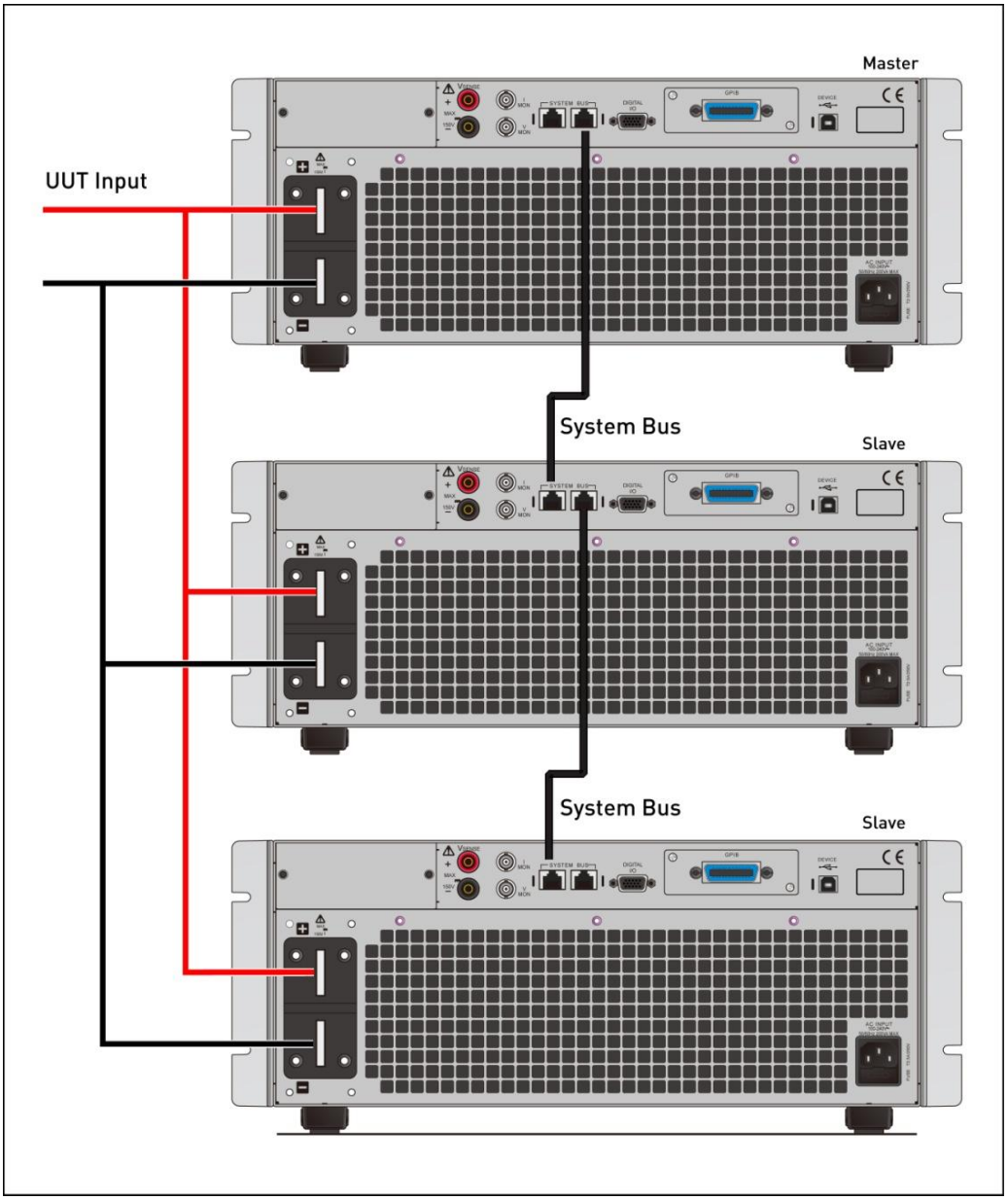
3.3.1 Voltage & Current Monitoring (V/I Mon)

Each channel on the load has two independent BNC connectors to monitor the voltage and current, also to output signals to I MON and V MON. The connectors are located on the rear panel. A 0 to 10V output signal is mapping to a 0 to full scale input range.

3.3.2 System Bus Port

A System Bus is a common used parallel port for 63200A Series Electronic Loads. The two System Bus ports are 10-pin connectors (RJ-45 male connector.) Be sure to use the cable of Chroma's standard accessory and ensure the load input power is connected correctly before connecting the System Bus.

See section 3.5.3 for the detailed parameter settings of System Bus.



⚠WARNING The chassis is grounded through the 3rd pin of power cord. Be sure the power socket is 3-pin type and the pin is properly grounded. The parallel cable is a standard Chroma accessory. Do not use the cable of other brand to avoid damaging the equipment. The System Bus is a parallel connecting port of 63200A Series Electronic Load; do not connect it with other devices to avoid damaging the equipment.

3.3.3 DIGITIAL IO

The IO port is a 15-pin D-SUB male connector on the rear panel of 63200A Series Electronic Load. It contains 0-10V_{DC} external input analog signals and digital I/O signals. The digital I/O signals are TTL compatible and defined as below:

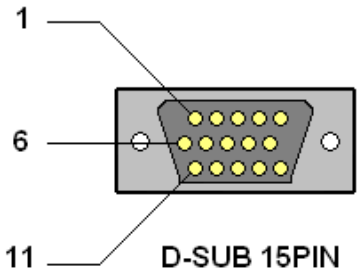


Figure 3-3 63200A Series I/O Port Connector

Table 3-4 Pin Assignments of 63200A Series I/O Port Connector

Pin	Signal	Pin	Signal	Pin	Signal
1	EXT_WAVE_I	**6**	LOAD_ON_ST	**11**	DI1
2	EXT_WAVE_V	**7**	TRIG_SEQ	**12**	DI2
3	GND	**8**	DO1	**13**	DI3
4	SHORT_ST	**9**	DO2	**14**	GND
5	TRIG_DIGI	**10**	DO3	**15**	GND

Notice

1. Pin [1:2]: EXT_WAVE[I:V]→ the external waveform input signal with input range from 0 to 10V.
2. Pin [3:14:15]: the GND signal.
3. Pin [4]: SHORT ST→ the Short ON output signal, TTL Level and Active High.
4. Pin [5]: the trigger source for TRIG_DIGI external trigger input signal to be become digital. TTL Level, falling edge and pulse width ≥1μs.
5. Pin [6]: the Load ON output signal, TTL Level and Active High.
6. Pin [7]: TRIG_ SEQ → the external input signal is automatically triggered in the following sequence: TTL Level, falling edge, and pulse width ≥1μs.
7. Pin [8:9]: DO[1:2]→ the binary digital output signal, high level: 4.7kΩ resistance increases to 5V, low level <0.6V, loading current = 10mA.
8. Pin [10]: DO3
9. Pin [11:12]: DI[1:2] provides External Load ON/OFF function so that the user can use the input signal to control Load ON/OFF externally. When DI1 and DI2 are both set to External Load ON/OFF, both signals need to be HIGH to Load OFF and on the contrary both signals need to be LOW to Load ON.
   When DI1 (or DI2) is set to Remote Inhibit and Low, all channels in the Electronic Load are Load OFF and a message of REMOTE INHIBIT will appear. If this protection is not cleared, even the DI1 (or DI2) is High, Load on cannot be executed. DI1 and DI2 are for communication control and the action time should be less than 5ms.

3.3.4 Extended Communication Interface

The GPIB communication interface can be expanded. The user should know the GPIB address when using PC with GPIB to remote programming the Electronic Load. Every device that connects to the GPIB interface will be assigned a unique address.

See section 3.5.6 *Setting Remote Communication Interface* for the parameter settings of GPIB communication interface.

3.3.5 USB Remote Control

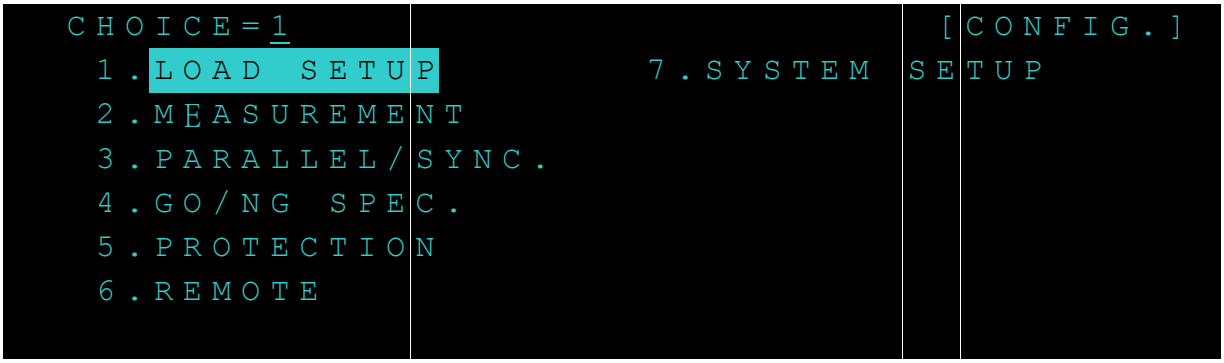
The Universal Serial Bus (USB) port on the rear panel is a 4-pin USB connector that can be used to connect the remote controller or PC for remote control.

3.4 Local/Remote Control

Local (front panel) control effects right after the device is powered on. The keys and display on the front panel can be operated manually. The remote control begins when the 63200A Series Electronic Load receives commands via GPIB / USB interface. Only the PC/Remote Controller can control the Load when remote control is in effect. The front panel keys are all invalid except **LOCAL** key. The user can press **LOCAL** to return to local control mode.

The detailed descriptions of basic remote programming are listed in Chapter4.

3.5 Configure



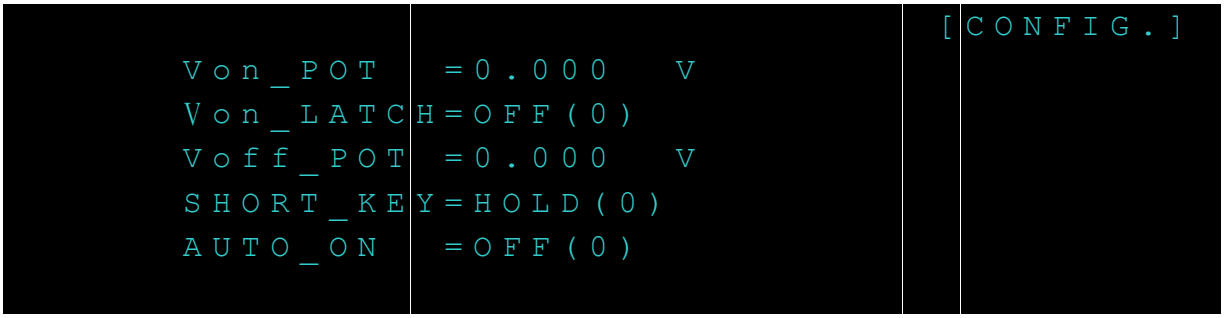
Main function setup description:

	Main Function	Description	Refer to
Configure	Load Setup	Setup for loading parameters.	3.5.1
	Measurement	Setup for measurement parameters.	3.5.2
	Parallel & Sync.	Setup for parallel & sync. functions.	3.5.3
	GO/NG Spec	Setup for spec inspection parameters.	3.5.4
	Protection	Setup for current, power protection parameters.	3.5.5
	Remote	Setup for communication interface.	3.5.6
	System Setup	Setup for system functions.	3.5.7

Sub function setup description:

Main Function	Sub Function	Description
Load Setup	Von_POT	Set the start loading voltage.
	Von Latch	Lock the start loading voltage.
	Von_Voff	Set the voltage to unload.
	Short Key	Set short circuit simulation function.
	Auto On	Set auto loading at power on.
Measurement	Window T	Set the average measurement time.
	Sign of Voltage	Set the voltage sign for display.
	Digitizing	Set the data capturing function.
Parallel & Sync.	Address	Set the communication address.
	Terminator	Set the terminal resistor.
	Sync.	Set the synchronization function.
	Parallel	Set the parallel function.
	PARA. NUM	Set the parallel number.
	INITIAL	Initialization for parallel.
Protection	OCP	Over current protection defined by user.
	OPP	Over power protection defined by user.
Remote	GPIB	Set the GPIB communication interface.
	Digital I/O	Set the I/O function.
System Setup	Enter Key	Switch to the input parameter.
	Sound	Set the button to beep when pressed.
	Brightness	Adjust the VFD brightness.
	Factory Default	Restore to factory default.
	Information	Show the production information.
	Calibration	Set the calibration function.

3.5.1 Load Setup



Von_POT, set the start loading voltage level

The current will start loading when the Electronic Load is in Load ON state and the UUT output voltage reaches the start loading voltage level (Von).

Von_LATCH, lock the start loading voltage

Latch ON means Load will continue loading current when it reaches Von.
Latch OFF means loading current will stop when the UUT voltage is lower than Von.
The Von latch default is OFF.

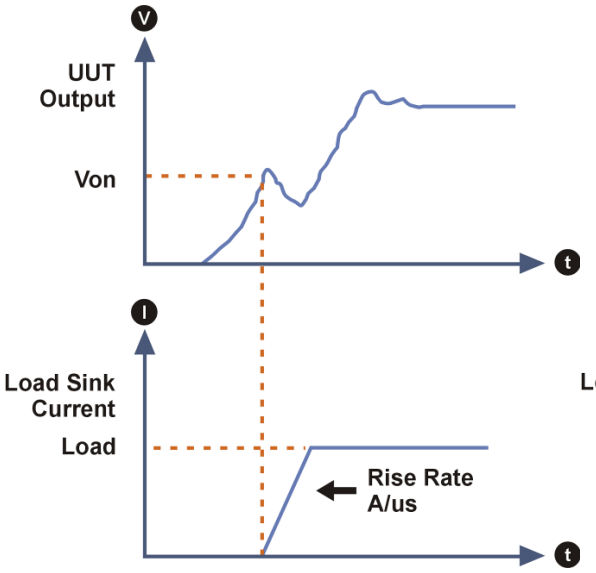
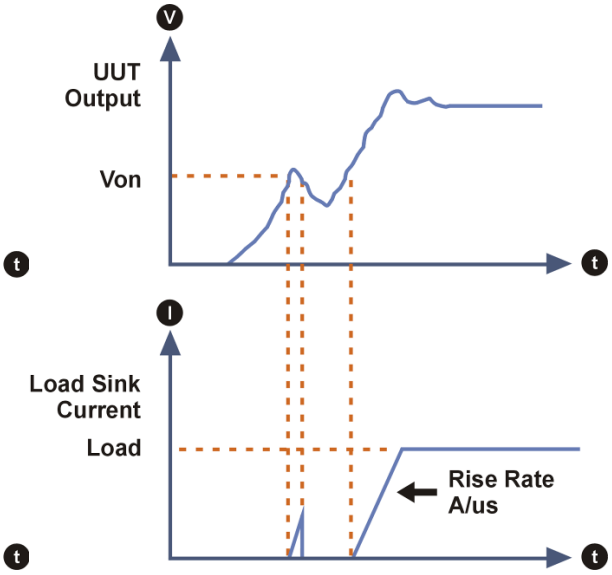


Figure 3-4 Von LATCH ON Current Waveform



Von LATCH OFF Current Waveform

Voff_POT, set the unload voltage level

The Electronic Load will close the loading state (Load OFF) when the UUT output is dropped to Voff. The Voff default is 0V.

The Electronic Load is able to simulate the loading conditions. When the UUT output voltage reaches Von, the Electronic Load will start or stop loading current. The Electronic Load starts loading current when it is ON and the input voltage exceeds Von and stops loading when it is OFF or the input voltage is lower than Von.

CAUTION

1. To avoid logic error, Voff should be smaller than or equal to Von.
2. If Von_POT is set lower than the UUT minimum operating voltage, it could cause the UUT unable to turn on or to generate overshoot voltage or current when the load is set too high. Therefore, it is necessary to consider if the UUT minimum operating voltage spec is met when setting Von_POT.

Short Key, set for short circuit

Before using the short circuit function, the user has to set it first so that it can be controlled by the Short key on the front panel or remotely. The settings are described as below.

Disable: Turn off the SHORT key function.
HOLD: Press and hold the SHORT key to function. The Short state is cleared when released.
TOGGLE: Press SHORT key to enter into Short state and press SHORT key again to clear the state.
The default is Disable.

Notice

1. When operating in Short mode, the Load uses the maximum rated current and power of the range to simulate the short circuit.
2. It will not affect the programmed settings when Short is on, and the Load input will return to the previous programmed value when Short is off.

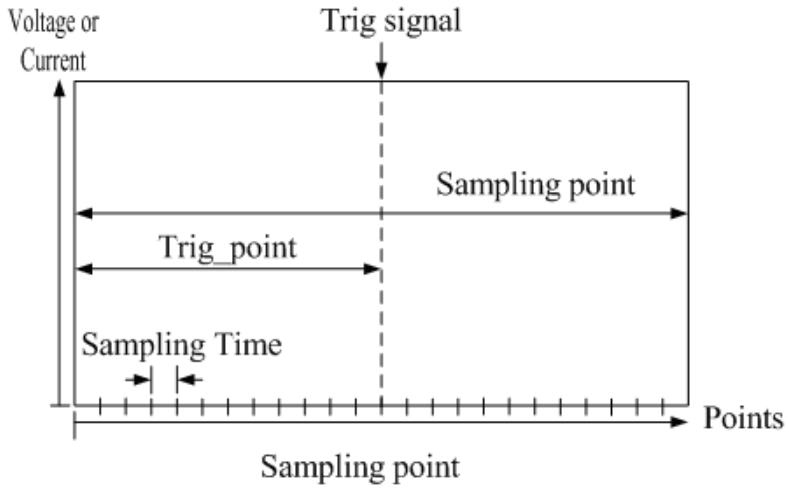
AUTO ON, set for auto loading at power on
When Auto is on, the Load will apply the loading parameters and mode set last time before turned off for loading when power on next time. The default is OFF.

3.5.2 Measurement

Window Time
This function adjusts the average measurement time.
The setting range is 0.001s~10s and the default is 0.02s.

Sign of Voltage
This function changes the voltage sign for display.
The voltage shows a negative sign when MINUS is selected and shows no sign if PLUS is selected. The default is PLUS.

Digitizing (capturing measured data)
The 63200A Series Electronic Load provides data capturing function for measured data to record the waveform. It can record the measured data during loading via this function.



Parameters:
Sampling Time: The sampling time for measured data.
Sampling Point: The total sampling point for measured data.
Trig Source: The trigger conditions for data capturing. There are Load ON, Load OFF, TTL (DIGITAL IO:TRIG_DIGI signal), BUS trigger and Manual trigger available for triggering. The default is Load ON.
Trig Point: Set the trigger point.
DIGITIZING: Trigger the data capturing.

3.5.3 Parallel & Sync.

The Electronic Load is able to set for parallel and synchronization. First follow the steps described in section 2.4.3 to connect the SYSTEM BUS on the rear panel.

For parallel, simply set the MASTER and it can control the loading on the MASTER and SLAVE in the parallel group.

For synchronization, the loading values need to be set separately for all MASTER and SLAVE; however, the synchronization of LOAD ON/OFF is controlled by MASTER.

ADDRESS
In the SYSTEM BUS network, all Electronic Load has to set a communication address without duplicates. The setting range is 1~10 and the default is 1.

Terminator
It sets the terminal resistor required for SYSTEM BUS. The terminator function needs to be enabled on the first and last Electronic Load in the SYSTEM BUS network. As to the devices in between, they need to be set to OFF. It can set to ON(1)/OFF(0) and the default is OFF(0).

SYNC MODE
Set the standalone device to be MASTER or SLAVE in a synchronization group. It can set to DISABLE(0), MASTER(1), SLAVE(2) and the default is OFF(0).

PARA MODE
Set the standalone device to be MASTER or SLAVE in a parallel group. It can set to DISABLE(0), MASTER(1), SLAVE(2) and default is OFF(0).

PARA. NUM
Set the number for parallel at a maximum of 10. The setting of PARA. NUM is Master + Slave and the set number should be the same as the actual paralleled number.

INITIAL
It initializes for parallel. When ON is selected for INITIAL, the parallel communication will be connected and disconnected when OFF is selected.

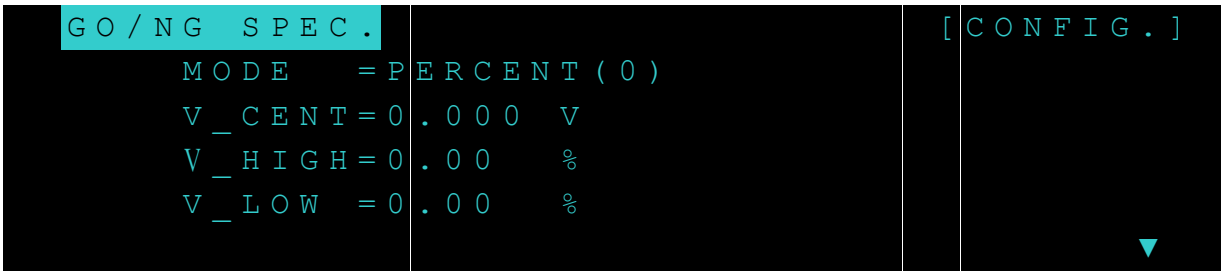
CAUTION

1. The terminator function needs to be enabled on the first and last Electronic Load in the SYSTEM BUS network. As to the devices in between, they need to be set to OFF. It could cause bad communication if the terminators are set wrong. When the 63200A Series Loads are paralleled, the Address must start from 1 to 10 sequentially without any skip. For example, if two 63200A Series Loads are paralleled, the first one is Master and the Address has to be 1, while the second one is Slave and the Address must be 2 with no number skipped.
2. Set NONE for the unit not to be paralleled. For instance, set the 6^{th} and the unit followed to NONE when paralleling 5 units; otherwise, connection error may occur during parallel connection.

3.5.4 GO/NG Spec. Testing

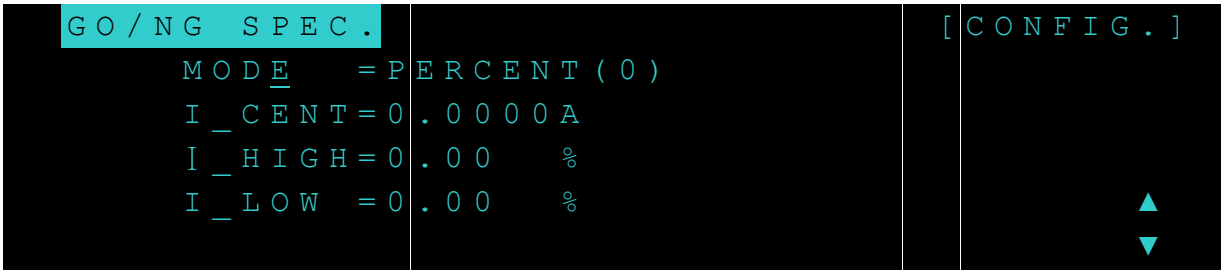
The Electronic Load GO/NG testing function allows the user to program the spec of voltage, current and power. Turn on the SPEC testing function during testing and the testing result can be displayed simultaneously. GO will show if the SPEC is met and NG will appear if not.

1. Setting the voltage spec.:



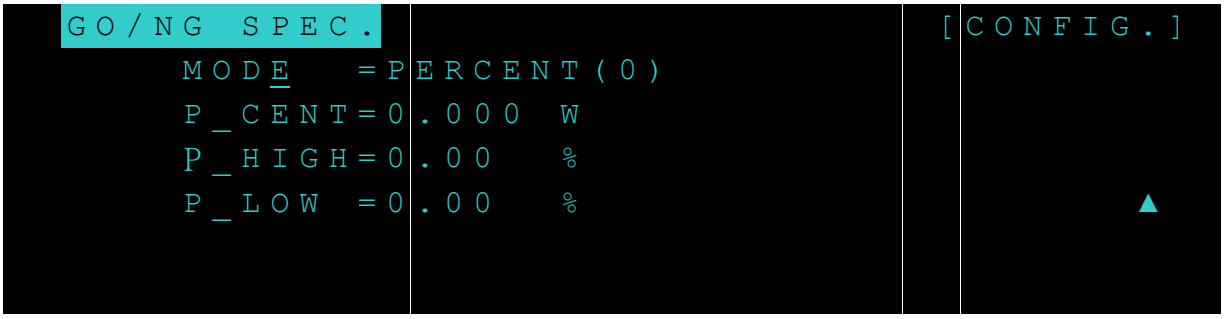
Parameters:
MODE: There are VALUE and PERCENT two modes for setting.
V_CENTER: The setting for input reference level.
V_HIGH: The parameter setting is voltage level when the MODE is set to VALUE and the percentage range (0 to 100%) when the MODE is set to PERCENT.
V_LOW: The parameter setting is voltage level when the MODE is set to VALUE and the percentage range (0 to 100%) when the MODE is set to PERCENT.

2. Setting the current spec.:



Parameters:
MODE: There are VALUE and PERCENT two modes for setting.
I_CENTER: The setting for input reference level.
I_HIGH: The parameter setting is current level when the MODE is set to VALUE and the percentage range (0 to 100%) when the MODE is set to PERCENT.
I_LOW: The parameter setting is current level when the MODE is set to VALUE and the percentage range (0 to 100%) when the MODE is set to PERCENT.

3. Setting the power spec.:



Parameters:
MODE: There are VALUE and PERCENT two modes for setting.
P_CENTER: The setting for input reference level.

P_HIGH: The parameter setting is power level when the MODE is set to VALUE and the percentage range (0 to 100%) when the MODE is set to PERCENT.
P_LOW: The parameter setting is power level when the MODE is set to VALUE and the percentage range (0 to 100%) when the MODE is set to PERCENT.

Notice The SPEC function can be enabled for GO/NG to test the loading spec. The user needs to press SHIFT first and then SPEC.

3.5.5 Customized Protection

OCP (over current protection defined by user)
The Electronic Load has over current protection that can be customized for different UUT to prevent them from being damaged due to error operation.

OPP (over power protection defined by user)
The Electronic Load has over power protection that can be customized for different UUT to prevent them from being damaged due to error operation.

3.5.6 Setting Remote Communication Interface

GPIB
It sets the GPIB address.

Digital I/O
It sets the digital I/O for the system I/O port on the 63200A Series rear panel.

DOUT_1/DOUT_2 can set to the following status:

NONE(0)
OCP TEST PASS-H(1)
OCP TEST PASS-L(2)
GONG TEST PASS-H(3)
GONG TEST PASS-L(4)
OTP OVP OCP OPP REV-H(5)
BUS CTRL. ACTIVE_H(6)
BUS CTRL. ACTIVE_L(7)

DIN_1/DIN_2 can set to the following status:

NONE(0)
EXTERNAL LOAD ON/OFF(1)
REMOTE INHIBIT(2)

3.5.7 System Setup

Enter Key
It automatically switches the parameter to the next item when pressed. It can set to NEXT or FIXED. The default is NEXT.

Sound
The key beeps when pressed. The default is ON.

Brightness
The VFD brightness adjustment: 25 % / 50% / 75% / 100%. The default is 100%.

Factory Default
It returns to the factory default including the settings and parameters under Configure.

Information
The product information including model number, serial number and firmware version.

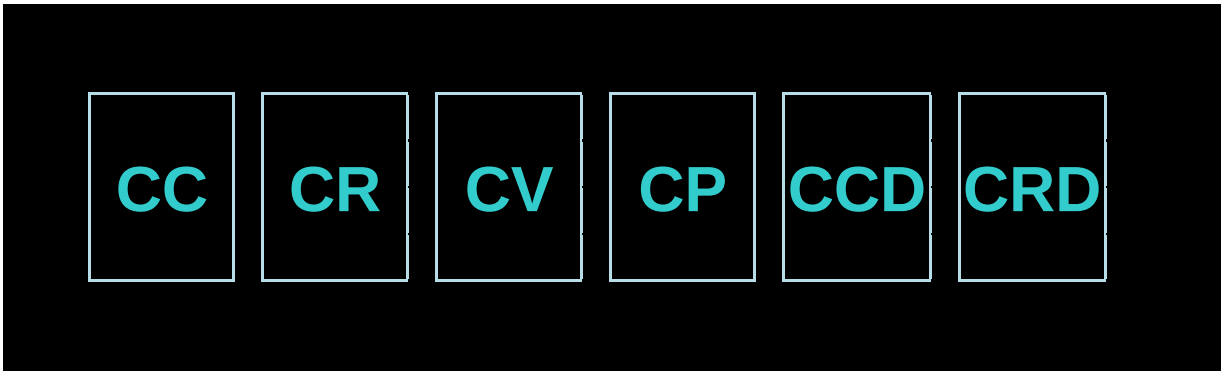
Calibration
The calibration function.

Notice Be sure to contact the technical service center of Chroma for any calibration requirements.

3.6 Basic Operation Modes

There are six modes of operation: Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), Constant Power (CP), Constant Current Dynamic (CCD) and Constant Resistance Dynamic (CRD).

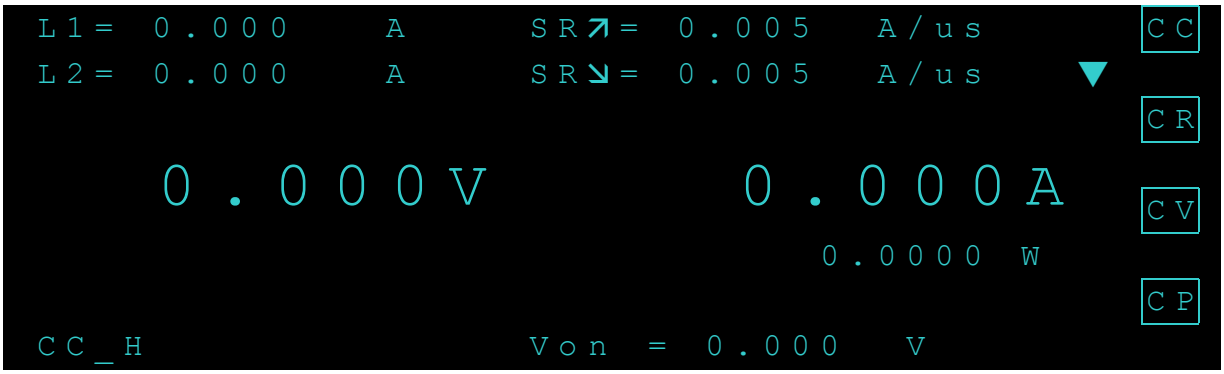
When you press MODE key to program a mode, the Load will change to a new mode. In change of modes the Load's input is momentarily disabled before a new mode is enabled. The parameters in current, resistance or voltage mode can be programmed easily when the mode is selected.



The parameter set in all modes will be rescaled to fit the resolution of that parameter. In local mode any value can be set by the keypad. When the programmed parameter 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 parameter is over the maximum or minimum value.

3.6.1 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 and select **CC** mode.



Parameters:
L1: Set the loading value for A load.
L2: Set the loading value for B load.
SR↗: Set the current rise slew rate data.
SR↘: Set the current fall slew rate data.
Vrange: Set the voltage measurement range of Electronic Load. There are H, M and L for selection.
The push button rotary and arrow keys can be used to change the selection and the numeric keys can input the setting values.

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 VFD range indicator is active at you want to select. The mode change will affect the Load, 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 is active, the new setting will change the input immediately at a rate determined by the slew rate setting.

A/B State Switch
The static function has two setting levels L1 and L2. Use the A/B key on the Load to

manually switch between the two programmed states. Slew rate determines the rate at which Load level changes from one load level state to another. Figure 3-5 shows the current level of load after pressing A/B key.

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

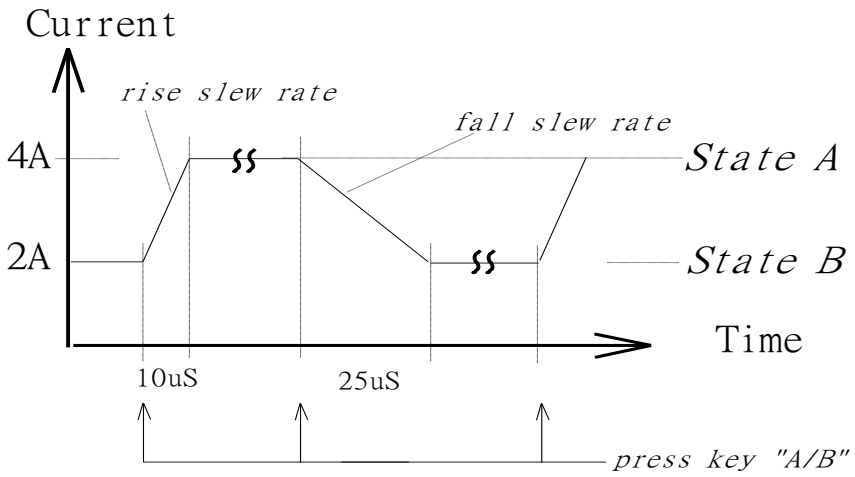
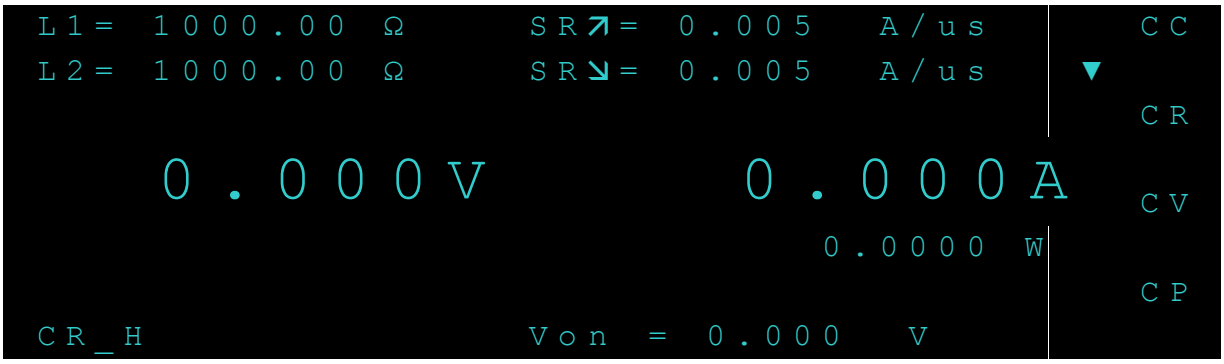
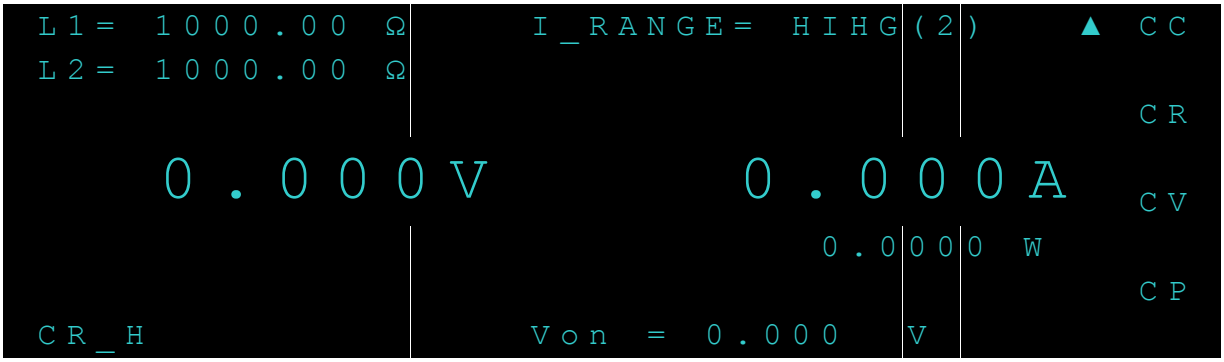


Figure 3-5 Load Level after Pressing A/B Key

3.6.2 Constant Resistance Mode

In CR mode, the Load will sink a resistance in accordance with the programmed value regardless of the input voltage. To enter into the CR mode, press the MODE key and select **CR** mode.





Parameters:
L1: Set the loading value for A load.
L2: Set the loading value for B load.
SR↗: Set the current rise slew rate data.
SR↘: Set the current fall slew rate data.
I_RANGE: Set the current measurement range of Electronic Load. There are H, M and L for selection.
The push button rotary and arrow keys can be used to change the selection and the numeric keys can input the setting values.

Ranges (Low, Middle, High)
Resistance can be programmed in any of the three ranges, low range, middle range and high range. The low range provides better resolution at low resistance 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 VFD range indicator is active at you want to select. The mode change will affect the Load, so will the change of range. Both of them will cause the input to go through an off state. If the CR mode of Load is active, the new setting will change the input immediately at a rate determined by the slew rate setting.

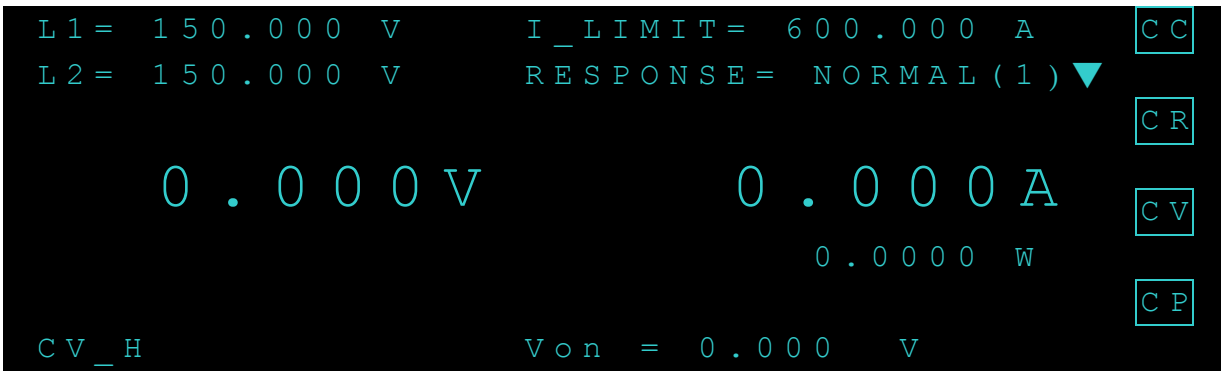
A/B State Switch

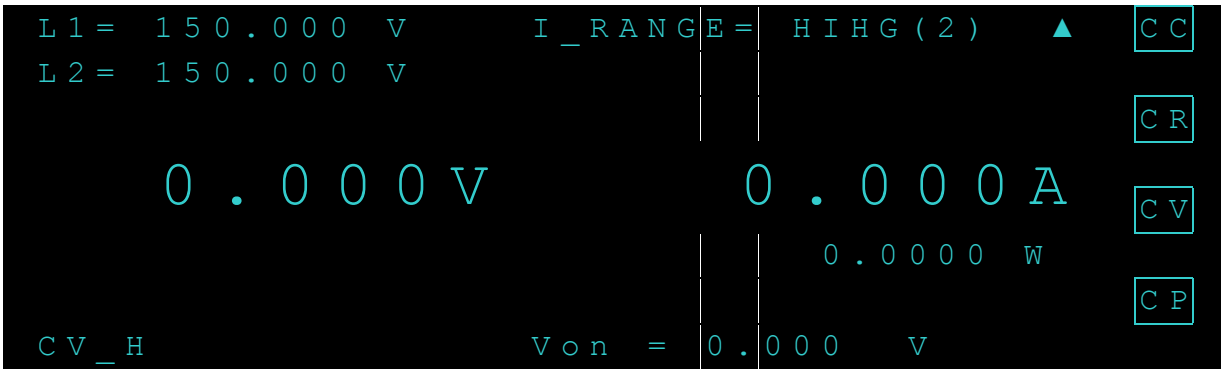
The static function has two setting levels L1 and L2. Use the A/B key on the Load to manually switch between the two programmed states. Slew rate determines the rate at which Load level changes from one load level state to another.

CAUTION It is suggested to use a remote sense cable to measure the UUT output voltage.

3.6.3 Constant Voltage Mode

In CV mode, the Load will sink current to control the voltage source in programmed value. Constant Voltage mode has 3 types of response speeds: fast, normal and slow. To enter into the CV mode, press the MODE key and select **CV** mode.





Parameters:
L1: Set the loading value for A load.
L2: Set the loading value for B load.
I_LIMIT: Set the maximum current for loading.
RESPONSE: Set the Electronic Load response speed to FAST, NORMAL or SLOW.
I_RANGE: Set the current measurement range of Electronic Load. There are H, M and L for selection.
The push button rotary and arrow keys can be used to change the selection and the numeric keys can input the setting values.

Ranges (Low, Middle, High)
Voltage can be programmed in any of the three ranges, low range, middle range and high range. The low range provides better resolution at low voltage 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 VFD range indicator is active at you want to select. The mode change will affect the Load, so will the change of range. Both of them will cause the input to go through an off state. If the CV mode of Load is active, the new setting will change the input immediately at a rate determined by the slew rate setting.

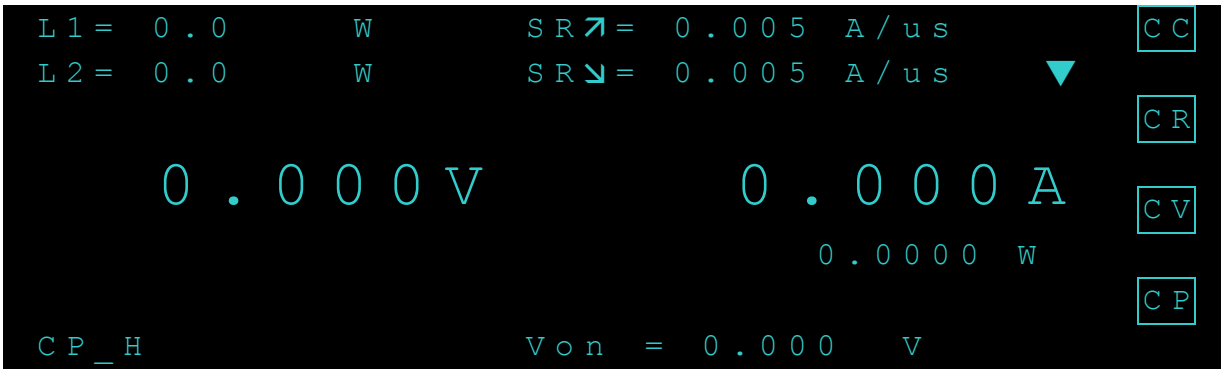
A/B State Switch

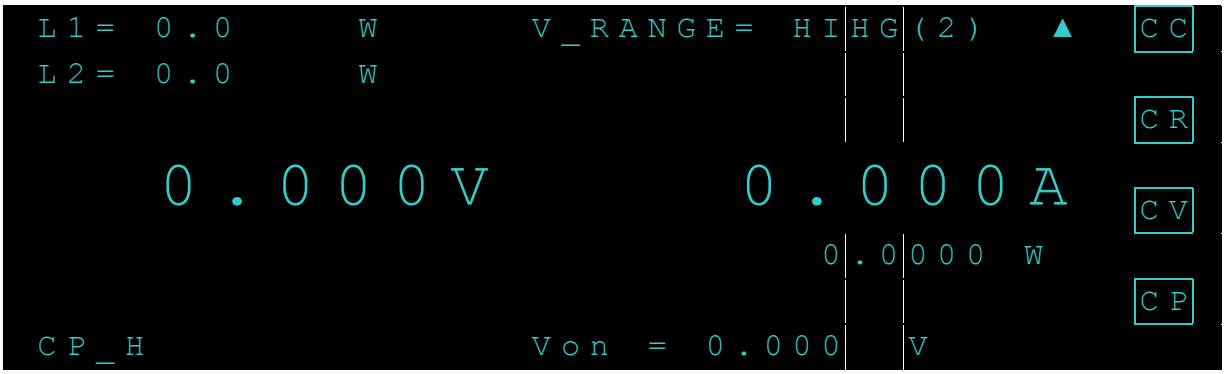
The static function has two setting levels L1 and L2. Use the A/B key on the Load to manually switch between the two programmed states. Slew rate determines the rate at which Load level changes from one load level state to another.

CAUTION It is suggested to use a remote sense cable to measure the UUT output voltage.

3.6.4 Constant Power Mode

In CP mode, the Load will sink a current according to the programmed power. To enter into the CP mode, press the MODE key and select **CP** mode.





Parameters:
L1: Set the loading value for A load.
L2: Set the loading value for B load.
SR↗: Set the current rise slew rate data.
SR↘: Set the current fall slew rate data.
Vrange: Set the voltage measurement range of Electronic Load. There are H, M and L for selection.
The push button rotary and arrow keys can be used to change the selection and the numeric keys can input the setting values.

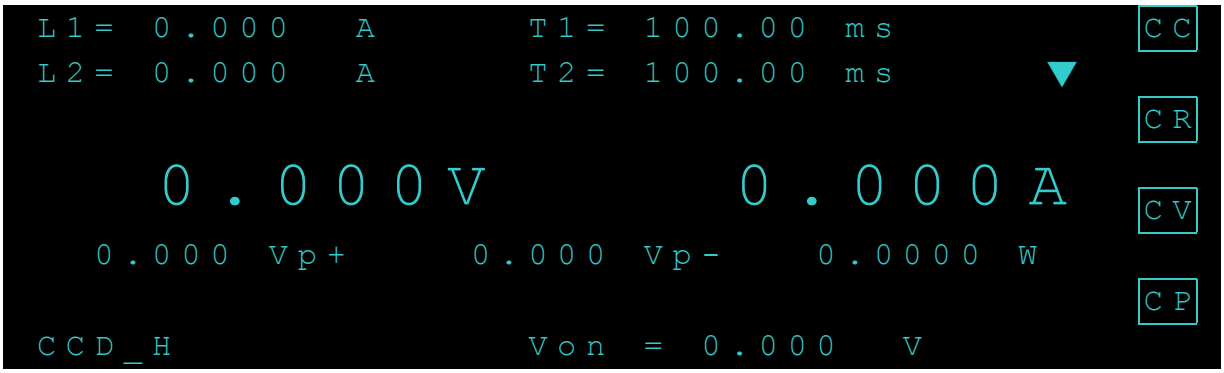
Ranges (Low, Middle, High)
Power can be programmed in any of the three ranges, low range, middle range and high range. The low range provides better resolution at low power setting. If any value is over the maximum of low range, you must select the middle range. When any value is over the maximum of middle range, you must select the high range. To change the range, press the RANGE key few times until the VFD range indicator is active at you want to select. The mode change will affect the Load, so will the change of range. Both of them will cause the input to go through an off state. If the CP mode of Load is active, the new setting will change the input immediately at a rate determined by the slew rate setting.

A/B State Switch

The static function has two setting levels L1 and L2. Use the A/B key on the Load to manually switch between the two programmed states. Slew rate determines the rate at which Load level changes from one load level state to another.

3.6.5 CCD Mode

In CCD mode, the Load will sink a dynamic current according to the programmed current and dynamic timing regardless of the input voltage. To enter into the CCD mode, press the MODE key and select **CCD** mode.



Parameters:
L1: Set the loading value for Load1.
L2: Set the loading value for Load2.
SR↗: Set the current rise slew rate data.
SR↘: Set the current fall slew rate data.
T1: Set the loading time for L1.
T2: Set the loading time for L2.
REPEAT: Set the number of time to repeat (0=infinite loop).
Vrange: Set the voltage measurement range of Electronic Load. There are H, M and L for selection.

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

Load1=4A, Load2=2A, SR / =0.2A/μs, SR \ =0.2A/μs, T1=10ms, T2=10ms, RT=0

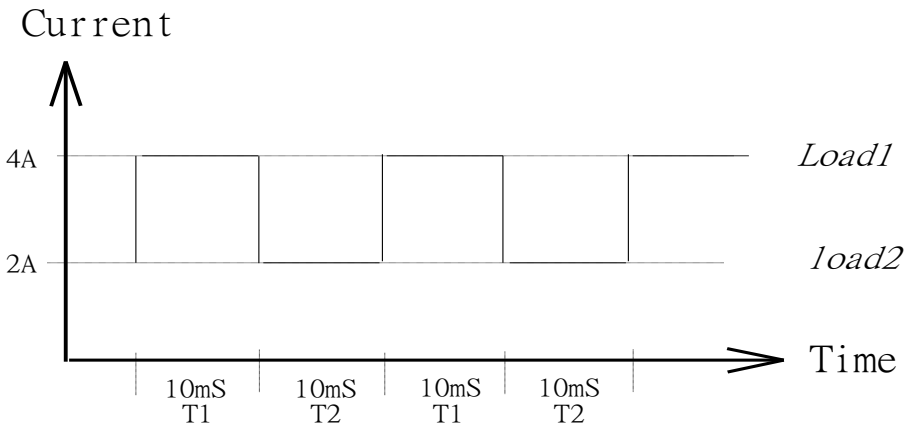
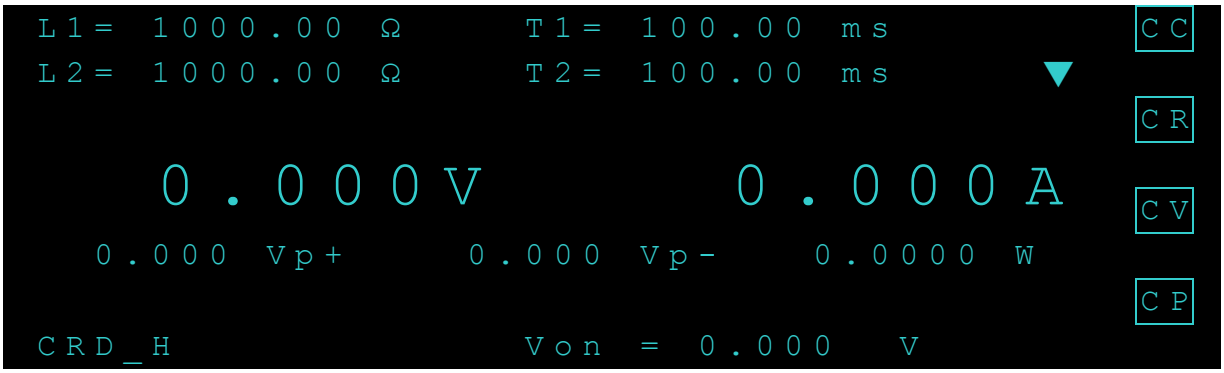
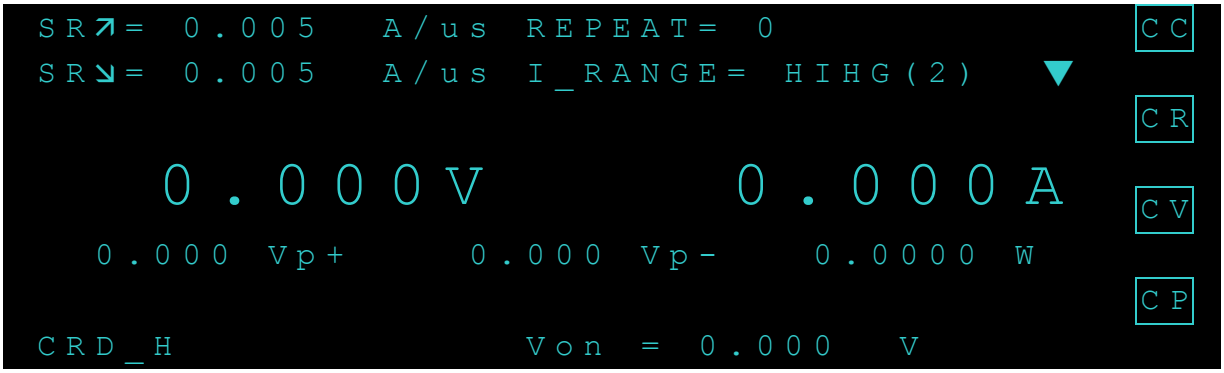


Figure 3-6 Dynamic Current Waveform

3.6.6 CRD Mode

In CRD mode, the Load will sink a dynamic resistance according to the programmed resistance and dynamic timing by the input voltage. To enter into the CRD mode, press the MODE key and select **CRD** mode.





Parameters:
L1: Set the loading value for Load1.
L2: Set the loading value for Load2.
SR↗: Set the current rise slew rate data.
SR↘: Set the current fall slew rate data.
T1: Set the loading time for L1.
T2: Set the loading time for L2.

REPEAT: Set the number of time to repeat (0=infinite loop).
I_RANGE: Set the current measurement range of Electronic Load. There are H, M and L for selection.

Ranges (Low, Middle, High)
Resistance can be programmed in any of the three ranges, low range, middle range and high range. The low range provides better resolution at low resistance 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 VFD range indicator is active at you want to select. The mode change will affect the Load, so will the change of range. Both of them will cause the input to go through an off state. If the CRD mode of Load is active, the new setting will change the input immediately at a rate determined by the slew rate setting.

UUT: 20V
Load1=5Ω, Load2=10Ω, SR / =0.2A/μs, SR\ =0.2A/μs, T1=10ms, T2=10ms, RT=0

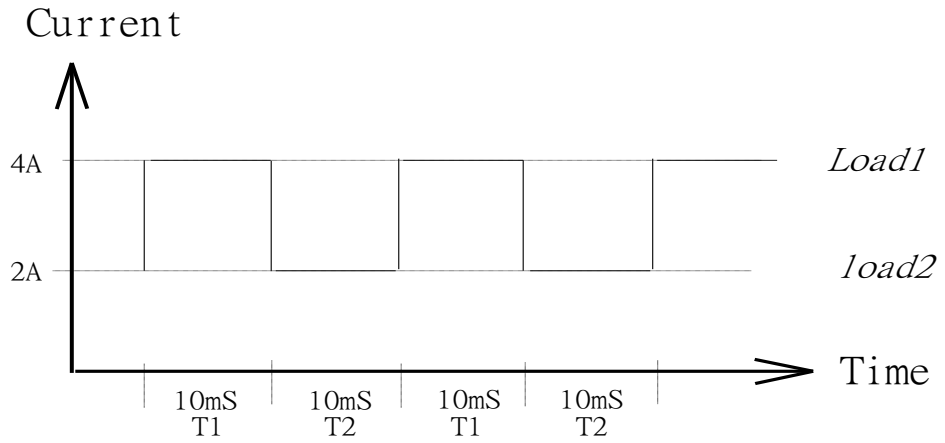
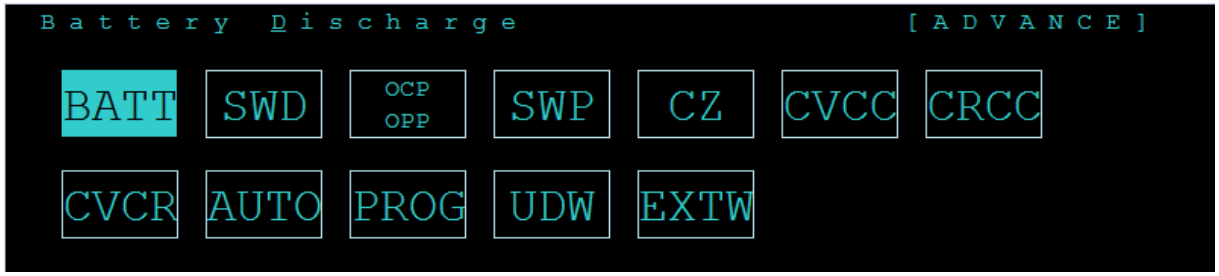


Figure 3-7

CAUTION It is suggested to use a remote sense cable to measure the UUT output voltage.

3.7 Advance Mode

The Electronic Load has useful advanced functions such as BATT and Sine Wave Dynamic measurement, etc. Press ADVA to enter into Advance page and use left/right arrow key to select the desired mode and press Enter.



The parameter set in all modes will be rescaled to fit the resolution of that parameter. In local mode any value can be set by the keypad. When the programmed parameter 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 parameter is over the maximum or minimum value.

3.7.1 BATT (Battery Discharge Timer)

The 63200A Series Electronic Load has a unique timer and measurement functions that can perform accurate time setting and measurement within the range of 00:00:00s to 27:46:39s. This feature allows the user to set the Final Voltage and Timeout during battery discharge testing and applications in similar.

To enter into BATT mode, press ADVA and select **BATT** and then press Enter.

Parameters:
MODE: Set the CC(0) &CR(1) & CP(2) modes.
I_SET: Set the loading parameter (R_SET for CR and P_SET for CP).
SR↗: Set the current rise slew rate data.
SR↘: Set the current fall slew rate data.
E_END: Set the final voltage.
T_OUT: Set the time for Electronic Load to timeout. The range is 0 to 99,999s.
V_RANGE: Set the voltage measurement range of Electronic Load. There are H, M and L for selection.

The internal timer of 63200A Series Electronic Load is shown in Figure 3-8. When Load ON is pressed, the timer will enable automatically. When the voltage reaches the set final voltage or is timeout, the Electronic Load will stop loading and the timer will stop counting. The Battery Discharge default is OFF.

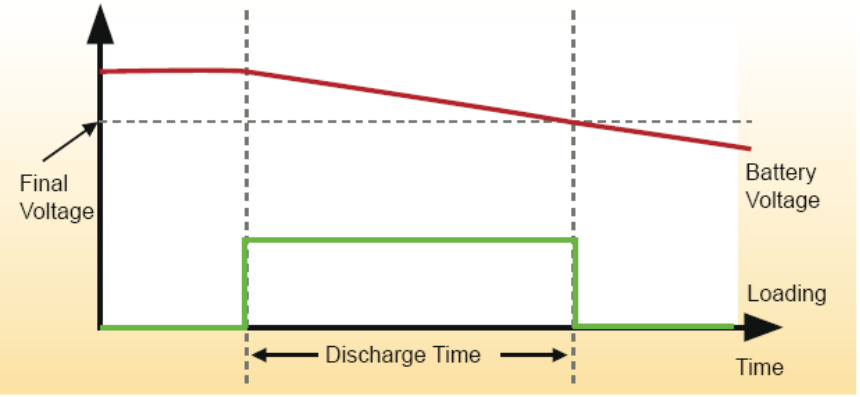


Figure 3-8 Timing Measurement Function

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

3.7.2 SWD (Sine Wave Dynamic)

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 3-9 shows Ch1 is the actual loading current waveform and Ch2 is the voltage waveform of the UUT (AC component.)

To enter into SWD mode, press ADVA and select **SWD** and then press Enter.

Parameters:
I_DC: Set the DC loading current bias.
I_AC: Set the AC peak to peak loading sine wave.
FREQ: Set the sine wave frequency 0~20KHz.

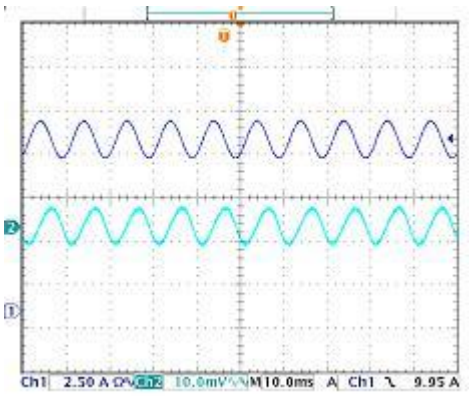
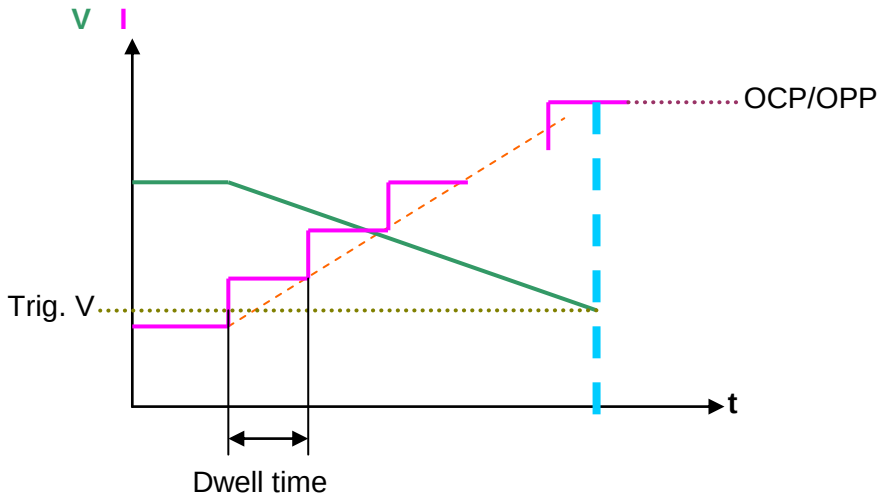


Figure 3-9

3.7.3 OCP&OPP

The OCP (or OPP) provides ramped up current (or power) for the Load to test the UUT voltage whether has reached trigger voltage level and to judge if the protection is acting normally or not.

To enter into OCP&OPP mode, press ADVA and select **OCP&OPP** and then press Enter.



Parameters:
TYPE: Set the OCP(0) &OPP (1) modes.
TRG: Set the trigger voltage. When the UUT output voltage is lower than the trigger level, the Load will stop loading current.
STR_I: Set the current start level.
EDN_I: Set the current end level.
STEP: Set the current change steps. The range is 1 to 1,000.
DWELL: Set the dwell time. The dwell time is the time from start to end of a set current level. The set range is 10μs to 1,000ms.
SPECH/L: Set the OCP spec to LOW or HIGH level.

3.7.4 SWP (CC Dynamic Sweep)

In SWP mode, the Load provides a unique constant current dynamic sweep to use frequency conversion to find out the UUT voltage of worst case.

The CC dynamic sweep allows the user to program two load levels (Load1 and Load2), start frequency, end frequency, step frequency, dwell, duty and slew rate (rise & fall). During operation, the loading will switch between two load levels according to the specified value.

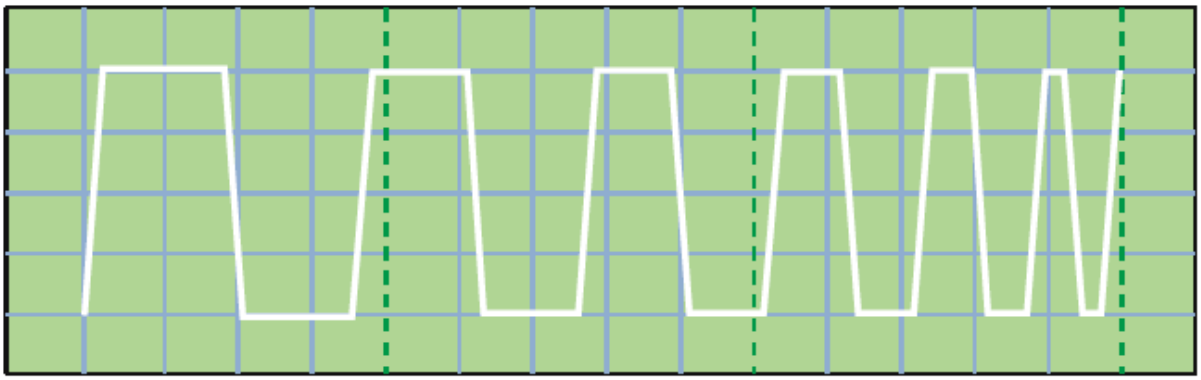


Figure 3-1 Current Waveform in CC Dynamic Sweep Mode

To enter into SWP mode, press ADVA and select **SWP** and then press Enter.

Parameters:
I_MAX: Set the maximum current level.
I_MIN: Set the minimum current level.
FSTER: Set the start frequency. The range is 0.01Hz to 50kHz.
FEND: Set the end frequency. The range is 0.01Hz to 50kHz.
FSTEP: Set the step frequency. The range is 0.01Hz to 50kHz.
DWELL: Set the dwell time. The dwell time is the time from start to end of a set step frequency. The set range is 1ms to 100s.
DUTY: Set the duty of load. The duty can set to 1%-99% but will be limited to the transient time between two load levels.
SR↗: Set the current rise slew rate data.
SR↘: Set the current fall slew rate data.

3.7.5 CZ Mode

In CZ mode, the Load will sink a current according to the programmed impedance. 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.

To enter into CZ mode, press ADVA and select **CZ** and then press Enter.

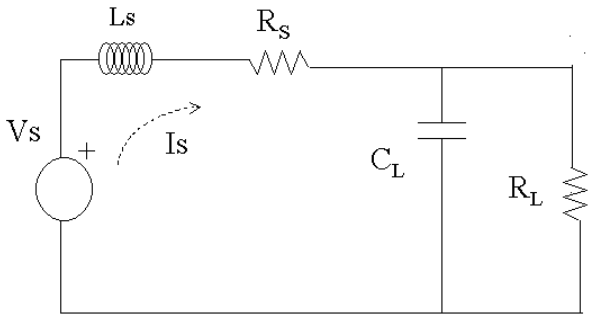


Figure 3-2 Constant Impedance Mode

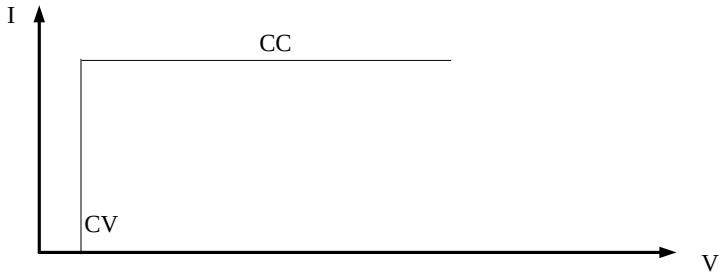
Parameters:
C_L: Set the level of equivalent parallel load capacitance C_L. The range is 30μF to 50,000μF.
R_L: Set the level of equivalent parallel load resistance R_L. The range is the same as the CR mode high range.
Ls: Set the level of equivalent series inductance Ls. The range is 0.1μH to 20μH.
Rs: Set the level of equivalent series resistance Rs. The range is 30mΩ to 20Ω.

CAUTION It is suggested to use a remote sense cable to measure the UUT output voltage.

3.7.6 CVCC

In CVCC mode, the Load will adjust the sink current to control the output voltage of current source by the programmed voltage. Constant voltage has three types of response speed: fast, normal and slow.

To enter into CVCC mode, press ADVA and select **CVCC** and then press Enter.



CV+CC mode:I/V Curve

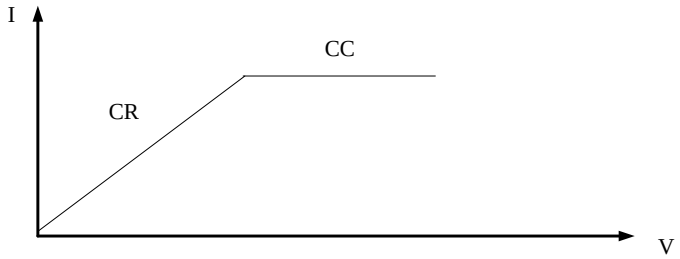
Parameters:
V_SET: Set the voltage level.

I_SET: Set the current level.
RESPONSE: Set the Electronic Load response speed to FAST, NORMAL or SLOW.

3.7.7 CRCC

In CRCC mode, it has to program the constant resistance and constant current first and then start the UUT for output. When the UUT voltage starts to output, the Load will sink in CR mode according to the programmed resistance. When the voltage rises to exceed the set constant current for sinking, it will switch to CR mode for sinking.

To enter into CRCC mode, press ADVA and select **CRCC** and then press Enter.



CR+CC mode: I/V Curve

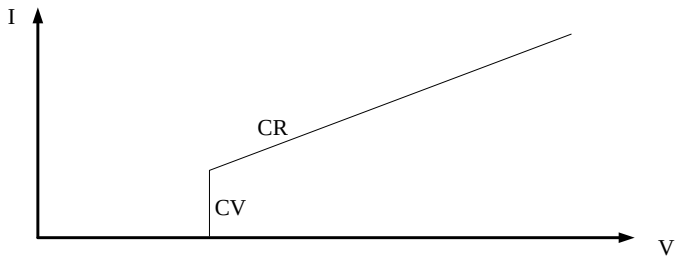
Parameters:
R_SET: Set the resistance level.
I_SET: Set the current level.

CAUTION This mode is suggested to be used in the UUT with CV output. It is suggested to use a remote sense cable to measure the UUT output voltage.

3.7.8 CVCR

In CVCR mode, it has to program the constant voltage and constant resistance first and then start the UUT for output. When the UUT voltage starts to output, the Load will sink in CV mode according to the programmed constant voltage. When the voltage rises to exceed the set constant resistance for sinking, it will switch to CR mode for sinking.

To enter into CVCR mode, press ADVA and select **CVCR** and then press Enter.



CV+CR mode: I/V Curve

Parameters:
V_SET: Set the voltage level.
R_SET: Set the resistance level.

CAUTION This mode is suggested to be used in the UUT with CV output. It is suggested to use a remote sense cable to measure the UUT output voltage.

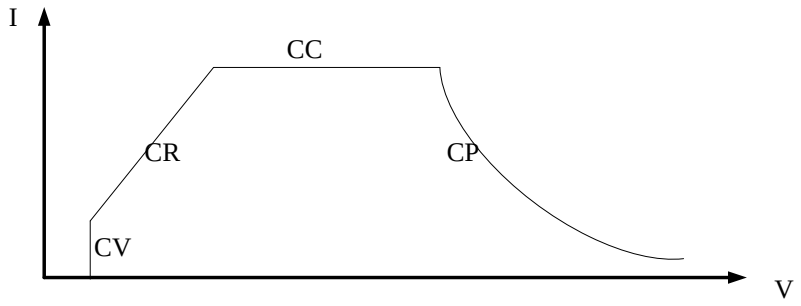
3.7.9 Auto Mode

In Auto mode, it has to program the constant voltage, constant resistance, constant current and constant power, and then start the UUT for output. When the UUT voltage starts to output, the Load will sink according to the programmed constant voltage in CV mode. When the voltage rises it will automatically switch to CR mode and to the CC mode at last for sinking. It will switch to CP mode for sinking if the UUT outputs high voltage abnormally.

To enter into Auto mode, press ADVA and select **AUTO** and then press Enter.

Parameters:
V_SET: Set the voltage level.
R_SET: Set the resistance level.
I_SET: Set the current level.
P_SET: Set the power level.

Auto mode:



CAUTION This mode is suggested to be used in the UUT with CV output. It is suggested to use a remote sense cable to measure the UUT output voltage.

3.7.10 Setting a Program Sequence

In PROG mode, the user can select the Electronic Load to do basic testing via the programmed sequences. Also different program sequences can be linked for auto execution.

The function of program sequence is very powerful. The Electronic Load has 10 programs that can set up 256 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 243 sequences. Or, it can set total 256 sequences in program 1. Different sequences combination can be created through the program chain.

For example, if program 1 has 5 sequences, program 2 has 8 sequences and program 3 has 15 sequences, it means the program 4 to 10 has 228 sequences left for editing. The user can use program chain to link program 1, 2 and 3 to execute the program sequence in 5→7→15, or to link program 2, 3 and 1 to execute the program sequence in 7→15→5. In other words, the programs can be linked in any away as desired through the program chain.

To enter into PROG, press ADVA and select **PROG** and then press Enter.

Program chain parameters:
PROG: Set the program no. → total 10 programs (1-10) and maximum 256 sequences.
TYPE: Set the program type → List and Step.
CHAIN: Set the program chain → the program chain enables the user to link the programs to access more test sequences. It means there is no program chain if the program chain number is 0. The program chain can chain to itself for cycle tests or other programs.
REPEAT: Set the number of times for the program chain to repeat. Turn the LOAD push button rotary to change the number of times.
REMAIN_SEQ: Display the remaining unset sequence number → the Load shows the remaining unset sequences that is a deduction from the total 256 sequences.
CLEAR_SEQ: Clear the set sequence → turn the push button rotary to change the display to YES and clear the set sequence.
TOTAL_SEQ: Set the sequence → turn the push button rotary to change the display to set sequence in PROG page.
NEXT:SET_SEQ: Set the sequence mode to SKIP, AUTO, MANUAL or External.

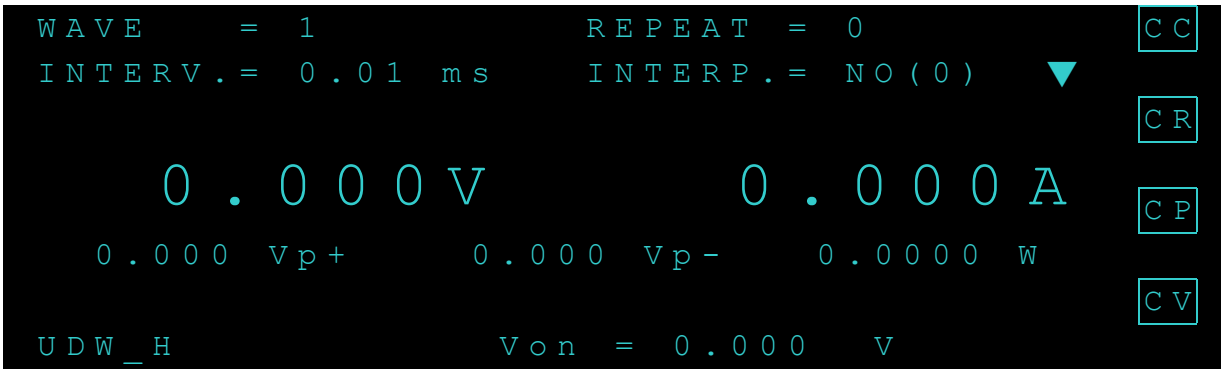
SKIP:	Skip the sequence. The Load will not change the input state.
AUTO:	The Load will run next sequence automatically when the Dwell time exceeds.
MANUAL:	Press ENTER to confirm and the Load will run next sequence automatically.
External:	Use external signal TRIG_ SEQ to control the Load input on/off. When the TRIG_ SEQ signal rising edge is active, the Load will run next sequence automatically.

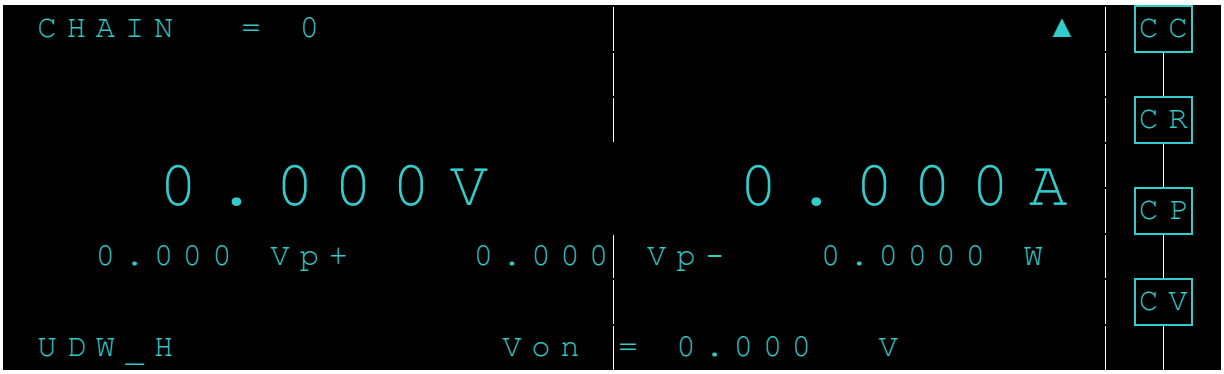
Sequence programming parameters:
MODE: Set the operation mode. There are CC, CR, CV and CP 4 modes for selection.
DWELL: Set the sequence dwell time. The range is 0.1ms to 30s.
RANGE: Set the range.
SET: Set the Load level.

Setting sequence P/F specification:
The Electronic Load allows the user to program the UUT specification for GO/NG verification in sequence. It will measure the UUT's performance for comparison when testing. The specification V, I and P can be set for the Load by the user. The specification has two levels: LOW and HIGH.
P/F_DLY: Set the Pass/Failure delay time when the Load state changes.
NEXT: SAVE the set parameter of this sequence.

3.7.11 UDW (User Defined Waveform)

The User Defined Waveform is able to simulate the actual sinking current and capture or edit the current through oscilloscope. The graphical operating software can easily save the waveform in the internal memory of 63200A Series Electronic Loads and the user defined waveform can be sunk as desired.

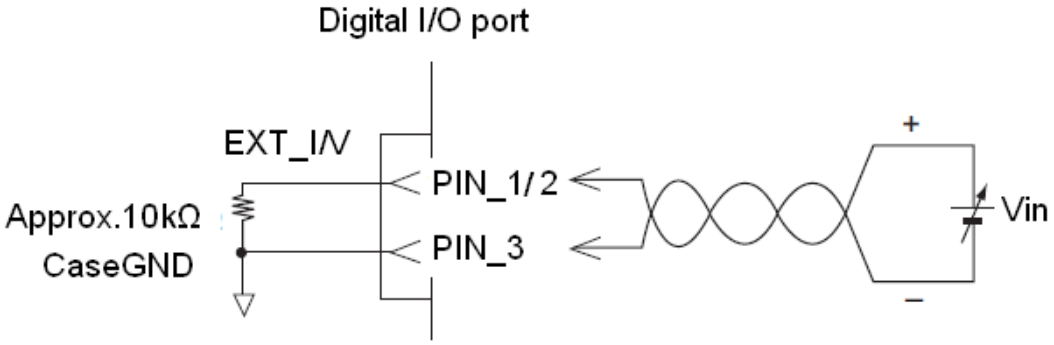




Parameters:
WAVE: Select the internal 10 stored memories.
INTERV: Set the interval for update.
REPEAT: Set the number of time to repeat.
INTERP: Set the open linear interpolation.
CHAIN: Set to link other memory.

3.7.12 EXTERNAL WAVE Control

In External Wave Control mode, it will sink following the selected mode and external waveform. The EXT V/I input connector is located on the Digital IO of rear panel. The external signal 0 to 10V maps to the sinking condition from 0 to full scale. The external signal is also applicable for 0 to 10V DC voltage bias.



To enter into EXTW mode, press ADVA and select **EXTW**.

MODE: Able to set to CC, CR or CV mode.

CC mode

$$Iset = \frac{Ext\_I}{10V} \times I_{F.S.}$$

CR mode

$$Rset = \frac{10V}{Ext\_V} \times R_{F.S.(\min)}$$

CV mode

$$Vset = \frac{Ext\_V}{10V} \times V_{F.S.}$$

$$I\_Limit = \frac{Ext\_I}{10V} \times I_{F.S.}$$

Ranges (Low, Middle, High)
It can be programmed in any of the three ranges, low range, middle range and high range. The low range provides better resolution. 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 VFD range indicator is active at you want to select. The mode change will affect the Load, so will the change of range. Both of them will cause the input to go through an off state. The new setting will change the input immediately at a rate determined by the slew rate setting.

4. Remote Operation

4.1 Overview

This section describes how to program the 63200A Series DC Electronic Loads remotely from a GPIB or USB. The command set introduced here can be applied to all electronic loads of 63200A Series Electronic Loads that equipped with optional GPIB card or USB.

GPIB or USB can be used one at a time. If GPIB is used first in remote control, USB will be disabled unless the machine is reset, and vice versa.

4.2 Introduction to Programming

4.2.1 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.

4.2.2 Numerical Data Formats

Chroma 63200A Electronic Load accepts the numerical data type listed in Table 4-1. Numeric data may be followed by a suffix to specify the dimension of the data. A suffix may be preceded by a multiplier. Chroma 63200A makes use of the suffixes listed in Table 4-2 and multipliers listed in Table 4-3.

Table 4-1 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 4-2 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 4-3 Suffix Multipliers

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

4.2.3 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.

Table 4-4

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*).

4.2.4 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>

4.2.5 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.

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

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

4.3 Language Dictionary

Commands for operating the 63200A 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.

4.3.1 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:

- 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
- Clear the Error Queue
- 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 5*.

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 5.

Standard Event Status Event Register

Bit Position	7	6	5	4	3	2	1	0
Condition	PON	0	CME	EXE	DDE	QYE	0	OPC
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 host to identify itself.
Query Syntax *IDN?
Return Parameters:<aard>
Query Example: *IDN?

String	***Information***
Chroma ATE Inc.	Manufacture
63205A-150-500	Model
63205A000001	Serial number
1.00	HOST‘s version of F/W
1.00	HOST‘s version of FPGA
1.00	HOST‘s version of PCB

Return Example: Chroma ATE Inc.,63205A-150-500,63205A000001,1.00,1.00,1.00

****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 Load 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>, 0 ~ 10, 0:Factory default file, 1~10:User define file
Setting Example: *RCL 5

****RST Reset Command***

Type: Device State
Description: This command forces an ABORt, *CLS, LOAD=PROT=CLE command and sets the parameters to factory default.
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>, 1 ~ 10
Setting Example: *SAV 5

****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* 5.
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* 5 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

4.3.2 Specific Commands

The 63200A series products are equipped with the following specific GPIB commands.

4.3.2.1 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, CCDL, CCDM, CCDH, CRDL, CRDM, CRDH, BATL, BATM, BATH, SWDL, SWDM, SWDH, OCPL, OCPM, OCPH, CCSL, CCSM, CCSH, CZL, CZM, CZH, CVCC, CRCC, CVCR, AUTO, PROG, MPPTL, MPPTM, MPPTL, MPPTH, UDWL, UDWM, UDWH, EXTL, EXTM, EXTH

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, CCDL, CCDM, CCDH, CRDL, CRDM, CRDH, BATL, BATM, BATH, SWDL, SWDM, SWDH, OCPL, OCPM, OCPH, CCSL, CCSM, CCSH, CZL, CZM, CZH, CVCC, CRCC, CVCR, AUTO, PROG, MPPTL, MPPTM, MPPTL, MPPTH, UDWL, UDWM, UDWH, EXTL, EXTM, EXTH
Query Example: MODE?

4.3.2.2 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	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Condition		MAX_LIM	RMT_INH	VCC	FAN	SYNC	OTP	OPP3	OPP2	OPP1	OCP3	OCP2	OCP1	REV	OV2	OV1
Bit Weight	32768	16384	8192	4096	2048	1024	512	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), DISABLE(2)
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(0), TOGGLE(1)
Query Example: LOAD:SHOR:KEY?

LOAD:ID?

Type: Channel-Specific
Description: This query requests the load to identify itself.
Setting Syntax: None
Setting Parameters:None
Setting Example: None
Query Syntax: LOAD:ID?
Return Parameters:<aard>,[Unit = None]
Query Example: LOAD:ID?

String	***Information***
Chroma ATE Inc.	Manufacture
63205A-150-500	Model

63205A000001	Serial number
1.00	LOAD‘s version of F/W
1.00	LOAD‘s version of FPGA
1.00	LOAD‘s version of PCB

Return Example: Chroma ATE Inc.,63205A-150-500,63205A000001,1.00,1.00,1.00

4.3.2.3 CONFIGURE Subsystem

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(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: CONF:VOLT:RANG?

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: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: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(0), ON(1) [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: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(0), MINUS(1) [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+>, 0.02s ~ 61.00s, Resolution = 20ms, 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: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(0), MASTER(1), SLAVE(2) [Unit = None]

Query Example: CONF:SYNC:MODE?

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(0), ON(1) [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(0), MASTER(1), SLAVE(2) [Unit = None]
Query Example: CONF:PARA:MODE?

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(0), ON(1) [Unit = None]
Query Example: CONF:AUTO:ON?

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(0), FIXED(1) [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>, HOLD(0), TOGGLE(1) , DISABLE(2)
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>, HOLD(0), TOGGLE(1), DISABLE(2) [Unit = None]
Query Example: CONF:SHOR:KEY?

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(0), ON(1) [Unit = None]
Query Example: CONF:SOUN?

CONFigure:DIO:IN1
Type: Frame-Specific
Description: Set the DI1 type the pin No.11 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.12 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.8 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.9 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?

DIO:OUT1

Type: Frame-Specific
Description: It sets the system I/O port pin 8 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 the system I/O port pin 9 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?

4.3.2.4 CURRENT Subsystem

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: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:VRNG

Type: Channel-Specific
Description: Set the voltage measurement range in CC mode.
Setting Syntax: CURRent STATic:VRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: CURR:STAT:VRNG HIGH Set voltage range to High.
CURR:STAT:VRNG M Set voltage range to Middle.
CURR:STAT:VRNG 0 Set voltage range to Low.
Query Syntax: CURRent: STATic: VRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: CURR:STAT:VRNG?

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: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: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: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:VRNG

Type: Channel-Specific
Description: Set the voltage measurement range in CCD mode.
Setting Syntax: CURRent:DYNamic:VRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: CURR:DYN:VRNG HIGH — Set voltage range to High.
CURR:DYN:VRNG M — Set voltage range to Middle.
CURR:DYN:VRNG 0 — Set voltage range to Low.
Query Syntax: CURRent: DYNamic: VRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: CURR:DYN:VRNG?

4.3.2.5 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:RISE

Type: Channel-Specific
Description: Set the rising slew rate of current for constant resistance mode.
Setting Syntax: RESistance:STATic:RISE<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: RES:STAT:RISE 2.5 Set rising slew rate to 2.5A/μs.
RES:STAT:RISE 1A/μs Set rising slew rate to 1A/μs.
RES:STAT:RISE MAX Set rising slew rate to the maximum value of static load.
RES:STAT:RISE MIN Set rising slew rate to the minimum value of static load.
Query Syntax: RESistance:STATic:RISE?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = A/μs]
Query Example: RES:STAT:RISE?
RES:STAT:RISE? MAX
RES:STAT:RISE? MIN

RESistance:STATic:FALL

Type: Channel-Specific
Description: Set the falling slew rate of current for constant resistance mode.
Setting Syntax: RESistance:STATic:FALL<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: RES:STAT:FALL 2.5 Set falling slew rate to 2.5A/μs.
RES:STAT:FALL 1A/μs Set falling slew rate to 1A/μs.
RES:STAT:FALL MAX Set falling slew rate to the maximum value of static load.
RES:STAT:FALL MIN Set falling slew rate to the minimum value of static load.
Query Syntax: RESistance:STATic:FALL?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = A/μs]
Query Example: RES:STAT:FALL?
RES:STAT:FALL? MAX
RES:STAT:FALL? MIN

RESistance:STATic:IRNG

Type: Channel-Specific
Description: Set the current measurement range in CR mode.
Setting Syntax: RESistance:STATic:IRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: RES:STAT:IRNG HIGH Set current range to High.
RES:STAT:IRNG M Set current range to Middle.
RES:STAT:IRNG 0 Set current range to Low.
Query Syntax: RESistance:STATic:IRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: RES:STAT:IRNG?

RESistance:DYNamic:L1

Type: Channel-Specific
Description: Set the load resistance during T1 period for constant resistance dynamic mode.

Setting Syntax: RESistance:DYNamic:L1<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: RES:DYN:L1 20 Set the dynamic load parameter L1 = 20Ω.
RES:DYN:L1 10 OHM Set the dynamic load parameter L1 = 10Ω.
RES:DYN:L1 MAX Set the dynamic load parameter L1 = maximum value.
RES:DYN:L1 MIN Set the dynamic load parameter L1 = minimum value.
Query Syntax: RESistance:DYNamic:L1?[<space><MAX | MIN>]
Return Parameters:<NR2>,[Unit = Ohm]
Query Example: RES:DYN:L1?
RES:DYN:L1? MAX
RES:DYN:L1? MIN

RESistance:DYNamic:L2

Type: Channel-Specific
Description: Set the load resistance during T2 period for constant resistance dynamic mode.
Setting Syntax: RESistance:DYNamic:L2<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: RES:DYN:L2 20 Set the dynamic load parameter L2 = 20Ω.
RES:DYN:L2 10 OHM Set the dynamic load parameter L2 = 10Ω.
RES:DYN:L2 MAX Set the dynamic load parameter L2 = maximum value.
RES:DYN:L2 MIN Set the dynamic load parameter L2 = minimum value.
Query Syntax: RESistance:DYNamic:L2?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ohm]
Query Example: RES:DYN:L2?
RES:DYN:L2? MAX
RES:DYN:L2? MIN

RESistance:DYNamic:T1

Type: Channel-Specific
Description: Set duration parameter T1 for constant resistance dynamic mode.
Setting Syntax: RESistance:DYNamic:T1<space><NRf+>[suffix]
Setting Parameters:<NRf+>, 10μs ~ 100s, Resolution = 10μs, Unit = Second
Setting Example: RES:DYN:T1 10ms Set the dynamic duration T1 = 10ms.
RES:DYN:T1 2 Set the dynamic duration T1 = 2s.
RES:DYN:T1 MAX Set the dynamic duration T1 as maximum value.
RES:DYN:T1 MIN Set the dynamic duration T1 as minimum value.
Query Syntax: RESistance:DYNamic:T1?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Second]
Query Example: RES:DYN:T1?
RES:DYN:T1? MAX
RES:DYN:T1? MIN

RESistance:DYNamic:T2

Type: Channel-Specific
Description: Set duration parameter T2 for constant resistance dynamic mode.
Setting Syntax: RESistance:DYNamic:T2<space><NRf+>[suffix]
Setting Parameters:<NRf+>, 10μs ~ 100s, Resolution = 10μs, Unit = Second
Setting Example:

RES:DYN:T2 10ms	Set the dynamic duration T2 = 10ms.
RES:DYN:T2 2	Set the dynamic duration T2 = 2s.
RES:DYN:T2 MAX	Set the dynamic duration T2 as maximum value.
RES:DYN:T2 MIN	Set the dynamic duration T2 as minimum value.

Query Syntax: RESistance:DYNamic:T2?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Second]
Query Example: RES:DYN:T2?
RES:DYN:T2? MAX
RES:DYN:T2? MIN

RESistance:DYNamic:REPeat

Type: Channel-Specific
Description: Set the repeat count for constant resistance dynamic mode.
Setting Syntax: RESistance:DYNamic:REPeat<space><NRf+>
Setting Parameters:<NRf+>, 0 ~ 65535, Resolution = 1, Unit = None
Setting Example:

RES:DYN:REP 500	Set repeat count = 500
RES:DYN:REP MAX	Set repeat count = maximum value.
RES:DYN:REP MIN	Set repeat count = minimum value.

Query Syntax: RESistance:DYNamic:REPeat?[<space><MAX | MIN>]
Return Parameters:<NR1>, [Unit = None]
Query Example: RES:DYN:REP?
RES:DYN:REP? MAX
RES:DYN:REP? MIN

RESistance:DYNamic:RISE

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

RES:DYN:RISE 2.5	Set rising slew rate to 2.5A/μs.
RES:DYN:RISE 1A/μs	Set rising slew rate to 1A/μs.
RES:DYN:RISE MAX	Set rising slew rate to the maximum value of dynamic load.
RES:DYN:RISE MIN	Set rising slew rate to the minimum value of dynamic load.

Query Syntax: RESistance:DYNamic:RISE?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = A/μs]
Query Example: RES:DYN:RISE?
RES:DYN:RISE? MAX
RES:DYN:RISE? MIN

RESistance:DYNamic:FALL

Type: Channel-Specific
Description: Set the falling slew rate of current for constant resistance dynamic mode.

Setting Syntax: RESistance:DYNamic:FALL<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: RES:DYN:FALL 2.5 Set falling slew rate to 2.5A/μs.
RES:DYN:FALL 1A/μs Set falling slew rate to 1A/μs.
RES:DYN:FALL MAX Set falling slew rate to the maximum value of dynamic load.
RES:DYN:FALL MIN Set falling slew rate to the minimum value of dynamic load.
Query Syntax: RESistance:DYNamic:FALL?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = A/μs]
Query Example: RES:DYN:FALL?
RES:DYN:FALL? MAX
RES:DYN:FALL? MIN

RESistance:DYNamic:IRNG

Type: Channel-Specific
Description: Set the current measurement range in constant resistance dynamic mode.
Setting Syntax: RESistance:DYNamic:IRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: RES:DYN:IRNG HIGH Set current range to High.
RES:DYN:IRNG M Set current range to Middle.
RES:DYN:IRNG 0 Set current range to Low.
Query Syntax: RESistance:DYNamic:IRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: RES:DYN:IRNG?

4.3.2.6 VOLTAGE Subsystem

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: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:RESponse

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

VOLTage:STATic:IRNG

Type: Channel-Specific
Description: Set the current measurement range in constant voltage mode.
Setting Syntax: VOLTage:STATic:IRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: VOLT:STAT:IRNG HIGH Set current range to High.
VOLT:STAT:IRNG M Set current range to Middle.
VOLT:STAT:IRNG 0 Set current range to Low.
Query Syntax: VOLTage: STATic: IRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: VOLT:STAT:IRNG?

4.3.2.7 POWER Subsystem

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: POWer:STATic:L1?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example:
POW:STAT:L1?
POW:STAT:L1? MAX
POW: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

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:VRNG

Type: Channel-Specific
Description: Set the voltage measurement range in constant power mode.
Setting Syntax: POWer:STATic:VRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: POW:STAT:VRNG HIGH Set voltage range to High.
POW:STAT:VRNG M Set voltage range to Middle.
POW:STAT:VRNG 0 Set voltage range to Low.
Query Syntax: POWer: STATic: VRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: POW:STAT:VRNG?

4.3.2.8 ADVANCE Subsystem

[ADVance:]BATTery:MODE

Type: Channel-Specific
Description: Set run mode in battery discharge mode.
Setting Syntax: [ADVance:]BATTery:MODE<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, CC(0), CR(1), CP(2)
Setting Example: BATT:MODE CC Set run mode = CC
BATT:MODE 2 Set run mode = CP
Query Syntax: [ADVance:]BATTery:MODE?
Return Parameters:<CRD>, CC(0), CR(1), CP(2) [Unit = None]
Query Example: BATT:MODE?

[ADVance:]BATTery:VALue

Type: Channel-Specific
Description: Set load value according to the run mode in battery discharge mode.
Setting Syntax: [ADVance:]BATTery:VALue<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example:
When BATT:MODE set to CC mode, then
BATT:VAL 0.5 Set current = 0.5A
BATT:VAL 500mA Set current = 0.5A
BATT:VAL MAX Set current = maximum value.

BATT:VAL MIN Set current = minimum value.
When BATT:MODE set to CR mode, then
BATT:VAL 0.5 Set resistance = 0.5Ω.
BATT:VAL 500mΩ Set resistance = 0.5Ω.
BATT:VAL MAX Set resistance = maximum value.
BATT:VAL MIN Set resistance = minimum value.
When BATT:MODE set to CP mode, then
BATT:VAL 0.5 Set power = 0.5W.
BATT:VAL 500mW Set power = 0.5W.
BATT:VAL MAX Set power = maximum value.
BATT:VAL MIN Set power = minimum value.

Query Syntax: [ADVance:]BATTery:VALue?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere | Ohm | Watt]
Query Example: BATT:VAL?
BATT:VAL? MAX
BATT:VAL? MIN

[ADVance:]BATTery:RISE

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

[ADVance:]BATTery:FALL

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

[ADVance:]BATTery:ENDVoltage

Type: Channel-Specific
Description: Set end voltage for battery discharge mode.
Setting Syntax: [ADVance:]BATTery:ENDVoltage<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.

Setting Example: BATT:ENDV 0.5 Set end voltage = 0.5V
BATT:ENDV 500mV Set end voltage = 0.5V
BATT:ENDV MAX Set end voltage = maximum value.
BATT:ENDV MIN Set end voltage = minimum value.
Query Syntax: [ADVance:]BATTery:ENDVoltage?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Volt]
Query Example: BATT:ENDV?
BATT:ENDV? MAX
BATT:ENDV? MIN

[ADVance:]BATTery:TOUT

Type: Channel-Specific
Description: Set timeout for battery discharge mode.
Setting Syntax: [ADVance:]BATTery:TOUT<space><NRf+>[suffix]
Setting Parameters:<NRf+>, 0s~100000s, Resolution = 1s, Unit = Second
Setting Example: BATT:TOUT 100 Set timeout = 100s
BATT:TOUT MAX Set timeout = maximum value.
BATT:TOUT MIN Set timeout = minimum value.
Query Syntax: [ADVance:]BATTery:TOUT?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Second]
Query Example: BATT:TOUT?
BATT:TOUT? MAX
BATT:TOUT? 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: SINE:IAC 0.5 Set AC current = 0.5A.
SINE:IAC 500mA Set AC current = 0.5A.
SINE:IAC MAX Set AC current = maximum value.
SINE:IAC MIN Set AC current = minimum value.
Query Syntax: [ADVance]:SINE:IAC?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: SINE:IAC?
SINE:IAC? MAX
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: SINE:IDC 0.5 Set DC current = 0.5A.
SINE:IDC 500mA Set DC current = 0.5A.
SINE:IDC MAX Set DC current = maximum value.
SINE:IDC MIN Set DC current = minimum value.
Query Syntax: [ADVance:]SINE:IDC?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: SINE:IDC?
SINE:IDC? MAX
SINE:IDC? MIN

[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: SINE:FREQ 1000 Set frequency = 1kHz.
SINE:FREQ 1kHz Set frequency = 1kHz.
SINE:FREQ MAX Set frequency = maximum value.
SINE:FREQ MIN Set frequency = minimum value.
Query Syntax: [ADVance:]SINE:FREQuency?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Hertz]
Query Example: SINE:FREQ?
SINE:FREQ? MAX
SINE:FREQ? MIN

[ADVance:]OCP:STARt

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

[ADVance:]OCP:END

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

OCP:STEP MIN Set step count = minimum value.
Query Syntax: [ADVance:]OCP:STEP?[<space><MAX | MIN>]
Return Parameters:<NR1>, [Unit = None]
Query Example: OCP:STEP?
OCP:STEP? MAX
OCP:STEP? MIN

[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: OCP:DWEL 0.5 Set off time = 0.5s.
OCP:DWEL 500ms Set off time = 0.5s.
OCP:DWEL MAX Set off time = maximum value.
OCP:DWEL MIN Set off time = minimum value.
Query Syntax: [ADVance:]OCP:DWELl?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Second]
Query Example: OCP:DWEL?
OCP:DWEL? MAX
OCP:DWEL? 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: OCP:TRIG:VOLT 0.5 Set trigger voltage = 0.5V.
OCP:TRIG:VOLT 500mV Set trigger voltage = 0.5V.
OCP:TRIG:VOLT MAX Set trigger voltage = maximum value.
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: OCP:TRIG:VOLT?
OCP:TRIG:VOLT? MAX
OCP:TRIG:VOLT? 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: OCP:SPEC:H 0.5 Set high level current = 0.5A.
OCP:SPEC:H 500mA Set high level current = 0.5A.
OCP:SPEC:H MAX Set high level current = maximum value.
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: OCP:SPEC:H?
OCP:SPEC:H? MAX
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: OCP:SPEC:L 0.5 Set low level current = 0.5A.
OCP:SPEC:L 500mA Set low level current = 0.5A.
OCP:SPEC:L MAX Set low level current = maximum value.
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: OCP:SPEC:L?
OCP:SPEC:L? MAX
OCP:SPEC:L? 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: OCP:LATC OFF Set latch = OFF
OCP:LATC 1 Set latch = ON
Query Syntax: [ADVance:]OCP:LATCh?
Return Parameters:<CRD>, OFF(0), ON(1) [Unit = None]
Query Example: OCP:LATC?

[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: OCP:RES?

[ADVance:]OPP:STARt

Type: Channel-Specific
Description: Set start power for OPP test mode.
Setting Syntax: [ADVance:]OPP:STARt<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: OPP:STAR 100 Set start power = 100W.
OPP:STAR 500mw Set start power = 0.5W.

OPP:STAR MAX Set start power = maximum value.
OPP:STAR MIN Set start power = minimum value.
Query Syntax: [ADVance:]OPP:STARt?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: OPP:STAR?
OPP:STAR? MAX
OPP:STAR? MIN

[ADVance:]OPP:END

Type: Channel-Specific
Description: Set end power for OPP test mode.
Setting Syntax: [ADVance:]OPP:END<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: OPP:END 100 Set end power = 100W.
OPP:END 500mW Set end power = 0.5W.
OPP:END MAX Set end power = maximum value.
OPP:END MIN Set end power = minimum value.
Query Syntax: [ADVance:]OPP:END?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: OPP:END?
OPP:END? MAX
OPP:END? MIN

[ADVance:]OPP:STEP

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

[ADVance:]OPP:DWELl

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

[ADVance:]OPP:TRIGger:VOLTage

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

[ADVance:]OPP:SPECification:H

Type: Channel-Specific
Description: Set high level power of specification for OPP test mode.
Setting Syntax: [ADVance:]OPP:SPECification:H<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: OPP:SPEC:H 0.5 Set high level power = 0.5W.
OPP:SPEC:H 500mW Set high level power = 0.5W.
OPP:SPEC:H MAX Set high level power = maximum value.
OPP:SPEC:H MIN Set high level power = minimum value.
Query Syntax: [ADVance:]OPP:SPECification:H?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: OPP:SPEC:H?
OPP:SPEC:H? MAX
OPP:SPEC:H? MIN

[ADVance:]OPP:SPECification:L

Type: Channel-Specific
Description: Set low level power of specification for OPP test mode.
Setting Syntax: [ADVance:]OPP:SPECification:L<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: OPP:SPEC:L 0.5 Set low level power = 0.5W.
OPP:SPEC:L 500mW Set low level power = 0.5W.
OPP:SPEC:L MAX Set low level power = maximum value.
OPP:SPEC:L MIN Set low level power = minimum value.
Query Syntax: [ADVance:]OPP:SPECification:L?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: OPP:SPEC:L?
OPP:SPEC:L? MAX
OPP:SPEC:L? MIN

[ADVance:]OPP:LACTh

Type: Channel-Specific
Description: Set load latch function for OPP test mode.
Setting Syntax: [ADVance:]OPP:LATCh<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, OFF(0), ON(1)
Setting Example: OPP:LATC OFF Set latch = OFF
OPP:LATC 1 Set latch = ON
Query Syntax: [ADVance:]OPP:LATCh?

Return Parameters:<CRD>, OFF(0), ON(1) [Unit = None]
Query Example: OPP:LATC?

[ADVance:]OPP:RESult?

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

[ADVance:]CURRent:SWEep:IMAXimum

Type: Channel-Specific
Description: Set the maximum current for constant current frequency sweep mode.
Setting Syntax: [ADVance:]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: [ADVance:]CURRent:SWEep:IMAXimum?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: CURR:SWE:IMAX?
CURR:SWE:IMAX? MAX
CURR:SWE:IMAX? MIN

[ADVance:]CURRent:SWEep:IMINimum

Type: Channel-Specific
Description: Set the minimum current for constant current frequency sweep mode.
Setting Syntax: [ADVance:]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: [ADVance:]CURRent:SWEep:IMINimum?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: CURR:SWE:IMIN?
CURR:SWE:IMIN? MAX
CURR:SWE:IMIN? MIN

[ADVance:]CURRent:SWEep:FSTArt

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

[ADVance:]CURRent:SWEep:FEND

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

[ADVance:]CURRent:SWEep:FSTEp

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

[ADVance:]CURRent:SWEep:DWELl

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

[ADVance:]CURRent:SWEep:DUTY

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

[ADVance:]CURRent:SWEep:RISE

Type: Channel-Specific
Description: Set the rising slew rate of current for constant current frequency sweep mode.
Setting Syntax: [ADVance:]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/μs Set 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: [ADVance:]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

[ADVance:]CURRent:SWEep:FALL

Type: Channel-Specific
Description: Set the falling slew rate of current for constant current frequency sweep mode.
Setting Syntax: [ADVance:]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: [ADVance:]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

[ADVance:]IMPedance:STATic:CL

Type: Channel-Specific
Description: Set the equivalent parallel load capacitance for constant impedance mode.
Setting Syntax: [ADVance:]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: [ADVance:]IMPedance:STATic:CL?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Farad]
Query Example: IMP:STAT:CL?
IMP:STAT:CL? MAX
IMP:STAT:CL? MIN

[ADVance:]IMPedance:STATic:LS

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

[ADVance:]IMPedance:STATic:RS

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

[ADVance:]IMPedance:STATic:RL

Type: Channel-Specific
Description: Set the equivalent parallel load resistance for constant impedance mode.
Setting Syntax: [ADVance:]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: [ADVance:]IMPedance:STATic:RL?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = OHM]
Query Example: IMP:STAT:RL?
IMP:STAT:RL? MAX
IMP:STAT:RL? 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

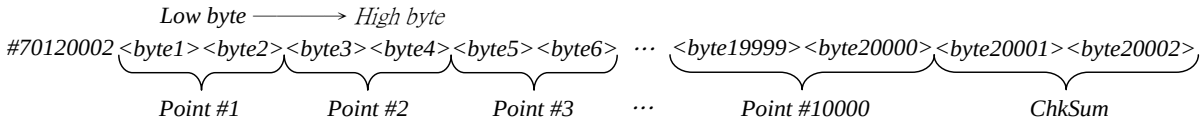
[ADVance:]USER:WAVeform:DATA

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

[ADVance:]CVCC:VSET

Type: Channel-Specific
Description: Set the static load voltage in CV+CC mode.
Setting Syntax: [ADVance:]CVCC:VSET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: CVCC:VSET 8 Set VSET as 8V.
CVCC:VSET 24V Set VSET as 24V.
CVCC:VSET MAX Set VSET as the maximum value.
CVCC:VSET MIN Set VSET as the minimum value.
Query Syntax: [ADVance:]CVCC:VSET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Volt]
Query Example: CVCC:VSET?
CVCC:VSET? MAX
CVCC:VSET? MIN

[ADVance:]CVCC:RESponse

Type: Channel-Specific
Description: Set the response speed in CV+CC mode.
Setting Syntax: [ADVance:]CVCC:RESponse<space><NRf>
Setting Parameters:<NRf>, SLOW(0), NORMAL(1), FAST(2)
Example: CVCC:RES FAST
CVCC:RES SLOW
Query Syntax: [ADVance:]CVCC:RESponse?
Return Parameters:<CRD>, SLOW(0), NORMAL(1), FAST(2)
Query Example: CVCC:RES?

[ADVance:]CVCC:ISET

Type: Channel-Specific
Description: Set the static load current in CV+CC mode.
Setting Syntax: [ADVance:]CVCC:ISET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: CVCC:ISET 20 Set the ISET = 20A.
CVCC:ISET 10A Set the ISET = 10A.
CVCC:ISET MAX Set the ISET = maximum value.
CVCC:ISET MIN Set the ISET = minimum value.
Query Syntax: [ADVance:]CVCC:ISET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: CVCC:ISET?
CVCC:ISET? MAX
CVCC:ISET? MIN

[ADVance:]CRCC:RSET

Type: Channel-Specific
Description: Set static resistance level in CR+CC mode.
Setting Syntax: [ADVance:]CRCC:RSET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: CRCC:RSET 20 Set the RSET = 20Ω.
CRCC:RSET 10 OHM Set the RSET = 10Ω.
CRCC:RSET MAX Set the RSET = maximum value.
CRCC:RSET MIN Set the RSET = minimum value.
Query Syntax: [ADVance:]CRCC:RSET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = OHM]
Query Example: CRCC:RSET?
CRCC:RSET? MAX
CRCC:RSET? MIN

[ADVance:]CRCC:ISET

Type: Channel-Specific
Description: Set the static load current in CR+CC mode.
Setting Syntax: [ADVance:]CRCC:ISET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: CRCC:ISET 20 Set the ISET = 20A.
CRCC:ISET 10A Set the ISET = 10A.
CRCC:ISET MAX Set the ISET = maximum value.
CRCC:ISET MIN Set the ISET = minimum value.
Query Syntax: [ADVance:]CRCC:ISET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: CRCC:ISET?

CRCC:ISET? MAX
CRCC:ISET? MIN

[ADVance:]CVCR:VSET

Type: Channel-Specific
Description: Set the static load voltage in CV+CR mode.
Setting Syntax: [ADVance:]CVCR:VSET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: CVCR:VSET 8 Set VSET as 8V.
CVCR:VSET 24V Set VSET as 24V.
CVCR:VSET MAX Set VSET as the maximum value.
CVCR:VSET MIN Set VSET as the minimum value.
Query Syntax: [ADVance:]CVCR:VSET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Volt]
Query Example: CVCR:VSET?
CVCR:VSET? MAX
CVCR:VSET? MIN

[ADVance:]CVCR:RSET

Type: Channel-Specific
Description: Set static resistance level in CV+CR mode.
Setting Syntax: [ADVance:]CVCR:RSET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: CVCR:RSET 20 Set the RSET = 20Ω.
CVCR:RSET 10 OHM Set the RSET = 10Ω.
CVCR:RSET MAX Set the RSET = maximum value.
CVCR:RSET MIN Set the RSET = minimum value.
Query Syntax: [ADVance:]CVCR:RSET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = OHM]
Query Example: CVCR:RSET?
CVCR:RSET? MAX
CVCR:RSET? MIN

[ADVance:]AUTO:VSET

Type: Channel-Specific
Description: Set the static load voltage in AUTO mode.
Setting Syntax: [ADVance:]AUTO:VSET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: AUTO:VSET 8 Set VSET as 8V.
AUTO:VSET 24V Set VSET as 24V.
AUTO:VSET MAX Set VSET as the maximum value.
AUTO:VSET MIN Set VSET as the minimum value.
Query Syntax: [ADVance:]AUTO:VSET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Volt]
Query Example: AUTO:VSET?
AUTO:VSET? MAX
AUTO:VSET? MIN

[ADVance:]AUTO:RSET

Type: Channel-Specific
Description: Set static resistance level in AUTO mode.
Setting Syntax: [ADVance:]AUTO:RSET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.

Setting Example: AUTO:RSET 20 Set the RSET = 20Ω.
AUTO:RSET 10 OHM Set the RSET = 10Ω.
AUTO:RSET MAX Set the RSET = maximum value.
AUTO:RSET MIN Set the RSET = minimum value.
Query Syntax: [ADVance:]AUTO:RSET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = OHM]
Query Example: AUTO:RSET?
AUTO:RSET? MAX
AUTO:RSET? MIN

[ADVance:]AUTO:ISET

Type: Channel-Specific
Description: Set the static load current in AUTO mode.
Setting Syntax: [ADVance:]AUTO:ISET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: AUTO:ISET 20 Set the ISET = 20A.
AUTO:ISET 10A Set the ISET = 10A.
AUTO:ISET MAX Set the ISET = maximum value.
AUTO:ISET MIN Set the ISET = minimum value.
Query Syntax: [ADVance:]AUTO:ISET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Ampere]
Query Example: AUTO:ISET?
AUTO:ISET? MAX
AUTO:ISET? MIN

[ADVance:]AUTO:PSET

Type: Channel-Specific
Description: Set the static load power in AUTO mode.
Setting Syntax: [ADVance:]AUTO:PSET<space><NRf+>[suffix]
Setting Parameters:Refer to respective specification for valid value range.
Setting Example: AUTO:PSET 20 Set the PSET = 20W.
AUTO:PSET 10W Set the PSET = 10W.
AUTO:PSET MAX Set the PSET = maximum value.
AUTO:PSET MIN Set the PSET = minimum value.
Query Syntax: [ADVance:]AUTO:PSET?[<space><MAX | MIN>]
Return Parameters:<NR2>, [Unit = Watt]
Query Example: AUTO:PSET?
AUTO:PSET? MAX
AUTO:PSET? MIN

[ADVance:]EXTernal:WAVeform:MODE

Type: Channel-Specific
Description: Set run mode in external waveform mode.
Setting Syntax: [ADVance:]External:WAVeform:MODE<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, CC(0), CR(1), CV(2)
Setting Example: BATT:MODE CC Set run mode = CC
BATT:MODE 2 Set run mode = CV
Query Syntax: [ADVance:]EXTernal:WAVeform:MODE?
Return Parameters:<CRD>, CC(0), CR(1), CV(2) [Unit = None]
Query Example: EXT:WAV:MODE?

[ADVance:]EXTernal:WAVeform:CC:VRNG

Type: Channel-Specific
Description: Set the voltage measurement range in external waveform when the mode is set to CC mode.
Setting Syntax: [ADVance:]EXTernal:WAVeform:CC:VRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: EXT:WAV:CC:VRNG HIGH Set voltage range to High.
EXT:WAV:CC:VRNG M Set voltage range to Middle.
EXT:WAV:CC:VRNG 0 Set voltage range to Low.
Query Syntax: EXTernal:WAVeform:CC:VRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: EXT:WAV:CC:VRNG?

[ADVance:]EXTernal:WAVeform:CR:IRNG

Type: Channel-Specific
Description: Set the current measurement range in external waveform when the mode is set to CR mode.
Setting Syntax: [ADVance:]EXTernal:WAVeform:CR:IRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: EXT:WAV:CR:IRNG HIGH Set current range to High.
EXT:WAV:CR:IRNG M Set current range to Middle.
EXT:WAV:CR:IRNG 0 Set current range to Low.
Query Syntax: EXTernal:WAVeform:CR:IRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: EXT:WAV:CR:IRNG?

[ADVance:]External:WAVeform:CV:IRNG

Type: Channel-Specific
Description: Set the current measurement range in external waveform when the mode is set to CV mode.
Setting Syntax: [ADVance:]EXTernal:WAVeform:CV:IRNG<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOW | L | 0, MIDDLE | M | 1, HIGH | H | 2
Setting Example: EXT:WAV:CV:IRNG HIGH Set current range to High.
EXT:WAV:CV:IRNG M Set current range to Middle.
EXT:WAV:CV:IRNG 0 Set current range to Low.
Query Syntax: EXTernal:WAVeform:CV:IRNG?
Return Parameters:<CRD>, LOW(0), MIDDLE(1), HIGH(2) [Unit = None]
Query Example: EXT:WAV:CV:IRNG?

4.3.2.9 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

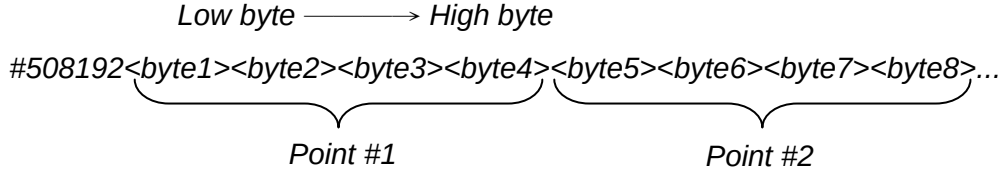
Type: Channel-Specific
Description: Set the trigger source for digitizing function.
Setting Syntax: DIGitizing:TRIGger:SOURce<space><CRD | NR1>
Setting Parameters:<CRD | NR1>, LOADON(0), LOADOFF(1), TTL(2), BUS(3) | MANUAL(4) [Unit = None]
Setting Example: DIG:TRIG:SOUR TTL Set trigger source to TTL.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

4.3.2.10 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

4.3.2.11 FETCH Subsystem

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	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Condition		MAX_ LIM	RMT _INH	VCC	FAN	SYNC	OTP	OPP3	OPP2	OPP1	OCP3	OCP2	OCP1	REV	OV2	OV1
Bit Weight	32768	16384	8192	4096	2048	1024	512	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

4.3.2.12 MEASURE Subsystem

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(0), UUT(1)
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

4.3.2.13 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

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

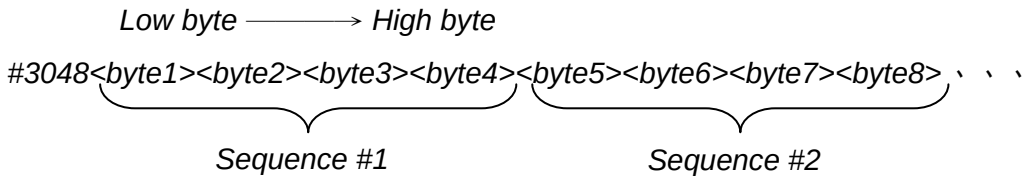
PROGram:SEQuence:REMain

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

4.3.2.14 SYNCHRONOUS Subsystem

SYNChronous:RUN

Type: All Channels
Description: Set all electronic loads to “ON” in sync. dynamic 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 63200A to master or slave for sync. dynamic run.
Setting Syntax: SYNChronous:TYPE<space><NRf>
Setting Parameters:<NRf>, NONE(0), MASTER(1), SLAVE(2)
Setting Example: SYNC:TYPE MASTER Set the 63200A to master for sync. dynamic.
SYNC:TYPE SLAVE Set the 63200A to slave for sync. dynamic.
SYNC:TYPE NONE Disables the 63200A to sync.

4.3.2.15 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	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Condition		MAX_ LIM	RMT _INH	VCC	FAN	SYNC	OTP	OPP3	OPP2	OPP1	OCP3	OCP2	OCP1	REV	OV2	OV1
Bit Weight	32768	16384	8192	4096	2048	1024	512	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 ~ 2^{32}-1, 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 ~ 2^{32}-1, 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 ~ 2^{32}-1, 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	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Condition		MAX_ LIM	RMT _INH	VCC	FAN	SYNC	OTP	OPP3	OPP2	OPP1	OCP3	OCP2	OCP1	REV	OV2	OV1
Bit Weight	32768	16384	8192	4096	2048	1024	512	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 ~ 2^{32}-1, 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 ~ 2^{32}-1, 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

4.3.2.16 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 63200A 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 63200A will be set in the LOCAL state, and the front panel will work.
Setting Syntax: SYSTem:LOCal
Setting Parameters: None
Setting Example: SYST:LOC

5. Status Reporting

5.1 Introduction

This chapter explains the status data structure of Chroma 63200A Series Electronic Load as shown in Figure 5-1. 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.

5.2 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.

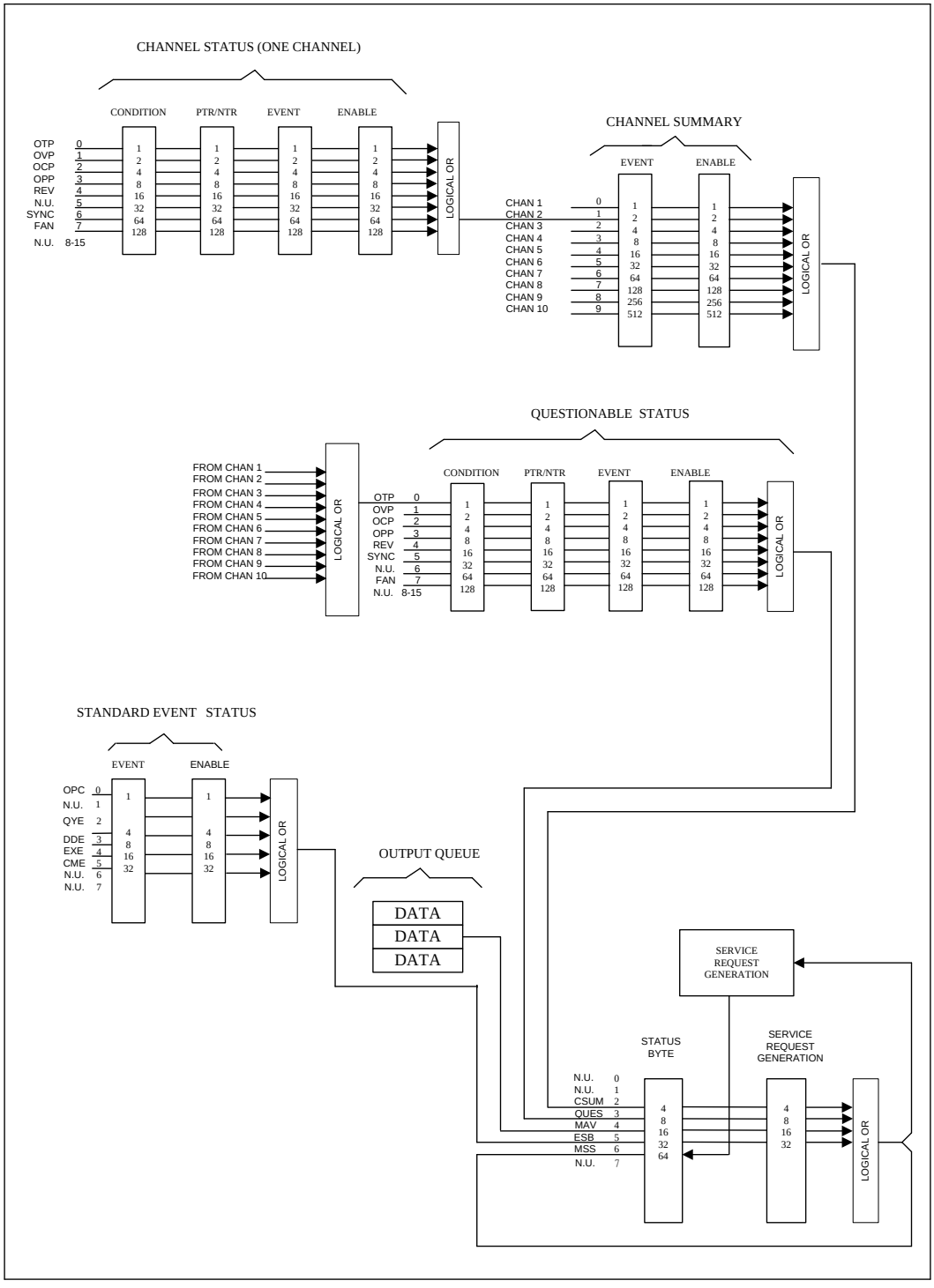


Figure 5-1 Status Registers of Electronic Load

5.2.1 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 5-1 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 5-1 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.

5.2.2 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.

5.2.3 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 5-2 lists the questionable status conditions that are applied to the electronic load. These conditions are same as the channel status conditions. Refer to Table 5-1 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 5-2 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*

5.2.4 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.

5.2.5 Standard Event Status

- All programming errors that have occurred will set one or more error bits in the Standard Event Status register. Table 5-3 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 5-3 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.

5.2.6 Status Byte Register

- The Status Byte register summarizes all of the status events for all status registers. Table 5-4 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 5-4 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.

5.2.7 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.

6. Verification

6.1 Introduction

This chapter contains test procedures for checking the operation and specification of Chroma 63200A Series. The tests are performed using the 63200A Series models and some required equipment. The required test equipment is listed in Table 6-1. 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 63200A Series meet the published specifications. For the detailed information of operation and programming please refer to the *Chapter 3 and Chapter 4.*

If any of the 63200A 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.

6.2 Equipment Required

The following table lists the equipment or its equivalent required for verification.

Table 6-1 Equipment Suggested for Verification

Equipment	Characteristics	Recommended Model
Voltmeter	5 1/2 digits or more	Agilent 34401A, Agilent 3458A
Current Transducer	2000A	DC-CT(ITZ-2000-SBPR)
DC Source	10V/1200A, 600V/8A	CHROMA 62120-10-1200, Chroma 62012P-600-8
Mainframe		Chroma 63200A

Connection
Connect the Load, DC Source, DMM and Current Shunt as shown in Figure 6-1. Use DMM (I) to measure the voltage that passes through the shunt resistor measurement port, and get the Load current.

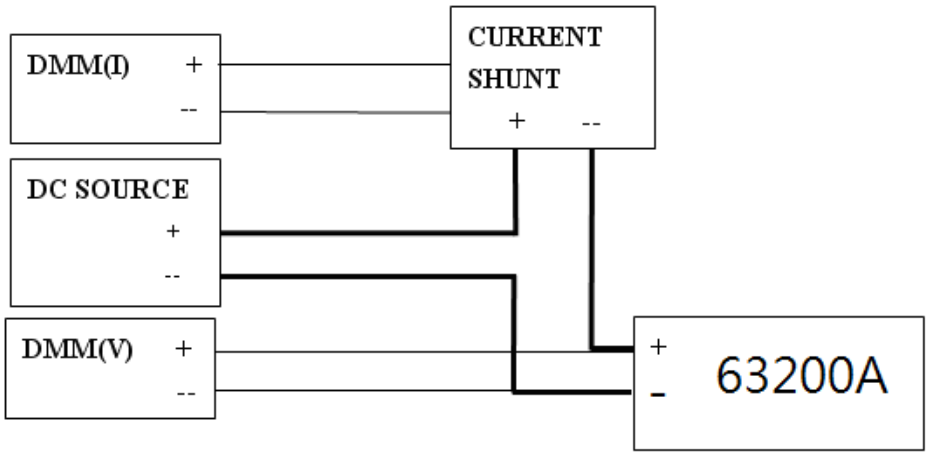


Figure 6-1

6.3 Performance Tests

6.3.1 CC Mode Verification

This test verifies if the current programming and readings are within specifications when 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

Checking High Current Range

A. Connect the Load, DC Source, DMM and Current Shunt as shown in Figure 6-1. Use DMM (I) to measure the voltage that passes through the shunt resistor measurement port, and get the load current.

B. Select the right range for the current shunt resistor. Press MODE to select **CC** and press RANGE to H range.

C. Press EDIT to enter into CC Mode for setting. Use push button rotary and ◀ or ▶ to program the current listed in Table 6-2.

D. Turn on the DC source and set output voltage to 5V. Set current limit of DC source larger than the set current in Table 6-2. 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 6-2

Model	CCH Current Setting	Shunt Current		Front Panel Display Reading
		Max.	Min.	
63205A-150-500	500.0 A	500.45A	499.55A	DMM Ai ±0.45A
	5.0A	5.25A	4.75A	DMM Ai ±0.25A
63206A-150-600	600.0 A	600.48A	599.52A	DMM Ai ±0.48A
	6.0A	6.24A	5.76A	DMM Ai ±0.24A

Checking Medium Current Range

A. After tested the high current range, press RANGE to M range.

B. Press EDIT to enter into CC Mode for setting. Use push button rotary and ◀ or ▶ to program the current listed in Table 6-3.

C. Turn on the DC source and set output voltage to 5V. Set current limit of DC source larger than the set current in Table 6-3. 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 6-3

Model	CCH Current Setting	Shunt Current		Front Panel Display Reading
		Max.	Min.	
63205A-150-500	250.0 A	250.225A	249.775A	DMM Ai ±0.225A
	2.5A	5.125A	4.875A	DMM Ai ±0.125A
63206A-150-600	300.0 A	300.24A	299.76A	DMM Ai ±0.24A
	3.0A	3.12A	2.88A	DMM Ai ±0.12A

Checking Low Current Range

A. After tested the medium current range, press RANGE to L range.

B. Press EDIT to enter into CC Mode for setting. Use push button rotary and ◄ or ► to program the current listed in Table 6-4.

C. Turn on the DC source and set output voltage to 5V. Set current limit of DC source larger than the set current in Table 6-4. 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 6-4

Model	CCH Current Setting	Shunt Current		Front Panel Display Reading
		Max.	Min.	
63205A-150-500	50.0 A	50.045A	49.955A	DMM Ai ±0.045A
	0.50A	0.525A	0.475A	DMM Ai ±0.025A
63206A-150-600	60.0 A	60.048A	59.952A	DMM Ai ±0.048A
	0.60A	0.624A	0.576A	DMM Ai ±0.024A

6.3.2 CV Mode Verification

This test verifies if the voltage programming and reading value on the front panel display are within specifications when 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.

Checking High Voltage Range

A. Connect the Load, DC source, DMM and Current Shunt as shown Figure 6-1. Use DMM (V) to measure the voltage passing through the Load input terminal.

B. Press MODE till the VFD shows CV and press RANGE to H range.

C. The DC Source voltage outputs the voltage/current values listed in Table 6-5.

D. Wait for 30 seconds after the DC Source outputted and to record the voltage measured by DMM (V) and the Load.

Table 6-5

Model	DC Source Output Voltage	Front Panel Display Reading

632xxA-150-xxx	150V	DMM (V)±0.045V
	15V	DMM (V)±0.0247V

Checking Medium Voltage Range

A. After tested the high voltage range, press RANGE to M range.
B. The DC Source voltage outputs the voltage/current values listed in Table 6-6.
C. Wait for 30 seconds after the DC Source outputted and to record the voltage measured by DMM (V) and the Load.

Table 6-6

Model	DC Source Output Voltage	Front Panel Display Reading
632xxA-150-xxx	80V	DMM (V)±0.024V
	8V	DMM (V)±0.0132V

Checking Low Voltage Range

A. After tested the medium voltage range, press RANGE to L range.
B. The DC Source voltage outputs the voltage/current values listed in Table 6-7.
C. Wait for 30 seconds after the DC Source outputted and to record the voltage measured by DMM (V) and the Load.

Table 6-7

Model	DC Source Output Voltage	Front Panel Display Reading
632xxA-150-xxx	16V	DMM (V)±0.0048V
	1.6V	DMM (V)±0.00264V

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.

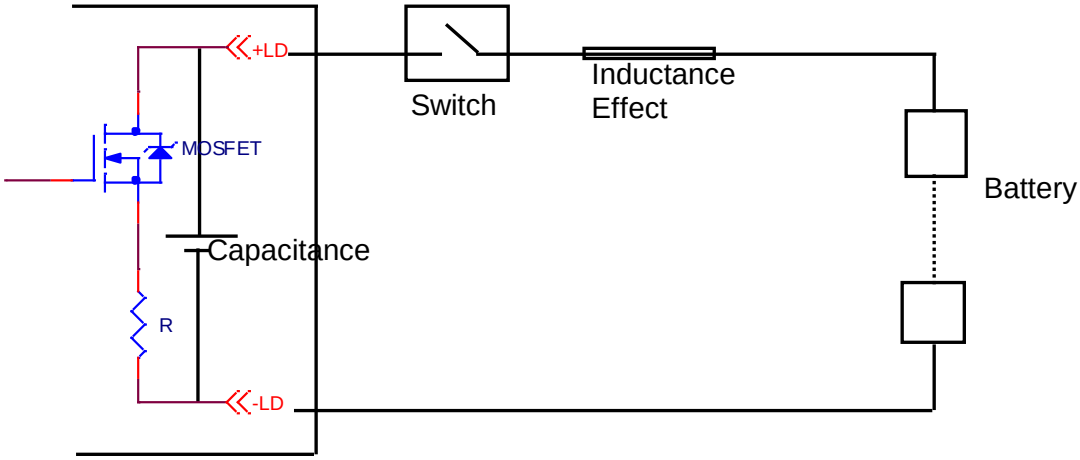


Figure A-1 Wire Connection of Electronic Load & Battery

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

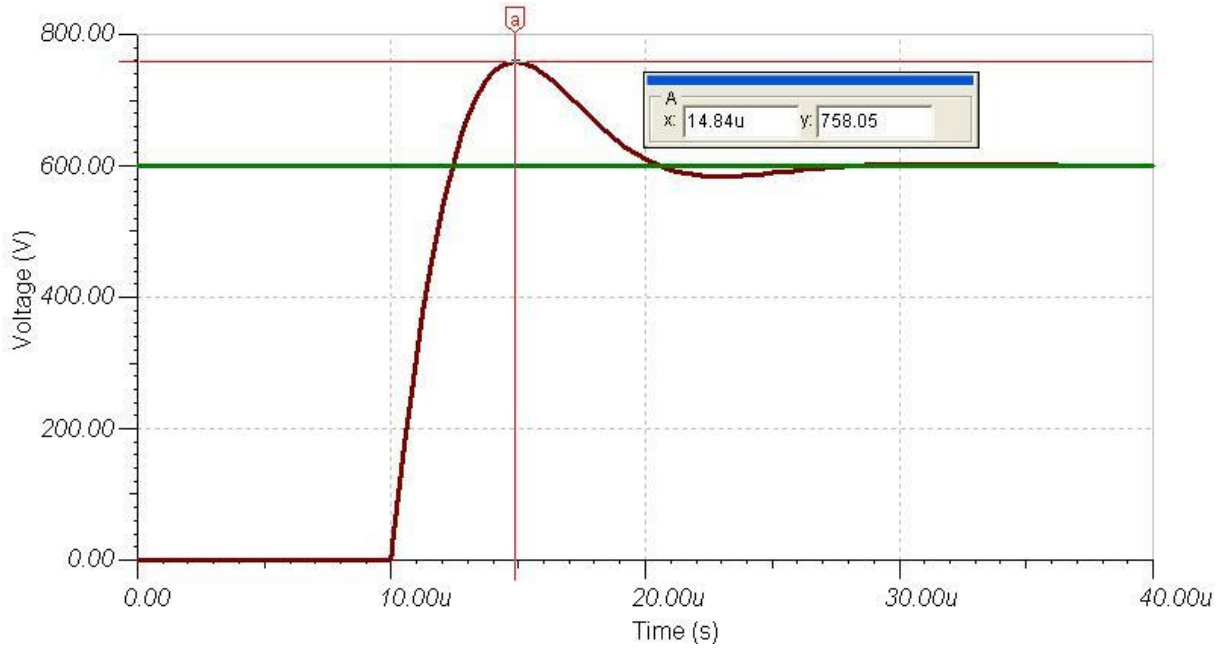


Figure A-2 Simulation of Surge Chart when Switching between Electronic Load & Battery

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.

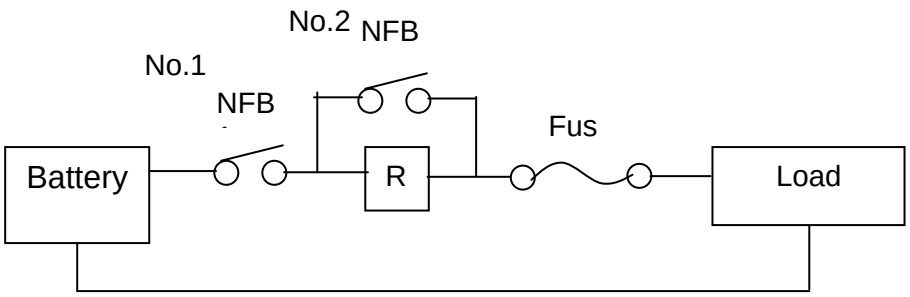


Figure A-3 Wire Connecting Diagram of LOAD & Battery

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.

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