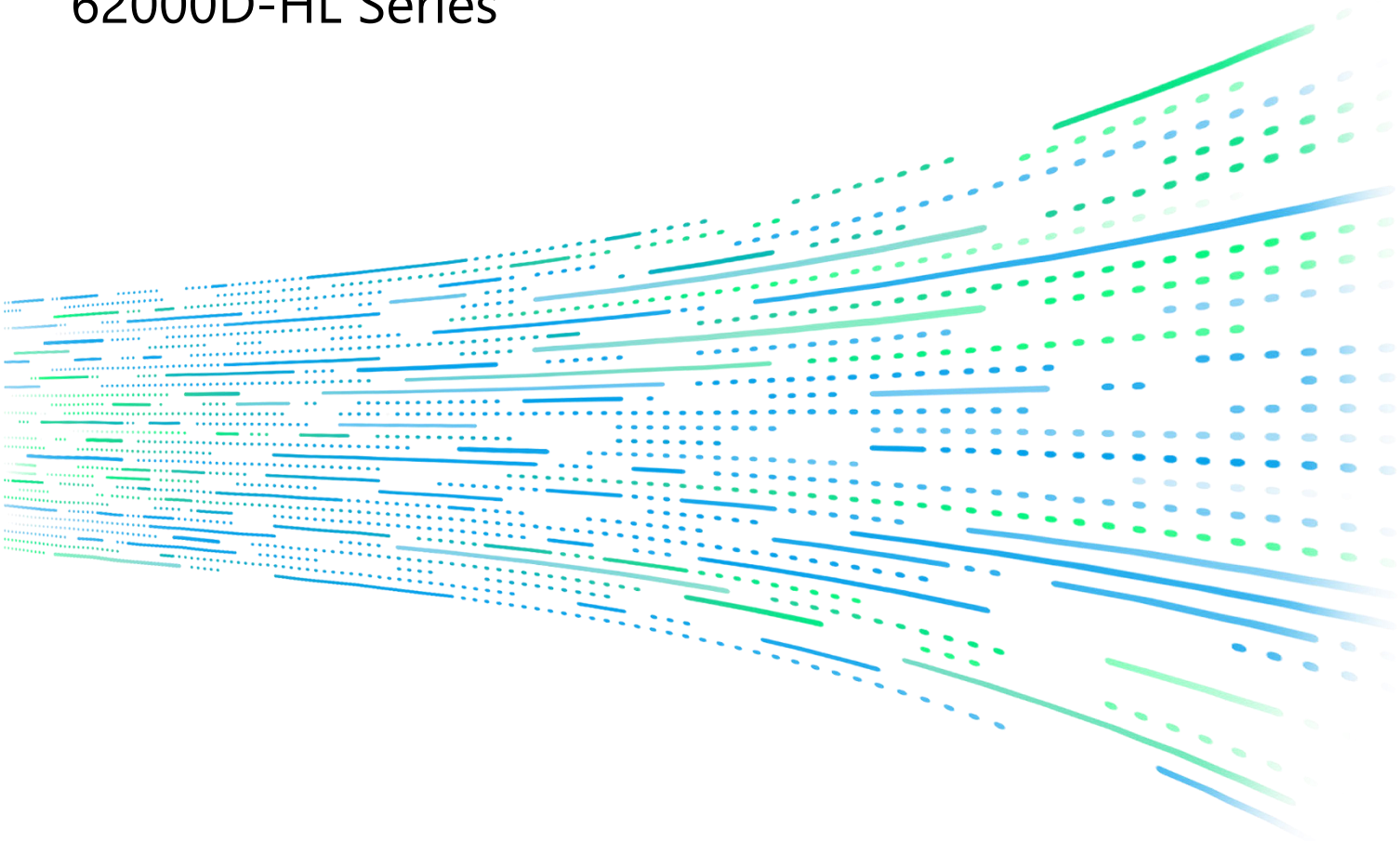
Chroma
Advancing Excellence

Operating and Programming Manual

Programmable Bidirectional DC Power Supply 62000D-HL Series



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DC Power Supply
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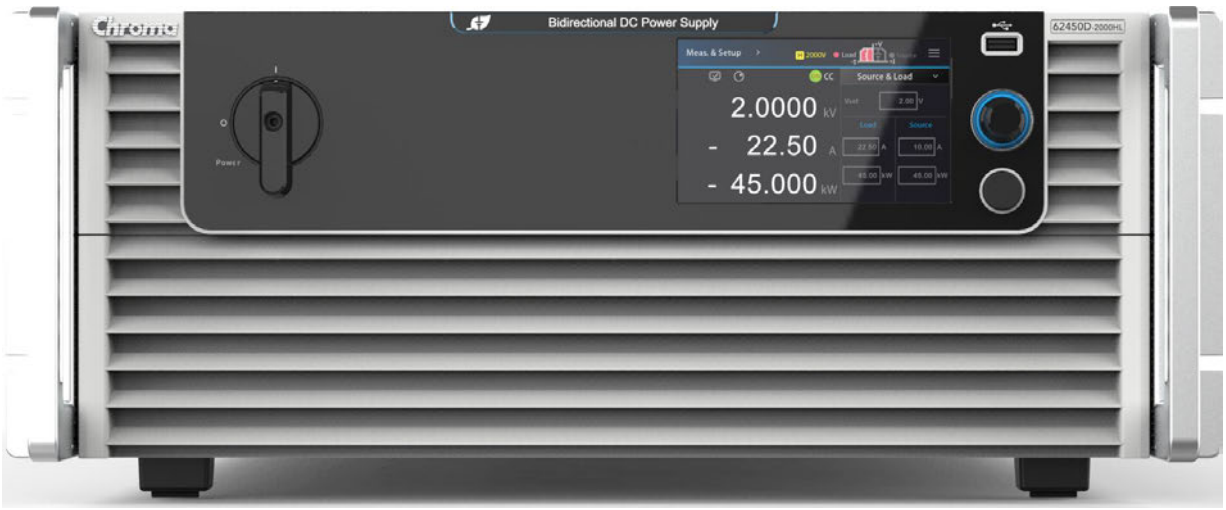

Version 1.0
May 2024

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CHROMA ATE INC.
88 Wenmao Rd., Guishan Dist., Taoyuan City 333001, Taiwan

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Material Contents Declaration

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


: See **<Table 1>**.


: See **<Table 2>**.

<Table 1>

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

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

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

Remarks:
1. The CE marking on the product is a declaration of product compliance with EU Directive 2011/65/EU and 2015/863/EU.
2. This product is complied with EU REACH regulations and no SVHC is in use.

Disposal

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

<Table 2>

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

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

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

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

Disposal

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

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CE

Declaration of Conformity

For the following equipment :

Programmable Bidirectional DC Power Supply; Regenerative DC Electronic Load

(Product Name/ Trade Name)

62450D-2000HL, 62360D-650, 62360D-1200HL, 62360D-1500HL, 62360D-2000HL, 62450D-650, 62450D-1200HL, 62450D-1500HL, 63736-650-180, 63736-1200-180HL, 63736-1500-180HL, 63736-2000-180HL, 63745-650-180, 63745-1200-180HL, 63745-1500-180HL, 63745-2000-180HL

(Model Designation)

Chroma ATE Inc.

(Manufacturer Name)

88 Wenmao Rd., Guishan Dist., Taoyuan City 333001, Taiwan

(Manufacturer Address)

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

EN IEC/BS EN IEC 61326-1:2021

EN/BS EN 61000-3-12:2011, EN IEC/BS EN IEC 61000-3-11:2019

IEC 61000-4-2 Ed.2.0:2008, IEC 61000-4-3 Ed.4.0:2020,

IEC 61000-4-4 Ed.3.0:2012, IEC 61000-4-5 Ed.3.1:2017,

IEC 61000-4-6 Ed.5.0:2023, IEC 61000-4-8 Ed.2.0:2009, IEC 61000-4-34 Ed.1.1:2009

IEC 61010-1:2010+A1:2016, EN/BS EN 61010-1:2010+A1:2019

The equipment describe above is in conformity with Directive 2011/65/EU and 2015/863/EU of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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

Chroma ATE Europe B.V.

(Authorized Representative Name)

Morsestraat 32, 6716 AH Ede, The Netherlands

(Authorized Representative Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU/Vice President

(Position/Title)

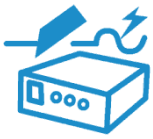
Taiwan	**2024.02.19**	Vincent Wu
(Place)	(Date)	(Legal Signature)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate the 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 device.

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 the 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.

⚠WARNING When the voltage and current are set and outputting, the output terminal on the rear panel has dangerous voltage, touching it may result in death.

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 manual.
	**High temperature:** This symbol indicates the temperature is hazardous. Do not touch to avoid personal injury.
	**Protective grounding terminal:** This symbol indicates that the terminal must be connected to the ground before operating 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)
	**Rotating 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 and modifications in this manual at each revision.

Date	Version	Revised Sections
May 2024	1.0	Complete this manual.

Table of Contents

1. Overview

1.1 Introduction

The Chroma 62000D-HL Series are high power density, bidirectional DC power supplies. These supplies have regenerative load characteristics with dual quadrant operation allowing energy feed back to the grid from UUT. They are suitable for testing modern energy storage systems, providing a stable DC output and accurate measurements for regenerative power applications.

The features of 62000D-HL Series DC power supplies include:

(1) H/L output available ➡ as per user's requirement. The system output can be set to a High range providing a maximum voltage of 2000V or changed to a Low range providing a maximum current of 180A to meet various voltage and current requirements. Up to 10 times of CP wide range output can be provided.
(2) Voltage mode & Current Mode with two loops control ➡ provides stable and fast response output, also able to set the rising and falling slew rate of output voltage and current.
(3) High power density output ➡ the maximum output power can be up to 45kW under 4U height.
(4) 16-bit ADC/16-bit DAC ➡ provides excellent resolution for measurement and output.
(5) Lower transient spike and transient response time ➡ provide stable output and the best protection under load variations.
(6) Editing mode (Programming Mode) for output waveform ➡ provides multiple output voltage and current combinations in real-time for long-period tests.
(7) Rotary knob control on the front panel ➡ to set the output voltage and current.
(8) Touch panel ➡ provide users with a high brightness and wide viewing angle interface for operation.
(9) Via GPIB/CAN (option), USB, Ethernet, or APG (analog programmable interface) interface ➡ to do remote control.
(10) Active PFC design ➡ the PF value of 62000D-HL series DC power supplies is >0.99. The high PF value increases the distribution capacity and wiring utilization.
(11) CP (Constant Power Operating Envelope) ➡ provides for a wide voltage and current operation. Customers do not need to add additional power supplies to cover low voltage/high current test requirements.

1.2 System Function

1.2.1 Operation Mode

1. Local operation is performed by the touch panel and rotary knob on the front panel.
2. The remote control is done via GPIB/CAN (option), USB, or Ethernet interface.
3. Through the APG input to control output via an analog signal.

1.2.2 Protection

1. Protections for voltage phase loss, input over voltage or under voltage, output over voltage, over current, over power, over temperature, fan fail, CV/CC foldback, etc. are available.
2. Smart fan control: Turn the fan speed from low to high based on the device temperature, output current, and output power to reduce the audible noise.

1.2.3 Output and Indicator

1. Analog outputs are provided to monitor (V/I Monitor) output voltage and current instantaneously. This allows signals to be easily monitored by external instruments (DMM, Oscilloscope, etc.). The analog monitoring points are stored in the buffer for protection
2. Output indicator (DC ON) signal.
3. Protection state indication (OVP/AD OCP/DD OCP/OPP/FAN LOCK/AC FAULT, etc.).
4. Over temperature (OTP) protection signal.
5. CV/CC status indicators.
6. Output status indicators.

1.2.4 Control Signals for Input

1. Remote sense input for voltage drop compensation.
2. Analog programming (APG) voltage input, in which the voltage and current settings can be adjusted using the voltage source to obtain the required panel settings.
3. Remote inhibit control signal (TTL)

1.2.5 Measuring and Editing

1. Measurement for voltage, current, and power.
2. 10 programs and 100 sequences editable voltage/current waveform for output.
3. Built-in a voltage waveform editor that can be used for long-hour planning.

1.3 Specification

Chroma 62000D-HL Series high power density and bidirectional DC power supplies include 36kW (6360D-2000HL) and 45kW (6450D-2000HL) two models. The output specifications of these models are listed in Table 1-1. It is suggested to warm up the instruments for more than 10 minutes before performing various tests. The test condition is 25 ± 5°C and under a resistance load.

Table 1-1 Specifications

Model No.	**62360D-2000HL**	**62450D-2000HL**
Output Ratings		
Output Voltage[1]	650V / 2000V	650V / 2000V
Output Current[2]	±180A / ±60A (650V/2000V)	±180A / ±60A (650V/2000V)
Output Power	±36000W	±45000W
Min. Load Voltage (@ I Load Max)	35V / 105V	
Line Regulation[3]		
Voltage	+/- 0.01% F.S.	
Current	+/- 0.05% F.S.	
Load Regulation[4]		
Voltage	+/- 0.04% F.S.	
Current	+/- 0.1% F.S.	
Voltage Measurement		
Range[17]	650V / 2000V	
Accuracy	0.02% + 0.02%F.S.	
Current Measurement		
Range	±180A / ±60A	
Accuracy	0.04% + 0.04%F.S.	
Output Noise & Ripple		
P-P (20MHz)[11]	850mV / 3500mV	
rms (Voltage)[11]	80mV / 240mV	
rms (Current)[5]	135mA / 75mA	
OVP Adjustment Range		
Range	0-110% programmable	
Accuracy	+/- 1% of full-scale output	
Programming Response Time		
Rise Time (Full Load)	20ms	
Rise Time (No Load)	10ms	
Fall Time (Full Load)	20ms	
Fall Time (No Load)	10ms	
Slew Rate Control		
Voltage Slew Rate Range[10] (No Load)	0.0001V/ms ~ 65V/ms / 0.0001V/ms ~200V/ms	
Voltage Slew Rate Range[10] (Full Load)	0.0001V/ms ~ 32V/ms / 0.0001V/ms ~ 100V/ms	
Current Slew Rate Range	0.0001A ~ 90A/ms / 0.0001A ~ 30A/ms	
Minimum Transition Time	0.5 ms	
Transient Response Time (CV)[15]	Recovers within 500μs to ±0.5% of F.S. output for a 50% to 100% or 100% to 50% load change (1A/μs)	
Operating Mode		
Source & Load	CC, CV, CP, CR, Ri	
Source (Source)	CC, CV, CP, Ri	
Load (Sink)	CC, CP, CR	
CC		
Range	±180A / ±60A	
Resolution	10 mA	
Program Accuracy	0.2% of Imax	
CV		
Range	650V / 2000V	
Resolution	10mV	

Model No.	**62360D-2000HL**	**62450D-2000HL**
Program Accuracy	0.05% of Vmax	
CP		
Range	±36000W	±45000W
Resolution	10mW	10mW
Program Accuracy	0.3% of Pmax	0.375% of Pmax
Ri[18 19]		
Range	10mΩ-2Ω	
Resolution	10mΩ	
Program Accuracy	(I*R+V F.S.)*0.05%	
CR		
Range	0.01Ω-65kΩ / 0.01Ω-200kΩ	0.01Ω-65kΩ / 0.01Ω-200kΩ
Resolution	10mΩ	
Program Accuracy	Vin/Rset*(0.2%)+0.2% IF.S.	
SAS	Optional	
Battery Simulator	Standard	
Efficiency[6 13]	Source > 93.6%	Source > 94.3%
	Sink > 93.6%	Sink > 94%
Drift (30 minutes)[7]		
Voltage	0.04% of Vmax	
Current	0.06% of Imax	
Drift (8 hours)[8]		
Voltage	0.02% of Vmax	
Current	0.04% of Imax	
Temperature Coefficient[9]		
Voltage	0.04% of Vmax/°C	
Current	0.06% of Imax/°C	
Programming & Measurement Resolution		
Voltage (Front Panel)	100mV	
Current (Front Panel)	10mA	
Voltage (Digital Interface)	0.002% of Vmax	
Current (Digital Interface)	0.004% of Imax	
Voltage (Analog Interface)	0.04% of Vmax	
Current (Analog Interface)	0.04% of Imax	
Remote Interface		
Analog Programming	Standard	
USB	Standard	
GPIB	Optional	
CAN FD	Optional	
Aurora	Optional	
LAN Interface	Standard	
System bus	Standard for Master/slave control	
Programming Accuracy		
Voltage (Front Panel and Digital Interface)	0.05% of Vmax	
Current (Front Panel and Digital Interface)	0.2% of Imax	
Power (Front Panel and Digital Interface)	0.3% of Pmax	
Voltage (Analog Interface)	0.2% of Vmax	

Model No.	**62360D-2000HL**	**62450D-2000HL**
Current (Analog Interface)	0.3% of Imax	
APG Measurement Accuracy		
Voltage (Analog Interface)	0.5% of Vmax	
Current (Analog Interface)	0.75% of Imax	
GPIB Command Response Time		
Vout Setting	GPIB send command to DC source receiver <20ms	
Measure Volt & Current	Under GPIB command using Measure <25ms	
Analog Interface (I/O)		
Voltage and Current Programming Inputs (I/P)	Voltage : 0 - 10Vdc of F.S.	
	Current : Source I = 0 - 10Vdc of F.S.	
	Load I = 0 - 10Vdc of F.S.	
Voltage and Current Monitor Output (O/P)	Voltage : 0 - 10Vdc of F.S.	
	Current : -10 - 10Vdc of F.S.	
External ON/OFF (I/P)	TTL: Active Low or High (Selective)	
DC_ON Signal (O/P)	Level by user-defined. (Time delay= 1ms at a voltage slew rate of 10V/ms)	
CV or CC Mode Indicator (O/P)	TTL Level High=CV mode;	
	TTL Level Low=CC mode	
OTP Indicator (O/P)	TTL: Active Low	
System Fault Indicator (O/P)	TTL: Active Low	
Safety Interlock (I/P)	Time accuracy: <100ms	
Remote Inhibit (I/P)	TTL: Active Low	
Series & Parallel Operation	Master / Slave control for 12 units. (Parallel: twelve units)	
Auto Sequencing (List mode)		
Number of Program	10	
Number of Sequence	100	
Dwell time Range	2ms – 15000s	
Trig. Source	Manual / Auto / External	
Auto Sequencing (Step mode)		
Start Voltage	0 to Full scale	
End Voltage	0 to Full scale	
Run Time	hh : mm : ss.sss (00:00:00.001 to 99:59:59.999)	
Trig. Source	Auto	
Input Specification		
AC Input Voltage 3-phase, 3-wire + ground	3Φ 380Vac - 480Vac ± 10%	3Φ 380Vac - 480Vac ± 10%
	w/o Neutral	w/o Neutral
AC Frequency Range	47 – 63 Hz	
Power Factor	Source, PF>0.99	Source, PF>0.99
	Sink, PF>0.99	Sink, PF>0.99
iTHD[20]	Source < 3% @380Vac Sink < 6% @380Vac	Source < 3% @380Vac Sink < 5% @380Vac
General Specification		
Maximum Remote Sense Line Drop Compensation[12]	2% of full scale voltage per line(4% total)	
Operating Temperature Range	0°C ~ +40°C	
Storage Temperature Range	-25°C ~ +70°C	
Dimension Size (HxWxD)	177 x 428 x 903mm / 6.97 x 16.85 x35.55 inch	
Fan Noise[16]	76dB (Max.)	
Weight	72kg / 159lbs	72kg / 159lbs

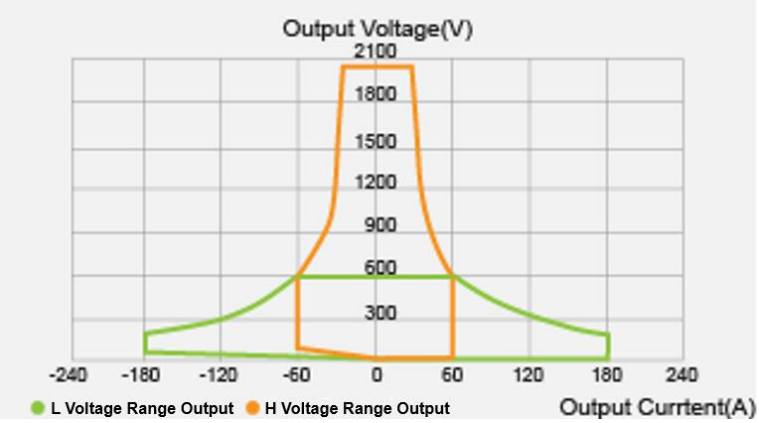
All specifications are subject to change without prior notice.

Note

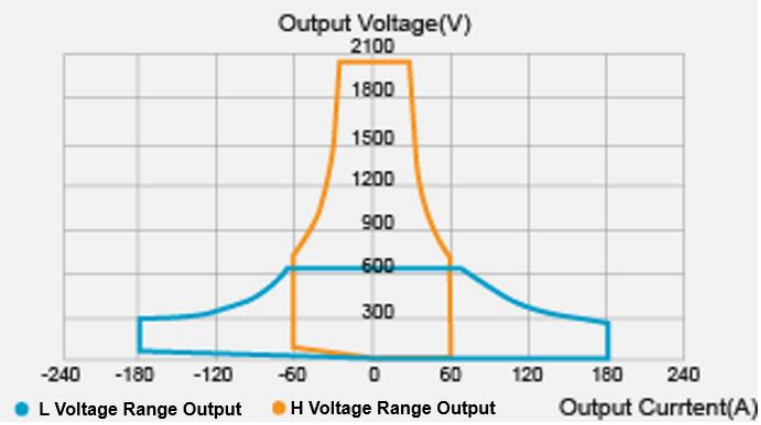
1. The minimum output voltage is <0.5% of the rated voltage at zero output setting.
2. The minimum output current is <0.2% of the rated current at zero output setting when measured with rated load resistance.
3. When it is under ±10% variation of rated mains power.
4. The 0-100% load variation under fixed voltage input.

Load Regulation in CC Mode (Current)	
62360D-2000HL	H range: Guaranteed specifications above 105V. L range: Guaranteed specifications above 35V.
62450D-2000HL	H range: Guaranteed specifications above 105V. L range: Guaranteed specifications above 35V.

5. Current mode ripple is measured from 10% to 100% of the rated output voltage.
6. Efficiency at 480Vac input voltage and full load output (Vo Max).
7. Maximum drift over 30 minutes with constant input, loading, and temperature after power on.
8. Maximum drift over 8 hours with constant input, loading, and temperature after 30 minutes of warm-up.
9. Change in output per degree C in ambient temperature during constant input and loading.
10. The rise and fall slew rates are affected by the output capacitors.
11. From 20 Hz to 20 MHz peak-to-peak noise, the valid noise range is 20 Hz to 300 kHz. (*The 62450D-2000HL and 62360D-2000HL measure the 44nF and 104.7μF capacitor on the output terminal.)
12. The VO and IO output ranges are shown below.



62360D-2000HL



62450D-2000HL

13. The efficiency of input voltage and full load output (Vo Max) at 380Vac and 480Vac.

Model：62360D-2000HL

	380Vac	480Vac
Source eff.	>93%	>93.6%
Sink eff.	>93%	>93.6%

Model：62450D-2000HL

	380Vac	480Vac
Source eff.	>93%	>94.3%
Sink eff.	>93%	>94%

14. Use “standard programmable commands” to get the measured values.
15. H Range F.S.= 2000V
    L Range F.S.= 650V
16. The maximum noise is measured at an ambient temperature of 23°C, a relative humidity of 60% with the fan running at full speed for 30 seconds, and a distance of 1 meter from the chassis (tested to comply with ISO 7779).
17. The panel voltage measurement high and low ranges are only applicable to the Source mode. The 1. Load mode, 2. Sink direction in bidirectional mode, and 3. The power supply OFF state only supports high-range voltage measurement.
18. The setting range of Ri applies to the following conditions:
    62360D-2000HL: The L Range output voltage must be above 5V to meet the specifications.
    The H Range output voltage must be above 15V to meet the specifications.
    62450D-2000HL: The L Range output voltage must be above 5V to meet the specifications.
    The H Range output voltage must be above 15V to meet the specifications.
19. The resolution above 1A is 10mΩ, and the resolution between 0.1A~1A is 30mΩ.
20. VTHD<2%

* Specifications apply from >2% to 100% of rated voltage and from >2% to 100% of rated current.

CAUTION

1. For applications with fast switchable power loads and cable lengths more than 20cm, it is recommended the cables be twisted and parallel capacitance be added to prevent oscillations, see Figure 1-1.
2. Do not wrap the external input, output, and communication cables together to avoid cross-interference errors.
3. Be sure to place the power supply horizontally (top side up) when using or for storage. Do not stand the power supply vertically for a long period to avoid internal damage to the supply.

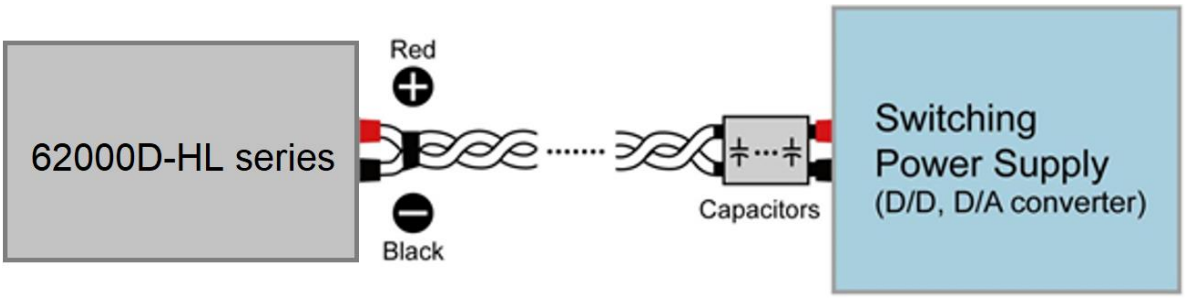


Figure 1-1

WARNING Voltage from the two output terminals to earth varies with the 62000D-HL Series models as Table 1-2 shows below:

Table 1-2

Model	Max. Voltage (Vdc) Difference between Output Terminal and Earth
62360D-2000HL	3,000
62450D-2000HL	

If the voltage exceeds the above range it may damage the DC power supply.

1.4 Function Buttons

1.4.1 Front Panel

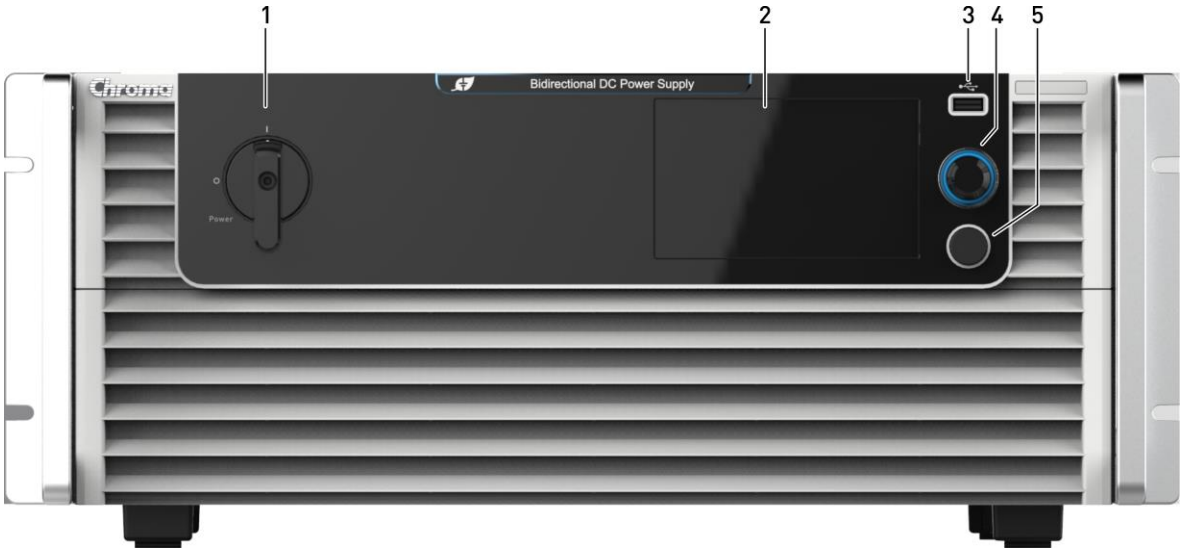


Figure 1-2 Front Panel of 62000D-HL Series Models

Table 1-3 Front Panel Description

Item	Symbol	Description
1		**Main Power Switch:** Turn on or off the power.
2		**LCD Touch Panel:** Use the icons as they appear on the touch screen to set the voltage/current, and measurements, control the program sequence, preview the output waveform, and display the test results.
3		**USB HOST:** Allows for data download.
4		**Rotary Knob:** The rotary knob is used to edit the settings on the screen. When the settings are complete, press the rotary knob to confirm the input value.
5		**Output ON Button.** Press the ON button, the light on means Output ON, and the light off means Output OFF.

1.4.2 Rear Panel

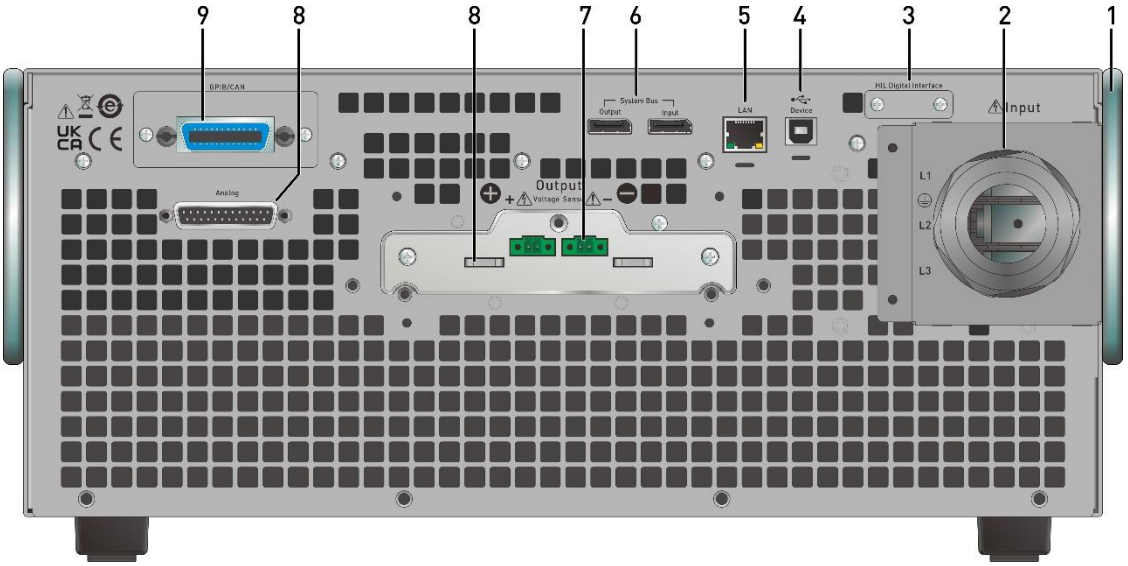


Figure 1-3 Rear Panel of 62000D-HL Series

Table 1-4 Rear Panel Description

Item	Name	Description
1	Rear auxiliary carrying handle	It assists the device to be moved.
2	AC power cord anti-pulling device	Connects to the AC power cord connector to prevent the cord from loosening due to external force during operation.
3	Aurora connector (reserved)	A fiber communication connector is reserved for Aurora interface.
4	USB port	The remote controller uses a USB bus to connect to the PC for remote operation.
5	Ethernet connector	The remote controller uses the ETHERNET bus to connect to the PC for remote operation.
6	System bus	For serial/parallel data transmission. (Remove this cable if the power supply is not connected in series or parallel.)
7	Voltage sense connector	Connecting this connector to the load can compensate for the voltage drop generated due to cable resistance. Be sure to connect the remote sense connector “+” to the positive output terminal and the “–” connector to the negative output terminal. Do not reverse connect the polarity of the "+" and "-" output terminals to the remote sense connector.
8	Output terminal	The output terminals of the DC power supply.
9	ANALOG interface signal connecting terminal	25 pins signals include APG input/output terminals and system status signal terminals. See *Appendix A* for detailed pin assignments.
10	GPIB/CAN FD connector	Used for GPIB/CAN control via an external PC for remote operation.

Notice Item 10 in Figure 1-4 is an optional GPIB/CAN FD interface of 62000D-HL selected by the user. A blank panel will be installed if no interface is selected.

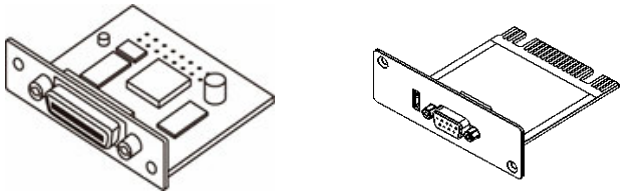


Figure 1-4 GPIB/CAN FD Interface

1.5 Dimension

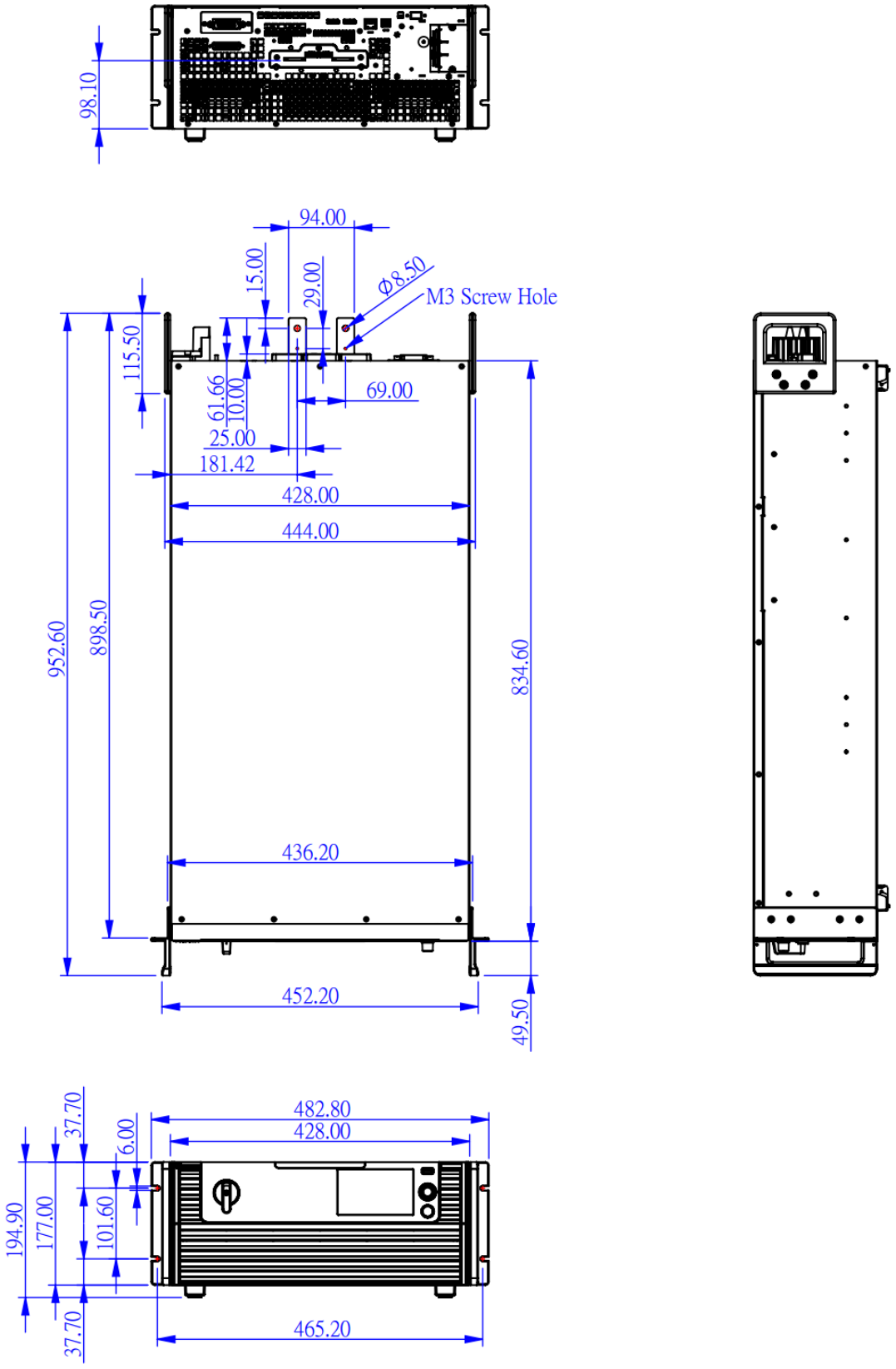


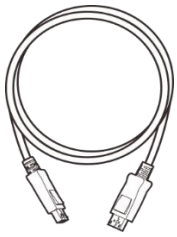
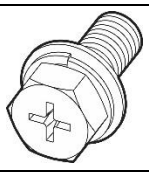
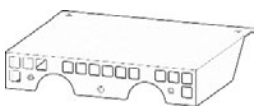
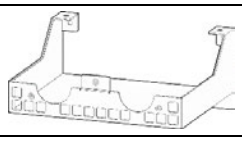
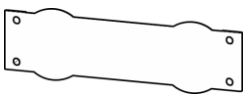
Figure 1-5 Dimension of 62360D-2000HL and 62450D-2000HL Models

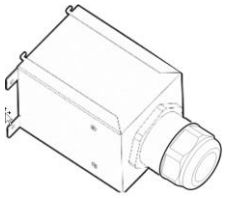
2. Installation

2.1 Checking the Package

1. Check for any damage or missing accessories after unpacking.
2. Should any damage be found, contact the shipping carrier and Chroma's service department immediately. It is also recommended that pictures are taken of both the instrument's damage and shipping container and that the shipping container is kept for future use.

The standard accessories list of 62360D-2000HL / 62450D-2000HL is listed as follows:

Standard Accessories				
Item				
Name	Current Sharing Cable (Display port 30cm)	USB Cable	Stylus	Stylus Spring Wire
P/N	W38-000844 *1	W38-000082 *1	A55-000289 *1	G55-001131 *1
Item				
Name	USB Cable Hoop	Ethernet Cable Hoop	Ethernet Cable	M3x6L Flat Head Screw
P/N	G32-005010 *1	G32-005011 *1	W31-000053 *1	H61-300621 *5
Item				
Name	M8x20 Screw	M8-13 Nut	M8x22 Washer	M3x6 Screw
P/N	H61-000436 *2	H71-806500 *2	H81-802200 *2	H69-300641 *10
Item				
Name	Output Cover Set Top	Output Cover Set Bottom	Output Snap Bushing	Output cover (No Cable)
P/N	G29-000164 *1 G51-000759 *1	G29-000163 *1 G51-000758 *1	W61-000011 *2	G29-000171 *1

Standard Accessories				
Item				
Name	AC Input Cover	M3 Copper Pillar		
P/N	G29-000162 *1 G51-000760 *1 H61-300621 *4 M61-000043 *1 G32-017626 *2 G32-275400 *1	W72-000181 *4		

Notice

1. Please keep all of the packing materials in case the device has to be returned for repair.
2. Do not return the instrument to the factory without obtaining prior RMA acceptance from Chroma.
3. Check if all accessories listed in the packing list are well received.

CAUTION The power supply is too heavy for one person to safely lift and mount. To avoid injury, ask for assistance during installation.

2.1.1 Maintenance and Cleaning

Remove all connected wires and cables on the instrument before cleaning. Use a brush to clean the dust. If there are stains on the chassis that cannot be removed by brush, wipe with a volatile liquid (such as Cleaning Naphtha). Do not use any corrosive liquid to avoid damaging the chassis. Use a damp cloth with soap water or soft detergent to clean the LCD front panel. For internal cleaning, use a low-pressure air gun to clean the dust inside or send it back to our agent for cleaning.

2.2 Preparation for Use

1. Be sure the power supply is connected to the AC line input that meets the specification.
2. The instrument must be installed in a well-ventilated area to avoid the internal temperature getting too high.
3. Ensure ambient temperature does not exceed 40°C.

2.2.1 Normal Environment Conditions

1. Indoor use.
2. Altitude up to 2,000 meters.
3. Operating ambient temperature 0°C to 40°C.
4. Operating ambient humidity 0%rh to 90%rh (non-condensing).
5. Storage ambient temperature -25°C to 70°C.
6. Storage ambient humidity 0%rh to 90%rh (non-condensing).

7. Input AC supply voltage fluctuations can be up to ±10% of the rated voltage.
8. Transient over voltage is impulse withstand CAT II.
9. Pollution degree II.

2.3 Requirements of Input Power

2.3.1 Ratings

(1) Model 62360D-2000HL
Input voltage/frequency range: V_{LL}: 380-480V±10% 3~ 4W / 47-63Hz
Maximum input power: 42.0kVA
Maximum input current:

Model / Vin	62360D-2000HL
380Vac	70A
480Vac	56A

(2) Model 62450D-2000HL
Input voltage/frequency range: V_{LL}: 380-480V±10% 3~ 4W / 47-63Hz
Maximum input power: 52.0kVA
Maximum input current:

Model / Vin	62450D-2000HL
380Vac	86A
480Vac	70A

(3) The input leakage current of the 62000D-HL series model is about 3mA or below.
(4) The 62000D-HL Series is a full-range power supply with different input ranges to match different output power settings. Therefore, it requires waiting for 60 seconds to start up the power supply again after shutdown so that the system can turn off completely. Otherwise, the power supply will be misjudged as AD_UVP or AD_OVP and an alarm message will be issued.

2.3.2 Input Connection

(1) The input power connector is located at the right of the rear panel.
(2) The power line must be rated at least 105°C.
(3) The power cable width must be 6AWG at least.
(4) Assembly ➡ see Figure 2-1 (a)~(d) and execute the following steps.
   a. Pass the AC input power cord through the cable cleat and the protective cover.
   b. Secure the power cable and the AC input connector. Secure the grounding terminal of the input power to the grounding copper stud on the chassis (via an M4x0.7 flange nut).
   c. Insert the AC power supply protective cover into the rear guide slot, slide the protective cover to the right, and snap it onto the chassis. Make sure the protection cover is connected and secure it (via M3x6 flat head screw).
   d. Secure the input cable cleat to prevent the AC power connecting terminal from falling off.

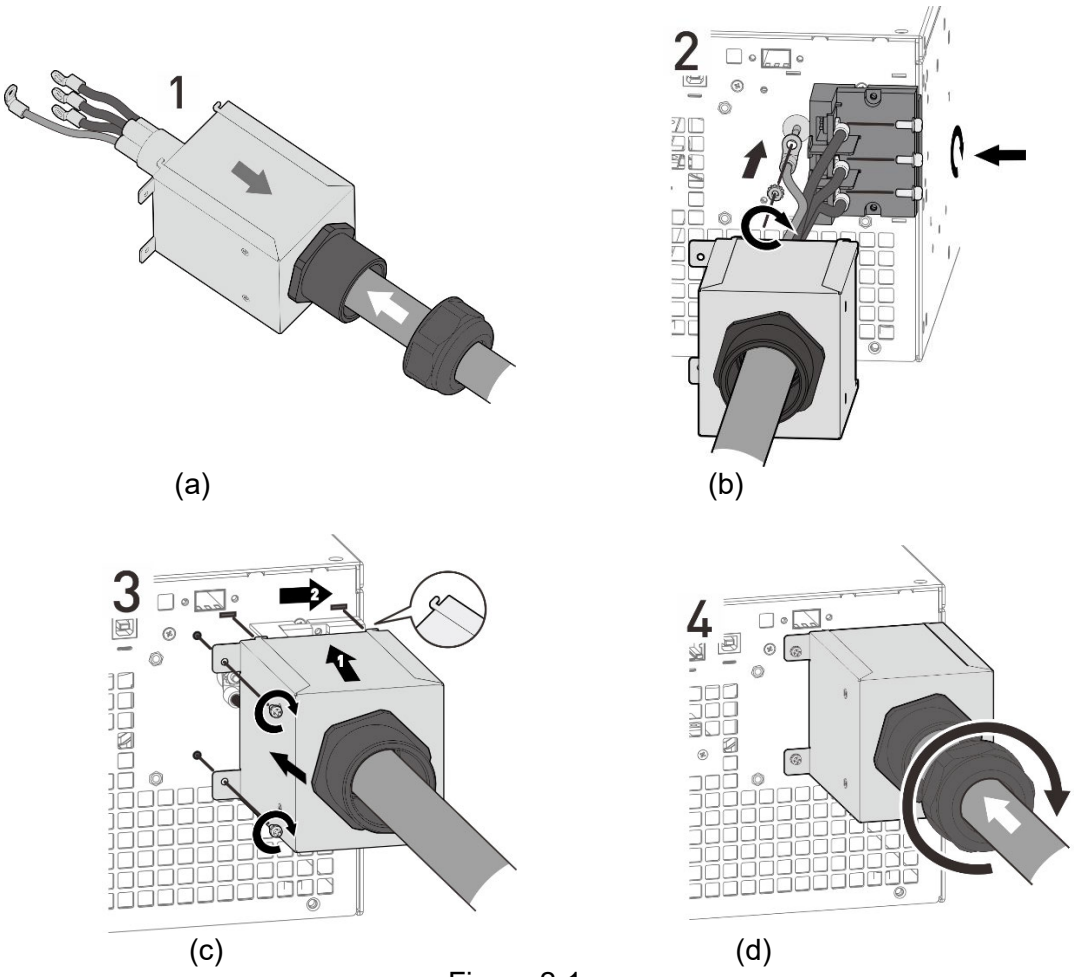


Figure 2-1

Notice

1. Connect the green or green/yellow grounding wire to the ⏚ terminal.
2. Connect the red, black, or blue power wire to the “L1, L2, L3” terminal.

⚠WARNING

1. To protect the operators, the wire connected to the GND terminal (⏚) must be connected to the earth. Under no circumstances shall this DC power supply be operated without an adequate ground connection.
2. Installation of the power cord must be done by a professional and compliant with local electrical codes.

⚡ CAUTION

1. Be sure to select an appropriate withstand voltage cable based on the varied input voltage.
2. To ensure operation safety, follow the input power source during installation to select the currently rated breaker that closes to each phase and connect it to the input terminal in series.
3. The breaker should be installed inside the building. See Table 2-3 for the rating.

The conductor sectional area for safe use of the input current and anti-pulling wire diameter is listed in Table 2-1.

Table 2-1 Suggested Cable Specification

Conductor Area Sectional Area mm^2	Safe Current (A) Copper Conductor	Diameter for Anti-pulling Standard (mm)
22	90	24~31.4 (AC input cable)

Table 2-2 lists the PVC (105°C) wire specification references when the ambient temperature is 30°C.

Table 2-2 PVC (105°C) Cable Specification

Conductor Area Sectional Area mm^2	Safe Current (A)	
	Copper Conductor	Aluminum Conductor
1.25	15	--
2.0	20	--
3.5	30	--
5.5	40	--
8.0	55	--
14	70	50
22	90	70
30	120	90
38	145	100
50	175	120
80	230	150
100	260	200
125	300	240
150	350	270
200	425	330
250	500	380
325	600	450
400	700	500
500	800	600

Table 2-3 Breaker Rating

Model	Breaker Rating(A)
62360D-2000HL	90A max.
62450D-2000HL	80A max.

2.3.3 Remote Sensing

2.3.4 Correct Connection

1. Connecting remote sensing wires correctly will ensure the output voltage is the set voltage at the end of the output cable. The DC power supply can compensate 4% V_MAX line voltage drop.

2. Figure 2-2 shows the correct connection. Use two wires to connect the positive/negative connector of the load to the remote sensing connector on the rear panel. The connecting wire diameter must be 22AWG, and its withstand voltage should meet the 3kV specification.
3. Though remote sensing can compensate for the voltage drop, if the line loss is too large (see specification) it will cause protection error on remote sensing.
4. The remote sensing wire must be connected to the DC power supply's local output or the UUT's remote input.

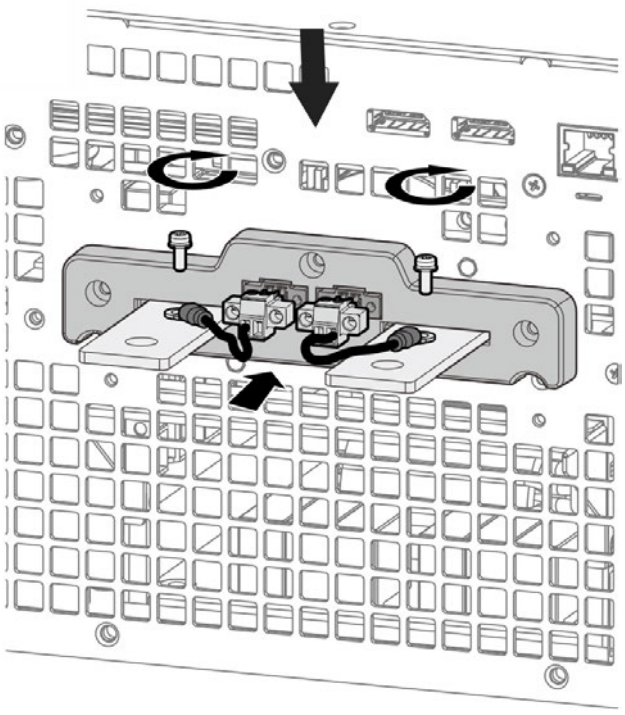


Figure 2-2

2.3.5 Reverse Connection of Remote Sensing Wire Polarity

The polarity of the remote sensing wire must be connected correctly, the "+" terminal must be connected to the "+" side of the unit under test and the "–" terminal must be connected to the "–" side of the unit under test. If the polarity is connected reversely, the output will drop to 0V and prompt an error message "SENSE FAULT" as Figure 2-3 shows.

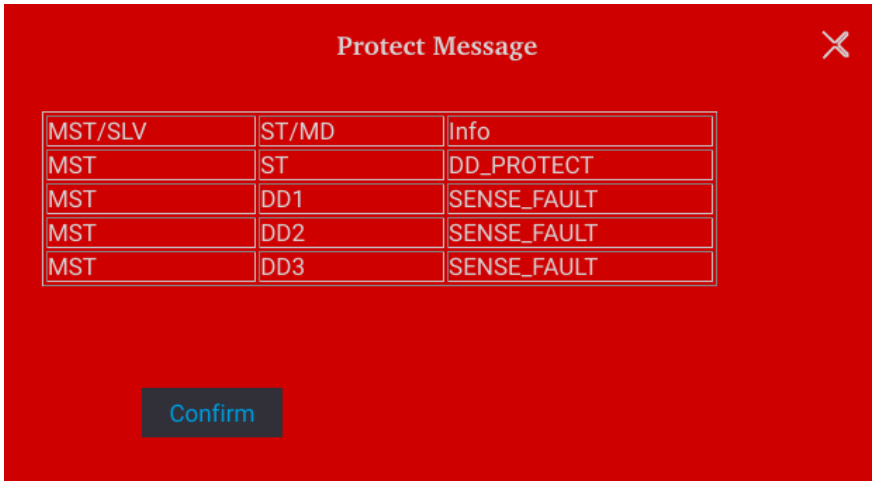


Figure 2-3

Notice

In the event of a reverse polarity error condition, proceed as follows to reset it:

1. First power it off.
2. Connect the remote sensing wire properly.
3. Restart the DC power supply.

CAUTION

1. If there is a voltage on the power supply output, do not reverse connect the Remote sense to it or to the UUT to avoid damaging the power supply.
2. The voltage of the Remote Sense and local output needs to be smaller than 4% V_MAX to avoid damaging the power supply.
3. It may cause the output voltage to overshoot when the Remote sense wire is dropped. Be sure the connect the Remote sense wire correctly to the DC power supply local output or the Load UUT before operating the power supply.

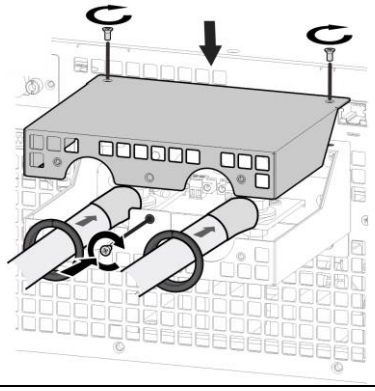
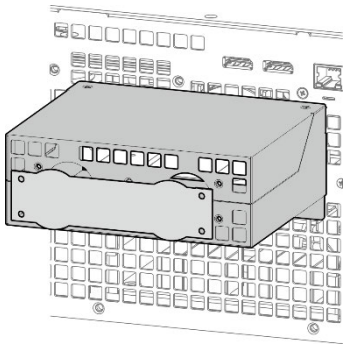
2.4 Output Connection

The output connector of the 62000D-HL Series DC power supply is located in the upper middle area on the rear panel. The load is connected to the "+" and "–" output terminal.

2.4.1 Rear Panel Output

(1) The output terminal is located in the upper middle area on the rear panel.
(2) The output cable must be rated to at least 105°C with a conductor sectional area of more than 38mm^2.
(3) Assembly ➡ follow Table 2-4 and Figure 2-4 to execute the steps below.
   a. Strip insulation off the ends of the power cable tip (the bare portion is about 1cm) and use an O-type terminal to crimp it.
   b. Secure the power cable and input terminal with a Phillips screwdriver.
   c. Secure the safety cover latch and safety cover to prevent the cable from falling or the electric terminal from exposing.

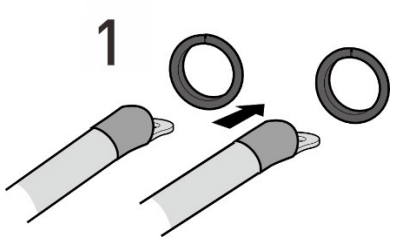
Table 2-4 Safety Cover

Safety Cover	Applicable Range	Applicable Model
	Vdc = 0~2000V Io = -180A~180A max	62360D-2000HL 62450D-2000HL
	Vdc = 0~2000V (when output is not connected)	62360D-2000HL 62450D-2000HL

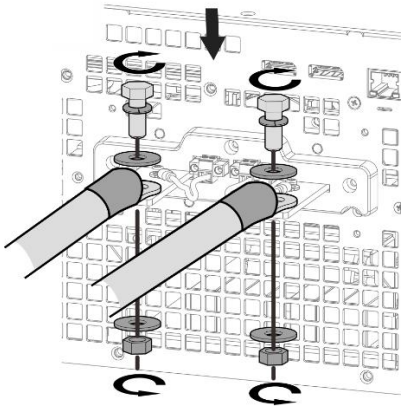
For the models requiring a larger safety cover, a cable with a wider diameter is needed. To ensure the output terminal is not stressed, assemble it as Table 2-4 and Figure 2-4 show.

Figure 2-4:

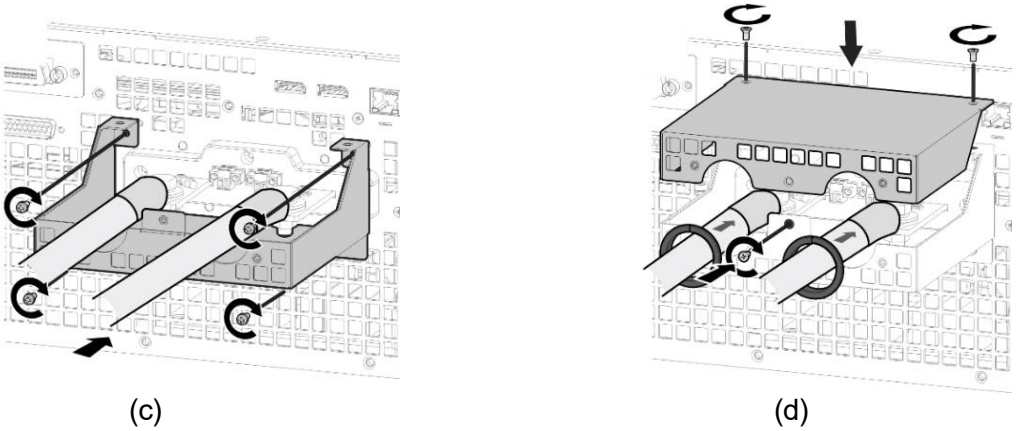
a. Pass the power output wire through the snap bushing.
b. Secure the power wire (via M5x15 round head screws, M5x13 flat washers, and M5 hex nuts) on the power supply output terminal.
c. Secure the output safety cover A (via M3x6 round head screws) on the chassis.
d. Secure the output safety covers A and B (via M3x6 flat head screws) on the chassis.



(a)



(b)



(c) (d)

Figure 2-4 Output Safety Cover Assembly

CAUTION

1. To meet the safety requirement, the safety cover must be tightly secured.
2. The diameter of the wire connected to the load must be able to carry the maximum current applied.
3. Be sure to select a proper output wire that can withstand the voltage based on the model.

WARNING

For safety, do not exceed the rated current (varies with 62000D-HL series models) for the output current.

2.4.2 Specification of Connecting Wire

The maximum inductance of the connecting wire to the power supply is the total inductance of two wires after being twisted or processed. Do not exceed the specifications listed in the table below including self-inductance and mutual inductance.

Table 2-5

Model	Maximum Output Inductance (μH)
62360D-2000HL	H range: 1200uH L range: 1200uH
62450D-2000HL	H range: 1200uH L range: 1200uH

CAUTION

1. To ensure the system's stability, the wire inductance should not exceed the above limits.
2. Do not use wire with an extra thin diameter to avoid overheating and causing a hazard.

2.4.3 Specification of Parallel Capacitance

The parallel capacitance for output varies with the 62000D-HL Series models as listed in Table 2-6

Table 2-6

Model	Max. Parallel Capacitance for Output (μF)
62360D-2000HL	H range: 500uF L range: 3000uF
62450D-2000HL	H range: 500uF L range: 3000uF

CAUTION

1. Be aware of the polarity and it withstands voltage when paralleling capacitance.
2. The user can try to switch to CV Slow mode if a larger parallel capacitance is required. (See section 3.2.2)
3. Since the capacitance varies with frequency and temperature, the value in Table 2-6 is for reference only.

2.5 Power On Procedure

Plug in the power cord and turn on the power switch on the front panel. The DC power supply will run a series of self-tests. The display on the front panel will turn on to run self-tests for CPLD (complex programmable logic device), memory, data, and communication as Figure 2-5 shows.

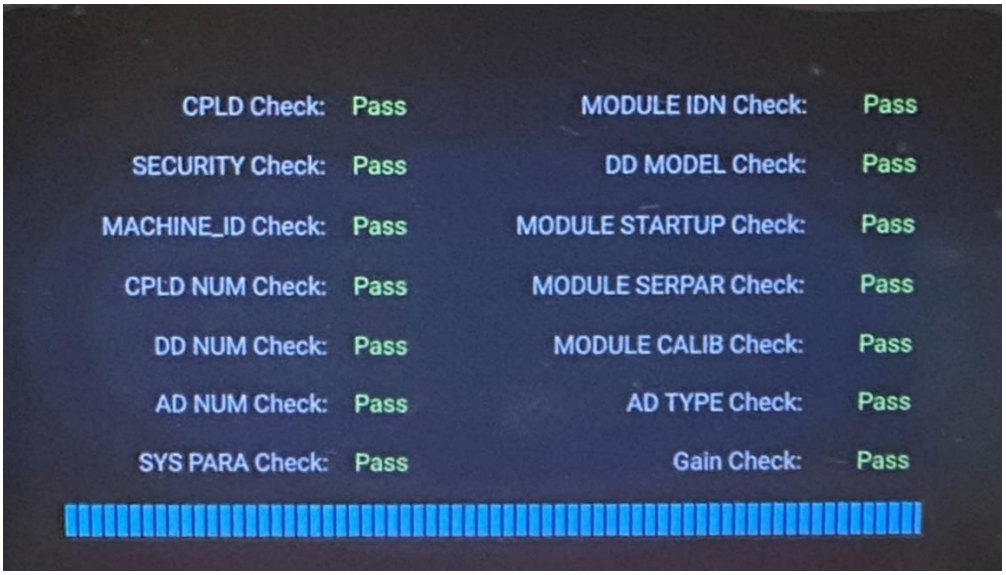


Figure 2-5

When the self-tests of memory, data, and communication are done, the screen turns to the MAIN page automatically as Figure 2-6 shown below:

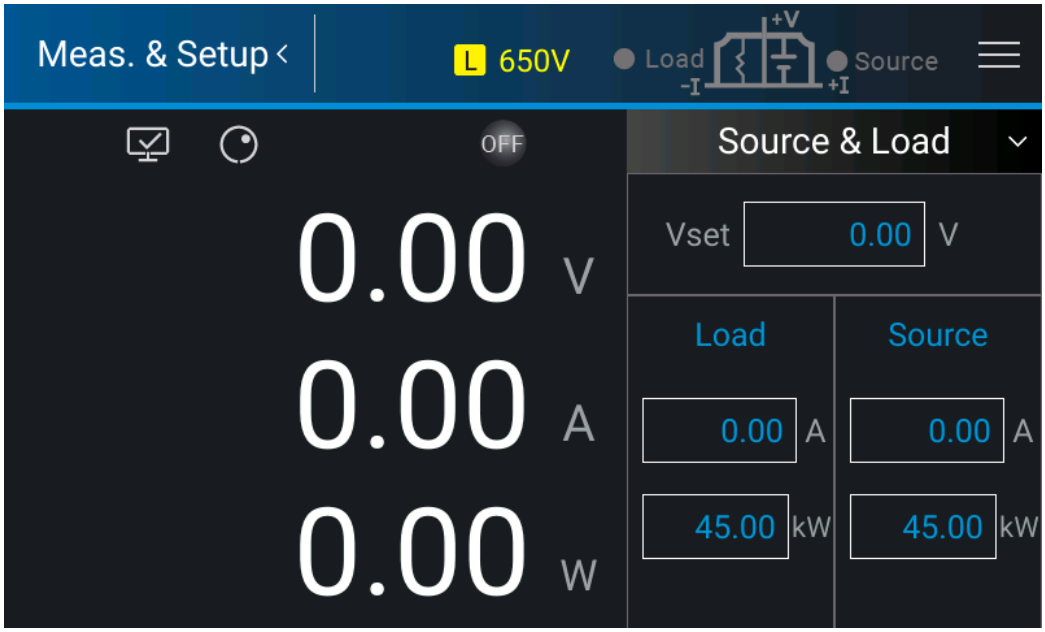


Figure 2-6

CAUTION The DC power supply internal circuit may not be able to reset if it is powered off and on immediately. It is suggested to wait for 60 seconds after powering it off and power it on again.

WARNING Before turning on the power supply, all protective grounding terminals, extension cords, and devices must connect to the earth. The hazard of potential electric shock may cause injury or death if any grounding is interrupted.

3. Manual Operation

3.1 Introduction

The DC power supply can be operated manually or remotely via GPIB/CAN (option), LAN, USB, or APG interface which is described in Chapter 5 and section 3.2.5.1. Refer to the manual operation for using the front touch panel or rotary knob to input data described in this chapter.

Notice The operation mode defaults to manual mode whenever power to the supply is turned on.

3.2 Menu for Setup

The Menu provides you with various settings for configuring the system functions of the DC power supply. The functions include:

1. Meas. & Setup : To set output voltage, current, and power parameters.
2. Output Setup : To set various output parameters including voltage/current slew rate, etc.
3. System Setup : To set the display panel, various protections, time, and factory defaults.
4. Program Seq. : To set LIST MODE & V_STEP MODE.
5. Advance : To set advanced functions.
6. Configuration : To set the communication interface, serial/parallel settings, power on status, and calibration.

The Menu screen is shown in Figure 3-1.

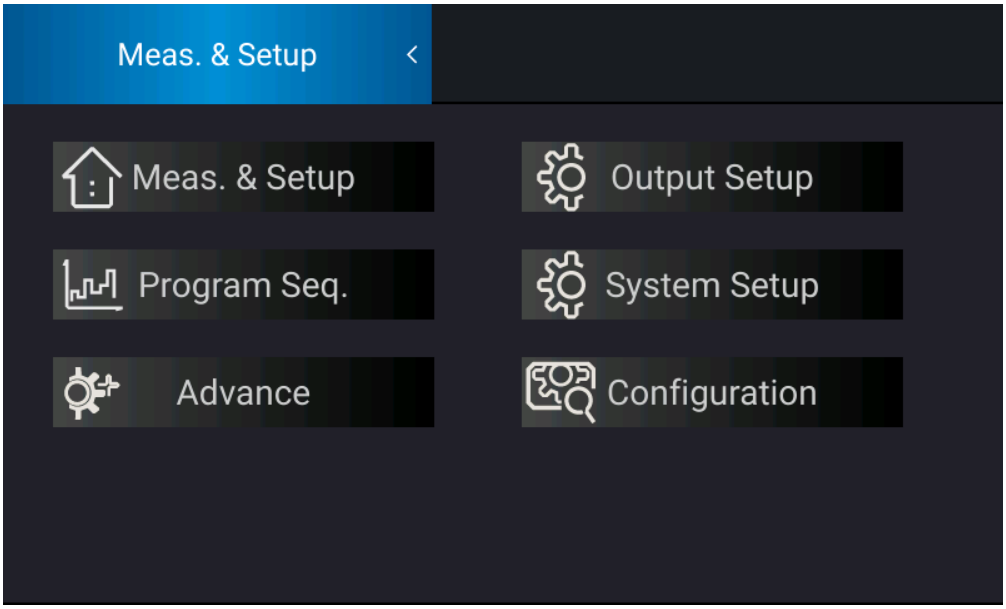


Figure 3-1

3.2.1 Meas. & Setup

3.2.1.1 Source & Load Mode

There are two ways to set the output voltage (CV MODE).

Method 1:

1. Tap V next to the numbers of Vset, and the touch panel will switch to a numeric keypad as Figure 3-2 shows.
2. Use the numeric buttons（0 ~9）to set the value and tap "" to complete the voltage setting.
3. Press "" to output the set voltage. (Be noted that to maintain the output in CV mode the current setting must be larger than the load current, otherwise the output voltage will not equal the set voltage.)

Method 2:

1. Tap on the panel to use the "Rotary" ( ) knob and tap V next to the numbers of Vset, the cursor at the lower right of the number on the main screen will flicker.
2. When using the "Rotary" ( ) knob for setting, pressing the knob can move the cursor to an individual digit, and then turn the rotary knob to increase or decrease the set value.
3. Press "" to output the set voltage. (Be noted that to maintain the output in CV mode the current setting must be larger than the load current, otherwise the output voltage will not equal the set voltage.)

Figure 3-2

Following is the way to set the current (LOAD CC MODE):

Tap A next to the numbers under Source, and the rest of the settings are the same as shown in Figure 3-3.

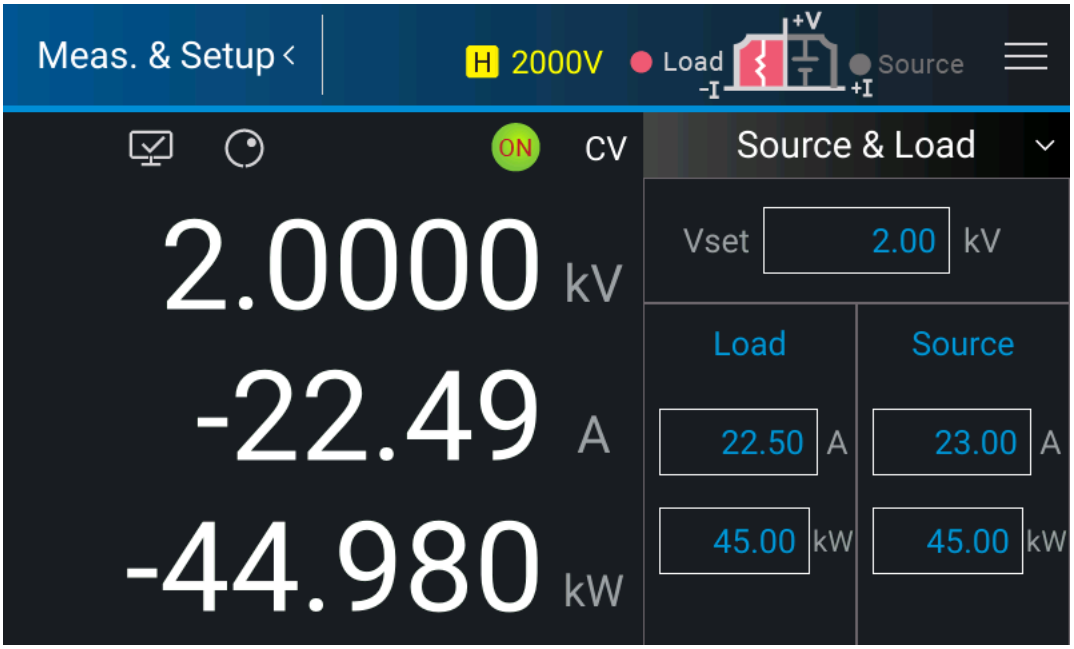


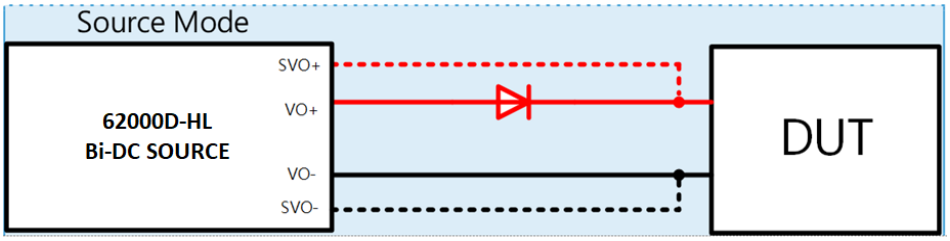
Figure 3-3

3.2.1.2 Source Mode

Following is the way to set Source Mode:

1. Tap the drop-down menu and select Source Mode; the panel will switch to the screen as Figure 3-4 shows.
2. The rest settings are the same as Source & Load Mode.

⚠WARNING In Source Mode, a negative current will still be generated even when the output is reversed. (It is recommended to add a blocking diode when connected to the source.)



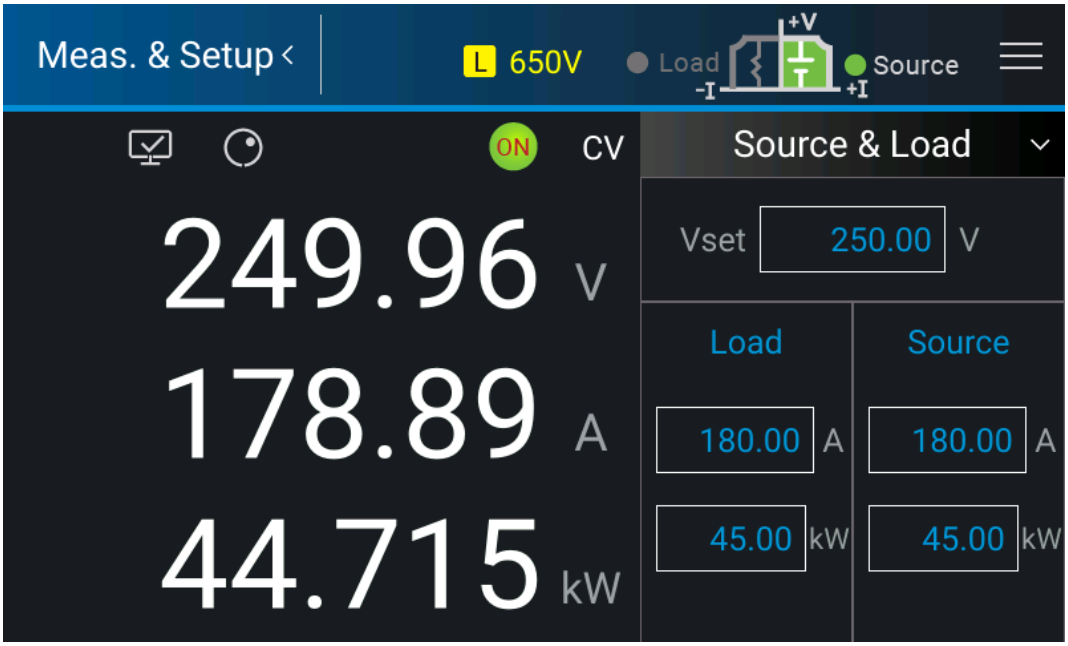


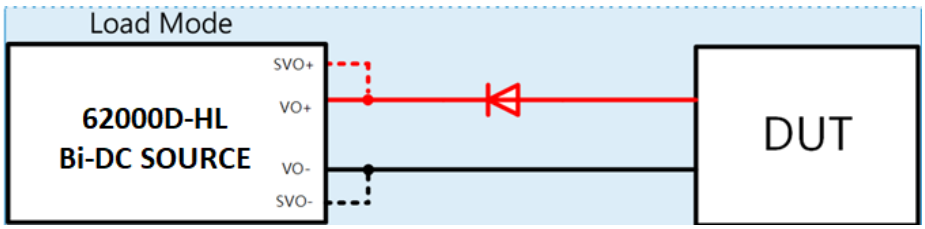
Figure 3-4

3.2.1.3 Load Mode

The following describes how to set Load Mode:

1. Tap the drop-down menu and select Load Mode; the panel will switch to the screen as Figure 3-5 shows.
2. The actual loading current is I=Vo/R, thus the minimum calculated from the set value is the actual loading current as Figure 3-6 shows.
   Ex: When the Iset is 25A, the Cr calculating result is Io=20A, the maximum of Io is controlled by the Io of CR, so Io=20A. On the contrary, if the calculation result of Cr is Io=30A, then Io will be limited to 25A by Iset.
3. The rest of the settings are the same as Source & Load Mode.

⚠WARNING In Load Mode, a positive current will still be generated even when the output voltage drops suddenly. (It is recommended to add a blocking diode at the customer site.)



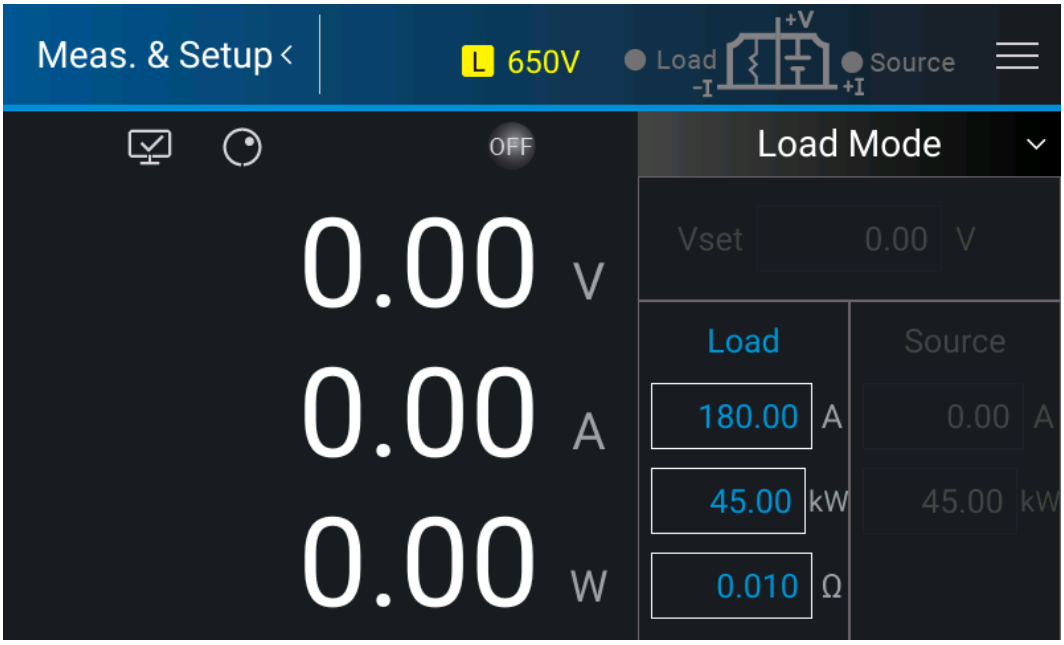


Figure 3-5

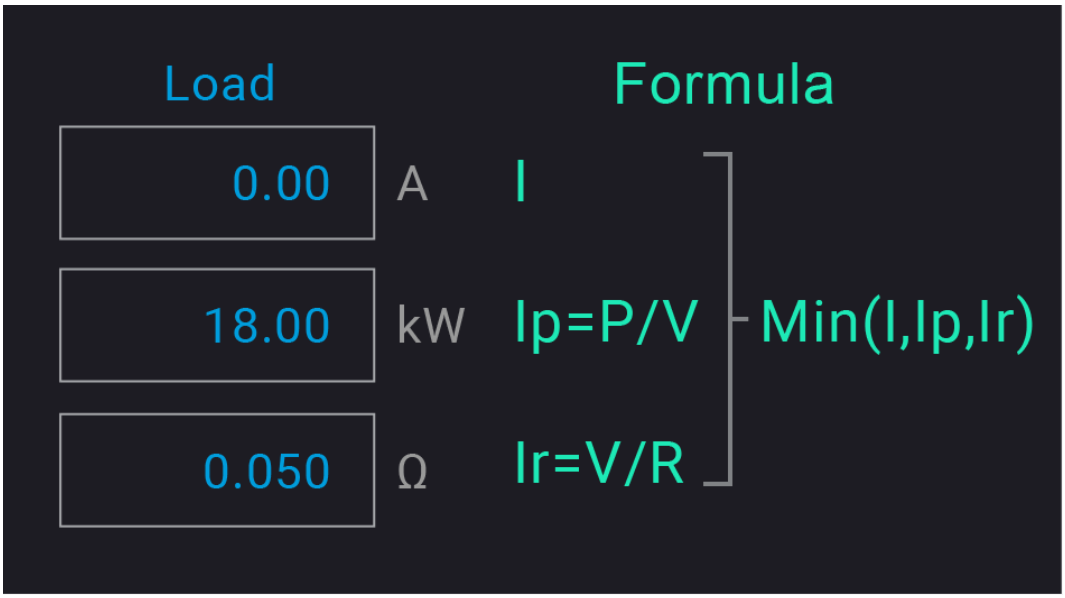


Figure 3-6

3.2.2 Output Setup

Tap “Output Setup” in the Menu screen to enter the setup page as Figure 3-7 shows.

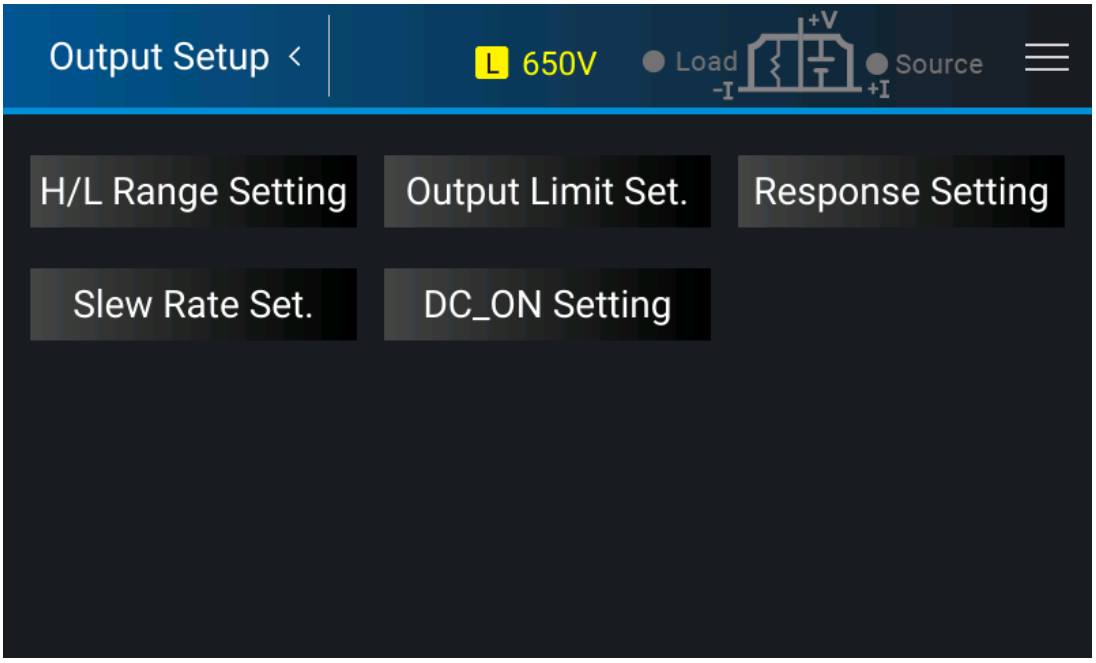


Figure 3-7

Notice The values (for reference only) in Figure 3-7 are not the default settings of the DC power supply.

3.2.2.1 H/L Range Setting

The panel operation can switch voltage levels in two ways

First, tap the yellow icon (L 650V or H 2000V) directly in the middle on the upper panel.
Second, tap “H/L Range Setting” from the “Output Setup” page.

(1) High range: The output range of the voltage is 0~2000V and the current is -60~60A.
(2) Low range: The output range of the voltage is 0~650V and the current is -180~180A.

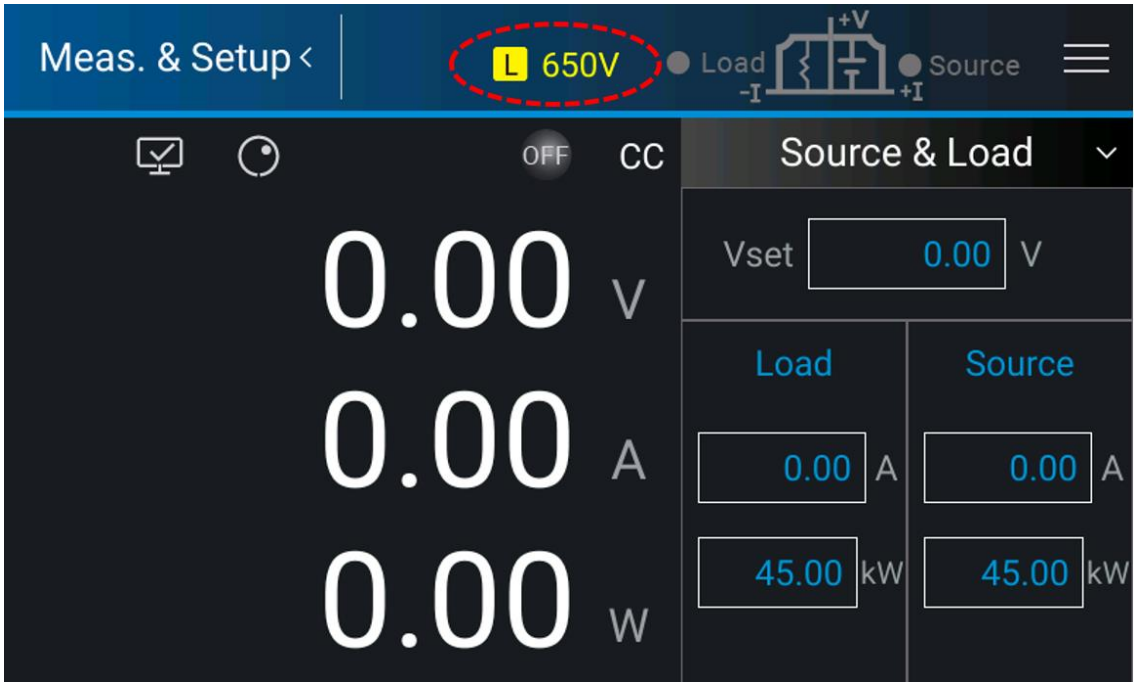


Figure 3-8 Setting H/L Range via Shortcut Key

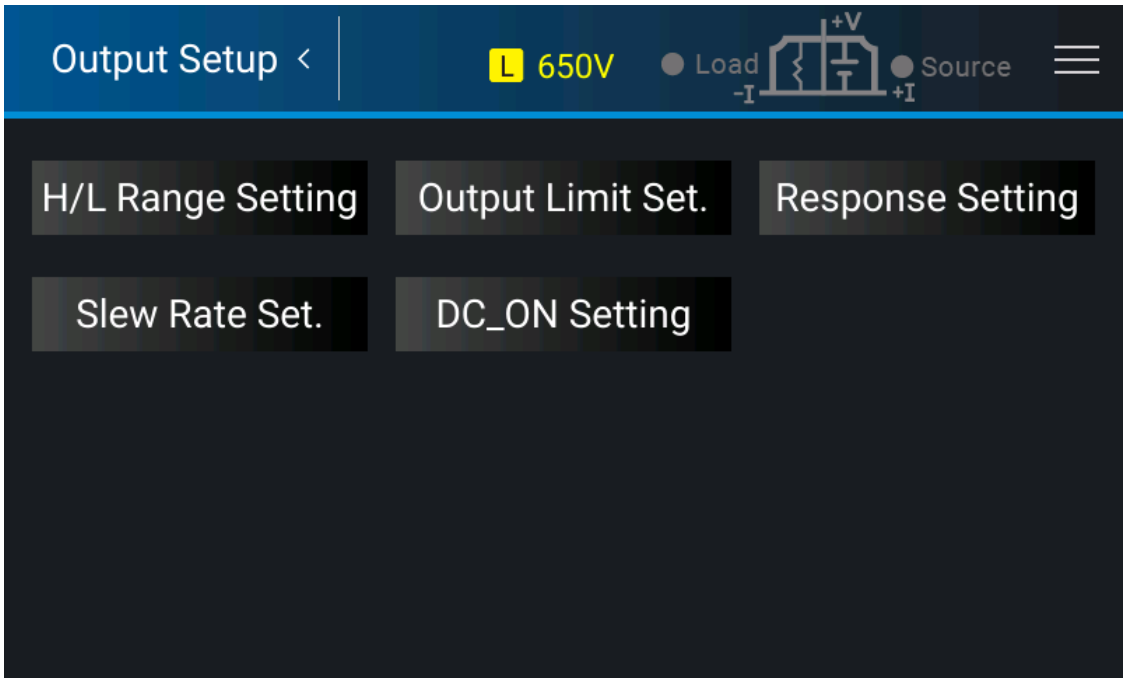


Figure 3-9 Setting H/L Range via Output Setup Menu

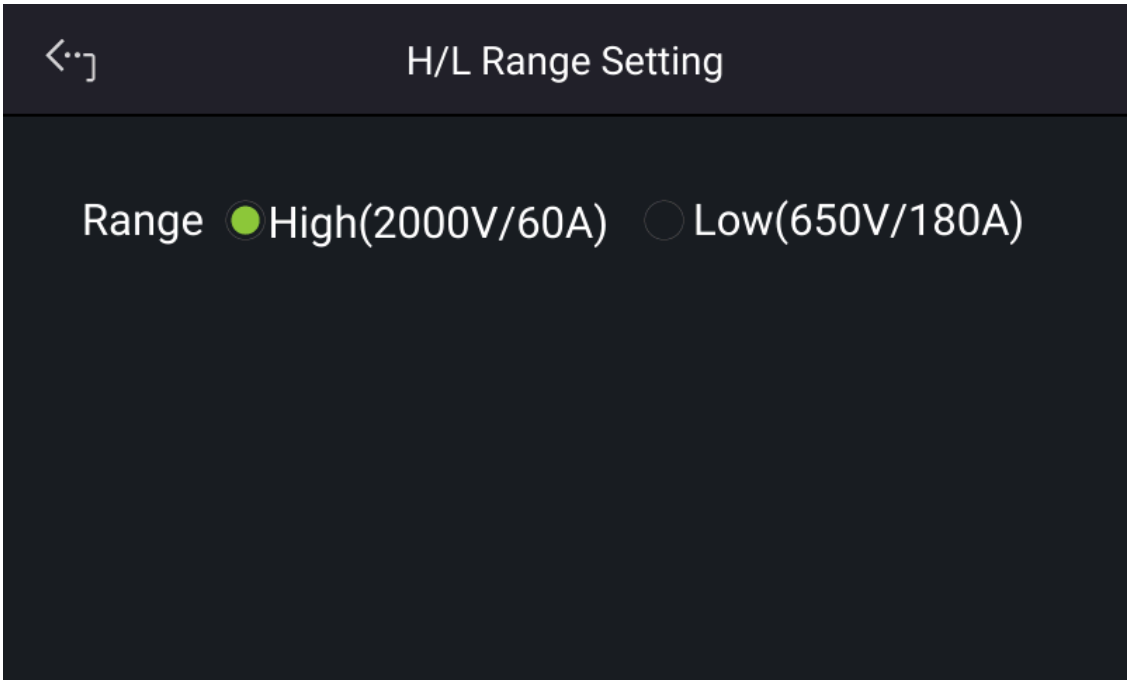


Figure 3-10 Setting H/L Range

3.2.2.2 Response CV

- Slow: This option reduces the voltage output response speed with a higher priority on output stability.
- Fast: This option increases the voltage output response speed with a higher priority on output response speed (default at power on).

3.2.2.3 Response CC

- Slow: This option reduces the current output response speed with a higher priority on output stability.
- Fast: This option increases the current output response speed with a higher priority on output response speed (default at power on).

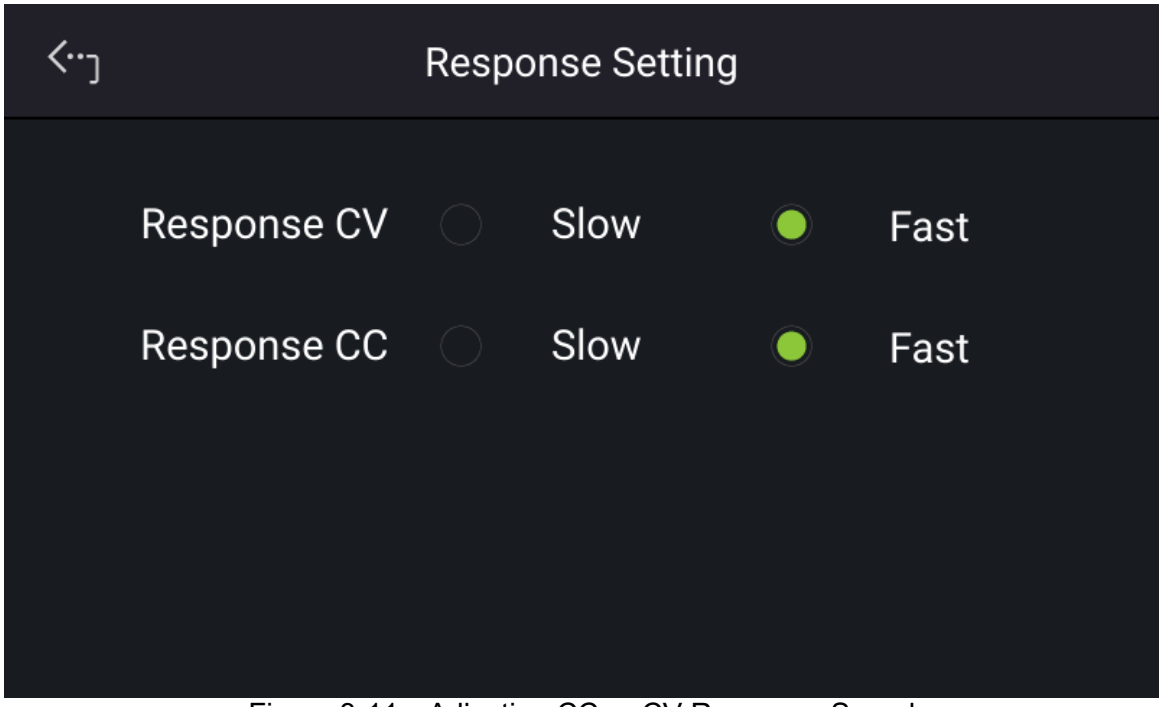


Figure 3-11 Adjusting CC or CV Response Speed

3.2.2.4 V Limit

Select the V Limit Max/Min corresponding space to set the value.

Use this option to narrow down its range by setting the MIN and MAX. When setting the output voltage, the DC power supply allows setting the voltage within the range of [MIN value ≤ user-defined value ≤ MAX value] which is V LIMIT: MAX=100V, MIN=20V. If the setting exceeds the output voltage 110V set by the user, the BUZZER will beep one time (if BUZZER is set to ON) and the main screen will automatically prompt a warning message.

3.2.2.5 I Limit

Select the I Limit Max/Min corresponding space to set the value.

Using this option can narrow down its range by setting the MIN and MAX. When setting the output current, the DC power supply allows setting the current within the range of [MIN value ≤ user-defined value ≤ MAX value] which is I LIMIT: MAX=20A, MIN=2A. If the setting exceeds the output current 21A set by the user, the BUZZER will beep one time (if BUZZER is set to ON) and the main screen will automatically prompt a warning message.

3.2.2.6 P Limit

Select the P Limit Max/Min corresponding space to set the value.

Using this option can narrow down its range by setting the MIN and MAX. When setting the output power, the DC power supply allows setting the current within the range of [MIN value ≤ user-defined value ≤ MAX value] which is P LIMIT: MAX=20W, MIN=2W. If the setting

exceeds the output current 21W set by the user, the BUZZER will beep one time (if BUZZER is set to ON) and the main screen will automatically prompt a warning message.

3.2.2.7 V SLEW RATE

Tap “Slew Rate Set.” on the “Output Setup” page to show as Figure 3-12.

Figure 3-12

1. Select the V slew rate corresponding space to set the value.
   The output voltage slew rate of the DC power supply is set as follows. The maximum input Slew Rate is 2000V/ms and the minimum is 0.0001V/ms. The output of the DC power supply will follow the slew rate to rise to the set output voltage while the fall slew rate is limited by the load. (See Figure 3-13 for the calculation formula.)

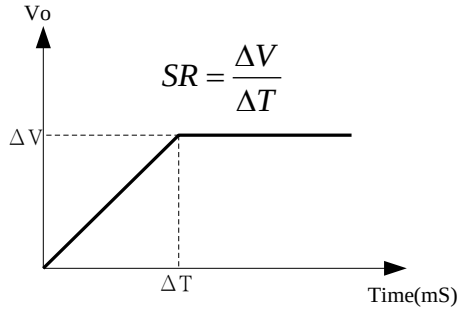


Figure 3-13

Notice The minimum transient time is (△T) = 0.5 ms.

3.2.2.8 I SLEW RATE

1. Select the I slew rate corresponding space as shown in Figure 3-12 to set the value.
2. The output current slew rate of the DC power supply is set as follows. The maximum input Slew Rate is 90A/ms and the minimum is 0.0001A/ms. The output of the DC power supply will follow the slew rate to rise to the set output current. (See Figure 3-14 for the calculation formula.)

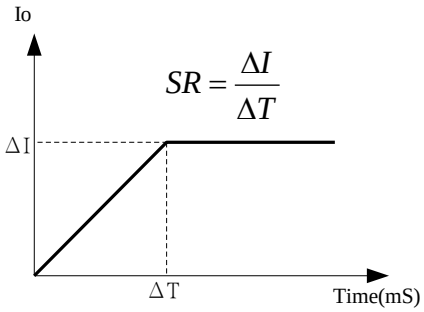
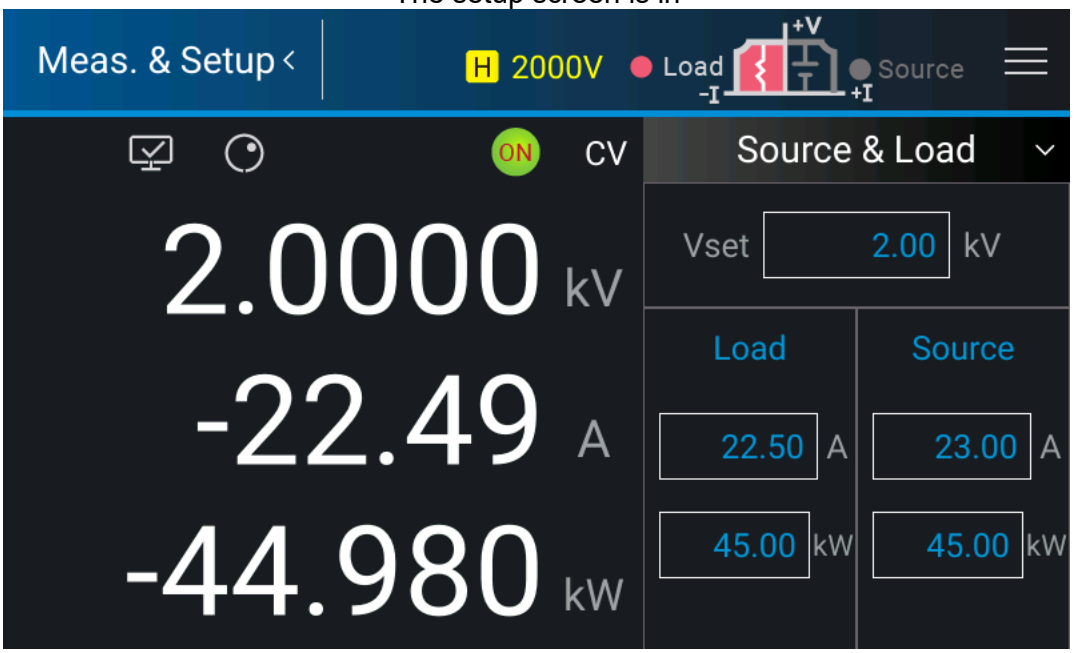


Figure 3-14

3.2.2.9 P SLEW RATE

The setup screen is in



1. Figure 3-3. Click the Psource/Pload mapping column and input the setting value.
2. This option is to set the slew rate of the DC power supply's output power. The definition of the fixed Slew Rate is 1W/ms, and the output power of the DC power supply is set based on this slew rate. (See Figure 3-15 for the calculation formula.)

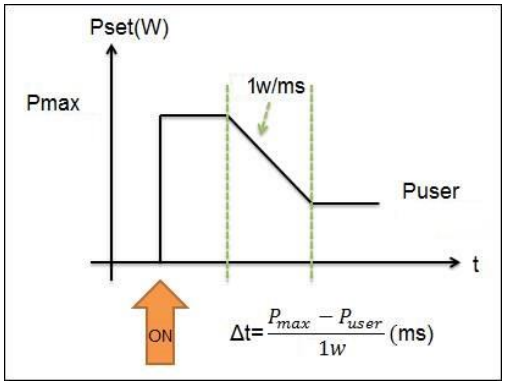


Figure 3-15

3.2.2.10 DC_ON

When the DC power supply is ON and the voltage is over VDC_R, the pin10 DCOUT_ON of the ANALOG INTERFACE on the rear panel will turn to HIGH; also when the DC power supply is OFF and the voltage is lower than VDC_F, the pin1 DCOUT_ON of the ANALOG INTERFACE on the rear panel will turn to LOW, allowing you to use them for other purposes as Figure 3-16 shows:

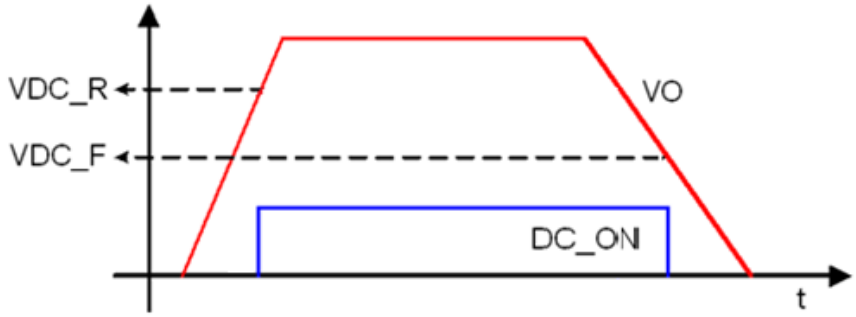


Figure 3-16

Set DC_ON as described below:

1. The setting page is shown in Figure 3-7. Use the touch panel to enter the value. The low limit of DC_ON RISE/FALL is 0V and the high limit is 600V.
2. Tap the upper left corner on the touch panel and select the menu item.
3. Tap “MEAS. & Setup” to return to the main page.

3.2.2.11 IV CURVE Parameter

The setting columns in the IV Curve Parameter can modify the parameters of the IV curve such as Control Mode, Input Filter, Output Speed, and Setting Margin as shown in Figure 3-17. These IV curve parameter settings can adjust the IV curve algorithm in Table mode, SAS mode, and IV Program.

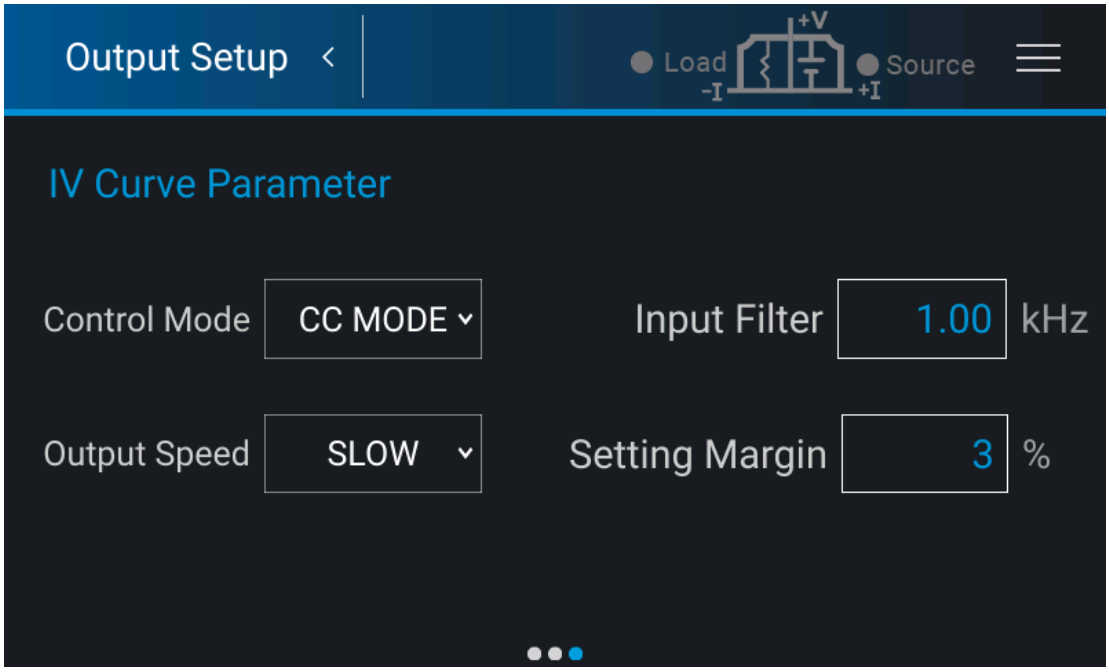
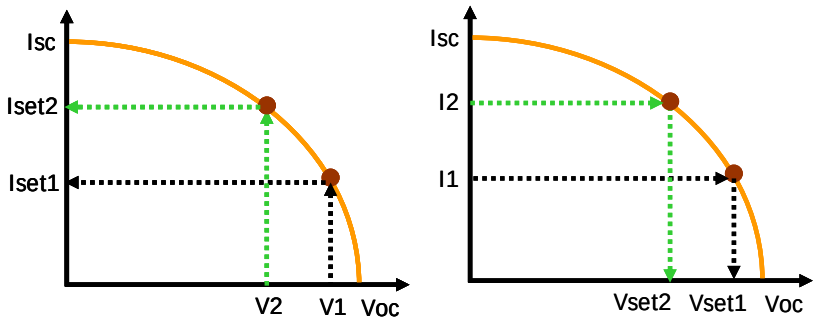


Figure 3-17

(**Note:** This is an optional function setting screen. If SAS is not selected, the setting parameter will be grayed out.)

3.2.2.11.1 Setting Control Mode

When the DC Power Supply is operated in IV mode, the control mode will affect the setting values and measuring object of the IV curve. When set to CC mode, the DC Power Supply will measure the output voltage using the current value that corresponds to the IV curve as the control current to draw the set IV curve Figure 3-18 (a) shows. If set to CV mode, the DC Power Supply will measure the output current using the voltage value that corresponds to the IV curve as the control voltage to draw the set IV curve as Figure 3-18 (b) shows.



(a) CC Mode (b) CV Mode

Figure 3-18

Tap the Control Mode column to set CC MODE or CV MODE. The default setting is CC MODE.

3.2.2.11.2 Setting Input Filter

The Input Filter in IV mode can utilize the measured signal through this digital filter for IV curve calculation. For example, assuming the measured voltage waveform has a 20kHz ripple and when the input filter is set to 1kHz, it can filter 20kHz of the ripple component.

Tap the Input Filter column and set the filter frequency ranging from 1~ 1kHz. The default is 1kHz.

3.2.2.11.3 Setting Output Speed

The Output Speed indicates the output response speed of the IV curve, which has FAST, MIDDLE, and SLOW available for setting.

Tap the Output Speed column to set the speed. The default setting is SLOW.

3.2.2.11.4 Setting Margin

The Setting Margin indicates the margin of the non-controllable setting in the IV curve. For example, the non-controllable is the voltage setting when set to CC mode and the current setting when set to CV mode. To ensure that the control mode can maintain a fixed mode, the value of this item needs to be greater than 3%.

Tap the Setting Margin column to set the percentage. The default setting is 3%.

3.2.3 System Setup

On the Menu page, tap “System Setup” to enter into the screen as Figure 3-19 shows.

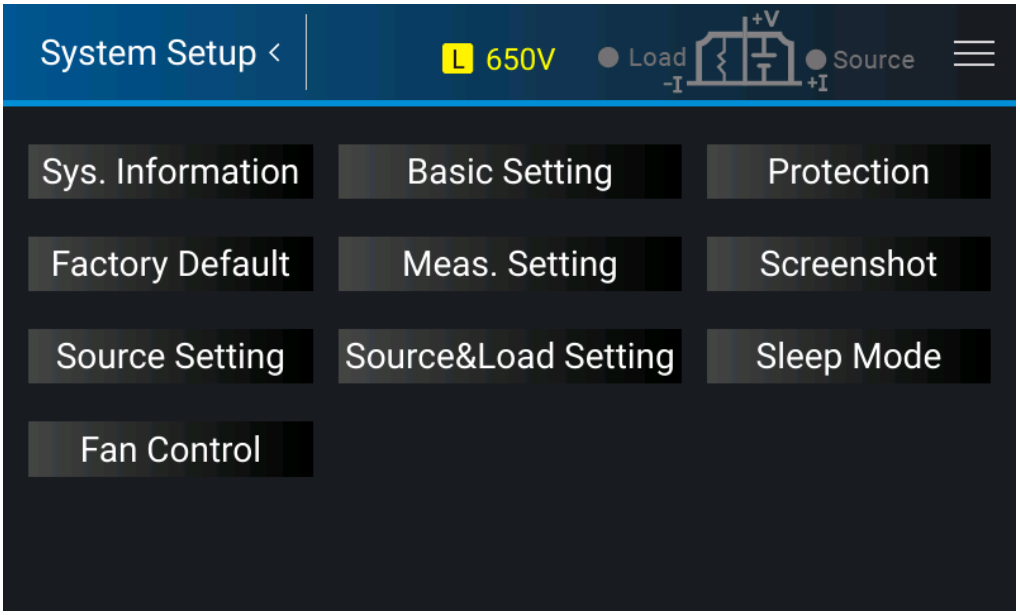


Figure 3-19

3.2.3.1 System Information

This function allows you to learn the firmware information of the DC power supply. Tap “Sys. Information” to access it.

The display of each item is explained as follows:

Device Model	:	Displays the power supply model no. as shown in Figure 3-20.
Serial No.	:	Displays the device serial no. as shown in Figure 3-20.
Host	:	Displays the version of D board firmware, CPLD, PCB, and UI as shown in Figure 3-20.
AD1~AD3	:	Displays the firmware version no. of the front stage module as shown in Figure 3-21.
DD1~DD3	:	Displays the firmware, CPLD, and PCB version no. of the rear stage module as shown in Figure 3-22.

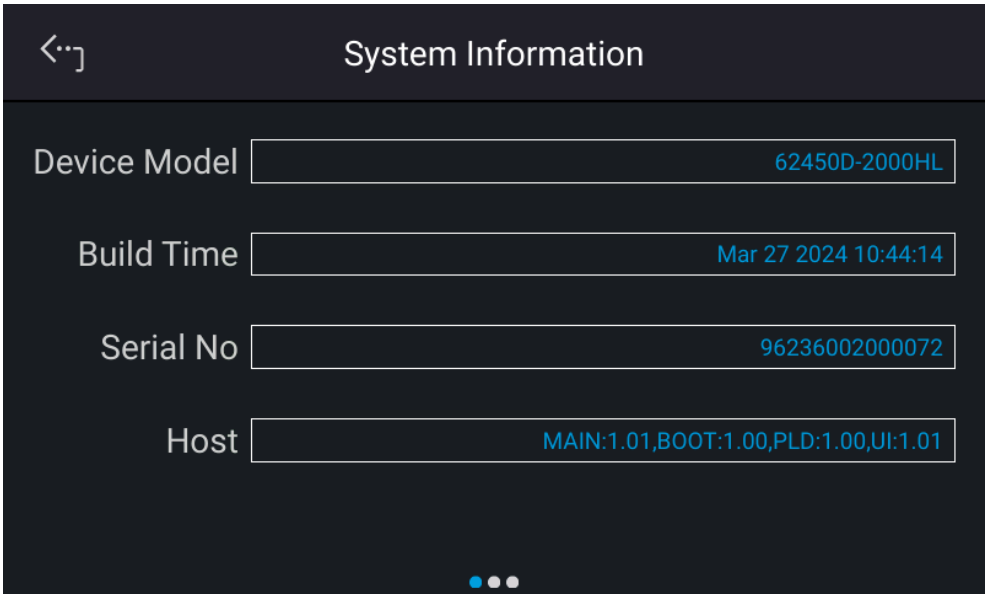


Figure 3-20

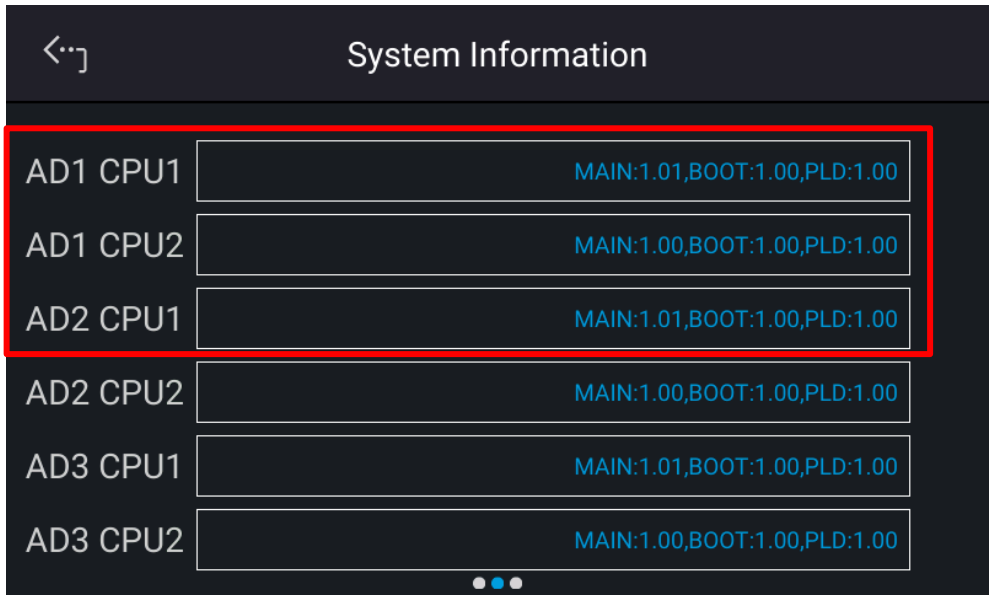


Figure 3-21

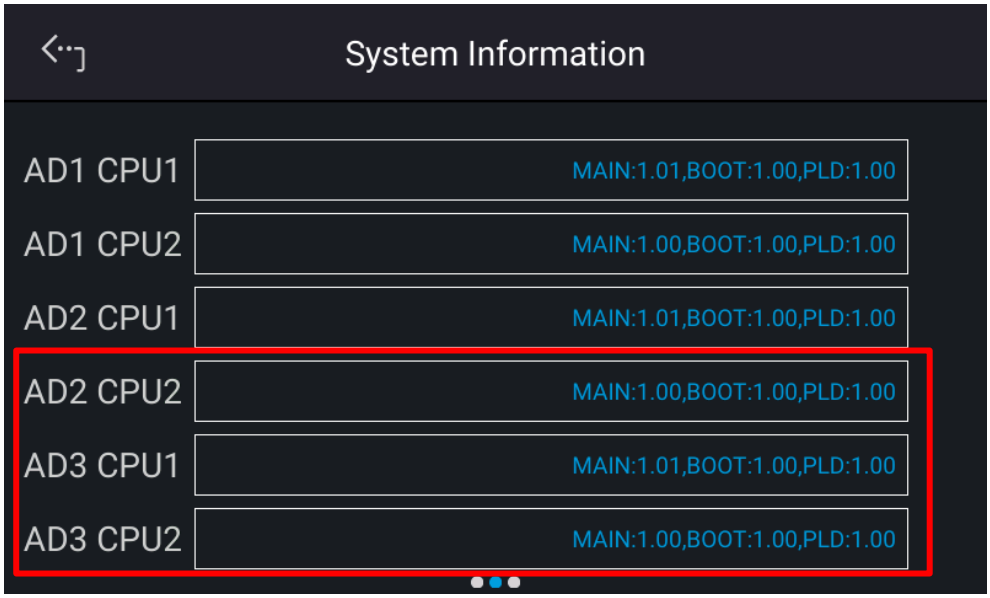


Figure 3-22

3.2.3.2 Factory Setup

This function lets you reset the DC power supply to its factory default settings.

1. On the Menu page, tap “System Setup” and select “Factory Default”, the screen appears as Figure 3-23 shows.

2. Tap Recall Factory Default, a warning message will prompt as Figure 3-24 shows. It will remain the last configuration settings saved by you if No is selected, and return all configurations to the factory default if Yes is selected.

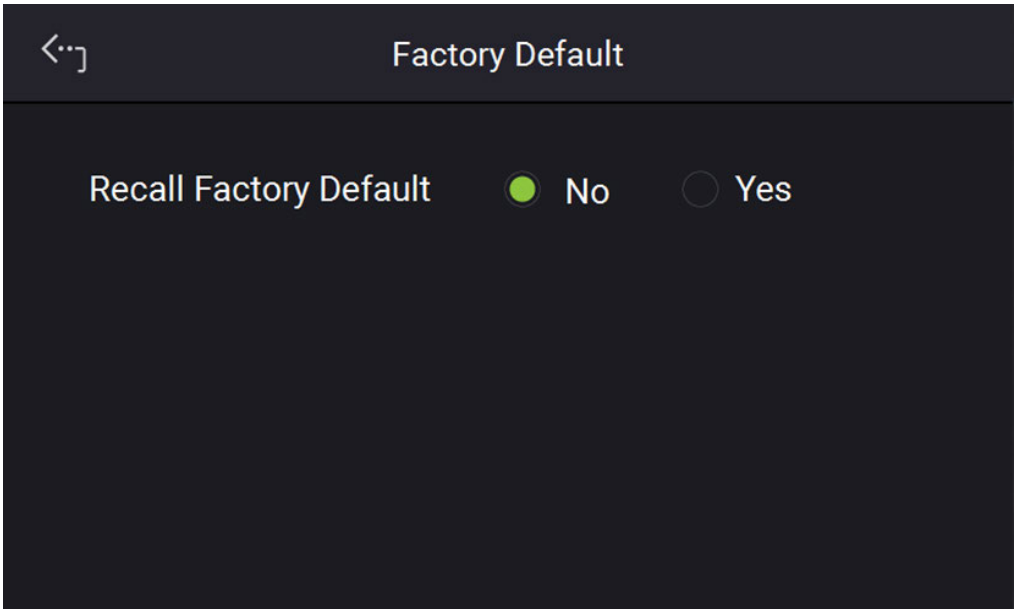


Figure 3-23

Figure 3-24

3.2.3.3 Basic Setting

This function allows you to set the brightness of the backlight, language, buzzer, time, and date. On the Menu page, tap “System Setup” and select “Basic Setting”, the screen will appear as Figure 3-25 or Figure 3-26 shows.

1. Tap Backlight to set its brightness.

Notice

1. There are 3 selections for BRIGHTNESS: **HIGH /NORMAL/ DIMMED**, the default is **HIGH**.
2. The lower the backlight brightness, the longer the display panel life. Thus, it is suggested to turn the backlight brightness to **DIMMED** when the device is doing burn-in to prolong the product life of the VFD display.

2. Tap Language to set the desired language.

3. The buzzer sounds when the touch panel or the rotary knob on the front panel is tapped or turned to remind the user. It can be turned off if it is not necessary. (The default is ON.)

Notice

1. BUZZER has two options: ON / OFF.
2. When the BUZZER is set to ON, press any key or turn the rotary knob will beep once to remind the user.
3. When the BUZZER is set to ON, the BUZZER will beep continuously if system protection occurs to remind the user.
4. When BUZZER is set to OFF then it will not beep in any situation.

4. Swipe the “Basic Setup” page left to set “Time” and “Date” in the format of hh:mm:ss and yyyy-mm-dd as shown in Figure 3-26.

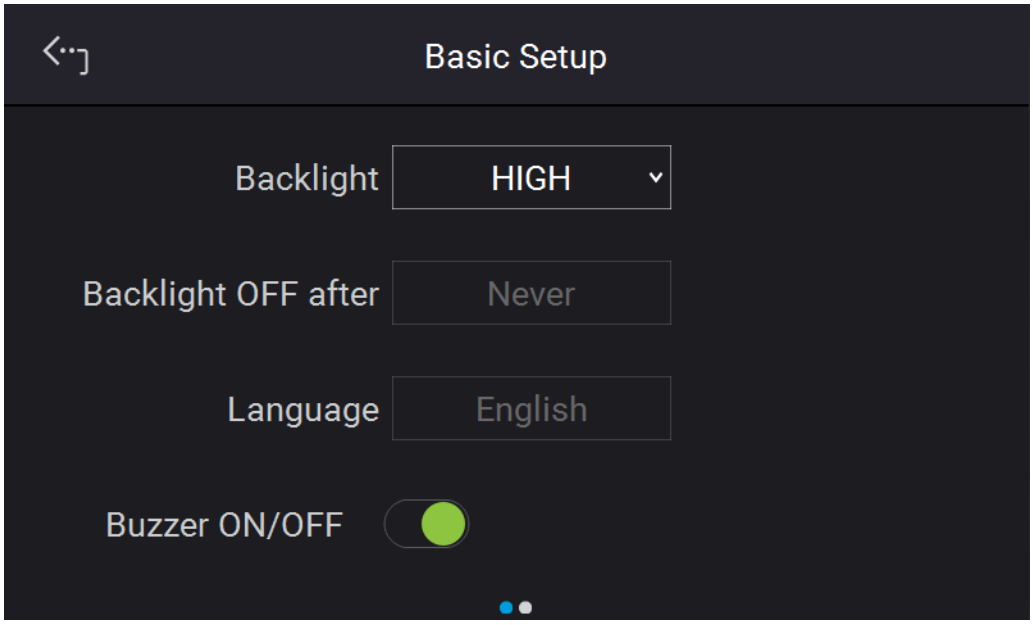


Figure 3-25

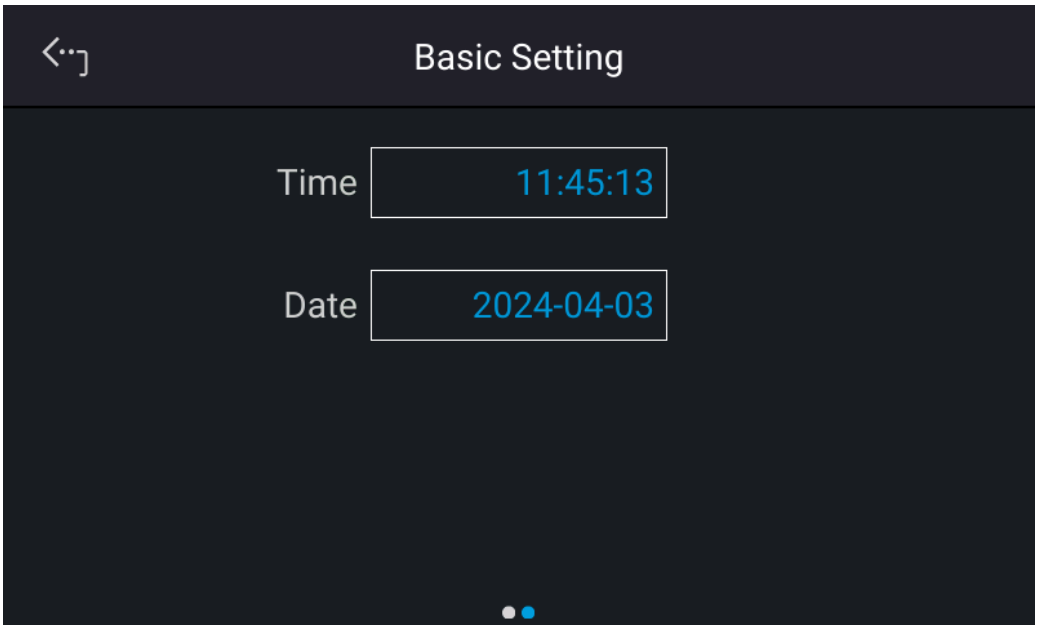


Figure 3-26

3.2.3.4 Protection

Chroma 62000D-HL Series DC Power Supplies have complete protection functions divided into two classes. The first type of protection includes over voltage, over current, over power, and FOLDBACK; while the second type of protection includes over temperature, fan failure, and over/under input voltage. The first class protection trigger point is set by the user as described below, while the second class protection is auto-detected by the system hardware protection circuit.

On the “System Setup” page, select “Protection” to set each protection as shown below. The first page sets the OVP, OCP, OPP, and Foldback as Figure 3-27 shows.

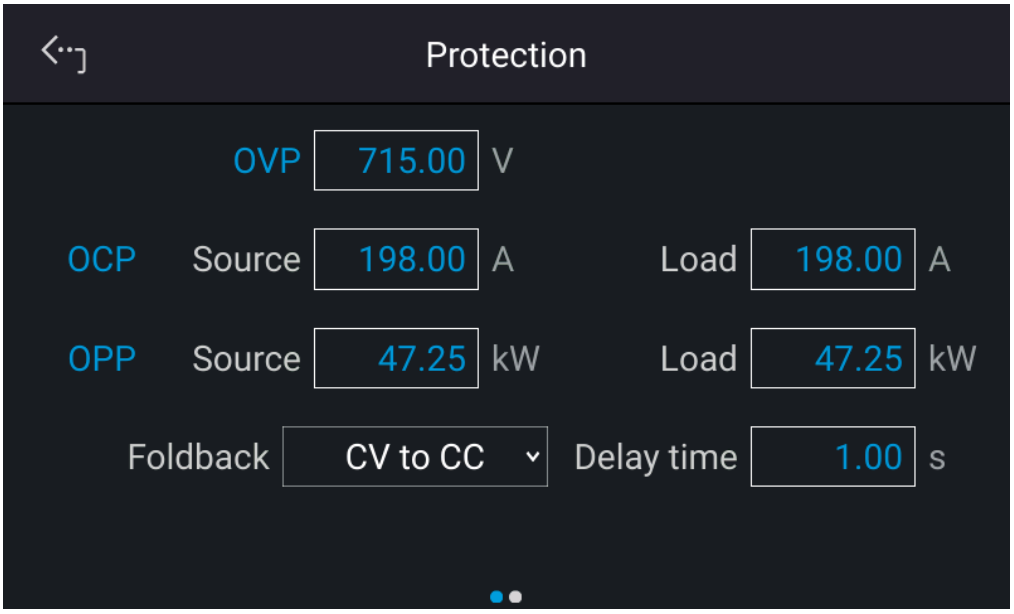


Figure 3-27

3.2.3.4.1 OVP

Use the touch panel to set OVP. This function sets the protection point for Over Voltage. Once the output voltage exceeds the range, it will turn off the output that is OUTPUT = OFF to protect the unit under test.

Notice

Table 3-1 shows the voltage range of OVP.

Table 3-1

Model	Min. OVP (V)	Max. OVP (V)
62xxxD-xxxxHL	0	1.10 x Vo_MAX

When OVP occurs the main page will prompt a protect message as Figure 3-28 shows. Tap "Confirm" to return to the setup page.

Figure 3-28

3.2.3.4.2 OCP

Use the touch panel to set OCP 132.00. This function sets the protection point for Over Current. Once the output current exceeds the range, it will turn off the output that is OUTPUT = OFF to protect the unit under test.

There are A/D and D/D over current protections. The A/D OCP occurs when the device internal is having an overcurrent while the D/D OCP occurs when the output terminal is having an overcurrent.

Notice Table 3-2 shows the current range of OCP.

Table 3-2

Model	Min. OCP (A)	Max. OCP (A)
62xxxD-xxxxHL	0	1.10 x Io_MAX

When OCP occurs the main page will prompt a protect message as Figure 3-29 shows. Tap "Confirm" to return to the setup page.

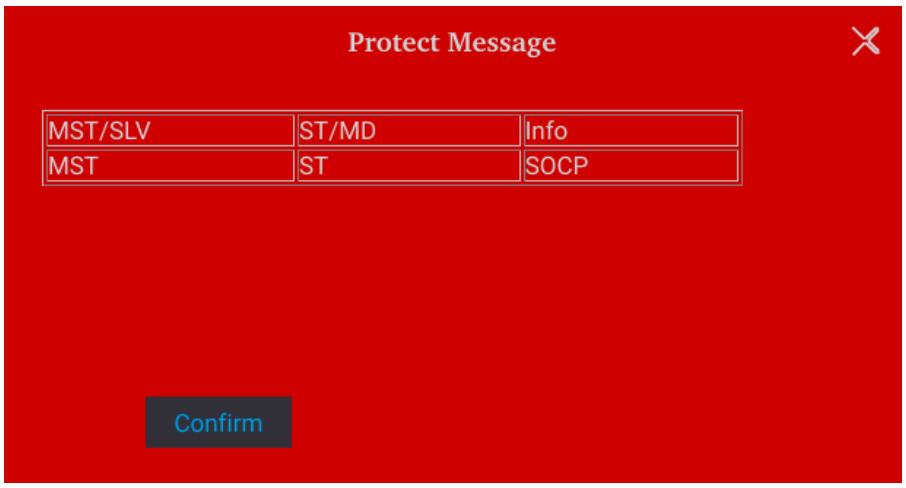


Figure 3-29

3.2.3.4.3 OPP

Use the touch panel to set OPP. This function sets the protection point for Over Power. Once the output power exceeds the range, it will turn off the output that is OUTPUT = OFF to protect the unit under test.

Notice Table 3-3 shows the power range of OPP.

Table 3-3

Model	Min. OPP (W)	Max. OPP (W)
62xxxD-xxxxHL	0	1.05 x Po_MAX

When OPP occurs the main page will prompt a protect message as Figure 3-30 shows. Tap "Confirm" to return to the setup page.

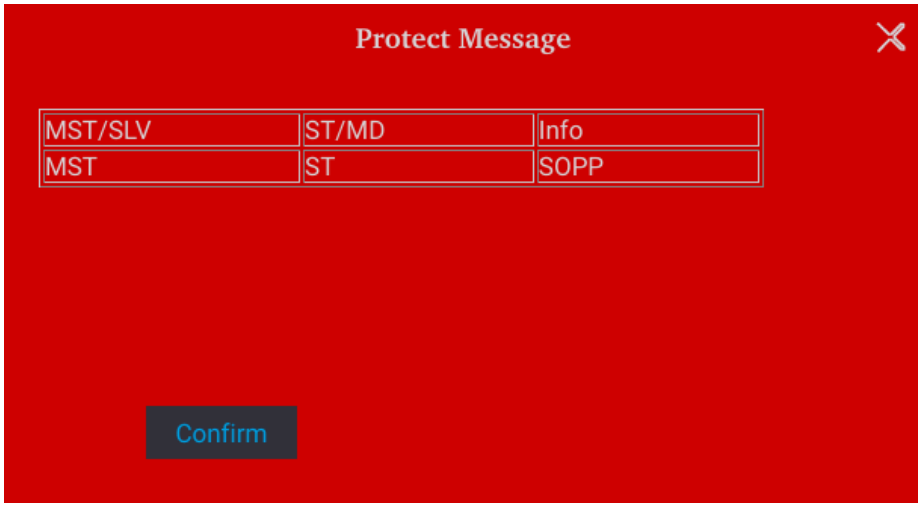


Figure 3-30

3.2.3.4.4 SAFETY INT.LOCK

This function allows you to control the DC power supply to be OFF temporarily through the Pin 3 (Interlock) of ANALOG INTERFACE.

1. Use the touch button to set Safety Int. Lock mode to disable or enable as Figure 3-31 shows.

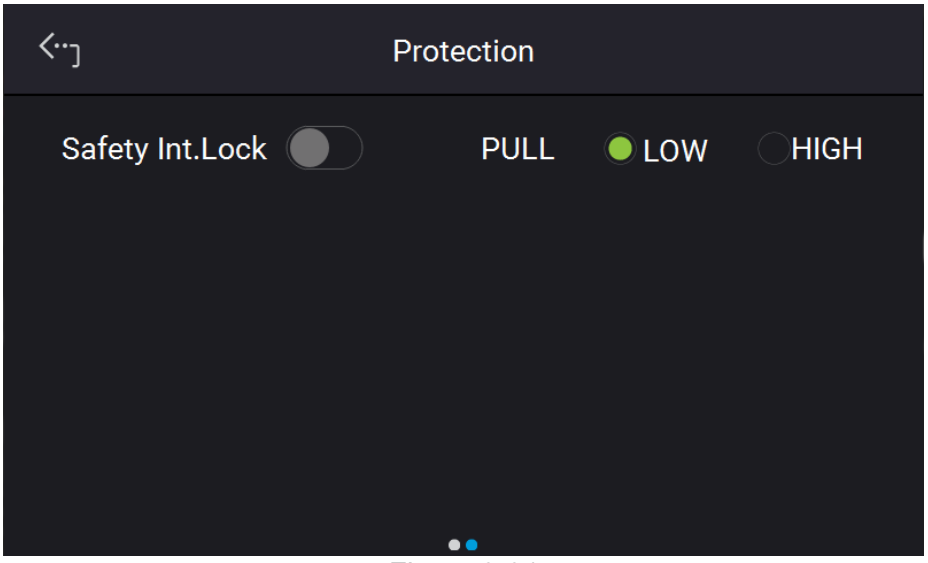


Figure 3-31

(1) Set to disable: It closes this function.
(2) Set to enable: It enables the Safety Int. Lock. The DC power supply's ON/OFF is still controlled by "". When the PIN 3 of ANALOG INTERFACE is at a low level, it indicates the power supply is outputting normally and when it is at a high level, it closes the power supply output temporarily (the "" is still on) and issues a protection signal. Once Pin 3 of ANALOG INTERFACE is returned to a low level, the DC power supply will continue to output normally.

2. When protection occurs to Safety Interlock the main page will show this protection message as Figure 3-32 shows.

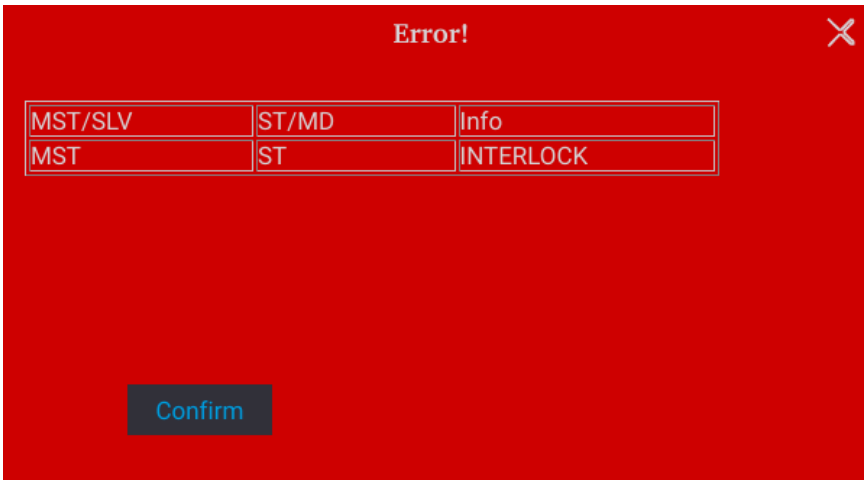


Figure 3-32

3. Pin 3 is the input pin of the TTL Level and can set the initial state to PULL=HIGH or PULL=LOW.

4. When the DC power supply is set to OUTPUT = ON, the detailed actions of the Safety Interlock are shown in Figure 3-33.

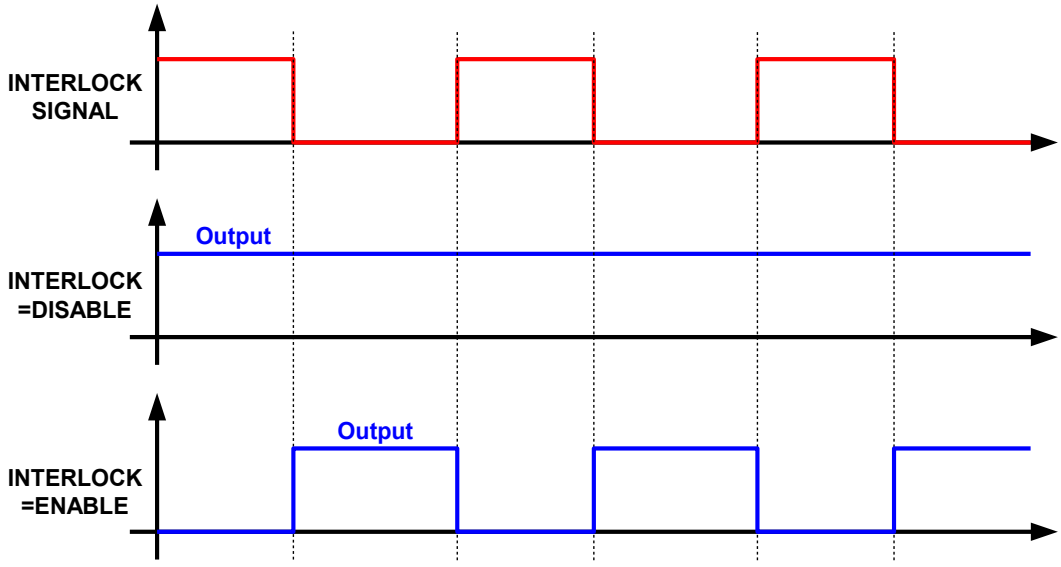


Figure 3-33

3.2.3.4.5 FOLDBACK

This function allows users to turn off the output that is OUTPUT = OFF when changing output mode (CV to CC, or CC to CV) to protect the unit under test as Figure 3-34 shows.

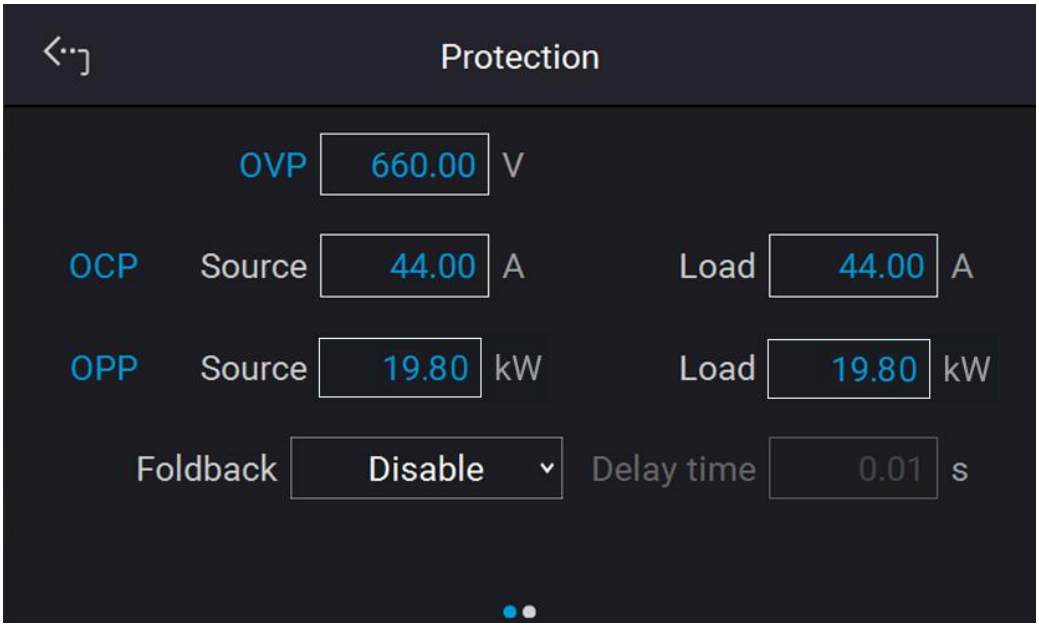


Figure 3-34

1. Use the touch button to set Foldback mode. There are three options available for selection: Disable, CV TO CC, and CC TO CV.

   (1) Disable: Ignore the output close function.
   (2) CV TO CC: Active in CV MODE only. Once the operating mode changes to CC MODE the system will turn off the output to protect the UUT.
   (3) CC TO CV: Active in CC MODE only. Once the operating mode changes to CV MODE the system will turn off the output to protect the UUT.

   When the FOLDBACK option is set to CV TO CC or CC TO CV, a selection for DELAY TIME will prompt beneath for users to set the delay time for protection after changing the mode as Figure 3-35 shows.

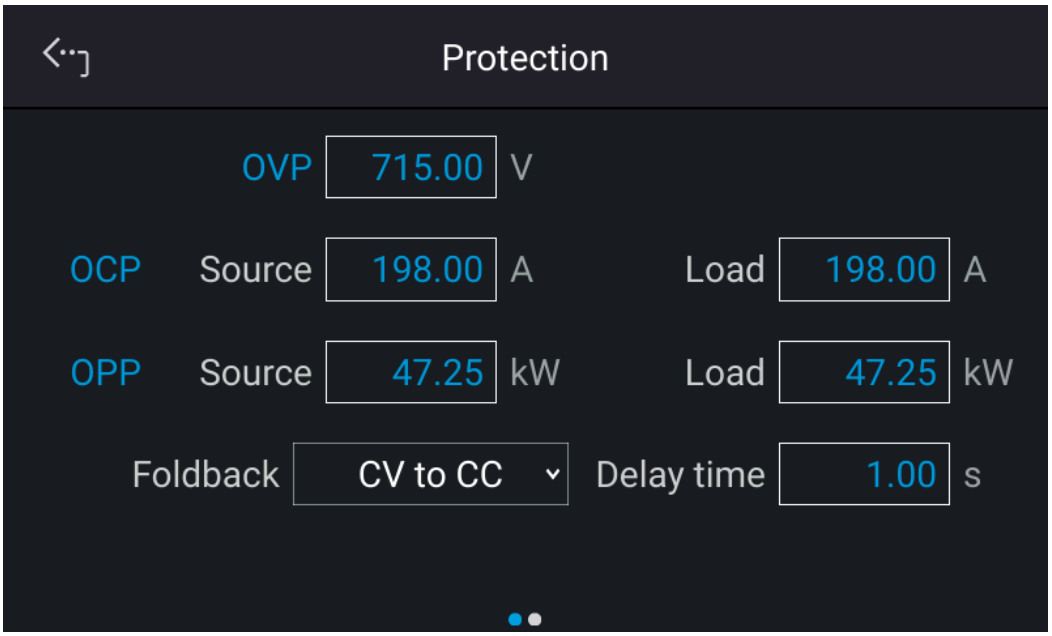


Figure 3-35

When Foldback protection occurs the main page will prompt a Protect Message as Figure 3-36 shows.

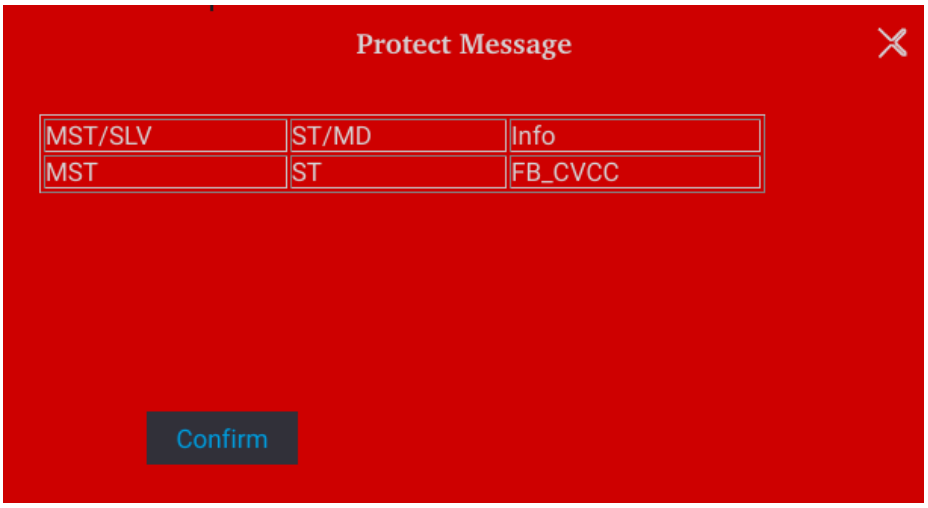


Figure 3-36

Be aware that if the delay time is set to *t* seconds, it means the Foldback that is set to CV TO CC or CC TO CV will not be activated unless it sustains *t* seconds when a mode change is detected. If the change time of mode is less than *t* seconds it will return to its original state and Foldback protection will not occur as Figure 3-37 shows.

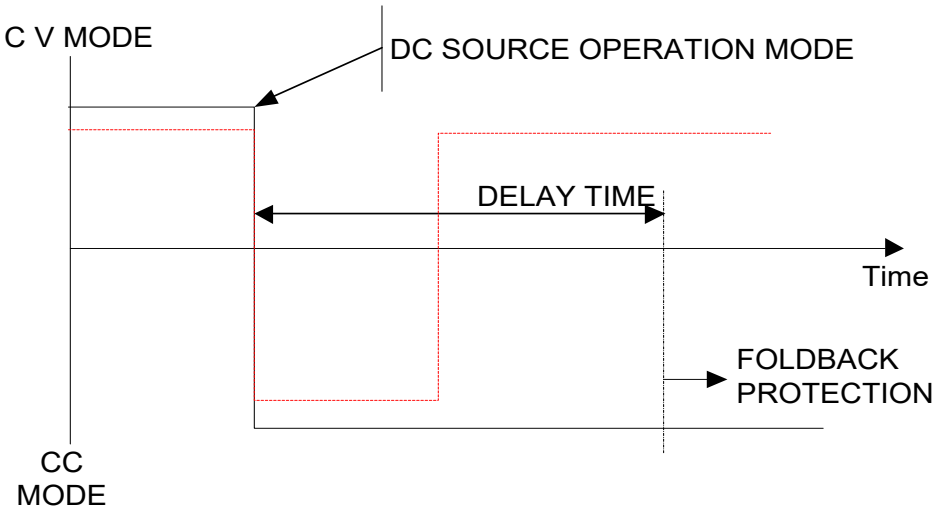


Figure 3-37

Assuming the Foldback is set to CV TO CC, the solid line in Figure 3-37 will create Foldback protection while the dotted line will not.

3.2.3.5 Meas. Setting

1. Tap Meas. Setting to enter into Measurement Setup as Figure 3-38 shows.
2. There are Average Time and Average Method for setting.

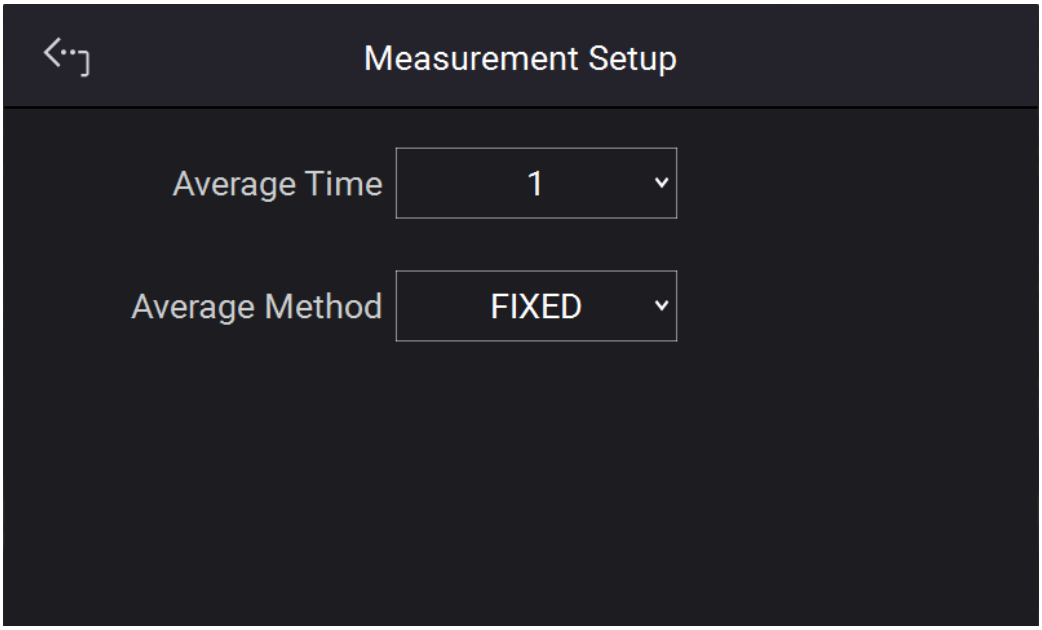


Figure 3-38

The way to change the Reading Average Times is shown in Figure 3-39.

3. Tap the touch screen to set the desired average times. Reading Average Time can be set to 1, 2, 4, and 8.

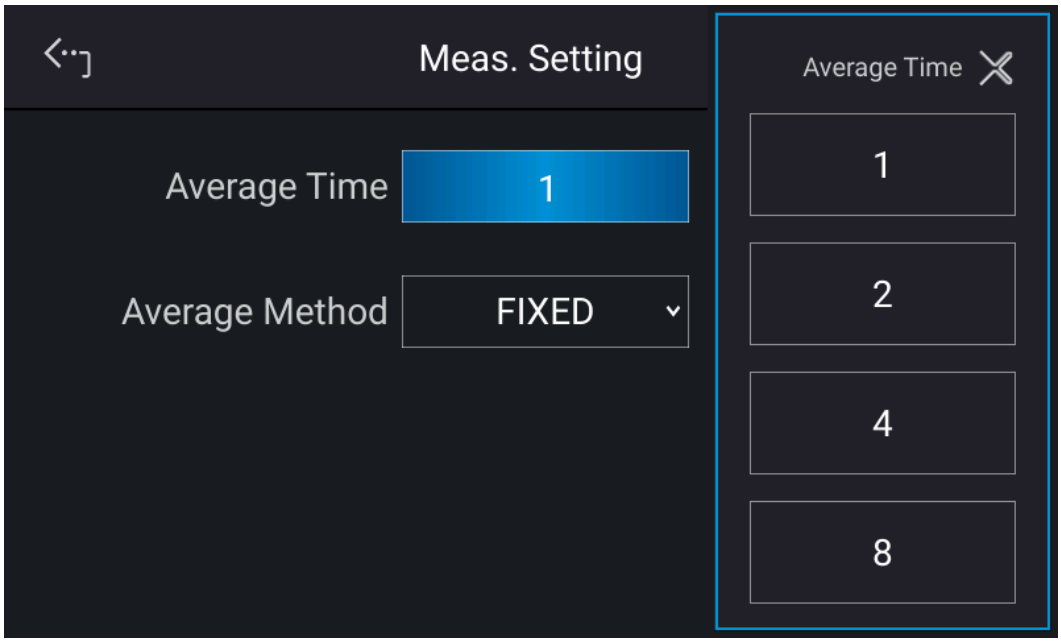


Figure 3-39

Notice

1. Assuming the Reading Average Time is set to = 8, the Average Method is set to FIXED, readings sampling is that the device clears all of the old samples (A1 ~ A8) in the buffer and saves the new samples (B1 ~ B8), then average them in repetition as Figure 3-40 shows.

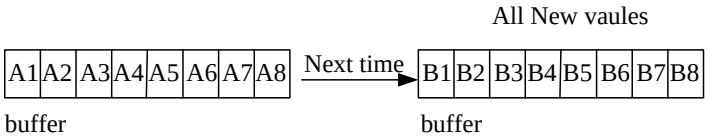


Figure 3-40

2. Assuming the Reading Average Time is set to = 8, the Average Method is set to MOVING, the readings sampling is that the device removes the oldest sample in the buffer and saves a new sample, then averages them in repetition as Figure 3-41 shows.

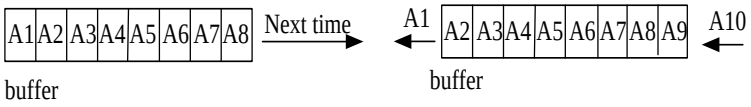


Figure 3-41

3. The panel reading is refreshed at the rate of 200ms.

Following is the way to change the Average Method:

– Tap the touch screen to select the desired average method. The Average Method can be set to FIXED and MOVING as shown in Figure 3-42.

Figure 3-42

3.2.3.6 Screenshot

In Factory Default, tap Screenshot to turn on or off the screen capture gadget. It allows the users to capture the desired screens such as protection or error messages and save them to USB for technical service or RD engineer use. The screen is shown in Figure 3-43 (with a small camera icon appearing in the lower right corner.)

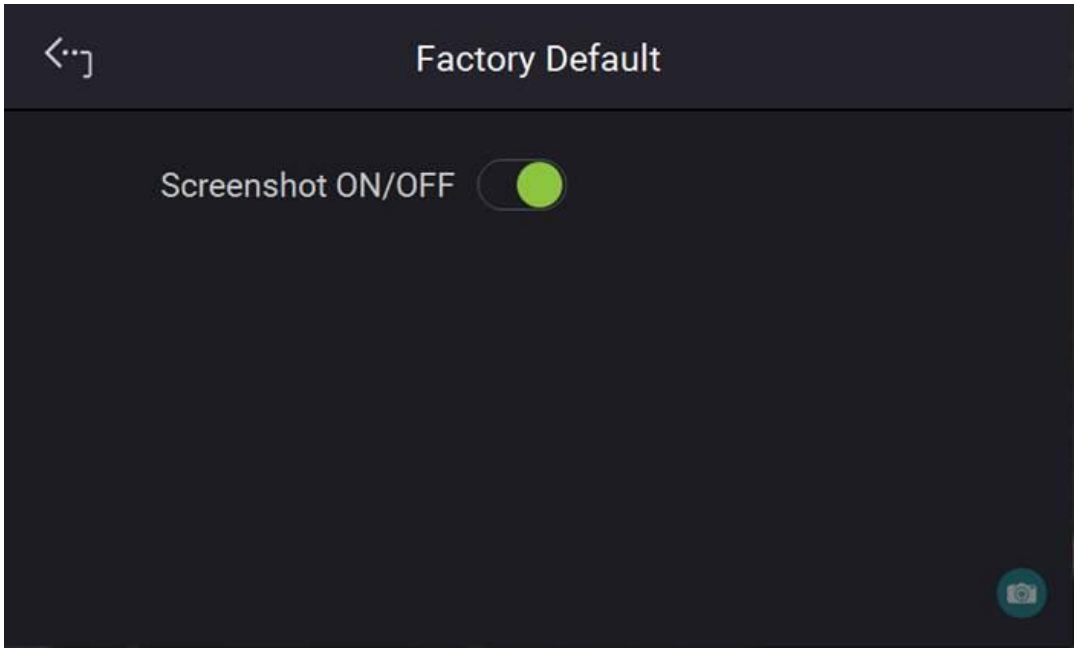


Figure 3-43

3.2.3.7 Source Setting

Tap Source Setting to turn on or off the Ri function as Figure 3-44 shows. When the Ri function is turned on, the main screen of Source Mode will add a new setting item for Ri as shown in Figure 3-45. The Ri function is to simulate the power supply's internal resistance. When Ri is started, the output voltage will change following the external current, the actual output voltage (V) is V=Vset-Io*Ri.

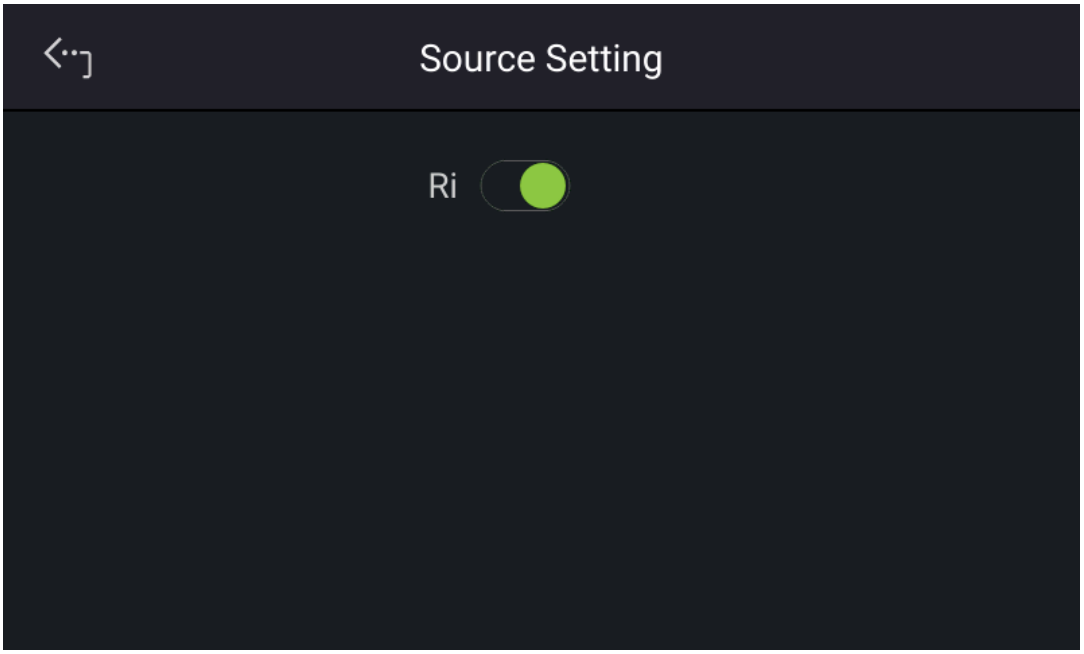


Figure 3-44

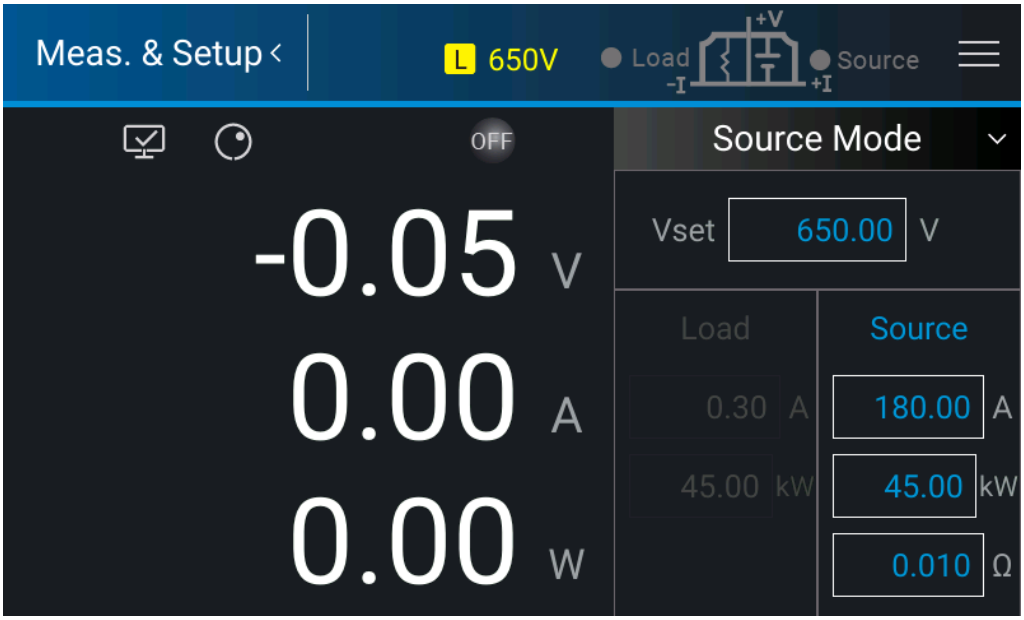


Figure 3-45

3.2.3.8 Source & Load Setting

Tap Source & Load Setting to enable or disable the R function as Figure 3-46 shows. When the R function is enabled, the Source & Load main screen will add a new setting item of R as shown in Figure 3-47. The R function in the Source direction is to simulate the internal resistance Ri of the power supply. Once R is started, the output voltage will change following the external current, the actual output voltage (V) is V=Vset-Io*R. Meanwhile, the R function in the Load direction simulates the constant resistance for current control, and the actual load current is I=Vo/R.

Note The CR function is always enabled in pure Load mode thus there is no need to enable this option.

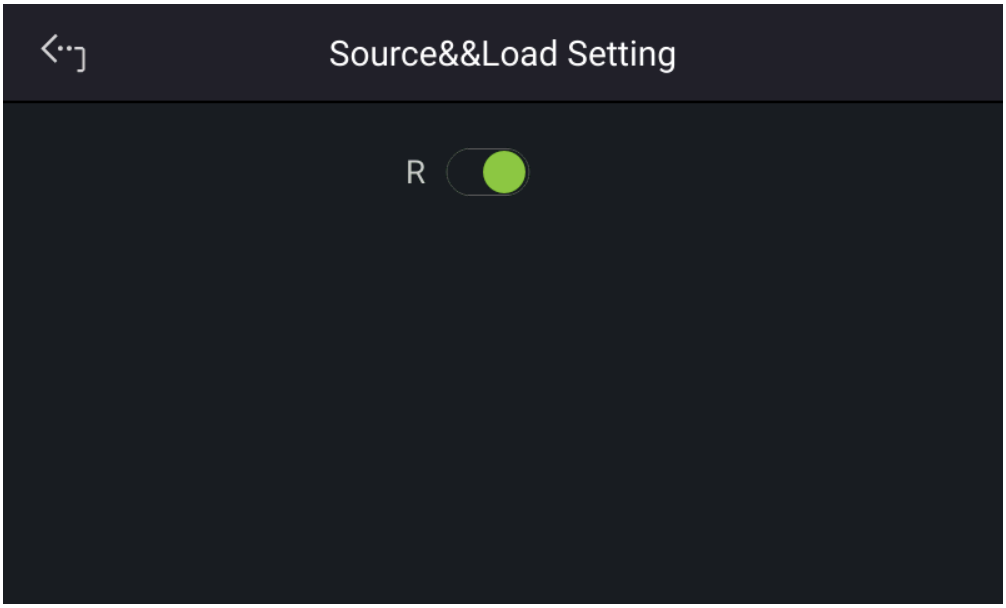


Figure 3-46

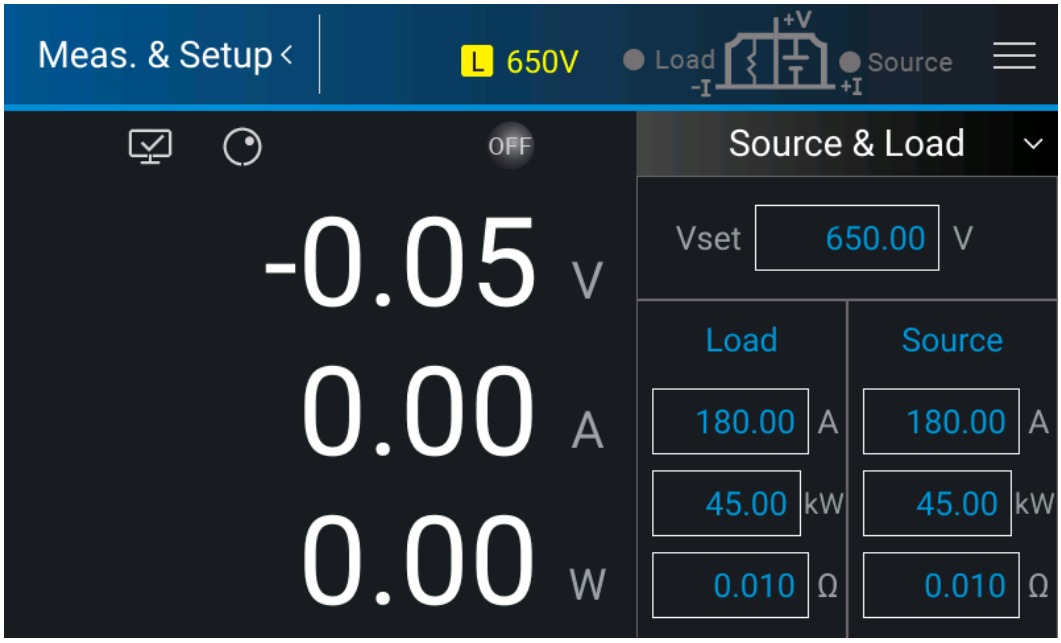


Figure 3-47

3.2.4 Advance

Chroma 62000D-HL Series with solar array simulation models provides the following 4 output modes for use.

(1) Table Mode: It gets the Solar Array IV curve by importing the voltage/current settings in the Excel table through the Solar Array Simulation Soft Panel. (**Note:** This function can only be used when B620003 is purchased.)
(2) SAS Mode: It executes the Solar Array Simulation function via the built-in formula from a standalone unit to get the Solar Array IV curve. (**Note:** This function can only be used when B620003 is purchased.)
(3) EN50530 Mode: It uses the EN50530 built-in formula to get the Solar Array IV curve. (**Note:** This function can only be used when B620003 is purchased.)
(4) SANDIA_ Mode: It uses the SANDIA built-in formula to get the Solar Array IV curve. (**Note:** This function can only be used when B620003 is purchased.)
(5) Refer to the specification table for the minimum CV Regen voltage (Min. Load Voltage (@ I Load Max))

Tap “Advance” from the Menu to enter into the Advance setup page as Figure 3-48 shows.

Figure 3-48

3.2.4.1 SAS Mode

Chroma 62000D-HL Series with solar array simulation models can simulate the solar cell curves via the Solar Array Simulation Soft Panel. In addition, the standalone model has also built in a solar array simulation function which is called SAS mode for use.

Select “SAS” from the Mode menu to enter the SAS setup page.

Voc: Open Circuit Voltage
Isc: Short Circuit Current
Vmp: Max. Power Voltage
Imp: Max. Power Current

Due to the factor of the model formula, the input Vmp and Imp may be different from the maximum power point Vmp and Imp obtained by the formula. When the Fill Factor (FF) is smaller the difference is bigger. Thus, the screen on the standalone will show the result obtained by the formula besides displaying the set values of the four parameters.

Setting procedure:

1. Tap the VOC column to set the open circuit voltage.
2. Tap the ISC column to set the short circuit current.
3. Tap the VMP column to set the maximum power voltage.
4. Tap the IMP column to set the maximum power current.
5. Tap “Trigger” to refresh the parameter.
6. Check all settings are done and tap “  ” to execute the SAS function.

When outputting in SAS MODE, the EQ_PMP, EQ_VMP, and EQ_IMP are the actual operating points obtained by the user-defined VMP and IMP settings computed by the device’s built-in formula.

The user can directly change the VOC, ISC, VMP, and IMP parameters from the operation screen. Tap “Trigger” to refresh the parameters when any of them is changed. The IV curve will be updated immediately and so are the EQ_PMP, EQ_VMP, and EQ_IMP parameters.

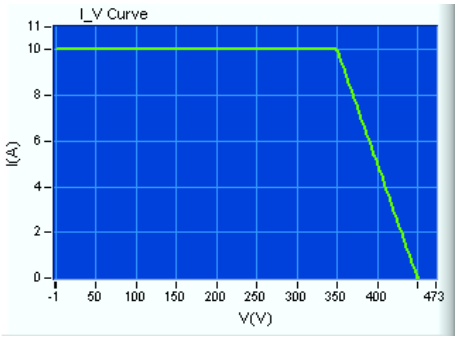
Notice

1. The definition of Fill Factor (FF) is: $\mathrm{FF} = \dfrac{V_{mp} I_{mp}}{V_{oc} I_{sc}}$
2. The setting limits of Voc, Vmp, Isc, and Imp are:
   a. $V_{oc} > V_{mp} > 0$
   b. $I_{sc} > I_{mp} > 0$
   c. $V_{mp} > V_{oc}\left(1 - \dfrac{I_{mp}}{I_{sc}}\right)$

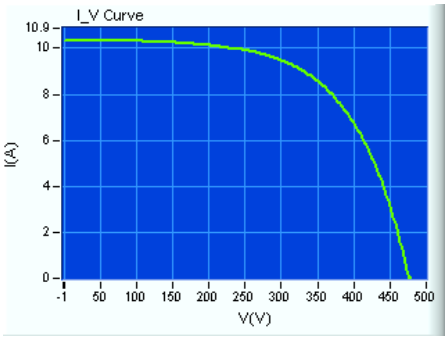
3.2.4.2 Table Mode

Solar Array Simulation Soft Panel is required to operate this function. The user can edit the IV curve data in an Excel file and then use the soft panel to import the IV curve data to the power supply for solar array simulation. This mode allows the user to edit various IV curves as shown in Figure 3-49. Therefore, different types of solar cell IV curves or IV curves of different environments, such as changes in illuminance, temperature, and shading phenomena, can be simulated. It can also transform curves in real-time to facilitate users operating IV curves with various conditions.

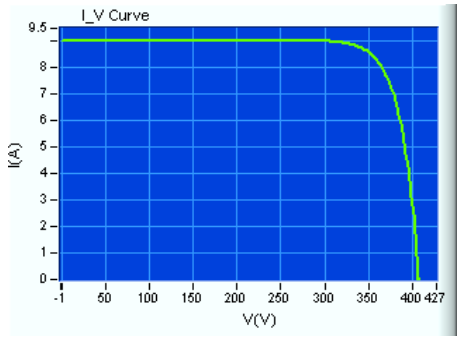
Select “Table” from the Mode menu to enter the Table setup page.



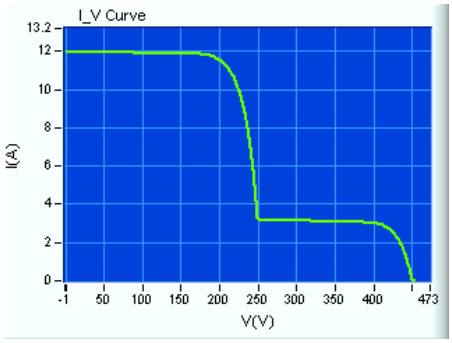
(a) Linear tracing



(b) FF Gentle slope curve tracing



(c) FF Steep slope curve tracing



(d) Cloud cover curve

Figure 3-49

The power supply is displayed as shown in Figure 3-50 when executing the Solar Array Simulation Soft Panel. The user cannot change the settings directly from the power supply.

Figure 3-50

Notice

Following is the way to create IV curve data in an Excel file.

1. Set voltage/current to indicate the IV curve data.
2. Select a blank worksheet.
3. In the worksheet, the first column is voltage and the second column is current.
4. The first line in the worksheet is the first dot of the IV curve and a total of 128 dots can be edited. The curve can have less than 128 dots but must be over 3 dots with no duplicate setting.
5. When editing the voltage/current of an IV curve, the voltage and current must be in ascending or descending format. When the voltage is in ascending format, the corresponding current is in descending, and vice versa.
6. Edit the first dot voltage to be zero or the maximum, which is contrary to the corresponding current. For example, when the voltage is zero, the current is the maximum. Moreover, the editing of the last dot depends on the voltage of the first dot. If the first dot voltage is zero, the last dot voltage is the maximum while the corresponding current is zero. The voltage maximum is the open circuit voltage (Voc) of the solar cell and the current maximum is the short circuit current (Isc).
7. Figure 3-51 shows the 10-dot data in two editing arrangements, where column A is voltage, column B is current, and lines 1 to 10 are 10 dots of data.

	A	B
1	0	7.5
2	100	7.498
3	260	7.437
4	280	7.406
5	320	7.291
6	380	6.809
7	400	6.471
8	440	5.222
9	460	4.111
10	500	0

	A	B
1	500	0
2	460	4.111
3	440	5.222
4	400	6.471
5	380	6.809
6	320	7.291
7	280	7.406
8	260	7.437
9	100	7.498
10	0	7.5

Figure 3-51

3.2.4.3 EN50530 Mode

Besides simulating the solar cell curve via the Solar Array Simulation Soft Panel, the 62000D-HL Series with solar array simulation power supply has a built-in EN50530 formula for solar cell curve simulation.

Select “EN50530” from the Mode menu to enter into the EN50530 setup page as shown in Figure 3-52.

Figure 3-52

Setting procedure:

1. Tap the VMP column to set the maximum power voltage.
2. Tap the PMP column to set the maximum power.
3. Tap the FF column to set the PV cell type fill factor.
4. Tap the IRR column to set the irradiation.

5. Tap “Trigger” to refresh the parameter.
6. Check all settings are done and tap “  ” to execute the EN50530 function.

When outputting in EN50530_MODE, the EQ_VOC, EQ_VMP, EQ_ISC, and EQ_IMP are the actual operating points obtained by the user-defined VMP and PMP settings computed by the device’s built-in formula.

The user can directly change the VMP and PMP parameters from the operation screen. Tap “Trigger” to refresh the parameters when any of them is changed. The IV curve will be updated immediately and so are the EQ_VOC, EQ_VMP, EQ_ISC, and EQ_IMP parameters.

3.2.4.4 Sandia Mode

Besides simulating the solar cell curve via the Solar Array Simulation Soft Panel, the 62000D-HL Series with solar array simulation power supply has a built-in SANDIA_MODE formula for solar cell curve simulation.

Select “Sandia” from the Mode menu to enter into the Sandia setup page as shown in Figure 3-53 and Figure 3-54.

Figure 3-53

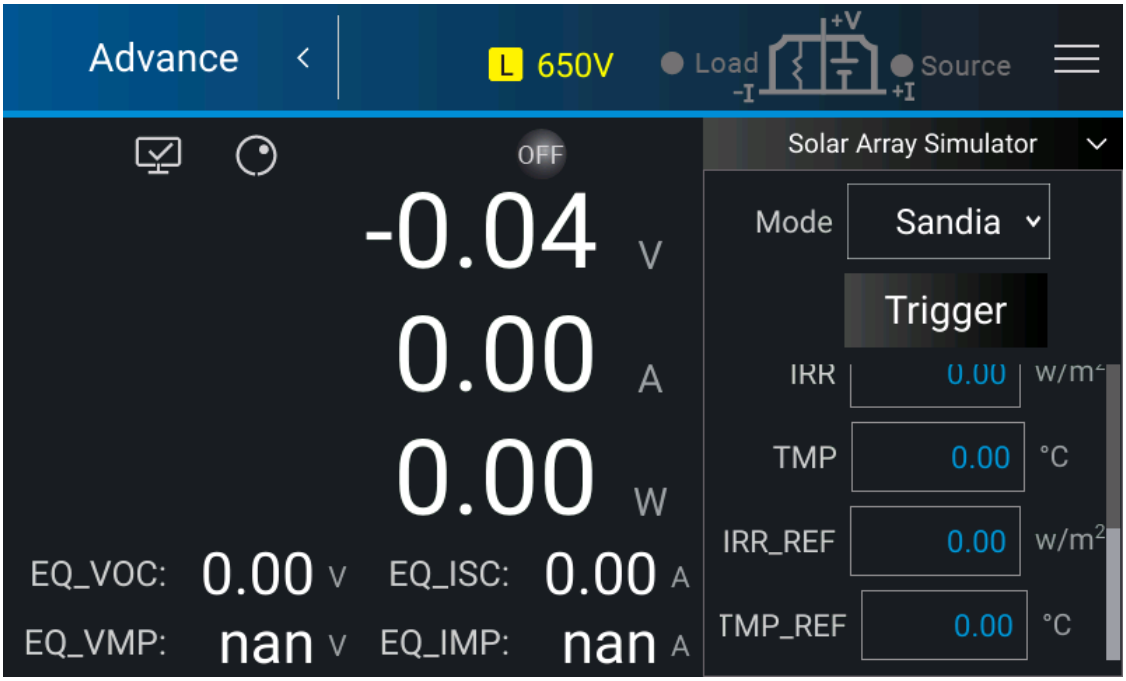


Figure 3-54

Setting procedure:

1. Tap the VMP column to set the maximum power voltage.
2. Tap the PMP column to set the maximum power.
3. Tap the FF column to set the fill factor.
4. Tap the BETA column to set the voltage temperature coefficient process technology.
5. Tap the IRR column to set the irradiation.
6. Tap the TMP column to set the temperature.
7. Tap the IRR REF column to set the irradiation reference.
8. Tap the TMP REF column to set the temperature reference.
9. Tap “Trigger” to refresh the parameter.
10. Check all settings are done and tap “  ” to execute the SANDIA function.

When outputting in SANDIA_MODE, the EQ_VOC, EQ_VMP, EQ_ISC, and EQ_IMP are the actual operating points obtained by the user-defined VMP and PMP settings computed by the device’s built-in formula.

The user can directly change the VMP and PMP parameters from the operation screen. Tap “Trigger” to refresh the parameters when any of them is changed. The IV curve will be updated immediately and so are the EQ_VOC, EQ_VMP, EQ_ISC, and EQ_IMP parameters.

3.2.4.5 Battery Simulator

Select Advance in the Menu and tap Battery Simulator to enter the setting page as shown in Figure 3-55~Figure 3-57. The Battery Simulator can set and simulate the battery’s characteristics by setting the following parameters. When outputting in this mode, the panel parameters will appear in grayscale and cannot be modified.

Figure 3-55

VH: Set the maximum battery voltage.
VL: Set the minimum battery voltage
Initial Status: Select SOC or VOL to set the initial status.
SOC: Set the percentage of battery capacity, the actual output voltage will follow this ratio to output a voltage between VH~VL.

Figure 3-56

Capacity: Set the battery capacity.
DCR: Set the internal resistance, the internal resistance is similar to the Ri on the main screen, which is V=Vset-Io*DCR. However, the Battery Simulator is suitable for both charging and discharging.

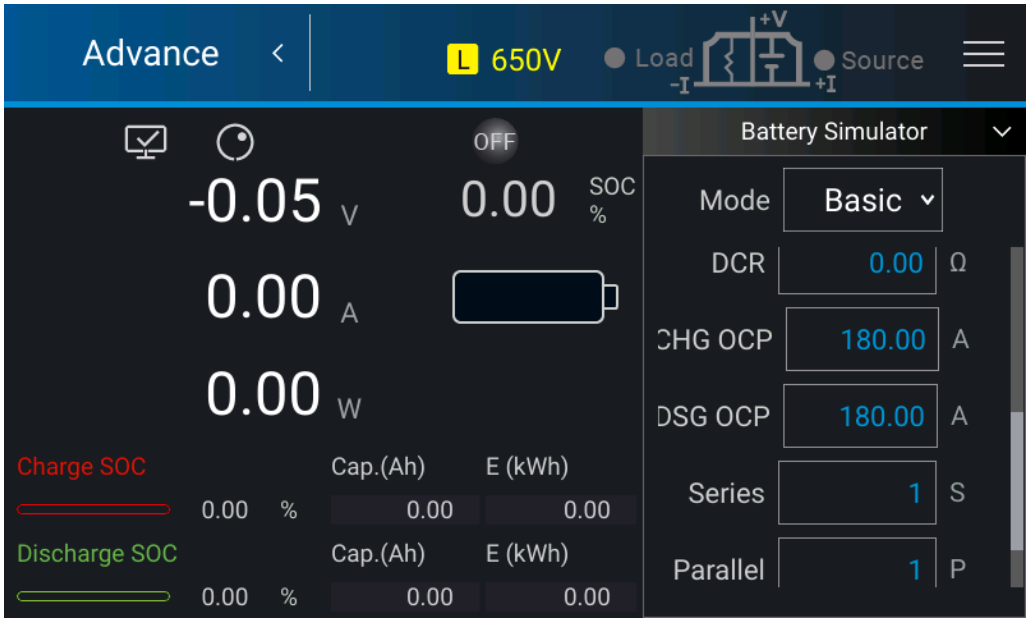


Figure 3-57

CHG OCP: Set the protection point for charging overcurrent.
DSG OCP: Set the protection point for discharging overcurrent.
Series: Set the battery number for the series connection.
Parallel: Set the battery number for parallel connection.

3.2.5 Configuration

3.2.5.1 Interface

Tap Configuration on the Menu page and select Interface and APG as shown in Figure 3-58 and Figure 3-59.

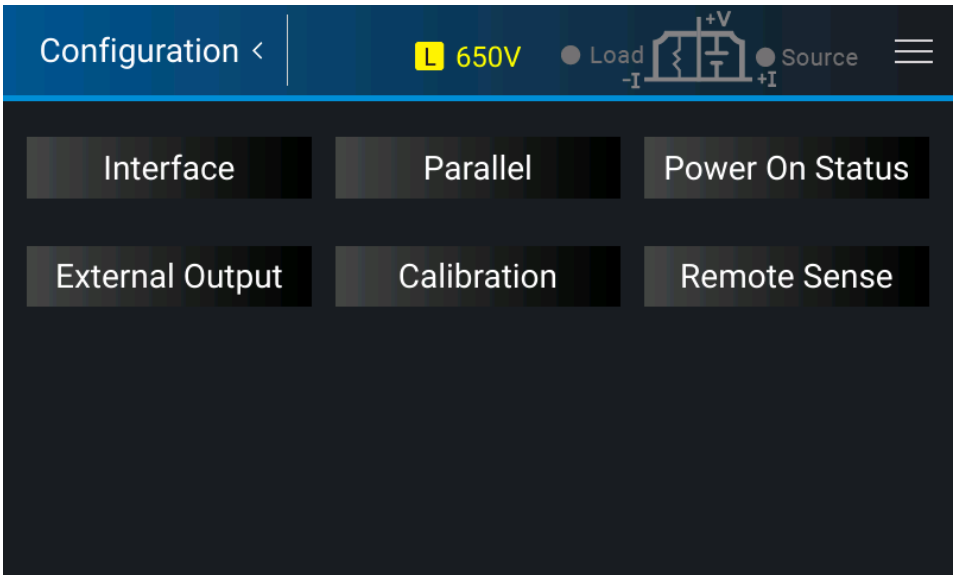


Figure 3-58

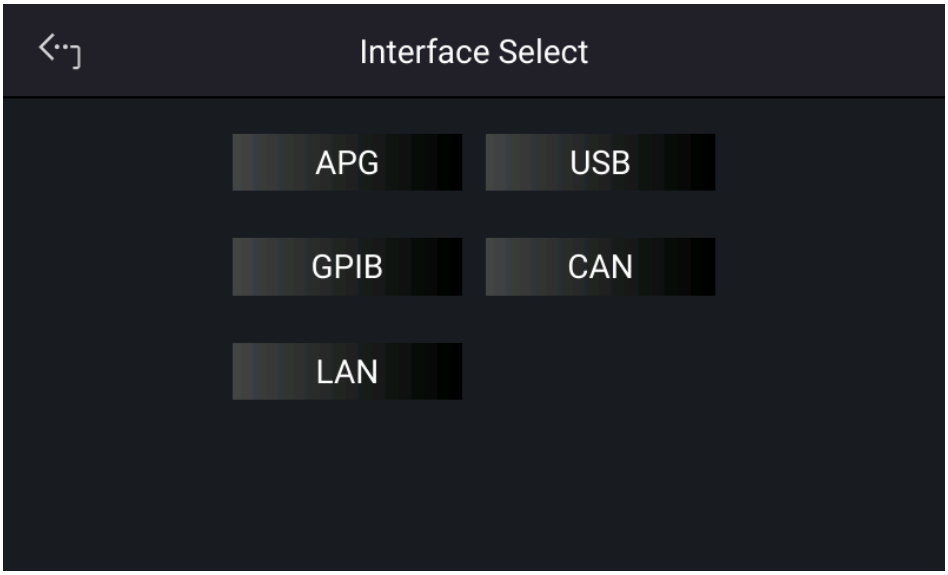


Figure 3-59

3.2.5.1.1 APG

Analog Programming interface (APG) can perform the following two functions: 1. use the analog signal control panel to set the value and 2. Use the analog signal to indicate the panel measurement. Users can specify the SET and MEAS values separately as described below.

1. Tap “Interface” and select APG to appear on the screen as Figure 3-60 or Figure 3-61 shows.

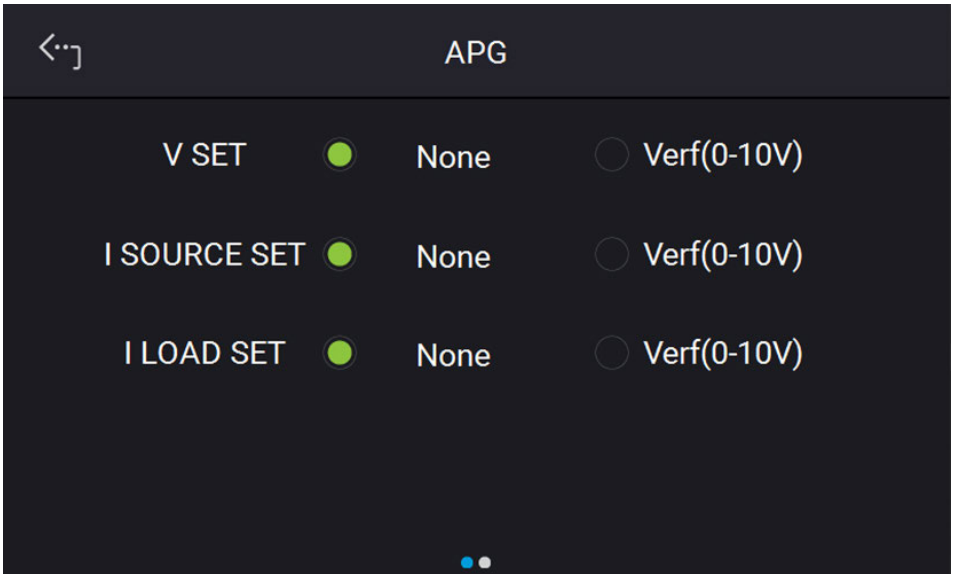


Figure 3-60

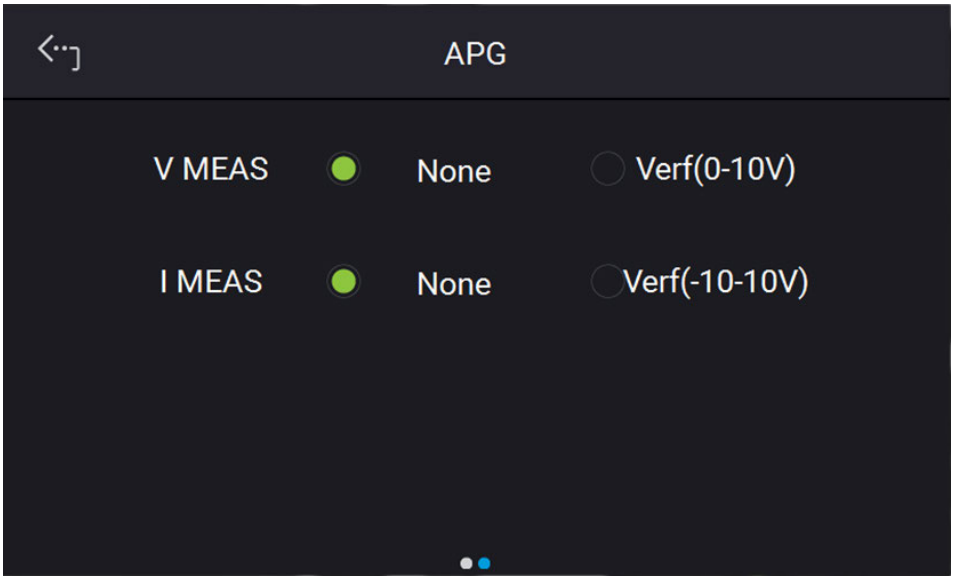


Figure 3-61

2. **V SET**: Use the touch panel to set the mode. There are 2 selections for V SET which are NONE/Vref (0-10V), where:

   NONE: It means not using the programming function.
   Vref (0-10V): It means using the external voltage source as the programming setting.

3. **I SOURCE SET**: Use the touch panel to set the mode. There are 2 selections for I SOURCE SET which are NONE/Vref (0-10V), where:

   NONE: It means not using the programming function.
   Vref (0-10V): It means using the external voltage source as the programming setting.

4. **I LOAD SET**: Use the touch panel to set the mode. There are 2 selections for I LOAD SET which are NONE/Vref (0-10V), where:

   NONE: It means not using the programming function.
   Vref (0-10V): It means using the external voltage source as the programming setting.

5. **V MEAS:** Use the touch panel to set the mode. There are 2 selections for APG VMEAS which are NONE/Vref (0-10V), where:

   NONE: It means not using the programming function.
   Vref (0-10V): It means using the external voltage source as the programming setting.

6. **I MEAS**: Use the touch panel to set the mode. There are 2 selections for APG IMEAS which are NONE/Vref (-10-10V), where:

   NONE: It means not using the programming function.
   Vref (-10-10V): It means using the external voltage source as the programming setting.

7. Tap the upper left corner on the touch panel to go to the Menu page.

8. Tap “MEAS. & Setup” to return to the main page.

Notice

1. **APG VSET/APG ISET** has 2 selections which are NONE/Vref (0-10V).
   When selecting Vref=10V ➡ it means the DC power supply's output of 0~100% will map to 0~10V as Figure 3-62 shows.

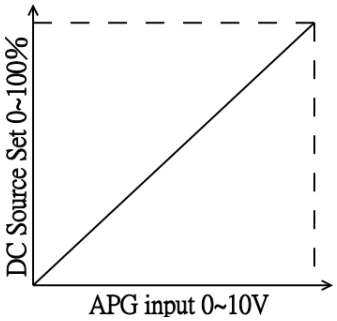


Figure 3-62

2. **APG VMEAS/APG IMEAS** has 2 selections which are NONE/Vref (0-10V).
   When selecting Vref=10V ➡ it means the DC power supply's output of 0~100% will map to 0~10V as Figure 3-63 shows.

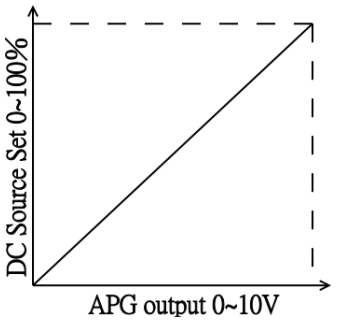


Figure 3-63

3. When using APG, in case the error is too large be sure to calibrate the APG settings and measurements first.
4. For APG pin assignments, please refer to *Appendix A*.

3.2.5.1.2 LAN

This DC power supply uses LAN to provide remote operation. The LAN address is required for remote operation.

Notice

1. The user needs to connect the network cable to the DC power supply for auto-detection.
2. If the network cable is not connected properly, it may cause the DC power supply screen to show abnormally. Turn off the DC power supply to resolve the network cable problem and reboot it to clear the abnormal screen.

1. Tap "Menu", "Configuration" and "Interface:" to select LAN as shown in Figure 3-58, Figure 3-59, and Figure 3-61.
2. Tap LAN to enter into the address setting screen.

Auto Detect:

The default of DHCP is ON. Swipe left to the second page as Figure 3-65 shows, the DC Power Supply will automatically detect the external network address (192.168.1.10).

Manual Detect:

1. Tap DHCP to set it to OFF.
2. Tap IP ADDR and set it.
3. Tap SUBNET MASK and set it.
4. Swipe left to the second page, tap GATEWAY ADDR, and set it.
5. Tap “Apply” and wait for the connection.
6. Touch the upper left corner to enter the Menu page.
7. Tap “MEAS. & Setup” to return to the main page.

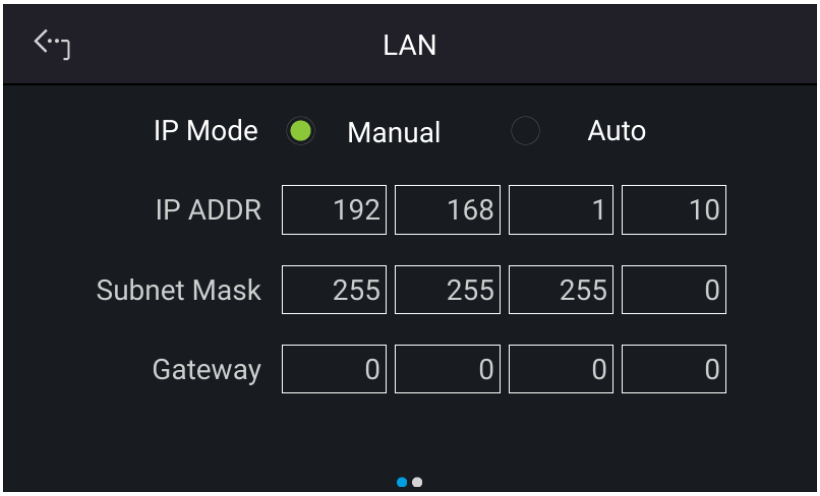


Figure 3-64

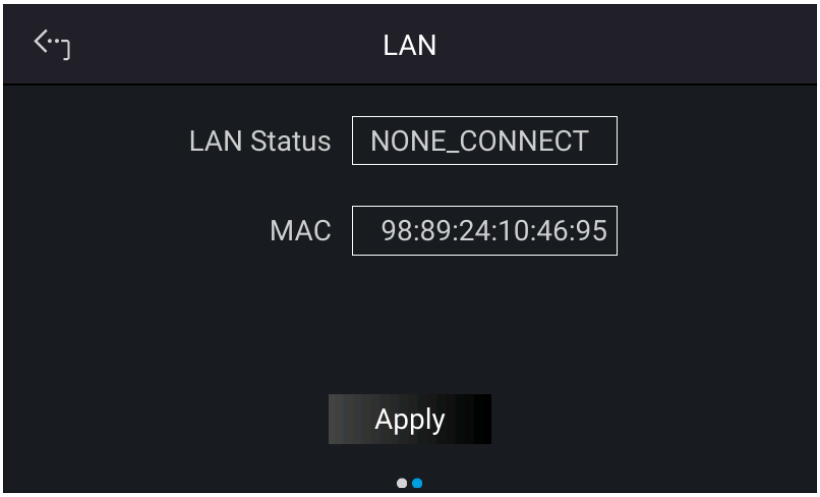


Figure 3-65

Notice

1. The LAN Status is displayed automatically in the following 6 types:
   CONNECTED: It means the network is connected.
   CONNECTING. . . .: It means the network is connecting.
   NONE CONNECT: It means the network is not connected.
   SETTING. . . .: It means the network is under the setting.
   ETHERNET MODULE FAIL: It means the network module is failed.
   DUPLICATE_IP: It means the device IP is in conflict.
2. The ETHERNET IP address is 0~255. In ETHERNET setting, DHCP=ON will get the address automatically and DHCP=OFF will get the address manually. Once the IP address is set, it needs to set APPLY=YES for the address to be in effect.

3.2.5.1.3 GPIB

This DC power supply supports remote operation via the GPIB function. It is necessary to set the GPIB address before operating remotely.

1. On the “Interface” page, select GPIB to enter the power supplies GPIB Address as shown in Figure 3-66.

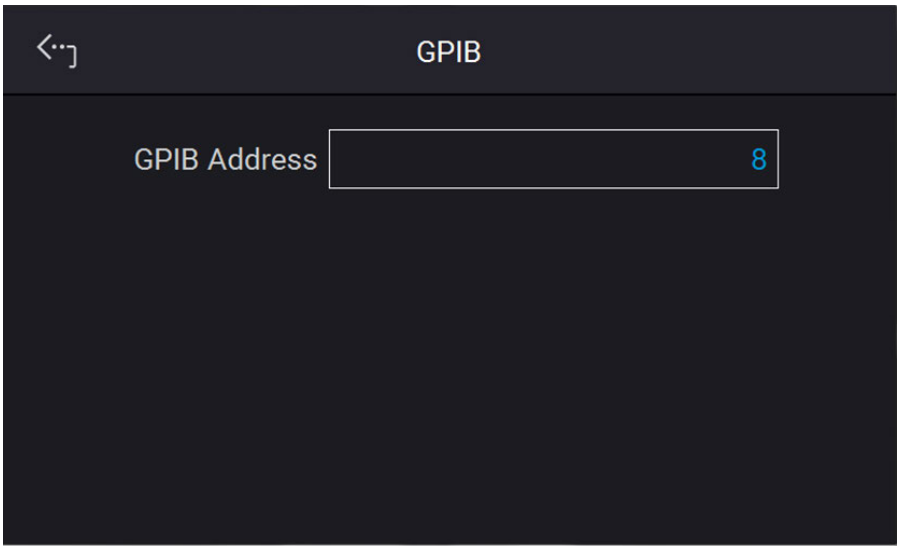


Figure 3-66

2. Tap to set the address.
3. Touch the upper left corner to enter the Menu page.
4. Tap “MEAS. & Setup” to return to the main page.

Notice Valid GPIB addresses are in the range of 1~30.

3.2.5.1.4 CAN/CAN FD

The D-series supplies support remote operation via the CAN bus. It is necessary to set the baud rate before operating remotely.

1. In the “Interface” page, select CAN as the screen shows in Figure 3-67 or Figure 3-68 shows.

2. Switch to use CAN or CAN FD on the upper right corner.
3. Tap Mode (CAN 11bit / 29bit mode) to set the bit number.
4. Tap Padding (CAN data padding) and set it.
5. Tap Baud (CAN baud rate) and set it from the drop-down menu.
6. Tap Cyclic Time (CAN cycle response) to set it.
7. Tap Data Rate (set the CAN FD data speed) and set it. This option only appears when switching to CAN FD.
8. Swipe left to the second page, then tap ID to set it.
9. Tap Mask (CAN ID mask) to set it.
10. Tap Cyclic ID (CAN cycle response command no.) to set it.
11. Tap SCPI ID (CAN SCPI ID) to set it.

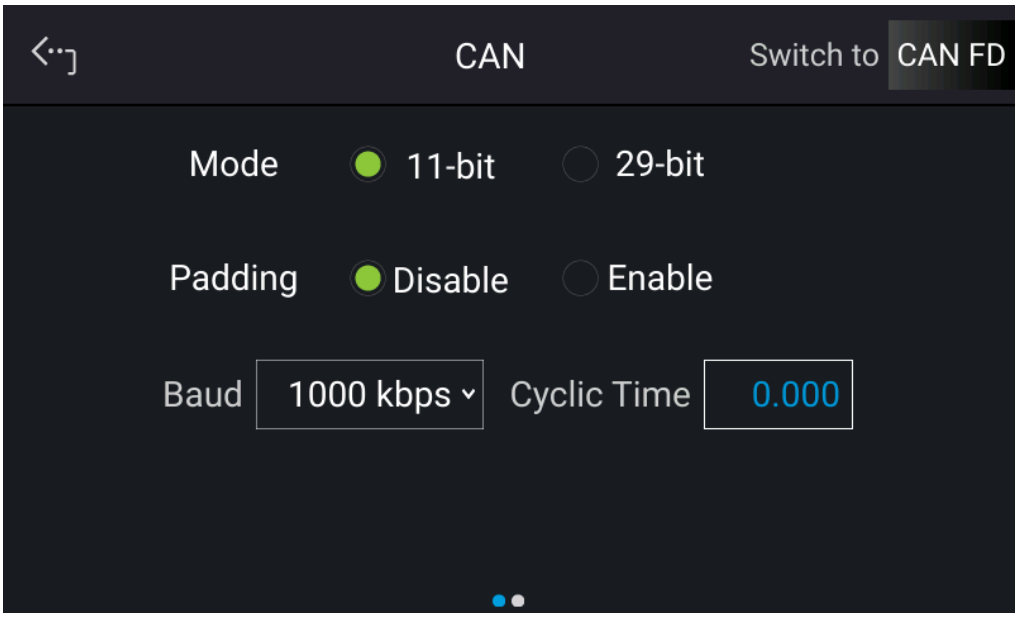


Figure 3-67

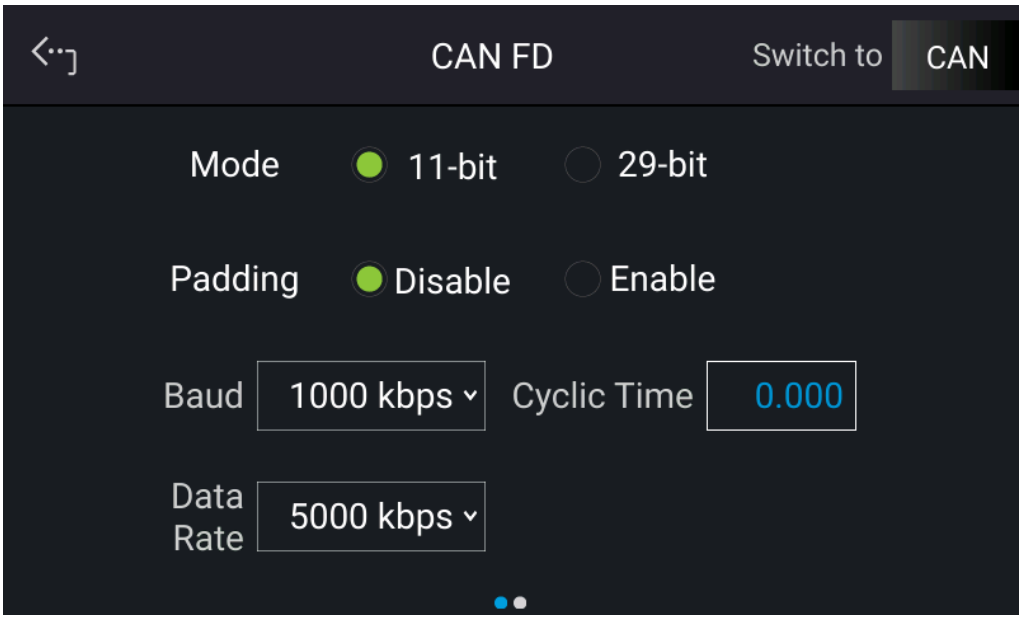


Figure 3-68

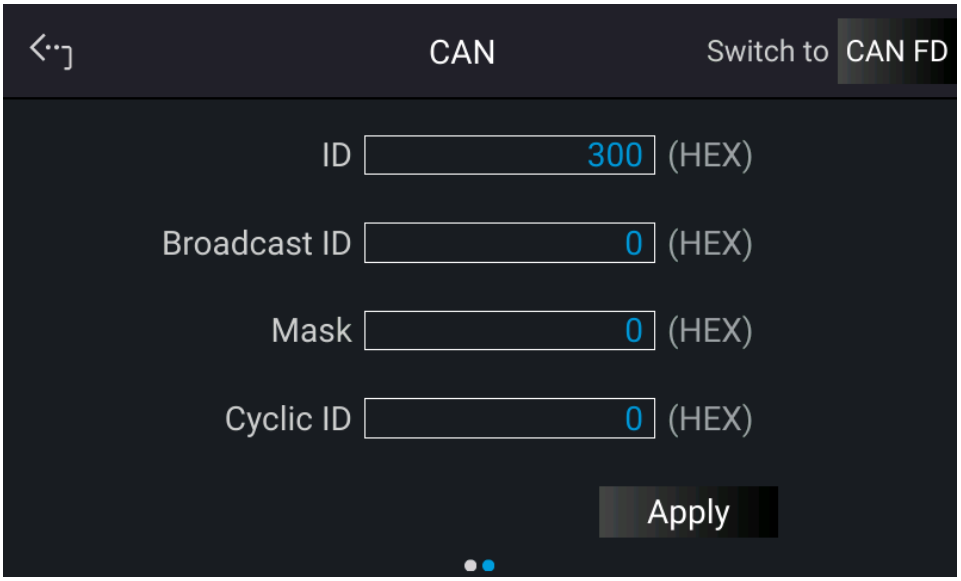


Figure 3-69

12. Tap Apply to execute the setting of each parameter (update the CAN device setting).
13. Touch the upper left corner to enter the Menu page.
14. Tap “MEAS. & Setup” to return to the main page.

3.2.5.1.5 USB

The power supplies support remote operation via the USB bus. It is necessary to query the USB address before operating remotely.

1. On the “Interface” page, select USB to enter into the USB Address screen as Figure 3-70 shows.

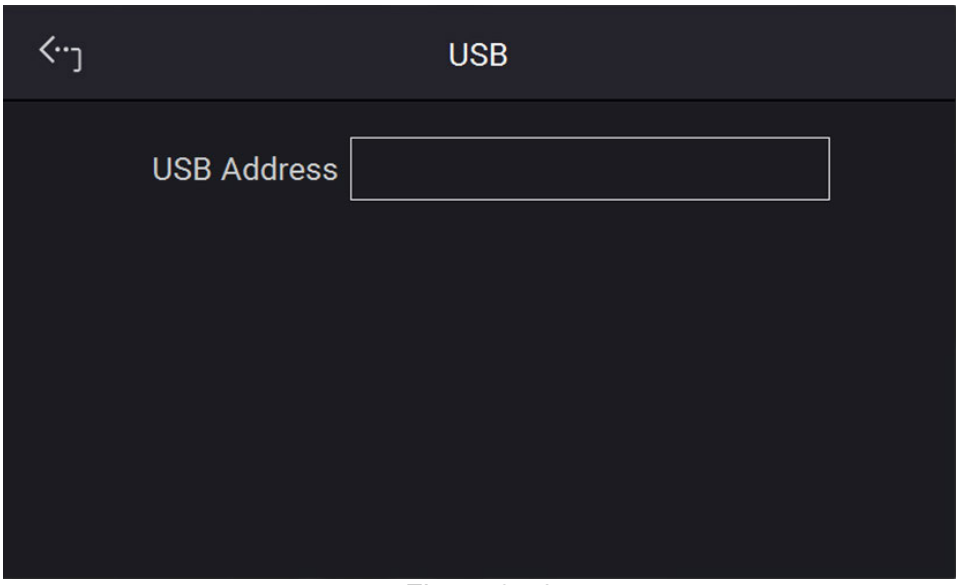


Figure 3-70

2. Touch the upper left corner to enter the Menu page.
3. Tap “MEAS. & Setup” to return to the main page.

Notice This function is for users to query the USB Address only.

3.2.5.2 Parallel

The 62000D-HL Series Power Supplies can be operated in parallel. When in parallel mode the maximum current is up to 2,160A. When the IV curve function is enabled, the Table Mode, SAS Mode, and IV Program only support parallel operation without serial function.

Notice

1. The 62000D-HL is for external parallel use only.
2. Only the same model can support the operation of parallel connections. Parallel connection of different models is not supported.
3. The maximum devices are listed in Table 3-4 below when operating the 62000D-HL power supplies in parallel.

Table 3-4

62000D-HL Series Model	Device No. in Parallel	Device No. for SAS in Parallel
62360D-2000HL	2	2
62450D-2000HL	2	2

4. Verify facility breaker capacity is large enough and that the earth wire is grounded to earth ground when parallel is in use.
5. All models in the 62000D-HL Series can be paralleled with the same model no., and a maximum of 2 devices are planned. When the devices to be paralleled are over 2 sets, please contact the Sales Rep. or agent of Chroma.

3.2.5.2.1 Output Connection in Parallel

The output connections for connecting 3 DC power supplies in parallel are shown in Figure 3-71.

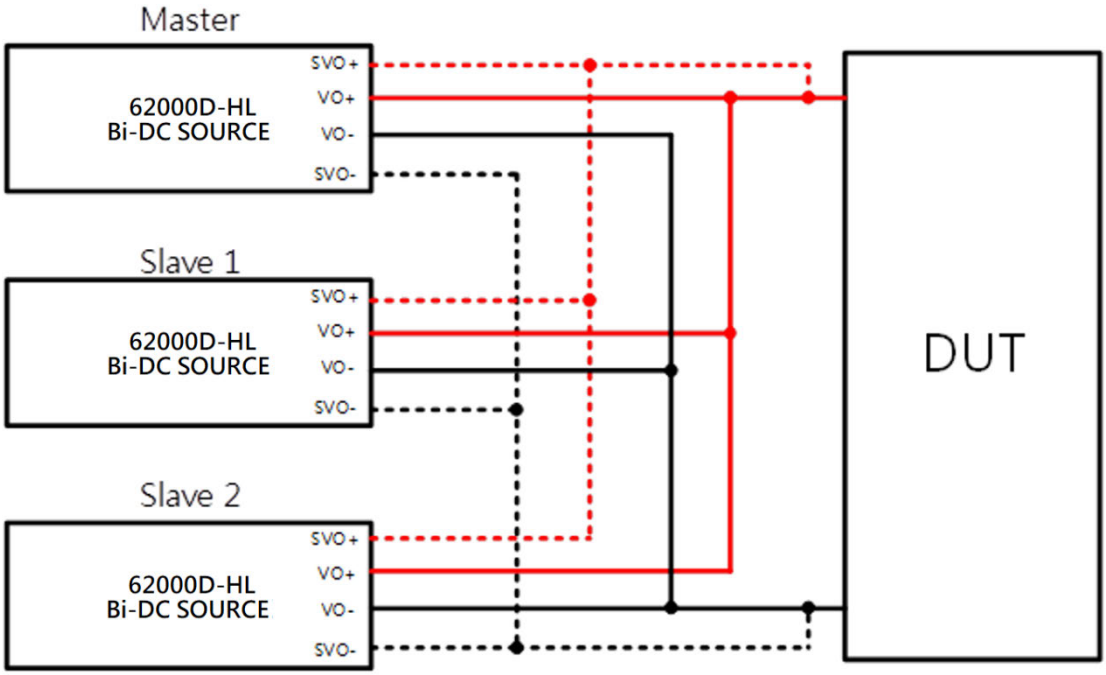


Figure 3-71

3.2.5.2.2 Installing Parallel Communication Interface

1. When 2 DC power supplies are connected in parallel, the DisplayPort connector on the rear panel must be connected as shown in Figure 3-72.

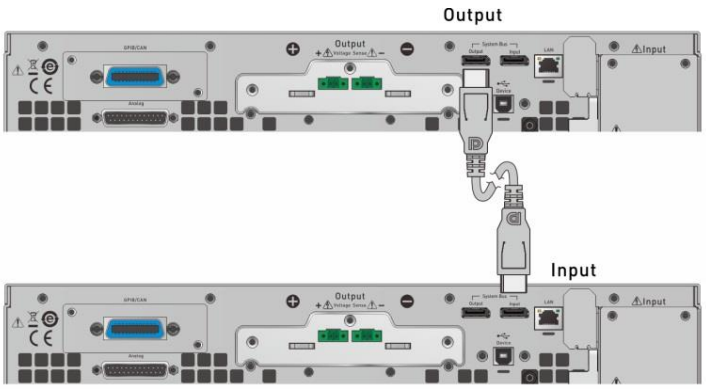


Figure 3-72

2. When 3 DC power supplies are connected in parallel for operation, the DisplayPort connector on the rear panel must be connected as shown in Figure 3-73. (A schematic diagram of 62000D.)

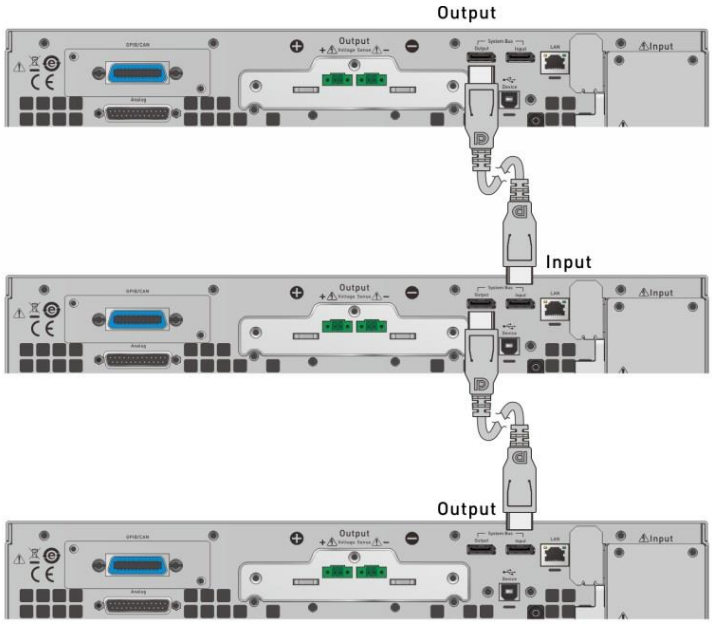


Figure 3-73

Notice

Each D-series supply has two DisplayPort female sockets. They need to be connected no matter if the connection is in series or parallel. There is no difference between the left and right connection ports but connected in series as shown in Figure 3-72 or Figure 3-73. The communication cable has a limit of 5 meters in length, do not exceed this limit to avoid unstable signals. The DisplayPort communication cable connected to the last DC power supply does not connect back to the first DC power supply.
(**Note:** The DisplayPort communication cable must be 1.2 meters or longer.)

⚠WARNING

If it is necessary to return to single unit mode from parallel mode, the DisplayPort connection must be removed or the single unit will not work normally.

3.2.5.2.3 Setting Parallel Operation Mode

CAUTION

It is necessary to set SLAVE first and MASTER last when operating 62000D-HL Series supplies in parallel mode, or a communication error may occur.

1. On the Menu page, tap “Configuration” → “Parallel” and the screen will appear as Figure 3-74.
2. Select the Type to be Master or Slave.
3. Master+ [1] means one Slave unit is connected to the master
4. If M/S Control is enabled, it means the parallel connection control is in execution.

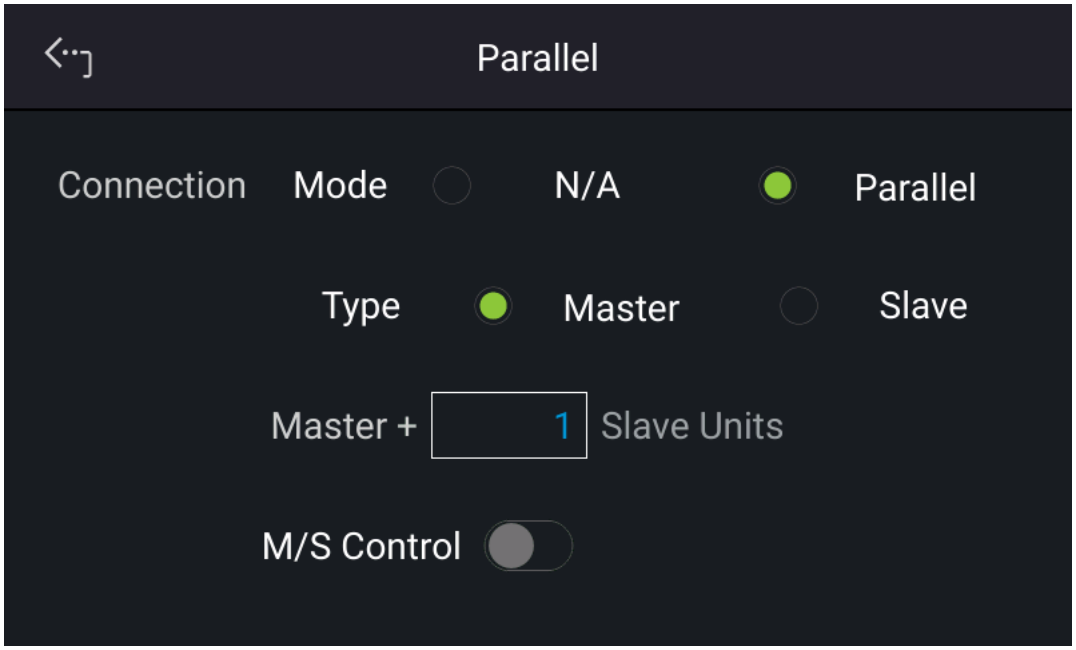


Figure 3-74

Notice When multiple DC power supplies are connected in parallel, only one DC power supply can be the Master and the rest have to be set to Slave.

Notice For example:

1. If there are 5 sets connected in parallel and 150V/900A is set, the setting of each set is 150V/180A and the total output will be 150V/900A.
2. The total sets for connecting in parallel are 12; therefore, the maximum number of Master+ **11** is 11.

3.2.5.2.4 Parallel Mode Connection

1. When the parallel communication interface is installed, follow the steps described in the previous section to enter into the Serial & Parallel page as Figure 3-74 shows.
2. Set one unit to Master, all others should be set to Slave mode.
3. When paralleling two units set Master+ **1** as shown in Figure 3-74.
4. After the above settings are made, M/S Control should be enabled to perform parallel connection control. When the connection is successful, the Master device displays as Figure 3-75 (ex. 62450D-2000HL) while the Slave device displays as Figure 3-76 shows.

Figure 3-75

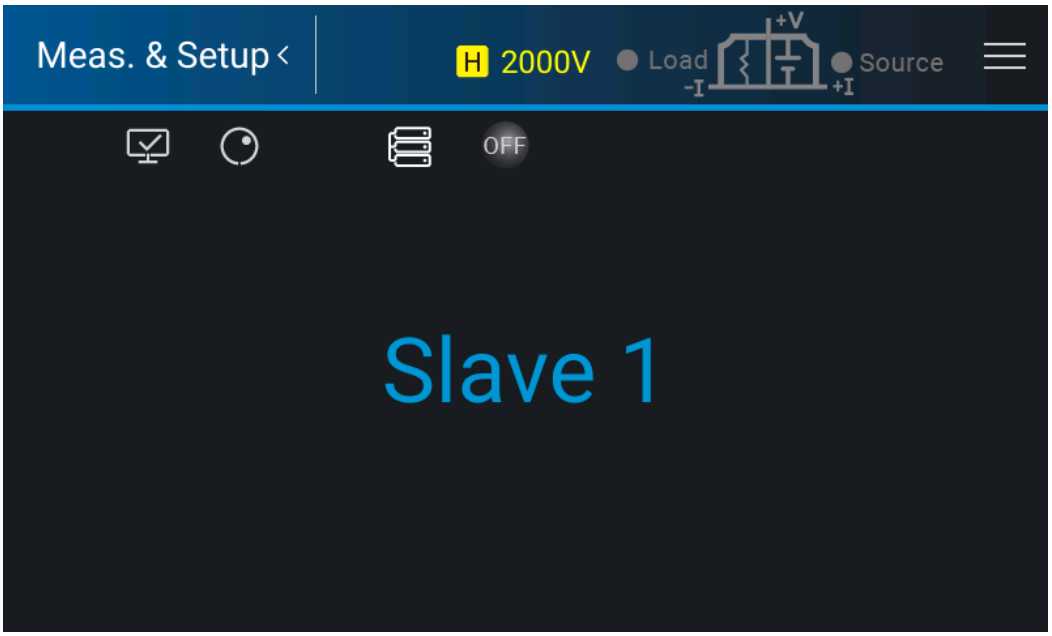


Figure 3-76

3.2.5.3 Power On Status

This function automatically loads the default output status after powered on, so that you don't have to set it again.

1. On the "Configuration" page, select "Power On Status" display will appear as Figure 3-77 shows.

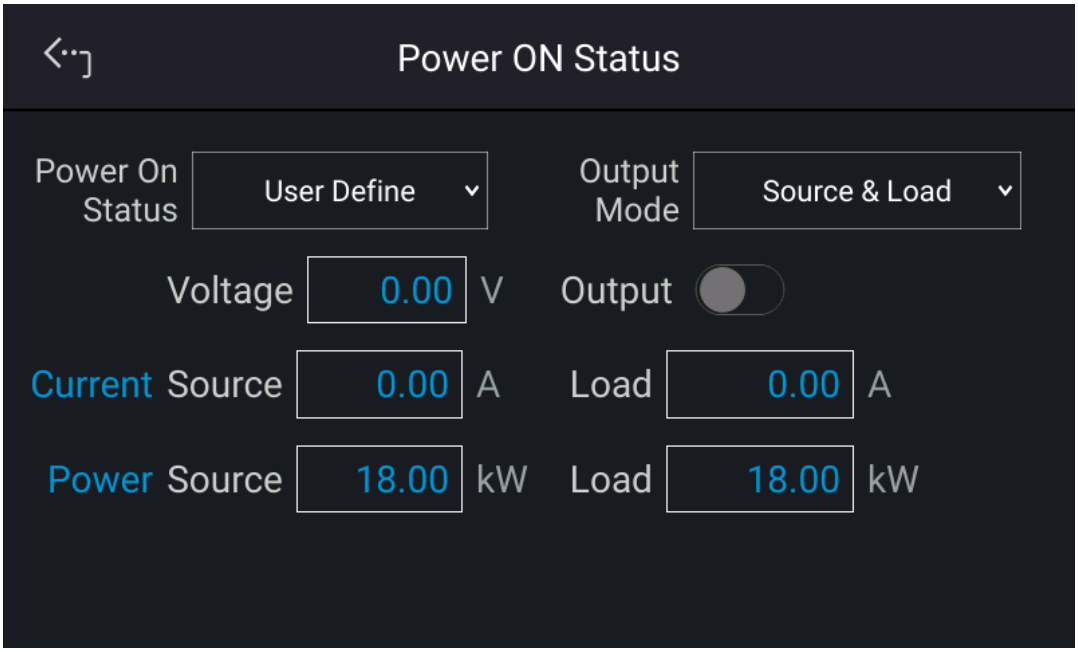


Figure 3-77

2. Select the setting.
   Power On Status has three options: Default / Last Turn Off / User Define.

   A. When set to Default, it means the output state is not defined specifically, which is V = 0.00V; I = 0.00A; OUTPUT = OFF.
   B. When set to Last Turn Off, the DC power supply will log the command voltage, command current, and output state before powering off, so that the power supply will return to these settings when next powered on.
   C. When set to User Define a setting line will prompt beneath the Power ON Status line as Figure 3-78 shows to set the default power-on state including voltage (V_SET), current (I_SET), and OUTPUT=ON/OFF.

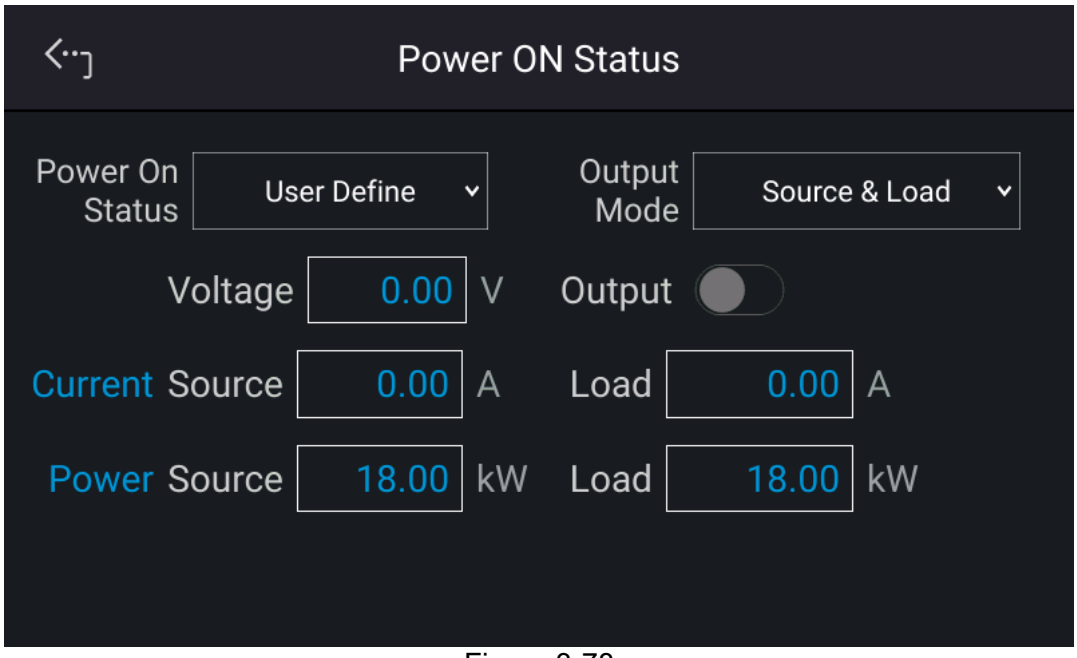


Figure 3-78

3. Touch the upper left corner to enter the Menu page.
4. Tap “MEAS. & Setup” to return to the main page.

3.2.5.4 Calibration

Chroma 62000D-HL Series DC power supplies have 6 calibration functions:

1. HOST V: the actual voltage output (CV mode) and its measurement accuracy.
2. HOST I: the actual current output (CC mode) and its measurement accuracy.
3. APG V SET: the actual voltage output in analog voltage control mode.
4. APG I SET: the actual current output in analog current control mode.
5. APG V MEA: the accuracy of analog V Monitor.
6. APG I MEA: the accuracy of analog I Monitor.

Calibration point for 62000D-HL:

Note Applicable for firmware version 1.00 or above (including FW 1.00) models.

Model (Vmax/Imax)	V_1	V_2	V_3	I_S1	I_S2	I_S3	I_L1	I_L2	I_L3
62360D-2000HL (2000V/180A)	60V	1000V	1800V	0A	90A	162A	0A	-90A	-162A
62450D-2000HL (2000V/180A)	60V	1000V	1800V	0A	90A	162A	0A	-90A	-162A

V_=V point, I_S=I Source point, I_L=I Load point

On the “Configuration” page, select “Calibration” and it will appear as Figure 3-79 shows.

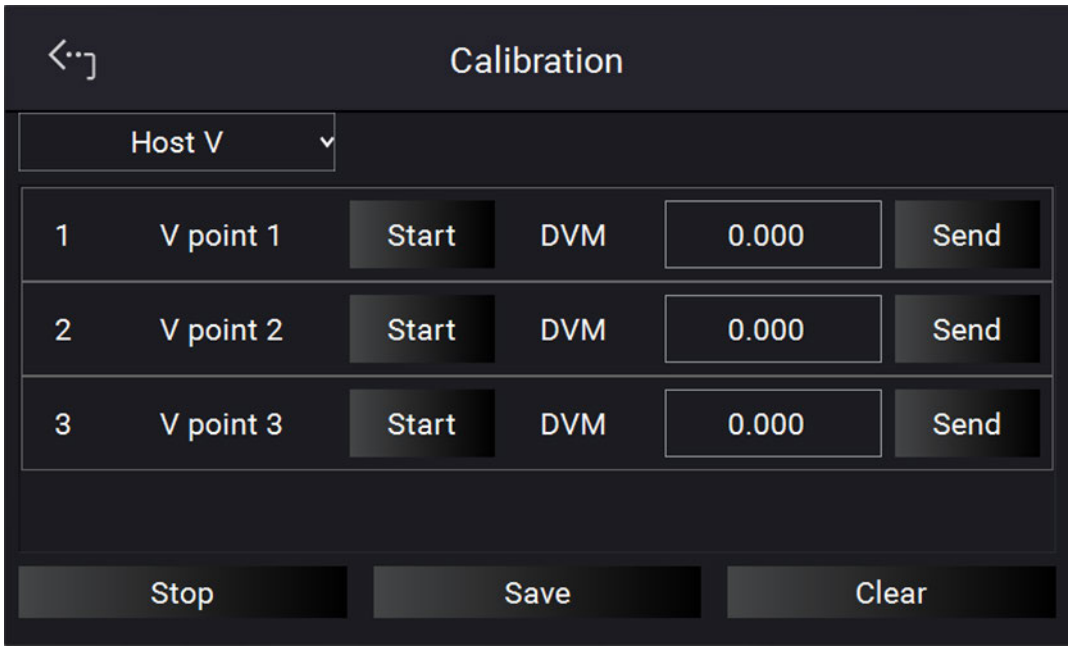


Figure 3-79

Notice The DC power supply should be calibrated annually. For further requirements, please contact Chroma to arrange for calibration again.

3.2.5.4.1 Voltage Output and Measurement Calibration

The required equipment is shown in Table 3-5.

Table 3-5

Device	Suggested Model or Capacity
DVM	0~1000V or under: HP 34461A or equivalent DVM. 1000V~2000V: VITREK 4700 or equivalent DVM.

The setup is shown in Figure 3-80.

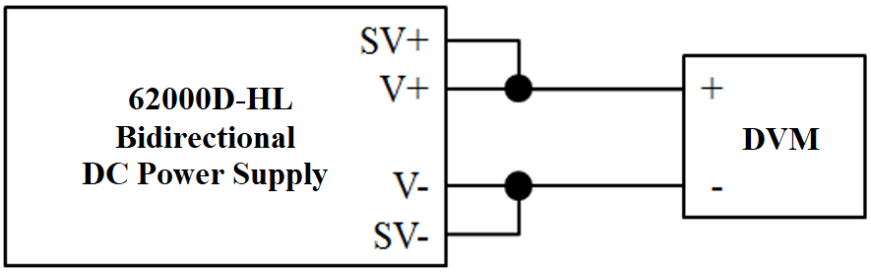


Figure 3-80

Notice

1. The instrument that is used to perform calibration its accuracy has to be higher than the accuracy of the spec.
2. It is suggested to set the Resolution parameter of HP34461A to SLOW 6 digits.
3. When conducting the voltage calibration, each calibration point has to key in at least 5 Arabic numerals to ensure the power supply accuracy after calibration.

Calibration Procedure (Model 62XXXD-HL):

1. On the Calibration page, tap “Host V” to list the voltage calibration items as shown in Figure 3-81.

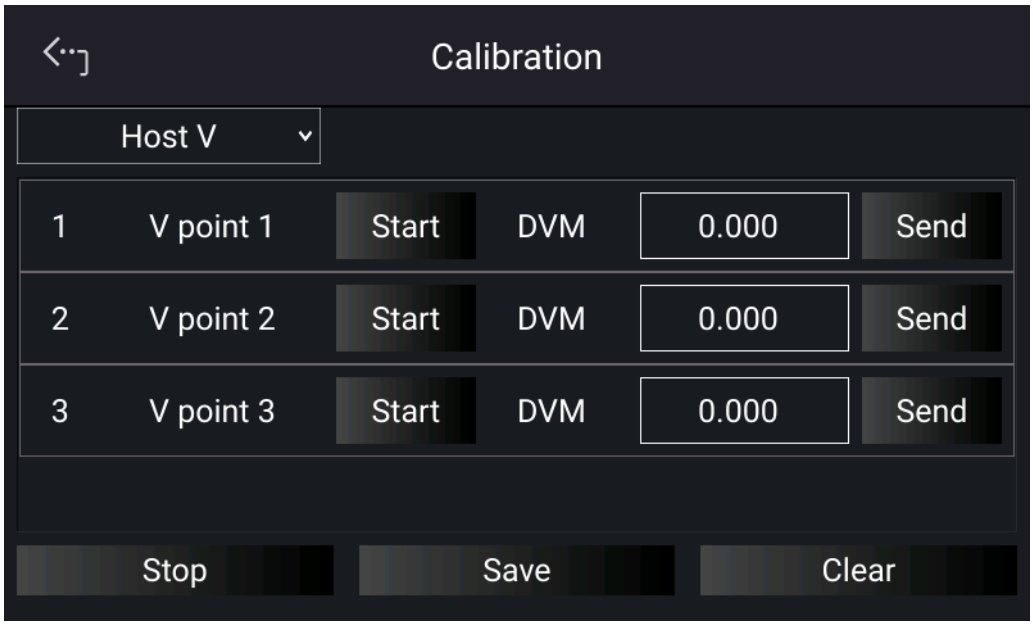


Figure 3-81

2. First, complete the point 1 voltage calibration by tapping “START” next to “V point 1”. The DC power supply will output 0.3% of Max Vo (High Range). Enter the actual voltage as measured by DVM in the position [1] entry box and tap “SEND” to confirm.

3. Next, tap “START” next to “V point 2” and complete the second point voltage calibration. The DC power supply will output 50% of Max Vo (High Range). Enter the voltage measured by DVM to position [2] and tap “SEND” to confirm.

4. Repeat the above for V point 3, the DC power supply will output 90% of Max Vo (High Range). Enter the voltage measured by DVM to position [3] and tap “SEND” to confirm.

5. When the above voltage calibrations are done, tap “STOP” to exit the calibration procedure. To save the calibration data, tap “SAVE”, and tap “CLEAR” to delete the calibration parameters if there is no need to save this data as shown in Figure 3-82.

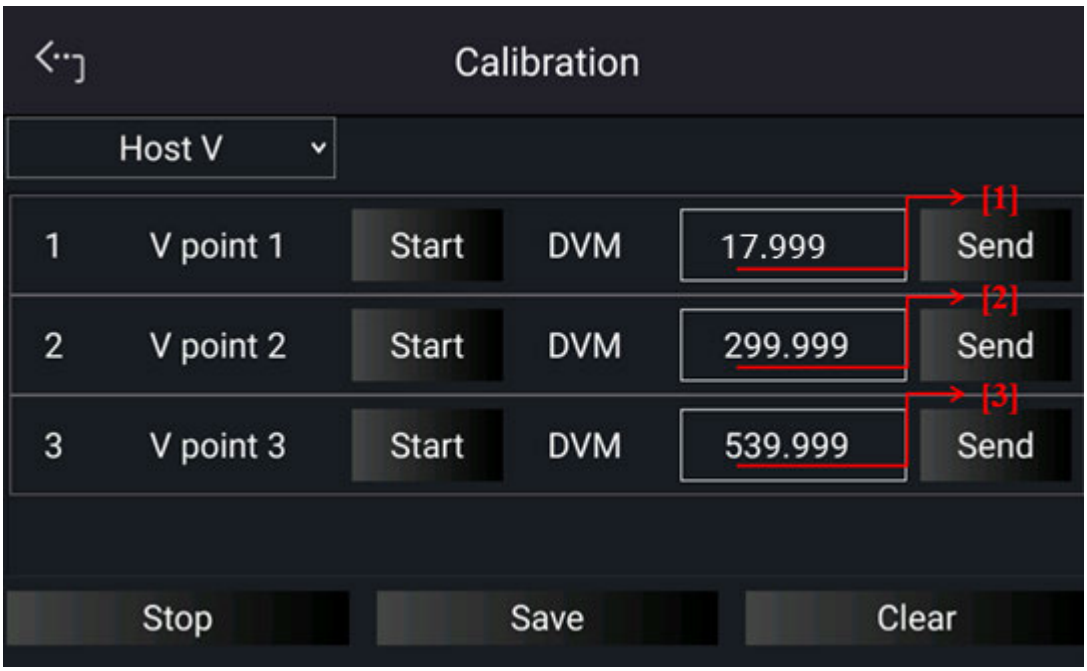


Figure 3-82

Notice

1. Calibration points may be different for other models (not 62450D-2000HL or 62360D-2000HL). Please operate according to the instructions displayed.
2. It is necessary to remove the output load when performing voltage calibration. When executing this procedure, make sure there is no load connected to the output and tap “START” to begin the calibration.

3.2.5.4.2 Current Output and Measurement Calibration

The hardware requirements are listed in Table 3-6.

Table 3-6

Device		Suggested Model or Capacity
DVM		HP 34461A or equivalent DVM.
DCCT (Current Shunt)		ULTRASTAB current transducer 600/2000A ITZ600-25PR or equivalent
LOAD	Bidirectional DC Power Supply 2	CHROMA 62450D-2000HL or equivalent

The setup is shown in Figure 3-83.

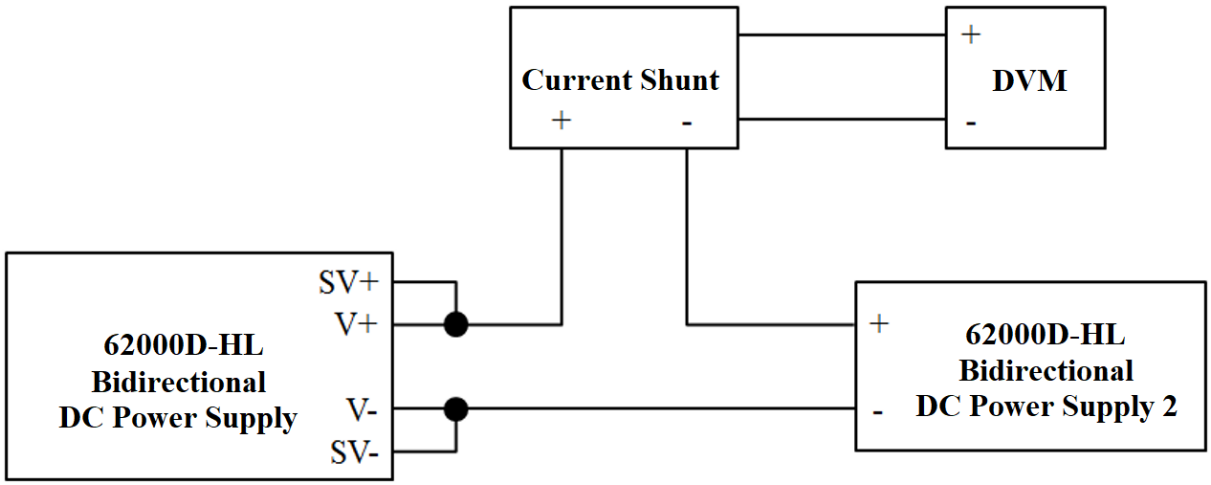


Figure 3-83

Notice When conducting current calibration, each calibration point has to be entered with at least 5 Arabic numerals to ensure the power supply accuracy after calibration.

Calibration Procedure (Model 62XXXD-HL):

1. Set the DC Power Supply 2 to CV mode at 80V.

2. In the Calibration page, tap “Host V” to set HOST I and list the current calibration items as shown in Figure 3-84.

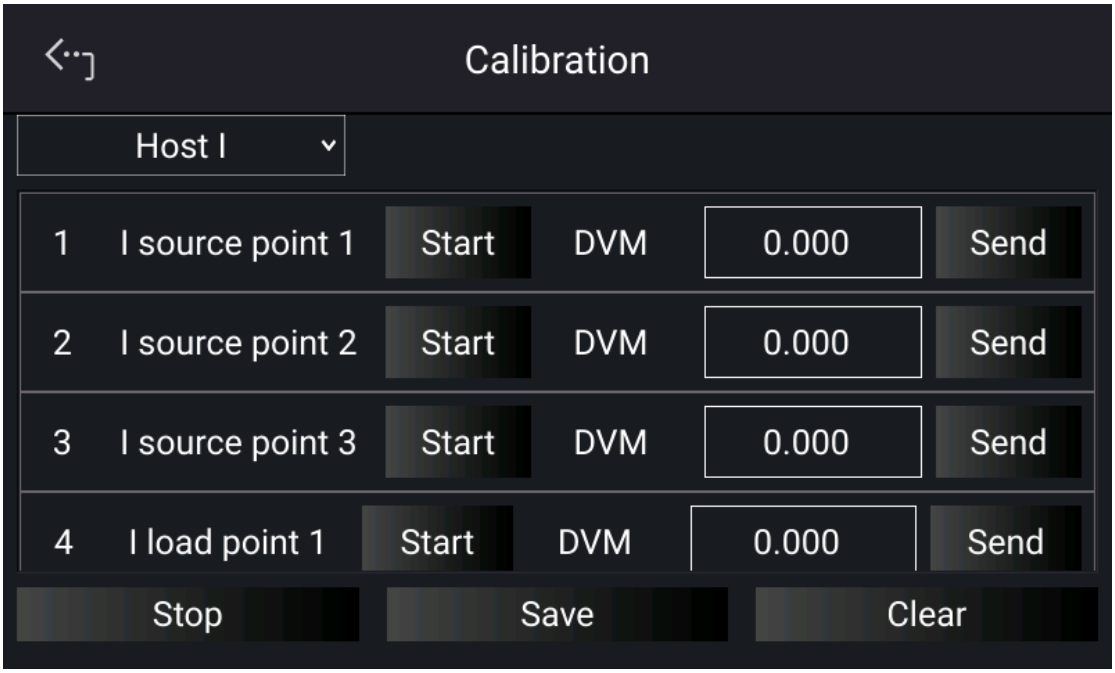


Figure 3-84

3. First, perform the calibration of “I source point 1” by tapping “START” next to it. The DC power supply will output 0A. Enter the current measured by the current shunt (DVM) in the box for point 1, and tap “SEND” to confirm it.

4. Next, tap “START” next to “I source point 2” to perform the second point current calibration. The DC power supply will output 50% of Max Io (High Range). Enter the current measured by the current shunt in the box of position [2], and tap “SEND” to confirm it.

5. Slide the screen down and tap “START” next to “I source point 3” to perform the third point current calibration. The DC power supply will output 90% of Max Io (High Range). Enter the current measured by the current shunt in the box of position [3] and tap “SEND” to confirm it.

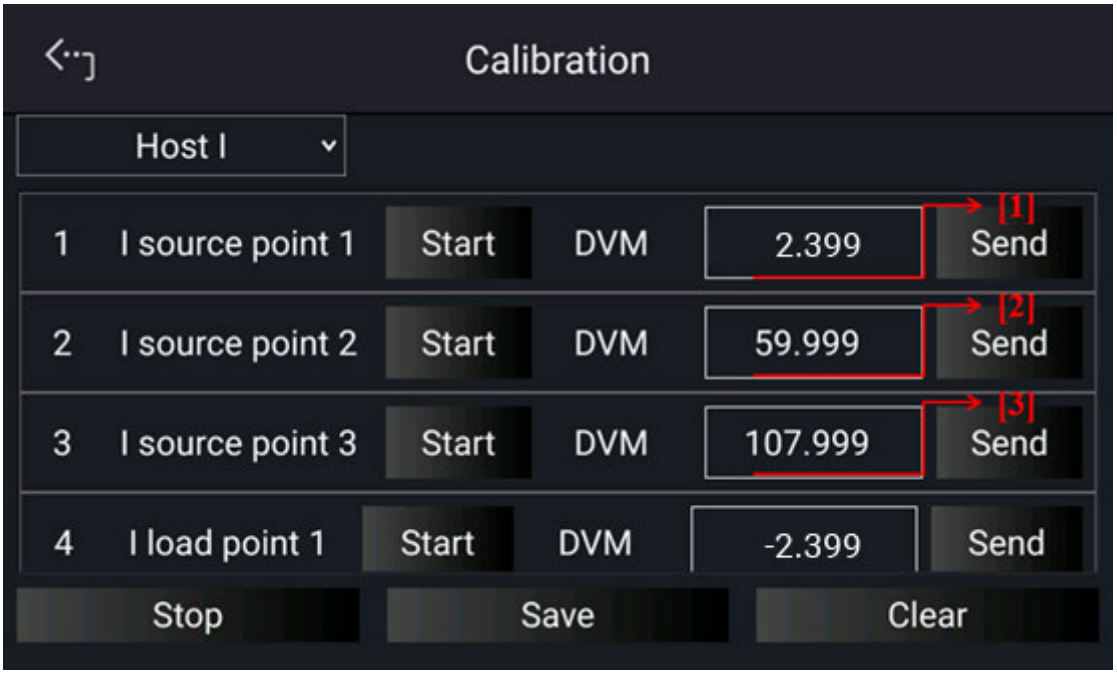


Figure 3-85

6. Next, tap “START” next to “I load point 1” to perform the first point of negative current calibration. The DC power supply will output 0A. Enter the current measured by the current shunt it in the box of position [4] and tap “SEND” to confirm it.

7. Slide the screen down and tap “START” next to “I LOAD POINT 2” to perform the second negative point current calibration. The DC power supply will output 50% of min -Io (High Range). Enter the current measured by the current shunt (DVM) in the box of position [5] and tap “SEND” to confirm it.

8. Next, tap “START” next to “I load point 3” to perform the third point of negative current calibration. The DC power supply will output 90% of min -Io (High Range). Enter the current measured by the current shunt (DVM) in the box of position [6] and tap “SEND” to confirm it.

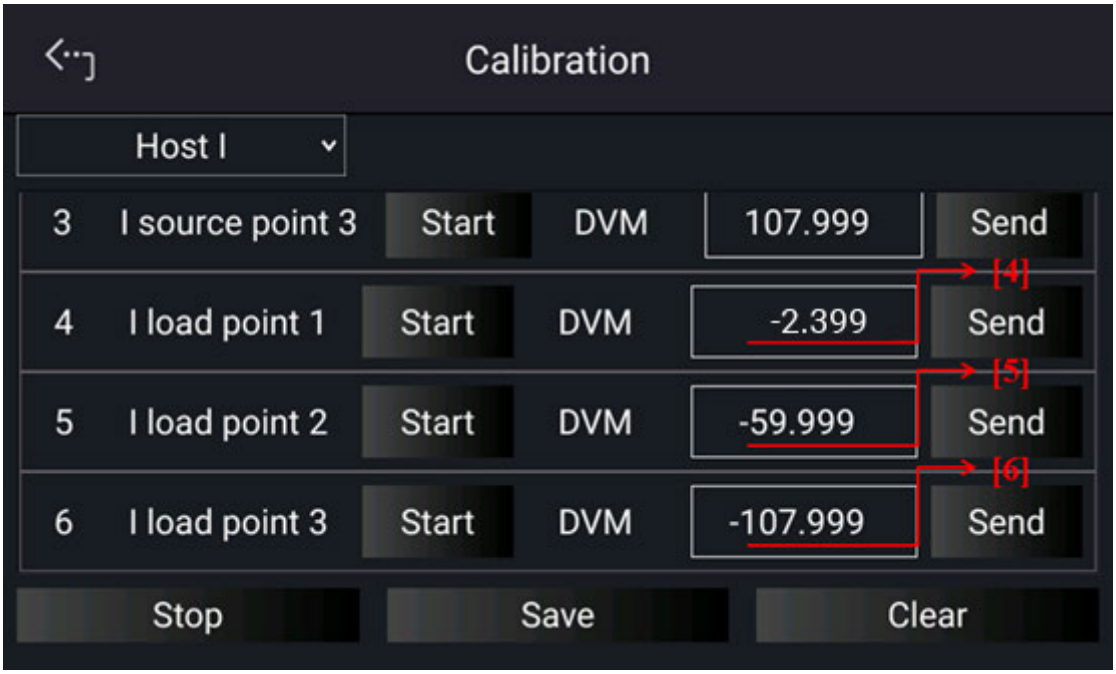


Figure 3-86

9. When the above voltage calibrations are done, tap “STOP” to exit the calibration procedure. To save the calibration data, tap “SAVE”, and tap “CLEAR” to delete the calibration parameters if there is no need to save them.

WARNING Improper shunt range selection may cause damage to the current shunt.

Notice Calibration points may be different for other models (not 62450D-2000HL or 62360D-2000HL). Please operate according to the instructions displayed.

3.2.5.4.3 APG Voltage Output Calibration

The hardware requirements for APG voltage output calibration are listed in Table 3-7.

Table 3-7

Device	Suggest Model or Capacity
DVM	HP 34461A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-87 shows the wire connection for APG voltage output calibration.

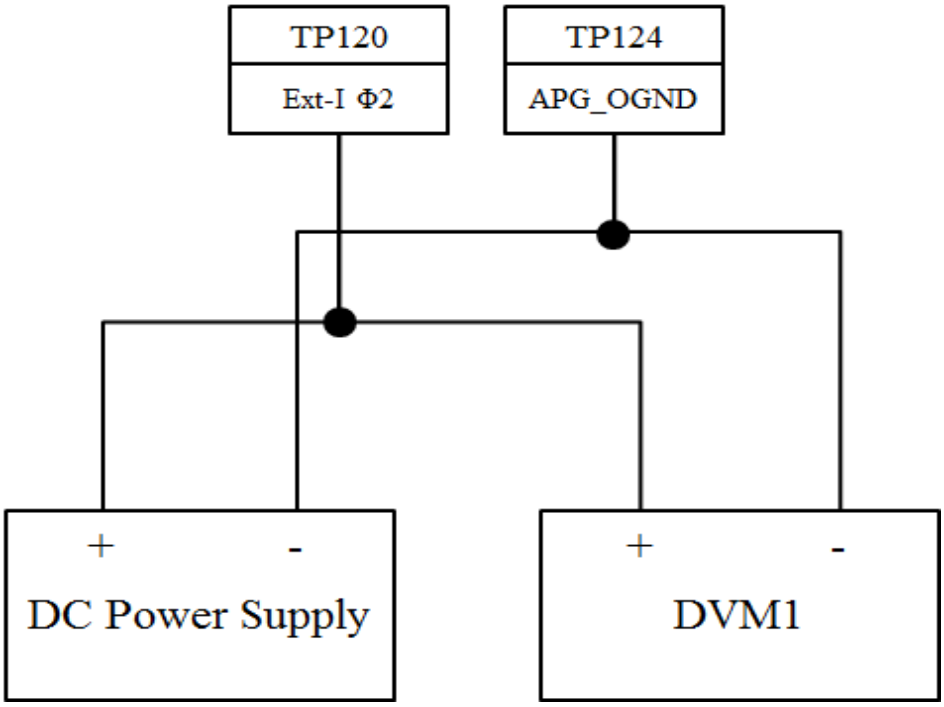


Figure 3-87

Notice When conducting the APG voltage output calibration, each calibration point has to be entered into at least 4 Arabic numerals to ensure the power supply accuracy after calibration.

Calibration Procedure (Model 62000D-HL):

1. On the Calibration page, tap “Host V” to select APG V SET and list the APG voltage calibration items as shown in Figure 3-88.

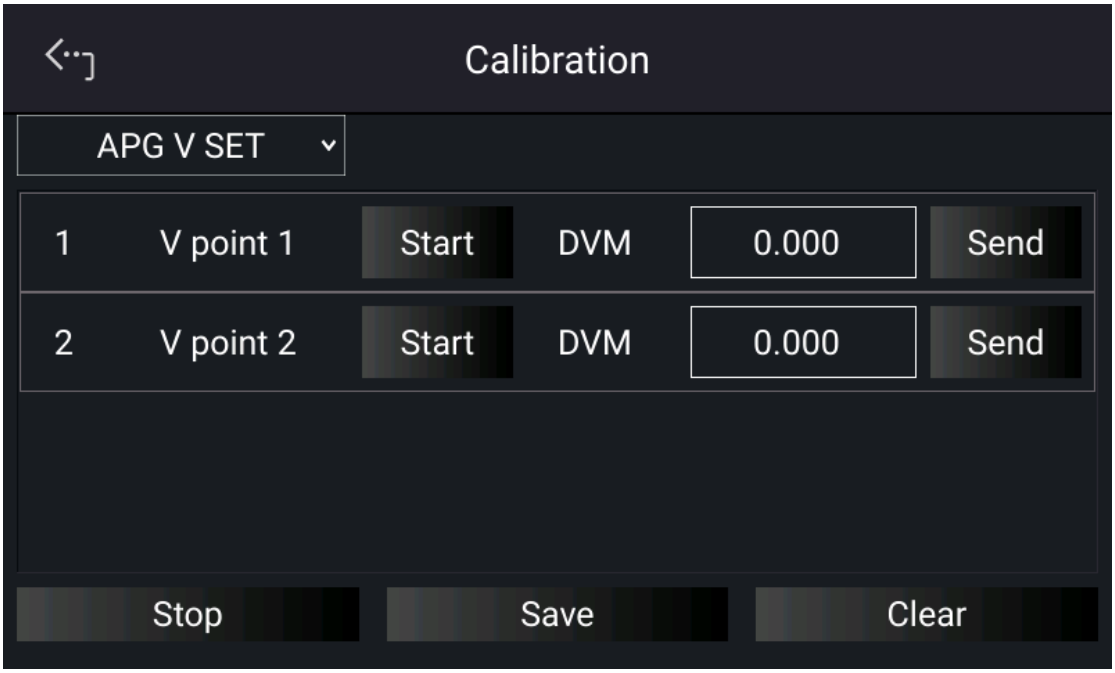


Figure 3-88

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.
2. If HP 34461A is used, the DVM1 and DVM2 can be connected to the front and rear measurement input terminals respectively.

2. When on the APG V SET page and the wires are correctly connected, tap “START” next to V point 1 to calibrate the first point voltage.

3. The user will be prompted to input approx. 1V voltage signal (TP120). Adjust the Power Supply to 1V±0.1V and use DVM1 to measure the Power Supply. Enter the measured voltage into position [1] and tap “SEND” to confirm.

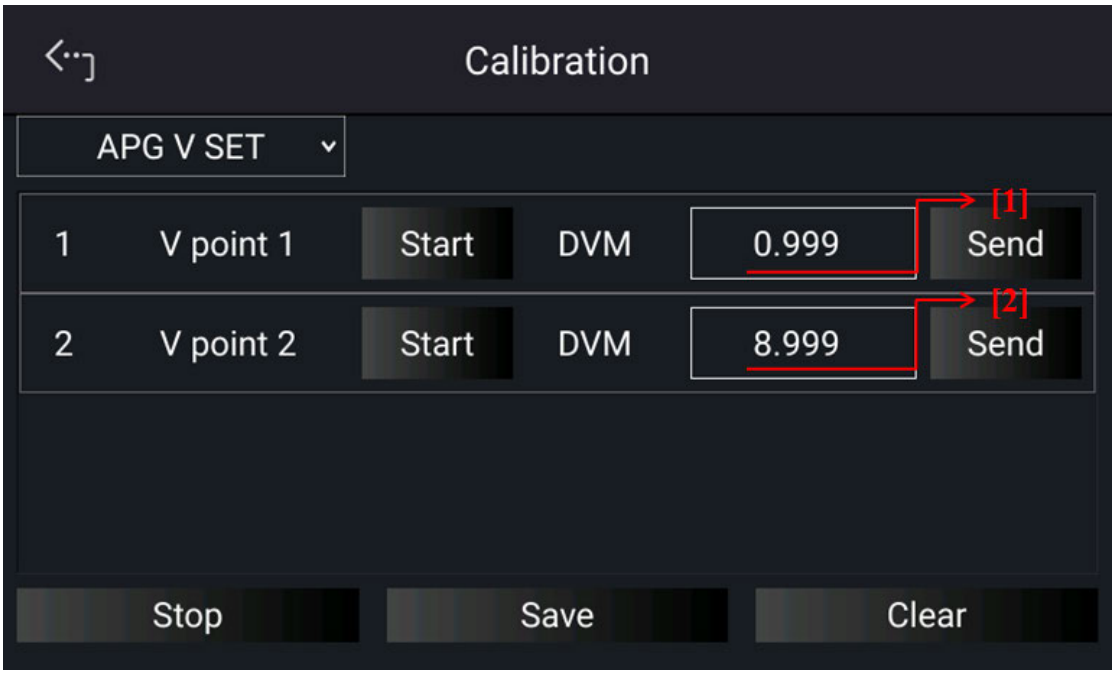


Figure 3-89

4. Next, tap “START” next to V point 2 to calibrate the second point voltage. The user will be prompted to input approx. 9.0V voltage signal (TP120). Adjust the Power Supply to 9V±0.1V and use DVM1 to measure the Power Supply. Enter the measured voltage to position [2] and tap “SEND” to confirm.

5. When the APG voltage calibrations are done, tap “STOP” to exit the calibration procedure. To save the calibration data, tap “SAVE”, and tap “CLEAR” to delete the calibration parameters if there is no need to save them.

3.2.5.4.4 APG Voltage Measurement Calibration

The hardware requirements for APG voltage measurement calibration are listed in Table 3-8.

Table 3-8

Device	Suggest Model or Capacity
DVM	HP 34461A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-90 shows the wire connection for APG voltage measurement calibration.

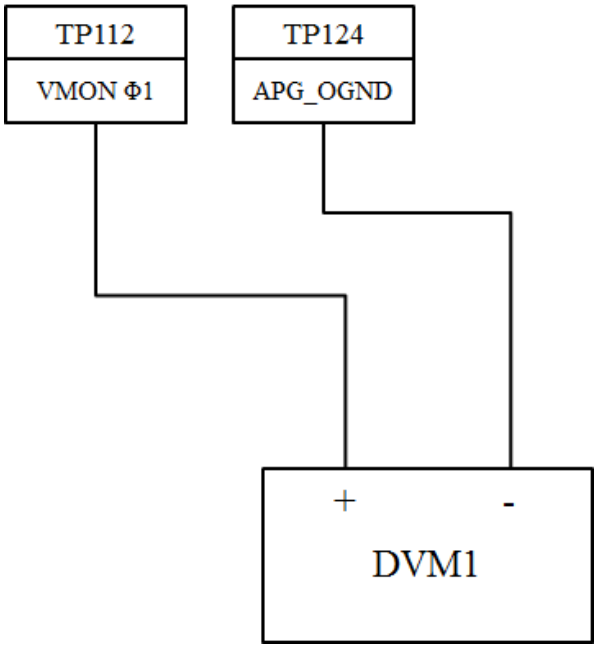


Figure 3-90

Notice When conducting the APG voltage measurement calibration, each calibration point has to enter at least 4 Arabic numerals to ensure the power supply accuracy after calibration.

Calibration Procedure (62000D-HL):

1. On the Calibration page, tap “Host V” to select APG V MEAS and list the APG voltage calibration items as shown in Figure 3-91.

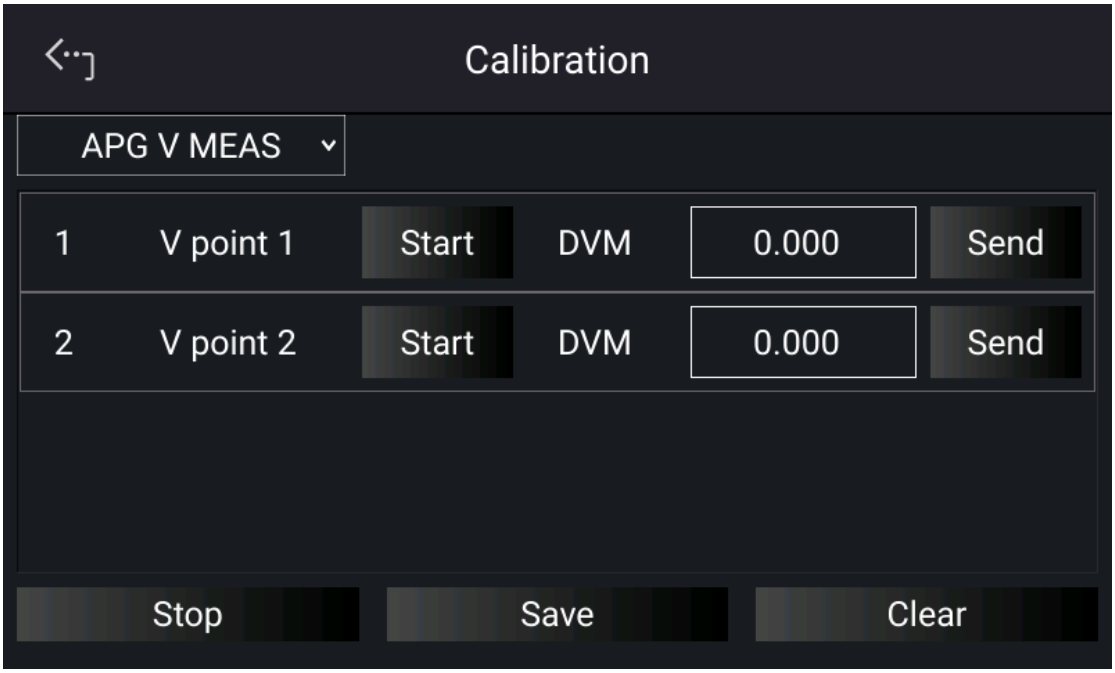


Figure 3-91

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.
2. If HP 34461A is used, the DVM1 and DVM2 can be connected to the front and rear measurement input terminals respectively.

2. When on the APG V MEAS page and the wires are correctly connected, tap “START” next to V point 1 to calibrate the first point voltage.

3. The system will set the output voltage on the rear panel to approx. 1.0V (TP112). Use DVM1 to measure the Power Supply. Enter the measured voltage to position [1] and tap “SEND” to confirm.

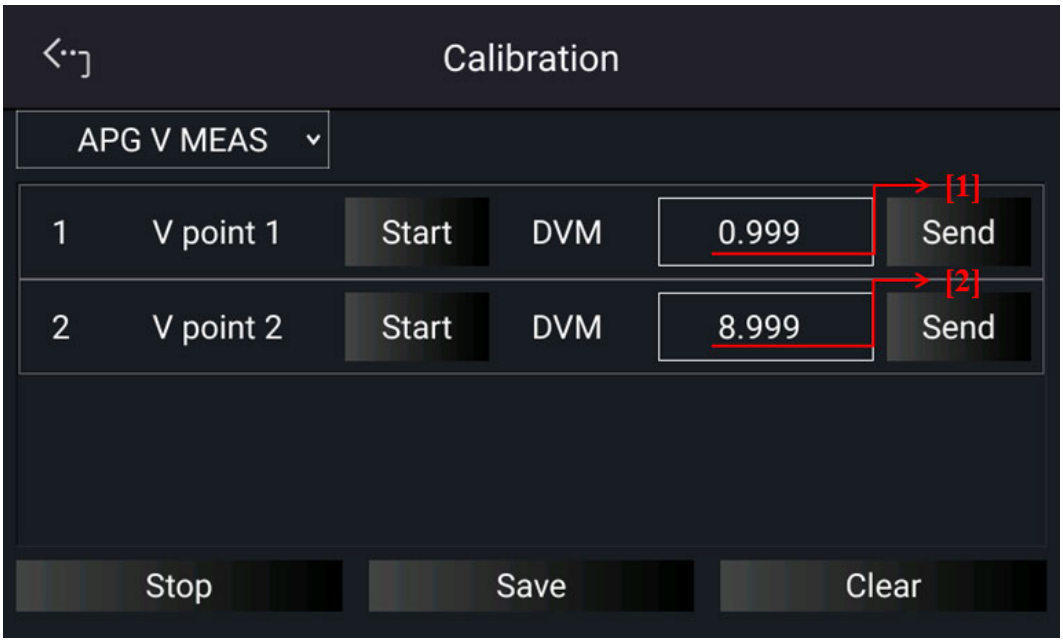


Figure 3-92

4. Next, tap “START” next to V point 2 to calibrate the second point voltage. The system will set the output voltage on the rear panel to approx. 9.0V (TP112). Use DVM1 to measure the Power Supply. Enter the measured voltage to position [2] and tap “SEND” to confirm.

5. When the APG voltage calibrations are complete, tap “STOP” to exit the calibration procedure. To save the calibration data, tap “SAVE”, and tap “CLEAR” to delete the calibration parameters if there is no need to save them.

Notice

Calibration points may be different for other models (not 62000D-HL). Please operate according to the instructions displayed.

3.2.5.4.5 APG Current Output Calibration

The hardware requirements for APG current output calibration are listed in Table 3-9.

Table 3-9

Device	Suggest Model or Capacity
DVM	HP 34461A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-90 shows the wire connection for APG voltage output calibration.

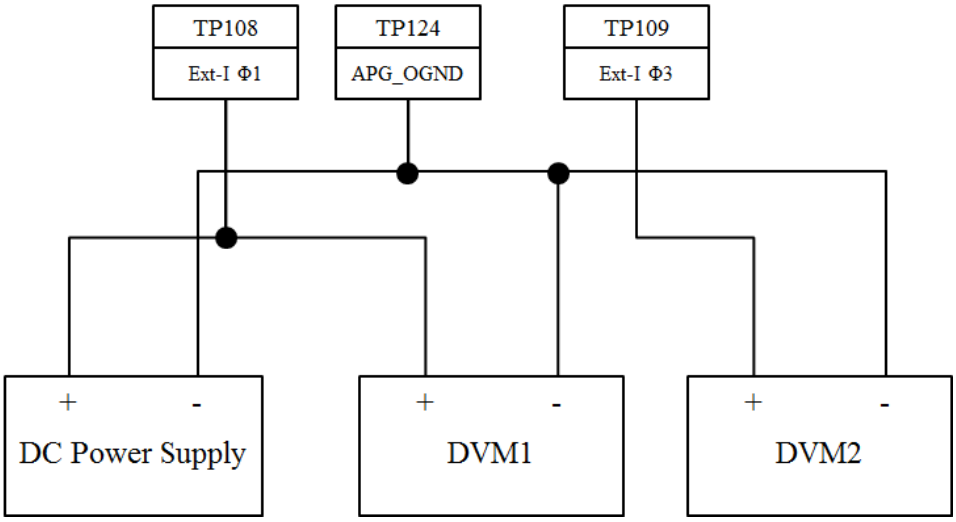


Figure 3-93

Notice When conducting the APG current output calibration, each calibration point has to enter at least 4 Arabic numerals to ensure the power supply accuracy after calibration.

Calibration Procedure (Model 62000D-HL):

1. Tap “Menu”, “Configuration” and “Interface” to select the “APG” page, and set the I SOURCE SET and I LOAD SET to Verf (0-10V).

2. On the Calibration page, tap “Host V” to select APG I SET and list the APG current calibration items as shown in Figure 3-94.

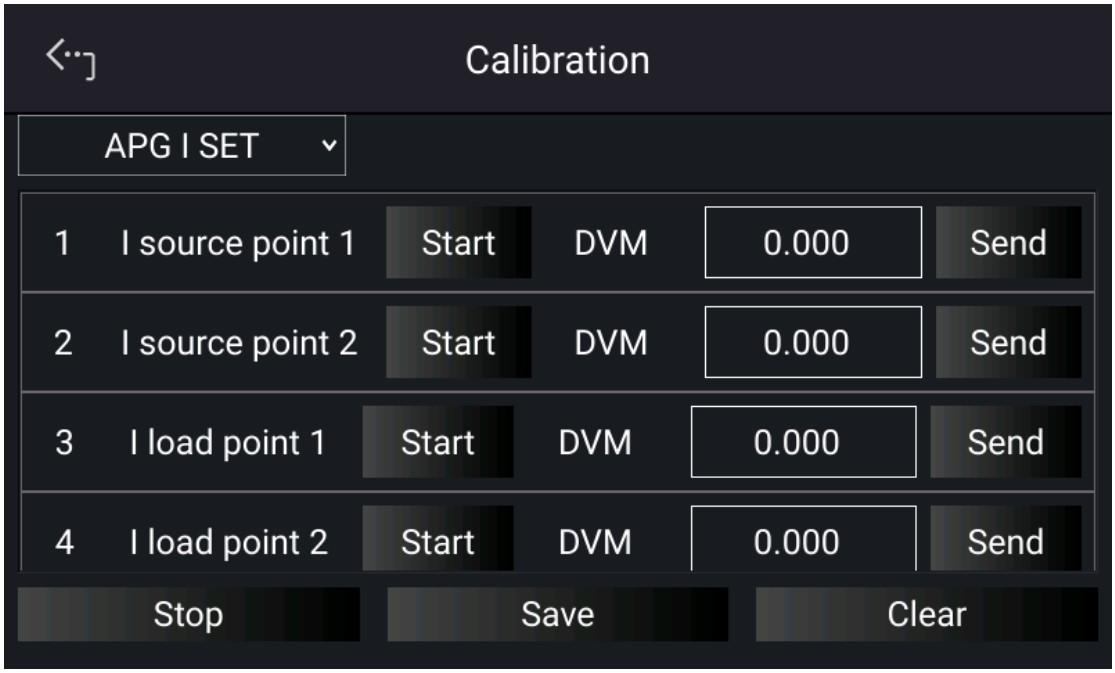


Figure 3-94

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.
2. Calibration points may be different for other models (not 62000D-HL), please operate it following the instructions displayed.

3. When on the APG I SET page and the wires are correctly connected, tap “START” next to I source point 1 to calibrate the first point current.

4. It will request you to input approx. 1V voltage signal (TP108). Adjust the Power Supply to 1V±0.1V and use DVM1 to measure the Power Supply. Enter the measured voltage to position [1] and tap “SEND” to confirm as Figure 3-95 shows.

5. Next, tap “START” next to I source point 2 to calibrate the second point current. Adjust the Power Supply to 9V±0.1V and use DVM1 to measure the Power Supply. Enter the measured voltage to position [2] and tap “SEND” to confirm as Figure 3-95 shows.

6. Tap “START” next to I load point 1 to calibrate the first point positive current. It will request you to input approx. 1V voltage signal (TP109). Adjust the Power Supply to 1V±0.1V and use DVM2 to measure the Power Supply. Enter the measured voltage to position [3] and tap “SEND” to confirm as Figure 3-95 shows.

7. Next, tap “START” next to I load point 2 to calibrate the second point negative current. Adjust the Power Supply to 9V±0.1V and use DVM2 to measure the Power Supply. Enter the measured voltage to position [4] and tap “SEND” to confirm as Figure 3-95 shows.

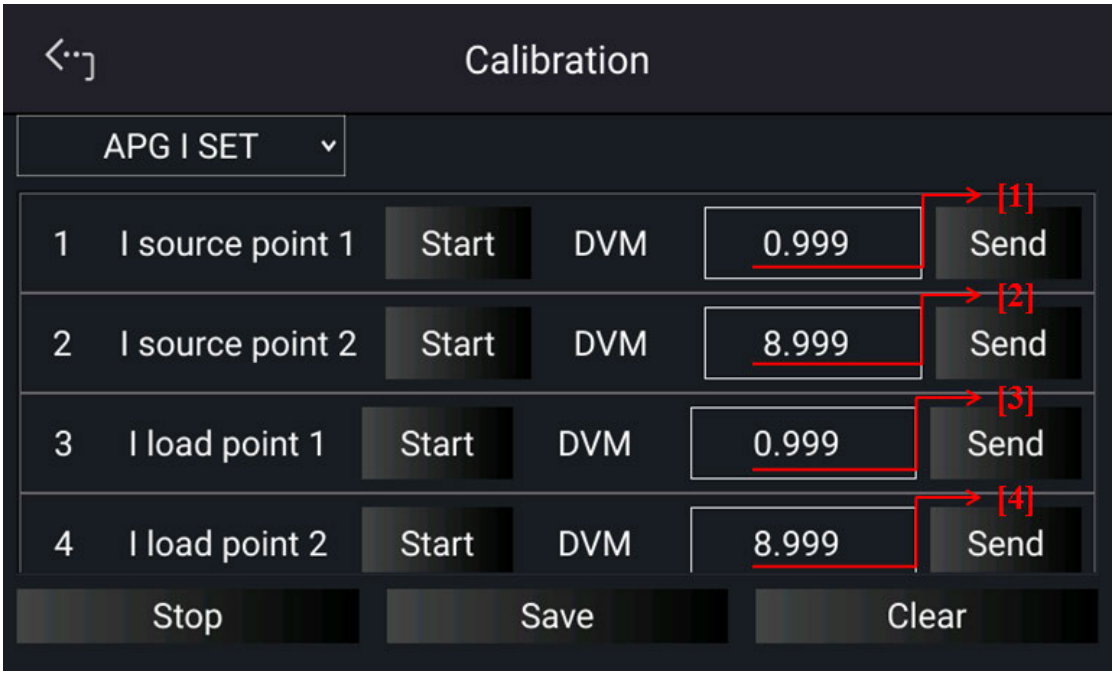


Figure 3-95

8. When the APG current calibrations are done, tap “STOP” to exit the calibration procedure. To save the calibration data, tap “SAVE”, and tap “CLEAR” to delete the calibration parameters if there is no need to save them as Figure 3-95 shows.

9. When done, return to the “APG” of “Interface” to set the I SOURCE SET and I LOAD SET to None.

3.2.5.4.6 APG Current Measurement Calibration

The hardware requirements for APG current measurement calibration are listed in Table 3-10.

Table 3-10

Device	Suggest Model or Capacity
DVM	HP 34461A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-96 shows the wire connection for APG current measurement calibration.

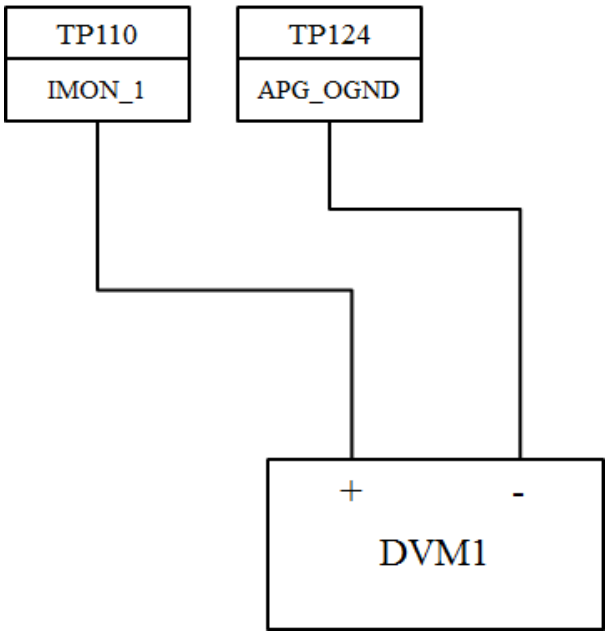


Figure 3-96

Notice

When conducting the APG current measurement calibration, each calibration point has to enter at least 4 Arabic numerals to ensure the power supply accuracy after calibration.

Calibration Procedure (Model 62000D-HL):

1. On the Calibration page, tap “Host V” to select APG I MEAS and list the APG current calibration items as shown in Figure 3-97.

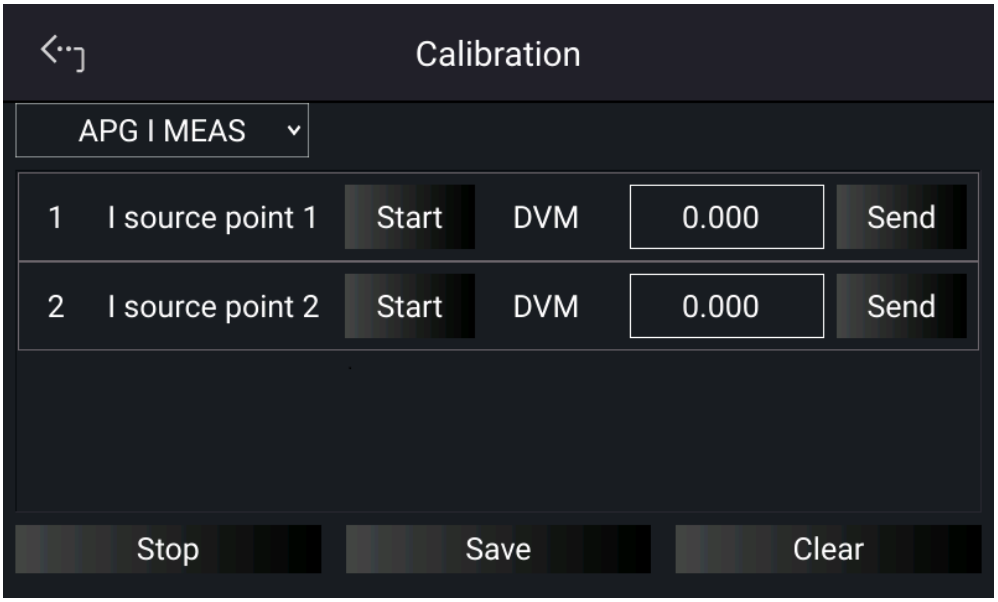


Figure 3-97

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.
2. Calibration points may be different for other models (not 62000D-HL), please operate it following the instructions displayed.

2. When on the APG I MEAS page and the wires are correctly connected, tap “START” next to I source point 1 to calibrate the first point current. The system will set the output voltage on the rear panel to approx. -9V (TP110). Use DVM1 to measure the Power Supply. Enter the measured current to position [1] and tap “SEND” to confirm.

3. Next, tap “START” next to I source point 2 to calibrate the second point current. The system will set the output voltage on the rear panel to approx. 9V (TP110). Use DVM1 to measure the Power Supply. Enter the measured current to position [2] and tap “SEND” to confirm.

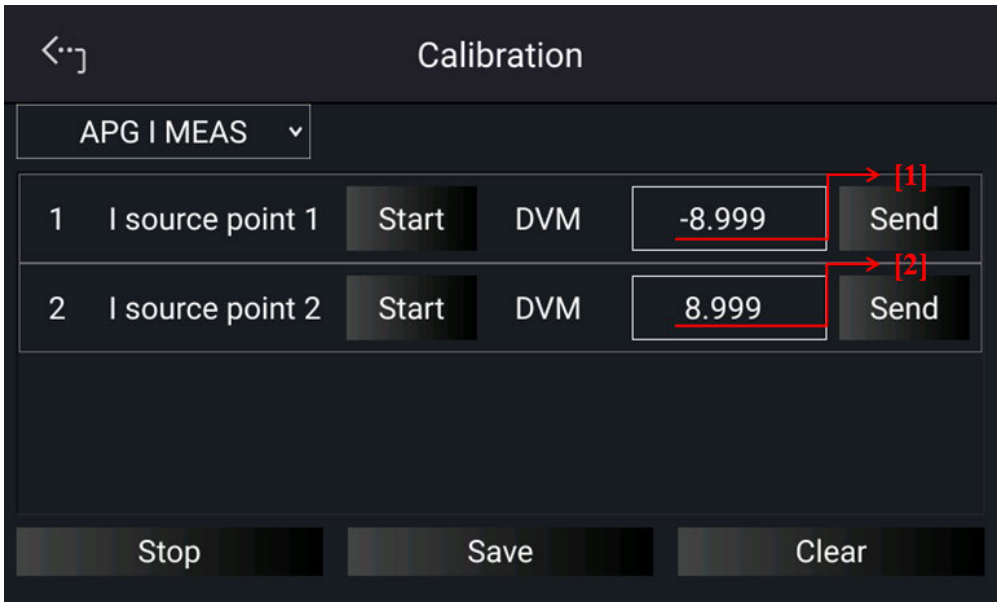


Figure 3-98

4. When the APG current calibrations are done, tap “STOP” to exit the calibration procedure. To save the calibration data, tap “SAVE”, and tap “CLEAR” to delete the calibration parameters if there is no need to save them as Figure 3-98 shows.

3.2.5.5 External Output

The setting of DI1 and DI2 functions needs to work with an external Analog Interface as Figure 3-99 shows.

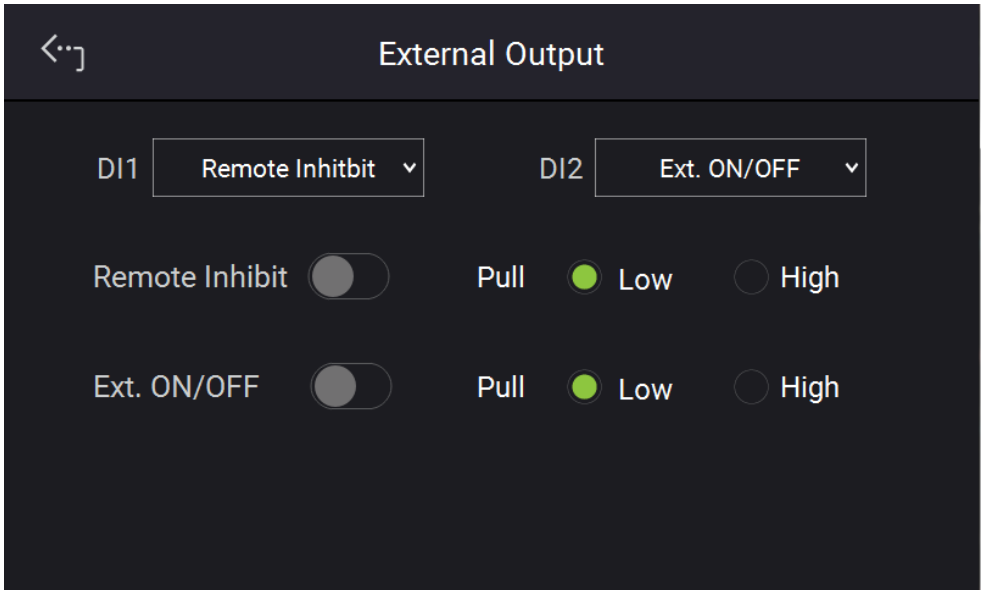


Figure 3-99

1. The remote INHIBIT function allows users to remotely turn off the power supply. Pull: Low sets Remote INHIBIT to enable, the power supply's ON/OFF is still controlled by "  ". When the Pin 6 and Pin18 (_INHIBIT) of ANALOG INTERFACE are triggered at a low level that equals to tap "  " on the front panel and set OUTPUT = OFF. The DC power supply will shut down and send out a protection signal (in this case the "  " button will be off), and Pin6 and Pin18 (_INHIBIT) of ANALOG INTERFACE cannot be used to unlock the protection.
2. When protection occurs to REMOTE INHIBIT the main page will appear with the protection message as Figure 3-100 shows.
3. Tap "Confirm" to return to the main page.

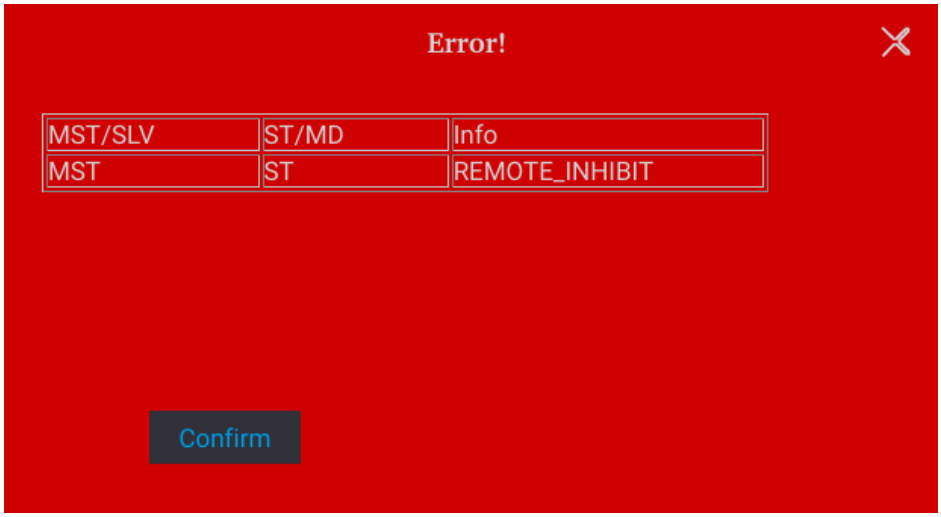


Figure 3-100

4. Pin6 and Pin18 are the input pins of the TTL Level and can set the initial state to logic: ON=HIGH or OFF=LOW.

5. When the DC power supply is set to OUTPUT = ON, the detailed actions of REMOTE INHIBIT are shown in Figure 3-101.

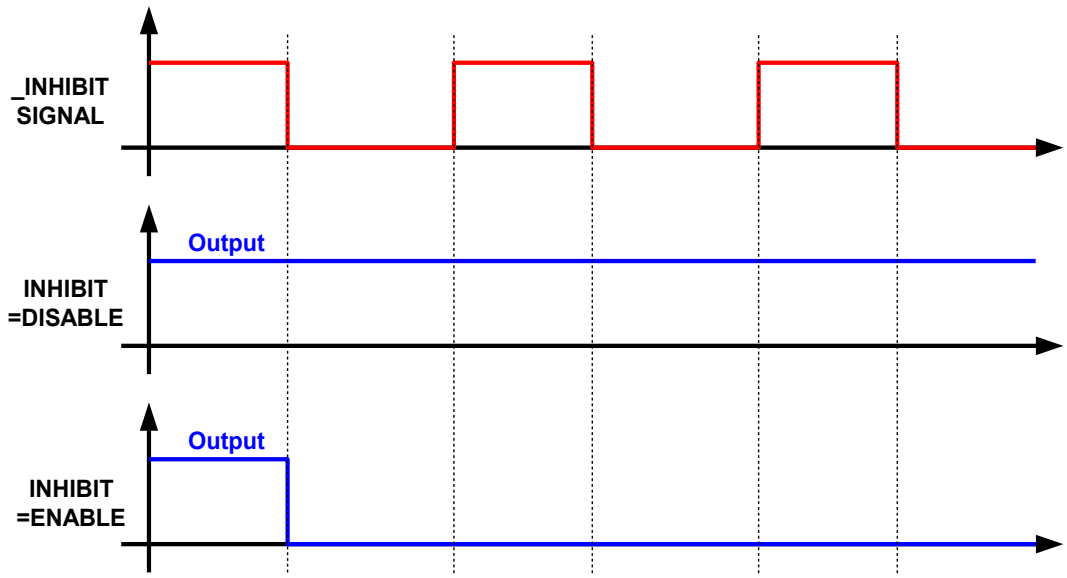


Figure 3-101

Ext. ON/OFF function allows users to control the DC power supply's output through the Pin 6 & 18 (_EXT_ON) of ANALOG INTERFACE.

6. Tap EXT ON/OFF to set DISABLE and ENABLE;

   (1) Selecting DISABLE: Turns output off.

   (2) Selecting ENABLE: Sets EXTERNAL ON/OFF to ENABLE and make the "  " invalid, also Pin 6 & 18 (_EXT_ON) replace the "  " to control the power supply's ON/OFF. When the Pin 6 & 18 (_EXT_ON) voltage level of ANALOG INTERFACE turns to HIGH, the power supply is unable to output, that is OUTPUT = OFF. When the Pin 6 & 18 (_EXT_ON) voltage level turns to LOW, the DC power supply outputs normally, that is OUTPUT = ON.

7. When the EXT. ON/OFF is enabled, and the MAIN page will appear with the EXT message. Moreover, Pin 6 & 18 are the input pins of TTL Level and can set the initial state to PULL=HIGH or PULL=LOW.

8. When the DC power supply is set to OUTPUT = ON, the detailed actions of EXTERNAL ON/OFF are shown in Figure 3-102.

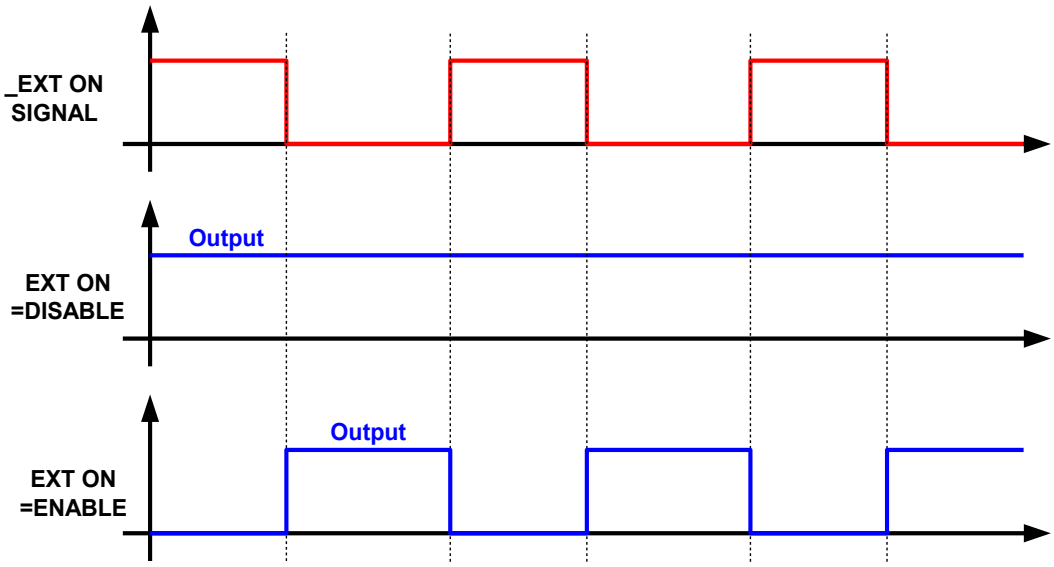


Figure 3-102

4. Program Sequence

The 62000D-HL Series DC power supplies allow users to program the sequence for output in List Mode and V Step Mode.

List Mode has 10 programs and each program can add new sequences liberally so that a total of 100 sequences is available for editing. Each sequence in List Mode can be edited for voltage settings, voltage slew rates, current settings, current slew rates, run times, and trigger types that can apply to almost any situation.

Setting steps:

1. Select "**Program Seq.**" from the Menu page.
2. On the Program Seq. page, select List Mode, and the screen appears as Figure 4-1.
3. To quit programming the sequence, tap "**Program Seq. >**" on the upper left to return to the Menu page.

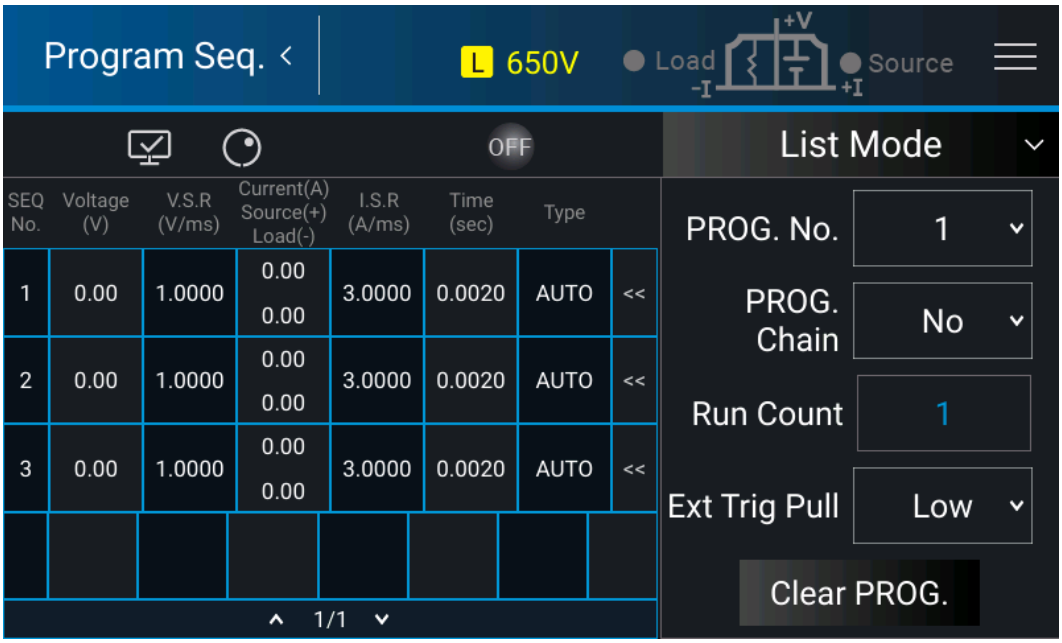


Figure 4-1

V Step Mode provides a run time voltage program with a maximum of 99 hours 59 minutes and 59.99 seconds.

Setting steps:

1. Enter into Program Seq. and the screen appears as shown in Figure 4-1.
2. Tap "**List Mode**" to open the options as Figure 4-2 shows.
3. Select "**V Step Mode**" to enter into V Step Mode as Figure 4-3 shows.
4. To quit programming the sequence, tap "**Program Seq. >**" on the upper left to return to the Menu page.

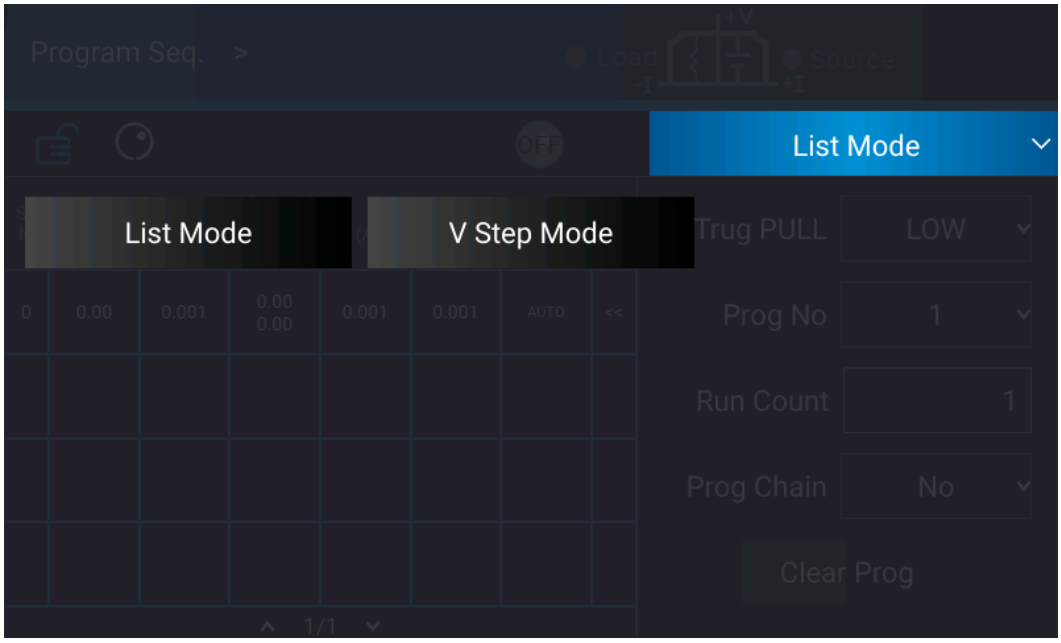


Figure 4-2

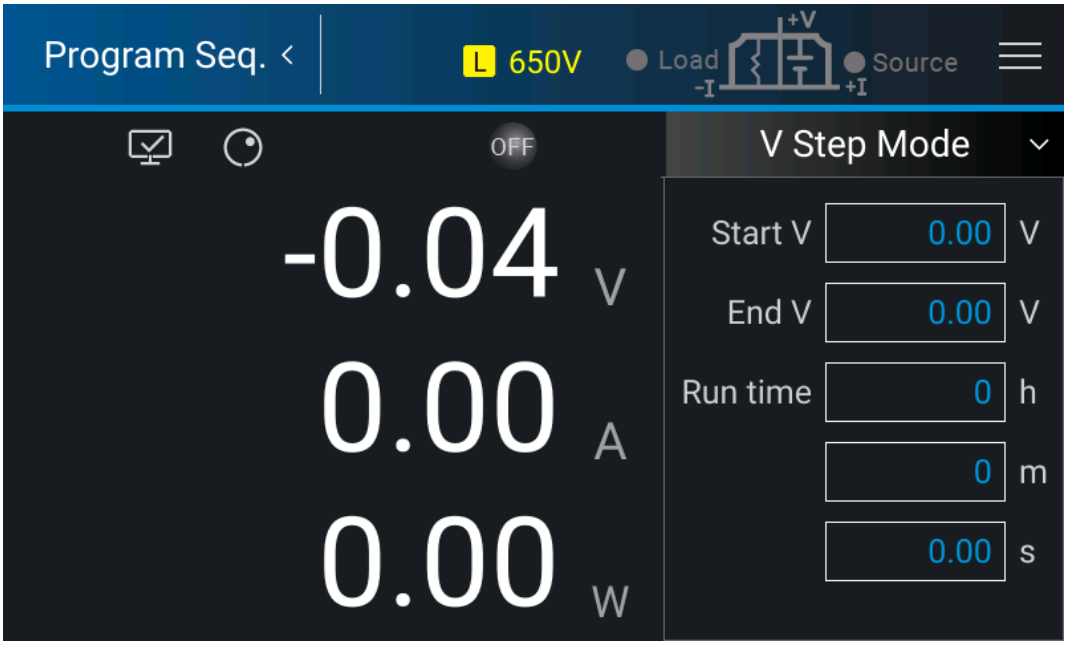


Figure 4-3

4.1 List Mode

In List Mode, there are a maximum of 100 sequences that can be added to one program. The sequence setting is described in section 4.1.2 and the complete program structure is listed in Figure 4-4.

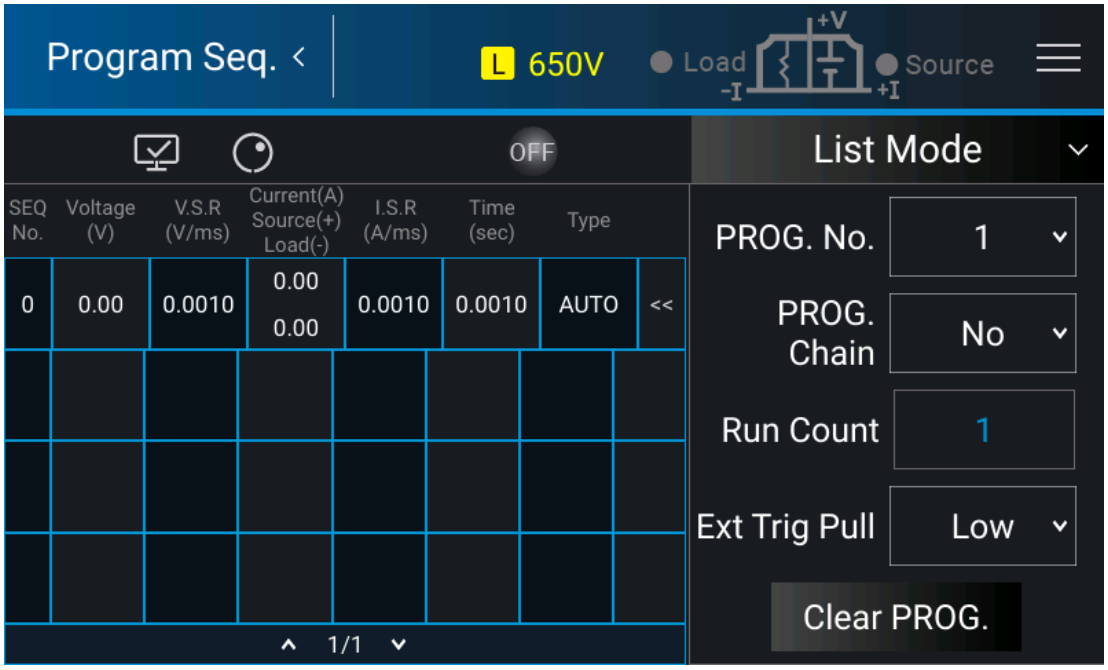


Figure 4-4

4.1.1 Program Settings

A program has 5 settings: (1) Ext Trig PULL, (2) Prog No, (3) Run Count, (4) Prog Chain, and (5) Clear Prog.

4.1.1.1 Setting Ext Trig Pull

Tap Ext Trig Pull on the right and select HIGH or LOW.

Notice

1. When the Ext Trig is set to HIGH, a negative edge trigger signal (TTL level) is needed from the Analog Interface PIN 15 on the rear panel to move to the next sequence step.
2. When the Ext Trig is set to LOW, a high-level signal from the Analog Interface PIN15 on the rear panel changes to a low-level signal (negative edge trigger) to move to the next sequence step.

4.1.1.2 Setting Prog No.

Tap Prog No. on the right, the valid range is 1~10.

4.1.1.3 Setting Run Count

Tap Run Count on the right and input the value.

Each program has a Run Count that sets the execution number.

Table 4-1 lists the Run Count range:

Table 4-1

Run Count	Min.	Max.
Times	1	15000

Ex. 1: Set RUN COUNT for a program
Set Prog Chain =3, Run Count =2 for Prog No.1.
Set Prog Chain =No, Run Count =2 for Prog No.3.
The program execution flow of Run Count is listed in Figure 4-5.

A1: Execution steps:
(1) When all Prog No.1 sequences are done, return to Prog No.1.
(2) Repeat step (1) twice, skip Prog No.2, and jump to Prog No.3.
(3) When all Prog No.3 sequences are done, return to Prog No.3.
(4) Repeat step (3) twice.
(5) End

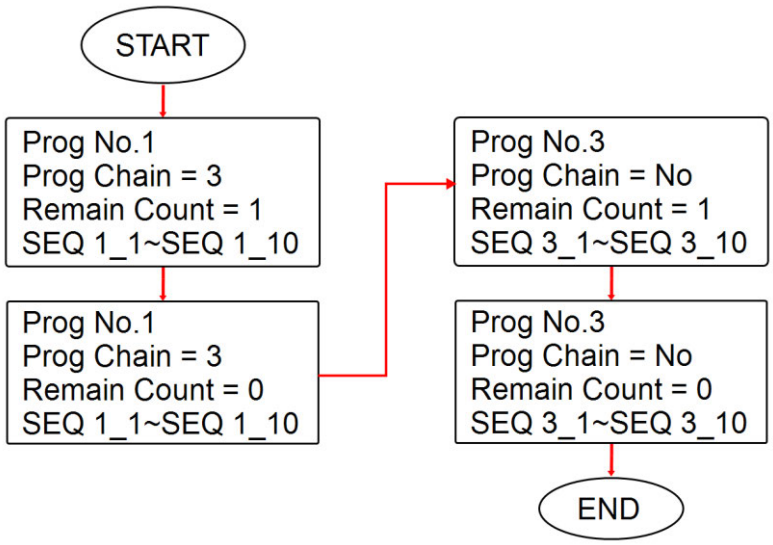


Figure 4-5

4.1.1.4 Setting Prog Chain

Tap “Prog Chain” on the right and select “No” or set the value from 1~10.

The Program Chain indicates the link among programs. To execute a different program, select the next Prog No. to be executed. The setting range is 0 ~ 10.

When the value is set to 1~10, it means to chain the programs as in the example shown below.

Ex. 2: Chain among programs
Set Prog Chain =3, Run Count =1 for Prog No.1.
Set Prog Chain =6, Run Count =1 for Prog No.3.
Set Prog Chain =No, Run Count =1 for Prog No.6.
The program execution flow is listed in Figure 4-6.

A2: Execution steps:

(1) When all Prog No.1 sequences are done, skip Prog No.2 and jump to Prog No.3.
(2) When all Prog No.3 sequences are done, skip Prog No.4 and Prog No.5, and jump to Prog No.6.
(3) End

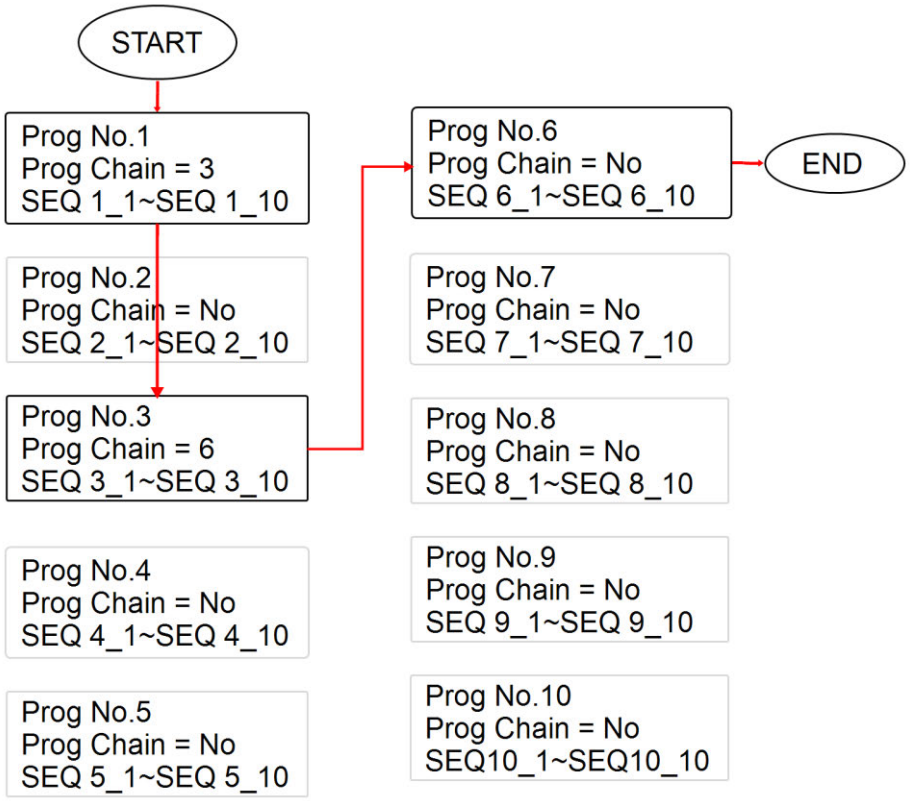


Figure 4-6

Ex. 3: Use a Program to form an infinite loop.
Set Prog Chain =1, Run Count =1 for Prog No.1.
The program execution flow is listed in Figure 4-7.

A3: Execution steps:

(1) When all Prog No.1 sequences are done, jump to Prog No.1.
(2) Rerun step (1).
(3) Form an infinite loop.

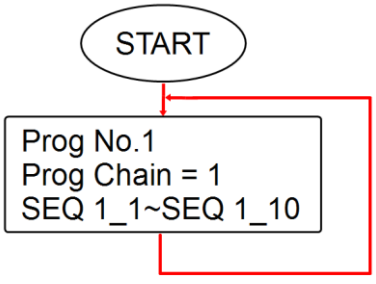


Figure 4-7

Notice If the program is commanded to skip to the next Program and there is no sequence or all sequences are set to Skip (see 4.1.2.1), then the program will stop execution.

4.1.1.5 Setting Clear Program

Tap Clear Prog on the right to clear all sequences in the program.

4.1.2 Setting Program Seq.

1. The default sequence of all programs is 0 and a maximum of 100 sequences can be added freely to a program. In other words, the total sequences to be used by 10 programs are 100 maximum.

2. Adding a new sequence:
   a. In the Program Seq. page (Figure 4-8), drag the "<<" boxed in red dot line to show a hidden function bar as shown in Figure 4-9.
   b. Select the red dot line box in Figure 4-9 to add a new sequence. Check if the SEQ No. column turns to 1 from 0 as Figure 4-10 shows.
   c. Repeat steps a and b to a new sequence.

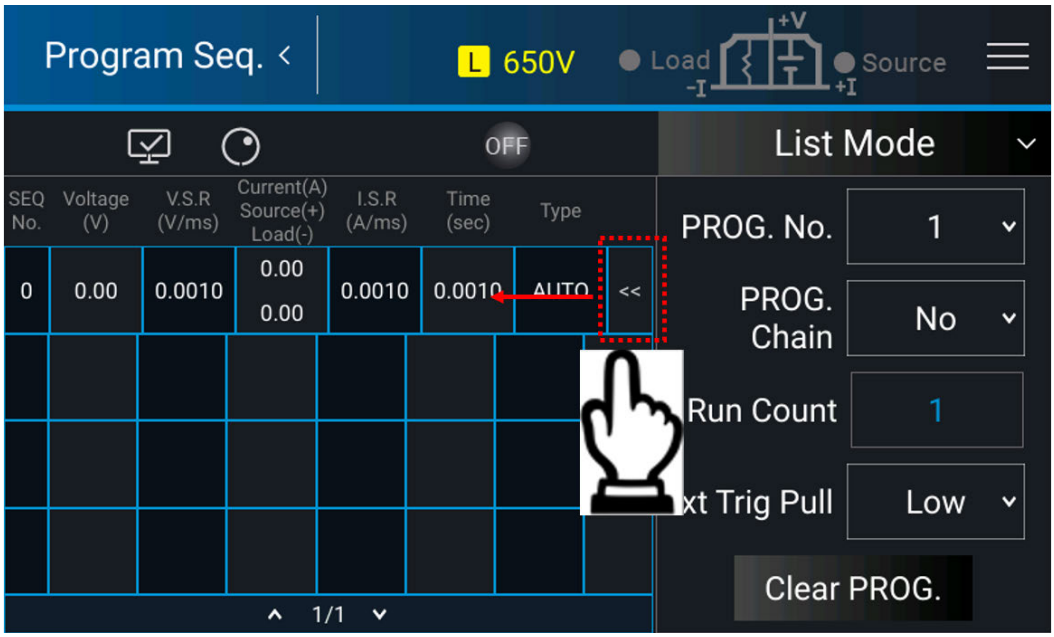


Figure 4-8

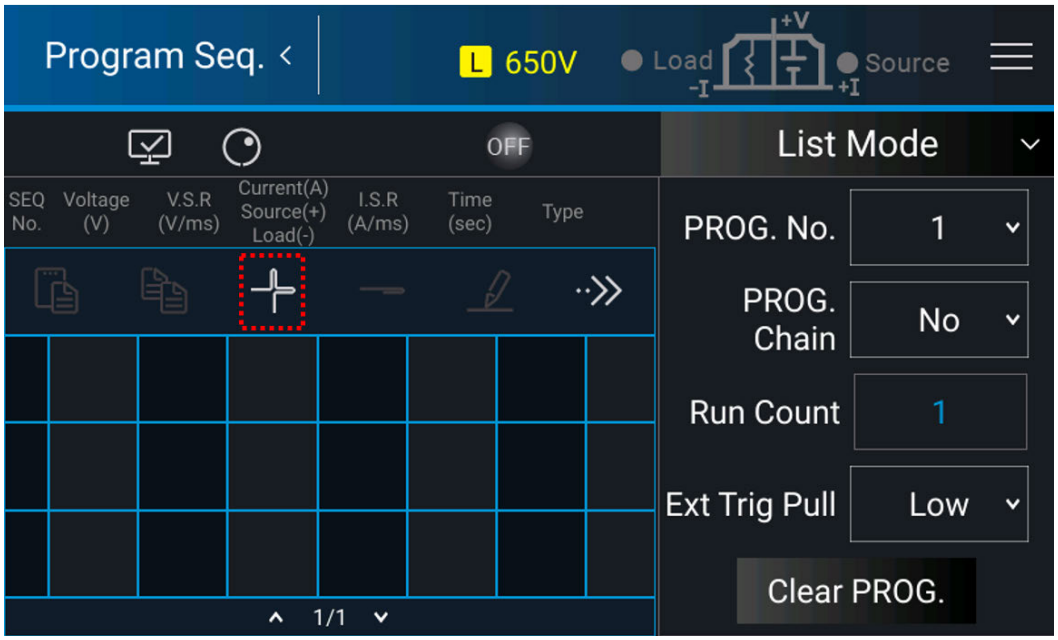


Figure 4-9

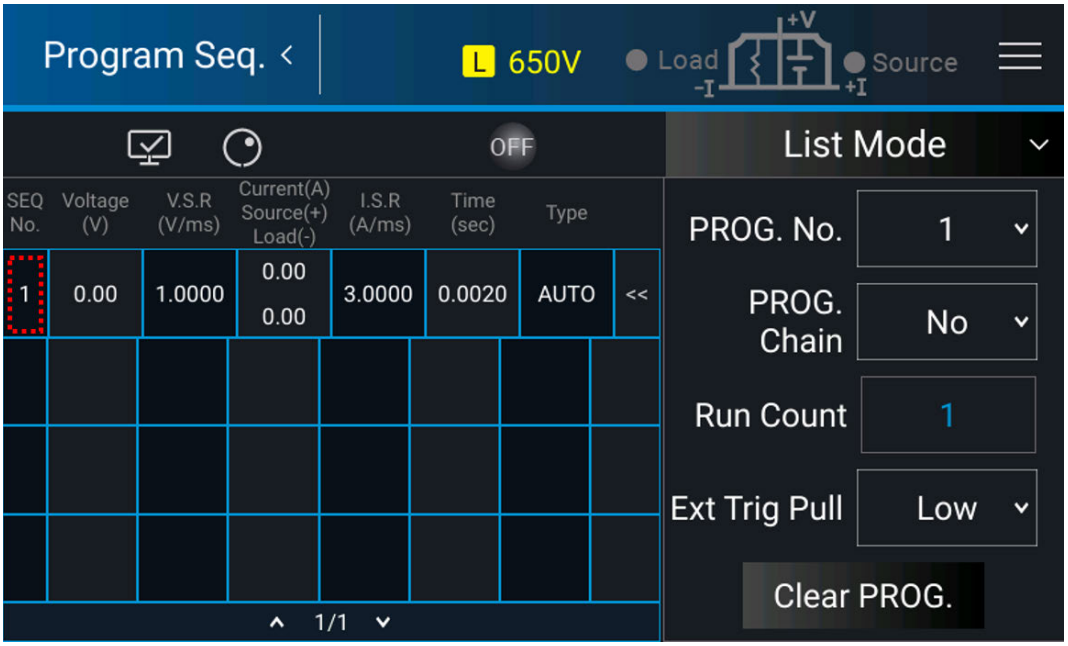


Figure 4-10

3. Setting a SEQUENCE:
   a. Repeat the steps to add a new sequence to show the hidden function bar. Tap the red dot line box in Figure 4-11 to perform the setting as Figure 4-12 shows.
   b. Each Sequence can include the following 7 items: (1) Voltage, (2) V slew rate, (3) Source current, (4) Load current, (5) I slew rate, (6) Type, and (7) Time as described below.

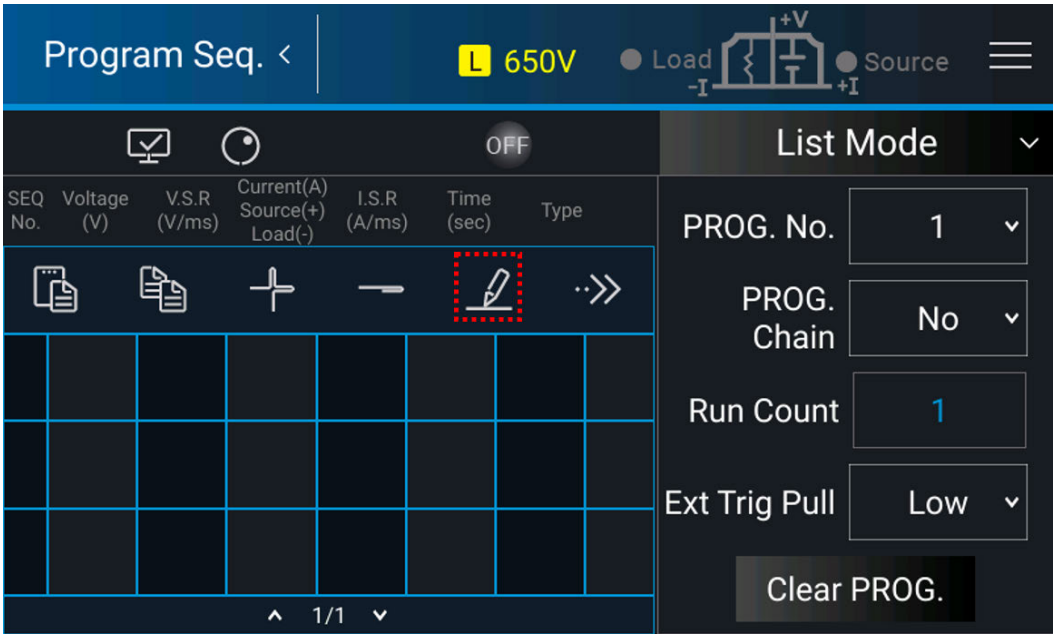


Figure 4-11

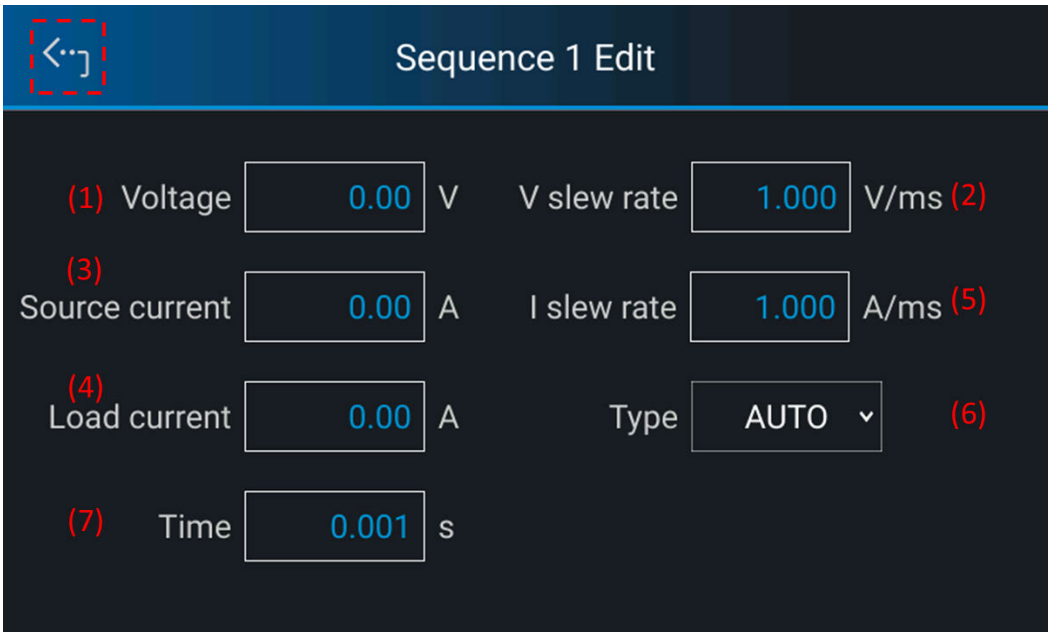


Figure 4-12

4.1.2.1 Setting Sequence Type

1. Tap Type as labeled (6) in Figure 4-12 to set the sequence type.

2. There are 4 sequence types, these are (a) AUTO, (b) MANUAL, (c) TRIGGER, and (d) SKIP.

   A. Setting sequence type to AUTO
   When SEQ TYPE = AUTO is selected, the page shown in Figure 4-13 indicates the sequence will complete the execution automatically and skip to the next sequence.

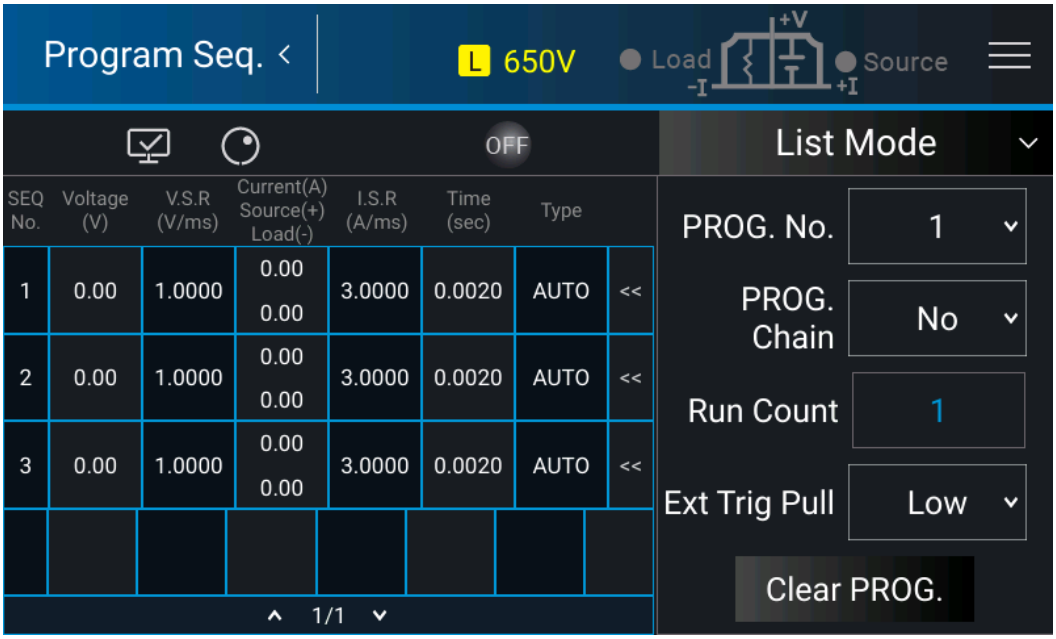


Figure 4-13

Execution steps:

(1) SEQ#1
  (1) Since SEQ TYPE = AUTO is set for SEQ#1, it begins to execute the settings in SEQ#1.
  (2) During SEQ#1 voltage rise, the maximum loading current is 1A and does not exceed the current setting 20A; therefore SEQ#1 is in CV Mode during voltage rise.
  (3) Once the voltage reaches the set 10V, the program lasts for 5 seconds from rising.
  (4) Skip to SEQ#2.

(2) SEQ#2
  (1) Since SEQ TYPE = AUTO is set for SEQ#2, it begins to execute the settings in SEQ#2.
  (2) During SEQ#2 voltage rise, the maximum loading current is 3A and does not exceed the current setting 20A; therefore, SEQ#2 is in CV Mode during the voltage rise.
  (3) Once the voltage reaches the set 30V, the program lasts for 10 seconds from rising.
  (4) Skip to SEQ#3.

(3) SEQ#3
  (1) Since SEQ TYPE = AUTO and TIME=0 are set for SEQ#3, it indicates SEQ#3 is not executing and the Program is ended.

(4) As RUN COUNT=2 is set, steps (1), (2), and (3) are executed again.

(5) End.

The output waveform is shown in Figure 4-14:

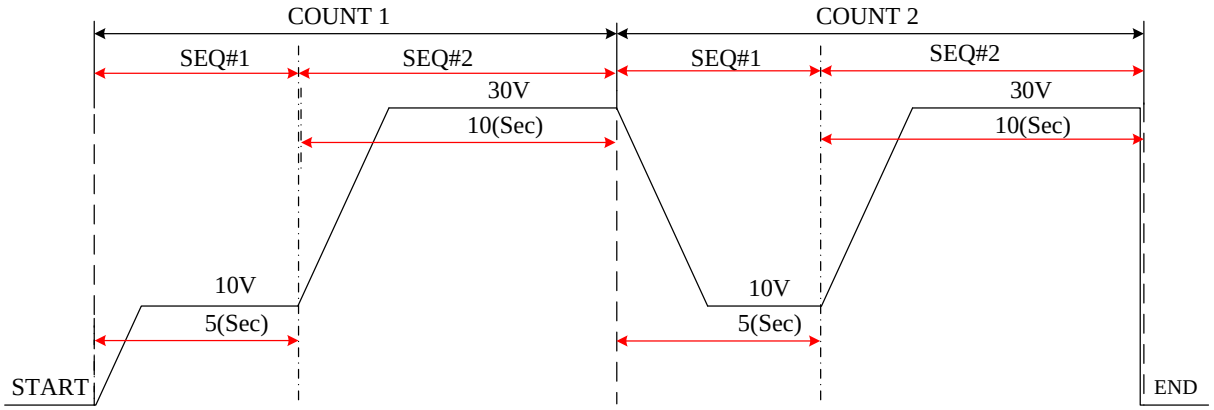


Figure 4-14

B. Setting sequence type to MANUAL
When SEQ TYPE = MANUAL is selected, the sequence will run automatically and stop at the setting of VOLTAGE or CURRENT without skipping to the next sequence until any key on the front panel is pressed.

C. Setting sequence type to TRIGGER
When SEQ TYPE = TRIGGER is selected, the sequence will run automatically and stop at the setting of VOLTAGE or CURRENT without skipping to the next sequence until inputting a signal from PIN15 of Analog Interface on the rear panel. See section 4.1.1.1 for the input signal definition of Analog Interface PIN 15.

D. Setting sequence type to SKIP
When SEQ TYPE = SKIP is selected, the Sequence page as shown in Figure 4-12 indicates the sequence will skip automatically and jump to the next sequence.

4.1.2.2 Setting Time

1. Tap Figure 4-12 (7) to set the time parameter.
2. The time range for setting is listed in the table below.

Table 4-2

Time	Min. (Sec)	Max. (Sec)
	0.002	15000

4.1.2.3 Setting Voltage

1. Tap Figure 4-12 (1) to set the voltage parameter.
2. See section 3.2 for a detailed description.

4.1.2.4 Setting Voltage Slew Rate

1. Tap Figure 4-12 (2) to set the voltage slew rate.
2. See section 3.2 for a detailed description.

4.1.2.5 Setting Current

1. Tap Figure 4-12 (3) and (4) to set the current parameter.
2. See section 3.2 for a detailed description.

4.1.2.6 Setting Current Slew Rate

1. Tap Figure 4-12 (5) to set the current slew rate.
2. See section 3.2 for a detailed description.

4.1.3 Execution in List Mode

When the sequences are finished for editing, press "  " to start execution and press "  " again to abort it.

4.2 V Step Mode

Allows users to set a run-time program using V Step Mode. Figure 4-15 shows the screen when V Step Mode is selected.

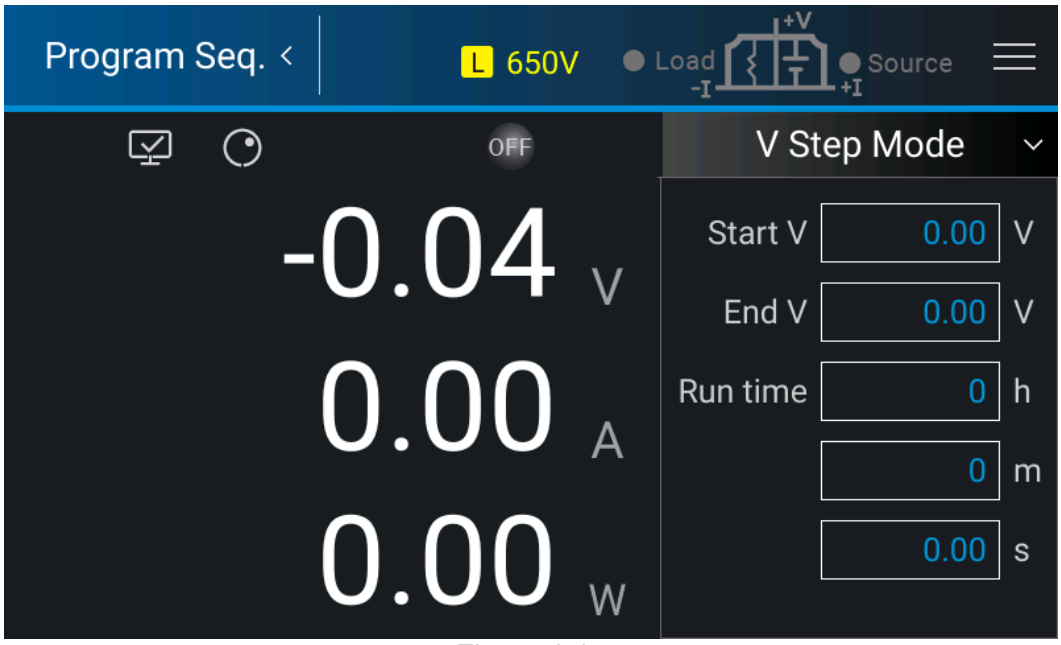


Figure 4-15

4.2.1 Setting V Step Mode

V Step Mode has three settings: (1) Start V, (2) End V, and (3) Run time.

4.2.1.1 Setting Start V

There are two methods to set Start V:

Method 1 (via touch panel):

1. Tap the 0.00 after Start V and the touch panel will switch to a numeric pad as shown in Figure 4-16.
2. Use numeric buttons (0 ~9) to set the value and tap "  " to complete the setting of Start V.

Figure 4-16

Method 2 (via rotary knob):

1. Tap  to use the "Rotary" () knob. Tap the value after Start V and the cursor at the lower right will flicker.
2. When the "Rotary" () knob is used for setting, pressing it can move the cursor to a different digit. Turning the rotary knob can increase or decrease the value of that digit.
3. When the value is confirmed, tap "  " to complete the Start V setting.

CAUTION When the initial voltage on the output of the supply does not equal the setting of Start V. There are two circumstances that may occur in V Step Mode: (1) The output voltage will rise to the setting of start voltage and the V Slew Rate is 1V/ms by default (which can be changed if desired), or (2) output voltage will fall to the setting of Start V and the falling time is calculated by the default 1V/ms (which can be changed if desired) while the actual V Slew Rate is varied by the load.

4.2.1.2 Setting End V

There are two methods to set End V:

Method 1 (via touch panel):

1. Tap the 0.00 after End V and the touch panel will switch to a numeric pad as shown in Figure 4-16.
2. Use numeric buttons (0 ~9) to set the value and tap "  " to complete the setting of End V.

Method 2 (via rotary knob):

1. Tap  to use the "Rotary" () knob. Tap the value after End V and the cursor at the lower right will flicker.
2. When the "Rotary" () knob is used for setting, pressing it can move the cursor to a different digit. Turning the rotary knob can increase or decrease the value of that digit.
3. When the value is confirmed, tap "  " to complete the End V setting.

4.2.1.3 Setting Run time

Sets the run time of V Step Mode. The time format is HOUR:MIN:SEC and the maximum setting is 99 hours 59 minutes and 59.99 seconds.

There are two methods to set the Run time:

Method 1 (via touch panel):

1. Tap the value after Run time and the touch panel will switch to a numeric pad.
2. Use numeric buttons (0 ~9) to set the value and tap "  " to complete the setting of Run time.

Method 2 (via rotary knob):

1. Tap  to use the "Rotary" () knob. Tap the value after Run time and the cursor at the lower right will flicker.
2. When the "Rotary" () knob is used for setting, pressing it can move the cursor to a different digit. Turning the rotary knob can increase or decrease the value of that digit.
3. When the value is confirmed, tap "  " to complete the Run time setting.

Notice

It is suggested to set the initial Vset voltage and the current under SOURCE & LOAD (the current setting value cannot be lower than the load current, otherwise the output time will not be equal to the Run time setting) in Meas. & Setup as shown in Figure 3-3 before entering V Step Mode and tapping "  " for output.

Ex. 1: Set the Start V to 10V, End V to 50V, and Run time to 10 minutes.

CASE1: The hardware's initial voltage is 0V and the output waveform is as Figure 4-17 shows.
CASE2: The hardware's initial voltage is 10V and the output waveform is as Figure 4-18 shows.
CASE3: The hardware's initial voltage is 20V and the output waveform is as Figure 4-19 shows.

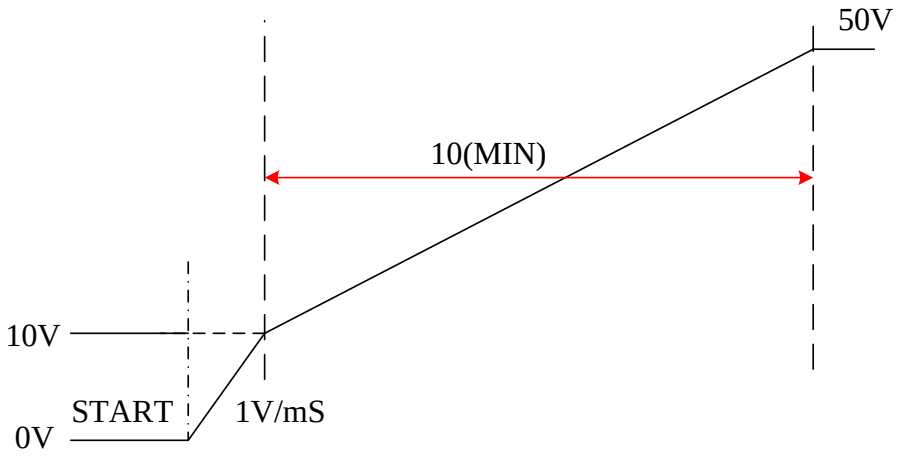


Figure 4-17

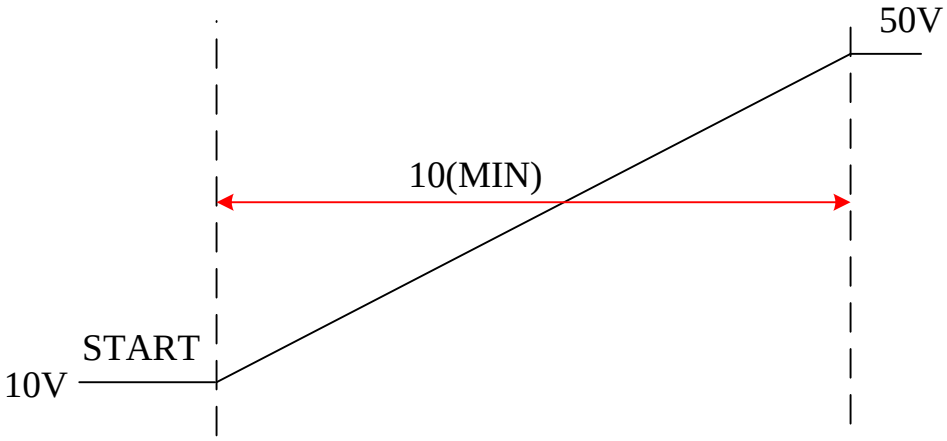


Figure 4-18

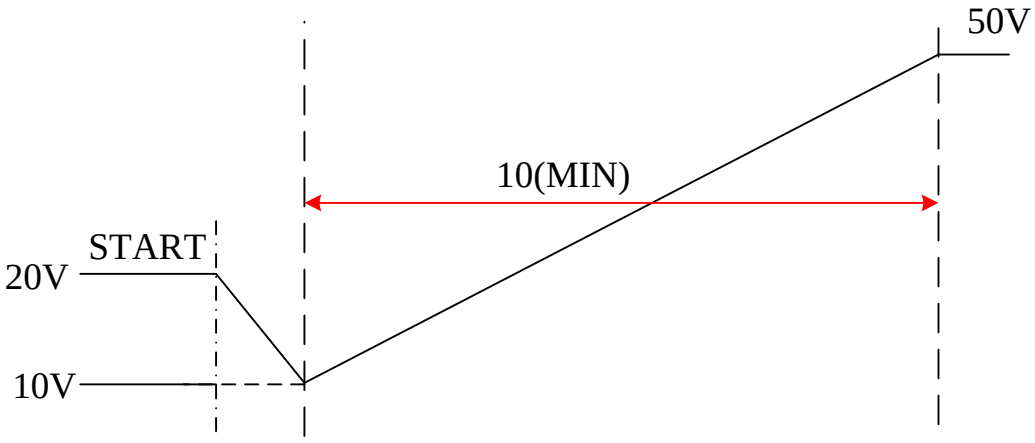


Figure 4-19

4.2.2 Execution in V Step Mode

After the settings of Start V, End V, and Run time are done, tap “  ” to confirm and start the execution. Tap “  ” again to abort.

4.2.2.1 Running V Step Mode

Tap “  ” to execute it and the screen will appear as Figure 4-20 shows.

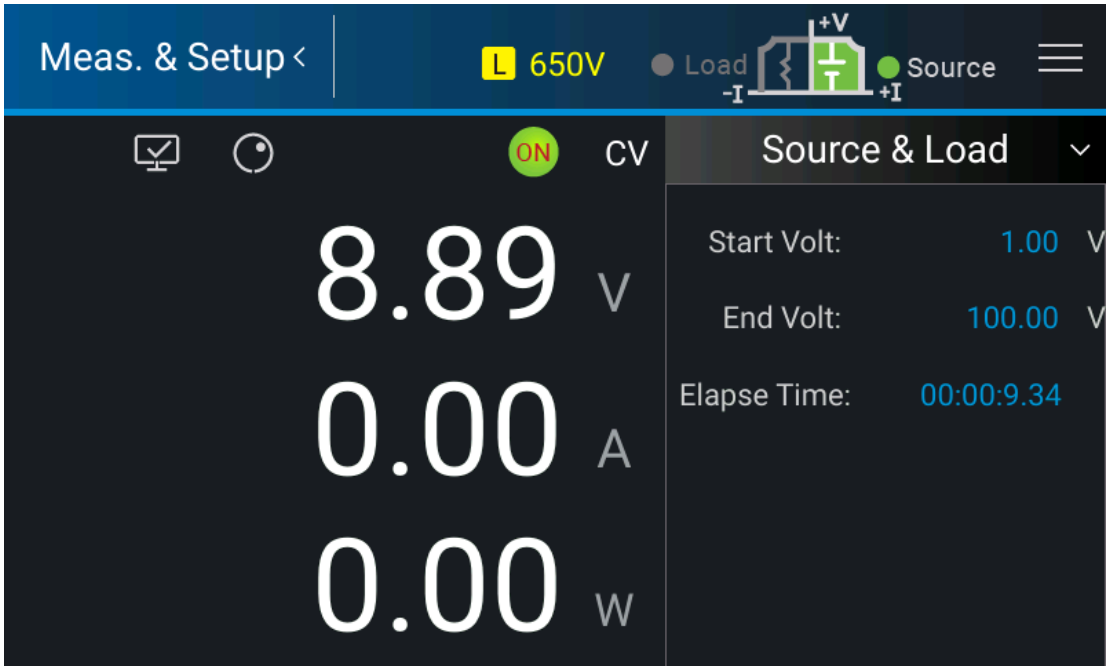


Figure 4-20

When V Step Mode is executed:

1. Start Volt: It is the start voltage setting of the V Step Mode.
2. End Volt: It is the end voltage setting of the V Step Mode.
3. Elapse Time: It is the executed time of V Step Mode. The time format is HOUR:MIN:SEC and the maximum display is 99 hours 59 minutes and 59.99 seconds.

5. Remote Operation

5.1 Overview

The 62000D-HL Series DC power supply can be controlled remotely via USB, GPIB, or Ethernet.

The USB interface supports USB 2.0/USB 1.1. GPIB interface is an 8-bit parallel data bus that synchronizes with the host bus commands. Ethernet interface is used in local area networks for data transmission.

5.1.1 USB Interface

(1)	Hardware Support:	USB 2.0 and USB 1.1
(2)	Software Support:	USBTMC class and USB488 subclass
(3)	OS Support:	Windows 98/2000/XP/Vista/Windows 7/Windows 8/ Windows10
(4)	Installing Driver:	62000D-HL Series USB Interface supports USBTMC, so if the PC OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) there is no need to install other drivers. The OS will search for the standard USBTMC driver installation program automatically.

If the PC's operating system does not support USBTMC, it is suggested to install the NI-VISA runtime version 3.00 or above first. When the installation of NI-VISA runtime is done, the USBTMC driver program is stored in the operating system. The PC can communicate with the 62000D-HL Series via NI-VISA after using the USB.

Related Documents:
1. USB Test and Measurement Class (USBTMC) specification, Revision 1.0, www.usb.org
2. USB Test and Measurement Class USB488 subclass specification, Revision 1.0, www.usb.org

5.1.2 Setting GPIB and Ethernet Parameters

See section 3.2.5.

5.1.3 Ethernet Remote Control

To remote program a 62000D-HL DC power supply via a PC with an Ethernet interface, the 62000D-HL needs to confirm the IP address, Gateway address, and Subnet mask in advance. To ensure reliable data transmission, TCP is used for data transmission and the communication port is 5025.

5.2 GPIB Function of 62000D-HL Series

Table 5-1

GPIB Function	Description
Talker/Listener	Commands and response messages can be sent and received over the GPIB bus. Status information can be read using a series poll.
Service Request	It sets the SRQ line to true if there is an enabled service request condition.
Remote/Local	Power-on in local mode, the front panel can be operated, and the commands are responded to through GPIB. When in remote mode, all front panel keys are invalid except . Tap " " to return to local mode.

5.3 Introduction to Programming

All commands and response messages are transmitted in ASCII codes. The response messages must be read completely before a new command is sent, or the remaining response messages will be lost and cause a query interrupt error.

5.3.1 Conventions

The conventions used in this section are listed in Table 5-2.

Table 5-2

Angle brackets	< >	Items in angle brackets are parameter abbreviations.
Vertical bar	|	The vertical bar separates alternative parameters.
Square brackets	[ ]	Items in square brackets are optional. For example, OUTP[:STATe] means that :STATe may be omitted.
Braces	{ }	Braces indicate the parameters that may be repeated. The notation <A> {<, B>} means that parameter "A" must be entered while parameter "B" may be omitted or entered once or more times.

5.3.2 Numerical Data Formats

The numerical data format of the 62000D-HL DC power supply is listed in Table 5-3. Numerical data can be added to the suffix to distinguish data while the multiplier can be placed before the suffix. Table 5-4 lists the suffix used by the 62000D-HL DC power supply and Table 5-5 lists the multiplier.

Table 5-3 Format of Numerical Data

Symbol	Description	Example
NR1	It is a digit without a decimal point. The decimal is assumed to be at the right of the least significant digit.	123, 0123
NR2	It is a digit with a decimal point.	12.3, .123
NR3	It is a digit with a decimal point and an exponent.	1.23E+2

Symbol	Description	Example
NRf	The flexible decimal format includes NR1, NR2 or NR3.	123, 12.3, .23E+3
NRf+	The extended decimal format includes NRf and MIN, MAX. MIN and MAX are the high and low limits of the parameter.	123, 12.3,1.23E+3, MIN, MAX

Table 5-4

Type	Suffix	Unit
Current	A	Ampere
Voltage	V	Volt
Time	S	Second

Table 5-5

Multiplier	Symbol	Definition
1E6	MA	Mega
1E3	K	Kilo
1E-3	M	Milli
1E-6	U	Micro
1E-9	N	Nano

5.3.3 Boolean Data Format

The <Boolean> parameter uses the form ON|OFF only.

5.3.4 Character Data Format

The character strings returned by the query command are shown in either of the following forms:

<CRD> Character Response Data: character string with a maximum length of 12.
<SRD> String Response Data: character string.

5.3.5 Basic Definition

5.3.5.1 Command Tree Structure

The commands of the DC power supply are based on a hierarchical structure, also known as a tree system. To obtain a particular command, the full path to that command must be specified. This path is represented in the structure by placing the highest node in the farthest left position of the hierarchy. Lower nodes in the hierarchy are indented in the position to the right, below the parent node.

5.3.5.2 Program Header

The program header is the keyword to identify a command. It follows the syntax described in section 5.6 of IEEE 488.2. The DC power supply accepts characters in both upper and lower case without distinguishing the difference. A program header consists of two distinctive types, a common command header and an instrument-controlled header.

5.3.5.3 Common Command and Query Header

The syntax of common command and query header is described in IEEE 488.2. It is used together with the IEEE 488.2-defined common commands and queries. The commands with a leading " * " are common.

5.3.5.4 Instrument-Controlled Header

An Instrument-controlled header can be used for all instrument commands. The header has long and short forms. The 62000D-HL Series only accepts the exact short or long form. A special notation will be taken to differentiate the short form header from the long one of the same header in this subsection. The short-form header is shown in characters of upper case, whereas the rest of the headers are shown in those of lower case.

5.3.5.5 Program Header Separator (:)

If a command has more than one header, the user must separate them with a colon (FETC:CURR FUNC:SHAP). Data must be separated from the program header in one space at least.

5.3.5.6 Program Message

The program message consists of a sequence of zero or other elements of the program message unit that are separated by separator elements of the program message unit.

5.3.5.7 Program Message Unit

The program message unit represents a single command, programming data, or a query.

Example: VOLT?, OUTPut ON.

5.3.5.7.1 Program Message Unit Separator (;)

The separator (semicolon ;) separates the program message unit from another element in a program message.

Example: VOLT 80; CURR 15<PMT>

5.3.5.7.2 Program Message Terminator (<PMT>)

A program message terminator represents the end of a program message. Three permitted terminators are:

(1) <END> : end or identify (EOI)
(2) <NL> : new line which is a single ASCII-encoded byte 0A (10 decimals).
(3) <NL> <END> : new line with EOI.

Notice The response message is terminated by <NL> <END> for GPIB.

5.4 Traversal of Command Tree

Multiple program message unit elements can be sent in a program message. The first command is always referred to as the root node. Subsequent commands are referred to the same tree level as the previous command in a program message. A colon preceding a program message unit changes the header path to the root level.

Example:

SOURce:VOLTage:SLEW 1	All colons are header separators.
:SOURce:VOLTage:SLEW 1	Only the first colon is a specific root.
SOURce:VOLTage:SLEW 1;:VOLT 100	Only the third colon is a specific root.

5.5 Execution Order

The 62000D-HL DC power supply executes program messages by the order received. Program message units except coupled commands are executed in order of reception. The execution of coupled commands is deferred until the program message terminator is received. A coupled command sets parameters, which are affected by the setting of other commands. Problems may arise because the prior state of the 62000D-HL DC power supply will affect the response of a coupled parameter to its programming.

5.6 DC Power Supply Commands

This section describes the syntax and parameters of all commands for DC power supply.

Command	Description
***CLS**	Clear status command
***ESE**	Standard event status enable
***ESR?**	Standard event status register
***IDN?**	Identification query
***OPC**	Operation complete command
***OPC?**	Operation complete query
***RCL**	Recall instrument state command
***RST**	Reset command
***SAV**	Save command
***SRE**	Service request enable command/query

Command	Description
***STB?**	Read status byte query
ABORt	Sets all output states to “OFF”.
CAL:REMote	Sets the measurement point of input voltage.
CONFigure:APGISet	Sets the action type of APG SOURCE / LOAD ISET.
CONFigure:APGIMeas	Sets the action type of APG IMEAS.
CONFigure:APGVSet	Sets the action type of APG VSET.
CONFigure:APGVMeas	Sets the action type of APG VMEAS.
CONFigure:AVG:TIMES	Sets the average times for measuring voltage/current.
CONFigure:AVG:METHod	Sets the average method for measuring voltage/current.
CONFigure:BRIGhtness	Sets the display brightness of the panel.
CONFigure:BEEPer	Sets beeper to ON or OFF.
CONFigure:DI1:FUNC	Sets the control function options of digital input signal 1.
CONFigure:DI1:PULL	Sets the boost resistance control function of digital input signal 1.
CONFigure:DI2:FUNC	Sets the control function options of digital input signal 2.
CONFigure:DI2:PULL	Sets the boost resistance control function of digital input signal 2.
CONFigure:FOLDback	Sets the action to generate FOLDBACK PROTECT.
CONFigure:FOLDTime	Sets the delay time for generating FOLDBACK PROTECT.
CONFigure:INTERLOCK	Executes the Safety Interlock control.
CONFigure:INTERLOCK:PULL	Executes the Safety Interlock input signal to enhance the resistance control.
CONFigure:MSTSLV	Executes the Master/Slave control.
CONFigure:MSTSLV:ID	Sets the device to Master.
CONFigure:MSTSLV:PARSER	Sets to series or parallel mode.
CONFigure:MSTSLV:NUMSLV	Sets the number of slaves to be controlled.
CONFigure:MSTSLV:READY?	Queries the Master/Slave connection status.
CONFigure:RESPonse:CC	Sets the response speed of output CC mode.
CONFigure:RESPonse:CV	Sets the response speed of output CV mode.
CONFigure:OUTPut	Sets the output voltage and current.
CONFigure:RESistance	Sets the function of resistance mode.
SYSTem:ERRor?	Returns the error message and code of the power supply.
SYSTem:DATE	Sets the system date.
SYSTem:TIME	Sets the system time.
SYSTem:COMMunicate:CAN:CYClic:TIME	Sets the CAN cycle time.
SYSTem:COMMunicate:CAN:CYClic:ID	Sets the CAN cycle command ID.
SYSTem:COMMunicate:CAN:BAUD	Sets the CAN baud rate.
SYSTem:COMMunicate:CAN:DATA	Sets the CAN data transmission baudrate.

Command	Description
SYSTem:COMMunicate:CAN:ID	Sets the CAN ID.
SYSTem:COMMunicate:CAN:MASK	Sets the CAN ID mask.
SYSTem:COMMunicate:CAN:MODE	Sets the CAN 11-bit / 29-bit mode.
SYSTem:COMMunicate:CAN:PADding	Sets the CAN padding function.
SYSTem:COMMunicate:CAN:SPEC	Sets the CAN function to Standard or FD mode.
SYSTem:COMMunicate:CAN:APPLY	Updates the CAN settings.
SYSTem:COMMunicate:GPIB:ADDRess	Sets the GPIB address.
SYSTem:COMMunicate:SOCK:DHCP	Sets the Ethernet DHCP function.
SYSTem:COMMunicate:SOCK:GATEway	Sets the Ethernet Gateway.
SYSTem:COMMunicate:SOCK:IP	Sets the Ethernet IP.
SYSTem:COMMunicate:SOCK:MASK	Sets the Ethernet IP Mask.
SYSTem:COMMunicate:SOCK:APPLY	Updates the Ethernet settings.
SYSTem:MODE	Sets the system Source/Load output mode.
SYSTem:MODule:VERSion?	Queries the module system version.
SYSTem:PONStatus	Sets the function mode of Power On Status.
SYSTem:PONStatus:CURR:LOAD	Sets the Load current of Power On Status.
SYSTem:PONStatus:CURR:SOUR	Sets the Source current of Power On Status.
SYSTem:PONStatus:OUTPut	Sets the output of Power On Status.
SYSTem:PONStatus:POWer:LOAD	Sets the Load power of Power On Status.
SYSTem:PONStatus:POWer:SOUR	Sets the Source power of Power On Status.
SYSTem:PONStatus:VOLT	Sets the voltage of Power On Status.
SYSTem:PONStatus:SAVE	Sets the Power On Status to save.
SYSTem:VERSion:INTernal?	Queries the Host system version.
SYSTem:SLEEP:MODE	Sets the Sleep function to ON or OFF.
STSTem:SLEEP:TIME	Sets the time to Sleep.
SYSTem:SLEEP:STAT?	Queries the Sleep status.
SYSTem:SLEEP:TIME:STAT?	Queries the duration of Sleep.
SYSTem:SLEEP:WAKEUP	Wakes up the system.
SYSTem:SLEEP:FORCE	Forces to sleep.
SYSTem:VOLTage:RANGe	Sets the output characteristics range.
SOURce:VOLTage	Sets the output voltage.
SOURce:VOLTage:LIMit:{HIGH/LOW}	Sets the output voltage range.
SOURce:VOLTage:PROTect:HIGH	Sets the range for over voltage protection.
SOURce:VOLTage:SLEW	Sets the rising or falling slew rate (volt/ms) of output voltage.
SOURce:CURRent	Sets the Source current output.
SOURce:CURRent:LIMit:{HIGH/LOW}	Sets the output current range.
SOURce:CURRent:PROTect:HIGH	Sets the range for over current protection of the Source.
SOURce:CURRent:SLEW	Sets the rising or falling slew rate (amp/ms) of output current.
SOURce:POWer	Sets the output power.
SOURce:POWer:LIMit:{HIGH/LOW}	Sets the output power range.
SOURce:POWer:PROTect:HIGH	Sets the range for over power protection.
SOURce:DCON	Sets the DC_ON function to be on or off.
SOURce:DCON:{RISE/FALL}	Sets the DC_ON signal active point.

Command	Description
SOURce:RESistance	Sets the Source resistance.
LOAD:CURRent	Sets the Load output current.
LOAD:CURRent:PROTect:HIGH	Sets the current range for Load over current protection.
LOAD:POWer	Sets the Load power output.
LOAD:POWer:PROTect:HIGH	Sets the power range for Load over power protection.
LOAD:RESistance	Sets the Load resistance.
FETCh:VOLTage?	Measures the output of the power supply and returns real-time voltage.
FETCh:CURRent?	Measures the output of the power supply and returns real-time current (with sign).
FETCh:POWer?	Measures the output of the power supply and returns real-time power (with sign).
FETCh:STATus?	Returns the status code of the power supply's state.
MEASure:VOLTage?	Returns the voltage measured at the output of the power supply.
MEASure:CURRent?	Returns the current measured at the output of the power supply (with positive and negative signs).
MEASure:POWer?	Returns the power measured at the output of the power supply (with positive and negative signs).
MEASure:STAT?	Returns the power supply status code.
PROGram:MODE	Sets the program output mode.
PROGram:RUN	Executes the program.
PROGram:SAVE	Saves the program.
PROGram:SELected	Sets the executed program no. in List mode.
PROGram:LINK	Links a program to another when ends in List mode.
PROGram:COUNT	Sets the no. of times for the program file to execute in List mode.
PROGram:PULL	Executes the PROGRAM TRIGGER input signal to enhance the resistance control in List mode.
PROGram:SEQuence:SELected	Sets the execution sequence of a program in List mode
PROGram:SEQuence:TYPE	Sets the action type of sequence in List mode.
PROGram:SEQuence:VOLTage	Sets the sequence for voltage output in List mode.
PROGram:SEQuence:VOLTage:SLEW	Sets the sequence of voltage slew rate for output in List mode.
PROGram:SEQuence:CURRent	Sets the sequence for Source current output in List mode.
PROGram:SEQuence:CURRent:SLEW	Sets the sequence of the current slew rate for output in List mode.
PROGram:SEQuence:CURRent:LOAD	Sets the sequence for Load current output in List mode.

Command	Description
PROGram:SEQuence:TIME	Sets the duration of the sequence in List mode.
PROGram:CLEAR	Clears all sequences from the program selected in List mode.
PROGram:ADD	Adds sequences to the program selected in List mode.
PROGram:MAX?	Queries the sequence amount of the program selected in List mode
PROGram:SEQuence	Sets the parameters of a single sequence in List mode.
PROGram:STEP:STARTV	Sets the Step Mode start voltage for output.
PROGram:STEP:ENDV	Sets the Step Mode end voltage for output.
PROGram:STEP:TIME	Sets the execution time for Step Mode.
INSTrument:STATus:AD?	Returns the AD module status.
INSTrument:STATus:DD?	Returns the DD module status.
IVCurve:VOC?	Queries the VOC value in IV Curve mode.
IVCurve:ISC?	Queries the ISC value in IV Curve mode.
IVCurve:VMPp?	Queries the VMP value in IV Curve mode.
IVCurve:IMPp?	Queries the IMP value in IV Curve mode.
IVCurve:PMPp?	Queries the PMP value in IV Curve mode.
IVCurve:STATus?	Queries the IV curve status.
IVCurve:CONFigure:CONTrol	Sets the output control mode of the IV curve.
IVCurve:CONFigure:FILTer	Sets the cutoff frequency (unit: Hz) of the IV curve measurement signal filter.
IVCurve:CONFigure:SPEed	Sets the output response speed of the IV curve.
IVCurve:CONFigure:MARGIN	Sets the margin of the IV curve (unit: %).
IVCurve:VT	Sets the 128 voltage dots in IV Curve mode.
IVCurve:IT	Sets the 128 current dots in IV Curve mode.
IVCurve:EDIT	Select the number of IV curve storage tables to set (1~100), the default is 1.
IVCurve:SELect	Select the number of IV curve storage tables to execute (1~100), the default is 1.
IVCurve:SEQuence:SELected	Select the execution sequence of an IV program.
IVCurve:SEQuence	Sets all parameters of a single sequence in an IV program.
IVCurve:SEQuence:RUN?	Queries the execution status of an IV program.
IVCurve:CONFigure:SAVE	Saves the IV curve.
SAS:MODEL	Sets the SAS operation model.
SAS:VOC	Sets the VOC value in SAS mode.
SAS:ISC	Sets the ISC value in SAS mode.
SAS:VMPp	Sets the VMPp value in SAS mode.
SAS:IMPp	Sets the IMPp value in SAS mode.
SAS:PMPp	Sets the PMPp value in EN50530 mode.
SAS:TECH	Sets the TECH value in EN50530 mode.

Command	Description
SAS:IRR	Sets the IRR value in EN50530 mode.
TRIG	Uses this command to update the SAS output waveform when in SAS mode.
SAS:SANDIA:IRRREF	Sets the IRRREF value in SANDIA mode.
SAS:SANDIA:TMPREF	Sets the TMPREF value in SANDIA mode.
SAS:SANDIA:BETA	Sets the BETA value in SANDIA mode.
SAS:SANDIA:FF	Sets the FF value in SANDIA mode.
SAS:SANDIA:IRR	Sets the IRR value in SANDIA mode.
SAS:SANDIA:TMP	Sets the TMP value in SANDIA mode.
SAS:SANDIA:PMP	Sets the PMP value in SANDIA mode.
SAS:SANDIA:VMP	Sets the VMP value in SANDIA mode.
BATTery:OUTPut	Sets the output of the battery simulator.
BATTery:INITial	Sets the initial state of the battery simulator to be SOC or VOL.
BATTery:INITial:CAP	Sets the initial capacitance of the battery simulator.
BATTery:INITial:VOLTage	Sets the initial voltage of the battery simulator.
BATTery:CAP	Sets the capacitance of the battery simulator.
BATTery:ESR	Sets the internal resistance of the battery simulator.
BATTery:VH	Sets the voltage high limit for the battery simulator.
BATTery:VL	Sets the voltage low limit for the battery simulator.
BATTery:[PROT:]SOURce:OCP	Sets the Source current protection point of the battery simulator.
BATTery:[PROT:]LOAD:OCP	Sets the Load current protection point of the battery simulator.
FUNCtion:OPTion:KEY	Inputs the product key no.
FUNCtion:OPTion?	Queries the product key function.
FUNCtion:OPTion:STATus?	Queries the product key status.

5.6.1 Common Commands Syntax

Commands are defined by the IEEE488.2 standard containing common and query commands. Common commands begin with a "*" and consist of three letters and/or one "?" (query). Common commands and queries are listed alphabetically.

***CLS** **Clear Status**
Type: Device status
Description: *CLS command acts the follows:
Clear Error Code Reset Error Message. If "*CLS" is followed by <nl>, the "output queue" and MAV bit will be clear as well.
Syntax: *CLS
Parameter: None

***ESE** **Standard Event Status Enable**

Type: Device status

Description: This command sets the condition of the Standard Event Status Enable register, which determines which events of the Standard Event Status Event register (see *ESR?) are allowed to set the ESB (Event Summary Bit) of the Status Byte register. A "1" in the bit position enables the corresponding event. All of the enable events of the Standard Event Status Event register are logically ORed to cause the ESB (bit 5) of the Status Byte register to be set.

Syntax: *ESE <NRf>

Parameter: 0 to 255

Example: *ESE 48 This command enables the CME and EXE events of the Standard Event Status Event register.

Query Syntax: *ESE?

Return Parameter: <NR1>

Query Example: *ESE? This query returns the current setting of Standard Event Status Enable.

***ESR?** **Standard Event Status Register**

Type: Device status

Description: This query reads the Standard Event Status register and clears it.

Query Syntax: *ESR?

Return Parameter: <NR1>

Query Example: *ESR? Return status readings of Standard Event Status register.

Return Example: 48

***IDN?** **Identification Query**

Type: System interface

Description: This query requests the power supply to identify itself.

Query Syntax: *IDN?

Query Example: *IDN?

String	Description
CHROMA ATE	Manufacturer
62450D-2000HL	Model name
123456	Serial No.
01.00	Firmware version

Return Example: Chroma,62450D-2000HL, 96218030123456,1.00

***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 DC power supply has completed all pending operations.

Syntax: *OPC

Parameter: None

***OPC?** **Operation Complete Query**

Type: Device status

Description: This query returns an ASCII “1” when all pending operations are completed.

Query Syntax: *OPC?

Return Parameter: <NR1>

Query Example: 1

***RCL** **Recall Instrument State Command**
Type: Device status
Description: This command restores the High Slew Rate Load to a state that was previously stored in memory with the *SAV command to the specified location (see *SAV).
Syntax: *RCL <NR1>
Parameter: None
Example: *RCL 1

***RST** **Reset Command**
Type: Device status
Description: Reset System
Syntax: *RST
Parameter: None

***SAV** **Save Command**
Type: Device status
Description: This command stores the present state of the DC power supply and the states of the current mode in a specified location in memory.
Syntax: *SAV
Example: *SAV

***SRE** **Service Request Enable Command/Query**
Type: Device status
Description: This command sets the condition of the Service Request Enable register, which determines which events of the Status Byte register (see *STB) are allowed to set the MSS (Master Status Summary) bit. A "1" in the bit position enables bits to be logically ORed to cause Bit 6 (the Master Summary Status Bit) of the Status Byte register to be set. See the Status Byte register for a detailed description.
Syntax: *SRE <NRf>
Parameter: 0 to 255
Example: *SRE 20 Enable the CSUM and MAV bit of the Service Request.
Query Syntax: *SRE?
Return Parameter: <NR1>
Query Example: *SRE? Return the current setting of 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 the RQS bit is returned in Bit 6. This bit indicates if the High Slew Rate 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.
Query Syntax: *STB?
Return Parameter: <NR1>
Query Example: *STB? Return the contents of Status Byte.
Return Example: 20

Notice

1. Status Byte Register
   The Status Byte Register is composed of eight bits that summarize an overlaying status data structure. The Status Byte Register can be read using *STB? to return a decimal expression of the register

contents (which means the total byte weight of all the bytes set to “1”.)

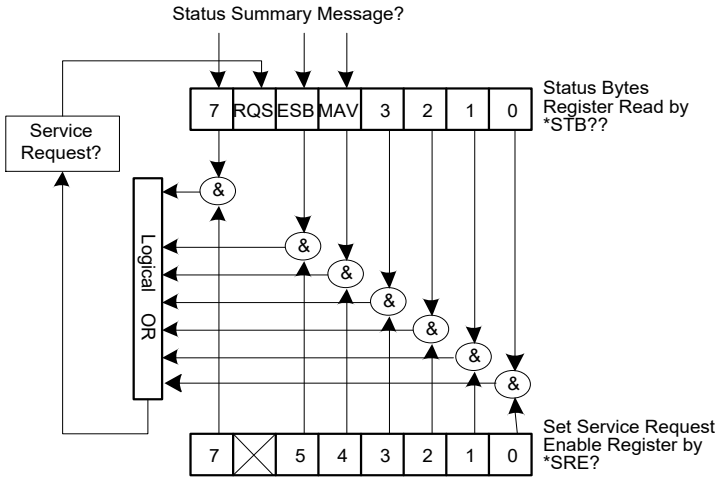


Figure 5-1

Table 5-6

Bit No.	Bit Weight	Description
7	128	Operation Status Register Summary Bit
6	64	Request Service Bit. This bit is set when any enabled bit of the Status Byte Register has been set, which indicates it has at least one reason for requesting service.
5	32	Standard Event Status Register Summary Bit.
4	16	Message Available Bit. This bit is set whenever there is data available in the output queue and is reset when the available data is read.
3-0		Always 0.

2. Standard Event Status Register
   The Standard Event Status Register is frequently used. The common use commands *ESE and *ESR? can be utilized to program it.

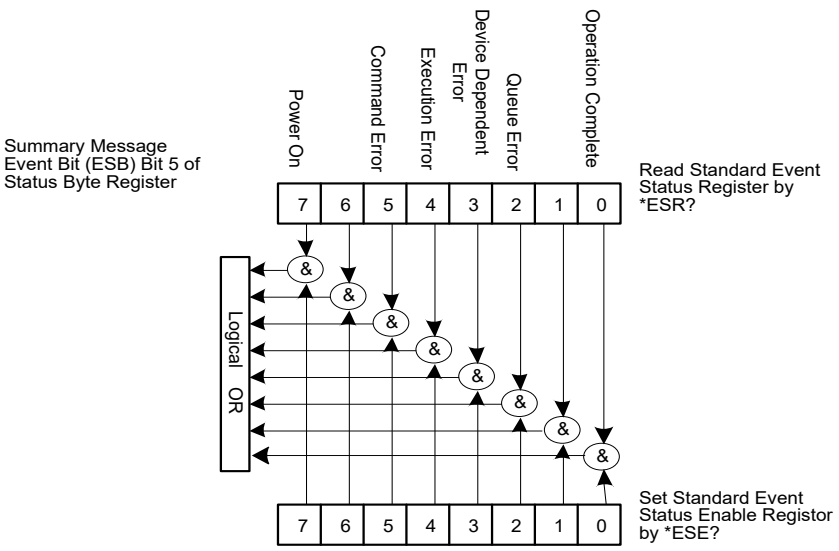


Figure 5-2

Table 5-7

Bit No.	Bit Weight	Description
7	128	Power on Bit. Reboot the power supply can set this bit to 1.
6		Always 0.
5	32	Command Error Bit. This bit is set to 1 if there is any IEEE 488.2 syntax error.
4	16	Execution Error Bit. This bit is set to 1 when the command parameter is out of valid range or inconsistent.
3	8	Device Dependent Error Bit. This bit is set to 1 when too many errors have occurred and the error queue is full.
2	4	Queue Error Bit. This bit is set to 1 when reading data from the output buffer and no data is present, or when the data is lost.
1		Always 0.
0	1	

5.7 Specific Commands for 62000D-HL Series

5.7.1 ABORT Subsystem

ABORt
Description: Sets all output states to “OFF”.
Syntax: ABORt

5.7.2 CAL Subsystem

CAL:REMote

Description:	Sets the measurement point position for measuring the input voltage.
Syntax:	CAL:REMote <Arg>
Parameter:	<Arg>: ON | OFF
Example:	CAL:REMote ON
Query Syntax:	CAL:REMote?
Return Parameter:	ON | OFF
Query Example:	CAL:REMote?
Return Example:	ON

5.7.3 CONFIGURE Subsystem

1. CONFigure:APGISet

Description:	Sets the action type of APG ISET.
Syntax:	CONFigure:APGISet <Arg>
Parameter:	<Arg>: NONE | VREF10
Example:	CONFigure:APGISet VREF10
Query Syntax:	CONFigure:APGISet?
Return Parameter:	NONE | VREF10
Query Example:	CONFigure:APGISet?
Return Example:	VREF10

Note Before setting it, use SYST:MODE to switch to APG SOURCE ISET or APG LOAD ISET.

2. CONFigure:APGIMeas

Description:	Sets the action type of APG IMEAS.
Syntax:	CONFigure:APGIMeas <Arg>
Parameter:	<Arg>: NONE | VREF10
Example:	CONFigure:APGIMeas VREF10
Query Syntax:	CONFigure:APGIMeas?
Return Parameter:	NONE | VREF10
Query Example:	CONFigure:APGIMeas?
Return Example:	VREF10

3. CONFigure:APGVSet

Description:	Sets the action type of APG VSET.
Syntax:	CONFigure:APGVSet <Arg>
Parameter:	<Arg>: NONE | VREF10
Example:	CONFigure:APGVSet VREF10
Query Syntax:	CONFigure:APGVSet?
Return Parameter:	NONE | VREF10
Query Example:	CONFigure:APGVSet?
Return Example:	VREF10

4. CONFigure:APGVMeas

Description:	Sets the action type of APG VMEAS.
Syntax:	CONFigure:APGVMeas <Arg>
Parameter:	<Arg>: NONE | VREF10

Example: CONFigure:APGVMeas VREF10
Query Syntax: CONFigure:APGVMeas?
Return Parameter: NONE | VREF10
Query Example: CONFigure:APGVMeas?
Return Example: VREF10

5. CONFigure:AVG:TIMES

Description: Sets the average times for measuring input voltage/current.
Syntax: CONFigure:AVG:TIMES <NR1>
Parameter: 0: 1 time
1: 2 times
2: 4 times
3: 8 times
Example: CONFigure:AVG:TIMES 0
Query Syntax: CONFigure:AVG:TIMES?
Return Parameter: 1 | 2 | 4 | 8
Query Example: CONFigure:AVG:TIMES?
Return Example: 1

6. CONFigure:AVG:METHod

Description: Sets the average method for measuring input voltage/current.
Syntax: CONFigure:AVG:METHOD <Arg>
Parameter: <Arg>: FIX/MOV
Example: CONFigure:AVG:METHOD FIX
Query Syntax: CONFigure:AVG:METHOD?
Return Parameter: FIX | MOV
Query Example: CONFigure:AVG:METHOD?
Return Example: FIX

7. CONFigure:BRIGhtness

Description: Sets the display brightness of the panel.
Syntax: CONFigure:BRIGhtness <Arg>
Parameter: <Arg>: HIGH | NOR | DIM
Example: CONFigure:BRIGhtness HIGH
Query Syntax: CONFigure:BRIGhtness?
Return Parameter: HIGH | NOR | DIM
Query Example: CONFigure:BRIGhtness?
Return Example: HIGH

8. CONFigure:BEEPer

Description: Sets the beeper to ON or OFF.
Syntax: CONFigure:BEEPer <Arg>
Parameter: <Arg>: ON | OFF
Example: CONF:BEEPer ON
Query Syntax: CONFigure:BEEPer?
Return Parameter: ON | OFF
Query Example: CONFigure:BEEPer?
Return Example: ON

9. CONFigure:DI1:FUNC

Description: Sets the digital input pin 1 to External ON/OFF or Remote Inhibit.
Syntax: CONFigure:DI1:FUNC <Arg>
Parameter: <Arg>: NONE | EXTON | INH

Example: CONFigure:DI1:FUNC EXTON
Query Syntax: CONFigure:DI1:FUNC?
Return Parameter: NONE | EXTON | INH
Query Example: CONFigure:DI1:FUNC?
Return Example: EXTON

10. CONFigure:DI1:PULL

Description: Executes the Remote Inhibit input signal to increase the resistance control function.
Syntax: CONFigure:DI1:PULL <Arg>
Parameter: <Arg>: LOW | HIGH
Example: CONFigure:DI1:PULL LOW
Query Syntax: CONFigure:DI1:PULL?
Return Parameter: LOW | HIGH
Query Example: CONFigure:DI1:PULL?
Return Example: LOW

11. CONFigure:DI2:FUNC

Description: Sets the digital input pin 2 to External ON/OFF or Remote Inhibit.
Syntax: CONFigure:DI2:FUNC <Arg>
Parameter: <Arg>: NONE | EXTON | INH
Example: CONFigure:DI2:FUNC INH
Query Syntax: CONFigure:DI2:FUNC?
Return Parameter: NONE | EXTON | INH
Query Example: CONFigure:DI2:FUNC?
Return Example: INH

12. CONFigure:DI2:PULL

Description: Executes the Remote Inhibit input signal to increase the resistance control function.
Syntax: CONFigure:DI2:PULL <Arg>
Parameter: <Arg>: LOW | HIGH
Example: CONFigure:DI2:PULL LOW
Query Syntax: CONFigure:DI2:PULL?
Return Parameter: LOW | HIGH
Query Example: CONFigure:DI2:PULL?
Return Example: LOW

13. CONFigure:FOLDback

Description: Sets the type of FOLDBACK protect.
Syntax: CONFigure:FOLDback <Arg>
Parameter: <Arg>: DISABLE | CVTOCC | CCTOCV
Example: CONFigure:FOLD DISABLE
Query Syntax: CONFigure:FOLD?
Return Parameter: DISABLE | CVTOCC | CCTOCV
Query Example: CONFigure:FOLD?
Return Example: DISABLE

14. CONFigure:FOLDT

Description: Sets the delay time of FOLDBACK protect.
Syntax: CONFigure:FOLDT <NRf+>
Parameter: 0.01~600.00 (Unit: Sec)
Example: CONF:FOLDT 10

Query Syntax:	CONF:FOLDT?
Return Parameter:	<NRf+>
Query Example:	CONF:FOLDT?
Return Example:	1.000000e+01

15. CONFigure:INTERLOCK

Description:	Executes the Safety Interlock control.
Syntax:	CONFigure:INTERLOCK <Arg>
Parameter:	<Arg>: DISABLE | ENABLE
Example:	CONFigure:INTERLOCK DISABLE
Query Syntax:	CONFigure:INTERLOCK?
Return Parameter:	DISABLE | ENABLE
Query Example:	CONFigure:INTERLOCK?
Return Example:	DISABLE

16. CONFigure:INTERLOCK:PULL

Description:	Executes the Safety Interlock input signal to enhance the resistance control.
Syntax:	CONFigure:INTERLOCK:PULL <Arg>
Parameter:	<Arg>: LOW | HIGH
Example:	CONFigure:INTERLOCK:PULL LOW
Query Syntax:	CONFigure:INTERLOCK:PULL?
Return Parameter:	LOW | HIGH
Query Example:	CONFigure:INTERLOCK:PULL?
Return Example:	LOW

17. CONFigure:MSTSLV

Description:	Executes the Master/Slave control.
Syntax:	CONFigure:MSTSLV <Arg>
Parameter:	<Arg>: ON | OFF
Example:	CONFigure:MSTSLV ON
Query Syntax:	CONF:MSTSLV?
Return Parameter:	ON | OFF
Query Example:	CONF:MSTSLV?
Return Example:	ON

Note

1. Set the following 3 commands before controlling this function:
   - CONFigure:MSTSLV:ID
   - ONFigure:MSTSLV:PARSER
   - CONFigure:MSTSLV:NUMSLV

   Use CONFigure:MSTSLV:READY? to query the connection status at present. If the status is WAIT, query again until the status is ON | OFF to perform this function.
2. When Program RUN is executed, series/parallel control is not available.

18. CONFigure:MSTSLV:ID

Description:	Sets the device to Master. This command is not required for the Slave device.
Syntax:	CONFigure:MSTSLV:ID <Arg>
Parameter:	<Arg>: MASTER
Example:	CONFigure:MSTSLV:ID MASTER
Query Syntax:	CONFigure:MSTSLV:ID?
Return Parameter:	MASTER | SLAVE1 | SLAVE2 | …… | SLAVE9
Query Example:	CONFigure:MSTSLV:ID?
Return Example:	MASTER

Note ⋮ CONFigure:MSTSLV? must be OFF when setting it. (Not in series/parallel mode.)

19. CONFigure:MSTSLV:PARSER

Description:	Sets to series or parallel mode. Both Master and Slave need to be set by this command.
Syntax:	CONFigure:MSTSLV:PARSER <Arg>
Parameter:	<Arg>: PARALLEL
Example:	CONFigure:MSTSLV:PARSER PARALLEL
Query Syntax:	CONFigure:MSTSLV:PARSER?
Return Parameter:	PARALLEL
Query Example:	CONFigure:MSTSLV:PARSER?
Return Example:	PARALLEL

Note ⋮ CONFigure:MSTSLV? must be OFF when setting it. (Not in series/parallel mode.)

20. CONFigure:MSTSLV:NUMSLV

Description:	Sets the number of SLAVE to be controlled. This command is not required for the Slave device.
Syntax:	CONFigure:MSTSLV:NUMSLV <NR1>
Parameter:	<NR1>
Example:	CONFigure:MSTSLV:NUMSLV 1
Query Syntax:	CONFigure:MSTSLV:NUMSLV?
Return Parameter:	<NR1>
Query Example:	CONFigure:MSTSLV:NUMSLV?
Return Example:	1

Note ⋮ 1. CONFigure:MSTSLV? must be OFF when setting it. (Not in series/parallel mode.)
⋮ 2. A maximum of 11 slaves can be set when in parallel mode.

21. CONFigure:MSTSLV:READY?

Description:	Queries the Master/Slave connection status.
Syntax:	CONFigure:MSTSLV:READY?
Return Parameter:	ON | OFF | WAIT
Query Example:	CONFigure:MSTSLV:READY?
Return Example:	ON | OFF | WAIT

22. CONFigure: RESPonse:CC

Description:	Sets the response CC speed.
Syntax:	CONFigure:RESPonse:CC <Arg>
Parameter:	<Arg>: SLOW | FAST
Example:	CONF:RESP:CC SLOW
Query Syntax:	CONFigure:RESPonse:CC?
Return Parameter:	SLOW | FAST
Query Example:	CONF:RESP:CC?
Return Example:	SLOW

23. CONFigure: RESPonse:CV

Description:	Sets the response CV speed.
Syntax:	CONFigure:RESPonse:CV <Arg>
Parameter:	<Arg>: SLOW | FAST
Example:	CONF:RESP:CV SLOW
Query Syntax:	CONFigure:RESPonse:CV?
Return Parameter:	SLOW | FAST

Query Example: CONF:RESP:CV?
Return Example: SLOW

24. CONFigure:OUTPut

Description: Sets the output voltage/current.
Syntax: CONFigure:OUTPut <Arg>
Parameter: <Arg>: ON | OFF
Example: CONFigure:OUTPut ON
Query Syntax: CONFigure:OUTPut?
Return Parameter: ON | OFF
Query Example: CONFigure:OUTPut?
Return Example: ON

25. CONFigure:RESistance

Description: Sets the resistance mode. The SYSTem:MODE needs to be set before enabling this function.
Syntax: CONFigure:RESistance <Arg>
Parameter: <Arg>: DISABLE | ENABLE
Example: SYSTem:MODE SOURCE-LOAD
CONF:RES ENABLE
Query Syntax: CONFigure:RESistance?
Return Parameter: ALL_DISABLE | Source-Load | Source | ALL_ENABLE
Query Example: CONF:RES?
Return Example: Source-Load

5.7.4 SYSTEM Subsystem

1. SYSTem:ERRor?

Description: Returns error message and code of power supply.
Query Syntax: SYSTem:ERRor?
Return Parameter: aard
Query Example: SYST:ERR?
Return Example: -203, “Data out of range”

Table 5-8

Code	Error Message	Code	Error Message
0	"No error"	-101	"Invalid character"
-102	"Syntax error"	-103	"Invalid separator"
-104	"Data type error"	-105	"GET not allowed"
-106	"Illegal parameter value"	-108	"Parameter not allowed"
-109	"Missing parameter"	-112	"Program mnemonic too long"
-113	"Undefined header"	-121	"Invalid character in number"
-123	"Numeric overflow"	-124	"Too many digits"
-131	"Invalid suffix"	-141	"Invalid character data"
-148	"Character data not allowed"	-151	"Invalid string data"
-158	"String data not allowed"	-202	"Setting conflict"
-203	"Data out of range"	-204	"Too much data"
-211	"Data stale"	-224	"Self-test failed"
-225	"Too many errors"	-226	"INTERRUPTED"
-227	"UNTERMINATED"	-228	"DEADLOCKED"
-229	"MEASURE ERROR"	-230	"Sequence overflow"

Code	Error Message	Code	Error Message
-231	"Sequence selected error"		

2. SYSTem:DATE

Description: Sets the system date.
Syntax: SYSTem:DATE <Arg1>,<Arg2>,<Arg3>
Parameter: Arg1: Year (NR1)
Arg2: Month (NR1)
Arg3: Day (NR1)
Example: SYSTem:DATE 2020,01,01
Query Syntax: SYSTem:DATE?
Return Parameter: <Arg1>,<Arg2>,<Arg3> same as the parameter.
Query Example: SYSTem:DATE?
Return Example: 2020,01,01

3. SYSTem:TIME

Description: Sets the system time.
Syntax: SYSTem:TIME <Arg1><,><Arg2><,><Arg3>
Parameter: <Arg1>: Hour (NR1)
<Arg2>: Minute (NR1)
<Arg3>: Second (NR1)
Example: SYSTem:TIME 20,30,01
Query Syntax: SYSTem:TIME?
Return Parameter: <Arg1>,<Arg2>,<Arg3> same as the parameter.
Query Example: SYSTem:TIME?
Return Example: 20,30,01

4. SYSTem:COMMunicate:CAN:CYClic:TIME

Description: Sets the CAN cycle time.
Syntax: SYSTem:COMMunicate:CAN:CYClic:TIME <NRf+>
Parameter: 0.001 to 3600
Example: SYSTem:COMMunicate:CAN:CYClic:TIME 1.001
Query Syntax: SYSTem:COMMunicate:CAN:CYClic:TIME?
Return Parameter: <NRf+>
Query Example: SYSTem:COMMunicate:CAN:CYClic:TIME?
Return Example: 1.001000e+00

5. SYSTem:COMMunicate:CAN:CYClic:ID

Description: Sets the CAN cycle command ID.
Syntax: SYSTem:COMMunicate:CAN:CYClic:ID <NRf+>
Parameter: 11bit: 0 to 2047 , 29bit: 0 to 536870911
Example: SYSTem:COMMunicate:CAN:CYClic:ID 10
Query Syntax: SYSTem:COMMunicate:CAN:CYClic:ID?
Return Parameter: <NR1>
Query Example: SYSTem:COMMunicate:CAN:CYClic:ID?
Return Example: 10

6. SYSTem:COMMunicate:CAN:BAUD

Description: Sets the CAN baudrate
Syntax: SYSTem:COMMunicate:CAN:BAUD <NRf+>
Parameter:

Parameter	Baudrate	Parameter	Baudrate
0	10k	7	200k
1	20k	8	250k

2	40k	9	400k
3	50k	10	500k
4	80k	11	800k
5	100k	12	1000k
6	125k		

Example: SYSTem:COMMunicate:CAN:BAUD 12
Query Syntax: SYSTem:COMMunicate:CAN:BAUD?
Return Parameter: <NR1>
Query Example: SYSTem:COMMunicate:CAN:BAUD?
Return Example: 12

7. SYSTem:COMMunicate:CAN:DATA

Description: Sets the CAN FD data transmission baudrate.
Syntax: SYSTem:COMMunicate:CAN:DATA <NRf+>
Parameter:

Parameter	Baudrate	Parameter	Baudrate
0	100k	6	800k
1	125k	7	1000k
2	200k	8	1250k
3	250k	9	2000k
4	400k	10	2500k
5	500k	11	5000k

Example: SYSTem:COMMunicate:CAN:DATA 11
Query Syntax: SYSTem:COMMunicate:CAN:DATA?
Return Parameter: <NR1>
Query Example: SYSTem:COMMunicate:CAN:DATA?
Return Example: 11

8. SYSTem:COMMunicate:CAN:ID

Description: Sets the CAN ID.
Syntax: SYSTem:COMMunicate:CAN:ID <NR1>
Parameter: 11bit: 0 to 2047, 29bit: 0 to 536870911
Example: SYSTem:COMMunicate:CAN:ID 1024
Query Syntax: SYSTem:COMMunicate:CAN:ID?
Return Parameter: <NR1>
Query Example: SYSTem:COMMunicate:CAN:ID?
Return Example: 1024

9. SYSTem:COMMunicate:CAN:MASK

Description: Sets the CAN ID mask.
Syntax: SYSTem:COMMunicate:CAN:MASK <NR1>
Parameter: 11bit: 0 to 2047, 29bit: 0 to 536870911
Example: SYSTem:COMMunicate:CAN:MASK 256
Query Syntax: SYSTem:COMMunicate:CAN:MASK?
Return Parameter: <NR1>
Query Example: SYSTem:COMMunicate:CAN:MASK?
Return Example: 256

10. SYSTem:COMMunicate:CAN:MODE

Description: Sets the CAN 11 bit / 29 bit mode.
Syntax: SYSTem:COMMunicate:CAN:MODE <NR1>
Parameter: 0: 11bit, 1: 29bit
Example: SYSTem:COMMunicate:CAN:MODE 1
Query Syntax: SYSTem:COMMunicate:CAN:MODE?

Return Parameter: <NR1>
Query Example: SYSTem:COMMunicate:CAN:MODE?
Return Example: 1

11. SYSTem:COMMunicate:CAN:PADding

Description: Sets the CAN padding function.
Syntax: SYSTem:COMMunicate:CAN:PADding <Arg>
Parameter: <Arg>: ENABLE | DISABLE
Example: SYSTem:COMMunicate:CAN:PADding ENABLE
Query Syntax: SYSTem:COMMunicate:CAN:PADding?
Return Parameter: ENABLE | DISABLE
Query Example: SYSTem:COMMunicate:CAN:MODE?
Return Example: ENABLE | DISABLE

12. SYSTem:COMMunicate:CAN:SPEC

Description: Sets the CAN function to Standard or FD mode.
Syntax: SYSTem:COMMunicate:CAN:SPEC <Arg>
Parameter: <Arg>: STANDARD | FD
Example: SYSTem:COMMunicate:CAN:SPEC FD
Query Syntax: SYSTem:COMMunicate:CAN:SPEC?
Return Parameter: STANDARD | FD
Query Example: SYSTem:COMMunicate:CAN:SPEC?
Return Example: FD

13. SYSTem:COMMunicate:CAN:APPLY

Description: Updates the CAN setting.
Syntax: SYSTem:COMMunicate:CAN:APPLY
Parameter: None
Example: SYSTem:COMMunicate:CAN:APPLY
Query Syntax: SYSTem:COMMunicate:CAN:APPLY?
Return Parameter: DONE | UNDONE
Query Example: SYSTem:COMMunicate:CAN:APPLY?
Return Example: DONE | UNDONE

14. SYSTem:COMMunicate:GPIB:ADDRess

Description: Sets the GPIB address.
Syntax: SYSTem:COMMunicate:GPIB:ADDRess <NR1>
Parameter: 0~30
Example: SYSTem:COMMunicate:GPIB:ADDRess 5
Query Syntax: SYSTem:COMMunicate:GPIB:ADDRess?
Return Parameter: <NR1>
Query Example: SYSTem:COMMunicate:GPIB:ADDRess?
Return Example: 5

15. SYSTem:COMMunicate:SOCK:DHCP

Description: Sets the Ethernet DHCP function.
Syntax: SYSTem:COMMunicate:SOCK:DHCP <Arg>
Parameter: <Arg>: ENABLE | DISABLE
Example: SYSTem:COMMunicate:SOCK:DHCP ENABLE
Query Syntax: SYSTem:COMMunicate:SOCK:DHCP?
Return Parameter: ENABLE | DISABLE
Query Example: SYSTem:COMMunicate:SOCK:DHCP?
Return Example: ENABLE | DISABLE

16. SYSTem:COMMunicate:SOCK:GATEway

Description:	Sets the Ethernet Gateway.
Syntax:	SYSTem:COMMunicate:SOCK:GATEway <Arg>
Parameter:	<Arg>: “255.255.255.0”
Example:	SYSTem:COMMunicate:SOCK:GATEway “255.255.255.0”
Query Syntax:	SYSTem:COMMunicate:SOCK:GATEway?
Return Parameter:	“255.255.255.0”
Query Example:	SYSTem:COMMunicate:SOCK:GATEway?
Return Example:	“255.255.255.0”

17. SYSTem:COMMunicate:SOCK:IP

Description:	Sets the Ethernet IP.
Syntax:	SYSTem:COMMunicate:SOCK:IP <Arg>
Parameter:	<Arg>: “192.168.1.1”
Example:	SYSTem:COMMunicate:SOCK:IP “192.168.1.1”
Query Syntax:	SYSTem:COMMunicate:SOCK:IP?
Return Parameter:	“192.168.1.1”
Query Example:	SYSTem:COMMunicate:SOCK:IP?
Return Example:	“192.168.1.1”

18. SYSTem:COMMunicate:SOCK:MASK

Description:	Sets the Ethernet IP Mask.
Syntax:	SYSTem:COMMunicate:SOCK:MASK <Arg>
Parameter:	<Arg>: “192.168.1.1”
Example:	SYSTem:COMMunicate:SOCK:MASK “192.168.1.1”
Query Syntax:	SYSTem:COMMunicate:SOCK:MASK?
Return Parameter:	“192.168.1.1”
Query Example:	SYSTem:COMMunicate:SOCK:MASK?
Return Example:	“192.168.1.1”

19. SYSTem:COMMunicate:SOCK:APPLY

Description:	Updates the Ethernet setting.
Syntax:	SYSTem:COMMunicate:SOCK:APPLY
Parameter:	None
Example:	SYSTem:COMMunicate:SOCK:APPLY
Query Syntax:	SYSTem:COMMunicate:SOCK:APPLY?
Return Parameter:	DONE | UNDONE
Query Example:	SYSTem:COMMunicate:SOCK:APPLY?
Return Example:	DONE | UNDONE

20. SYSTem:MODE

Description:	Sets the Source/Load output mode of the system.
Syntax:	SYSTem:MODE SOURCE-LOAD SYSTem:MODE SOUR SYSTem:MODE LOAD
Parameter:	SOURCE-LOAD | SOUR | LOAD
Example:	SYSTem:MODE SOURCE-LOAD
Query Syntax:	SYSTem:MODE?
Return Parameter:	Source-Load | Source | Load
Query Example:	SYSTem:MODE?
Return Example:	Source-Load

21. SYSTem:MODule:VERSion?

Description:	Queries the module version.

Query Syntax: SYSTem:MODule:VERSion? <Arg1>[<,><Arg2>]
Query Parameter: Arg1: Module No.: 1~3
Arg2: Module No.: 1~2, 1: AD, 2: DD
Query Example: SYSTem:MODule:VERSion? 1,2
Return Example: MAIN:0.90,BOOT:0_06,PLD:0.31,PCB:03

22. SYSTem:PONStatus

Description: Sets the function mode of Power On Status.
Syntax: SYSTem:PONStatus <NR1>
Parameter: 0~2
Example: SYSTem:PONStatus 0
Query Syntax: SYSTem:PONStatus?
Return Parameter: <NR1>
Query Example: SYSTem:PONStatus?
Return Example: 0

23. SYSTem:PONStatus:CURR:LOAD

Description: Sets the Load current of Power On Status.
Syntax: SYSTem:PONStatus:CURR:LOAD <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SYSTem:PONStatus:CURR:LOAD 1 It sets the initial power-on current to 1A.
Query Syntax: SYSTem:PONStatus:CURR:LOAD?
Return Parameter: <NR1>
Query Example: SYSTem:PONStatus:CURR:LOAD?
Return Example: 1.000000e+00

24. SYSTem:PONStatus:CURR:SOUR

Description: Sets the Source current of Power On Status.
Syntax: SYSTem:PONStatus:CURR:SOUR <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SYSTem:PONStatus:CURR:SOUR 1 It sets the initial power-on current to 1A.
Query Syntax: SYSTem:PONStatus:CURR:SOUR?
Return Parameter: <NR1>
Query Example: SYSTem:PONStatus:CURR:SOUR?
Return Example: 1.000000e+00

25. SYSTem:PONStatus:OUTPut

Description: Sets the output of Power On Status.
Syntax: SYSTem:PONStatus:OUTPut <Arg>
Parameter: <Arg>: ON | OFF
Example: SYSTem:PONStatus:OUTPut ON
Query Syntax: SYSTem:PONStatus:OUTPut?
Return Parameter: ON | OFF
Query Example: SYSTem:PONStatus:OUTPut?
Return Example: ON

26. SYSTem:PONStatus:POWer:LOAD

Description: Sets the Load power of Power On Status.
Syntax: SYSTem:PONStatus:POWer:LOAD <NR1>
Parameter: Refer to individual spec for valid numeric range.
Example: SYSTem:PONStatus:POWer:LOAD It sets the output power to 1 watt.

Query Syntax: SYSTem:PONStatus:POWer:LOAD?
Return Parameter: <NRf+>
Query Example: SYSTem:PONStatus:POWer:LOAD?
Return Example: 1.000000e+00

27. SYSTem:PONStatus:POWer:SOUR

Description: Sets the Source power of Power On Status.
Syntax: SYSTem:PONStatus:POWer:SOUR <NR1>
Parameter: Refer to individual spec for valid numeric range.
Example: SYSTem:PONStatus:POWer:SOUR It sets the output power to 1 watt.
Query Syntax: SYSTem:PONStatus:POWer:SOUR?
Return Parameter: <NRf+>
Query Example: SYSTem:PONStatus:POWer:SOUR?
Return Example: 1.000000e+00

28. SYSTem:PONStatus:VOLT

Description: Sets the Power On Status voltage.
Syntax: SYSTem:PONStatus:VOLT <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SYSTem:PONStatus:VOLT 1 It sets the initial power-on voltage to 1V.
Query Syntax: SYSTem:PONStatus:VOLT?
Return Parameter: <NR1>
Query Example: SYSTem:PONStatus:VOLT?
Return Example: 1.000000e+00

29. SYSTem:PONStatus:SAVE

Description: Sets the Power On Status to save.
Syntax: SYSTem:PONStatus:SAVE
Parameter: None
Example: SYSTem:PONStatus:SAVE

30. SYSTem:VERSion:INTernal?

Description: Queries the Host version.
Query Syntax: SYSTem:VERSion:INTernal? [<Arg>]
Query Parameter: Arg: Select subsystem: 1~2, 1: DSP-CPU1, 2: DSP-CPU2
Query Example: SYSTem:VERSion:INTernal?
Return Example: MAIN:0.70,PLD:0.27,PCB:01,UI:0.57

31. SYST:SLEEP:MODE

Description: Sets the Sleep function to ON or OFF.
Syntax: SYST:SLEEP:MODE <Arg>
Parameter: <Arg>: ENABLE | DISABLE
Example: SYST:SLEEP:MODE ON
Query Syntax: SYST:SLEEP:MODE?
Return Parameter: ENABLE | DISABLE
Query Example: SYST:SLEEP:MODE?
Return Example: ENABLE

32. SYST:SLEEP:TIME

Description: Sets the time to sleep.
Syntax: SYST:SLEEP:TIME <NR1>
Parameter: 5~20 min

Example: SYST:SLEEP:TIME 5
Query Syntax: SYST:SLEEP:TIME?
Return Parameter: 5~20 min
Query Example: SYST:SLEEP:TIME?
Return Example: 5

33. SYST:SLEEP:STAT

Description: Queries the Sleep state.
Query Syntax: SYST:SLEEP:STAT?
Return Parameter: STANDBY | SLEEP
Query Example: SYST:SLEEP:STAT?
Return Example: SLEEP

34. SYST:SLEEP:TIME:STAT

Description: Queries the duration of Sleep mode.
Query Syntax: SYST:SLEEP:TIME:STAT?
Return Parameter: 0~ 2147483647 min
Query Example: SYST:SLEEP:TIME:STAT?
Return Example: 5 min

35. SYSTem:SLEEP:WAKEUP

Description: Wakes up the system.
Syntax: SYSTem:SLEEP:WAKEUP
Parameter: None
Example: SYSTem:SLEEP:WAKEUP

36. SYSTem:SLEEP:FORCE

Description: Forces to sleep.
Syntax: SYSTem:SLEEP:FORCE
Parameter: None
Example: SYSTem:SLEEP:FORCE

37. SYSTem:VOLTage:RANGe

Description: Sets the power supply output range.
Syntax: SYST:VOLTage:RANGe <Arg>
Parameter: <Arg>: HIGH | LOW
Example: SYST:VOLTage:RANGe HIGH
Query Syntax: SYST:VOLTage:RANGe?
Return Parameter: HIGH | LOW | SETTING | ERR
Query Example: SYST:VOLTage:RANGe?
Return Example: HIGH

5.7.5 SOURCE Subsystem

1. SOURce:VOLTage

Description: Sets the output voltage.
Syntax: SOURce:VOLTage <NRf+>[suffix]
Parameter: Refer to individual spec for valid numeric range.
Example: SOUR:VOLT 0.01 It sets the output voltage to 0.01 volt.
SOUR:VOLT 80.00 It sets the output voltage to 80.00 volts.
Query Syntax: SOUR:VOLT? [{MAX | MIN}]
Return Parameter: <NRf+> [Unit=Volt]

Query Example:	SOUR:VOLT?	It returns the voltage.
	SOUR:VOLT? MAX	It returns the max. voltage can be set.
Return Example:	8.000000e+01	

2. SOURce:VOLTage:LIMit:{HIGH/LOW}

Description:	Sets the output voltage range.	
Syntax:	SOURce:VOLTage:LIMIT:HIGH <NRf+>[suffix]	
	SOURce:VOLTage:LIMIT:LOW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:LIMIT:HIGH 60.0	It sets the output voltage range to 60V maximum.
	SOUR:VOLT:LIMIT:LOW 20.0	It sets the output voltage range to 20V minimum.
Query Syntax:	SOUR:VOLT:LIMIT:HIGH? [{MAX/MIN}]	
	SOUR:VOLT:LIMIT:LOW? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Volt]	
Query Example:	SOUR:VOLT:LIMIT:HIGH?	It returns the voltage high limit.
	SOUR:VOLT:LIMIT:HIGH? MAX	It returns the max. voltage can be set.
Return Example:	8.000000e+01	

3. SOURce:VOLTage:PROTect:HIGH

Description:	Sets the voltage range for over voltage protection.	
Syntax:	SOURce:VOLTage:PROTect:HIGH <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:PROT:HIGH 60.0	It sets the high limit to 60V for voltage output protection.
Query Syntax:	SOUR:VOLT:PROT:HIGH? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Volt]	
Query Example:	SOUR:VOLT:PROT:HIGH?	It returns the high limit of voltage protection.
	SOUR:VOLT:PROT:HIGH? MAX	It returns the max. over voltage protection.
Return Example:	8.800000e+01	

4. SOURce:VOLTage:SLEW

Description:	Sets the rising or falling slew rate (volt/ms) of output voltage.	
Syntax:	SOURce:VOLTage:SLEW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:SLEW 0.01	It sets the output voltage slew rate to 0.01 volt/ms.
	SOUR:VOLT:SLEW 10	It sets the output voltage slew rate to 10 volts/ms.
Query Syntax:	SOUR:VOLT:SLEW? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Volt/ms]	
Query Example:	SOUR:VOLT:SLEW?	It returns the voltage slew rate.
	SOUR:VOLT:SLEW? MAX	It returns the max. voltage slew rate.
Return Example:	1.000000e+01	

5. SOURce:CURRent

Description:	Sets the output current (ampere).
Syntax:	SOURce:CURRent <NRf+>[suffix]

Parameter: Refer to individual spec for valid numeric range.
Example: SOUR:CURR 1 It sets the output current to 1 amps.
SOUR:CURR 60.00 It sets the output current to 60.00 amps.
Query Syntax: SOUR:CURR? [{MAX/MIN}]
Return Parameter: <NRf+> [Unit=Amp]
Query Example: SOUR:CURR? It returns the current.
SOUR:CURR? MAX It returns the max. current can be set.
Return Example: 1.000000e+00

6. SOURce:CURRent:LIMit:{HIGH/LOW}

Description: Sets the output current range.
Syntax: SOURce:CURRent:LIMIT:HIGH <NRf+>[suffix]
SOURce:CURRent:LIMIT:LOW <NRf+>[suffix]
Parameter: Refer to individual spec for valid numeric range.
Example: SOUR:CURR:LIMIT:HIGH 60.0 It sets the output current range to 60A maximum.
SOUR:CURR:LIMIT:LOW 20.0 It sets the output current range to 20A minimum.
Query Syntax: SOUR:CURR:LIMIT:HIGH? [{MAX/MIN}]
SOUR:CURR:LIMIT:LOW? [{MAX/MIN}]
Return Parameter: <NRf+> [Unit=Amp]
Query Example: SOUR:CURR:LIMIT:HIGH? It returns the current high limit.
SOUR:CURR:LIMIT:HIGH? MAX It returns the max. current can be set.
Return Example: 6.000000e+01

Note : Source and Load currents share this setting.

7. SOURce:CURRent:PROTect:HIGH

Description: Sets the current range for over current protection.
Syntax: SOURce:CURRent:PROTect:HIGH <NRf+>[suffix]
Parameter: Refer to individual spec for valid numeric range.
Example: SOUR:CURR:PROT:HIGH 60.0 It sets the high limit to 60A for current output protection.
Query Syntax: SOUR:CURR:PROT:HIGH? [{MAX/MIN}]
Return Parameter: <NRf+> [Unit=Amp]
Query Example: SOUR:CURR:PROT:HIGH? It returns the high limit of current protection.
SOUR:CURR:PROT:HIGH? MAX It returns the max. over current protection.
Return Example: 6.000000e+01

8. SOURce:CURRent:SLEW

Description: Sets the rising or falling slew rate (amp/ms) of output current.
Syntax: SOURce:CURRent:SLEW <NRf+>[suffix]
Parameter: Refer to individual spec for valid numeric range.
Example: SOUR:CURR:SLEW 0.01 It sets the output current slew rate to 0.01 Amp/ms.
SOUR:CURR:SLEW 1.00 It sets the output current slew rate to 1.00 Amp/ms.
Query Syntax: SOUR:CURR:LIMIT:HIGH? [{MAX/MIN}]
SOUR:CURR:LIMIT:LOW? [{MAX/MIN}]
Return Parameter: < NRf+> [Unit=Amp/ms]

Query Example:	SOUR:CURR:SLEW?	It returns the current slew rate.
	SOUR:CURR:SLEW? MAX	It returns the max. current slew rate.
Return Example:	1.000000e+00	

Note ⋮ Source and Load currents share this setting.

9. SOURce:POWer

Description:	Sets the output power (watt).	
Syntax:	SOURce:POWer <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:POW 1	It sets the output power to 1 watt.
	SOUR:POW 60.00	It sets the output power to 60 watts.
Query Syntax:	SOUR:POW? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Watt]	
Query Example:	SOUR:POW?	It returns the power.
	SOUR:POW? MAX	It returns the max. power can be set.
Return Example:	1.000000e+00	

10. SOURce:POWer:LIMit:{HIGH/LOW}

Description:	Sets the output power range.	
Syntax:	SOURce:POWer:LIMIT:HIGH <NRf+>[suffix]	
	SOURce:POWer:LIMIT:LOW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR: POW:LIMIT:HIGH 60.0	It sets the output power range to 600V maximum
	SOUR: POW:LIMIT:LOW 20.0	It sets the output power range to 200V minimum.
Query Syntax:	SOUR:POW:LIMIT:HIGH? [{MAX/MIN}]	
	SOUR:POW:LIMIT:LOW? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Watt]	
Query Example:	SOUR: POW:LIMIT:HIGH?	It returns the power high limit.
	SOUR: POW:LIMIT:HIGH? MAX	It returns the max. power can be set.
Return Example:	8.000000e+01	

Note ⋮ Source and Load functions share this setting.

11. SOURce:POWer:PROTect:HIGH

Description:	Sets the power range for over power protection.	
Syntax:	SOURce:POWer:PROTect:HIGH <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:POW:PROT:HIGH 1260	It sets the high limit to 1260W for power output protection.
Query Syntax:	SOUR:POW:PROT:HIGH? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Watt]	
Query Example:	SOUR:POW:PROT:HIGH?	It returns the high limit of power protection.
	SOUR:POW:PROT:HIGH? MAX	It returns the max. power protect can be set.
Return Example:	1.260000e+03	

12. SOURce:DCON

Description:	Sets the DC_ON function to be on or off.
Syntax:	SOURce:DCON <Arg>
Parameter:	<Arg>: ENABLE | DISABLE
Example:	SOURce:DCON ENABLE
Query Syntax:	SOURce:DCON?
Return Parameter:	ENABLE | DISABLE
Query Example:	SOURce:DCON?
Return Example:	ENABLE

13. SOURce:DCON:{RISE/FALL}

Description:	Sets the DC_ON signal active point.	
Syntax:	SOURce:DCON:RISE <NRf+>[suffix]	
	SOURce:DCON:FALL <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:DCON:RISE 79.5	It sets the DC_ON rise to 79.5V.
	SOUR:DCON:FALL 0.5	It sets the DC_ON fall to 0.5V.
Query Syntax:	SOUR:DCON:RISE? [{MAX/MIN}]	
	SOUR:DCON:FALL? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Watt]	
Query Example:	SOUR:DCON:RISE?	It returns the setting.
Return Example:	7.950000e+01	

Note ⋮ The output must be OFF for setting.

14. SOURce:RESistance

Description:	Sets the Source resistance (Ohm).	
Syntax:	SOURce:RESistance <NRf+>	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:RES 1	It sets the Source to CR 1 Ohm.
Query Syntax:	SOURce:RESistance?	
Return Parameter:	<NRf+> [Unit=Ohm]	
Query Example:	SOUR:RES?	It returns the setting.
Return Example:	1.000000e+00	

5.7.6 LOAD Subsystem

1. LOAD:CURRent

Description:	Sets the Load output current (ampere).	
Syntax:	LOAD:CURRent <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	LOAD:CURR 1	It sets the output current to 1 amp.
	LOAD:CURR 60.00	It sets the output current to 60.00 amps.
Query Syntax:	LOAD:CURR? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Amp]	
Query Example:	LOAD:CURR?	It returns the current.
	LOAD:CURR? MAX	It returns the max. current can be set.
Return Example:	1.000000e+00	

2. LOAD:CURRent:PROTect:HIGH

Description:	Sets the current range for Load over current protection.

Syntax:	LOAD:CURRent:PROTect:HIGH <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	LOAD:CURR:PROT:HIGH 60.0	It sets the high limit to 60A for current output protection.
Query Syntax:	LOAD:CURR:PROT:HIGH? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Amp]	
Query Example:	LOAD:CURR:PROT:HIGH?	It returns the high limit of current protection.
	LOAD:CURR:PROT:HIGH? MAX	It returns the max. over current protection.
Return Example:	6.000000e+01	

3. LOAD:POWer

Description:	Sets the Load power output (watt).	
Syntax:	LOAD:POWer <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	LOAD:POW 1	It sets the output power to 1 watt.
	LOAD:POW 60.00	It sets the output power to 60 watts.
Query Syntax:	LOAD:POW? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Watt]	
Query Example:	LOAD:POW?	It returns the power
	LOAD:POW? MAX	It returns the max. power can be set.
Return Example:	1.000000e+00	

4. LOAD:POWer:PROTect:HIGH

Description:	Sets the power range for Load over power protection.	
Syntax:	LOAD:POWer:PROTect:HIGH < NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	LOAD:POW:PROT:HIGH 1260	It sets the high limit to 1260W for power output protection.
Query Syntax:	LOAD:POW:PROT:HIGH? [{MAX/MIN}]	
Return Parameter:	<NRf+> [Unit=Watt]	
Query Example:	LOAD:POW:PROT:HIGH?	It returns the high limit of power protection.
	LOAD:POW:PROT:HIGH? MAX	It returns the max. power protection can be set.
Return Example:	1.260000e+03	

5. LOAD:RESistance

Description:	Sets the Load resistance (Ohm).	
Syntax:	LOAD:RESistance <NRf+>	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	LOAD:RES 1	It sets the Load to CR 1 Ohm.
Query Syntax:	LOAD:RESistance?	
Return Parameter:	<NRf+> [Unit=Ohm]	
Query Example:	LOAD:RES?	It returns the setting.
Return Example:	1.000000e+00	

5.7.7 FETCH Subsystem

1. FETCh:VOLTage?

Description: Measures the output of the power supply and returns real-time voltage.
Query Syntax: FETCh:VOLTage?
Return Parameter: <NRf+> [Unit=Volt]
Query Example: FETC:VOLT?
Return Example: 9.983100e+00

2. FETCh:CURRent?

Description: Measures the output of the power supply and returns real-time current (with sign).
Query Syntax: FETCh:CURRent?
Return Parameter: <NRf+> [Unit=Amp]
Query Example: FETC:CURR?
Return Example: 2.000000e-04

3. FETCh:POWer?

Description: Measures the output of the power supply and returns real-time power (with sign).
Query Syntax: FETCh:POWer?
Return Parameter: <NRf+> [Unit=Power]
Query Example: FETC:CURR?
Return Example: 5.000000e+03

4. FETCh:STATus?

Description: Returns the status code of the power supply's state.
Query Syntax: FETCh:STATus?
Return Parameter: <Arg1><,><Arg2><,><Arg3>
<Arg1>: return warning message 0~4294967295, 0: no warning, use binary for the rest, and identify the cause of the error.

BIT 0	OVP	BIT 16	DD_PROTECT
BIT 1	SOCP	BIT 17	Inter Lock
BIT 2	SOPP	BIT 18	FPGA Fail
BIT 3	Remote Inhibit	BIT 19	Open Short
BIT 4	OTP	BIT 20	Security IC Error
BIT 5	FAN Lock	BIT 21	Machine ID Error
BIT 6	Calibration Error	BIT 22	System parameter Error
BIT 7	Current Share	BIT 23	Boot Up Initial Error
BIT 8	Charge OCP	BIT 24	FAN Start Up Error
BIT 9	Discharge OCP	BIT 25	AD Number Error
BIT 10	Fold Back CV to CC	BIT 26	DD Number Error
BIT 11	Fold Back CC to CV	BIT 27	CD FPGA Number Error
BIT 12	LOCP	BIT 28	Keypro In/Out
BIT 13	LOPP	BIT 29	Sense Fault
BIT 14	UTP	BIT 30	Cascade Conn Error
BIT 15	AD_PROTECT	BIT 31	Slave Protect Alarm

<Arg2>: ON|OFF output status at present
<Arg3>: CV or CC status at present
Query Example: FETCh:STATus?

Return Example: 0,OFF,CV

5.7.8 MEASURE Subsystem

1. MEASure:VOLTage?

Description: Returns the voltage measured at the output of the power supply.
Query Syntax: MEASure:VOLTage?
Return Parameter: <NRf+> [Unit=Volt]
Query Example: MEAS:VOLT?
Return Example: 8.120000e+01

2. MEASure:CURRent?

Description: Returns the current measured at the output of the power supply (with sign).
Query Syntax: MEASure:CURRent?
Return Parameter: <NRf+> [Unit=Amp]
Query Example: MEAS: CURR?
Return Example: 3.150000e+01

3. MEASure:POWer?

Description: Returns the power measured at the output of the power supply (with sign).
Query Syntax: MEASure: POWer?
Return Parameter: <NRf+> [Unit=Watt]
Query Example: MEAS: POWer?
Return Example: 5.000000e+03

5.7.9 PROGRAM Subsystem

1. PROGram:MODE

Description: Sets the program output mode.
Syntax: PROGram:Mode <Arg>
Parameter: <Arg>: LIST | STEP
Example: PROGram:Mode STEP
Query Syntax: PROGram:Mode?
Return Parameter: LIST | STEP
Query Example: PROG:MODE?
Return Example: STEP

2. PROGram:RUN

Description: Executes the program.
Syntax: PROGram:RUN <Arg>
Parameter: <Arg>: ON | OFF
Example: P PROG:RUN ON
Query Syntax: PROGram:RUN?
Return Parameter: ON | OFF
Query Example: PROGram:RUN?
Return Example: ON

3. PROGram:SAVE

Description:	Saves the program.
Syntax:	PROGram:SAVE
Parameter:	None
Example:	PROG:SAVE

4. PROGram:SELected

Description:	Sets the executed program no. in List mode.
Syntax:	PROGram:SELected <NR1>
Parameter:	1 to 10
Example:	PROG:SEL 10
Query Syntax:	PROG:SEL?
Return Parameter:	<NR1>
Query Example:	PROG:SEL? It returns the program no. in use.
Return Example:	10

5. PROGram:LINK

Description:	Links a program to another at the end of a List.
Syntax:	PROGram:LINK <NR1>
Parameter:	0 to 10 (0 is not linked)
Example:	PROG:LINK 7
Query Syntax:	PROG:LINK?
Return Parameter:	<NR1>
Query Example:	PROG:LINK?
Return Example:	7

6. PROGram:COUNT

Description:	Sets the number of times the program file is to be executed in List mode.
Syntax:	PROGram:COUNT <NR1>
Parameter:	1 to 15000
Example:	PROG:COUNT 7
Query Syntax:	PROG:COUNT?
Return Parameter:	<NR1>
Query Example:	PROG:COUNT?
Return Example:	7

7. PROGram:PULL

Description:	Executes the PROGRAM TRIGGER input signal to enhance the resistance control in List.
Syntax:	PROGram:PULL <ARG>
Parameter:	<ARG>: LOW | HIGH
Example:	PROGram:PULL LOW
Query Syntax:	PROGram:PULL?
Return Parameter:	LOW | HIGH
Query Example:	PROGram:PULL?
Return Example:	LOW

8. PROGram:SEQuence:SELected

Description:	Sets the execution sequence of a program in List mode.
Syntax:	PROGram:SEQuence:SELected <NR1>
Parameter:	1 to the sequence no. of the present program.
Example:	PROG:SEQ:SEL 3
Query Syntax:	PROGram:SEQuence:SELected? [{MAX/MIN}]

Return Parameter: <NR1>
Query Example: PROG:SEQ:SEL?
Return Example: 3

9. PROGram:SEQuence:TYPE

Description: Sets the action type of a sequence in List mode.
Syntax: PROGram:SEQuence:TYPE <Arg>
Parameter: <Arg> AUTO | MANUAL | TRI | SKIP
Example: PROG:SEQ:TYPE AUTO
Query Syntax: PROG:SEQ:TYPE?
Return Parameter: AUTO | MANUAL | EXT.TRIGGER | SKIP
Query Example: PROG:SEQ:TYPE?
Return Example: AUTO

10. PROGram:SEQuence:VOLTage

Description: Sets the sequence for voltage output in List mode.
Syntax: PROGram:SEQuence:VOLTage <NRf+>
Parameter: <NRf+>
Example: PROG:SEQ:VOLT 40.5
Query Syntax: PROG:SEQ:VOLT? [{MAX/MIN}]
Return Parameter: <NRf+>
Query Example: PROG:SEQ:VOLT?
Return Example: 4.050000e+01

11. PROGram:SEQuence:VOLTage:SLEW

Description: Sets the sequence of voltage slew rate for output in List mode.
Syntax: PROGram:SEQuence:VOLTage:SLEW <NRf+>
Parameter: <NRf+>
Example: PROG:SEQ:VOLT:SLEW 1
Query Syntax: PROG:SEQ:VOLT:SLEW? [{MAX/MIN}]
Return Parameter: <NRf+>
Query Example: PROG:SEQ:VOLT:SLEW?
Return Example: 1.000000e+01

12. PROGram:SEQuence:CURRent

Description: Sets the sequence for Source current output in List mode.
Syntax: PROGram:SEQuence:CURRent <NRf+>
Parameter: <NRf+>
Example: PROG:SEQ:CURR 45
Query Syntax: PROG:SEQ:CURR? [{MAX/MIN}]
Return Parameter: <NRf+>
Query Example: PROG:SEQ:CURR?
Return Example: 4.500000e+01

13. PROGram:SEQuence:CURRent:SLEW

Description: Sets the sequence of the current slew rate for the output in List mode.
Syntax: PROGram:SEQuence:CURRent:SLEW <NRf+>
Parameter: <NRf+>
Example: PROG:SEQ:CURR:SLEW 1
Query Syntax: PROG:SEQ:CURR:SLEW? [{MAX/MIN}]
Return Parameter: <NRf+>
Query Example: PROG:SEQ:CURR:SLEW?
Return Example: 1.000000e+00

Note : The current of Source and Load share this setting.

14. PROGram:SEQuence:CURRent:LOAD

Description:	Sets the sequence for Load current output in List mode.
Syntax:	PROGram:SEQuence:CURRent:LOAD <NRf+>
Parameter:	<NRf+>
Example:	PROG:SEQ:CURR:LOAD 45
Query Syntax:	PROG:SEQ:CURR:LOAD? [{MAX/MIN}]
Return Parameter:	<NRf+>
Query Example:	PROG:SEQ:CURR:LOAD?
Return Example:	4.500000e+01

15. PROGram:SEQuence:TIME

Description:	Sets the duration of the sequence in List mode.
Syntax:	PROGram:SEQuence:TIME <NRf+>
Parameter:	0.001~15000 seconds
Example:	PROG:SEQ:TIME 10
Query Syntax:	PROG:SEQ:TIME? [{MAX/MIN}]
Return Parameter:	<NRf+>
Query Example:	PROG:SEQ:TIME?
Return Example:	1.000000e+01

16. PROGram:CLEAR

Description:	Clears all sequences from the program selected in List mode.
Syntax:	PROGram:CLEAR
Parameter:	None
Example:	PROG:CLEAR

17. PROGram:ADD

Description:	Adds sequences to the program selected in List mode.
Syntax:	PROGram:ADD <NR1>
Parameter:	1~100 (based on the remaining sequence no. for configuration)
Example:	PROG:ADD 15
Query Syntax:	PROGram:ADD? (It returns the configurable sequence no.)
Return Parameter:	<NR1>
Query Example:	PROGram:ADD?
Return Example:	85 – it indicates the remaining no. is 85.

18. PROGram:MAX?

Description:	Queries the sequence amount of the program selected in List mode.
Query Syntax:	PROGram:MAX?
Return Parameter:	None
Query Example:	PROG:MAX?
Return Example:	2 – it means there are two sequences under the present program.

19. PROGram:SEQuence

Description:	Sets the parameters of a single sequence in List mode.
Syntax:	PROGram:SEQuence <Arg1><,><Arg2><,><Arg3><,><Arg4><,><Arg5><,><Arg6><,><Arg7>
Parameter:	<Arg1>: Sequence TYPE (0: Auto, 1: Manual, 2: EXT.Trig, 3: Skip)

<Arg2>: Sequence Voltage (NRf+ unit: voltage)
<Arg3>: Sequence Voltage Slewrate (NRf+ unit: voltage)
<Arg4>: Sequence Source Current (NRf+ unit: current)
<Arg5>: Sequence Current Slewrate (NRf+ unit: current), Source and Load share this setting.)
<Arg6>: Sequence Load Current (NRf+ unit: current)
<Arg7>: Sequence TIME (NRf+ unit: SEC, only valid when Sequence Type is AUTO) (

Example: PROGram:SEQuence 0,80,10,15,1, 15,10
Query Syntax: PROG:SEQ?
Return Parameter: <arg1><,><arg2><,><arg3><,><arg4><,><arg5><,><arg6><,><arg7>
Same as the set sequence.
Query Example: PROG:SEQ?
Return Example: 0,8.000000e+01,1.000000e+01,1.500000e+01,1.000000e+00,0,1.000000e+010,80,10,15,1,15,1

20. PROGram:STEP:STARTV

Description: Sets the Step Mode start voltage for output.
Syntax: PROGram:STEP:STARTV <NRf+>
Parameter: <NRf+>
Example: PROGram:STEP:STARTV 20
Query Syntax: PROGram:STEP:STARTV?
Return Parameter: <NRf+>
Query Example: PROGram:STEP:STARTV?
Return Example: 2.000000e+01

21. PROGram:STEP:ENDV

Description: Sets the Step Mode end voltage for output.
Syntax: PROGram:STEP:ENDV <NRf+>
Parameter: <NRf+>
Example: PROGram:STEP:ENDV 50
Query Syntax: PROGram:STEP:ENDV?
Return Parameter: <NRf+>
Query Example: PROGram:STEP:ENDV?
Return Example: 5.000000e+01

22. PROGram:STEP:TIME

Description: Sets the execution time for Step Mode.
Syntax: PROGram:STEP:TIME <Arg1><,><Arg2><,><Arg3>
Parameter: <Arg1>: Hour (NR1) 0 ~ 99
<Arg2>: Minute (NR1) 0 ~ 59
<Arg3>: Second (NR1) 0 ~ 59.99
Example: PROG:SEQ:TIME 10
Query Syntax: PROG:SEQ:TIME? [{MAX/MIN}]
Return Parameter: <Arg1><,><Arg2><,><Arg3> same as the parameter.
Query Example: PROG:SEQ:TIME?
Return Example: 1.000000e+01

5.7.10 INSTRUMENT Subsystem

1. INSTrument:STATus:AD?

Description: Returns the AD module status.
Syntax: INSTrument:STATus:AD? <NR1>
Query Syntax: 1 | 2 | 3
Return Parameter: 0 ~ 4294967295 (2^{32}-1)

BIT 0	OVP_VDC_F	BIT 16	OCP_IO_REGEN
BIT 1	UVP_VDC_F	BIT 17	OCP_IL_R
BIT 2	OVP_Vrs_F	BIT 18	OCP_IL_S
BIT 3	OVP_Vtr_F	BIT 19	OCP_IL_T
BIT 4	OVP_Vst_F	BIT 20	AC_FAIL
BIT 5	UVP_Vrs	BIT 21	PFC_FAIL
BIT 6	UVP_Vtr	BIT 22	D2CP_ALM
BIT 7	UVP_Vst	BIT 23	UVP_VO_S
BIT 8	OVP_VO_F	BIT 24	IP_LLC_FAULT
BIT 9	UVP_VO_F	BIT 25	LLC_CMPSS
BIT 10	RELAY FAIL	BIT 26	FLASH ERR
BIT 11	DESAT_LLC_S	BIT 27	LLC_FAIL
BIT 12	UVP_VD_F	BIT 28	VAC_UBL
BIT 13	OVP_VD_F	BIT 29	OCP_IP_S
BIT 14	OCP_IO_SRC	BIT 30	DESAT_PFC
BIT 15	OTP_NTC	BIT 31	DESAT_LLC_P

Query Example: INSTrument:STATus:AD? 1
Return Example: 4194304

2. INSTrument:STATus:DD?

Description: Returns the DD module status.
Syntax: INSTrument:STATus:DD? <NR1>
Query Syntax: 1 | 2 | 3
Return Parameter: 0 ~ 4294967295 (2^{32}-1)

BIT 0	OVP	BIT 16	SRAM ERR
BIT 1	SOCP	BIT 17	MOS SHORT
BIT 2	LOCP	BIT 18	UVP
BIT 3	IL_SHARE	BIT 19	Reserved
BIT 4	SENSE_FAULT	BIT 20	Reserved
BIT 5	MODULE_ERR	BIT 21	Reserved
BIT 6	AD_ERR	BIT 22	Reserved
BIT 7	OTP	BIT 23	Reserved
BIT 8	HOST_SHUTDOWN	BIT 24	Reserved
BIT 9	UTP	BIT 25	PWM_CH1_WARN
BIT 10	Reserve	BIT 26	PWM_CH2_WARN
BIT 11	PWM_SHORT	BIT 27	PWM_CH3_WARN
BIT 12	HOST_SYNC	BIT 28	PWM_CH4_WARN
BIT 13	DB_FAULT	BIT 29	CALIB_WARN
BIT 14	AUX_FAULT	BIT 30	CAN_ID_WARN
BIT 15	Local OPP	BIT 31	PCB_VER_WARN

Query Example: INSTrument:STATus:DD? 1
Return Example: 256

5.7.11 IV Subsystem

1. IVCurve:VOC?

Description:	Queries the VOC value in IV Curve mode.
Query Syntax:	IVCurve:VOC?
Return Parameter:	<NRf+>
Query Example:	IVC:VOC?
Return Example:	6.000000e+02

2. IVCurve:ISC?

Description:	Queries the ISC value in IV Curve mode.
Query Syntax:	IVCurve:ISC?
Return Parameter:	<NRf+>
Query Example:	IVC:ISC?
Return Example:	8.000000e+00

3. IVCurve:VMPp?

Description:	Queries the VMPp value in IV Curve mode.
Query Syntax:	IVCurve:VMPp?
Return Parameter:	<NRf+>
Query Example:	IVC:VMP?
Return Example:	5.000000e+02

4. IVCurve:IMPp?

Description:	Queries the IMPp value in IV Curve mode.
Query Syntax:	IVCurve:IMPp?
Return Parameter:	<NRf+>
Query Example:	IVC:IMP?
Return Example:	5.000000e+00

5. IVCurve:PMPp?

Description:	Queries the PMPp value in IV Curve mode.
Query Syntax:	IVCurve:PMPp?
Return Parameter:	<NRf+>
Query Example:	IVC:PMP?
Return Example:	5.000000e+01

6. IVCurve:STATus?

Description:	Queries the IV curve status.
Query Syntax:	IVCurve:STATus?
Return Parameter:	<ARG1>,<ARG2>,... ,<ARG4>
	<ARG1> Voltage
	<ARG2> Current
	<ARG3> Execution time, the unit is millisecond (ms)
	<ARG4> Power
Query Example:	IVC:STATus?
Return Example:	50.0000,2.0000,5,100.0000
	(Return: Voltage = 50,
	Current = 2,
	Execution time = 5,
	Power = 100)

7. IVCurve:CONFigure:CONTrol

Description:	Sets the output control mode of IV curve.
Syntax:	IVCurve:CONFigure:CONTrol <ARG>
Parameter:	<ARG>: CC | CV
Example:	IVC:CONF:CONT CC
Query Syntax:	IVCurve:CONFigure:CONTrol?
Return Parameter:	CC | CV
Query Example:	IVC:CONF:CONT?
Return Example:	CC

8. IVCurve:CONFigure:FILTer

Description:	Sets the cutoff frequency (unit: Hz) of the IV curve measurement signal filter.
Syntax:	IVCurve:CONFigure:FILTer <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	IVC:CONF:FILT 1000
Query Syntax:	IVCurve:CONFigure:FILTer?
Return Parameter:	<NRf+>
Query Example:	IVC:CONF:FILT?
Return Example:	1.000000e+03

9. IVCurve:CONFigure:SPEed

Description:	Sets the output response speed of the IV curve.
Syntax:	IVCurve:CONFigure:SPEed <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	IVC:CONF:SPE 1000
Query Syntax:	IVCurve:CONFigure:SPEed?
Return Parameter:	<NRf+>
Query Example:	IVC:CONF:SPE?
Return Example:	1.000000e+03

10. IVCurve:CONFigure:MARGIN

Description:	Sets the margin of the IV curve (unit: %).
Syntax:	IVCurve:CONFigure:MARGIN <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	IVC:CONF:MARGIN 100
Query Syntax:	IVCurve:CONFigure:MARGIN?
Return Parameter:	<NRf+>
Query Example:	IVC:CONF:MARGIN?
Return Example:	1.000000e+02

11. IVCurve:VT

Description:	Sets the 128 voltage dots in IV Curve mode.
Syntax:	IVCurve:VT <NRf+>...< NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	IVC:VT <V1>,<V2,...<V128>
Query Syntax:	IVCurve:VT?
Return Parameter:	<NRf+>,...,<NRf+>
Query Example:	IVC:VT?
Return Example:	<V1>,<V2,...<V128>

12. IVCurve:IT

Description:	Sets the 128 current dots in IV Curve mode.
Syntax:	IVCurve:IT <NRf+>...< NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	IVC:IT <I1>,<I2,...<I128>
Query Syntax:	IVCurve:IT?
Return Parameter:	<NRf+>,...,<NRf+>
Query Example:	IVC:IT?
Return Example:	<I1>,<I2,...<I128>

13. IVCurve:EDIT

Description:	Select the number of IV curve storage tables to set (1~100), the default is 1.
Syntax:	IVCurve:EDIT <NRf+>
Parameter:	1 to 100
Example:	IVC:EDIT 1
Query Syntax:	IVCurve:EDIT?
Return Parameter:	<NRf+>
Query Example:	IVC:EDIT?
Return Example:	1.000000e+00

14. IVCurve:SELect

Description:	Select the number of IV curve storage tables to execute (1~100), the default is 1.
Syntax:	IVCurve:SELect <NRf+>
Parameter:	1 to 100
Example:	IVC:SEL 1
Query Syntax:	IVCurve:SELect?
Return Parameter:	<NRf+>
Query Example:	IVC:SEL?
Return Example:	1.000000e+00

15. IVCurve:SEQuence:SELected

Description:	Select the execution sequence of an IV Program.
Syntax:	IVCurve:SEQuence:SELected <NRf+>
Parameter:	1 to 100
Example:	IVC:SEQ:SEL 1
Query Syntax:	IVCurve:SEQuence:SELected?
Return Parameter:	<NRf+>
Query Example:	IVC:SEQ:SEL?
Return Example:	1.000000e+00

16. IVCurve:SEQuence

Description:	Sets all parameters of a single sequence in an IV program.
Syntax:	IVCurve:SEQuence <ARG1><,><ARG2><,><ARG3><,><ARG4>
Parameter:	<Arg1>: Sequence Number (NR1: 1~100) <Arg2>: Sequence TYPE (NR1 0:Auto, 1:Manual) <Arg3>: Sequence FILE (NR1:1 ~ 100) <Arg4>: Sequence TIME (NR1 unit: SEC, it is only valid when Sequence Type is AUTO.)
Example:	IVC:SEQ 5,0,99,10
Query Syntax:	IVCurve:SEQuence?
Return Parameter:	SEQ NO,TYPE,FILE NO,TIME

Query Example: IVC:SEQ?
Return Example: 5,0,99,10

Note Before setting the sequence, be sure to check that it exists in the IV-Program. If not, it has to use PROG:ADD command to add the sequence.

17. IVCurve:SEQuence:RUN?

Description: Queries the IV Program execution status.
Query Syntax: IVCurve:SEQuence:RUN?
Return Parameter: <ARG1>,<ARG2>,... ,<ARG7>
<ARG1> Executing status at present
0: STOP
1:RUNNING
<ARG2> Executing Program no.
<ARG3> Remaining count for execution in the Program
<ARG4> Executing Sequence no.
<ARG5> Executing Sequence type (0: AUTO, 1: MANUAL)
<ARG6> Executing File no.
<ARG7> Execution time, the unit is second (s)
Query Example: IVC:SEQ:RUN?
Return Example: 1,2,3,0,5,1,123
(Return: RUNNING,
Program No=2,
Cnt_Remain=1,
Sequence No=3,
Sequence Type=AUTO,
File No=5,
Time=123 sec.)

18. IVCurve:CONFigure:SAVE

Description: Saves the IV curve.
Syntax: IVCurve:CONFigure:SAVE
Example: IVC:CONF:SAVE

5.7.12 SAS Subsystem

1. SAS:MODEL

Description: Sets the SAS mode.
Syntax: SAS:MODEL <ARG>
Parameter: <ARG>: DEFAULT | EN50530 | SANDIA
Example: SAS:MODEL DEFAULT
Query Syntax: SAS:MODEL?
Return Parameter: DEFAULT | EN50530 | SANDIA
Query Example: SAS:MODEL?
Return Example: DEFAULT

2. SAS:VOC

Description: Sets the VOC value in SAS mode.
Syntax: SAS:VOC <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SAS:VOC 600

Query Syntax:	SAS:VOC?
Return Parameter:	<NRf+>
Query Example:	SAS:VOC?
Return Example:	6.000000e+02

3. SAS:ISC

Description:	Sets the VOC value in ISC mode.
Syntax:	SAS:ISC <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	SAS:ISC 8
Query Syntax:	SAS:ISC?
Return Parameter:	<NRf+>
Query Example:	SAS:ISC?
Return Example:	8.000000e+00

4. SAS:VMPp

Description:	Sets the VMPp value in SAS or EN50530 mode according to the running mode.
Syntax:	SAS:VMPp <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	SAS:VMP 500
Query Syntax:	SAS:VMPp?
Return Parameter:	<NRf+>
Query Example:	SAS:VMP?
Return Example:	5.000000e+02

5. SAS:IMPp

Description:	Sets the IMPp value in SAS or EN50530 mode according to the running mode.
Syntax:	SAS:IMPp <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	SAS:IMP 5
Query Syntax:	SAS:IMPp?
Return Parameter:	<NRf+>
Query Example:	SAS:IMP?
Return Example:	5.000000e+00

Note

When executing in SAS mode, the following conditions must be followed due to the limitations of the formula.

$VOC \neq 0$, $ISC \neq 0$, $VMP \neq 0$, $IMP \neq 0$

$VMP < VOC$, $IMP < ISC$

$VMP > VOC \times \left(1 - \frac{IMP}{ISC}\right)$

6. SAS:PMPp

Description:	Sets the PMPp value in EN50530 mode.
Syntax:	SAS:PMPp <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	SAS:PMP 1500
Query Syntax:	SAS:PMPp?
Return Parameter:	<NRf+>
Query Example:	SAS:PMP?
Return Example:	1.500000e+03

7. SAS:TECH

Description:	Sets the TECH value in EN50530 mode.
Syntax:	SAS:TECH <ARG>
Parameter:	<ARG>: CSI | TF
Example:	SAS:TECH CSI
Query Syntax:	SAS:TECH?
Return Parameter:	CSI | TF
Query Example:	SAS:TECH?
Return Example:	CSI

8. SAS:IRR

Description:	Sets the IRR value in EN50530 mode.
Syntax:	SAS:IRR <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	SAS:IRR 1000
Query Syntax:	SAS:IRR?
Return Parameter:	<NRf+>
Query Example:	SAS:IRR?
Return Example:	1.000000e+03

9. TRIG

Description:	When executing in SAS mode, use this command to update the SAS output waveform.
Syntax:	TRIG
Example:	SAS:VOC 600 SAS:ISC 8 SAS:VMP 400 SAS:IMP 5 TRIG

10. SAS:SANDIA:IRRREF

Description:	Sets the IRRREF value in SANDIA mode.
Syntax:	SAS:SANDIA:IRRREF <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	SAS:SANDIA:IRRREF 1000
Query Syntax:	SAS:SANDIA:IRRREF?
Return Parameter:	<NRf+>
Query Example:	SAS:SANDIA:IRRREF?
Return Example:	1.000000e+03

11. SAS:SANDIA:TMPREF

Description:	Sets the TMPREF value in SANDIA mode.
Syntax:	SAS:SANDIA:TMPREF <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	SAS:SANDIA:TMPREF 100
Query Syntax:	SAS:SANDIA:TMPREF?
Return Parameter:	<NRf+>
Query Example:	SAS:SANDIA:TMPREF?
Return Example:	1.000000e+02

12. SAS:SANDIA:BETA

Description:	Sets the BETA value in SANDIA mode.
Syntax:	SAS:SANDIA:BETA <NRf+>
Parameter:	Refer to individual spec for valid numeric range.

Example: SAS:SANDIA:BETA -2
Query Syntax: SAS:SANDIA:BETA?
Return Parameter: <NRf+>
Query Example: SAS:SANDIA:BETA?
Return Example: -2.000000e+00

13. SAS:SANDIA:FF

Description: Sets the FF value in SANDIA mode.
Syntax: SAS:SANDIA:FF <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SAS:SANDIA:FF 0.4
Query Syntax: SAS:SANDIA:FF?
Return Parameter: <NRf+>
Query Example: SAS:SANDIA:FF?
Return Example: 4.000000e-01

14. SAS:SANDIA:IRR

Description: Sets the IRR value in SANDIA mode.
Syntax: SAS:SANDIA:IRR <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SAS:SANDIA:IRR 1000
Query Syntax: SAS:SANDIA:IRR?
Return Parameter: <NRf+>
Query Example: SAS:SANDIA:IRR?
Return Example: 1.000000e+03

15. SAS:SANDIA:TMP

Description: Sets the TMP value in SANDIA mode.
Syntax: SAS:SANDIA:TMP <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SAS:SANDIA:TMP 100
Query Syntax: SAS:SANDIA:TMP?
Return Parameter: <NRf+>
Query Example: SAS:SANDIA:TMP?
Return Example: 1.000000e+02

16. SAS:SANDIA:PMP

Description: Sets the PMP value in SANDIA mode.
Syntax: SAS:SANDIA:PMP <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SAS:SANDIA:PMP 1500
Query Syntax: SAS:SANDIA:PMP?
Return Parameter: <NRf+>
Query Example: SAS:SANDIA:PMP?
Return Example: 1.500000e+03

17. SAS:SANDIA:VMP

Description: Sets the VMP value in SANDIA mode.
Syntax: SAS:SANDIA:VMP <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: SAS:SANDIA:VMP 500
Query Syntax: SAS:SANDIA:VMP?
Return Parameter: <NRf+>
Query Example: SAS:SANDIA:VMP?

Return Example: 5.000000e+02

5.7.13 Battery Simulation Subsystem

1. BATTery:OUTPut

Description:	Sets the output for the battery simulator.
Syntax:	BATTery:OUTPut <Arg>
Parameter:	<Arg>: ON | OFF
Example:	BATT:OUTP ON
Query Syntax:	BATTery:OUTPut?
Return Parameter:	ON | OFF
Query Example:	BATT:OUTP?
Return Example:	ON

2. BATTery:INITial

Description:	Sets the initial state of the battery simulator to be SOC or VOL.
Syntax:	BATTery:INITial <Arg>
Parameter:	<Arg>: SOC | VOL
Example:	BATT:INIT SOC
Query Syntax:	BATTery:INITial?
Return Parameter:	SOC | VOL
Query Example:	BATT:INIT?
Return Example:	SOC

3. BATTery:INITial:CAP

Description:	Sets the initial capacitance of the battery simulator.
Syntax:	BATTery:INITial:CAP <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	BATT:INIT:CAP 30.1
Query Syntax:	BATTery:INITial:CAP?
Return Parameter:	<NRf+>
Query Example:	BATT:INIT:CAP?
Return Example:	3.010000e+01

4. BATTery:INITial:VOLTage

Description:	Sets the initial voltage of the battery simulator.
Syntax:	BATTery:INITial:VOLTage <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	BATT:INIT:VOLT 30
Query Syntax:	BATTery:INITial:VOLTage?
Return Parameter:	<NRf+>
Query Example:	BATT:INIT:VOLT?
Return Example:	3.000000e+01

5. BATTery:CAP

Description:	Sets the capacitance of the battery simulator.
Syntax:	BATTery:CAP <NRf+>
Parameter:	Refer to individual spec for valid numeric range.
Example:	BATT:CAP 1000
Query Syntax:	BATTery:CAP?
Return Parameter:	<NRf+>
Query Example:	BATT: CAP?

Return Example: 1.000000e+03

6. BATTery:ESR

Description: Sets the internal resistance of the battery simulator.
Syntax: BATTery:ESR <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: BATT:ESR 1
Query Syntax: BATTery:ESR?
Return Parameter: <NRf+>
Query Example: BATT:ESR?
Return Example: 1.000000e+00

7. BATTery:VH

Description: Sets the voltage high limit for the battery simulator.
Syntax: BATTery:VH <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: BATT:VH 200
Query Syntax: BATTery:VH?
Return Parameter: <NRf+>
Query Example: BATT:VH?
Return Example: 2.000000e+02

8. BATTery:VL

Description: Sets the voltage low limit for the battery simulator.
Syntax: BATTery:VL <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: BATT:VL 50
Query Syntax: BATTery:VL?
Return Parameter: <NRf+>
Query Example: BATT:VL?
Return Example: 5.000000e+01

9. BATTery:[PROT:]SOURce:OCP

Description: Sets the Source current protection point for the battery simulator.
Syntax: BATTery:[PROT:]SOURce:OCP <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: BATT:PROT:SOUR:OCP 30
Query Syntax: BATTery:[PROT:]SOURce:OCP?
Return Parameter: <NRf+>
Query Example: BATT:PROT:SOUR:OCP?
Return Example: 3.000000e+01

10. BATTery:[PROT:]LOAD:OCP

Description: Sets the Load current protection point for the battery simulator.
Syntax: BATTery:[PROT:]Load:OCP <NRf+>
Parameter: Refer to individual spec for valid numeric range.
Example: BATT:PROT:LOAD:OCP 30
Query Syntax: BATTery:[PROT:]LOAD:OCP?
Return Parameter: <NRf+>
Query Example: BATT:PROT:LOAD:OCP?
Return Example: 3.000000e+01

5.7.14 Function Subsystem

1. FUNCtion:OPTion:KEY

Description:	Input the product key no.
Syntax:	FUNCtion:OPTion:KEY <ARG>
Parameter:	<ARG>: Product key
Example:	FUNC:OPT:KEY “XXXXXXXXXXXX”
Query Syntax:	FUNCtion:OPTion:KEY?
Return Parameter:	IDLE | CORRECT | INCORRECT
Query Example:	FUNC:OPT:KEY?
Return Example:	INCORRECT

2. FUNCtion:OPTion?

Description:	Queries the product key function.
Query Syntax:	FUNCtion:OPTion?
Return Parameter:	SAS | TUV
Query Example:	FUNC:OPT?
Return Example:	SAS

3. FUNCtion:OPTion:STATus?

Description:	Queries the product key status.
Query Syntax:	FUNCtion:OPTion:STATus? <ARG>
Return Parameter:	<ARG>: “SAS”
Query Example:	FUNC:OPT:STAT? “SAS”
Return Example:	Slave No.1 does not have SAS function

6. Operation Theory

6.1 Overview

The 62000D-HL DC power supplies have AL, AY, AR, BD, PD, LD, CB, DP, DB, CP, D, E, EA, EB, EC, ED, EM, MI, EL, G, H, IR, CR, B, P, MB, MP, BC, UD, OT, PA, RP, SE, and the communication interface GPIB/CAN board (option). The instruments have a total of 34 printed circuit boards. The distribution of printed circuit boards in different output models is as follows:

No.	Board	Function	Model 62450D-2000HL	Model 62360D-2000HL
1	AL	3-phase AC input power	O	O
2	AC	AC input Y capacitor board	O	O
3	AR	AC input relay board	O	O
4	BD	DC to DC driver for output	O	O
5	PD	AD/DC input driver board	O	O
6	LD	DC/DC driver board	O	O
7	CB	Output measurement circuit board	O	O
8	DP	AD/DC input digital control board	O	O
9	DB	DC/DC output digital control board	O	O
10	CP	AC/DC input measurement circuit	O	O
11	D	System digital board	O	O
12	E	Input EMI filter	O	O
13	EA	Input EMI X capacitor board	O	O
14	EB	Surge absorber and Y capacitor board	O	O
15	EC	Input EMI X capacitor board	O	O
16	ED	EMI input differential choke board	O	O
17	EM	EMI input common choke board	O	O
18	MI	Current converter from EMI to module	O	O
19	EL	EMI capacitor board	O	O
20	G	Screen control board	O	O
21	H	Input AC/DC capacitor board	O	O
22	IR	Inrush current inhibits circuit board	O	O
23	CR	DC/DC resonant capacitor board	O	O
24	B	DC to DC output power stage board	O	O

25	P	Input stage boost and high voltage DC to DC power component board	O	O
26	MB	Output inductor board	O	O
27	MP	Input inductance and current measurement board	O	O
28	BC	Output capacitor board	O	O
29	UD	Fan connector adapter	O	O
30	OT	H/L Remote sense switch	O	O
31	PA	Module auxiliary circuit board	O	O
32	RP	Remote sense board	O	O
33	SE	Software security lock	O	O
34	GPIB/ CAN FD (Option)	Choose GPIB or CAN FD communication function according to customer requirements.	O	O

A system diagram example of model 62450D-2000HL is shown in Figure 6-1:

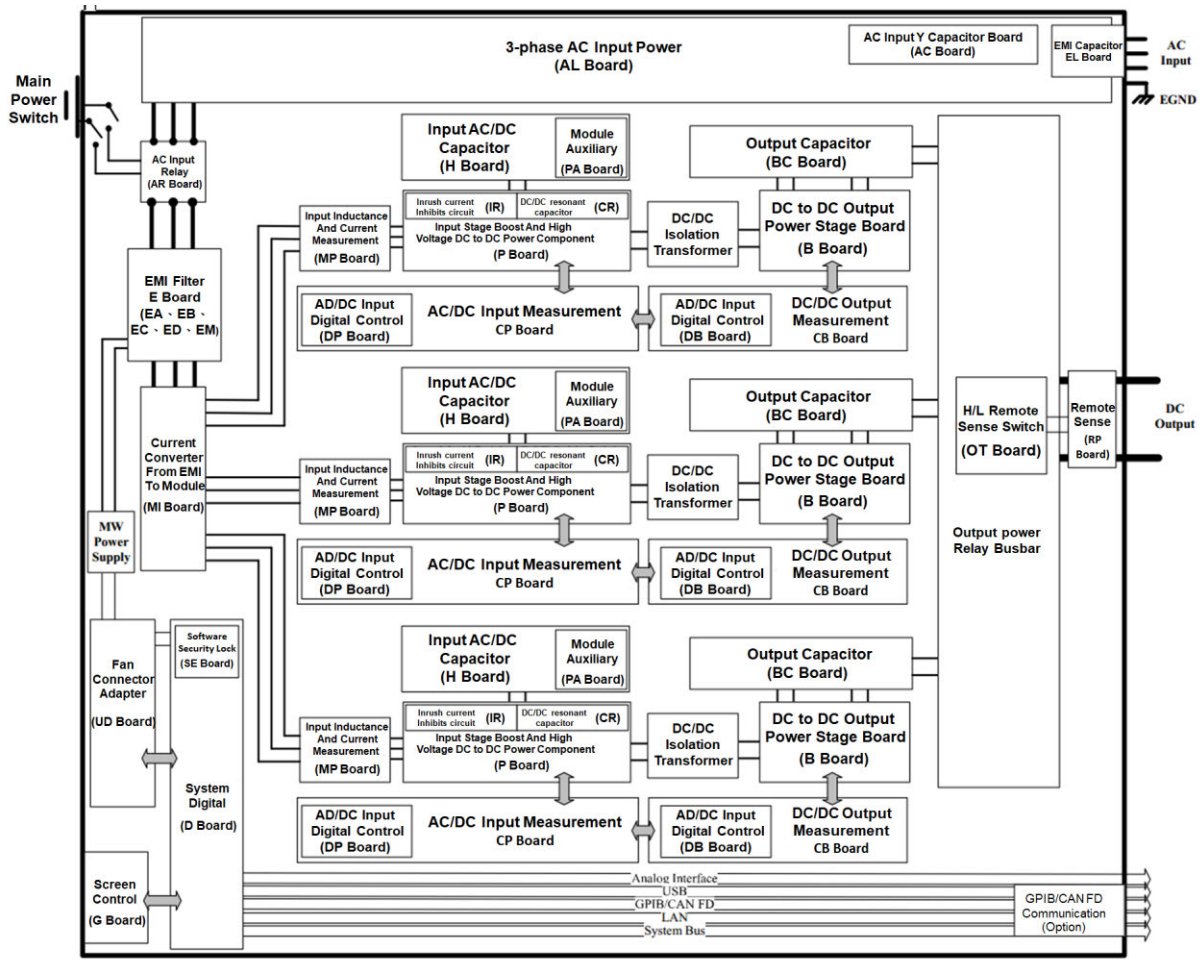


Figure 6-1

7. Self-Test and Troubleshooting

7.1 Overview

Follow the actions described in this chapter to inspect the 62000D-HL series DC power supply and troubleshoot problems if the instrument is unable to operate normally. Please consult Chroma or its sales agent if the information provided in this manual is unable to resolve the problem.

7.2 Troubleshooting

Operation problems and suggestions for resolution:

Problem	Cause	Resolution
Bad measurement for V, I	Feature swings due to aged components.	It needs calibration periodically. See section 3.2.5.4 Calibration.
Output is not within Accuracy SPEC.	Feature swings due to aged components.	It needs calibration periodically. See section 3.2.5.4 Calibration.
Over Temperature Protection (OTP)	1. The ambient temperature is too high. 2. The vent is blocked.	1. Operate the instrument within the temperature of 0 ~ 40°C. 2. Clear the vent.
Over Power Protection (OPP)	The output power exceeds the spec.	Remove the overload or enlarge the OPP settings.
Over Current Protection (OCP)	The output current exceeds the spec. or OCP settings.	Remove the overload or enlarge the OCP settings.
Fan Fail Protection (FAN LOCK)	1. The fan is out of order. 2. The feedback circuit is abnormal.	Consult with your local sales agent if it is unable to reset the protection state.
Input Error Protection 1 AC FAULT	The voltage of the AC input line is either too low or too high.	Adjust the voltage if it exceeds the spec. when measuring the input voltage.
No output voltage	1. The output voltage feedback is abnormal. 2. The D/D power stage is damaged.	Consult with your local sales agent if it is unable to reset the protection state.
Over Voltage Protection (OVP)	The output voltage exceeds the spec. or OVP settings.	1. Check the OVP settings. 2. Consult with your local sales agent if it is unable to reset the protection state.
Unable to control DC power supply via GPIB	1. The address of the DC power supply is incorrect. 2. The GPIB cable is loose and has fallen at the rear.	1. Update the address. 2. Check the cable connection and secure it with screws.
D/D power stage error protection (D/D FAULT)	1. The transient current is too big. 2. The D/D power stage is damaged.	1. When D/D FAULT protection occurs, first turn off the power supply and remove the load. Also, make sure cables are connected

Problem	Cause	Resolution
		correctly, and then power it on again. 2. Consult with your local sales agent for further assistance.
MATCH warning for incompatible models when connecting in series or parallel (ERROR!!! MASTER OR SLAVE NO MATCH)	The model numbers do not match.	1. The power supplies of different models are unable to be connected in series or parallel for use. 2. Consult with your local sales agent for further assistance.
FPGA UPDATE! version incompatible protection (FPGA IS TOO OLD, PLS UPDATE!)	The power supply's FPGA does not match the F/W.	Consult with your local sales agent for further assistance.

Appendix A Analog Interface Pin Assignments

The 25-pin connector is located at the rear panel as Figure A-1 shows:

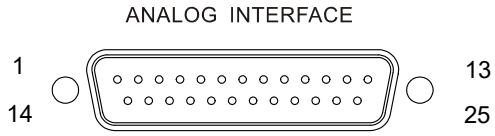


Figure A-1

Pin No.	Pin Definition	PUT	Pin No.	Pin Definition	PUT
1	DCOUT_ON	OUTPUT	14	FAULT	OUTPUT
2	DC_ON_ST	OUTPUT	15	PROG_TRIG	IN
3	INTERLOCK	IN	16	DPG_GND	GND
4	DO1	OUTPUT	17	DO2	OUTPUT
5	N.C.	OUTPUT(N.C)	18	DI1	IN
6	DI2	IN	19	DPG_GND	GND
7	N.C.	OUTPUT(N.C)	20	N.C.	OUTPUT(N.C)
8	AIO_S_SET_V	IN	21	AVO_SET_V	IN
9	AIO_L_SET_V	IN	22	APG_GND	GND
10	AIO_MEAS_V	OUTPUT	23	N.C.	OUTPUT(N.C)
11	N.C.	OUTPUT(N.C)	24	APG_GND	GND
12	AVO_MEAS_V	OUTPUT	25	N.C.	OUTPUT(N.C)
13	N.C.	OUTPUT(N.C)			

(1) PIN 1: DCOUT_ON, when the output voltage exceeds VDC_R, the DCOUT_ON will turn to HIGH. When the DC power supply output voltage is lower than the VDC_F setting, the DCOUT_ON will turn to LOW.
(2) PIN 2: DC_ON_ST, when DC ON, it outputs a signal to trigger the TTL Level to Active High.
(3) PIN 3: INTERLOCK, this function allows users to control the power supply for temporary OFF, see section 3.2.3.4.4 for detailed information.
(4) PIN 4: DO1, this pin is HIGH when in CV mode and LOW when in CC mode.
(5) PIN 5: N.C.
(6) PIN 6: DI2, provides an External Load ON/OFF function for you to control it. If DI1 and DI2 are set to External Load ON/OFF, both signals need to be HIGH to set the Load OFF, and on the contrary, both signals need to be LOW to set the Load ON.
(7) PIN 7: N.C.
(8) PIN 8: AIO_S_SET_V, Source current setting only that allows you to set in “voltage form” with input voltage range from 0 to 10V, see section 3.2.5.1.1 APG for the detailed information.
(9) PIN 9: AIO_L_SET_V, Load current setting only that allows you to set in “voltage form” with input voltage range from 0 to 10V, see section 3.2.5.1.1 APG for the detailed information.
(10) PIN 10: AIO_MEAS_V, current measurement only that allows you to set in “voltage form” with input voltage range from -10V to 10V, see section 3.2.5.1.1 APG for the detailed information.
(11) PIN 11: N.C.

(12) PIN 12: AVO_MEAS_V, voltage measurement only that allows you to set in “voltage form” with input voltage range from 0V to 10V, see section 3.2.5.1.1 APG for the detailed information.
(13) PIN 13: N.C.
(14) PIN 14: FAULT, the signals include output over voltage, output over current, output over power and FOLDBACK, over temperature, fan failure, and input over voltage or input under voltage protection; Pull: Low (negative edge trigger).
(15) PIN 15: PROG_TRIG, the external trigger signal (negative edge trigger) in program editing mode.
(16) PIN 16: DPG _GND, digital signal for grounding.
(17) PIN 17: DO2, over temperature protection signal. TTL: Active Low.
(18) PIN 18: DI1, provides an External Load ON/OFF function for you to control it. If DI1 and DI2 are set to External Load ON/OFF, both signals need to be HIGH to set the Load OFF, and on the contrary, both signals need to be LOW to set the Load ON.
When DI1 (or DI2) is set to Remote Inhibit and Low, all channels in FRAME are Load OFF and a REMOTE INHIBIT protection message will appear. This protection is not cleared even if the DI1 (or DI2) is High, thus Load ON is unable to be executed. DI1 and DI2 are communication control and the action time must less than 5ms.
(19) PIN 19: DPG _GND, digital signal for grounding.
(20) PIN 20: N.C.
(21) PIN 21: AVO_SET_V, dedicated voltage setting allowing you to set in “voltage form” with input voltage range from 0 to 10V, see section 3.2.5.1.1 APG for the detailed information.
(22) PIN 22: APG _GND, analog signal for grounding.
(23) PIN 23: N.C.
(24) PIN 24: APG _GND, analog signal for grounding.
(25) PIN 25: N.C.

Appendix B List of Protection

Follow the protections described in this appendix to inspect the 62000D-HL series DC power supply and troubleshoot any problems if the instrument is unable to operate normally. Please consult Chroma or the sales agent if the information provided in this manual is unable to resolve the problem.

The table below lists the system protection:

Message on Panel	Protection	Possible Cause	Troubleshooting
OVP	It means the output voltage exceeds the voltage set on the user protection interface.	The voltage set on the protection interface is lower than the output voltage. (The maximum voltage that can be set is Vmax×1.1.)	Check the protection interface voltage setting.
SOCP	It means the output current in Source Mode exceeds the current set on the user protection interface.	The current set on the protection interface is lower than the output current. (The maximum current can be set is Imax×1.1.)	Check the protection interface's current setting.
SOPP	It means the output power in Source Mode exceeds the power set on the user protection interface.	The power set on the protection interface is lower than the output power. (The maximum power that can be set is Pmax×1.05.)	Check the protection interface power setting.
RMT_INHIBIT	It means the analog RMT_INHIBIT triggers the device protection.	The analog RMT_INHIBIT triggers the device protection.	Check if the external analog RMT_INHIBIT triggers the device protect.
OTP	It means the internal temperature of the whole device is too high. (>56°)	1. The operating environment temperature is over the limit. 2. The circuit detection is malfunctioning	1. Eliminate the ambient overheating problem. 2. Check the abnormal fan circuit board and sensing wire, and replace them.
CALIB_ERR	It means the reading of the calibration file is failed and initial parameters are applied.	The calibration file is damaged.	Recalibrate it.

Message on Panel	Protection	Possible Cause	Troubleshooting
CHG_OCP	It means over charge protection is occurred in Charge and discharge mode.	The set charging value is lower than the charging value.	Check the set charging setting value.
DSG_OCP	It means over discharge protection is occurred in Charge and discharge mode.	The set discharging value is higher than the discharging value.	Check the set discharging setting value.
FB_CVCC	It means the CV to CC transition time exceeds the protection time set by the user.	The protection time setting is lower than the CV to CC transition time (setting time range: 0.01~600.00 sec.)	Check the CV to CC transition time setting.
FB_CCCV	It means the CC to CV transition time exceeds the protection time set by the user.	The protection time setting is lower than the CV to CC transition time (setting time range: 0.01~600.00 sec.)	Check the CV to CC transition time setting.
LOCP	It means the input current in Regen Mode exceeds the current set on the user protection interface.	The current set on the protection interface is lower than the output current. (The maximum current can be set is Imax×1.1.)	Check the protection interface's current setting.
LOPP	It means the input power in Regen Mode exceeds the power set on the user protection interface.	The power set on the protection interface is lower than the output power. (The maximum power that can be set is Pmax×1.05.)	Check the protection interface power setting.
UTP	It means the internal temperature of the whole device is too low. (<-8°)	1. The operating environment temperature is under the limit. 2. The module component is abnormal and the circuit detection is malfunctioning.	1. Eliminate the ambient temperature too low problem. 2. Check the abnormal fan circuit board and sensing wire, and replace them. (Please contact the technical service personnel or agents of Chroma.)
AD_PROTECT	It means the AC/DC and DC/DC (front) modules are	The AC/DC and DC/DC (front) modules will notify	Check and replace the AC/DC and DC/DC (front) module

Message on Panel	Protection	Possible Cause	Troubleshooting
	abnormal and notify the system.	the system of the alarm.	boards where the protection occurred. (Please contact the technical service personnel or agents of Chroma.)
DD_PROTECT	It means the DC/DC module is abnormal and notifies the system.	The DC/DC module will notify the system of the alarm.	Check and replace the DC/DC module board where the protection occurred. (Please contact the technical service personnel or agents of Chroma.)
INTERLOCK	It means the external ANALOG INPUT Inter Lock triggers full device protection.	ANALOG INPUT Interlock triggers the device protection.	Check if the external ANALOG INPUT Interlock triggers the device protection.
DFPGA_FAIL	It means the device power-on initialization of communication is abnormal.	The control board component of the system device is abnormal.	Check and replace the device system control board. (Please contact the technical service personnel or agents of Chroma.)
OP_SHORT_ERR	It means continuous short-circuit protection.	External continuous short-circuit tests are performed on the UUT.	Stop the short circuit test to restore it.
SECURE_IC_ERR	It means the Security IC identification is wrong.	The version of Security IC is not burned in.	Check if the correct version is burned in the Security IC. (Please contact the technical service personnel or agents of Chroma.)
MACHINE_ID_ERR	It means the identification of the model name (number of modules) is wrong.	1. The firmware in the Security IC version is wrong. 2. The Security IC has fallen off or been damaged. 3. The comm. module is abnormal or unable to activate.	1. Check the firmware in the Security IC version. 2. Check if the Security IC has fallen off or broken. 3. Check if the comm. module can be activated and work normally. (Please contact the technical service personnel or agents of Chroma.)
SYS_PARA_ERR	It means the device power-on initialization is	1. The firmware in the Security IC version is wrong.	1. Check the firmware in the Security IC version.

Message on Panel	Protection	Possible Cause	Troubleshooting
	abnormal when reading the data.	2. The system control board is abnormal.	2. Check and replace the system control board. (Please contact the technical service personnel or agents of Chroma.)
INITIAL_ERR	It means the device initialization process is abnormal.	1. The burned-in Security IC version is wrong. 2. The module startup failed. 3. The system control board is abnormal.	1. Check the firmware in the Security IC version. 2. Check if the module can be activated normally. 3. Check and replace the system control board. (Please contact the technical service personnel or agents of Chroma.)
AD_NUM_ERR	It means the AC/DC and DC/DC modules cannot be identified.	1. The comm. cable of the AC/DC and DC/DC (front) module control board is fallen off. 2. The control board of the AC/DC and DC/DC (front) modules is abnormal. 3. The DC/DC module startup failed.	1. Check if the comm. cable of the AC/DC and DC/DC (front) module control board is fallen off. 2. Check and replace the control board of the AC/DC and DC/DC (front) module. 3. Check if the DC/DC module can be activated normally. (Please contact the technical service personnel or agents of Chroma.)
DD_NUM_ERR	It means the DC/DC module cannot be recognized.	1. The comm. cable of the DC/DC module control board has fallen off. 2. The control board DC/DC module is abnormal.	1. Check if the comm. cable of the DC/DC module control board has fallen off. 2. Check and replace the control board of the DC/DC module. (Please contact the technical service

Message on Panel	Protection	Possible Cause	Troubleshooting
			personnel or agents of Chroma.)
CD_FPGA_NUM_ERR	It means the DC/DC module cannot be recognized.	1. The comm. cable of the DC/DC module control board has fallen off. 2. The control board of the DC/DC module is abnormal.	1. Check if the comm. cable of the DC/DC module control board has fallen off. 2. Check and replace the control board of the DC/DC module. (Please contact the technical service personnel or agents of Chroma.)
CASCADE_CONN_ERR	It means the connection of multiple devices failed.	The comm. cable used for connecting multiple devices is wrong or has fallen off.	Check if the connecting comm. cable is wrong or has fallen off.
SLAVE_PROTECT_ERR	It means the connected multiple Slave devices are warning the Master.	A Slave warning status is applied to multiple devices.	Check the Slave warning status.
DD1_CONN_ERR DD2_CONN_ERR DD3_CONN_ERR	It means the DC/DC module communication has failed.	1. The DC/DC module comm. cable is fallen off. 2. The DC/DC module control board is abnormal.	1. Check if the comm. cable of the DC/DC module control board has fallen off. 2. Check and replace the control board of the DC/DC module. (Please contact the technical service personnel or agents of Chroma.)
AD1_CONN_ERR AD2_CONN_ERR AD3_CONN_ERR	It means the AC/DC module communication has failed.	1. The DC/DC module comm. cable is fallen off. 2. The DC/DC module control board is abnormal.	1. Check if the comm. cable of the DC/DC module control board has fallen off. 2. Check and replace the control board of the DC/DC module. (Please contact the technical service personnel or agents of Chroma.)
MST_DISCONN	It means the Master communication of multiple devices connection has failed.	The comm. cables used to connected multiple devices are wrong or fallen.	Check if the comm. cables connecting multiple devices are wrong or have fallen.

Message on Panel	Protection	Possible Cause	Troubleshooting
SLV_DISCONN	It means the Slave communication of multiple devices connection has failed.	The comm. cables used to connect multiple devices are wrong or fallen.	Check if the comm. cables connecting multiple devices are wrong or have fallen.
SERDES_DISCONN	It means the communication of multiple devices connection is failed.	The comm. cables used to connect multiple devices are wrong or fallen.	Check if the comm. cables connecting multiple devices are wrong or have fallen.
FAN_LOCK_1 FAN_LOCK_2 FAN_LOCK_3 … FAN_LOCK_12	It means the fan speed detection value is abnormal. (Latch)	1. The fan connecting cable has fallen. 2. The fan power supply is abnormal or damaged. 3. The fan is stuck by foreign matter.	1. Check if the fan is connected correctly. 2. Check if the fan is normal without breaking. 3. Make sure there is no foreign matter blocking the fan. (Please contact the technical service personnel or agents of Chroma.)
SENSE_FAULT	It means the output voltage detection of the power supply is abnormal (the voltage differences between the local and remote are 27V in the L range and 81V in the H range.)	1. The DC/DC module output voltage sense is connected reversely 2. The line loss on the load cable exceeds 27V/81V of voltage. 3. The voltage measurement circuit of the power supply is abnormal.	1. Remove the UUT and check if the voltage sense cable at the output terminal is correct. 2. Check if the load line loss exceeds the limit. 3. Check and replace the device system control board. (Please contact the technical service personnel or agents of Chroma.)

Notice The protection point varies by the measurement error, thus protection circuits may act before reaching the protection point set.

The table below lists the module protections.

Message	Protection	Possible Cause	Troubleshooting
OVP_VDC_F	It means the PFC Vdc transient voltage of the AD/DC module is too high. (>850V(peak))	1. The output transient power is too high. (Regen Mode) 2. The measurement circuit of the AC/DC module is	1. Remove the UUT and check if the operation is correct. 2. Check and replace the AC/DC module

Message	Protection	Possible Cause	Troubleshooting
		abnormal.	board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
UVP_VDC_F	It means the PFC Vdc transient voltage of the AD/DC module is too low. (<720V(peak))	1. The output transient power is too high. (Source Mode) 2. The measurement circuit of the AC/DC module is abnormal. 3. The AC/DC module relay drive signal is abnormal or the relay is damaged. 4. The AC/DC module PWM drive signal is abnormal. 5. The AC/DC power component is abnormal or damaged.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
OVP_Vrs_F OVP_Vst_F OVP_Vtr_F	It means the circuit transient input voltage peak of the AD/DC module is too high. (>781V(peak))	1. The input power is abnormal. 2. The measurement circuit of the AC/DC module is abnormal.	1. Check if the input power meets the rated value. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
UVP_Vrs UVP_Vtr UVP_Vst	It means the circuit transient input voltage peak of the AD/DC module is too low. (<311V(rms))	1. The input power is abnormal. 2. The measurement circuit of the AC/DC module is abnormal.	1. Check if the input power meets the rated value. 2. Check and replace the AC/DC module board that has protection occurred. (Please

Message	Protection	Possible Cause	Troubleshooting
			contact the technical service personnel or agents of Chroma.)
OVP_VO_F	It means the DC BUS transient voltage of the AD/DC module is too high. (>850V(peak))	1. The output transient power is too high. (Regen Mode) 2. The measurement circuit of the AC/DC module is abnormal.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
UVP_VO_F	It means the DC BUS transient voltage of the AD/DC module is too low. (<200V(peak))	1. The output transient power is too high. (Source Mode) 2. The measurement circuit of the AC/DC module is abnormal. 3. The AC/DC module relay drive signal is abnormal or the relay is damaged. 4. The AC/DC module PWM drive signal is abnormal. 5. The AC/DC power component is abnormal or damaged.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
RLY_FAIL	It means the relay lapping judgment has failed (the PFC Vdc is 3V less before and after lapping).	1. The relay power component is abnormal or damaged. 2. The measurement circuit of the AC/DC module is abnormal.	1. Check and replace the relay power component. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the

Message	Protection	Possible Cause	Troubleshooting
			technical service personnel or agents of Chroma.)
UVP_VD_F	It means the input voltage peak amplitude of the AD/DC module is too high. (>880V)	1. The input power is abnormal. 2. The AC/DC module input fuse is broken. 3. The measurement circuit of the AC/DC module is abnormal.	1. Check if the input power meets the rated value. 2. Measure the AC/DC module fuse and replace it. (Please contact the technical service personnel or agents of Chroma.) 3. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
OVP_VD_F	It means the input voltage peak amplitude of the AD/DC module is too low. (<140V)	1. The input power is abnormal. 2. The measurement circuit of the AC/DC module is abnormal.	1. Check if the input power meets the rated value. 2. Measure the AC/DC module fuse and replace it. (Please contact the technical service personnel or agents of Chroma.) 3. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
OCP_IO_SRC	It means the peak value of the transient output current of the AD/DC circuit is too low. (<-30A(peak))	1. The output transient power is too high (Source Mode) 2. The measurement	1. Remove the UUT and check if the operation is correct. 2. Check and

Message	Protection	Possible Cause	Troubleshooting
		circuit of the AC/DC module is abnormal. 3. The power component of the AC/DC module is abnormal or damaged.	replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
OTP_NTC	It means the internal temperature of the AC/DC module power component is too high. (>96°)	1. The operating environment temperature is over the limit. 2. The module component is abnormal. 3. The detect circuit is malfunctioning.	1. Solve the environmental overheating problem. 2. Check the power components of abnormal phases and replace them. (Please contact the technical service personnel or agents of Chroma.) 3. Check and replace the abnormal fan circuit board and sensor cable. (Please contact the technical service personnel or agents of Chroma.)
OCP_IO_REGN	It means the peak value of the transient output current of the AD/DC circuit is too high. (>30A(peak))	1. The output transient power is too high. (Regen Mode) 2. The measurement circuit of the AC/DC module is abnormal. 3. The power component of the AC/DC module is abnormal or damaged.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
OCP_IL_R OCP_IL_S OCP_IL_T	It means the transient input current of the	1. The output transient power is too high.	1. Remove the UUT and check if the operation is

Message	Protection	Possible Cause	Troubleshooting
	AD/DC circuit is too high. (>30A (rms))	2. The measurement circuit of AC/DC module is abnormal. 3. The power component of the AC/DC module is abnormal or damaged.	correct. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
AC_FAIL	It means the the AD/DC module has not reached the starting conditions and the PFC Vdc rectified voltage is lower than the specification. (PFC Vdc < Vrs*0.95 or PFC Vdc < 150)	1. The input power is connected wrong or disconnected. 2. The AC/DC module fuse is damaged. 3. The measurement circuit of the AC/DC module is abnormal. 4. The drive signal of the AC/DC module relay is abnormal or the relay is damaged. 5. The power component of the AC/DC module is abnormal or damaged.	1. Check if the input power meets the rated value. 2. Measure the AC/DC module fuse and replace it. (Please contact the technical service personnel or agents of Chroma.) 3. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.) 4. Check and replace the protective phase relay and power components. (Please contact the technical service personnel or agents of Chroma.)
PFC_FAIL	It means the AD/DC module failed to start and the DC BUS voltage is too low. (>(800-5)V)	1. The measurement circuit of the AC/DC module is abnormal. 2. The AC/DC module relay drive signal is abnormal or the relay is	1. Check and replace the AC/DC module board that has protection occurred. 2. Check and replace the

Message	Protection	Possible Cause	Troubleshooting
		damaged. 3. The AC/DC module PWM drive signal is abnormal. 4. The power component of the AC/DC module is abnormal or damaged.	protective phase relay and power components. (Please contact the technical service personnel or agents of Chroma.)
D2CP_ALM	It means the device (D) receives an irreversible alarm and notifies the AC/DC module (CP) to stop operating.	One of the AC/DC modules or DC/DC in the device has abnormal protection.	Check and replace the AC/DC or DC/DC module board with an abnormal protection phase. (Please contact the technical service personnel or agents of Chroma.)
UVP_VO_S	It means the DC BUS transient voltage of the AD/DC module is too low. (<750V(avg))	1. The output transient power is too high. (Source Mode) 2. The measurement circuit of the AC/DC module is abnormal. 3. The AC/DC module relay drive signal is abnormal or the relay is damaged. 4. The AC/DC module PWM drive signal is abnormal. 5. The power component of the AC/DC module is abnormal or damaged.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
IP_LLC_FAULT	It means the LLC hall sensor triggers the hardware protection.	1. The LLC hall sensor is broken. 2. The measurement circuit of AC/DC module is abnormal.	1. Check and replace the LLC hall sensor. 2. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service

Message	Protection	Possible Cause	Troubleshooting
			personnel or agents of Chroma.)
FLASHERR	It means the DSP memory of the AC/DC module board is abnormal.	The DSP memory on the AC/DC module board is abnormal.	Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
LLC_FAIL	It means the DC BUS voltage of the AD/DC module is not between 0.95 and 1.05 times PFC_VO during the startup process.	1. The measurement circuit of the AC/DC module is abnormal. 2. The AC/DC module PWM drive signal is abnormal. 3. The power component of the AC/DC module is abnormal or damaged.	Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
VAC_UBL	It means the AD/DC module circuit input is unbalanced or out of phase.	1. The input power is incorrectly connected (line voltage difference is 10%) or disconnected. 2. The AC/DC module fuse is damaged. 3. The measurement circuit of the AC/DC module is abnormal.	1. Check if the three-phase input line voltage meets the rated value. 2. Measure the AC/DC module fuse and replace it. (Please contact the technical service personnel or agents of Chroma.) 3. Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
OCP_IP_S	It means the transient output current of the AD/DC circuit is too high. (>30A(avg))	1. The output transient power is too high. 2. The measurement circuit of the	1. Remove the UUT and check if the operation is correct. 2. Check and

Message	Protection	Possible Cause	Troubleshooting
		AC/DC module is abnormal. 3. The AC/DC module power component is abnormal or damaged.	replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
DESAT_PFC	It means the PFC end power component of the AC/DC module triggers hardware desat protection.	1. A phase power component of the DC/DC module is abnormal or damaged. 2. A phase power component of the DC/DC module has over current analog detection to protect the 62000D-HL. 3. The DC/DC module auxiliary power is abnormally low. 4. The hardware resistor is dropped or printed incorrectly.	Check and replace the DC/DC module board with a protection phase. (Please contact the technical service personnel or agents of Chroma.)
DESAT_LLC_FIRST	It means the power component on the primary side at the LLC end of the AC/DC module triggers hardware desat protection.		
DESAT_LLC_S	It means the power component on the secondary side at the LLC end of the AC/DC module triggers hardware desat protection.		
OFP	It means the AD/DC module circuit input frequency is over the specification.	The mains frequency is abnormal.	Check if the mains frequency exceeds the range (45Hz-65Hz).
OTP_MOS	It means the internal temperature of the AC/DC module power component is too high. (>73°)	1. The operating environment temperature is over the limit. 2. The module component is abnormal. 3. The detect circuit is malfunctioning.	1. Solve the environmental overheating problem. 2. Check and replace the power components of abnormal phases. (Please contact the technical service personnel or agents of Chroma.) 3. Check and replace the abnormal fan circuit board and sensor cable.

Message	Protection	Possible Cause	Troubleshooting
			(Please contact the technical service personnel or agents of Chroma.)
OVP	It means the DC/DC module circuit output voltage is too high. (>790V)	1. The power component of the DC/DC module is abnormal or damaged. 2. The measurement circuit of the DC/DC module is abnormal.	1. Check if the output active load meets the rated value. 2. Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
SOCP	It means the Source Mode output current of the DC/DC module circuit is too high. (>80A)	1. The output current is too high. (Source Mode) 2. The measurement circuit of the DC/DC module is abnormal.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
LOCP	It means the Regen Mode output current of the DC/DC module circuit is too low. (<-80A)	1. The output current is too high. (Regen Mode) 2. The measurement circuit of the DC/DC module is abnormal.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)

Message	Protection	Possible Cause	Troubleshooting
IL_SHARE	It means the current flow in the DC/DC module is uneven.	1. The measured current within the module differs by more than 5A. 2. The measurement circuit of the DC/DC module is abnormal.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
SENSE_FAULT	It means the DC/DC module output voltage detection is abnormal (the local and remote voltages differ by 5V at low speed and 10V at high speed.)	1. The DC/DC module output voltage sense is reversed. 2. It occurs when the load line loss is over 5V. 3. The measurement circuit of the DC/DC module is abnormal.	1. Remove the UUT and confirm if the voltage sense wiring of the output terminal is correct. 2. Check if the load line loss is over the limit. 3. Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
MODULE_ERROR	It means the model identification of the DC/DC module is abnormal.	1. The GPIO pin is abnormal. 2. The hardware resistor is dropped or printed wrong.	Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
AD_ERR	It means the AC/DC is abnormal, and notify the DC/DC module to be used.	The AC/DC module will notify the DC/DC module if there is any alarm.	Check and replace the AC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)

Message	Protection	Possible Cause	Troubleshooting
OTP	It means the internal temperature of the power component in the DC/DC module is too high. (>93°)	1. The operating environment temperature is over the limit. 2. The module component is abnormal. 3. It detects circuit malfunction.	1. Eliminate the ambient temperature too high problem. 2. Check and replace the abnormal power components. (Please contact the technical service personnel or agents of Chroma.) 3. Check the abnormal fan circuit board and sensing wire, and replace them. (Please contact the technical service personnel or agents of Chroma.)
HOST_SHUTDOWN	It means the soft shutdown protection is triggered.	Accidentally triggers the soft shutdown command.	Restart the device.
UTP	It means the internal temperature of the power component in the DC/DC module is too low. (<-8°)	1. The operating environment temperature is under the limit. 2. The module component is abnormal. 3. It detects circuit malfunction.	1. Eliminate the ambient temperature too low problem. 2. Check and replace the abnormal power components. (Please contact the technical service personnel or agents of Chroma.) 3. Check the abnormal fan circuit board and sensing wire, and replace them. (Please contact the technical service personnel or agents of Chroma.)
PWM_SHORT	It means the PWM output signal of the	1. The DSP components output abnormal	Check and replace the DC/DC module board that has

Message	Protection	Possible Cause	Troubleshooting
	DC/DC module is abnormal.	PWM signals. 2. FPGA detects circuit malfunction	protection occurred. (Please contact the technical service personnel or agents of Chroma.)
HOST_SYNC	It means one of the modules connected to multiple devices alarmed.	1. The power component of a certain module phase is abnormal or damaged. 2. The module detects abnormal circuits.	Check and replace the module that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
DB_FAULT PWM_CH1_WARN PWM_CH2_WARN PWM_CH3_WARN PWM_CH4_WARN	It means the power component of the DC/DC module triggers hardware desat protection. Use PWM_CHx_WARN to confirm any phase abnormality in the module.	1. A phase power component of the DC/DC module is abnormal or damaged. 2. A phase power component of the DC/DC module has over current analog detection to protect the 62000D-HL. 3. The DC/DC module auxiliary power is abnormally low. 4. The hardware resistor is dropped or printed incorrectly.	Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
AUX_FAULT	It means the auxiliary power of the DC/DC module is abnormally low.	1. The circuit detection function is abnormal. 2. The auxiliary power of the DC/DC module is abnormally low.	Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)
LOCAL_OPP	It means the DC/DC module is using over power.	1. Over power is used. 2. The measurement circuit of the DC/DC module is abnormal.	1. Eliminate the over power conditions. 2. Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents

Message	Protection	Possible Cause	Troubleshooting
			of Chroma.)
SRAM_ERR	It means the status check failed when powered on and checked emif communication one time.	The SRAM on the DC/DC module board is abnormal.	Check and replace the DC/DC module board. (Please contact the technical service personnel or agents of Chroma.)
UVP	It means the output voltage of the DC/DC module circuit is too low. (<-5V)	1. The module output terminal has a negative voltage. 2. The measurement circuit of the DC/DC module is abnormal.	1. Check if the output voltage is reversely connected causing negative voltage. 2. Check if the output series and parallel relay are normal. (Please contact the technical service personnel or agents of Chroma.) 3. Check and replace the DC/DC module board that has protection occurred. (Please contact the technical service personnel or agents of Chroma.)

Notice

- The protection message is marked _F(FAST) and _S(SLOW) by a transient and steady state.
- The protection point varies by the measurement error, thus protection circuits may act before reaching the protection point set.
- Please contact the after-sales service personnel if there is a need to remove the cover and replace the parts.

Appendix C Precautions for Battery Test

How to Safely Connect the 62000D-HL Bi-Directional DC Power Supply to the Battery

The Chroma 62000D-HL series of bidirectional power supplies offer two-quadrant operations with positive current/positive voltage and negative current/positive voltage. This allows the instruments to function as both DC power supplies and regenerative DC loads. One of the typical applications is testing the CC-CV charge/discharge characteristics of traction batteries. This involves testing the standard charge/discharge conditions when verifying battery specifications, including a capacity test after charging/discharging under different temperature requirements as well as an End-of-Line (EOL) charge/discharge test.

However, there is a risk of damaging the battery and equipment when connecting the 62000D-HL to the battery. As the battery always carries a charge and the 62000D-HL has a capacitor on the internal output side, upon being connected the capacitor will be affected by the voltage difference, which will generate a potentially damaging inrush current on the circuit. This is why it's important to use a pre-charge circuit to limit the inrush current. To prevent spark over and a large influx of current from damaging the equipment, the 62000D-HL output capacitor should be connected only when the crossover voltage is close to the actual voltage of the battery.

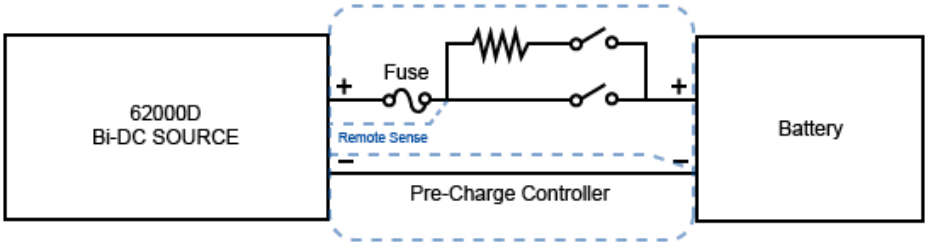
The following is divided into two use cases; one with and one without a battery management system (BMS).

Use Case 1:
The device under test (DUT) is a battery with BMS, as shown in the figure below. Situated between the battery and the 62000D-HL, the BMS has its pre-charge circuit. While the relay (contactor) is in an open state, there will be no current surge when connecting the devices. Therefore, this type of battery can be directly connected to the 62000D-HL.

After the 62000D-HL is connected to the battery, the following steps should be performed before starting the test:

Step 1. Obtain the battery's voltage value through the BMS.
Step 2. Set the voltage level of the 62000D-HL to the value obtained in Step 1. Set the Source & Load to 1A, and run the 62000D-HL output.
Step 3. Activate the pre-charge circuit by communicating between CAN and battery.
Step 4. After the pre-charge line is connected, you can start the charge and discharge test.

Use Case 2:
If you want to connect a battery that does not have a pre-charge circuit, you need to manually install a pre-charge circuit between the 62000D-HL and the battery as shown in the figure below.



Before connecting the 62000D-HL to the battery, it is necessary to add the following parts to the circuit as shown above: relay switches (S1/S2), a resistor (R), and a fuse. When selecting the components, make sure that the S1, S2, and fuse can withstand the maximum charge or discharge current specifications, and that the resistance is 1ohm/10W.

The circuit is executed in 7 steps:

Step 1. Switch S1 & S2 are initially in a disconnected state.
Step 2. Measure the battery voltage with an external meter.
Step 3. Set the 62000D-HL to the battery voltage value measured in Step 2, then set the current to 1A for Source and Load, and execute the 62000D-HL output.
Step 4. Use an external meter again to measure the 62000D-HL output voltage and the battery voltage to make sure the difference between the two sides falls within +/- 0.5V.
Step 5. First manually close S1 (at this time the voltage difference between 62000D-HL and the battery is very small and the current can be withstood by the resistance).
Step 6. Wait for about 1 second.
Step 7. Then manually close the S2; you can now start the battery charge/discharge test.

Turn Off Step: When you want to stop the test, make sure to adjust the current to 0A first, then turn off the 62000D-HL output, and then disconnect S1 and S2 to avoid the battery from being discharged through the 62000D-HL circuit when it is not being tested.

Notice If you need to use Remote Sense for voltage compensation, please refer to the wiring node in the circuit diagram.

Capable of acting as both power supply and load, Chroma 62000D-HL provides an all-in-one solution for battery charge and discharge testing. As a safety measure, users should make sure to install a pre-charge circuit before connecting the tester to the battery, to bring the voltage of the 62000D-HL's output capacitor close to the actual voltage of the battery. By following the steps described in use cases 1 and 2, the inrush current can be effectively limited to ensure the safety of the test.

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