Chroma

Programmable Bidirectional DC Power Supply 62000D Series

Operating and Programming Manual

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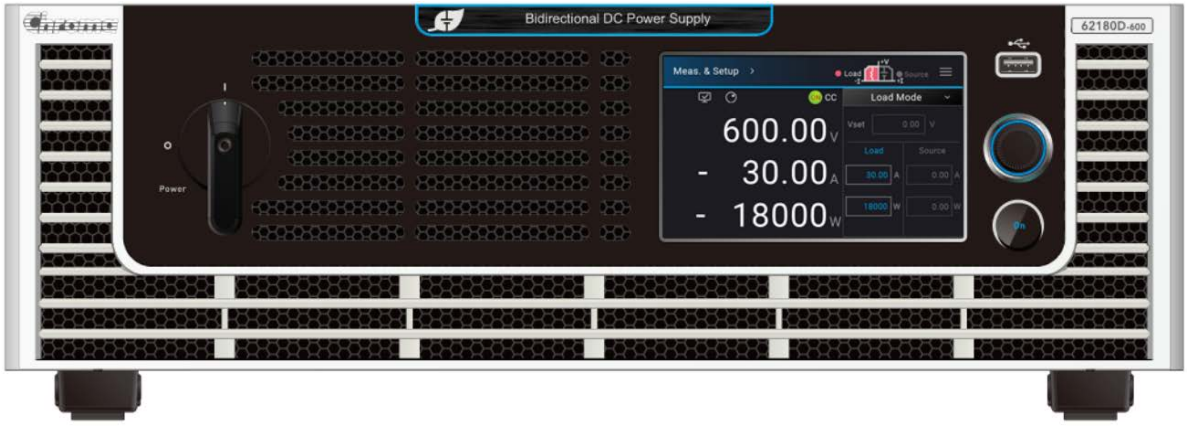

Version 1.0
October 2020

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CHROMA ATE INC.
66 Huaya 1st Road, Guishan, Taoyuan 33383, 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 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 regulation and no SVHC in use.

Disposal

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

<Table 2>

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

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

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

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

Disposal

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

www.chromaate.com Chroma

CE

Declaration of Conformity

For the following equipment :

Programmable Bidirectional DC Power Supply

(Product Name/ Trade Name)

62060D-600,62120D-600,62180D-600,62060H-600P,62120H-600P,62180H-600P,A620037

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

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

EN 61326-1:2013 Class A

EN 61326-2-1:2013

EN 61000-3-12:2011, EN 61000-3-11:2000

EN 61326-1:2013(industrial locations)

EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010, EN 61000-4-4:2012

EN 61000-4-5:2014+A1:2017, EN 61000-4-6:2014, EN 61000-4-8:2010

EN 61000-4-34:2004+A1:2017

IEC 61010-1:2010+A1:2016(Edition 3.1) , EN 61010-1:2010+A1:2019

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

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

CHROMA ATE INC.

(Company Name)

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

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

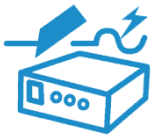
Taiwan	**2020.08.18**	Vincent. Wu.
(Place)	(Date)	(Legal Signature)

Safety Summary

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

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

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



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

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

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

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

⚠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 instruction 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 ground before operation of the equipment to protect against electrical shock in case of a fault.
	**Functional grounding:** To identify an earth (ground) terminal in cases where the protective ground is not explicitly stated. This symbol indicates the power connector does not provide grounding.
	**Frame or chassis:** To identify a frame or chassis terminal.
	**Alternating Current (AC)**
	**Direct Current (DC) / Alternating Current (AC)**
	**Direct Current (DC)**
	**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, deletions and modifications in this manual at each revision.

Date	Version	Revised Sections
Oct. 2020	1.0	Complete this manual.

Table of Contents

1. Overview

1.1 Introduction

The Chroma 62000D 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 stable DC output and accurate measurement for regenerative power applications.

The features of 62000D Series DC power supplies are:

1. Voltage mode & Current Mode with two control loops ➡ able to provide stable and quick response time performance. Instruments also provide the ability to program the slew rate of output voltage and current.
2. High power density output ➡ the maximum output power can up to 18kW under 3U height.
3. 16-bit ADC/16-bit DAC ➡ provides excellent resolution for measurement and output.
4. Lower transient spike and transient response time ➡ Provides for a stable output and the best protection under load variations.
5. Editing mode (Programming Mode) for output waveform ➡ provides multiple output voltage and current combinations in real time for long period tests.
6. Rotary knob control on the front panel ➡ to set the output voltage and current.
7. Touch panel ➡ provides users a high brightness and wide viewing angle interface for manual operation.
8. Via GPIB/CAN (option), USB, Ethernet or APG (analog programmable interface) interface ➡ to do remote control.
9. Active PFC design ➡ the PF value of 62000D series DC power supplies is >0.99. The high PF value increases the distribution capacity and wiring utilization.
10. 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 Functions

1.2.1 Operation Mode

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

1. Analog outputs are provided to monitor (V/I Monitor) output voltage and current instantaneously. This allows signals to be easily measured 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 signal allowing the output program and current to be sent using an analog reference signal.
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 to edit voltage/current waveform output.
3. Run time voltage program that can be set for up to an hour..

1.3 Specifications

Chroma 62000D Series high power density and bidirectional DC power supplies include three models; 6KW (62060D), 12KW (62120D), and 18KW (62180D) Table 1-1 lists the output specifications of these models. It is suggested to warm up the instruments for more than 10 minutes before performing verification tests. The test condition is 25 ± 5°C and under a resistance load.

Table 1-1 Specifications

Chroma Model Name	**62060D-600**	**62120D-600**	**62180D-600**
Output Ratings			
Output Voltage[1]	0-600V		
Output Current[2]	±40A	±80A	±120A
Output Power	±6000W	±12000W	±18000W
Min. Load voltage (@ I Load Max)	30V		
Line Regulation[3]			
Voltage	+/- 0.01% F.S.		
Current	+/- 0.05% F.S.		
Load Regulation[4]			
Voltage	+/- 0.02% F.S.		

Current	+/- 0.1% F.S.		
Voltage Measurement			
Range	120V / 600V		
Accuracy	0.05% + 0.05%F.S.		
Current Measurement			
Range	8A / 40A	16A / 80A	24A / 120A
Accuracy	0.1% + 0.1%F.S.		
Output Noise & Ripple			
P-P (20MHz)[11]	420mV		
rms (Voltage)[11]	85mV		
rms (Current[5)]	30mA	60mA	90mA
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]	0.001V/ms – 60V/ms		
Current slew rate range	0.001A/ms – 20A/ms	0.001A/ms – 40A/ms	0.001A/ms – 60A/ms
Minimum transition time	0.5 ms		
Efficiency[6]	Source > 91% Sink > 92%	Source > 92% Sink > 93%	Source > 92% Sink > 93%
Transient Response Time	Recovers within 0.5ms to +/- 0.75% of steady-state output for a 50% to 100% or 100% to 50% load change(1A/us)		
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/^{0}C		
Current	0.06% of Imax/^{0}C		
Programming &Measurement Resolution			
Voltage (Front Panel)	10 mV		
Current (Front Panel)	10 mA		
Voltage (Digital Interface)	0.002% of Vmax		
Current (Digital Interface)	0.002% 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
LXI Compliant LAN Interface	Standard
System bus(CAN)	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
Current (Analog Interface)	0.2% of Imax
APG Measure 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 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 Series: two units / Parallel: ten units
Auto Sequencing (List mode)	
Number of program	10

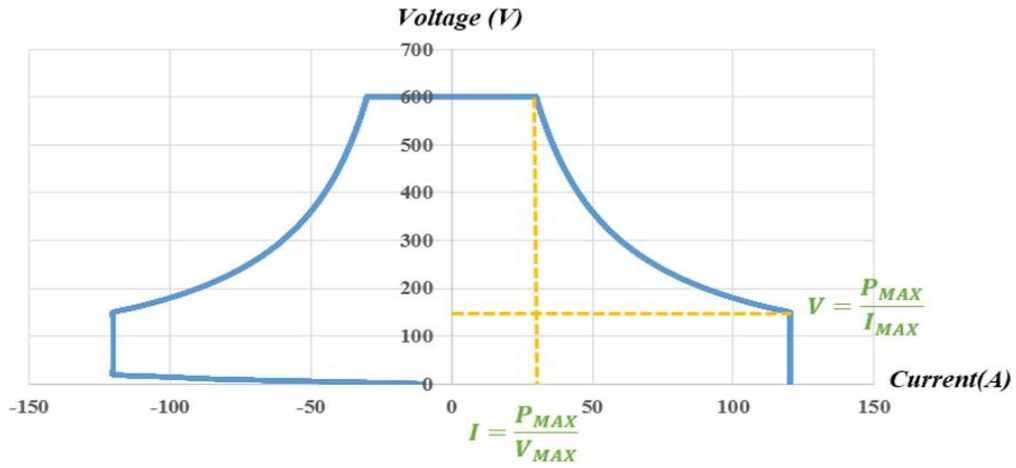
Number of sequence	100		
Dwell time Range	2ms – 15000Sec		
Trig. Source	Manual / Auto / External		
Auto Sequencing (Step mode)			
Start voltage	0 to Full scale		
End voltage	0 to Full scale		
Run time	00.001Sec to 100 hr		
Trig. Source	Auto		
Input Specification			
AC input voltage 3phase, 3wire + ground	3Φ 200Vac - 220Vac ± 10% 3Φ 380Vac - 480Vac ± 10% (Output=4kw@200-220 Vac input, Output=6kw@380-480 Vac input) w/o Neutral	3Φ 200Vac - 220Vac ± 10% 3Φ 380Vac - 480Vac ± 10% (Output=8kw@200-220 Vac input, Output=12kw@380-480 Vac input) w/o Neutral	3Φ 200Vac - 220Vac ± 10% 3Φ 380Vac - 480Vac ± 10% (Output=12kw@200-220 Vac input, Output=18kw@380-480 Vac input) w/o Neutral
AC frequency range	47 – 63 Hz		
Power factor	Source PF>0.97 @220Vac PF>0.97 @380Vac PF>0.95@480Vac Regn PF>0.97 @220Vac PF>0.95 @380Vac PF>0.92@480Vac	Source PF>0.97 @220Vac PF>0.97 @380Vac PF>0.95@480Vac Regn PF>0.97 @220Vac PF>0.95 @380Vac PF>0.92@480Vac	Source PF>0.97 @220Vac PF>0.97 @380Vac PF>0.95@480Vac Regn PF>0.97 @220Vac PF>0.95 @380Vac PF>0.92@480Vac
General Specification			
Maximum Remote Sense Line Drop Compensation[12]	2% of full scale voltage per line(4% total)		
Operating Temperature Rage	0^0C ~ +40^0C		
Storage Temperature Rage	-25^0C ~ +70^0C		
Dimension Size (HxWxD)mm	133 x 428 x 730 mm / 5.23 x 16.85 x 28.74 inch		
Weight (kg)	25kg / 55.1lbs	32kg / 70.5lbs	39kg / 86.0lbs

All specifications are subject to change without prior notice.

Note

1. Minimum output voltage is <0.5% of rate voltage at zero output setting.
2. Minimum output current is<0.2% of rate current at zero output setting when measured with rated load resistance.
3. For input voltage variation over the AC input voltage range with constant rated load.
4. For 0-100% load variation with constant nominal line voltage.
5. Current mode ripple is measured from 10% to 100% of rated output voltage full current.
6. Efficiency at 480Vac input Voltage and Full load output (Vo Max).
7. Maximum drift over 30 minutes with constant line, load, and temperature after power on.
8. Maximum drift over 8 hours with constant line, load, and temperature after 30 minute warm-up.
9. Change in output per 0C change in ambient temperature with constant line and load.

10. The fall rate will be affected by the discharge rate of the output capacitors especially under no load condition. (For 220Vac No load VS.R(max) = 50V/ms, Full load VS.R(max) = 25V/ms)
11. From 20 Hz to 20 MHz for peak-to-peak noise; from 20 Hz to 300 kHz for rms noise. (* 62180D-100、62180D-600 Measured across a 44nF & 104.7uF capacitor at the output terminal.) (Reference TN board Capacitor)
12. VO & IO Output range(ex: 62180D-600)



Constant Power: Equipped with wide voltage and wide current range for use

13. Efficiency at 220Vac & 380Vac input Voltage and Full load output (Vo Max).

Model：62180D-600

	220Vac	380Vac
Source eff.	>0.90	>0.91
Load eff.	>0.91	>0.92

Model：62120D-600

	220Vac	380Vac
Source eff.	>0.90	>0.91
Load eff.	>0.91	>0.92

Model：62060D-600

	220Vac	380Vac
Source eff.	>0.90	>0.91
Load eff.	>0.91	>0.92

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

CAUTION

1. For applications with fast switchable power loads and cable lengths greater 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 long time period to avoid internal damage to the supply.

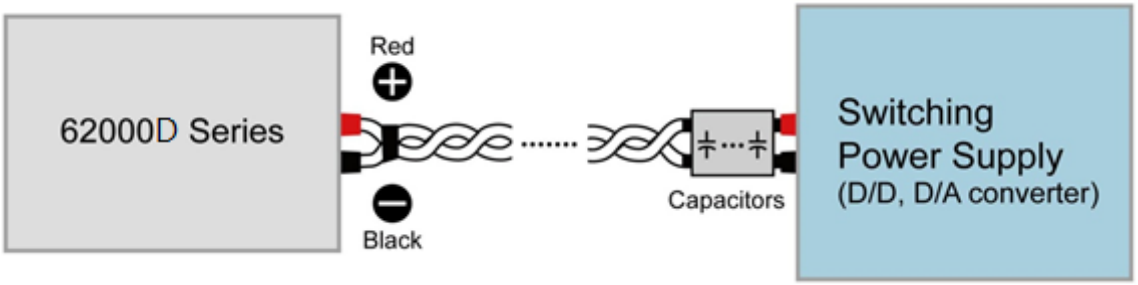


Figure 1-1

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

Table 1-2

Model	Max. Voltage (Vdc) Difference between Output Terminal and Earth
62060D-600	3000
62120D-600	3000
62180D-600	3000

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

1.4 Function Buttons

1.4.1 Front Panel

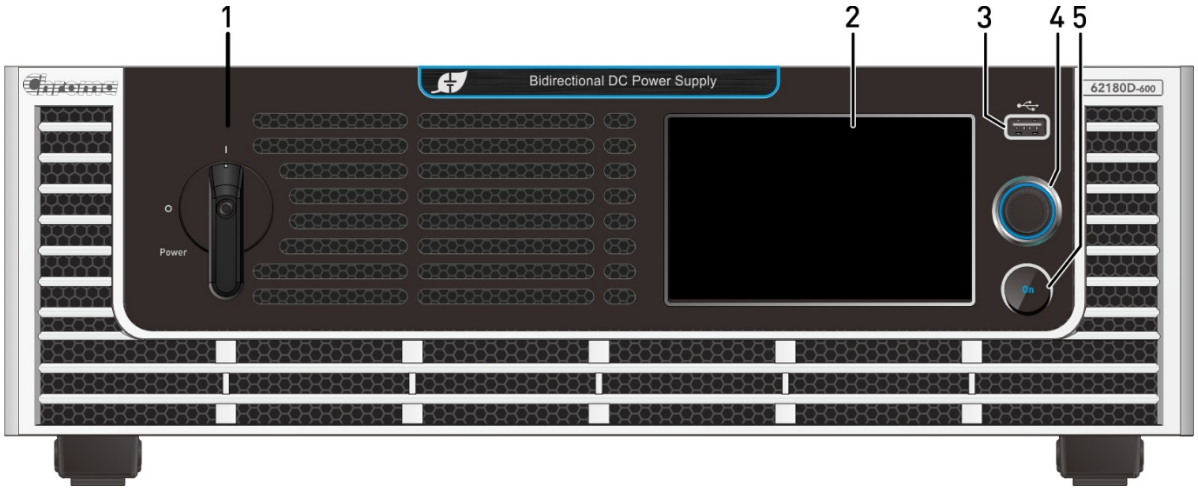


Figure 1-2 Front Panel of 62000D Series Models

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, measurements, control the program sequence, preview the output waveform, and display the test results.
3		**USB HOST:** Allows for programs to be read, download data and upgrade firmware, etc.
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

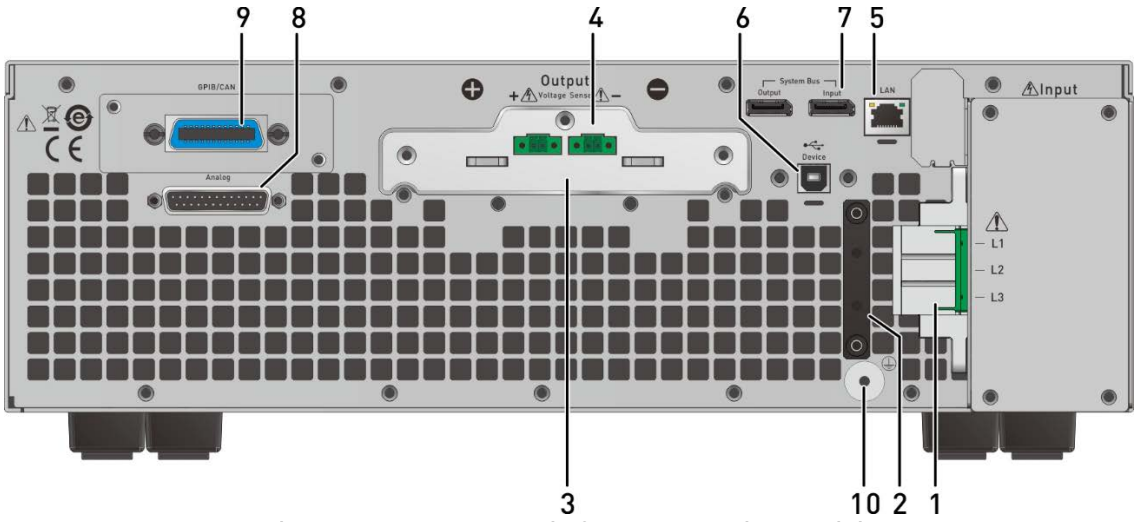


Figure 1-3 Rear Panel of 62000D Series Models

Table 1-4 Rear Panel Description

Item	Name	Description
1	AC power connector	AC power input connector.
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	Output terminal	The output terminals of DC power supply.
4	Voltage sense connector	Connecting this connector to load can compensate the voltage drop generated due to cable resistance. Be sure to connect the remote sense connector "+" to the positive output terminal of the device under test and "–" connector to the negative output terminal of the device under test. Reversing these connectors could cause damage to the power supply or the device under test.
5	Ethernet connector	The remote controller uses ETHERNET bus to connect to PC for remote operation.
6	USB port	The remote controller uses USB bus to connect to PC for remote operation.
7	System bus	It is for serial/parallel data transmission. (Remove this cable if the power supply is not connected in series or parallel.)
8	ANALOG interface signal connecting terminal	There are 25 pins signals that include APG input/output terminals and system status signal terminals. See *Appendix A* for detail pin assignments.
9	GPIB/CAN (option) connector	Used for GPIB/CAN control via and external PC for remote operation.
10	Functional Ground	This terminal is to connect the power supply to earth ground.

Notice Item 9 in Figure 1-3 is an optional GPIB/CAN interface of 62000D selected by the user. A blank panel will be installed if no interface is selected.

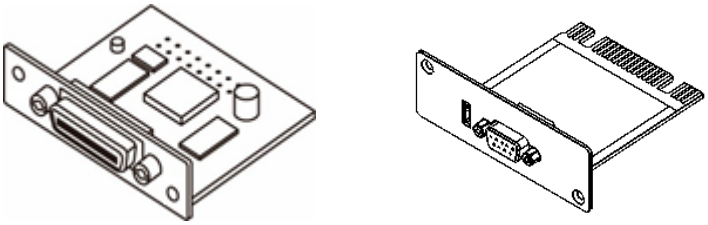


Figure 1-4 GPIB/CAN Interface

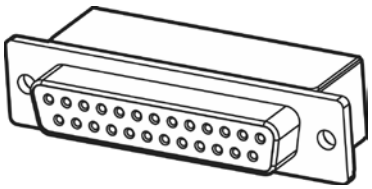
2. Installation

2.1 Checking the Package

1. Check for any damage or missing accessories after unpacking.
2. Should any damage be found, contact shipping company and Chroma's service department immediately of the agent that the device as purchase through shipment. 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 reference.

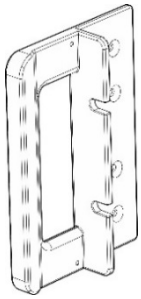
The accessories are shown in Figure 2-1 (a), (b), (c), (d), and (e).

(a) Cable for current sharing



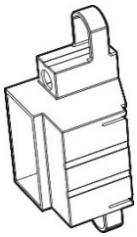
(b) D-SUB 25-pin (Keypro)

(c) Stylus



(d) Rack Handle

(e) Ethernet Cable Hoop



(f) AC Input connector cover

Figure 2-1

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 that are listed in the packing list are all 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 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 VFD front panel. For internal cleaning, use a low-pressure air gun 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 air does not exceed 40 deg C

2.2.1 Normal Environment Conditions

1. In door use.
2. Altitude up to 2000 meters.
3. Operating Temperature 0°C to 40°C.
4. Maximum relative humidity is 65% at 25°C and increasing linearly to 90% relative humidity for temperature up to 40°C.
5. Input AC supply voltage fluctuations can up to ±10% of the rated voltage.
6. Transient over voltage is impulse withstand CAT II.
7. Pollution degree II.

2.3 Requirements of Input Power

2.3.1 Ratings

(1) Model 62060D-600

Input voltage/frequency range:	V_{LL}: 380-480V±10% 3~ 4W / 47-63Hz
	V_{LL}: 200-220V±10% 3~ 4W / 47-63Hz
Maximum input power:	6.66 kVA
	4.73 kVA

(2) Model 62120D-600

Input voltage/frequency range:	V_{LL}: 380-480V±10% 3~ 4W / 47-63Hz
	V_{LL}: 200-220V±10% 3~ 4W / 47-63Hz
Maximum input power:	13.3 kVA
	9.46 kVA

(3) Model 62180D-600

Input voltage/frequency range:	V_{LL}: 380-480V±10% 3~ 4W / 47-63Hz

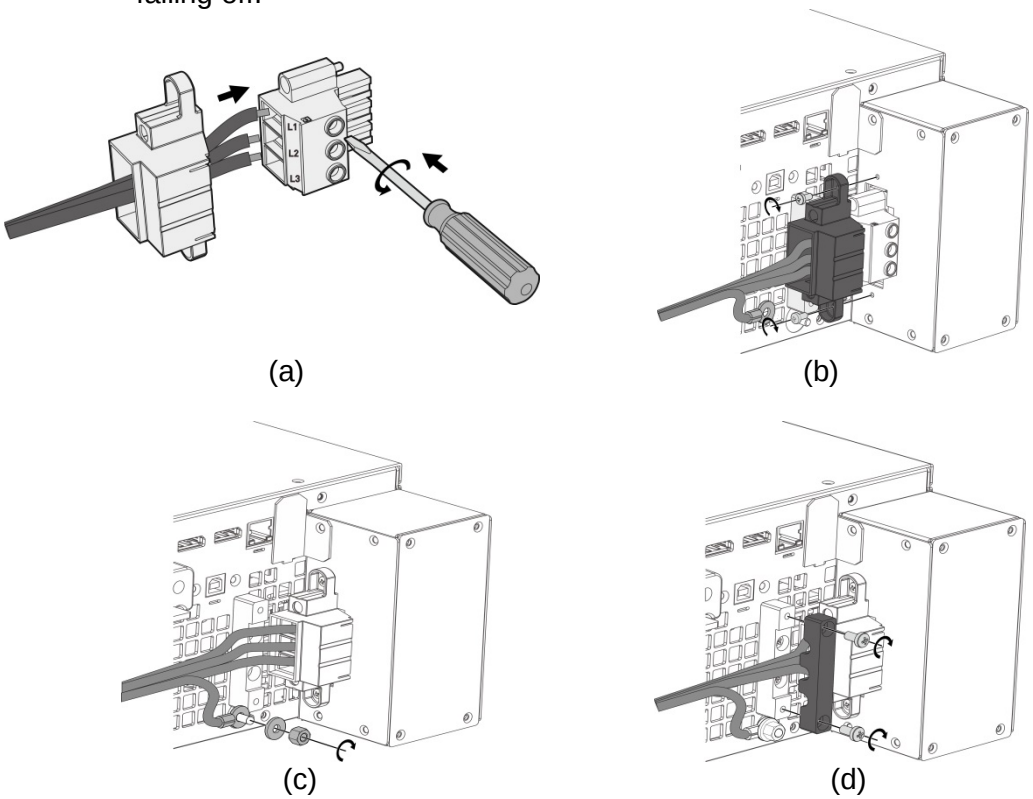
	V_{LL}: 200-220V±10% 3~ 4W / 47-63Hz
Maximum input power:	20 kVA
	14.2 kVA

Max Input Current:

Model / Vin	62060D-600	62120D-600	62180D-600
200	15 A	30 A	45.5A
380	10A	20A	30A
480	8A	16A	24A

2.3.2 Input Connection

(1) The input power connector is located at the right of rear panel.
(2) The power line must be rated at least 105°C
(3) The power cable width must be 8AWG at least.
(4) Assembly ➡ see Figure 2-2 (a)~(d) and execute the following steps:
   a. Secure the power cable and input terminal with a screwdriver.
   b. Insert the AC power connector to the AC terminal and secure protection cover.
   c. Secure the grounding terminal to the grounding copper stud on the chassis (use a M4*0.7 flange nut).
   d. Install the anti-pulling device to prevent the AC power connecting terminal from falling off.



(a) (b) (c) (d)

Figure 2-2

Notice

1. Connect the green or green/yellow grounding wire to ⏚ terminal.
2. Connect the red or black or blue power wire to “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 the operation safety, follow the input power source during installation to select the current rated breaker that closes to each phase and connect it to the input terminal in series.

The breaker should be installed inside the building. See

3. Table 2-3 for the rating.

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

Table 2-1 Suggested Cable Specification

Conductor Area Sectional Area mm^2	Safe Current (A) Copper Conductor	Diameter for Anti-pulling Standard (mm)
8.0	55	6.65±0.15

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)
62180D-600	50A max.
62120D-600	35A max.
62060D-600	20A max

2.4 Remote Sensing

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

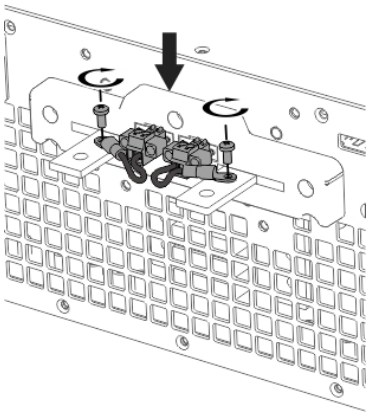


Figure 2-3

2.4.2 Reverse Connection of Remote Sensing Wire Polarity

The polarity of remote sensing wire must be connected correctly, the "+" terminal is 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 2-4 shows.

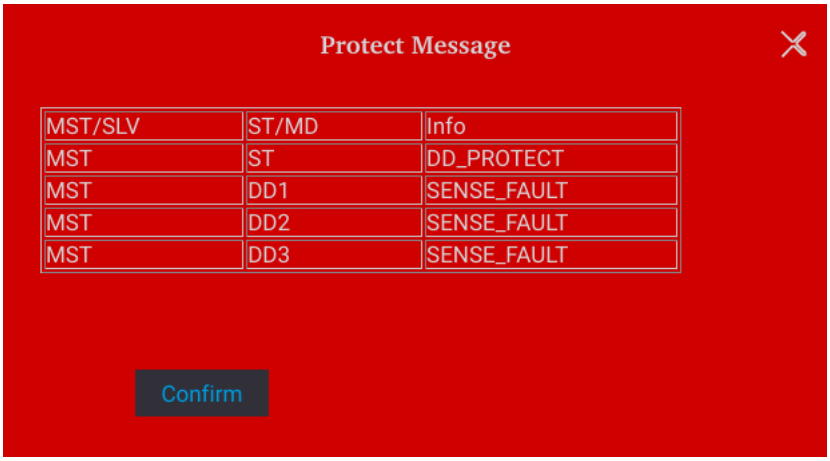


Figure 2-4

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 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 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.

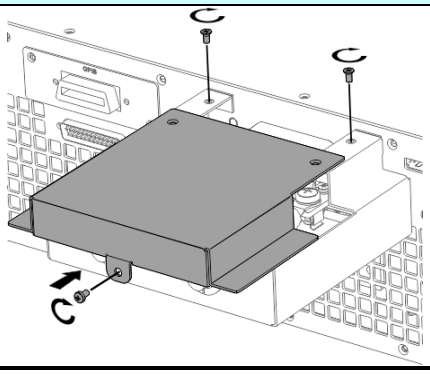
2.5 Output Connection

The output connector of 62000D Series DC power supply is located at the upper middle area on the rear panel. The load is connected to “+” and “–” output terminal.

2.5.1 Rear Panel Output

(1) The output terminal is located at the upper middle area on the rear panel.
(2) The output cable must be rate to at least 85°C with conductor sectional area more than 38mm^2.
(3) Assembly ➡ follow Figure (a)~(d) to execute the steps below:
   a. Strip insulation off ends of 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 Protective Cover

Protective Cover	Applicable Range	Applicable Model
	*Vo*=0~600V *Io*=1~120A	62060D-600 62120D-600 62180D-600

For the models requiring a larger protective cover, a cable with wider diameter is needed. To ensure the output terminal is not stressed assemble it as Figure 2-5 shows. First, thread the wire through the holes on the cover as shown in Figure 2-5 (a) and then secure the cable to the output copper as shown in Figure 2-5 (b). Next, secure the protective cover to the rear panel as Figure 2-5 (c) shows. At last, follow the Figure 2-5 (d) to lock the cover plate.

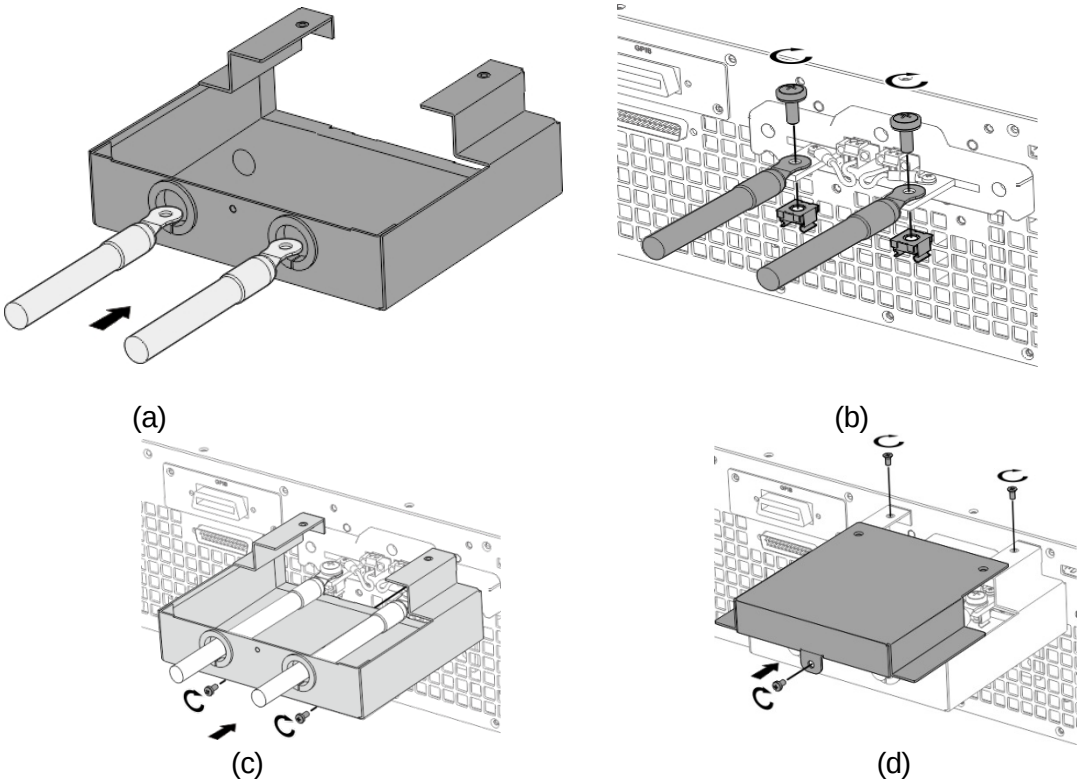


Figure 2-5

CAUTION

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

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

2.5.2 Specification of Connecting Wire

The maximum inductance of connecting wire to the power supply is <400μH (the total inductance of two wires after twisted or processed otherwise including self-inductance and mutual inductance).

⚡CAUTION
1. To ensure the system's stability, the cable inductance should not exceed 400μH.
2. Do not use wire with extra thin diameter to avoid overheating and causing a hazard.

2.5.3 Specification of Parallel Capacitance

The parallel capacitance for output varies with the 62000D Series models as listed in Table 2-5.

Table 2-5

Model	Max. Parallel Capacitance for Output (uF)
62060D-600	1666
62120D-600	3333
62180D-600	5000

⚡CAUTION To ensure the system's stability, the capacitance should not exceed the value listed in Table 2-5.
1. Be aware of the polarity and its withstand voltage when paralleling capacitance.
2. Switch to CV Slow mode if a larger parallel capacitance is required. (See section 3.2.1)

2.5.4 Installing the Handle

Use M4X12 flat head screws to secure the handle to the rack mounting kit as shown in Figure 2-6.

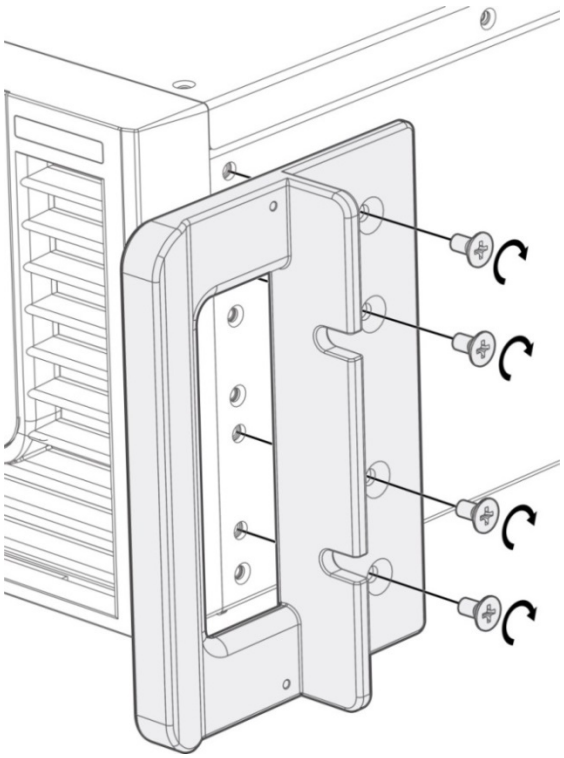


Figure 2-6

2.6 Power On Procedure

Plug in the power cord and turn on the power switch on 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), SRAM and EEPROM memory, data and communication as Figure 2-7 shown below..

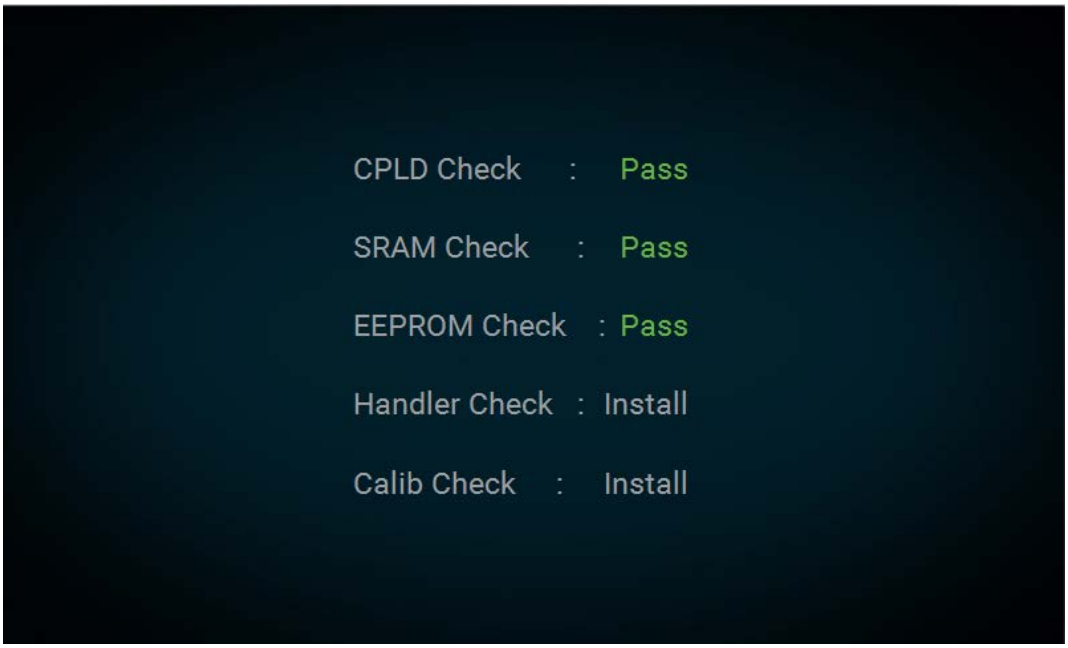


Figure 2-7

When the self tests of memory, data and communication are done, the screen turns to the MAIN page automatically as Figure 2-8 shown below:

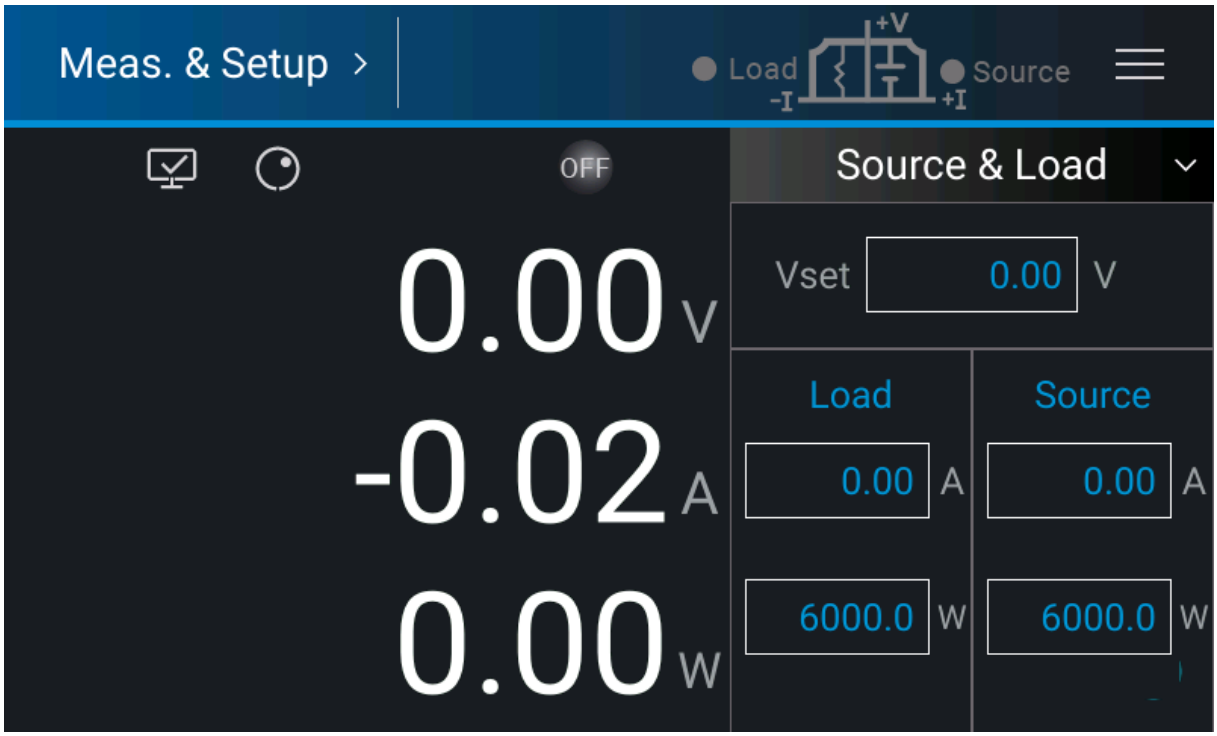


Figure 2-8

WARNING 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 3 seconds after powered off and power it on again.

CAUTION Before turning on the instrument, all protective grounding terminals, extension cord and devices must connect to earth. The hazard of potential electric shock may occur if any interrupted grounding and could cause injury or death.

3. Manual Operation

3.1 Introduction

The DC power supply can be operated manually or remotely via GPIB/CAN (option) or USB or APG interface which is described in Chapter 5 and section 3.2.4.1. 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 various settings for configuring the system functions of 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 and 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 (not supported yet).
6. Configuration : To set the communication interface, serial/parallel settings, power on status, and calibration.

The Menu screen is shown in Figure 3-1 with a complete function tree as shown in Figure 3-2.

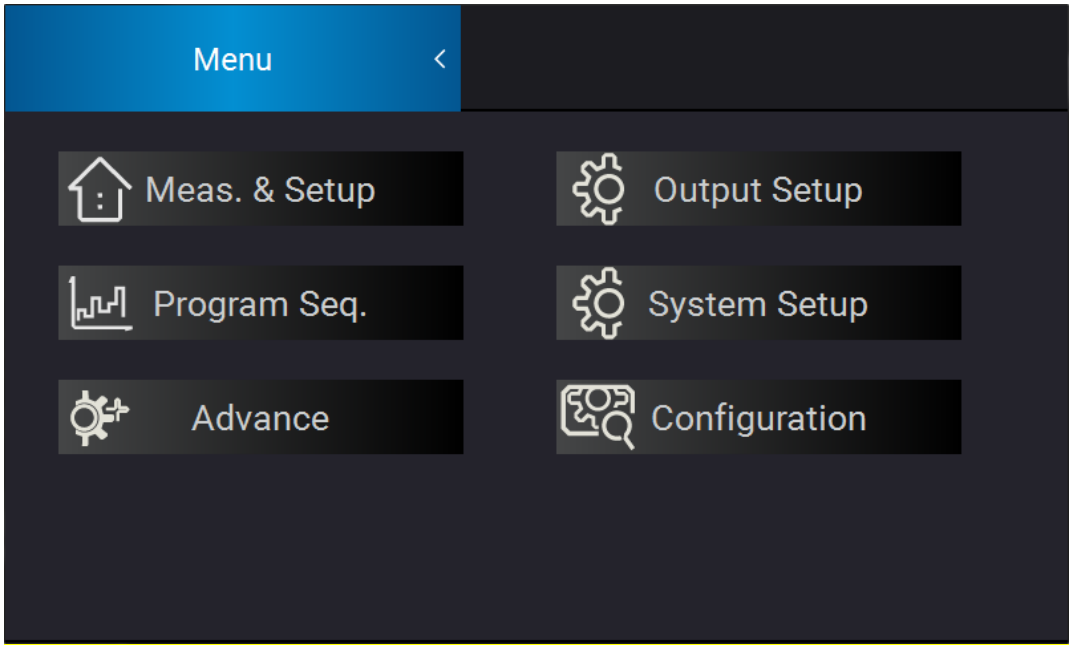


Figure 3-1

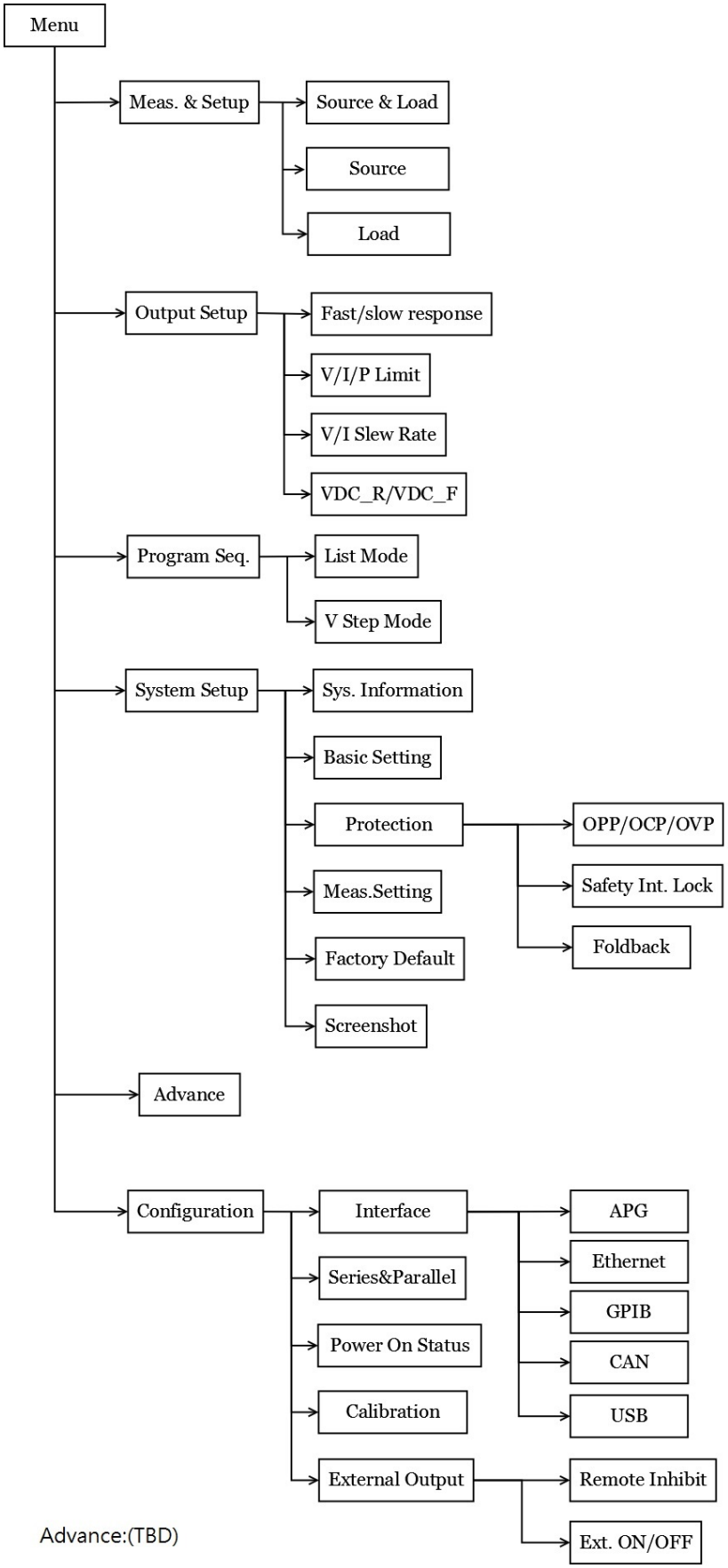

Menu
Meas. & Setup
Source & Load
Source
Load
Output Setup
Fast/slow response
V/I/P Limit
V/I Slew Rate
VDC_R/VDC_F
Program Seq.
List Mode
V Step Mode
System Setup
Sys. Information
Basic Setting
Protection
OPP/OCP/OVP
Safety Int. Lock
Foldback
Meas.Setting
Factory Default
Screenshot
Advance
Configuration
Interface
APG
Ethernet
GPIB
CAN
USB
Series&Parallel
Power On Status
Calibration
External Output
Remote Inhibit
Ext. ON/OFF
Advance:(TBD)

Figure 3-2

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, the touch panel will switch to a numeric keypad as Figure 3-3 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 in order to remain the output in CV mode the current setting must be larger than the load current, otherwise the output voltage will not equal to the set voltage.)

Method 2:

1. Tap on the panel to use “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 “Rotary” ( ) knob for setting, pressing the knob can move the cursor to 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 in order to remain the output in CV mode the current setting must be larger than the load current, otherwise the output voltage will not equal to the set voltage.)

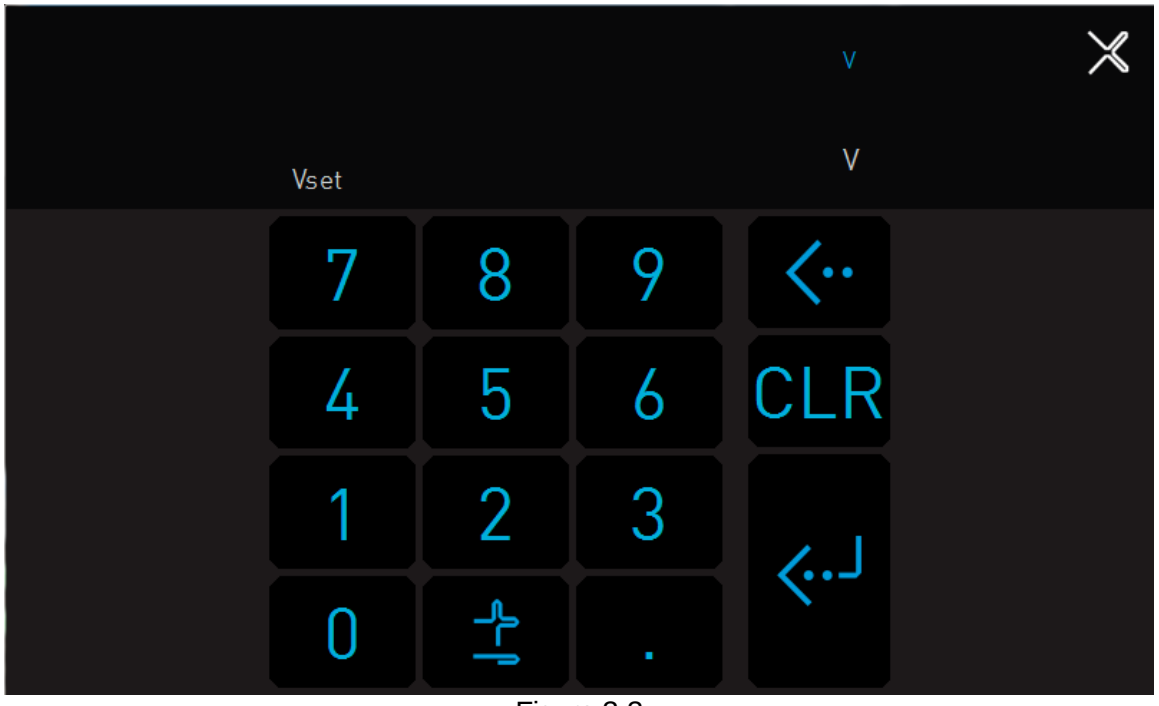


Figure 3-3

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

Tap A next to the numbers under Source, and the rest of the settings are same as shown in Figure 3-4.

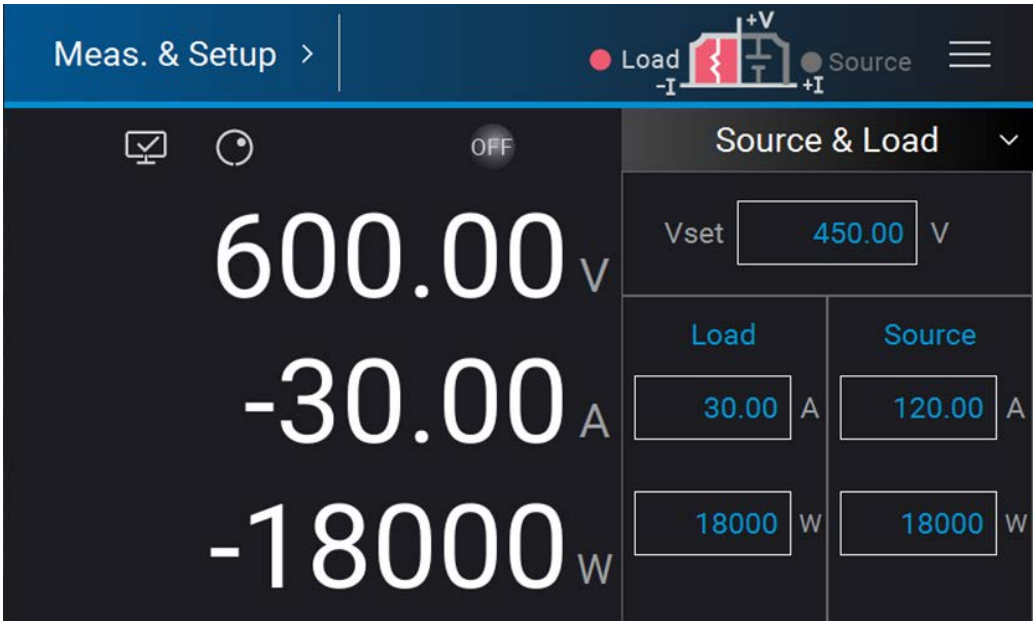


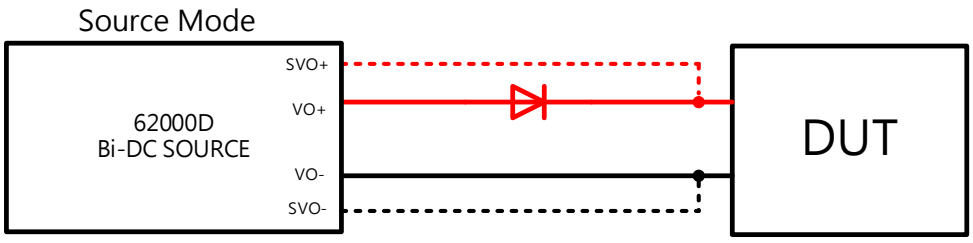
Figure 3-4

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 3-5 shows.
2. The rest settings are same as Source & Load Mode.

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



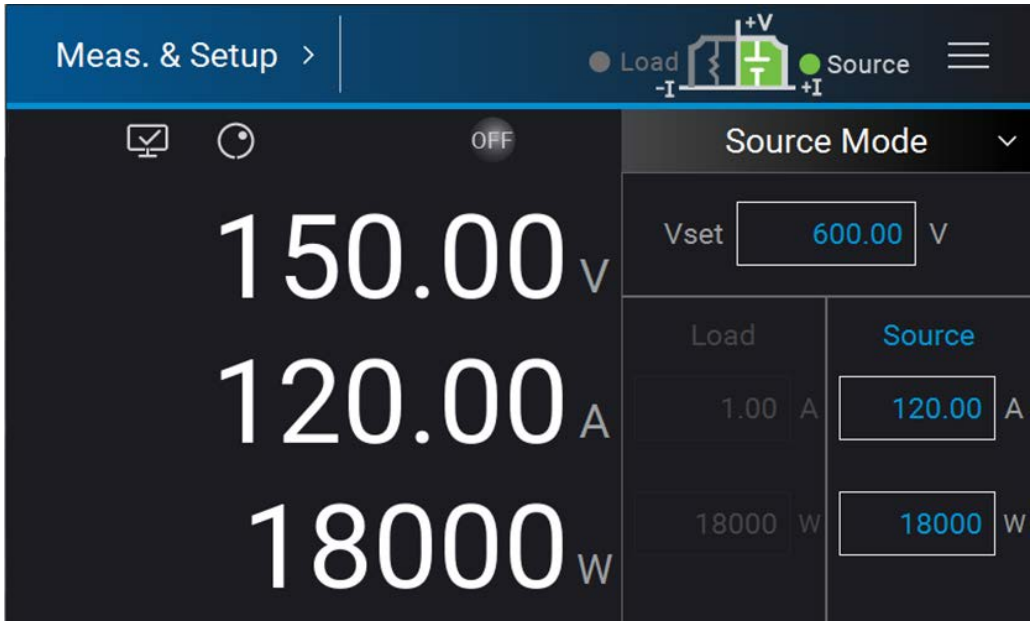


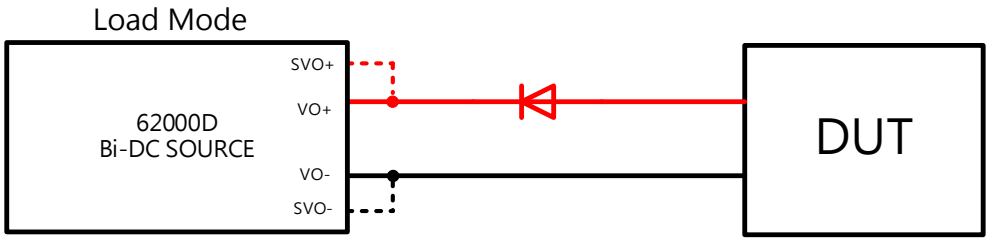
Figure 3-5

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 3-6 shows.
2. The rest of the settings are same as Source & Load Mode.

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



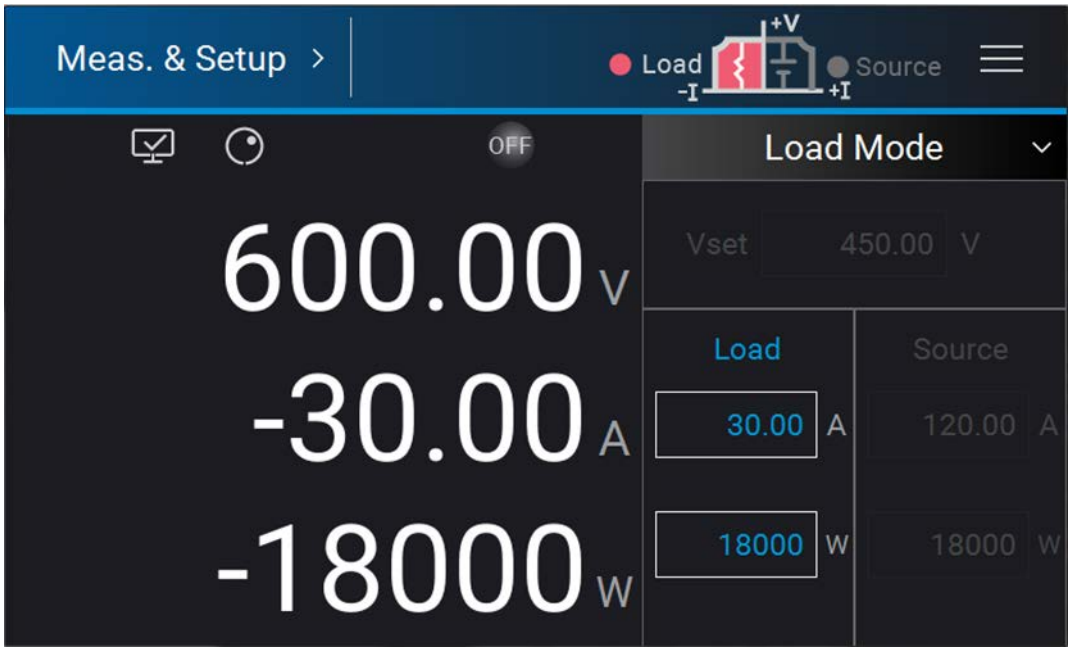


Figure 3-6

3.2.2 Output Setup

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

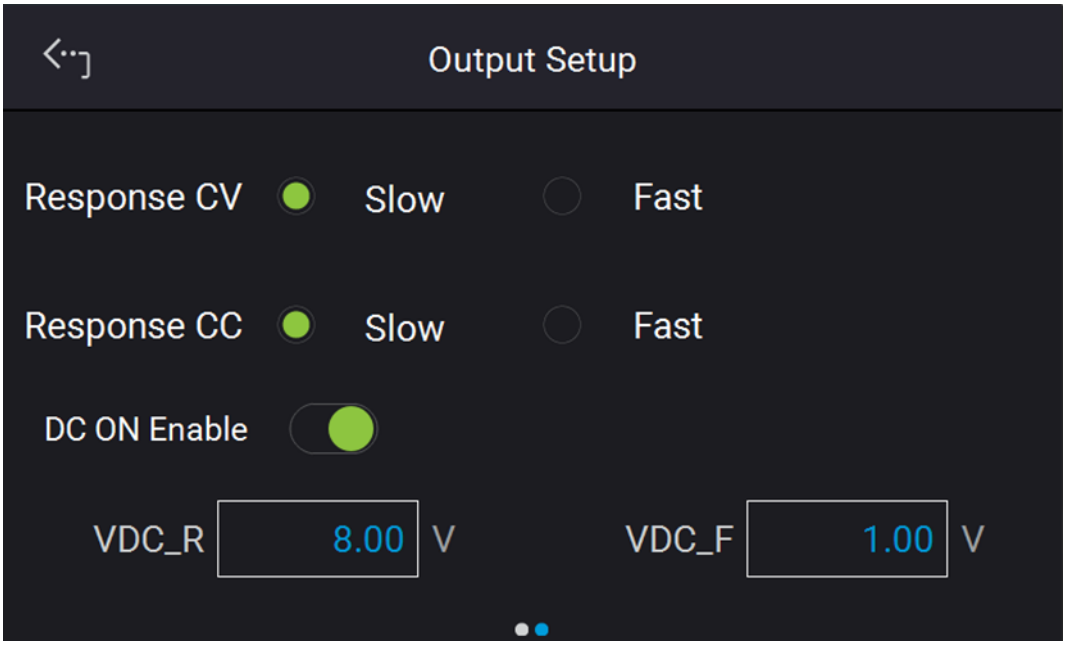


Figure 3-7

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

3.2.2.1 Response CV

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

3.2.2.2 Response CC

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

3.2.2.3 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.

3.2.2.4 I Limit

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

Use 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.

3.2.2.5 P Limit

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

Use 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.

3.2.2.6 V SLEW RATE

1. Swipe the “Output Setup” page on the touch screen left to next page as Figure 3-8 shows.

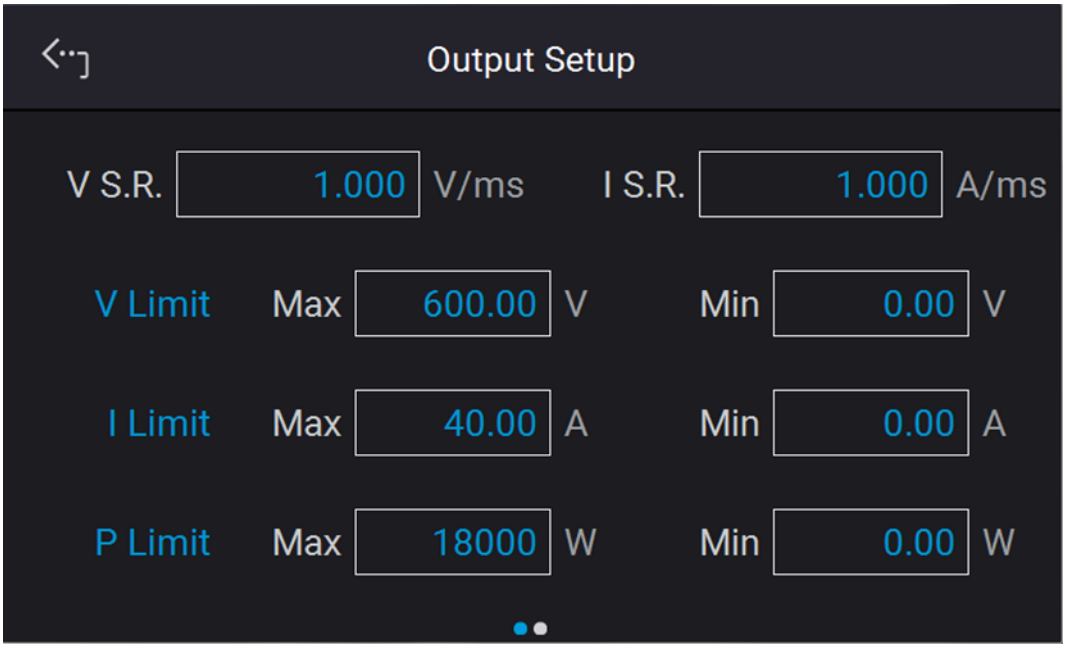


Figure 3-8

2. 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 60V/ms and the minimum is 0.001V/ms. The output of DC power supply will follow the slew rate to rise to the set output voltage while the fall slew rate is limited by load. (See Figure 3-9 for the calculation formula.)

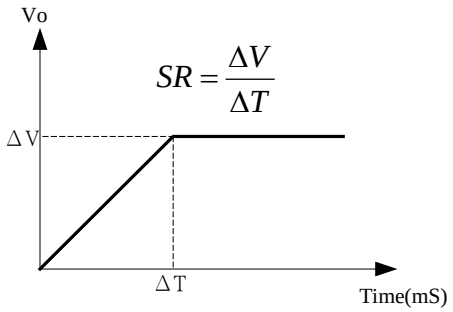


Figure 3-9

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

3.2.2.7 I SLEW RATE

1. Select the I slew rate corresponding space as shown in Figure 3-8 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 60A/ms and the minimum is 0.001A/ms. The output of DC power

supply will follow the slew rate to rise to the set output current. (See Figure 3-10 for the calculation formula.)

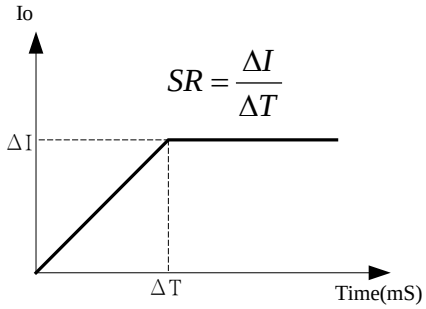


Figure 3-10

3.2.2.8 Setting 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 purpose as Figure 3-11 shows:

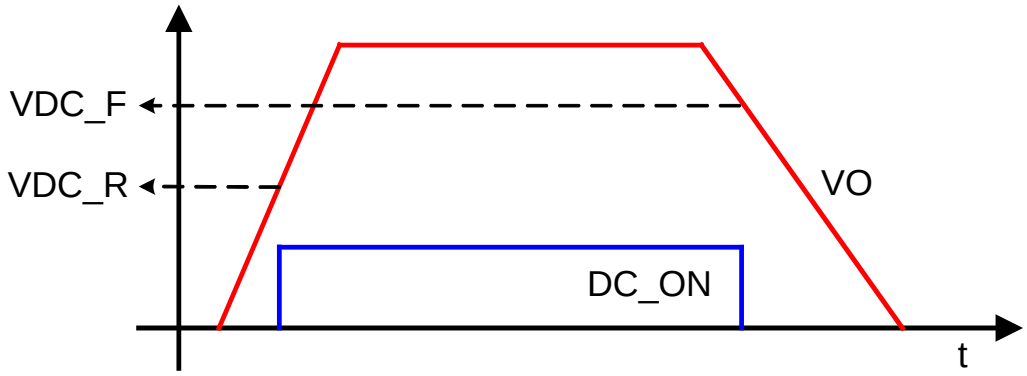


Figure 3-11

Set DC_ON as described below:

1. The setting page is shown as Figure 3-7. Use the touch panel to enter the value. The low limit of DC_ON RISE/FALL is 0V and 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.

3.2.3 System Setup

In Menu page, tap “System Setup” to enter into the screen as Figure 3-12 shows.

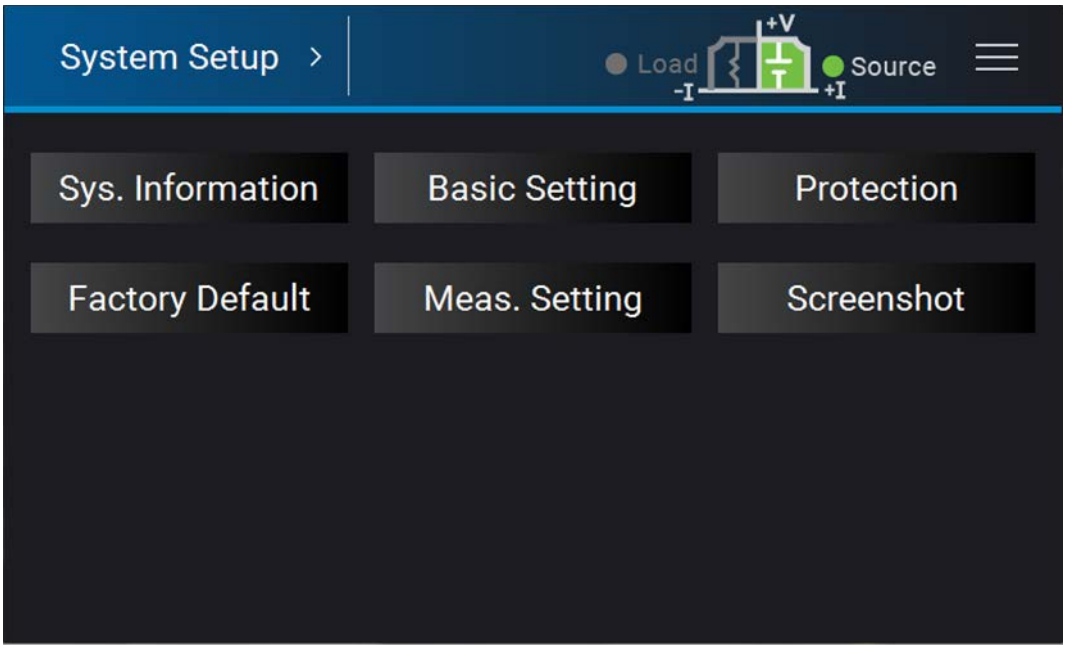


Figure 3-12

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 3-13.
Serial No.	:	Displays the device serial no. as shown in Figure 3-13.
Host	:	Displays the version of CPLD, PCB and UI as shown in Figure 3-13
AD1~AD3	:	Displays the firmware version no. of front stage module as shown in Figure 3-14.
DD1~DD3	:	Displays the firmware, CPLD, and PCB version no. of rear stage module as shown in Figure 3-15.

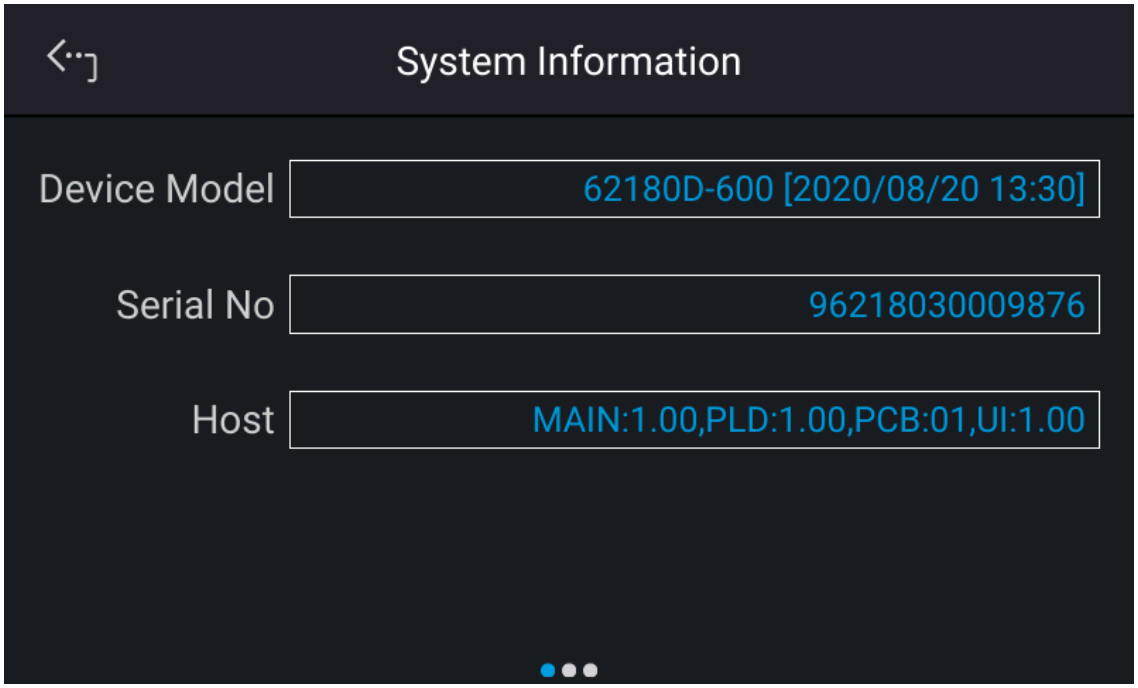


Figure 3-13

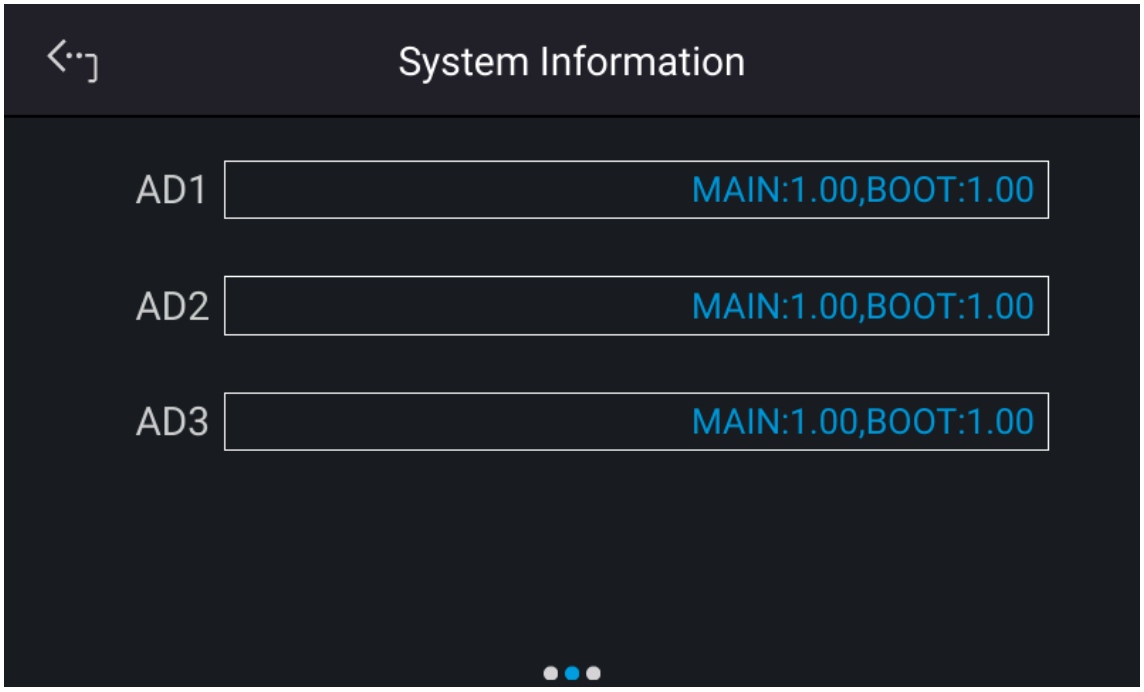


Figure 3-14

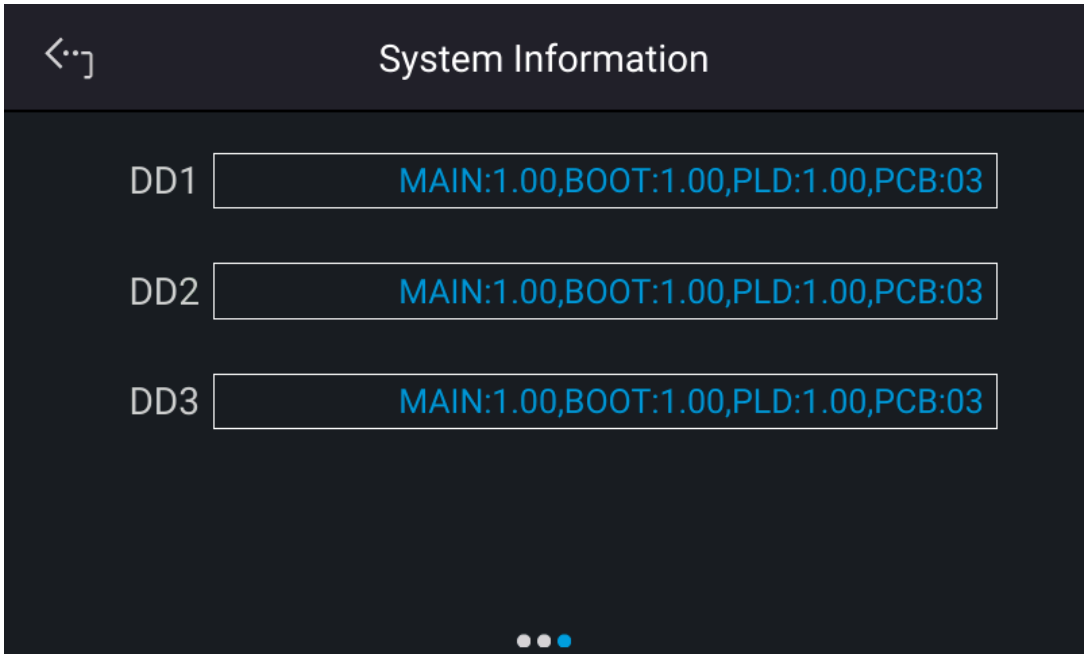


Figure 3-15

3.2.3.2 Factory Setup

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

1. In Menu page, tap “System Setup” and select “Factory Default”, the screen appears as Figure 3-16 shows.

2. Tap Recall Factory Default. A warning message will prompt as Figure 3-17 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.

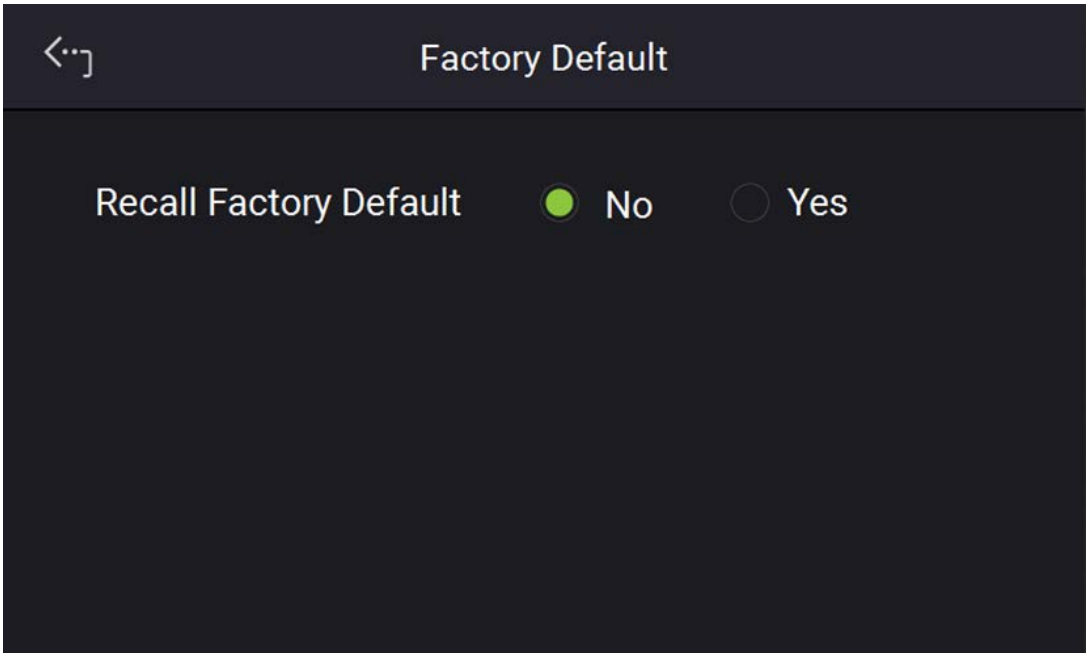


Figure 3-16

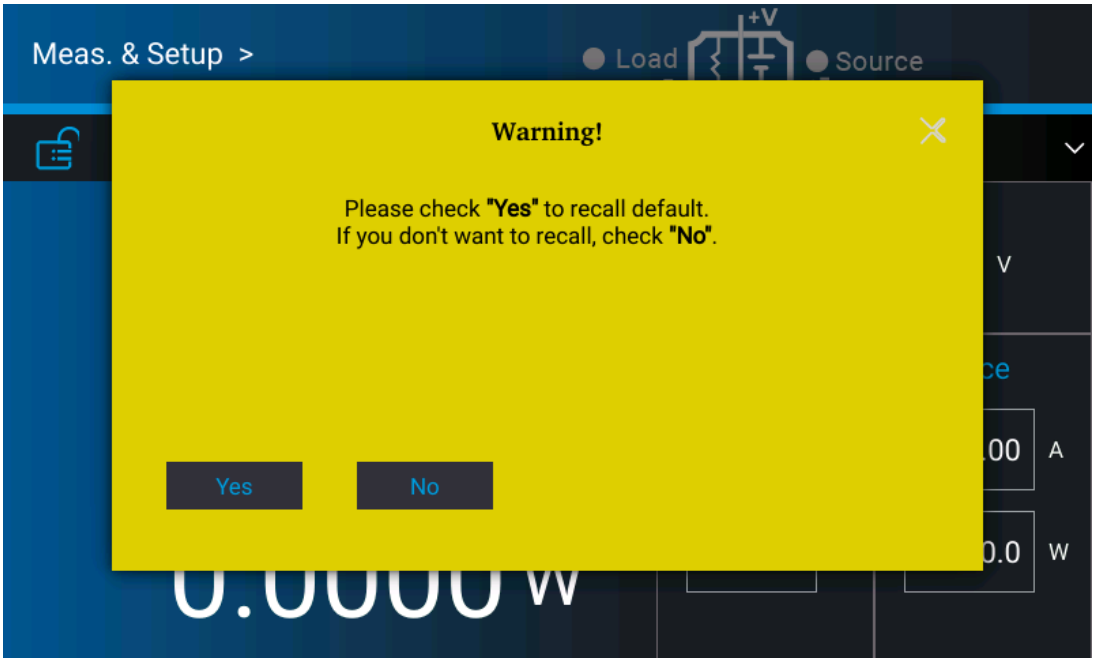


Figure 3-17

3.2.3.3 Basic Setting

This function allows you to set the brightness of backlight, language, buzzer, time and date. In Menu page, tap “System Setup” and select “Basic Setting”, the screen will appear as Figure 3-18 or Figure 3-19 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 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 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 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 user.
3. When the BUZZER is set to ON and the BUZZER will beep continuously if system protection occurs to remind 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 3-19.

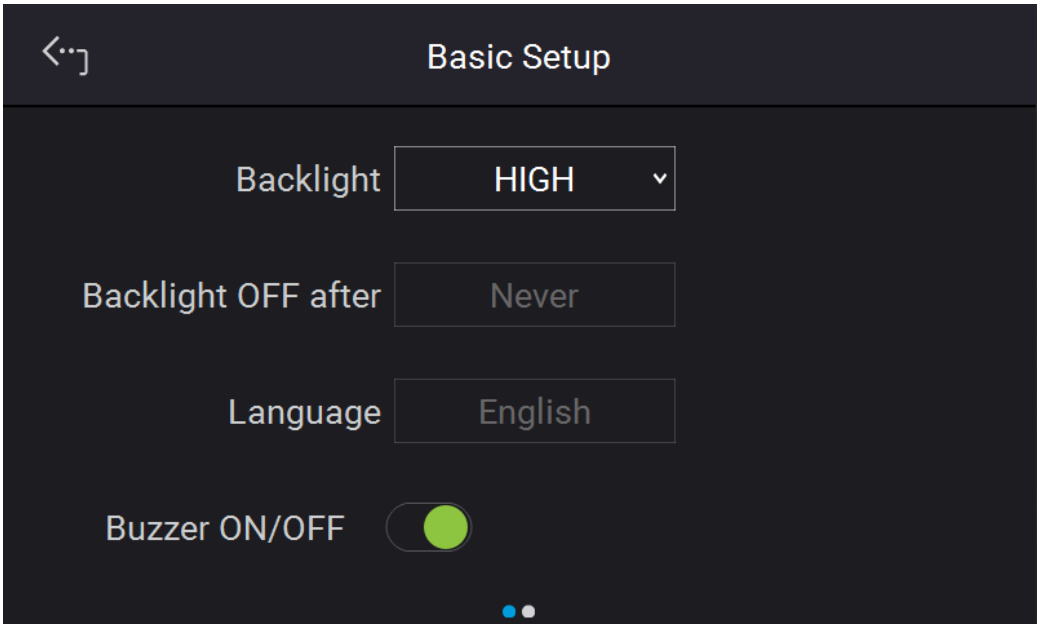


Figure 3-18

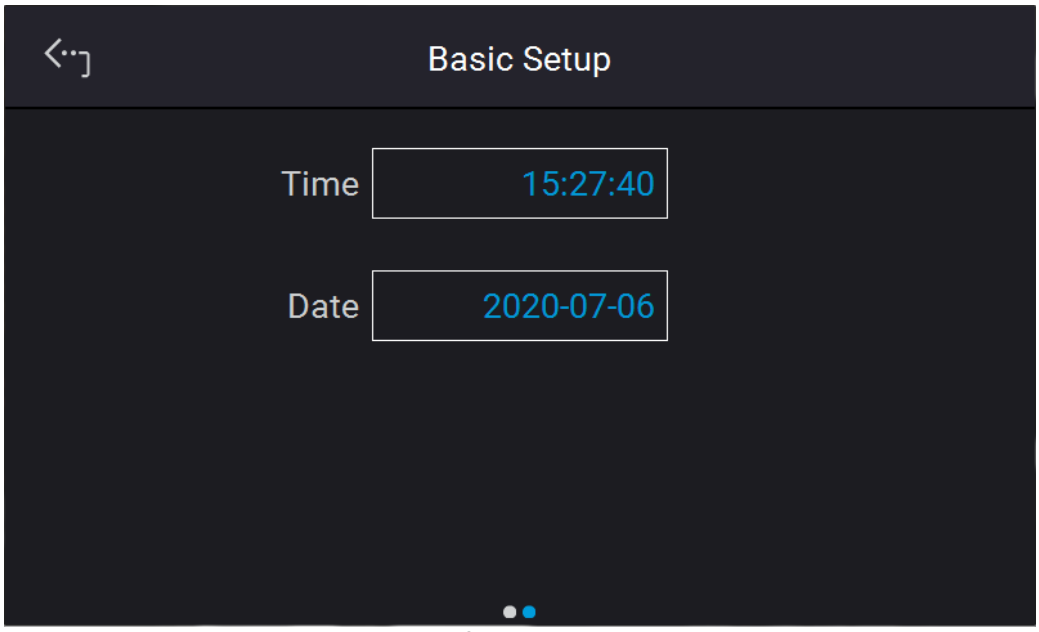


Figure 3-19

3.2.3.4 Protection

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

In “System Setup” page, select “Protection” to set each protection as shown below. The first page sets the OVP, OCP, OPP and Foldback as Figure 3-20 shows.

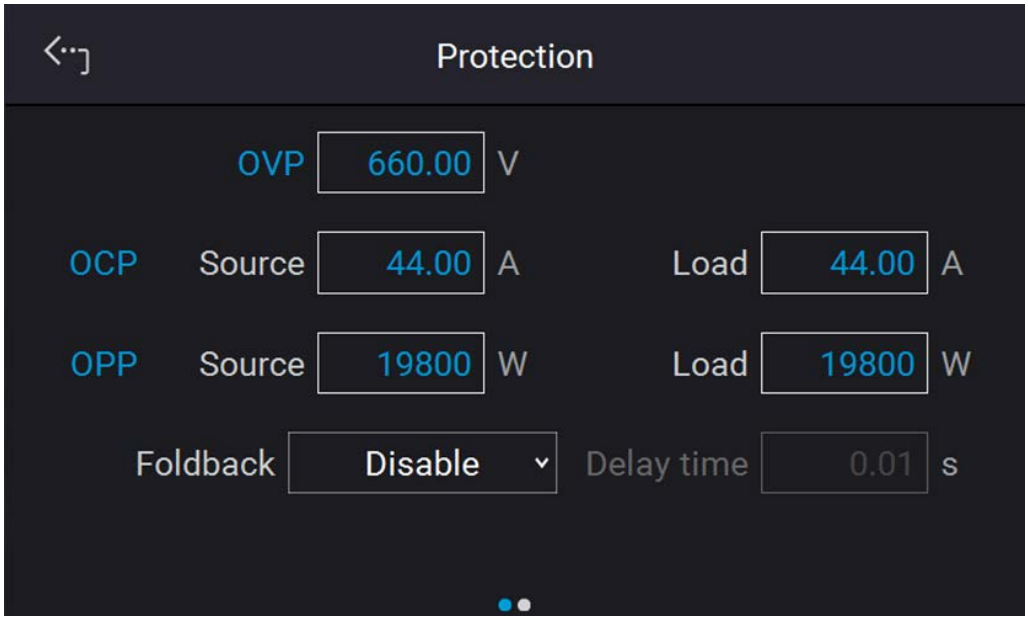


Figure 3-20

3.2.3.4.1 OVP

Use the touch panel to set OVP 660.00. 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-xxxx	0	1.10 x Vo_MAX

When OVP occurs the main page will prompt a protect message as Figure 3-21 shows. Tap "Confirm" to return to the setup page.

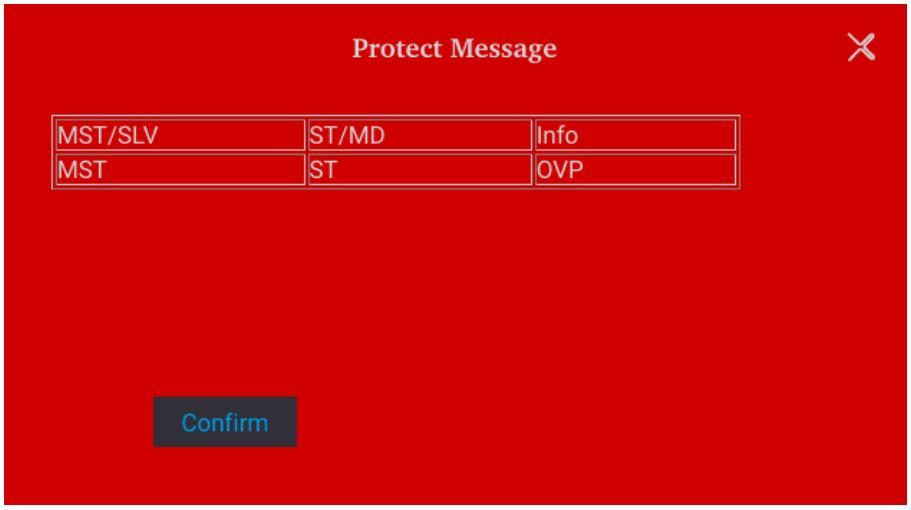


Figure 3-21

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 over current while the D/D OCP occurs when the output terminal is having over current.

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

Table 3-2

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

When OCP occurs the main page will prompt a protect message as Figure 3-22 shows. Tap "Confirm" to return to the setup page.

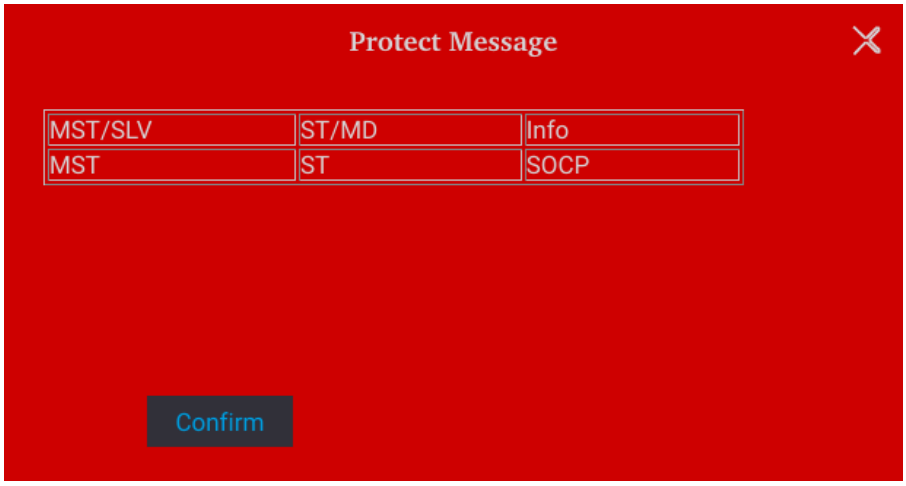


Figure 3-22

3.2.3.4.3 OPP

Use the touch panel to set OPP 18900. 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-xxxx	0	1.05 x Po_MAX

Table 3-4

When OPP occurs the main page will prompt a protect message as Figure 3-23 shows. Tap "Confirm" to return to the setup page.

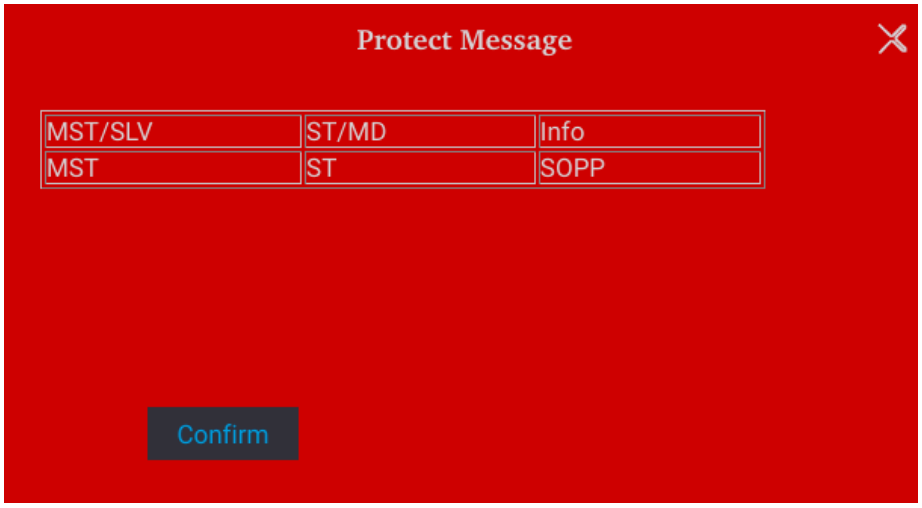


Figure 3-23

3.2.3.4.4 Safety Int. Lock

This function allows you to control the DC power supply to be OFF temporary 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 3-24 shows.

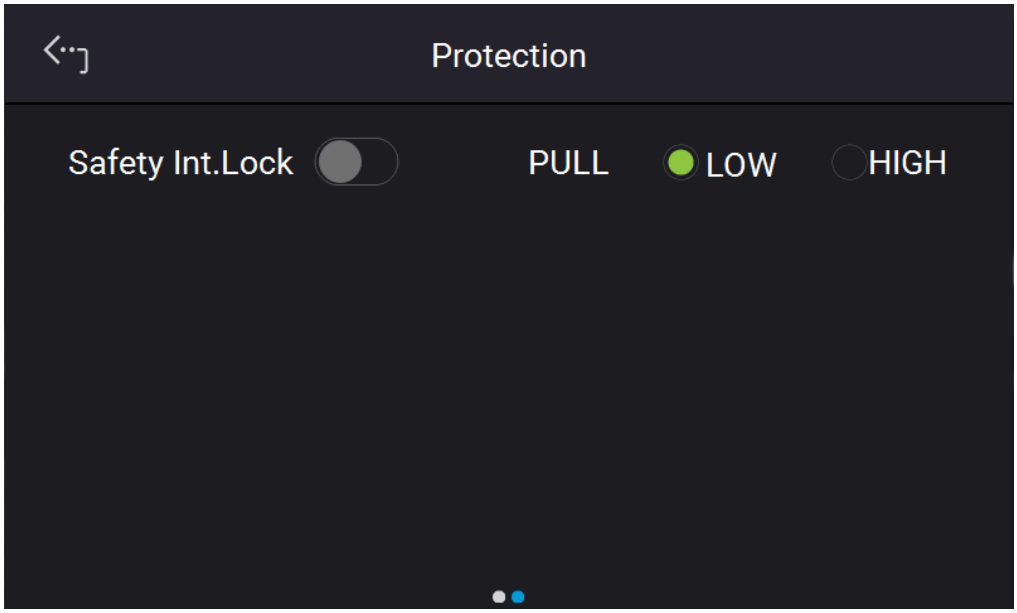


Figure 3-24

(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 low level, it indicates the power supply is outputting normally and when it is at high level, it closes the power supply output temporary (the "  " is still on) and issues

protection signal. Once the Pin 3 of ANALOG INTERFACE is returned to 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 3-25 shows.

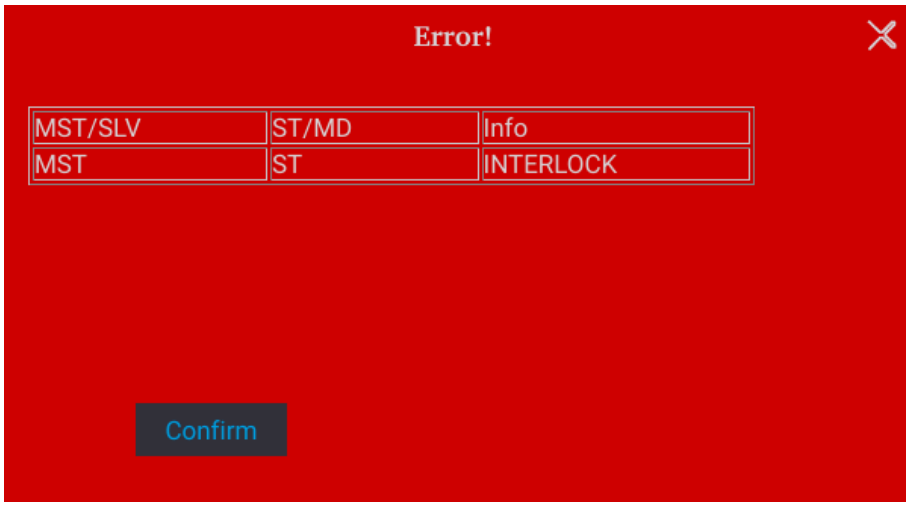


Figure 3-25

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

4. When the DC power supply is set to OUTPUT = ON, the detail actions of Safety Interlock are as shown in Figure 3-26.

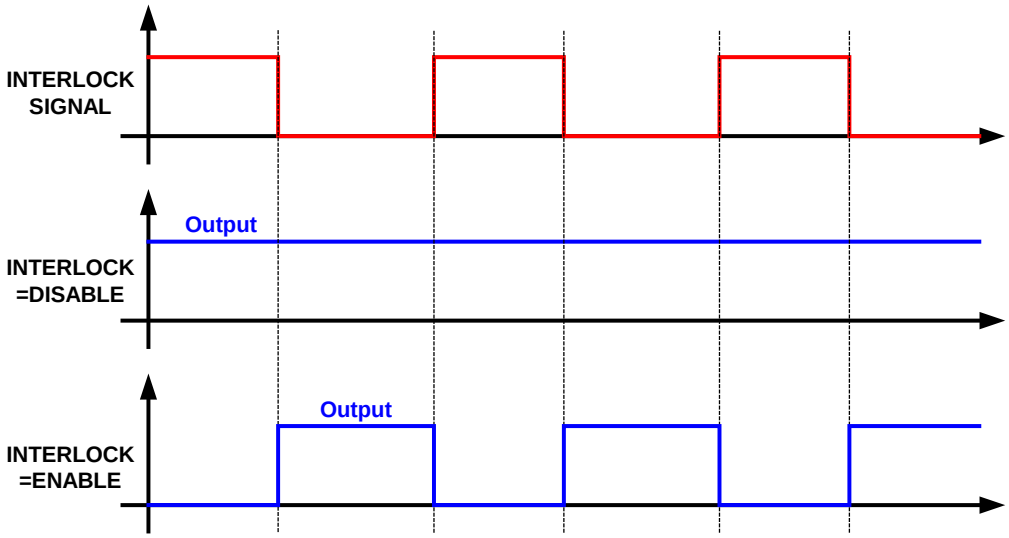


Figure 3-26

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 3-27 shows.

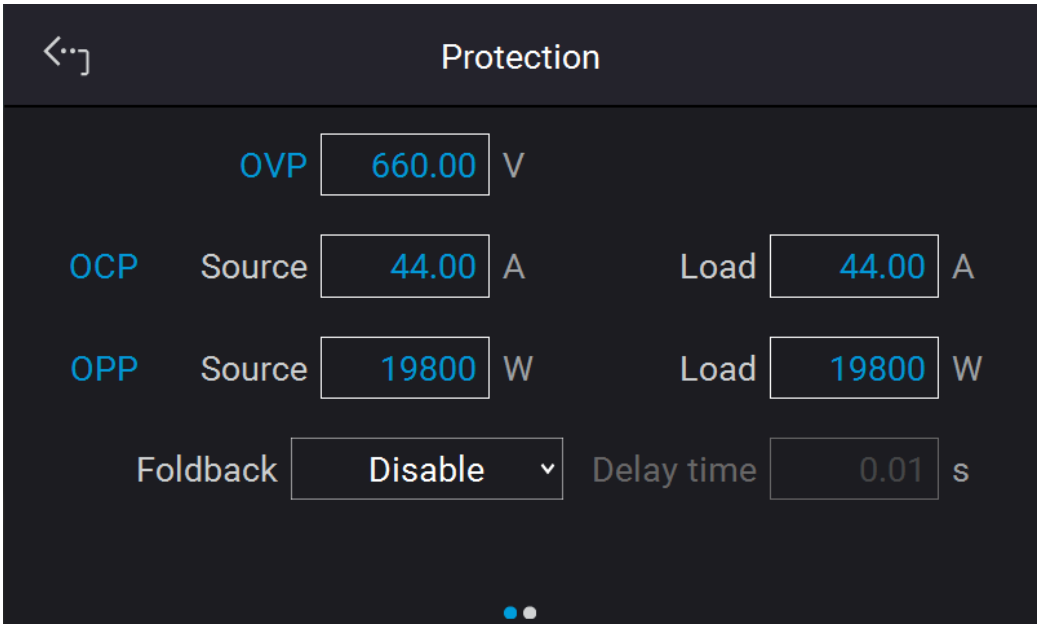


Figure 3-27

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 off 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 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 changed the mode as Figure 3-28 shows.

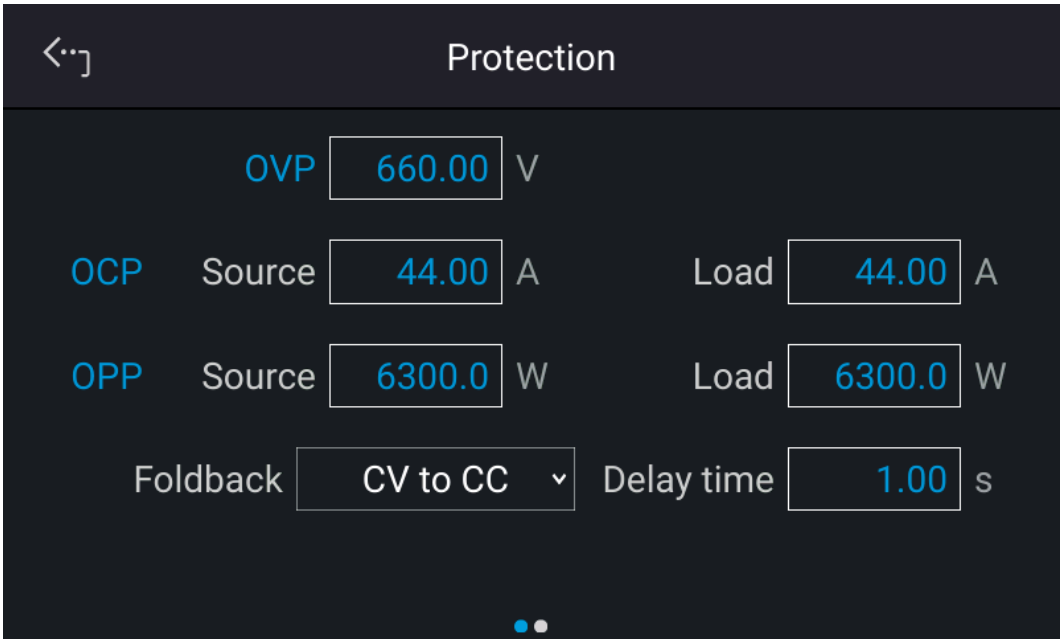


Figure 3-28

When Foldback protection occurs the main page will prompt a protect message as Figure 3-29 shows.

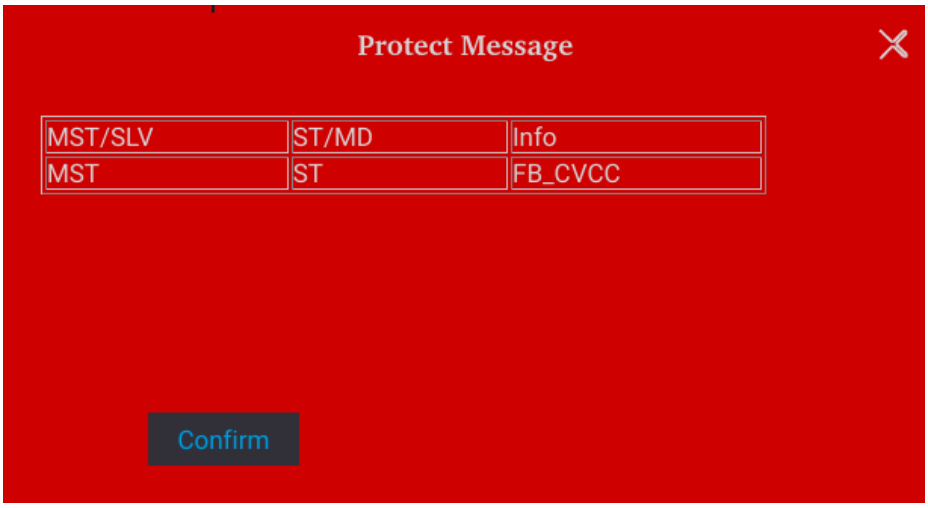


Figure 3-29

Be aware that if delay time sets to *t* seconds, it means the Foldback that set to CV TO CC or CC TO CV won't 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 3-30 shows.

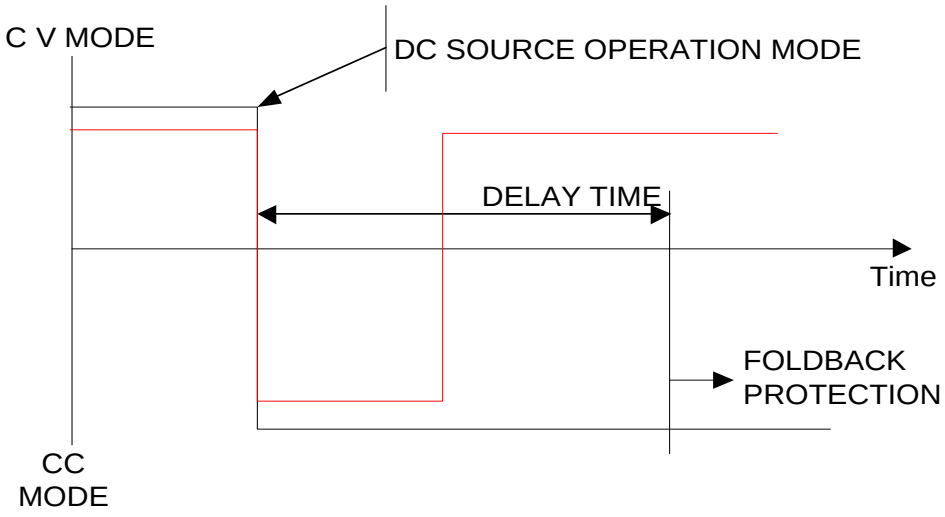


Figure 3-30

Assuming the Foldback is set to CV TO CC, the solid line in Figure 3-30 will create Foldback protection while the dot line will not.

3.2.3.5 Meas. Setting

1. Tap Meas. Setting to enter into Measurement Setup as Figure 3-31 shows.
2. There are Average Time and Average Method for setting.

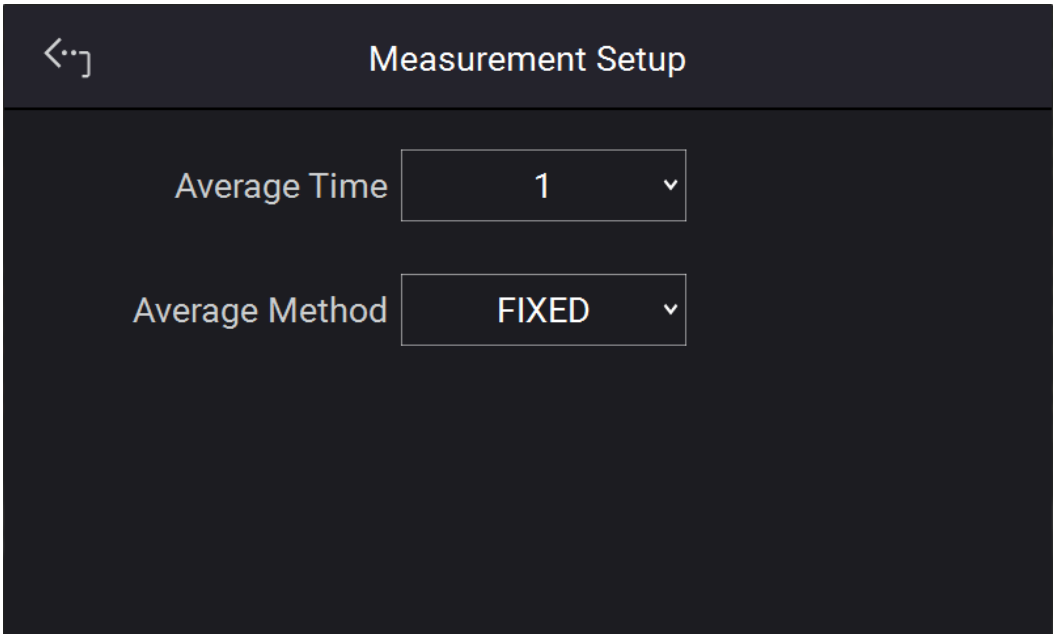


Figure 3-31

The way to change the Reading Average Times is shown in Figure 3-32.

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

Figure 3-32

Notice

1. Assuming the Reading Average Time is set to = 8, Average Method 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 3-33 shows.

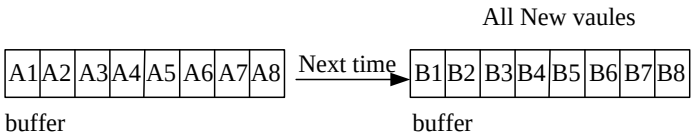


Figure 3-33

2. Assuming the Reading Average Time is set to = 8, Average Method to MOVING, the readings sampling is that the device removes the oldest sample in the buffer and saves a new sample, then average them in repetition as Figure 3-34 shows.

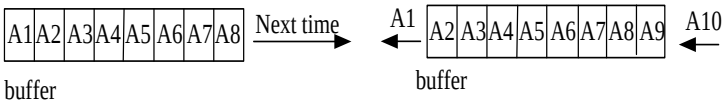


Figure 3-34

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

Following is the way to change the Average Method:

4. Tap the touch screen to select the desired average method. Average Method can be set to FIXED and MOVING as shown in Figure 3-35.

Figure 3-35

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 shows as Figure 3-36 (with a small camera icon appears on the lower right corner.)

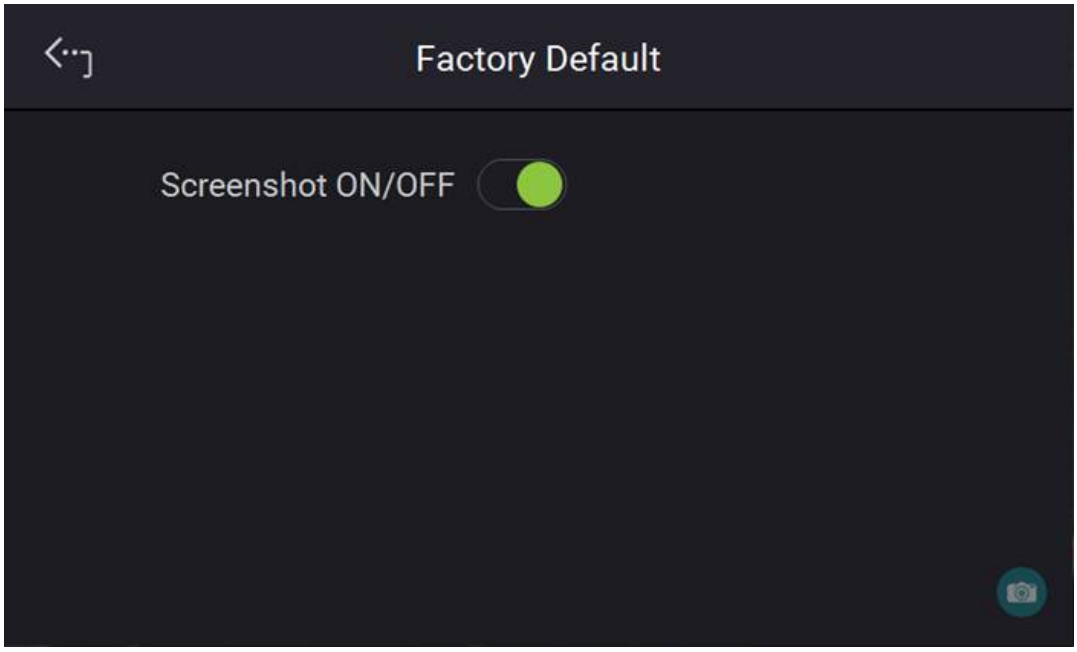


Figure 3-36

3.2.4 Configuration

3.2.4.1 Interface

Tap Configuration in Menu page and select Interface and APG as shown in Figure 3-37 and Figure 3-38.

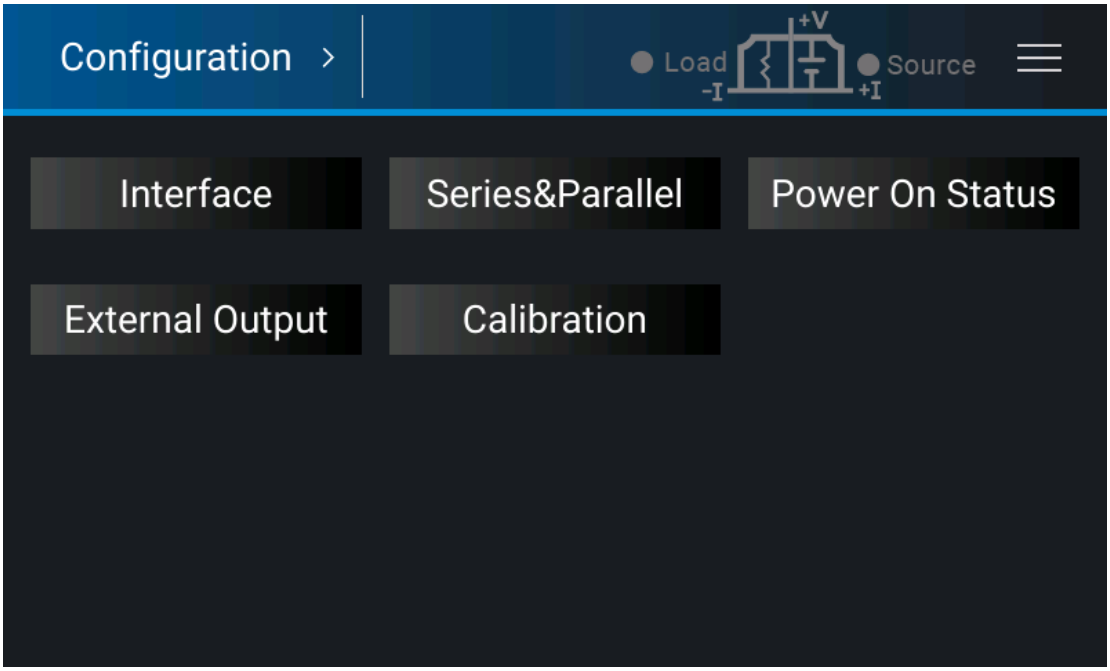


Figure 3-37

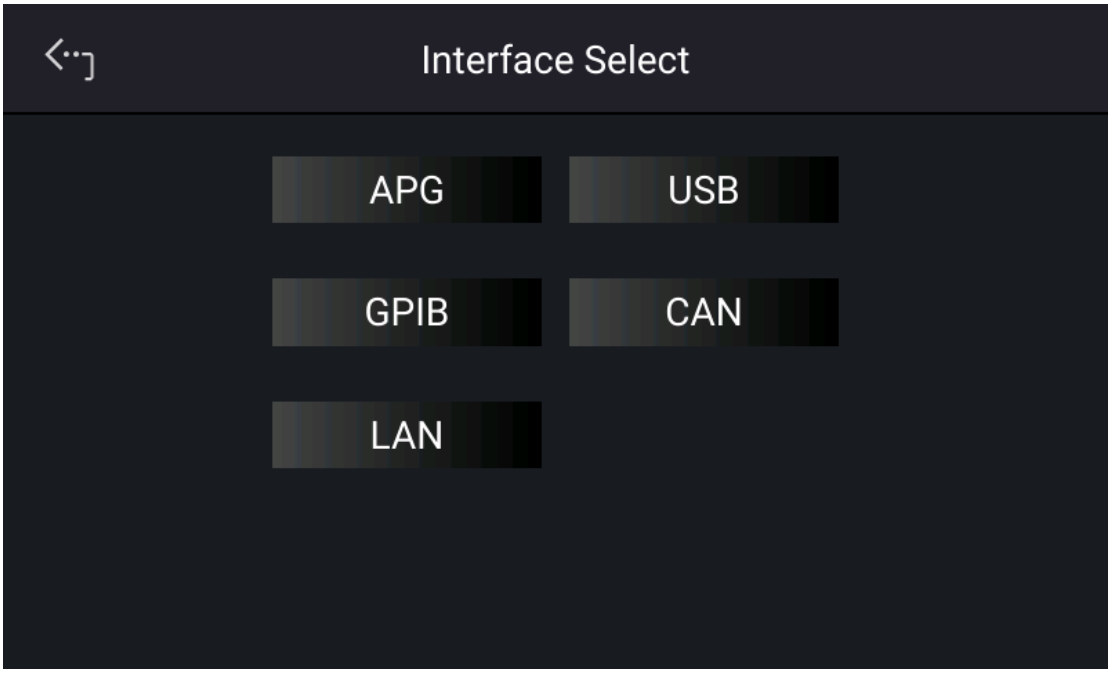


Figure 3-38

3.2.4.1.1 APG

Analog Programming interface (APG) is able to 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 value of set and measured values separately as described below.

1. Tap “Interface” and select APG to appear the screen as Figure 3-39 or Figure 3-40 shows.

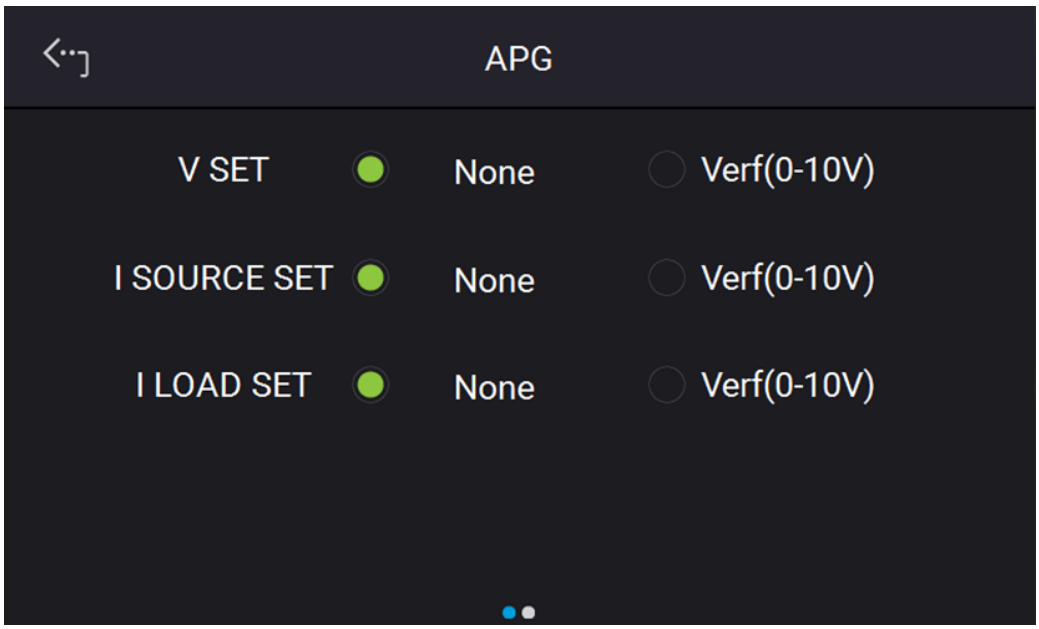


Figure 3-39

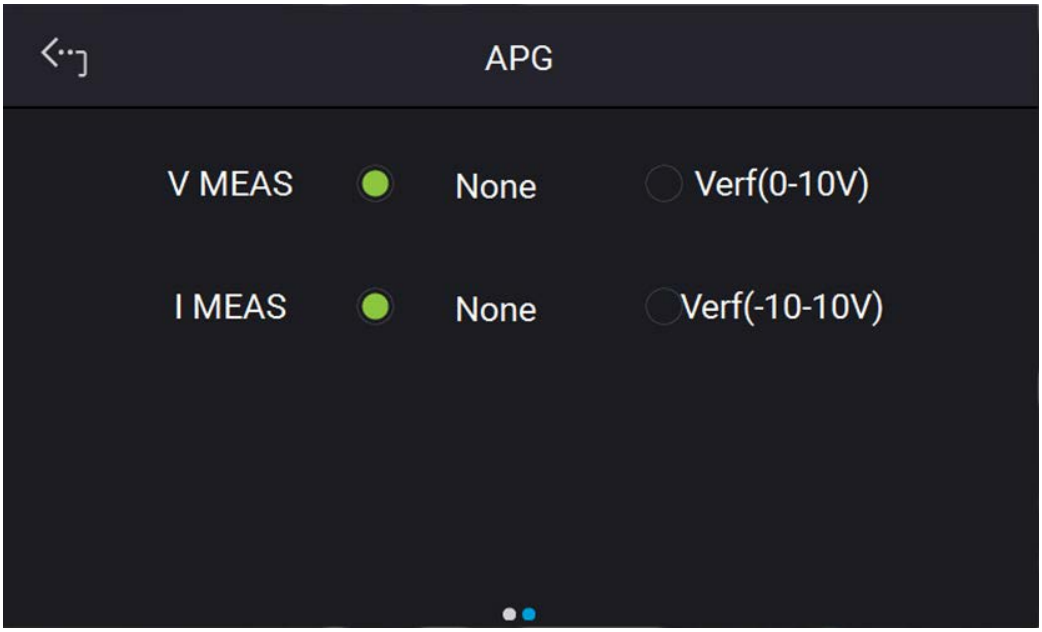


Figure 3-40

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 touch panel to go to Menu page.

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

Notice

1. **V SET/ I SOURCE SET** has 2 selections which are NONE/Vref (0-10V). When selecting Vref=10V ➡ it means the DC power supply's output 0~100% will map to 0~10V as Figure 3-41 shows.

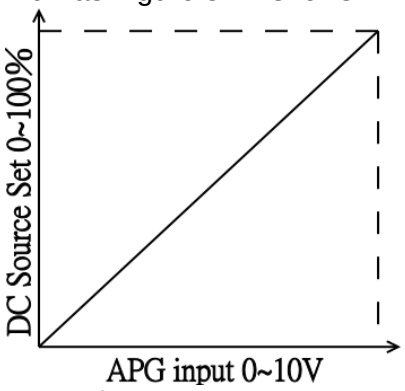


Figure 3-41

2. **V MEAS/ I MEAS** has 2 selections which are NONE/Vref (0-10V). When selecting Vref=10V ➡ it means the DC power supply's output 0~100% will map to 0~10V as Figure 3-42 shows.

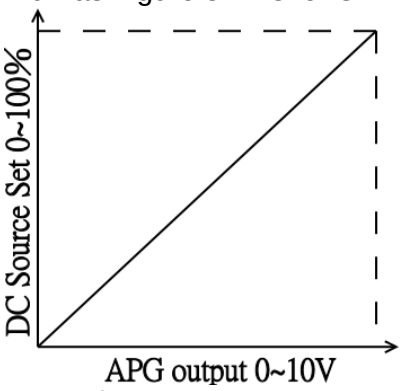


Figure 3-42

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 Analog Interface Pin Assignments.*

3.2.4.1.2 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 to as shown in Figure 3-37, Figure 3-38, and Figure 3-40.
2. Tap LAN to enter into the address setting screen.

Auto Detect:

The default of DHCP is ON. Swipe left to second page as Figure 3-44 shows, the DC Power Supply will automatically detect external network address.

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 connection.
6. Touch the upper left corner to enter into Menu page.
7. Tap “MEAS. & Setup” to return to the main page.

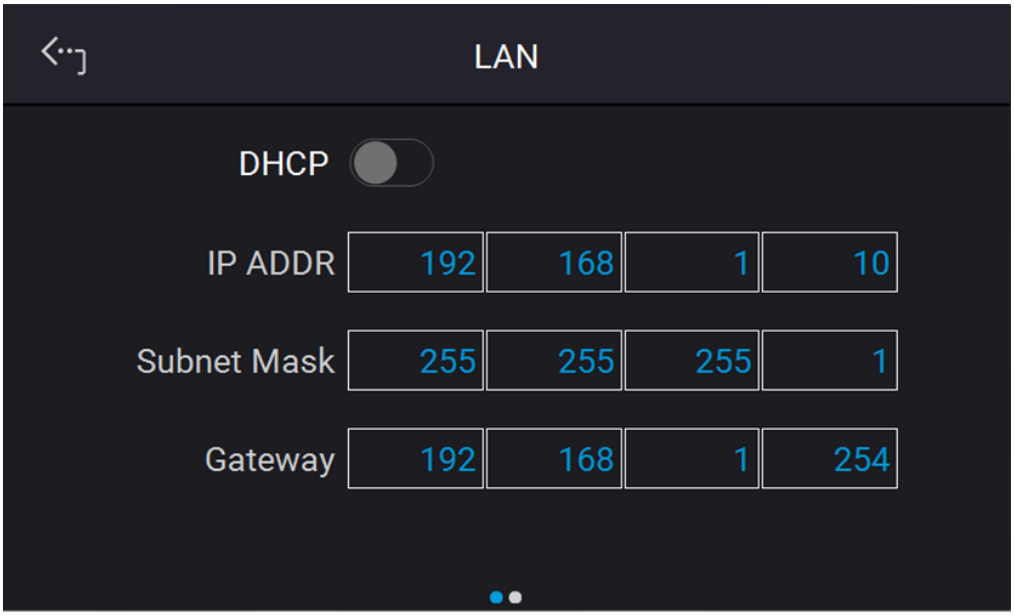


Figure 3-43

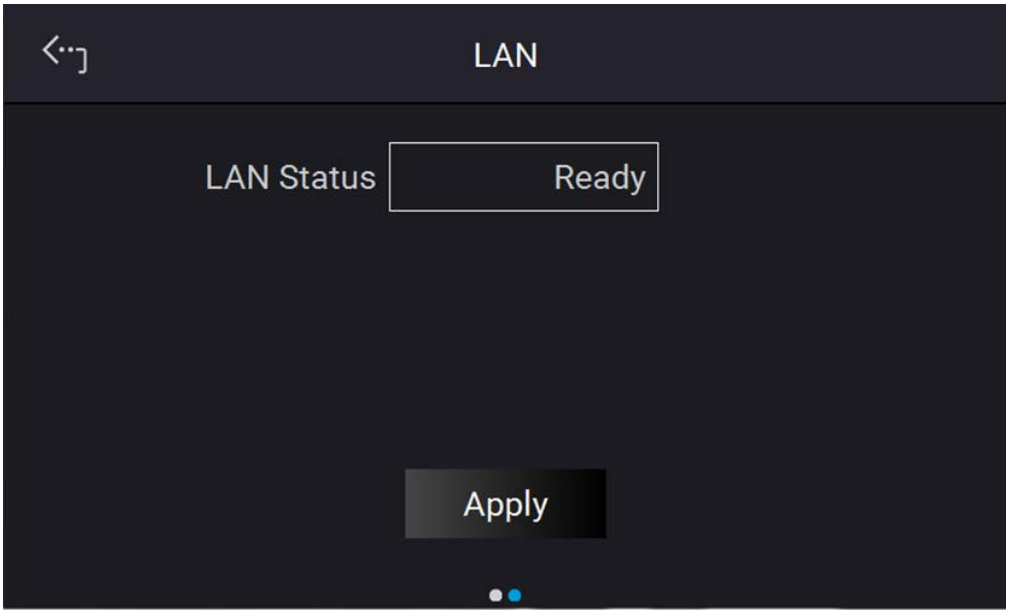


Figure 3-44

Notice

1. The LAN STATUS is displayed automatically in the following 5 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 setting.
   ETHERNET MODULE FAIL: It means the network module is fail.
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.

3.2.4.1.3 GPIB

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

1. In “Interface” page, select GPIB to enter the power supplies GPIB Address as shown in Figure 3-45.

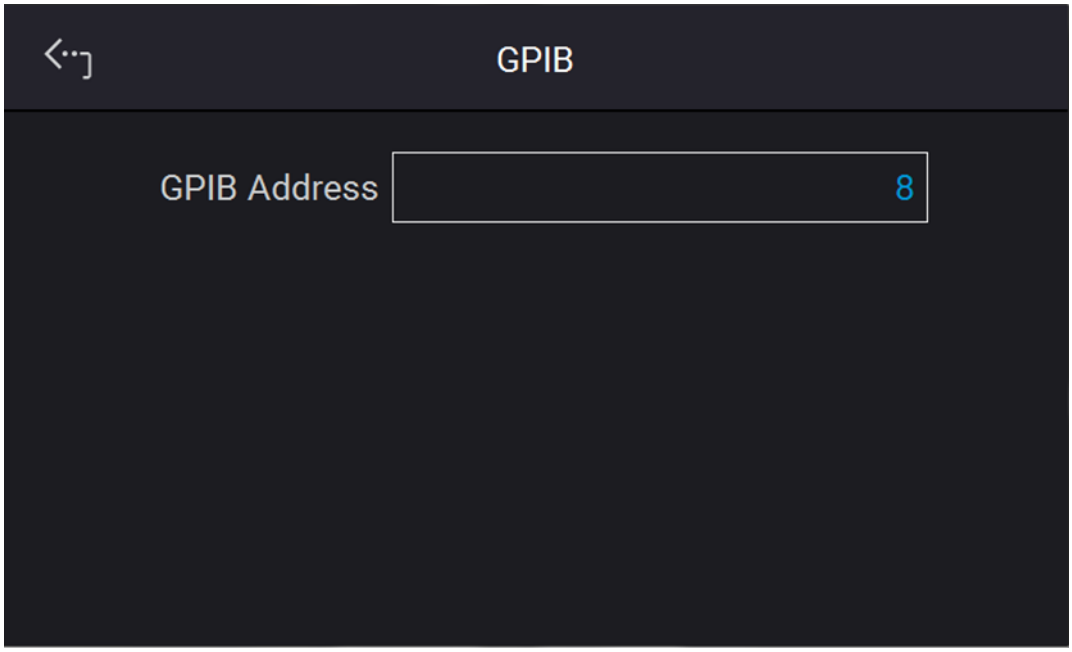


Figure 3-45

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

Notice V valid GPIB addresses are in the range of1~30.

3.2.4.1.4 CAN

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

1. In the “Interface” page, select CAN as the screen shows in Figure 3-46 or Figure 3-47 shows.
2. Tap Mode to set the bit number.
3. Tap Padding and set it.
4. Tap Baud and set it from the drop-down menu.
5. Tap Cyclic Time to set.
6. Swipe left to second page, then tap ID to set.
7. Tap Mask to set.
8. Tap Cyclic ID to set.
9. Tap SCPI ID to set.

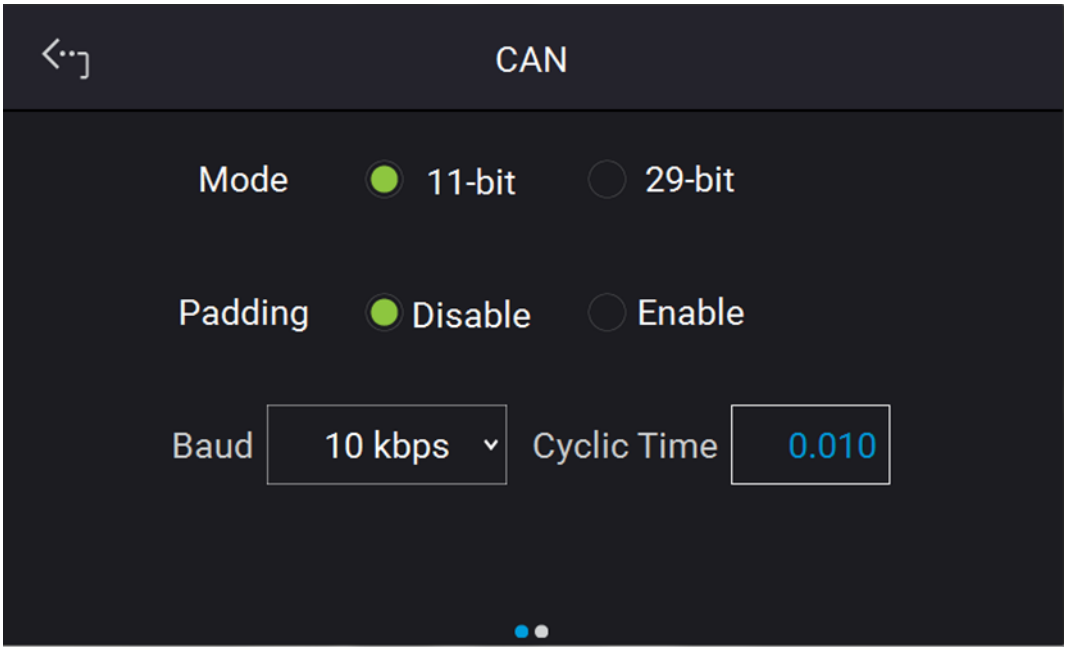


Figure 3-46

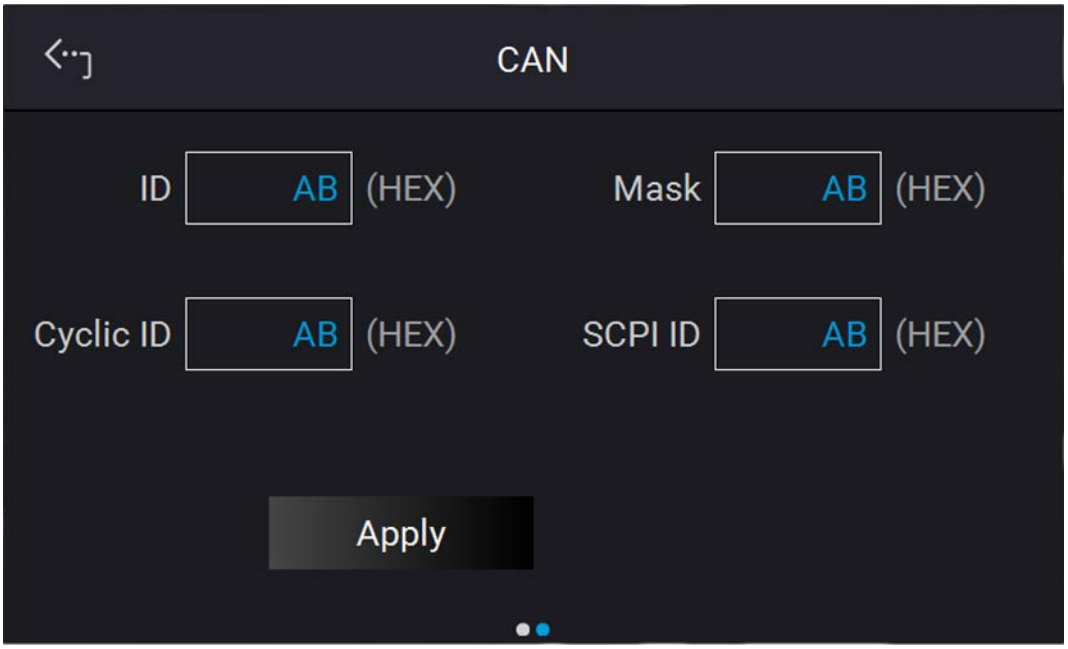


Figure 3-47

1. Tap Apply to execute the setting of each parameter.
2. Touch the upper left corner to enter into Menu page.
3. Tap “MEAS. & Setup” to return to the main page.

3.2.4.1.5 USB

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

1. In “Interface” page, select USB to enter into the USB Address screen as Figure 3-48 shows.

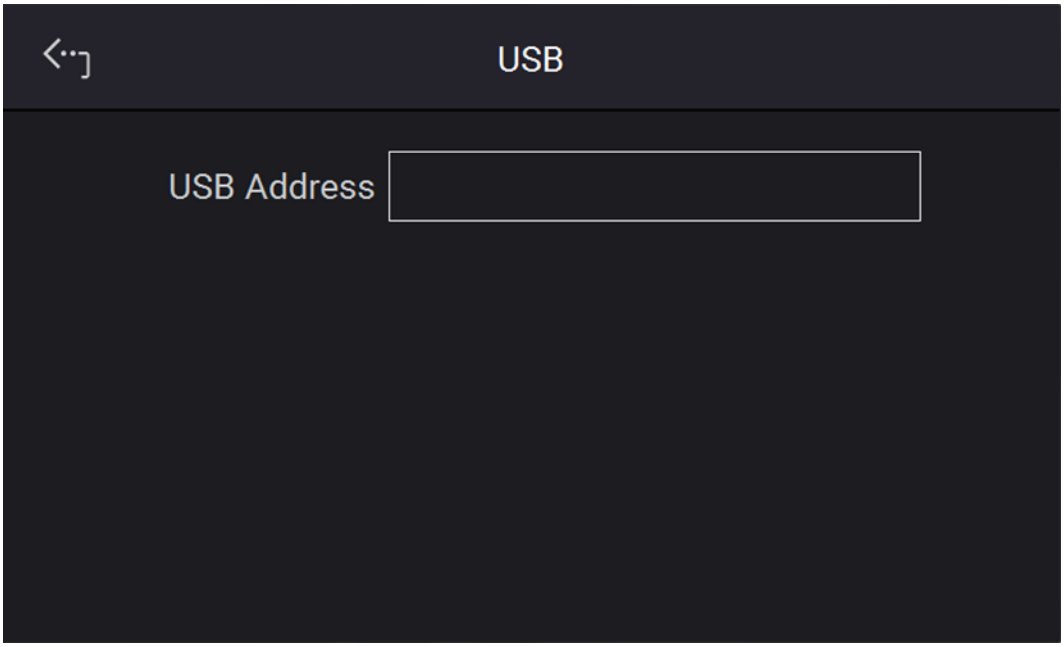


Figure 3-48

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

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

3.2.4.2 Series and Parallel Connection

The 62000D Series Power Supplies are able to operate in series or parallel. The maximum voltage is 1200V when connected in series and if connecting in series and 5400A when instruments are connected in parallel.

⚠WARNING For proper series mode operation, the power supplies must be equipped with a keypro fixture. Users must not use supplies in series without the keypro. Be sure to contact Chroma’s Service Center or agent before purchasing. **(* It is highly dangerous to configure 62000D supplies in series without factory assistance. The factory warranty does not cover damage from unauthorized series operation.)**

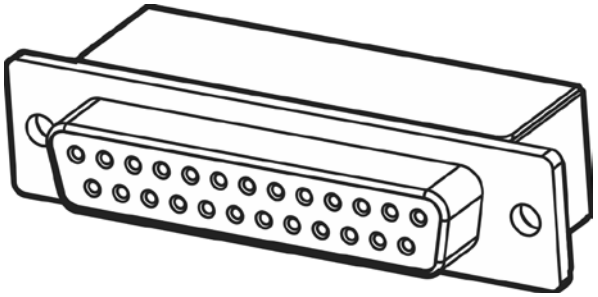


Figure 3-49

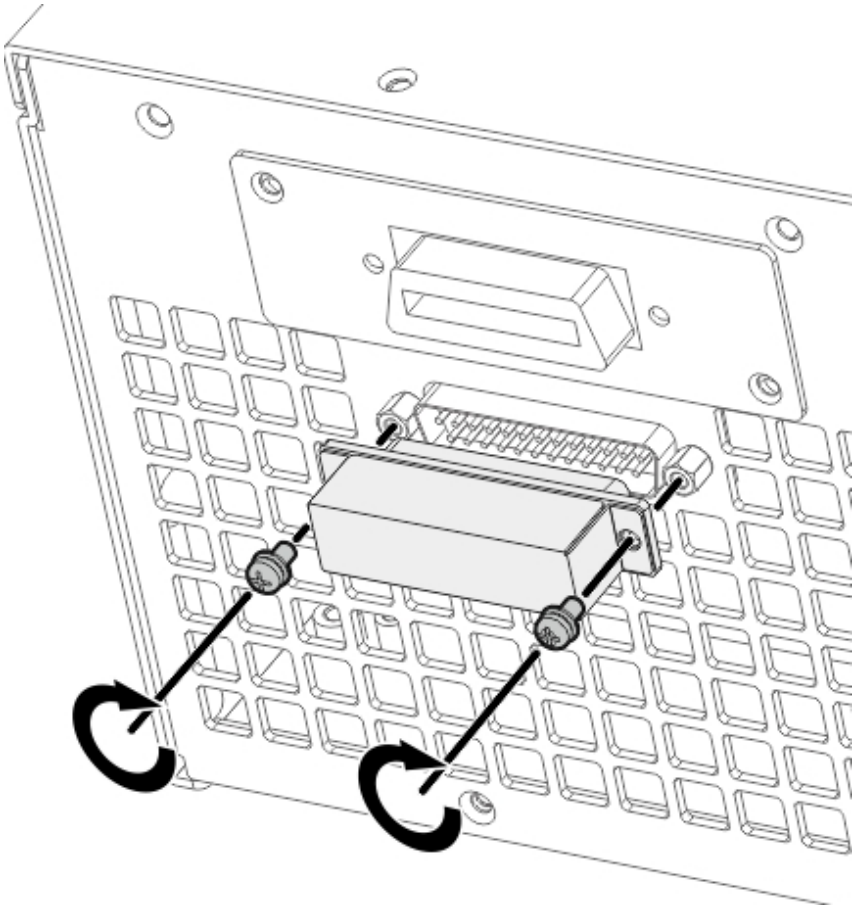


Figure 3-50

Notice

1. Series/Parallel cannot be mixed in use.
2. The maximum output voltage or current is 1200V or 1200A when operating the 62000D power supplies in series or parallel as shown in Table 2-4.

Table 3-5

62000D Series Model	Serial		Parallel	
	Max. Devices	Max. Output Voltage (V)	Max. Devices	Max. Output Voltage (V)
62060D-600	2	1200	10	400
62120D-600	2	1200	10	800
62180D-600	2	1200	10	1200

3. Some models maybe unable to be operated in parallel or serial.
4. Verify facility breaker capacity is large enough and the earth wire is grounded to earth ground when series/parallel is in use.
5. All models in 62000D Series can be paralleled with the same model no., and maximum 10 devices are planned. When the devices to be paralleled are over 3 sets, please contact the Service Center or agent of CHROMA.
6. In 62000D Series, only the 100V & 600V type with the same model no. can be connected in series. The rest of the voltage model numbers do not support series connection. Please contact the Service Center or agent of CHROMA for the special keypro fixture required for series mode.

3.2.4.2.1 Output Connection in Series

Output connections for series operation are shown in Figure 3-51. Dotted lines show sense line connections and should be twisted pairs.

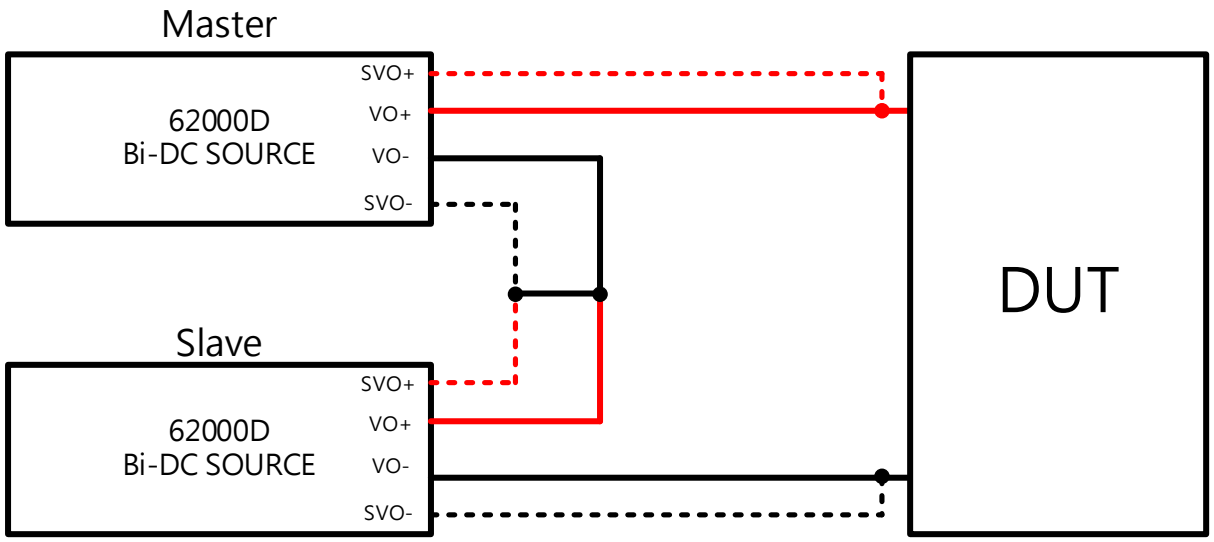


Figure 3-51

3.2.4.2.2 Output Connection in Parallel

The output connections for connecting three DC power supplies in parallel are shown in Figure 3-52. Dotted lines indicate sense line connections and should be twisted pairs.

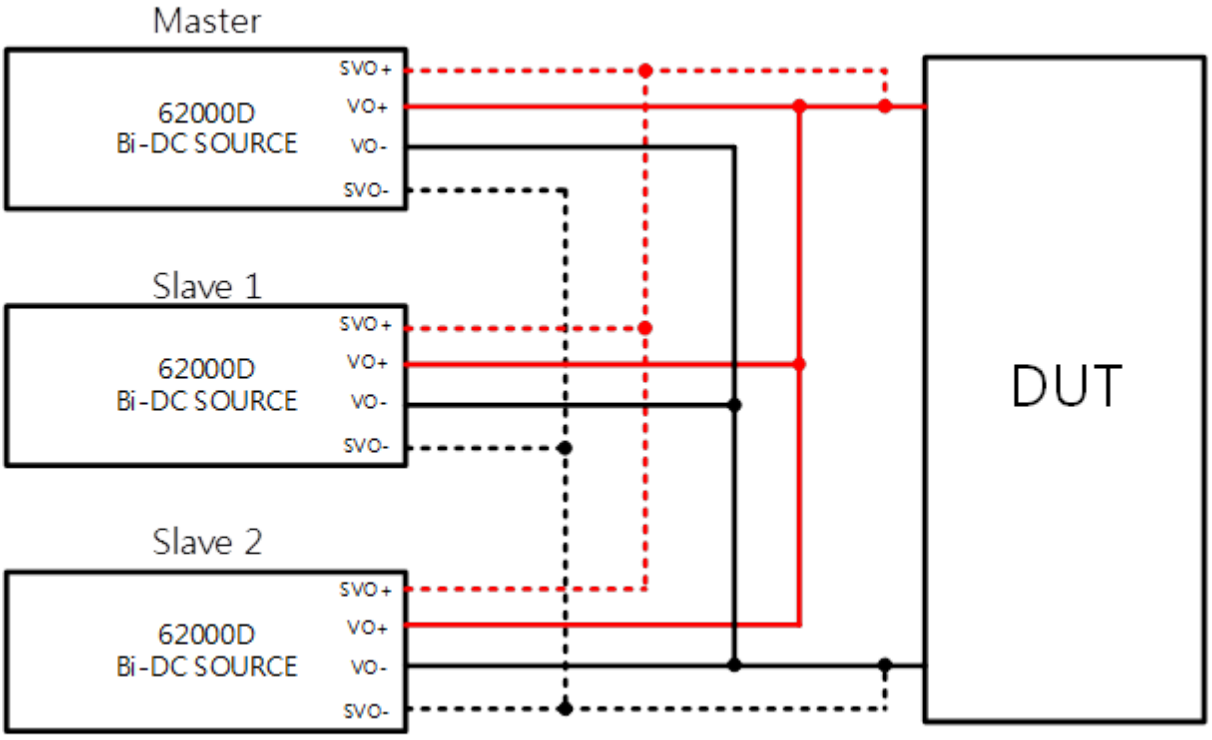


Figure 3-52

3.2.4.2.3 Installing Series/Parallel Communication Interface

1. When two DC power supplies are connected in series or parallel, the DisplayPort connector on the rear panel must be connected as shown in Figure 3-53.

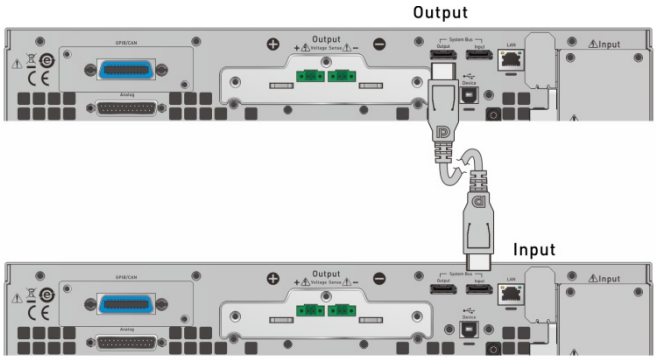


Figure 3-53

2. When three DC power supplies are connected in series or parallel for operation, the DisplayPort connector on the rear panel must be connected as shown in Figure 3-54.

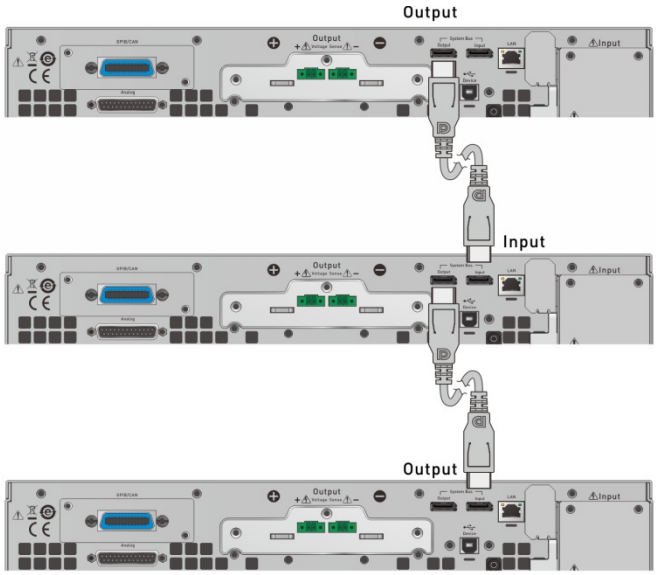


Figure 3-54

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 left and right connection ports but connected in series as shown in Figure 3-53 or Figure 3-54. The communication cable has a limit of 5 meters for length, do not exceed this limit to avoid unstable signal. The DisplayPort communication cable connected to the last DC power supply does not connect back to the first DC power supply.

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

3.2.4.2.4 Setting Series/Parallel Operation Mode

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

1. In Menu page, tap “Configuration” → “Series & Parallel” and the screen will appear as Figure 3-55.
2. Select Series or Parallel connection mode (keypro is required for Series mode).
3. Select the Type to be Master or Slave.
4. Master+ **1** = this indicates that one Slave unit is connected to the master
5. If Master/Slave must be enable for Series or Parallel operation.

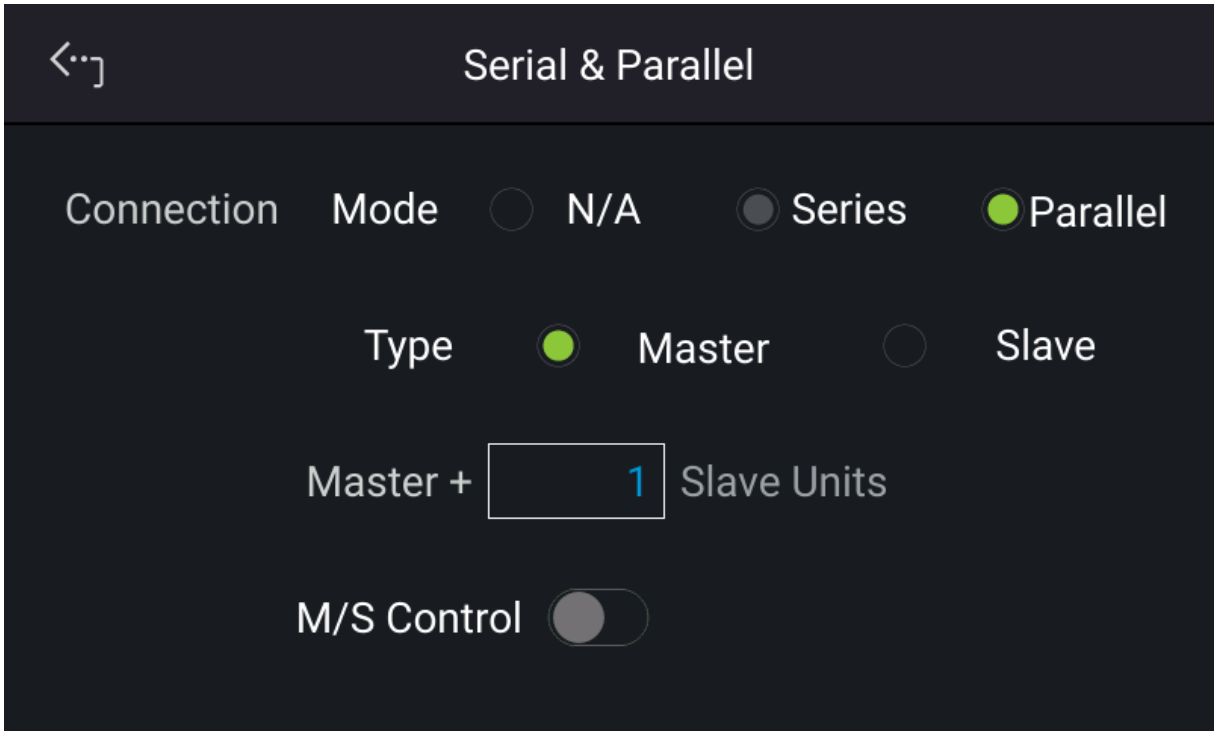


Figure 3-55

Notice When multiple DC power supplies are connected in series or 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/600A is set, the setting of each set is 150V/120A and the total output will be 150V/600A.
2. If there are 2 sets connected in series and 1200V/60A is set, the setting of each set is 600V/60A and the total output will be 1200V/60A.
3. The total sets for connecting in series are 2; therefore, the maximum number of Master+ **1** is 1.
4. The total sets for connecting in parallel are 10; therefore, the maximum number of Master+ **9** is 9.

3.2.4.2.5 Parallel Mode Connection

1. When the parallel communication interface is installed, follow the steps described in previous section to enter into Serial & Parallel page as Figure 3-55 shows. .
2. Set on one unit to Master, all others should be set to Slave mode.
3. When paralleling two units set Master+ **1** as shown in Figure 3-55.
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 display as Figure 3-56 (ex.62180D-600) shows while the Slave device displays as Figure 3-57 shows.

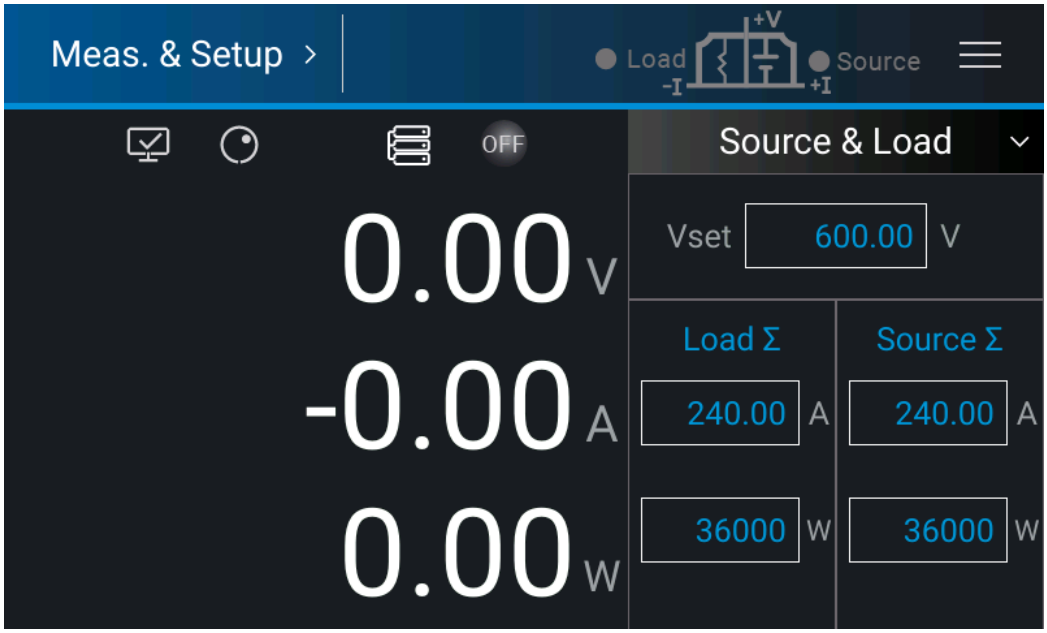


Figure 3-56

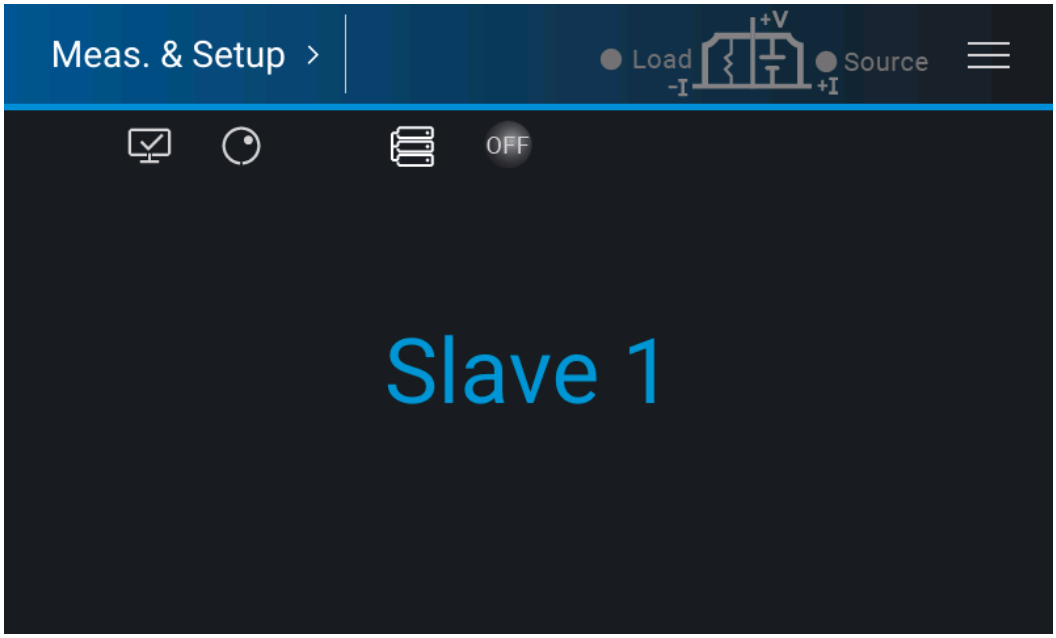


Figure 3-57

3.2.4.2.6 Series Mode Connection

1. When D-series power supplies are powered on after the keypro is installed the system will automatically enter into Serial & Parallel mode as Figure 3-58 shows. (Note: Standalone operation is invalid in this mode.)
2. Set one device to Master and the other to Slave.
3. Enable the M/S Control to perform series connection control. When the connection is successful, the Master device displays as Figure 3-59 (ex.62180D-600) shows while the Slave device displays as Figure 3-57 shows.

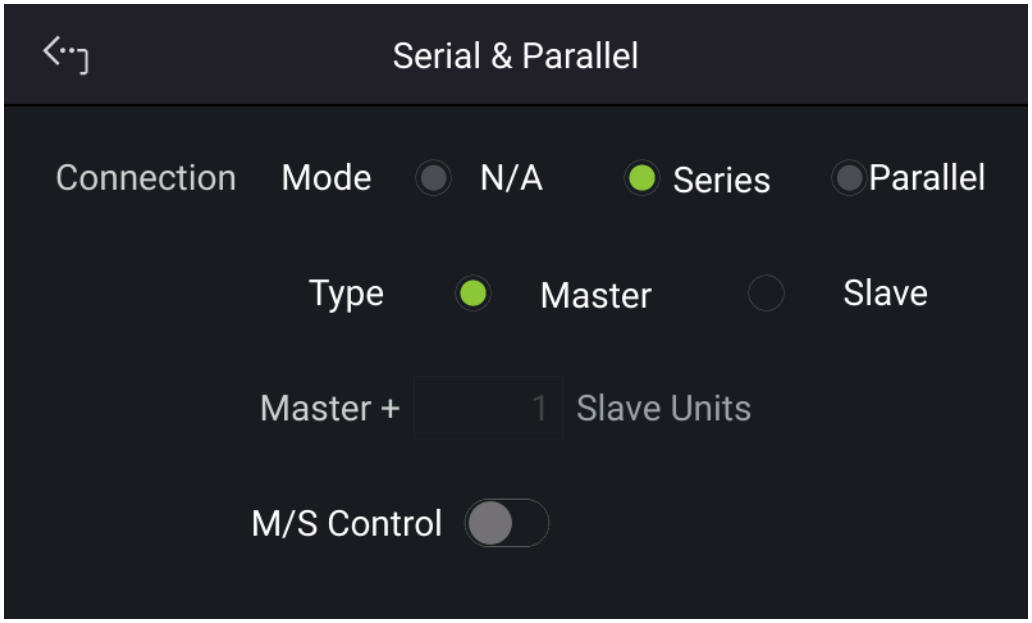


Figure 3-58

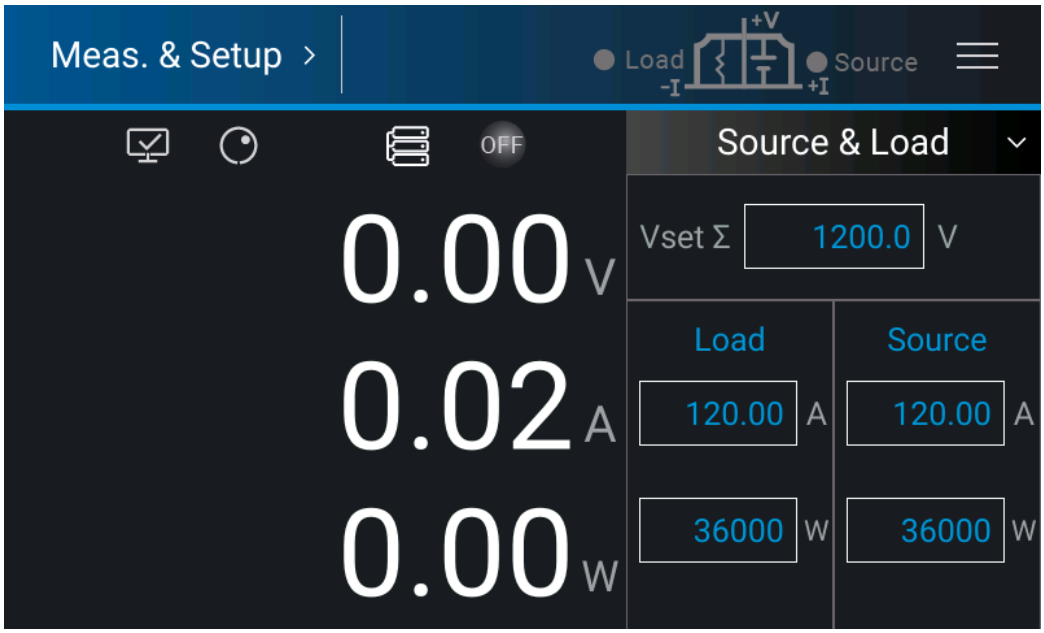


Figure 3-59

3.2.4.3 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. In "Configuration" page, select "Power On Status" display will appear as Figure 3-60 shows.

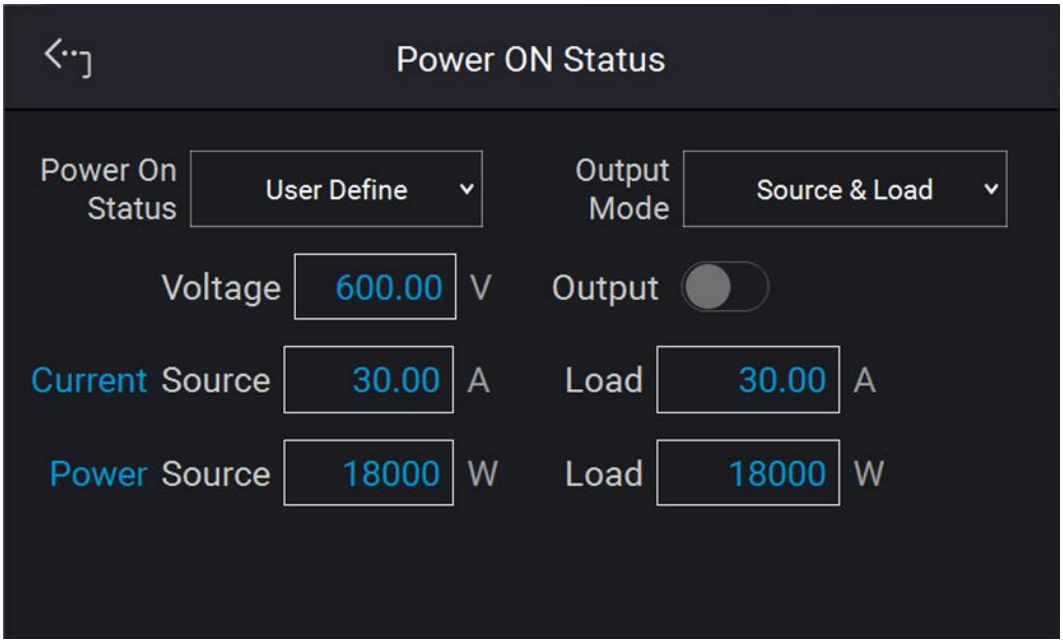


Figure 3-60

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 3-61 shows to set the default power-on state including voltage (V_SET), current (I_SET) and OUTPUT=ON/OFF.

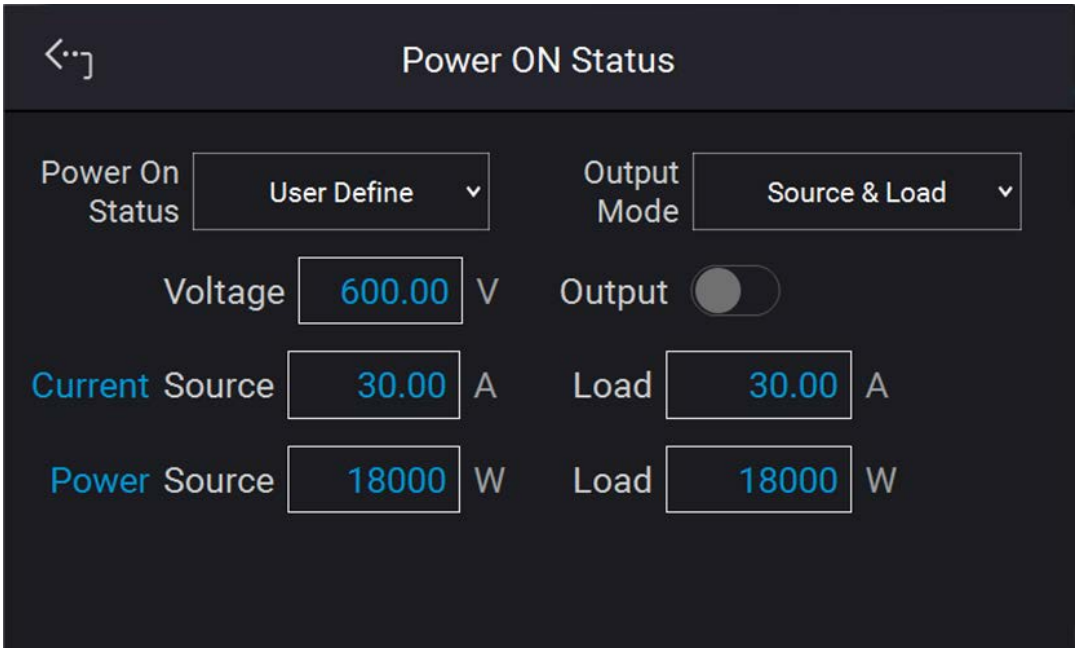


Figure 3-61

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

3.2.4.4 Calibration

Chroma 62000D 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.

In “Configuration” page, select “Calibration” and it will appear as Figure 3-62 shows.

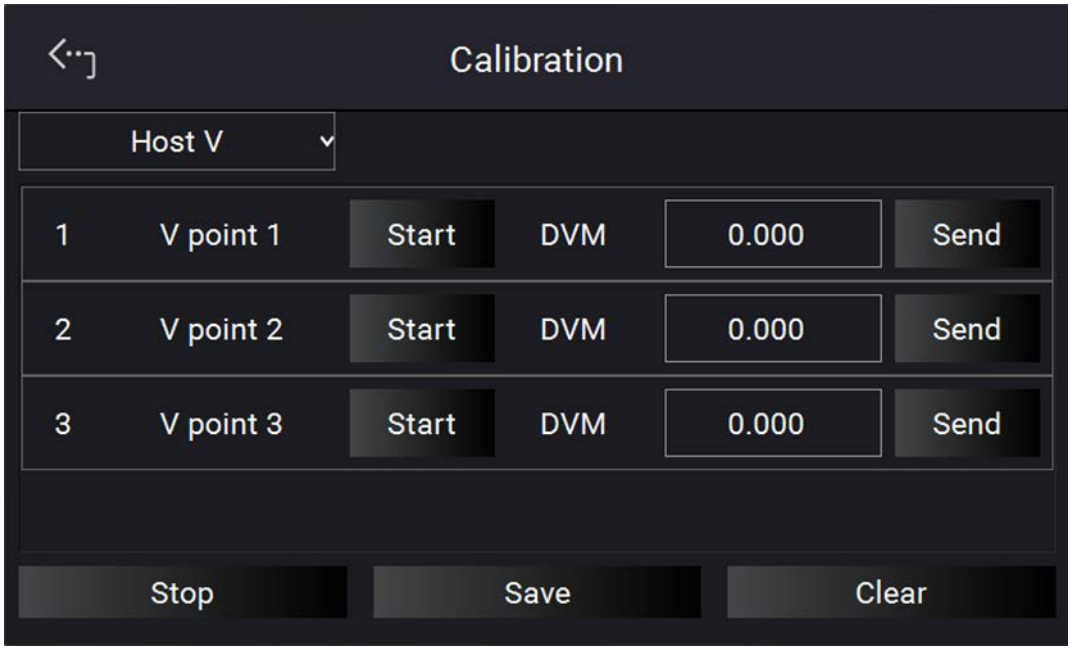


Figure 3-62

Notice

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

3.2.4.4.1 Voltage Output and Measurement Calibration

The recommend DMM for calibrations are shown in Table 3-6. Ensure the DMM is within its calibration validity period before calling the power supply.

Table 3-6

Device	Suggested Model or Capacity
DVM	HP 34461A or equivalent DVM

The setup is shown in Figure 3-63.

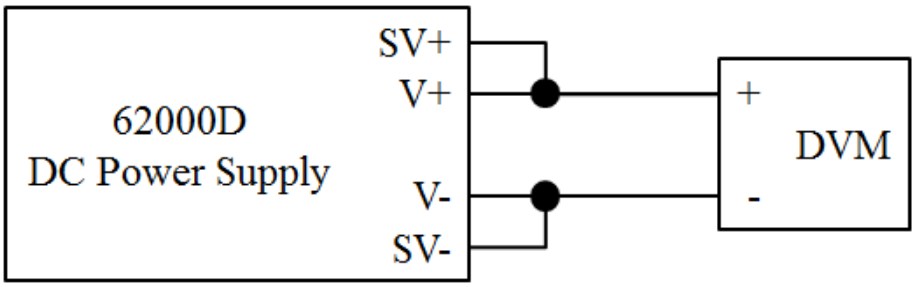


Figure 3-63

Notice

1. The instrument that is used to perform calibration its accuracy has to be higher than the accuracy of spec.
2. It is suggested to set the Resolution parameter of HP34401 to SLOW 6 digit.
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 62180D-600):

1. In Calibration page, tap “Host V” to list the voltage calibration items as shown in Figure 3-64.

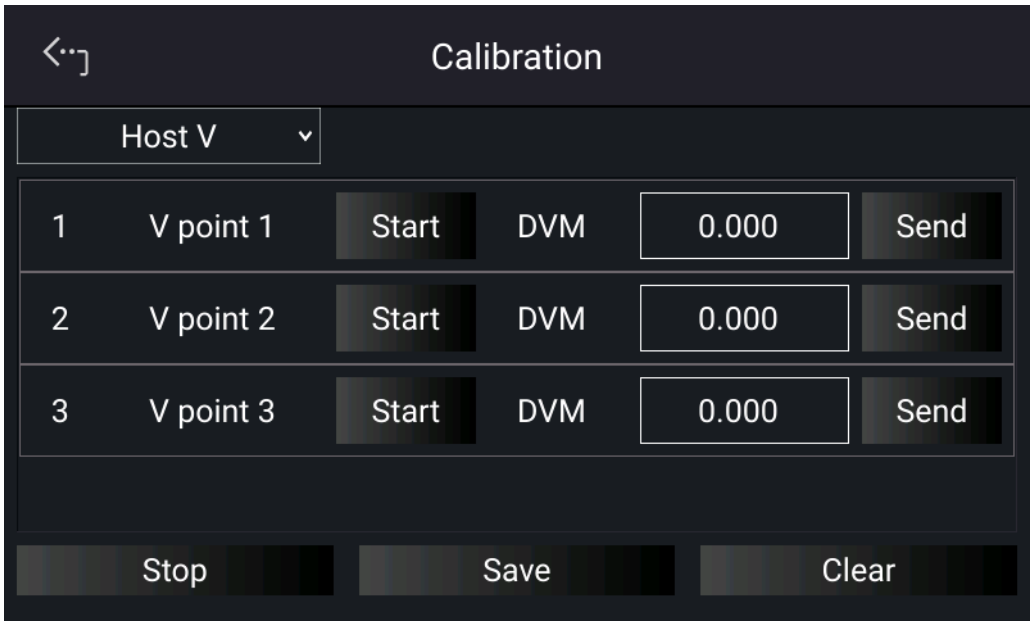


Figure 3-64

2. First complete the point 1 voltage calibration by tapping “START” next to “V point 1”. The DC power supply will output a voltage of approximately 60.00V. 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 a voltage of approximately 300.00V. 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 a voltage of approximately 540.00V. Enter the voltage measured by DVM to position [3] and tap “SEND” to confirm.

5. When 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 3-65.

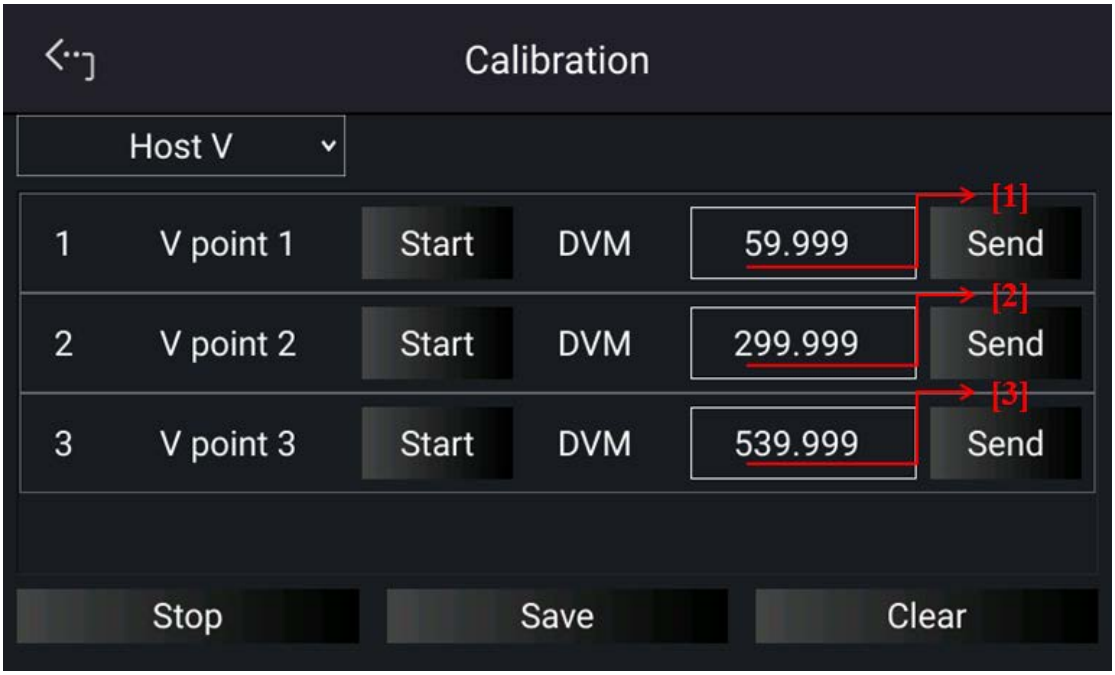


Figure 3-65

Notice

1. Calibration points will be different for other models (above example is for Model 62180D-600). It is necessary to remove the output load when performing voltage calibration. When performing this procedure, make sure there is no load connected to the output and sense line jumper are in place at the rear connectors, before tapping “START” to begin the calibration.

3.2.4.4.2 Current Output and Measurement Calibration

The following instruments are recommended for calibration of the 62000D power supplies or equivalent, Table 3-7.

Table 3-7

Device		Suggest Model or Capacity
DVM		HP 34401A or equivalent DVM
DCCT (Current Shunt)		ULTRASTAB current transducer 600/2000A ITZ600-25PR or equivalent
LOAD	DC Power Supply 2	CHROMA 62180D-600 or equivalent

The setup is shown in Figure 3-66.

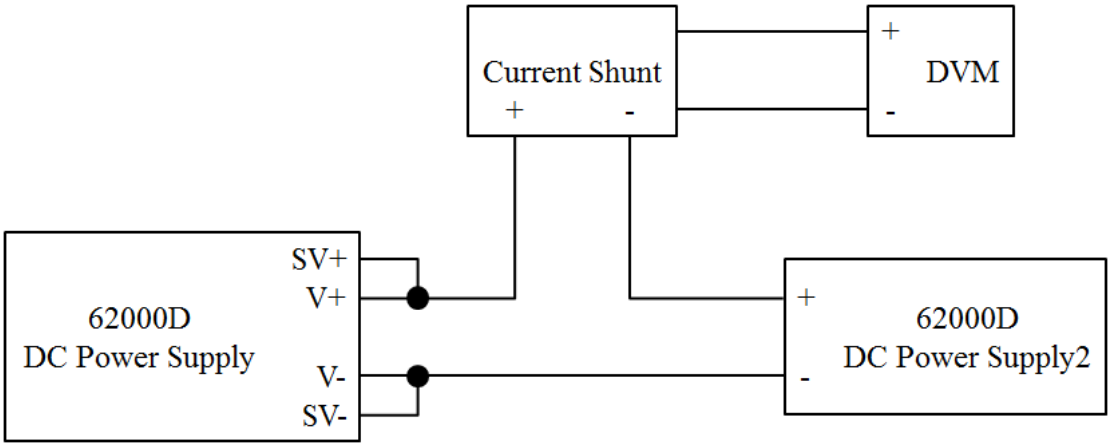


Figure 3-66

Notice When conduct current calibration, each calibration point has to be entered with at least 5 significant digits to ensure the power supply accuracy after calibration (I.e. 50.004Amps).

Calibration Procedure (Model 62180D-600):

1. Set the DC Power Supply to CV mode at 100V.

2. In the Calibration page, tap “Host V” to set HOST I and list the current calibration items as shown in Figure 3-67

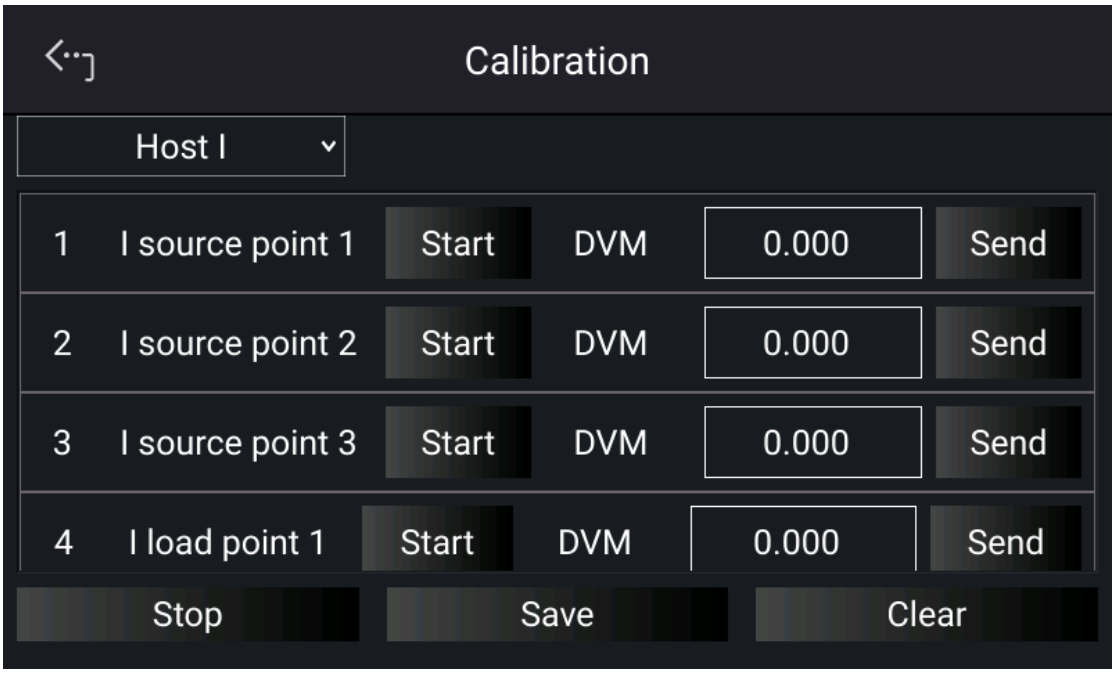


Figure 3-67

3. First perform the calibration of “I source point 1” by tapping “START” next to I source point 1. The DC power supply will output the current to approximately 12.00A. Enter the accrual current measured by across the current shunt and enter into entry box for point 1 and tap “SEND” to confirm.

4. Next, tap “START” next to “I source point 2” to perform the second point current calibration. The DC power supply will output a current of approximately 60.00A. Enter the accrual current measured by across the current shunt and enter into box for position [2] and tap “SEND” to confirm.

5. Repeat above for “I source point 3”. The DC power supply will output a current of approximately 108.00A. Enter the current measured across the current shunt and enter into position [3] entry box and tap “SEND” to confirm.

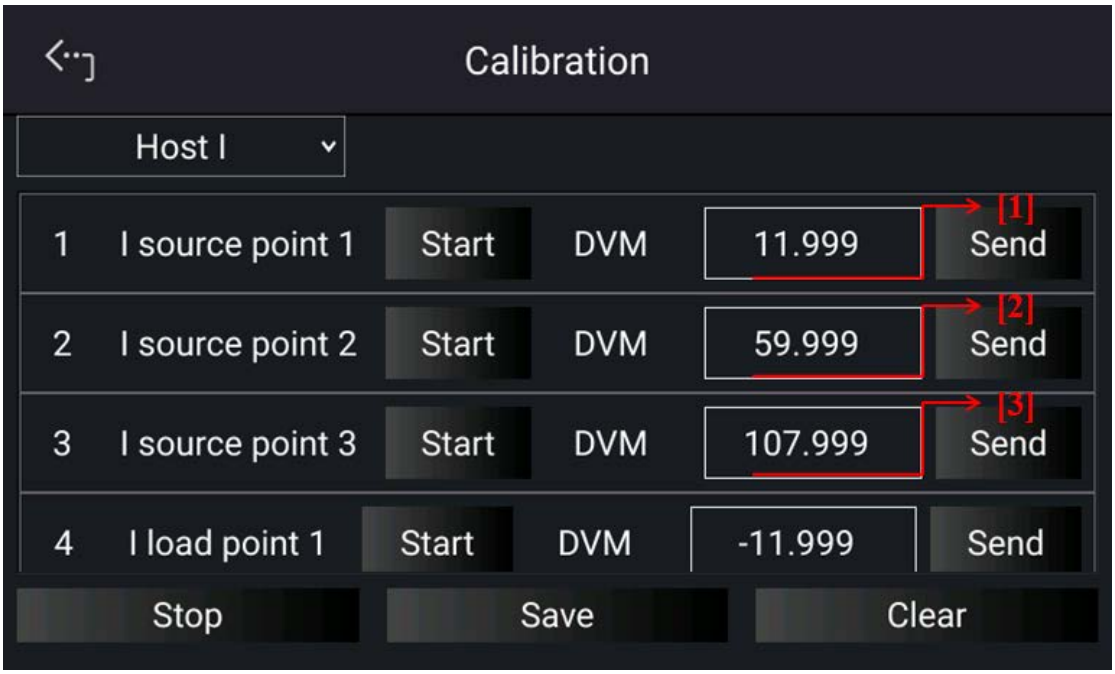


Figure 3-68

Next perform calibration of negative current points 1, 2 and 3 by following the above procedure and following display prompts. Calibration points will be -12A, -60A and -108A.

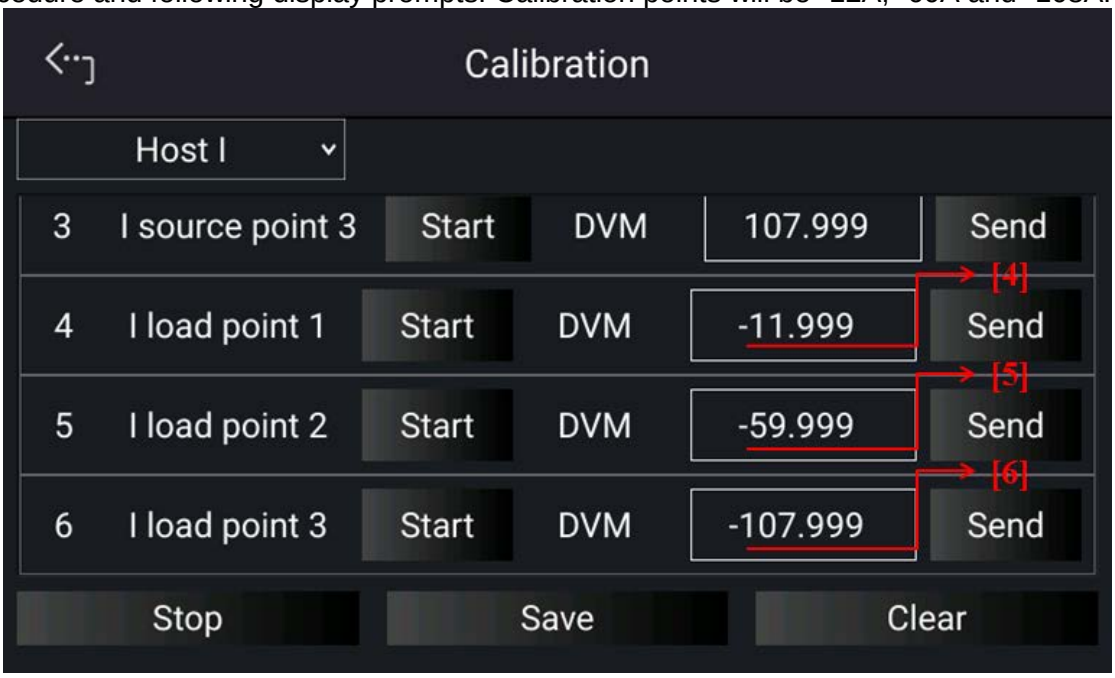


Figure 3-69

6. When 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 will be different for other models (example is for the Model 62180D-600), please following the same calibration instructions

3.2.4.4.3 APG Voltage Output Calibration

Table 3-8 lists the hardware requirements for APG voltage output calibration.

Table 3-8

Device	Suggest Model or Capacity
DVM	HP 34401A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-70 shows the wire connection for APG voltage output calibration.

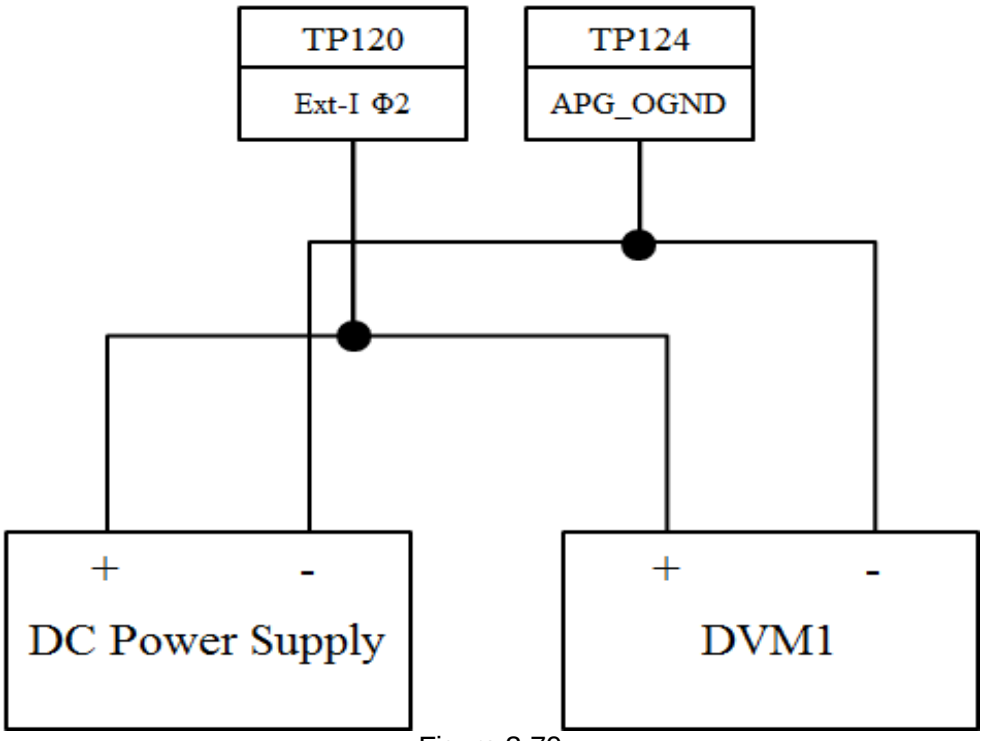


Figure 3-70

Notice When conducting the APG voltage output calibration, each calibration point has to be entered to at least 4 significant digits (i.e. 5.007V) to ensure the power supply accuracy after calibration.

Calibration Procedure (Model 62180D-600):

1. In Calibration page, tap “Host V” to select APG V SET and list the APG voltage calibration items as shown in Figure 3-71.

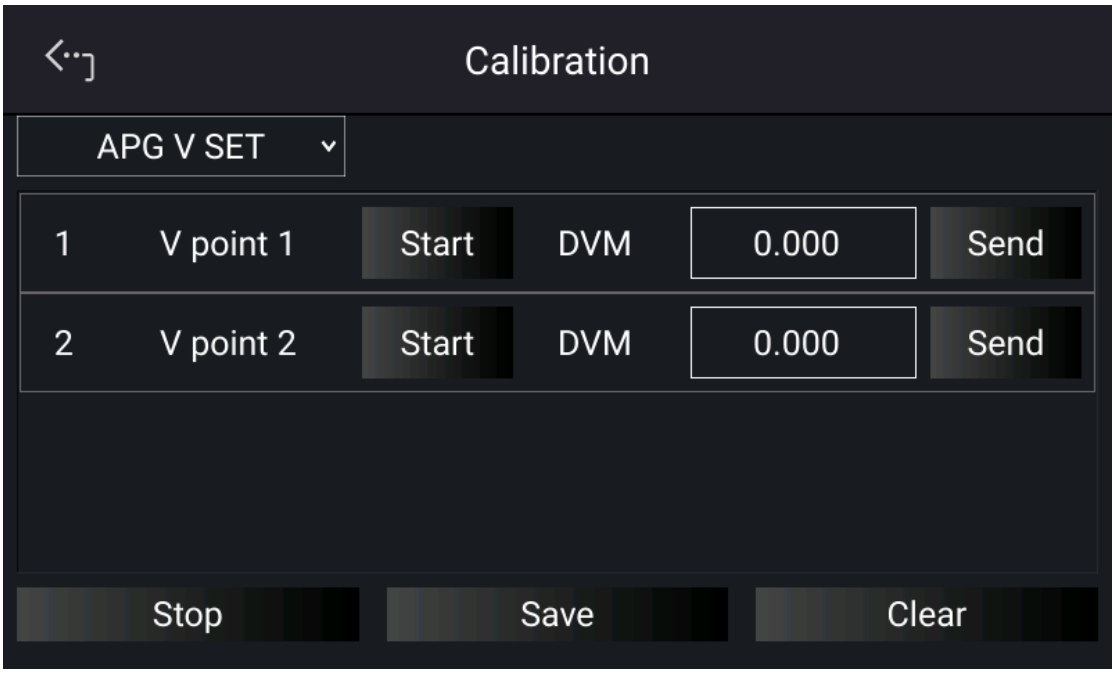


Figure 3-71

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.
2. If HP 34401 is used, the DVM1 and DVM2 can be connected to the front and rear measurement input terminal respectively.

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

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

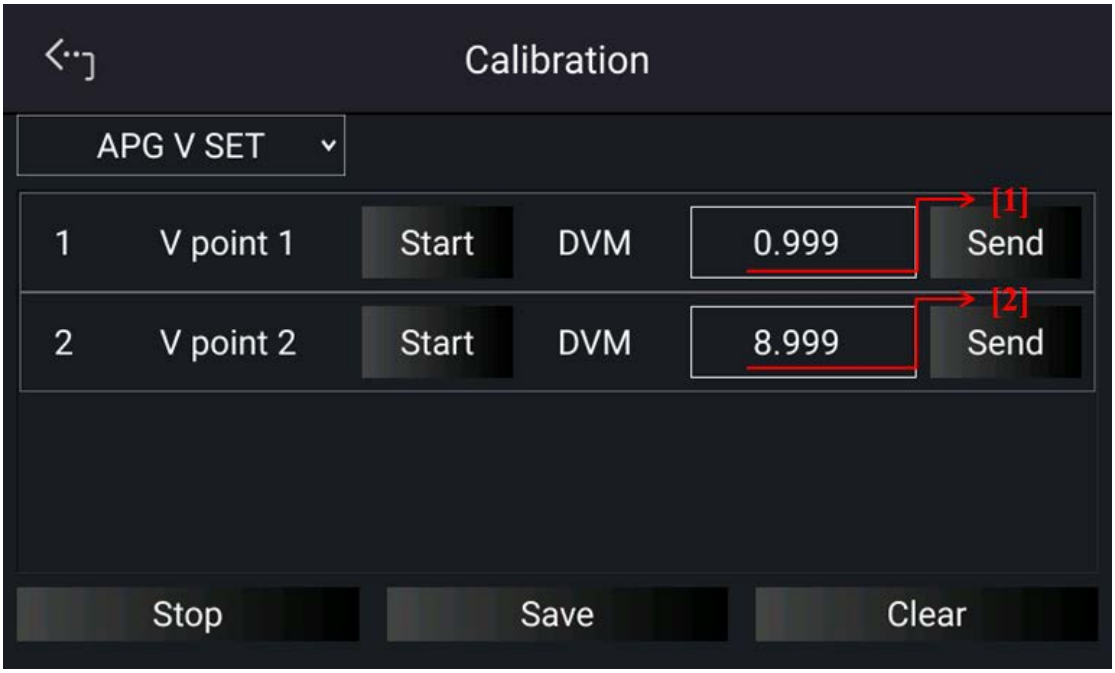


Figure 3-72

4. Next, tap “START” next to V point 2 to calibrate the second point voltage. User will be prompted to input about 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.

3.2.4.4.4 APG Voltage Measurement Calibration

Table 3-9 lists the hardware requirements for APG voltage measurement calibration.

Table 3-9

Device	Suggest Model or Capacity
DVM	HP 34401A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-73 shows the wire connection for APG voltage measurement calibration.

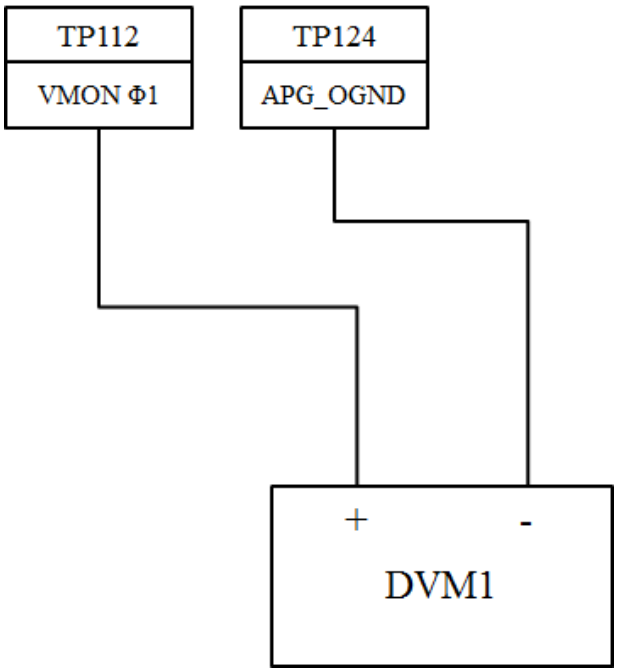


Figure 3-73

Notice When conducting the APG voltage measurement calibration, each calibration point has to enter at least four significant digits (4.005V) to ensure the power supply accuracy after calibration.

Calibration Procedure (Model 62180D-600):

1. In Calibration page, tap “Host V” to select APG V MEAS and list the APG voltage calibration items as shown in Figure 3-71.

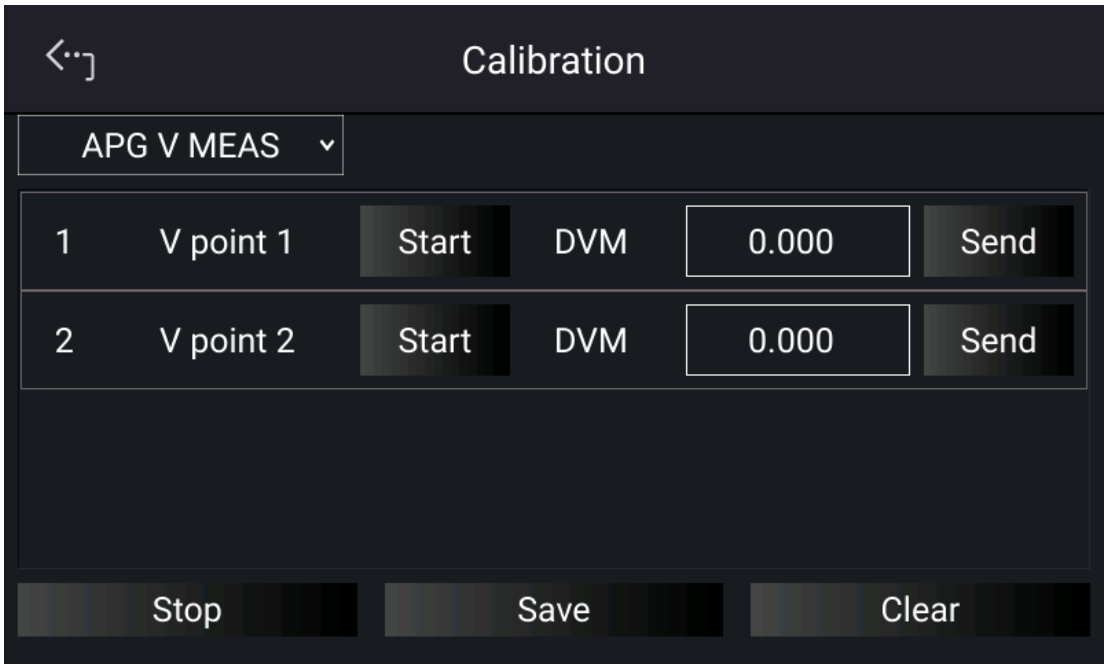


Figure 3-74

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.

2. If HP 34401 is used, the DVM1 and DVM2 can be connected to the front and rear measurement input terminal respectively.

2. When in 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.

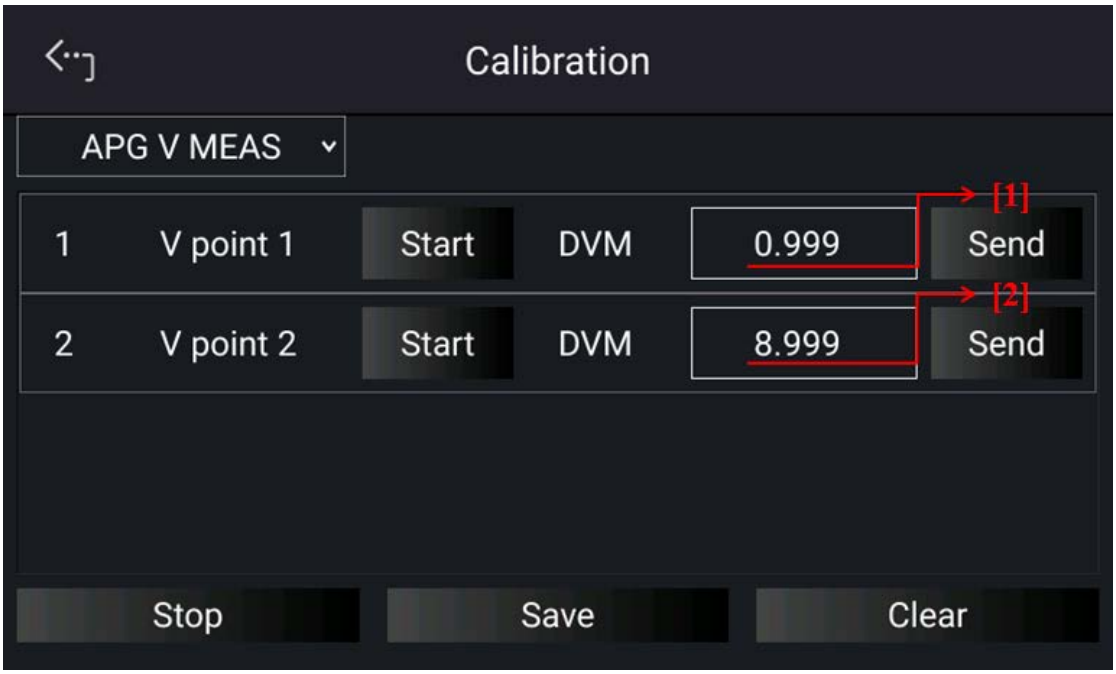


Figure 3-75

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 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 point will be different for other models, please follow above instructions for all models.

3.2.4.4.5 APG Current Output Calibration

Table 3-10 lists the hardware requirements for APG current output calibration.

Table 3-10

Device	Suggest Model or Capacity
DVM	HP 34401A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-73 shows the wire connection for APG voltage output calibration.

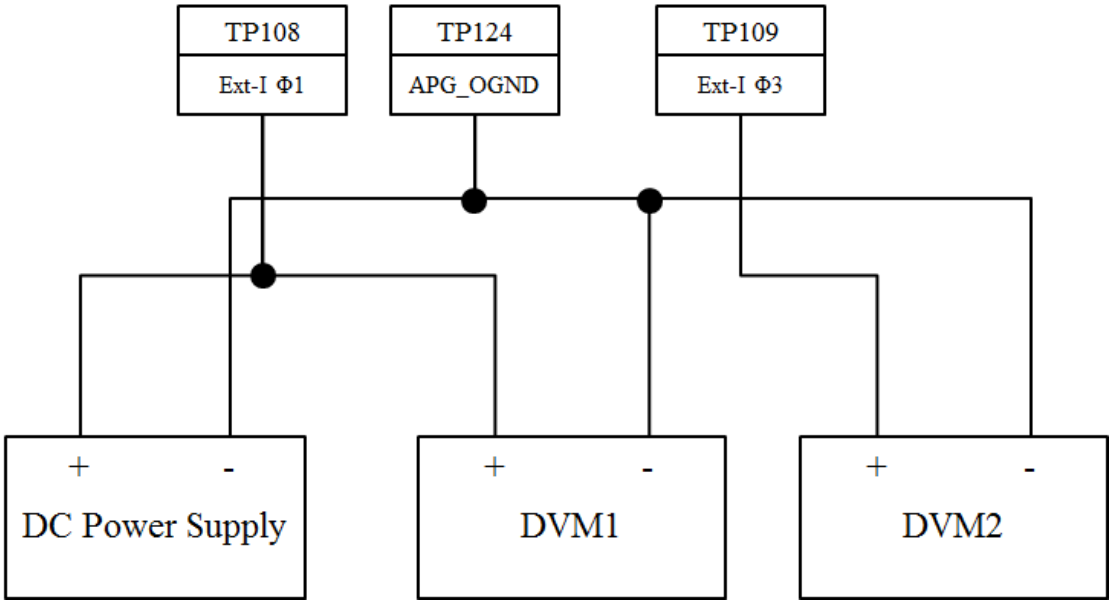


Figure 3-76

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

Calibration Procedure (Model 62180D-600):

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

2. In Calibration page, tap “Host V” to select APG I SET and list the APG current calibration items as shown in Figure 3-77.

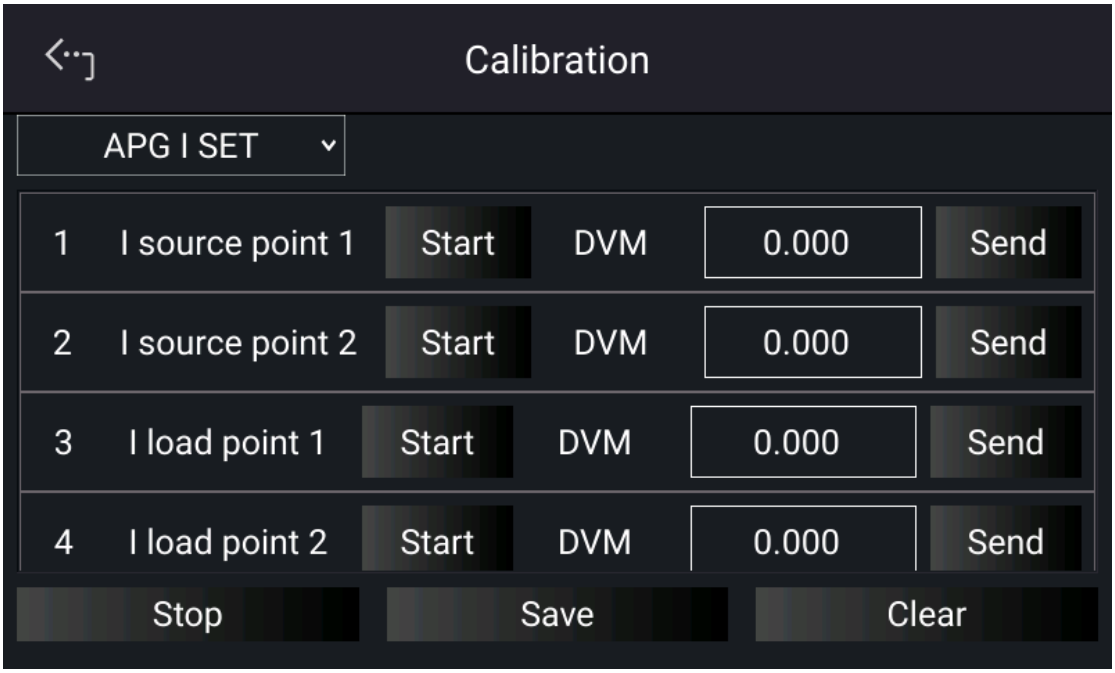


Figure 3-77

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.
2. Calibration points will be different for other models, please operate it following the instructions displayed.

3. When in 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 about 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 3-78 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 3-78 shows.

6. Tap “START” next to I load point 1 to calibrate the first point positive current. It will request you to input about 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 3-78 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 3-78 shows.

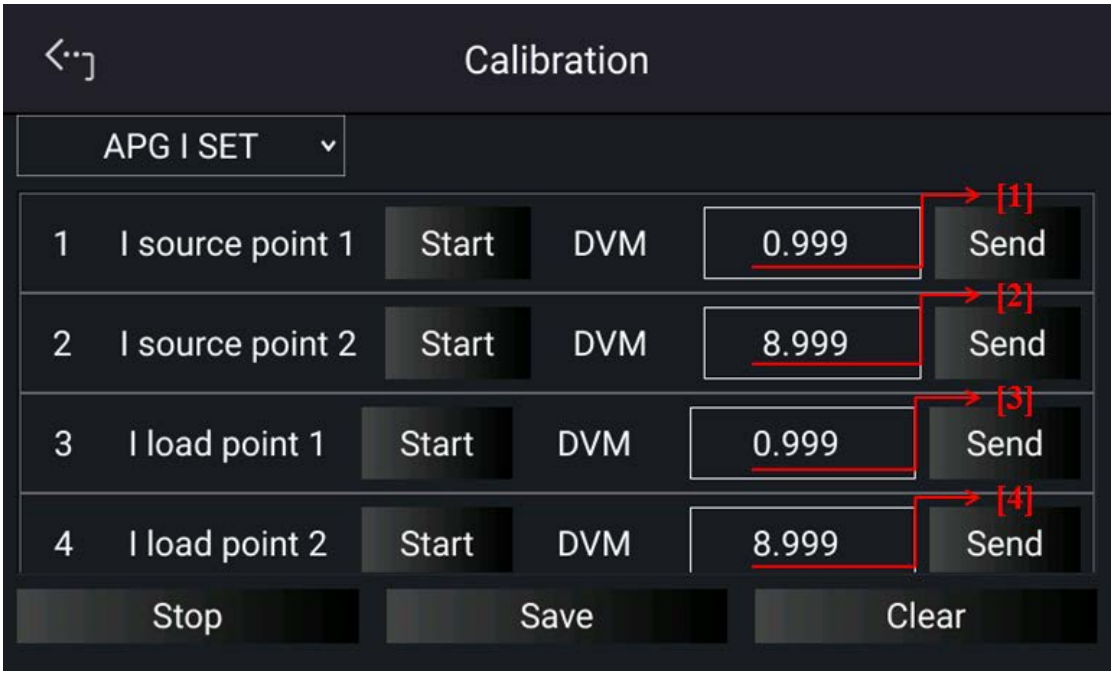


Figure 3-78

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 3-78 shows.

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

3.2.4.4.6 APG Current Measurement Calibration

Table 3-11 lists the hardware requirements for APG current measurement calibration.

Table 3-11

Device	Suggest Model or Capacity
DVM	HP 34401A or equivalent DVM
DC Power Supply	Any DC power supply or DC signal source that can output 10Vdc and drive more than 100mA.

Figure 3-79 shows the wire connection for APG current measurement calibration.

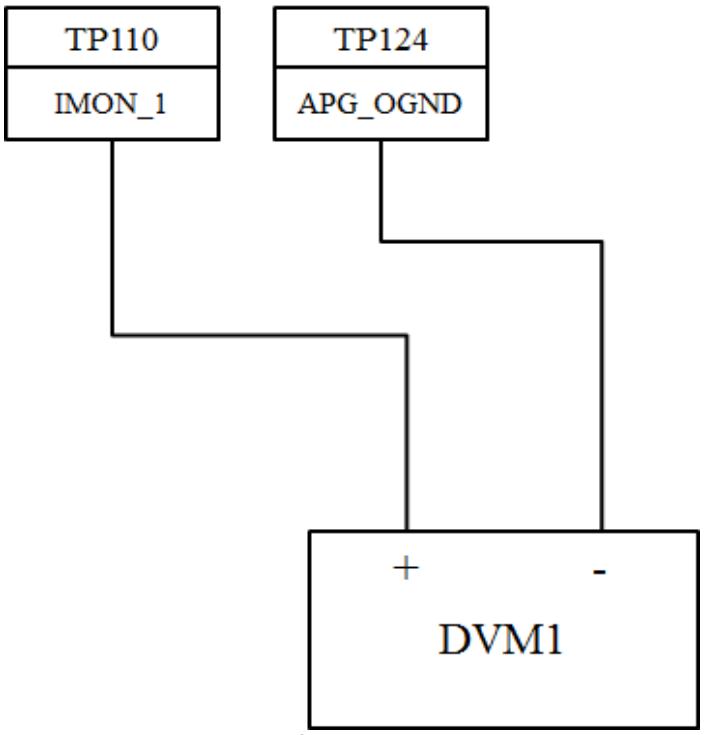


Figure 3-79

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 62180D-600):

1. In Calibration page, tap “Host V” to select APG I MEAS and list the APG current calibration items as shown in Figure 3-80.

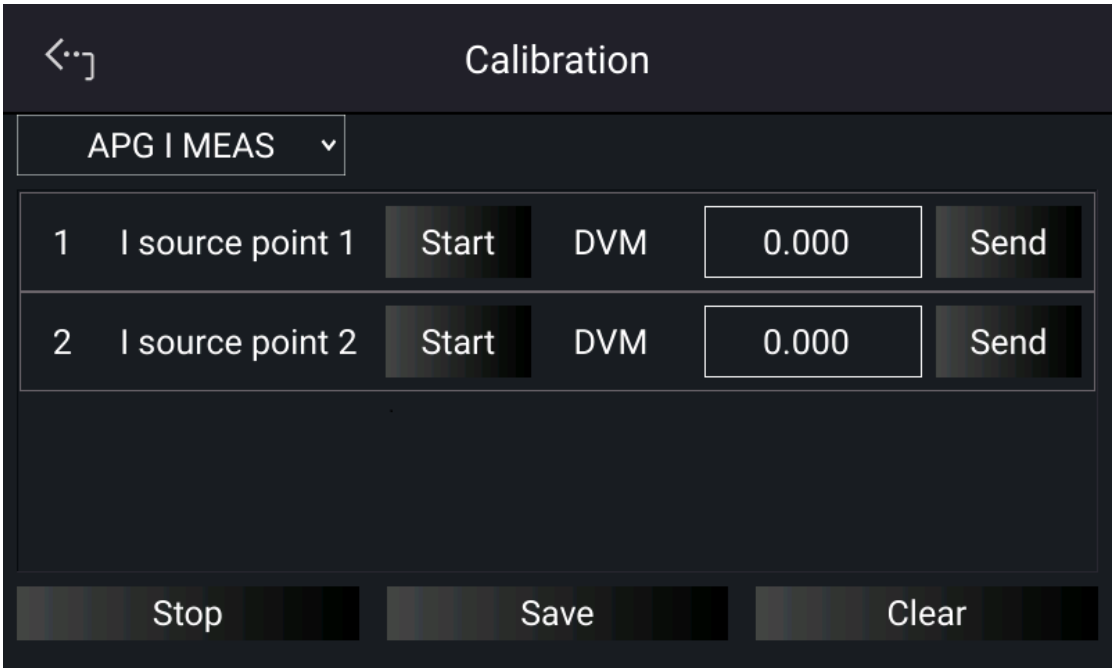


Figure 3-80

Notice

1. When entering into the Calibration page, be sure to check the interface connection on the rear panel is correct.
2. Calibration points will be different for other models, please operate it following the instructions displayed.

1. When in 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 -9V (TP110). Use DVM1 to measure the Power Supply. Enter the measured current to position [1] and tap “SEND” to confirm.

2. 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 9V (TP110). Use DVM1 to measure the Power Supply. Enter the measured current to position [2] and tap “SEND” to confirm.

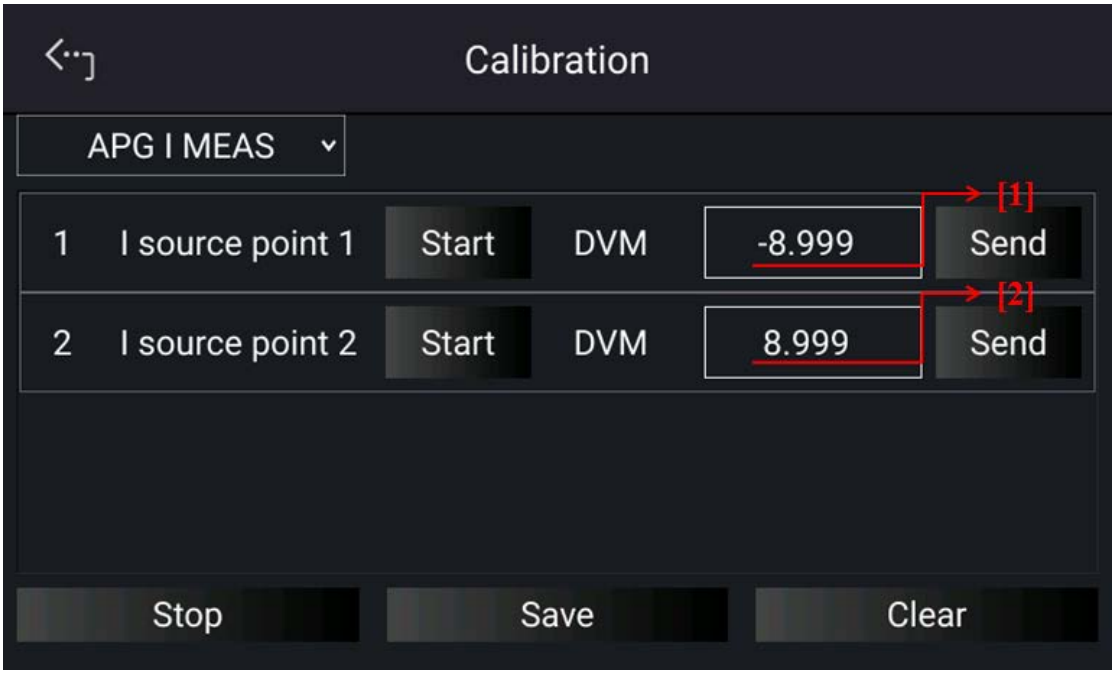


Figure 3-81

3. 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 3-81 shows.

3.2.4.5 External Output

The setting of DI1 and DI2 function needs to work with external Analog Interface as Figure 3-82 shows.

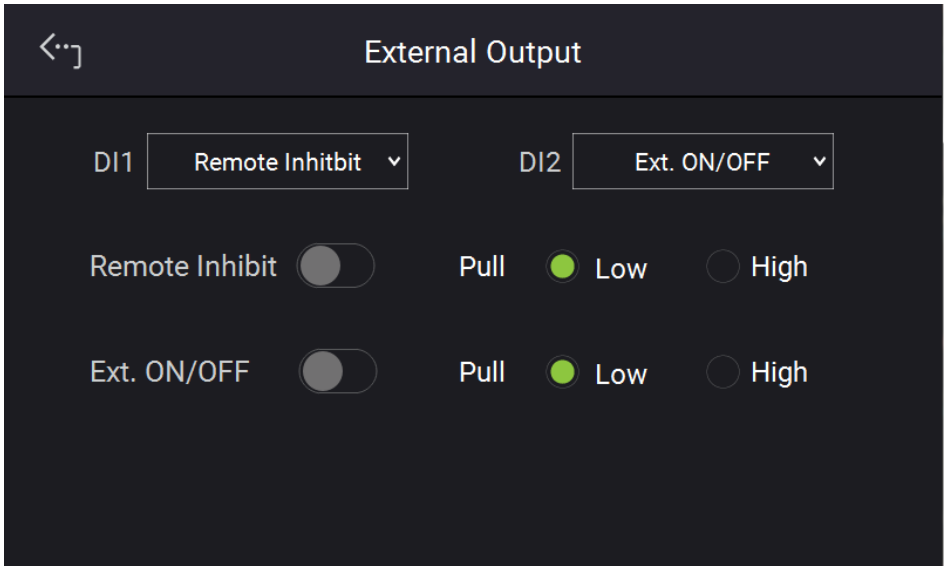


Figure 3-82

1. Remote INHIBIT function allows users to remotely turn-off power supply. Logic: Low sets Remote INHIBIT to enable, the power supply's ON/OFF is still controlled by "On". When the Pin 6 and Pin18 (_INHIBIT) of ANALOG INTERFACE are triggered in low level that equals to tap "On" on the front panel and set OUTPUT = OFF. The DC power supply will shut down and sends out a protection signal (in this case the "On" button will be off), and Pin6 and Pin18 (_INHIBIT) of ANALOG INTERFACE cannot be used to release the protection.
2. When protection occurs to REMOTE INHIBIT the main page will appear the protection message as Figure 3-83 shows.
3. Tap "Confirm" to return to the main page.

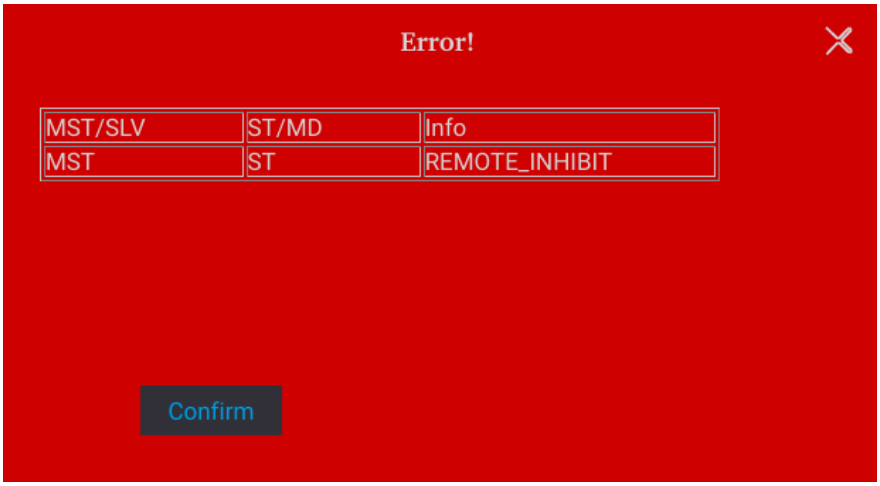


Figure 3-83

4. Pin6 and Pin18 are the input pins of TTL Level and are able to set the initial state to logic: ON=HIGH or OFF=LOW.
5. When the DC power supply is set to OUTPUT = ON, the detail actions of REMOTE INHIBIT are shown in Figure 3-84.

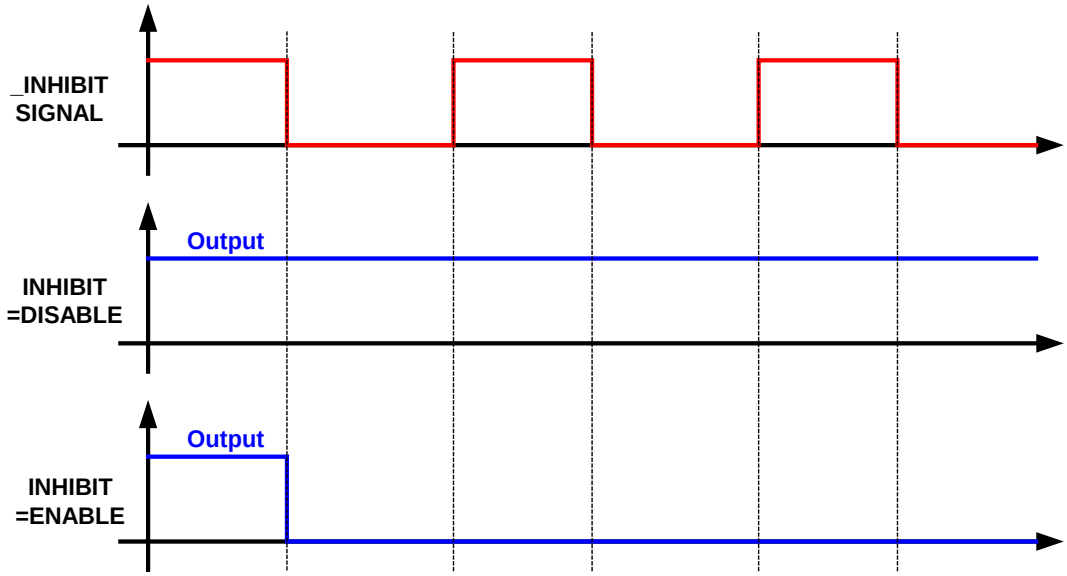


Figure 3-84

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

1. 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 the Pin 6 & 18 (_EXT_ON) replaces 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.

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

3. When the DC power supply is set to OUTPUT = ON, the detail actions of EXTERNAL ON/OFF are as shown in Figure 3-85.

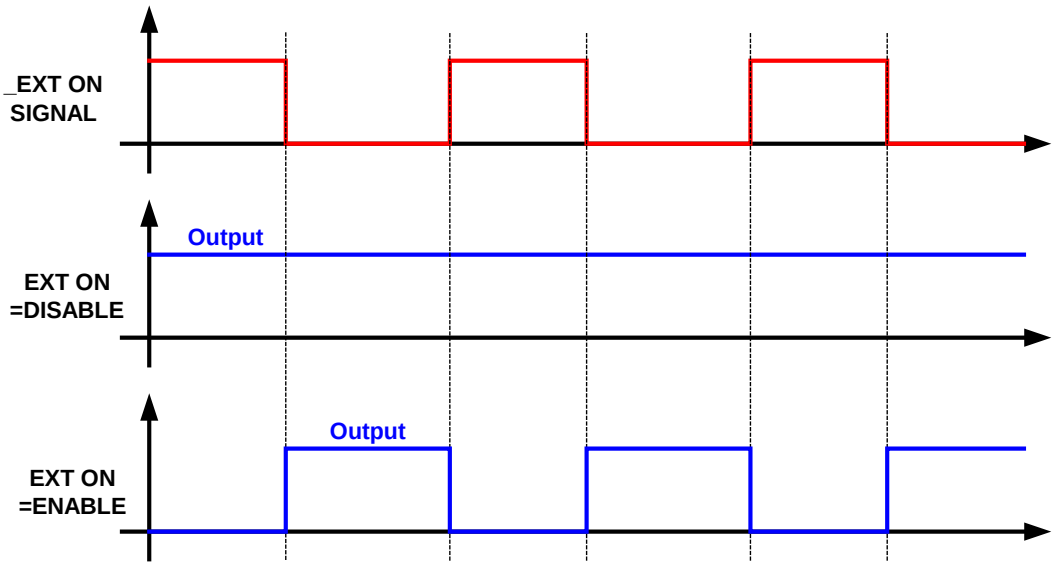


Figure 3-85

4. Program Sequence

The 62000D 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 that total 100 sequences are 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. In 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.

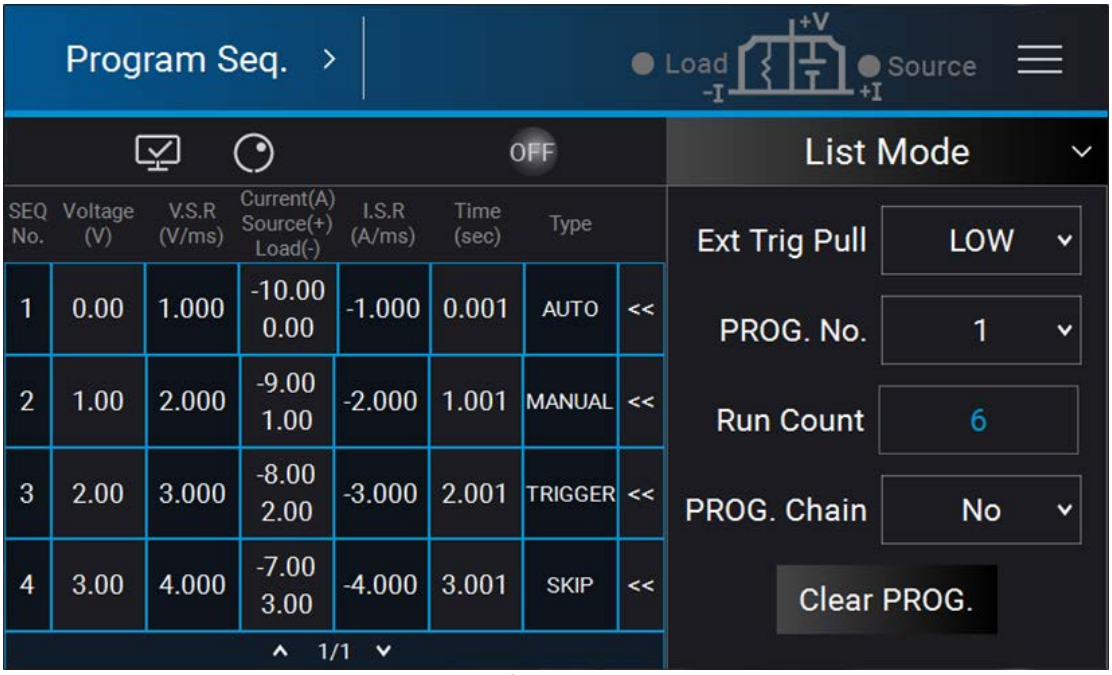


Figure 4-1

V_STEP MODE provides a run time voltage program with the 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.

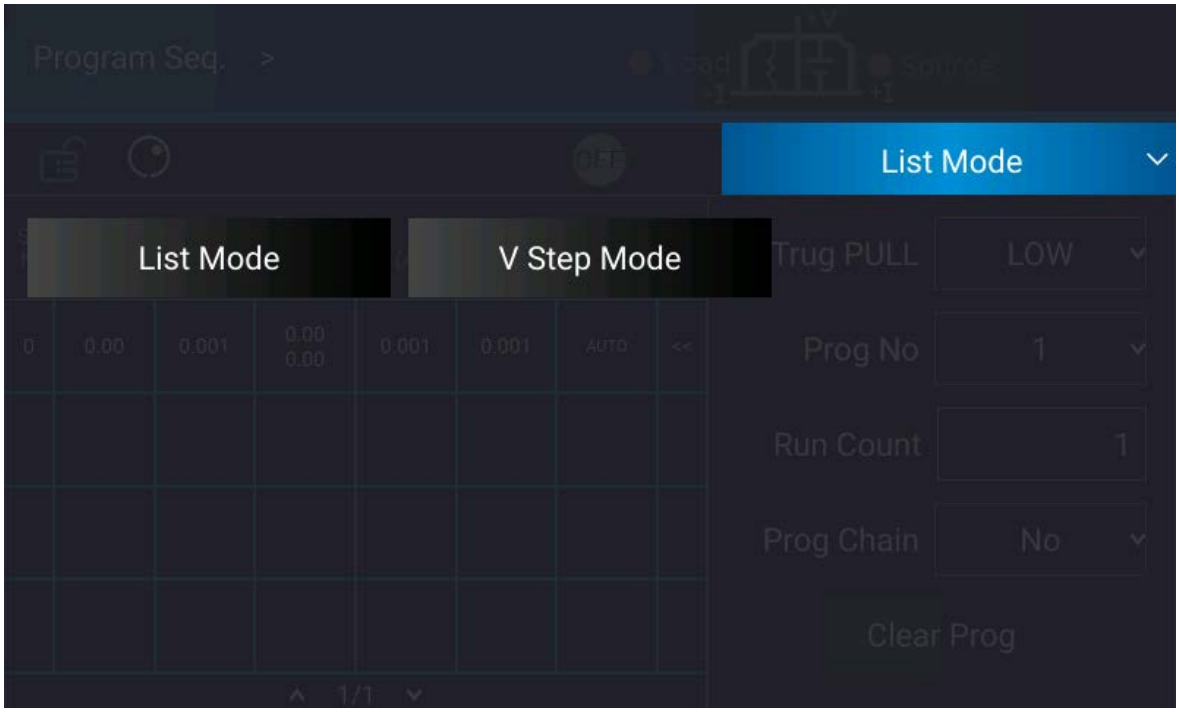


Figure 4-2

Figure 4-3

4.1 List Mode

In List Mode there are maximum 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.

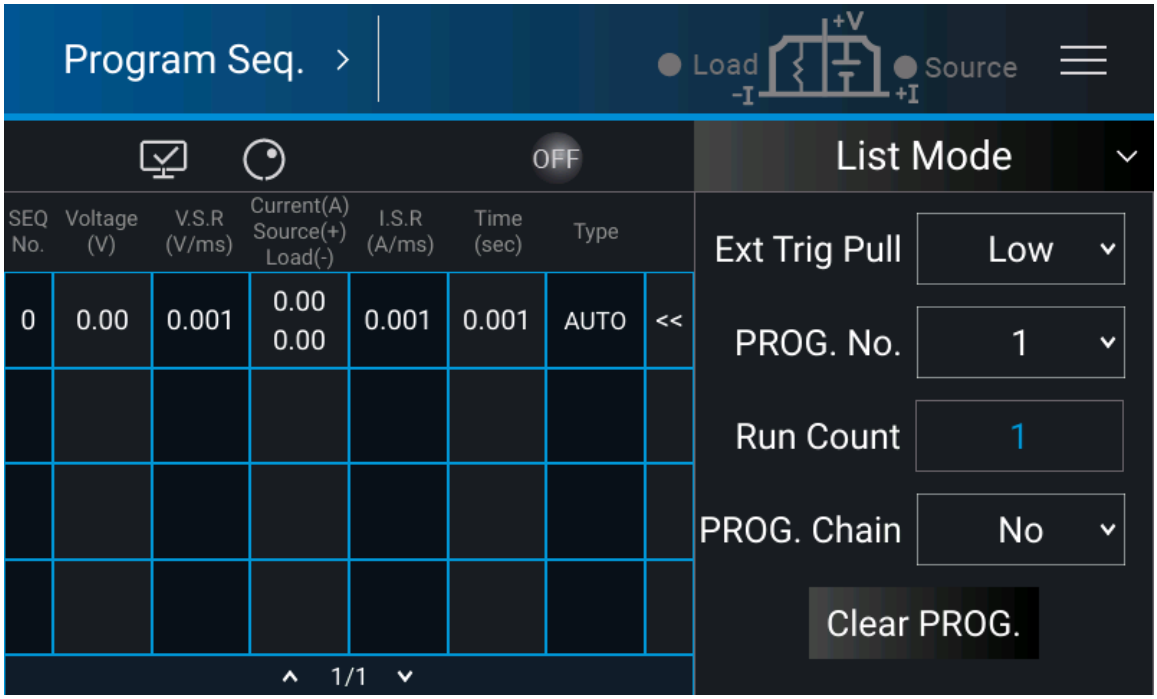


Figure 4-4

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 and changes it to 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 and 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

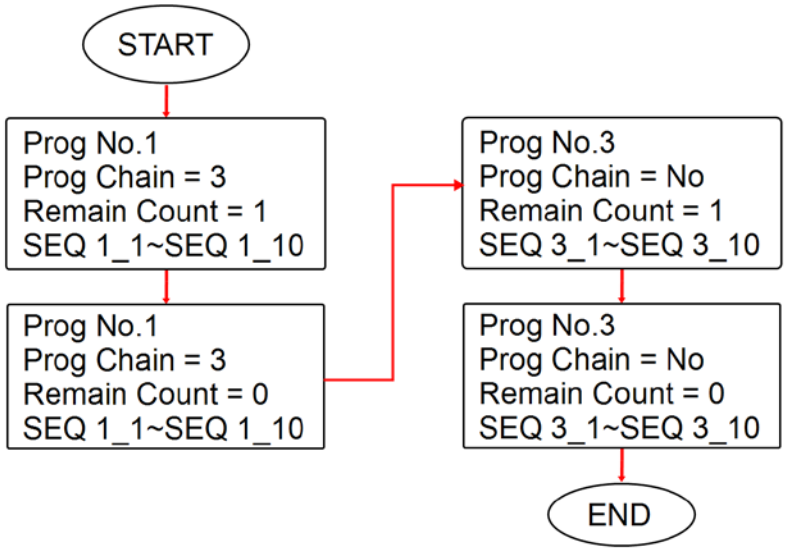


Figure 4-5

4.1.1.4 Setting Program 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 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, jump to Prog No.6.
(3) End

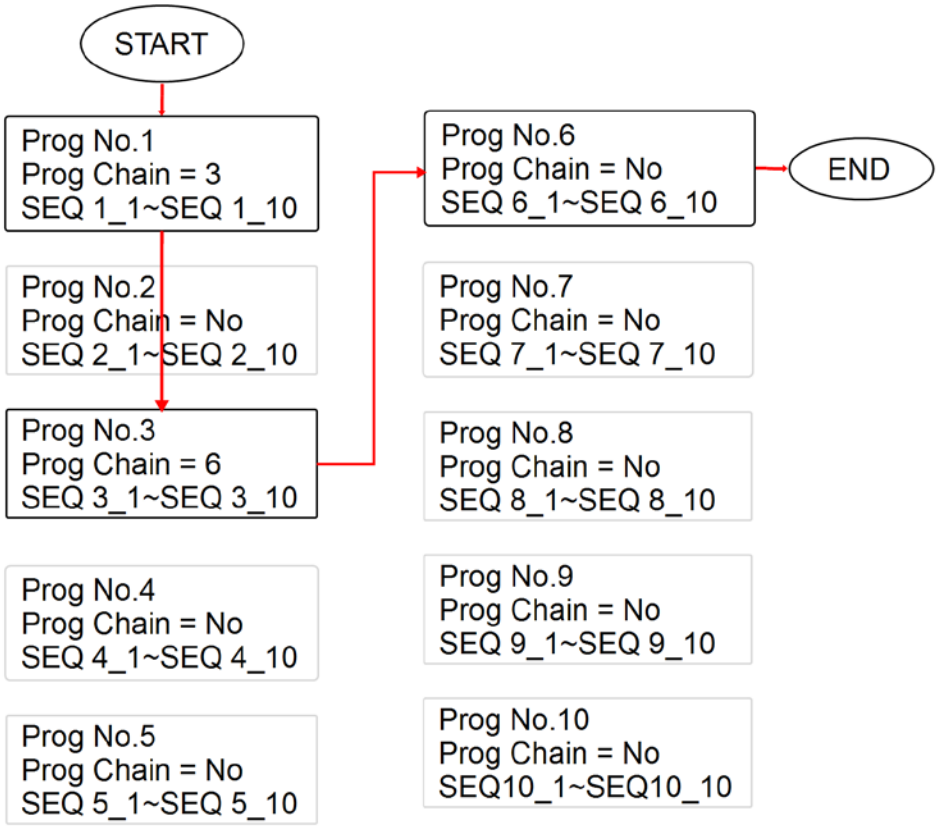


Figure 4-6

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.

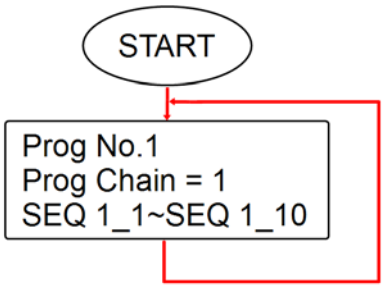


Figure 4-7

Notice If program is commanded to skip to next Program and there is no sequence or all sequences are set to Skip (see 4.1.2.1), then 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 maximum 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 step a and b to a new sequence.

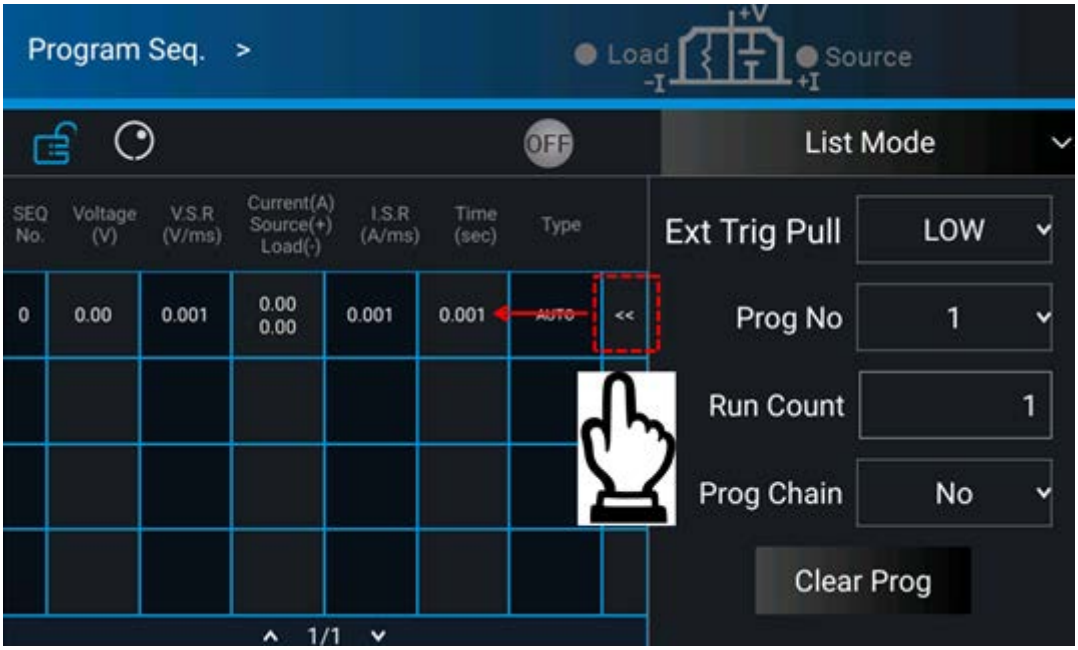


Figure 4-8

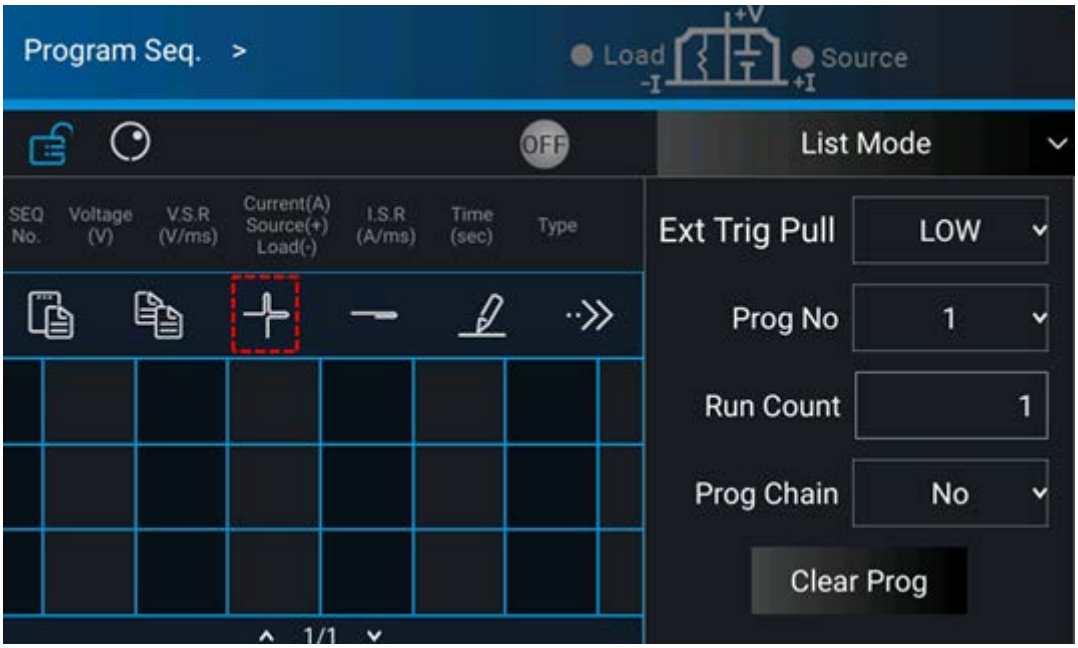


Figure 4-9

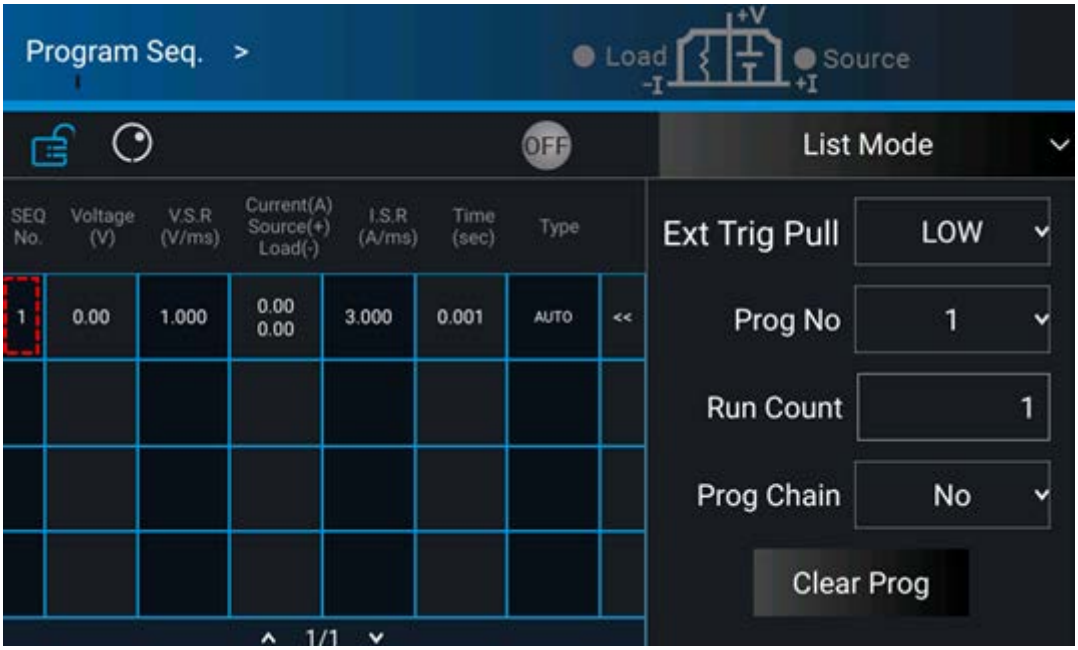


Figure 4-10

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 included 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.

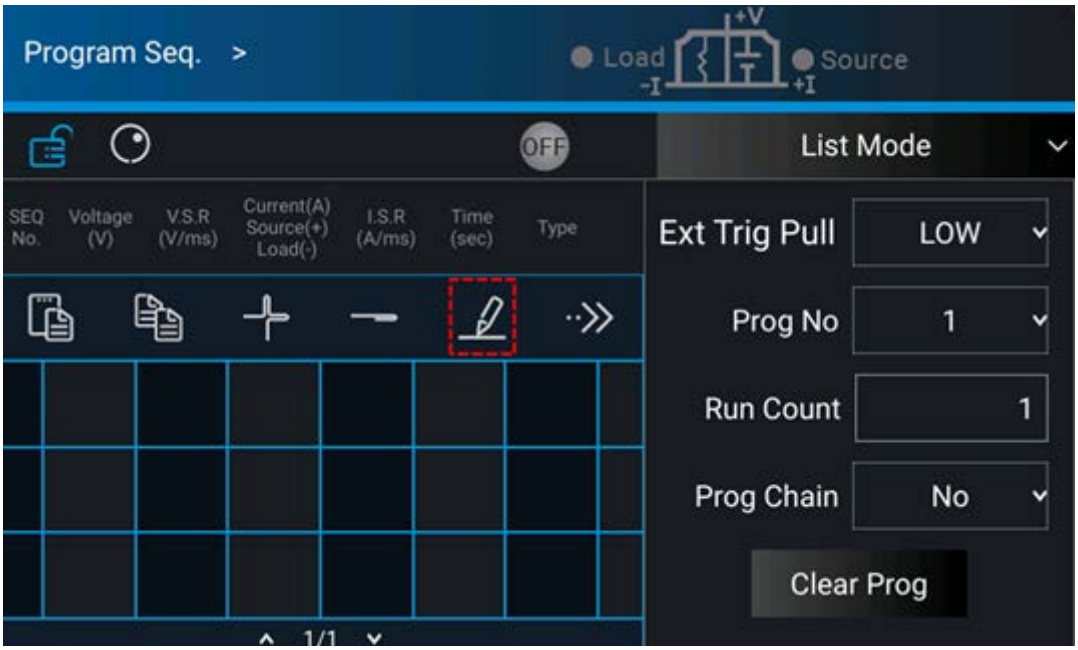


Figure 4-11

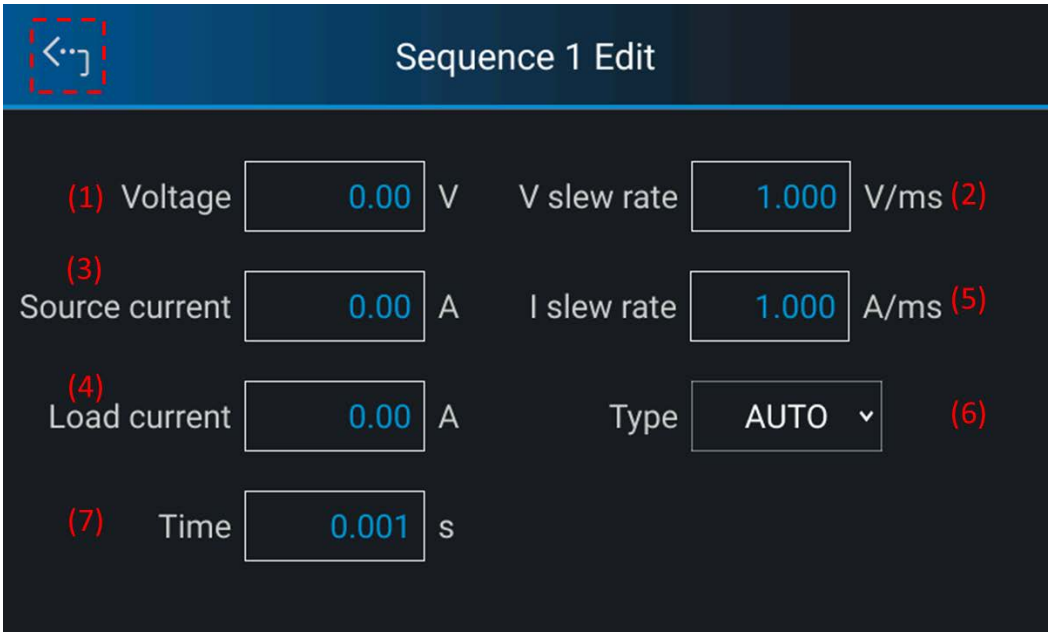


Figure 4-12

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 as Figure 4-13 indicates the sequence will complete the execution automatically and skip to next sequence.

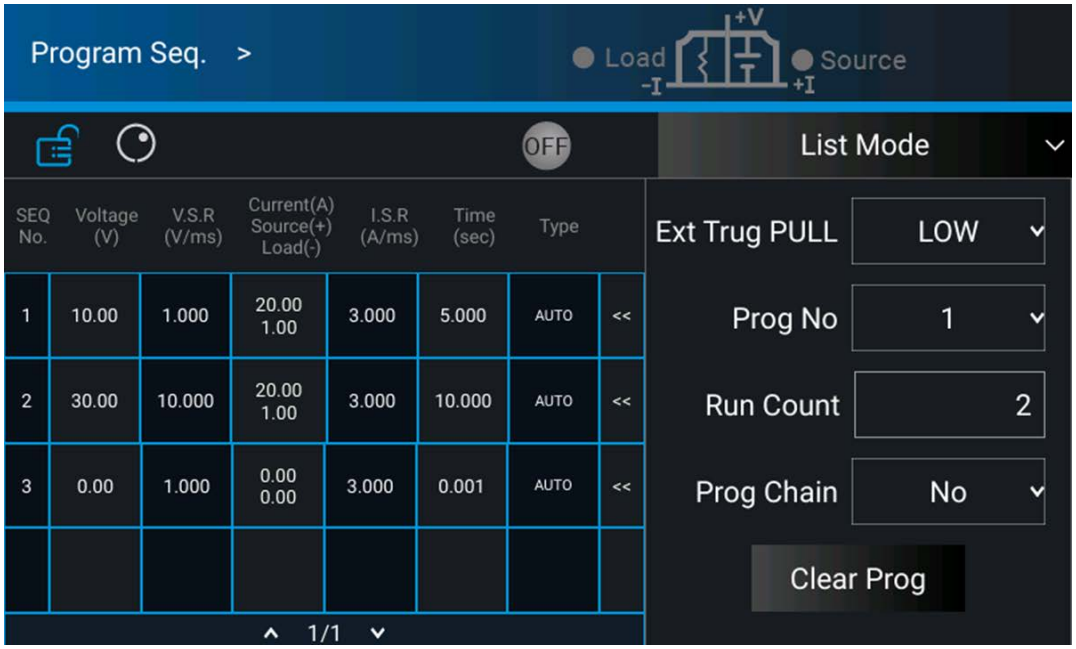


Figure 4-13

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 reached 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 voltage rise.
  (3) Once the voltage reached 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.

Figure 4-14 shows the output waveform:

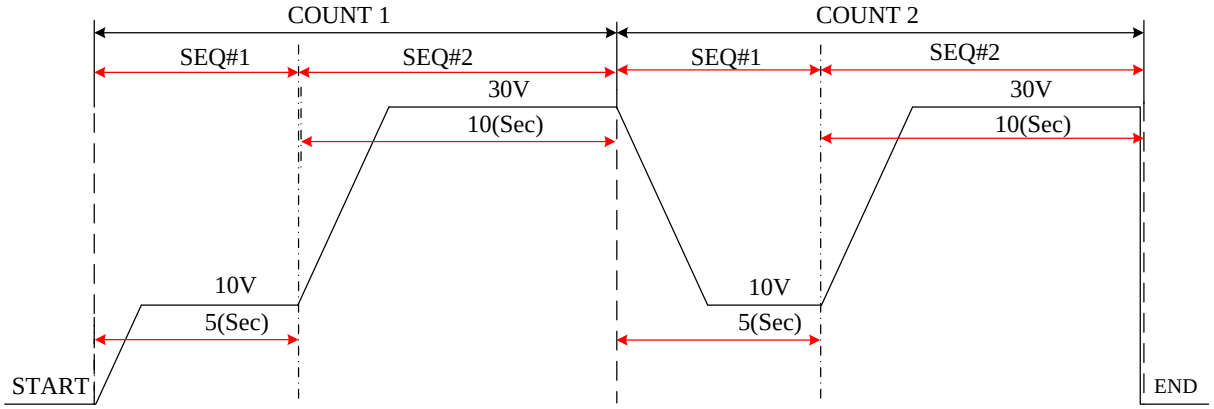


Figure 4-14

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 next sequence until any key on the front panel is presses. User will not be asked to enter the time the sequence to be remained when set to MANUAL.

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 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 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 detail 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 detail description.

4.1.2.5 Setting Current

1. Tap Figure 4-12 (3) (4) to set the current parameter.
2. See section 3.2 for detail 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 detail 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 user 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, (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 value box after Start V and the touch panel will switch to a numeric pad as show 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 “Rotary” ( ) knob. Tap the value box after Start V and the cursor at lower right will flicker.
2. When “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 load.

4.2.1.2 Setting End V

There are two methods to set End V:

Method 1 (via touch panel):

1. Tap the value box after End V and the touch panel will switch to a numeric pad as show 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 “Rotary” ( ) knob. Tap the value box after End V and the cursor at lower right will flicker.

2. When "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 box 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 "Rotary" ( ) knob. Tap the value box after Run time and the cursor at lower right will flicker.
2. When "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 V_SET 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 MAIN PAGE as shown in Figure 3-4 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 initial voltage is 0V and the output waveform is as Figure 4-17 shows.
CASE2: The hardware initial voltage is 10V and the output waveform is as Figure 4-18 shows.
CASE3: The hardware initial voltage is 20V and the output waveform is as Figure 4-19 shows.

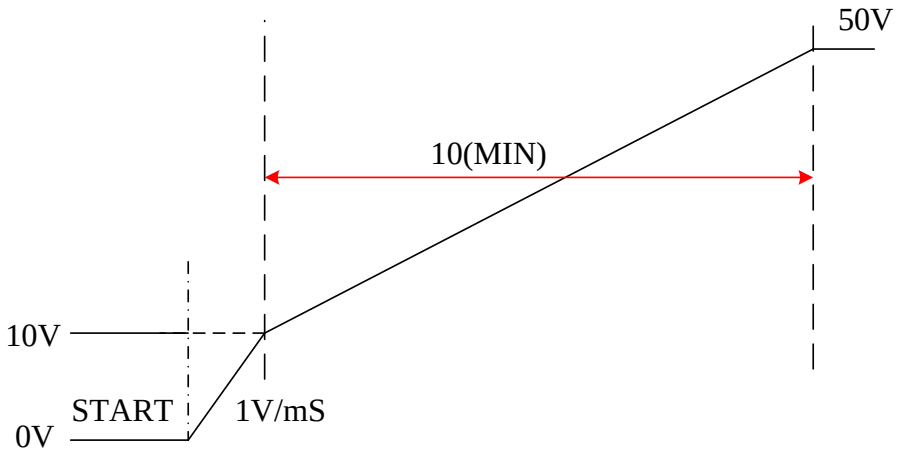


Figure 4-17

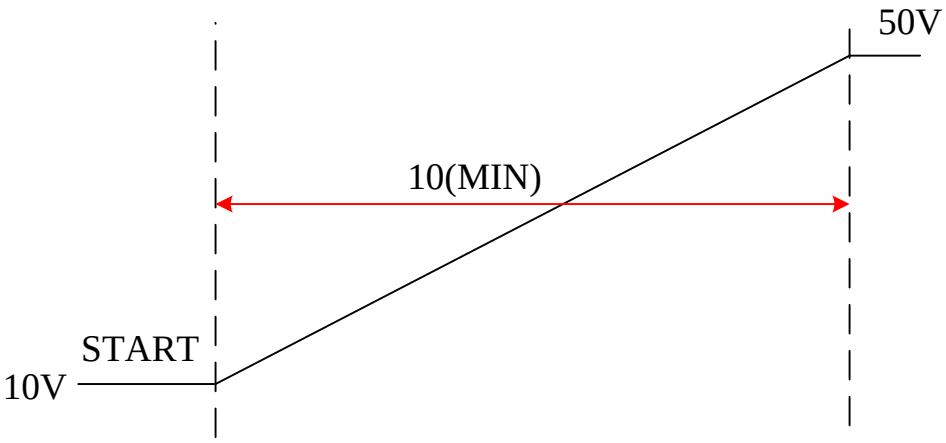


Figure 4-18

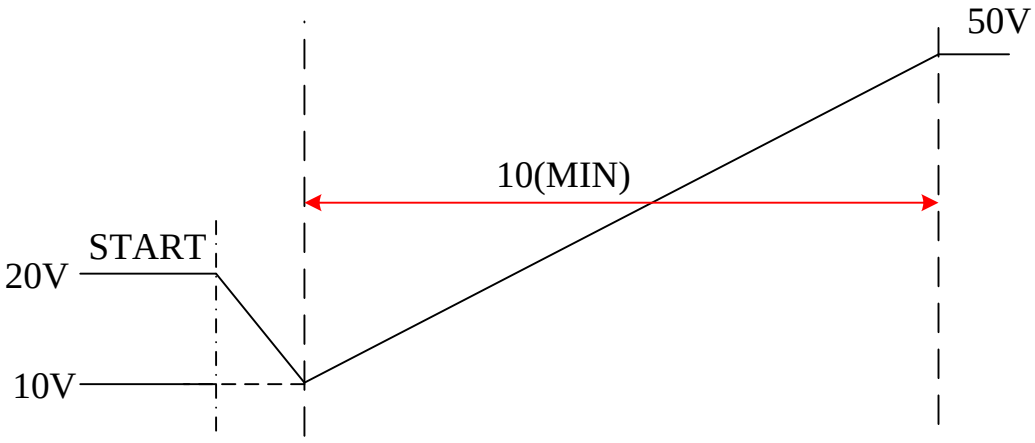


Figure 4-19

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.

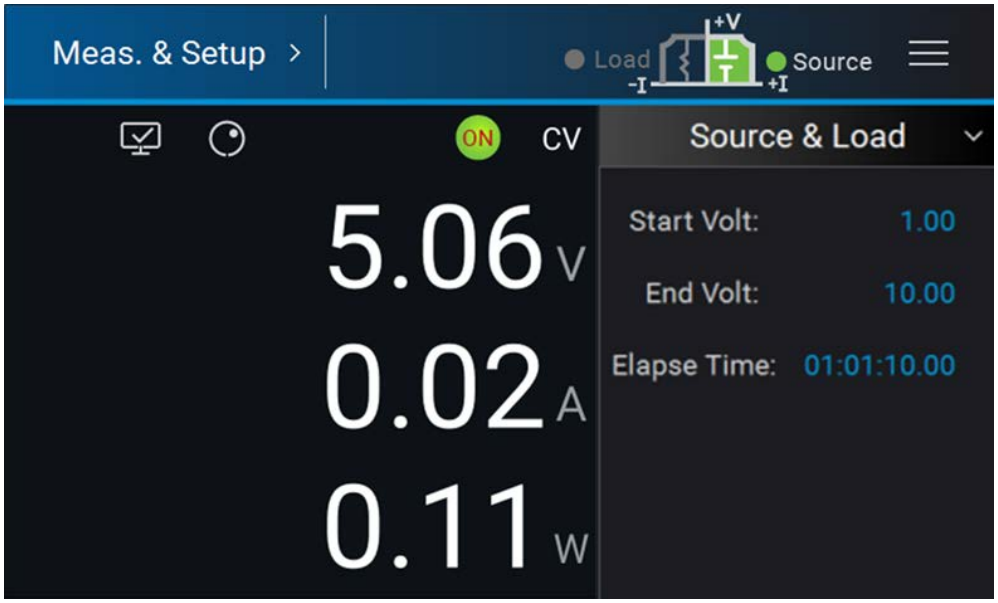


Figure 4-20

When V Step Mode is executed:

1. Start Volt: It is the start voltage setting of V Step Mode.
2. End_Volt: It is the end voltage setting of 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 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 network 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
(4)	Installing Driver:	62000D Series USB Interface supports USBTMC, so if the PC OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) it 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 62000D 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 3.2.4.

5.1.3 Ethernet Remote Control

To remote program a 62000D DC power supply via a PC with Ethernet interface, the 62000B 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 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 through GPIB. When in remote mode, all front panel keys are invalid except RMT. Tap " RMT " 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	|	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 62000D 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 prior the suffix. Table 5-4 lists the suffix used by 62000D 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 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
NRf	Flexible decimal format including NR1or NR2 or NR3.	123, 12.3, .23E+3

NRf+	Extended decimal format including NRf and MIN, MAX. MIN and MAX is the high and low limit of 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 query command are shown in either of the following forms:

<CRD> Character Response Data: character string with 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. In order 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 Headers

Program headers are key words that identify the command. They follow 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. Program headers consist of two distinctive types, common command headers and instrument-controlled headers.

5.3.5.3 Common Command and Query Headers

The syntax of common command and query headers 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 commands.

5.3.5.4 Instrument-Controlled Headers

Instrument-controlled headers are used for all other instrument commands. Each of them has a long form and a short form. 62000H Series only accepts the exact short and long forms. 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 program header with one space at least.

5.3.5.6 Program Message

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

5.3.5.7 Program Message Unit

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

Example: VOLT?, OUTPut ON.

5.3.5.7.1 Program Message Unit Separator (;)

The separator (semicolon ;) separates the program message unit from one 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 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 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 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 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 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.

***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
***STB?**	Read status byte query
ABORt	Sets all output state to “OFF”.
CONFigure:BEEPer	Sets beeper to ON or OFF.
CONFigure:OUTPut	Sets the voltage/current output.
CONFigure:FOLDback	Sets the type of FOLDBACK PROTECT.
CONFigure:FOLDT	Sets the delay time of FOLDBACK PROTECT.
CONFigure:APGVSet	Sets the action type of APG VSET.

CONFigure:APGVMeas	Sets the action type of APG VMEAS.
CONFigure:APGISet	Sets the action type of APG SOURCE / LOAD ISET.
CONFigure:APGIMeas	Sets the action type of APG IMEAS.
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 panel.
CONFigure:MSTSLV:ID	Sets the device to Master .
CONFigure:MSTSLV:PARSER	Sets to series or parallel mode.
CONFigure:MSTSLV:NUMSLV	Sets the number of SLAVE to be controlled.
CONFigure:MSTSLV:READY?	Queries the Master/Slave connection status.
CONFigure:MSTSLV	Executes the Master/Slave control.
CONFigure:INHibit	Executes the Remote Inhibit control.
CONFigure:INHibit:PULL	Executes the Remote Inhibit input signal to enhance the resistance control.
CONFigure:INTERLOCK	Executes the Safety Interlock control.
CONFigure:INTERLOCK:PULL	Executes the Safety Interlock input signal to enhance the resistance control.
CONFigure:EXTON	Executes the External ON/OFF control.
CONFigure: EXTON:PULL	Executes the External ON/OFF input signal to enhance the resistance control.
SOURce:VOLTage	Sets the output voltage.
SOURce:VOLTage:LIMit:{HIGH/LOW}	Sets the output voltage range.
SOURce:VOLTage:PROTect:HIGH	Sets the voltage range for over voltage protection.
SOURce:VOLTage:SLEW	Sets the rising or falling slew rate (volt/ms) of output voltage.
SOURce: CURRent	Sets the output current (ampere).
SOURce:CURRent:LIMit:{HIGH/LOW}	Sets the output current range.
SOURce:CURRent:PROTect:HIGH	Sets the current range for over current protection.
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 power range for over power protection.
SOURce:DCON:{RISE/FALL}	Sets the DC_ON signal active point.
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.
FETCh:VOLTage?	Measures the output of power supply and returns real time voltage.
FETCh:CURRent?	Measures the output of power supply and

	returns real time current (with sign).
FETCh:POWer?	Measures the output of power supply and returns real time power (with sign).
FETCh:STATus?	Returns the status code of power supply's state.
MEASure:VOLTage?	Returns the voltage measured at the output of power supply.
MEASure:CURRent?	Returns the current measured at the output of power supply (with sign).
MEASure:POWer?	Returns the power measured at the output of power supply(with sign).
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 current slew rate for output in List mode.
PROGram:SEQuence:CURRent:LOAD	Sets the sequence for Load current output in List mode.
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.
SYSTem:ERRor?	Returns the error message and code of power supply.
SYSTem:MODE	Sets the Source/Load output mode of the

	system.
SYSTem:VERSion:INTernal?	Queries the Host version
SYSTem:MODule:VERSion?	Queries the module version.
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 baudrate.
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:SCPI:ID	Sets the CAN SCPI ID.
SYSTem:COMMunicate:CAN:APPLY	Updates the CAN setting.
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 setting.
INSTrument:STATus:AD?	Returns the AD module status.
INSTrument:STATus:DD?	Returns the DD module status.

5.6.1 Common Command Syntax

Commands are defined by 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 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 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
62180D-600	Model name
123456	Serial No.
01.00	Firmware version

Return Example: Chroma,62180D-600, 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 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 enable bits are logically ORed to cause Bit 6 (the Master Summary Status Bit) of the Status Byte register to be set. See Status Byte register for detail 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 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 byte set to “1”.)

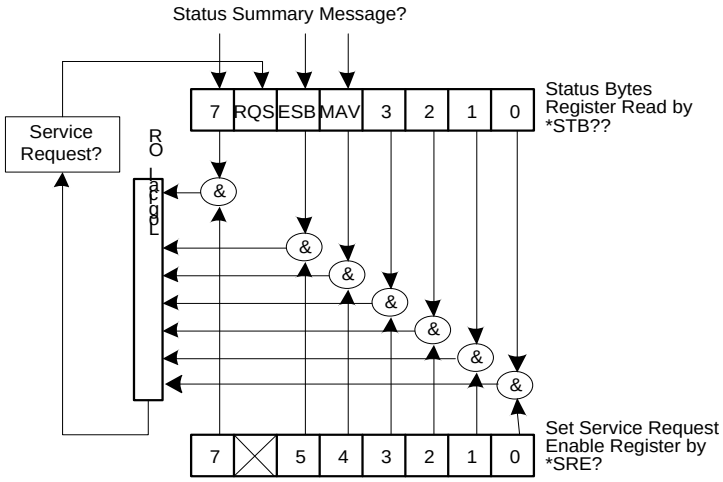


Figure 5-1

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.

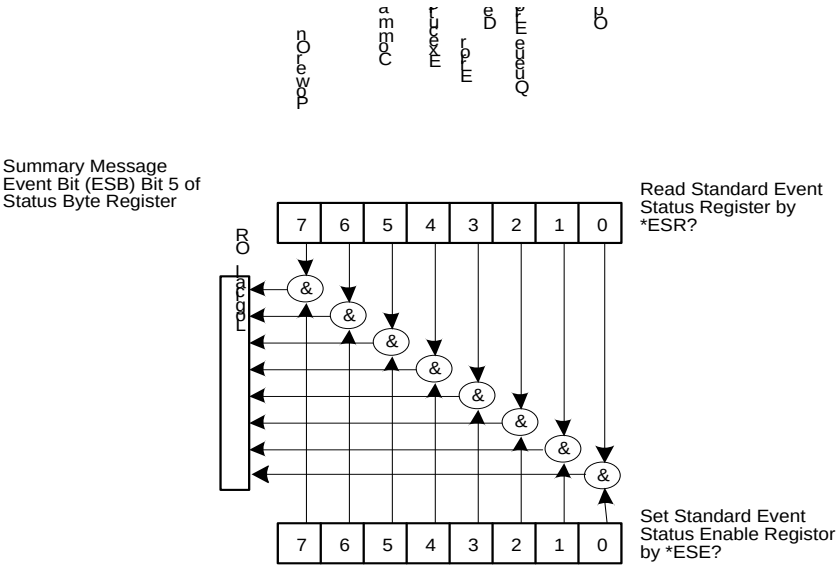


Figure 5-2

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 that 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	

5.6.2 Specific Commands for 62000D Series

5.6.2.1 Subsystem

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

5.6.2.2 CONFIGURE

1. 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

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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.

8. 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

9. 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

10. 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

11. CONFigure:BRIGhtness

Description:	Sets the display brightness of 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

12. 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.)

13. 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 | SERIES
Example:	CONFigure:MSTSLV:PARSER PARALLEL
Query Syntax:	CONFigure:MSTSLV:PARSER?
Return Parameter:	PARALLEL | SERIES
Query Example:	CONFigure:MSTSLV:PARSER?
Return Example:	PARALLEL

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

14. 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. Only 1 slave can be set when in series mode and maximum 3 slaves can be set when in parallel mode.
3. Keypro is required for series connection, so be sure to connect it first in series mode. Release and remove the keypro when operating standalone or in parallel mode.

15. 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

16. 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 command 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.

17. CONFigure:INHibit

Description:	Executes the Remote Inhibit control.
Syntax:	CONFigure:INHibit <Arg>
Parameter:	<Arg>: DISABLE | ENABLE
Example:	CONFigure:INHibit DISABLE
Query Syntax:	CONFigure:INHibit?
Return Parameter:	DISABLE | ENABLE
Query Example:	CONFigure:INHibit?
Return Example:	DISABLE

18. CONFigure:INHibit:PULL

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

19. 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

20. 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

21. CONFigure:EXTON

Description: Executes the External ON/OFF control.
Syntax: CONFigure:EXTON <Arg>
Parameter: <Arg>: DISABLE | ENABLE
Example: CONFigure:EXTON DISABLE
Query Syntax: CONFigure:EXTON?
Return Parameter: DISABLE | ENABLE
Query Example: CONFigure:EXTON?
Return Example: DISABLE

22. CONFigure: EXTON:PULL

Description: Executes the External ON/OFF input signal to enhance the resistance control
Syntax: CONFigure: EXTON:PULL <Arg>
Parameter: <Arg>: LOW | HIGH
Example: CONFigure: EXTON:PULL LOW
Query Syntax: CONFigure: EXTON:PULL?
Return Parameter: LOW | HIGH
Query Example: CONFigure: EXTON:PULL?
Return Example: LOW

5.6.2.3 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 volt.
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 volt/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 return 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 current 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 current 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 watt.
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:{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.

5.6.2.4 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 amps.
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 watt.
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 protect can be set.
Return Example:	1.260000e+03	

5.6.2.5 FETCH Subsystem

1. FETCh:VOLTage?

Description: Measures the output of 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 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 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 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 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	Reserve
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	Reserve	BIT 23	Boot Up Initial Error
BIT 8	Reserve	BIT 24	FAN Start Up Error

BIT 9	Reserve	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	Reserve
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

5.6.2.6 MEASURE Subsystem

1. MEASure:VOLTage?

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

5.6.2.7 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 到 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 for 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 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 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 : Source and Load current 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 –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

5.6.2.8 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"
-231	"Sequence selected error"		

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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

8. 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

9. 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

10. 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

11. 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

12. 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

13. 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

14. SYSTem:COMMunicate:CAN:SCPI:ID

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

15. 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

16. 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

17. 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

18. 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”

19. 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”

20. 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”

21. 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

5.6.2.9 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	AD_VDC_OVP	BIT 16	DD_IO_REG_OCP
BIT 1	AD_VDC_UVP	BIT 17	AD_RLY_STARTFAIL
BIT 2	AD_VRS_OVP	BIT 18	AD_PWM_TOP_FAULT
BIT 3	AD_VTR_OVP	BIT 19	AD_PWM_BOT_FAULT
BIT 4	AD_VST_OVP	BIT 20	AD_AC_STARTFAIL
BIT 5	AD_VRS_UVP	BIT 21	AD_PFC_STARTFAIL
BIT 6	AD_VTR_UVP	BIT 22	AD_HARD_ERR
BIT 7	AD_VST_UVP	BIT 23	DD_VO_UVP_S
BIT 8	DD_VO_OVP_F	BIT 24	AD_MODEL_RES_ERR
BIT 9	DD_VO_UVP_F	BIT 25	DD_SHORT
BIT 10	AD_IR_OCP	BIT 26	AD_MEM_ERR
BIT 11	AD_IT_OCP	BIT 27	DD_LLC_STARTFAIL
BIT 12	AD_IS_OCP	BIT 28	AD_VAC_UBL
BIT 13	AD_Vd_OVP	BIT 29	DD_IP_OCP

BIT 14	DD_IO_SRC_OCP	BIT 30	AD_Vd_UVP
BIT 15	AD_OTP	BIT 31	AD_FRE_ERR

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	Reserve
BIT 1	SOCP	BIT 17	Reserve
BIT 2	LOCP	BIT 18	Reserve
BIT 3	IL_SHARE	BIT 19	Reserve
BIT 4	SENSE_FAULT	BIT 20	Reserve
BIT 5	MODULE_ERR	BIT 21	Reserve
BIT 6	AD_ERR	BIT 22	Reserve
BIT 7	OTP	BIT 23	Reserve
BIT 8	HOST_SHUTDOWN	BIT 24	Reserve
BIT 9	UTP	BIT 25	Reserve
BIT 10	Reserve	BIT 26	Reserve
BIT 11	MOS_SHORT	BIT 27	PWM_CH1_WARN
BIT 12	HOST_SYNC	BIT 28	PWM_CH2_WARN
BIT 13	DB_FAULT	BIT 29	PWM_CH3_WARN
BIT 14	AUX_FAULT	BIT 30	CAN_ID_WARN
BIT 15	Reserve	BIT 31	PCB_VER_WARN

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

6. Operation Theory

6.1 Overview

The 62000D DC power supplies have AL, B, BD, CB, CD, CP, D, E, EA, EB, EC, EI, EL, F, G, H, IR, L, LC, OP, P, RP, SE, and the communication interface GPIB/CAN board (option). The instruments have a total of 24 internal circuit boards As follows;

- AL board is the 3-phase AC input power.
- B board is the DC to DC voltage power board for output stage.
- BD board is the DC to DC driver for output.
- CB board is the output measurement circuit board.
- CD board is the DC to DC output digit board.
- CP board is the input stage measurement circuit, module auxiliary power, and digital control board.
- D board is the system digital board.
- E board is the EMI filter.
- EA board is the EMI X capacitor board.
- EB board is the surge absorber.
- EC board is the EMI Y capacitor board.
- EI board is the 3-phase AC input connector.
- EL board is the EMI capacitor board.
- F board is the input stage boost capacitor board.
- G board is screen display.
- H board is the input stage boost inductor and rectifier output capacitor.
- IR board is the Inrush inhibit circuit board.
- L board outputs DC to DC inductor and rectifier capacitor.
- LC board is the DC to DC output filter circuit board.
- OP board is the output parallel board.
- P board is the voltage rise control board for input stage and DC to DC power component board for high voltage.
- RP board is the remote sense board.
- SE board is the software security protection lock.
- Communication interface GPIB/CAN board (option) per customer’s requirement.

Figure 6-1 shows the system diagram.

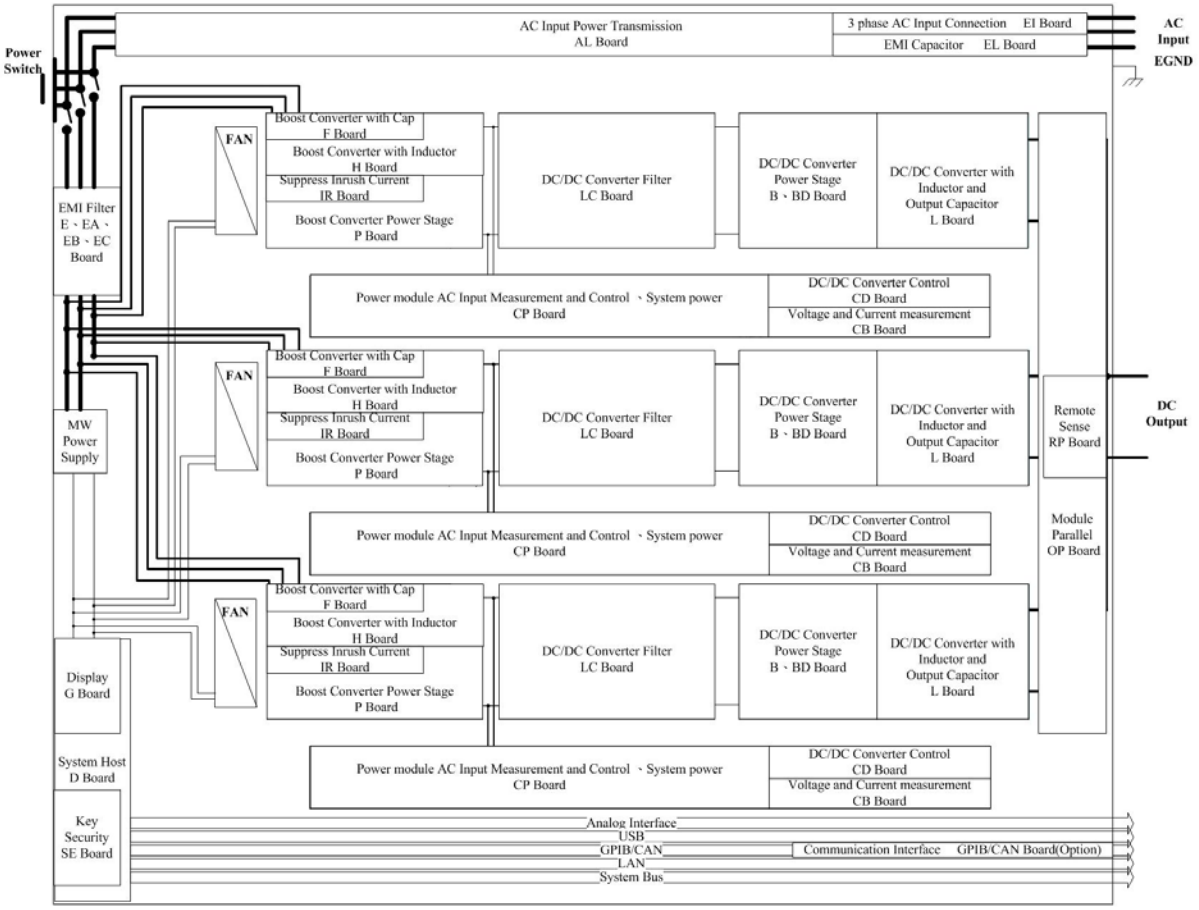

Power Switch
AC Input Power Transmission
AL Board
3 phase AC Input Connection EI Board
EMI Capacitor EL Board
AC Input
EGND
FAN
Boost Converter with Cap
F Board
Boost Converter with Inductor
H Board
Suppress Inrush Current
IR Board
Boost Converter Power Stage
P Board
DC/DC Converter Filter
LC Board
DC/DC Converter
Power Stage
B、BD Board
DC/DC Converter with
Inductor and
Output Capacitor
L Board
EMI Filter
E、EA、
EB、EC
Board
Power module AC Input Measurement and Control 、System power
CP Board
DC/DC Converter Control
CD Board
Voltage and Current measurement
CB Board
MW
Power
Supply
Remote
Sense
RP Board
DC
Output
Module
Parallel
OP Board
Display
G Board
System Host
D Board
Key
Security
SE Board
Analog Interface
USB
GPIB/CAN
LAN
System Bus
Communication Interface GPIB/CAN Board(Option)

Figure 6-1

7. Self Test and Troubleshooting

7.1 Overview

Follow the actions described in this chapter to inspect the instrument and troubleshoot problems if the power supply is unable to operate normally. Please consult the 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 3.2.4.4 Calibration.
Output is not within Accuracy SPEC.	Feature swings due to aged components.	It needs calibration periodically. See section 3.2.4.4 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 over load or enlarge the OPP settings.
Over Current Protection (OCP)	The output current exceeds the spec. or OCP settings.	Remove the over load 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 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 DC power supply is incorrect. 2. The GPIB cable is loose and fallen at 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 correctly and then power it on again. 2. Consult with your local sales

Problem	Cause	Resolution
		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 with 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 rear panel as Figure A-0-1 shows:

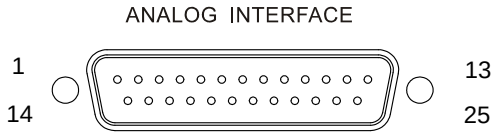


Figure A-0-1

Pin No.	Pin Definition	Pin No.	Pin Definition
1	DCOUT_ON	14	FAULT
2	DC_ON_ST	15	PROG_TRIG
3	INTERLOCK	16	DPG_GND
4	DO1	17	DO2
5	N.C.	18	DI1
6	DI2	19	DPG_GND
7	KEYPRO	20	N.C.
8	AIO_S_SET_V	21	AVO_SET_V
9	AIO_L_SET_V	22	APG_GND
10	AIO_MEAS_V	23	N.C.
11	N.C.	24	APG_GND
12	AVO_MEAS_V	25	N.C.
13	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 signal to trigger 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 detail description.
(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, it provides 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: KEYPRO, it is the foolproof mechanism for series/parallel hardware connection (KEYPRO), 0: Series, 1: Standalone and parallel.
(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 3.2.4.1.1 APG for detail 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 3.2.4.1.1 APG for detail 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 3.2.4.1.1 APG for detail 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 3.2.4.1.1 APG for detail 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; TTL: Active Low.
(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, it provides 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, voltage setting only that allows you to set in “voltage form” with input voltage range from 0 to 10V, see section 3.2.4.1.1 APG for detail 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 instrument and troubleshoot any problems if the 62000D DC power supply 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(*)	Means the output voltage exceeds the voltage set on the user protection interface .	The voltage set on protection interface is lower than the output voltage. (The maximum voltage can be set is Vmax×1.1.)	Check the protection interface voltage setting.
SOCP(*)	Means the output current in Source Mode exceeds the current set on the user protection interface.	The current set on protection interface is lower than the output current. (The maximum current can be set is Imax×1.1.)	Check the protection interface current setting.
SOPP(*)	Means the output power in Source Mode exceeds the power set on the user protection interface.	The power set on protection interface is lower than the output power. (The maximum power can be set is Pmax×1.05.)	Check the protection interface power setting.
OTP(*)	Means the internal temperature of the whole device is too high.	1. The operating environment temperature is over the limit. 2. The module component is abnormal. 3. The circuit detection is malfunction.	1. Eliminate the ambient overheating problem. 2. Check the abnormal phase power component and replace it. 3. Check the abnormal fan circuit board and sensing wire, and replace them.
FAN Lock(*)	Means the detected fan speed is abnormal.(Latch)	1. The fan is not connected. 2. The fan power is abnormal or damaged. 3. The fan is blocked by foreign object.	1. Make sure the fan is correctly connected. 2. Make sure the fan is normal and not damaged. 3. Make sure there is no foreign

			object blocking the fan.
Fold Back CV to CC(*)	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.
Fold Back CC to CV (*)	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(*)	Means the input current in Regen Mode exceeds the current set on the user protection interface.	The current set on protection interface is lower than the output current. (The maximum current can be set is Imax×1.1.)	Check the protection interface current setting.
LOPP(*)	Means the input power in Regen Mode exceeds the power set on the user protection interface.	The power set on protection interface is lower than the output power. (The maximum power can be set is Pmax×1.05.)	Check the protection interface power setting.
UTP(*)	Means the internal temperature of the whole device is too low.	1. The operating environment temperature is under the limit. 2. The module component is abnormal. 3. The circuit detection is malfunction.	1. Eliminate the ambient temperature too low problem. 2. Check the abnormal phase power component and replace it. 3. Check the abnormal fan circuit board and sensing wire, and replace them.
AD PROTECT(*)	Means the AC/DC and DC/DC (front) modules are abnormal and notify the system.	The AC/DC and DC/DC (front) module will notify the system for the alarm.	Check and replace the AC/DC and DC/DC (front) module boards where the protection occurred.
DD PROTECT(*)	Means the DC/DC (rear) module is abnormal and notifies the system.	The DC/DC (rear) module will notify the system for the alarm.	Check and replace the DC/DC (rear) module board where the protection occurred.
Inter Lock(*)	Means the external	ANALOG INPUT	Check if the external

	ANALOG INPUT Inter Lock triggers full device protection.	Interlock triggers the device protection.	ANALOG INPUT Interlock triggers the device protection.
FPGA_Fail(*)	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.
Security IC Error(*)	Means that an error is occurred during security IC identification.	The Security IC version is not correct.	Check if the correct Security IC version is correct.
Machine ID Error(*)	Means the identification of model name (number of modules) is wrong.	1. The firmware in Security IC version is wrong. 2. The Security IC is fallen off. 3. The Security IC is damaged.	1. Check the firmware in Security IC version. 2. Check if the Security IC is fallen off. 3. Check if the Security IC is broken.
System parameter Error(*)	Means the device power-on initialization is abnormal when reading the data.	1. The firmware in Security IC version is wrong. 2. The system control board is abnormal.	1. Check the firmware in Security IC version. 2. Check and replace the system control board.
Boot Up Initial Error(*)	Means the device initialization process is abnormal.	1. The burned in Security IC version is wrong. 2. The system control board is abnormal.	1. Check the firmware in Security IC version. 2. Check and replace the system control board.
AD Number Error(*)	Means the AC/DC and DC/DC (front) modules cannot be identified.	1. The comm. cable of AC/DC and DC/DC (front) module control board is fallen off. 2. The control board of AC/DC and DC/DC (front) module is abnormal.	1. Check if the comm. cable of AC/DC and DC/DC (front) module control board is fallen off. 2. Check and replace the control board of AC/DC and DC/DC (front) module.
DD Number Error (*)	Means the DC/DC (rear) module cannot be recognized.	1. The comm. cable of DC/DC (rear) module control board is fallen off.	1. Check if the comm. cable of DC/DC (rear) module control board is fallen off.

		2. The control board DC/DC (rear) module is abnormal.	2. Check and replace the control board of DC/DC (rear) module.
CD FPGA Number Error(*)	Means the DC/DC (rear) module cannot be recognized.	1. The comm. cable of DC/DC (rear) module control board is fallen off. 2. The control board DC/DC (rear) module is abnormal.	1. Check if the comm. cable of DC/DC (rear) module control board is fallen off. 2. Check if the control board of DC/DC (rear) module is damaged.
Cascade Conn Error(*)	Means the connection of multiple devices failed due to unable to recognize.	The comm. cable used for connecting multiple devices is wrong or fallen off.	Check if the connecting comm. Cable is wrong or fallen off.
Slave Protect Alarm(*)	Means the connected multiple Slave devices are warning the Master.	A Slave warning status is applied to multiple devices.	Check the Slave warning status.
Keypro In/Out(*)	Means the keypro for series connection has been re-plugged after rebooted.	This fixture is fallen off or unplugged during power on causing the protection.	Power off and remove the keypro, or re-plug the keypro and reboot the device.

The table below lists the protections of front stage module:

Message	Protection	Possible Cause	Troubleshooting
AD_OTP(*)	It occurs when the internal temperature of AC/DC or DC/DC (front) power module is too high.(Latch)	1. The operating environment temperature is over. 2. The module power switch is abnormal. 3. The circuit detection is malfunction.	1. Eliminate the ambient overheating problem. 2. Check the abnormal phase power module and replace it. 3. Check the abnormal fan circuit board and sensing wire, and replace them.
AD_VRS_OVP(*) AD_VTR_OVP(*) AD_VST_OVP(*)	Means the line transient input voltage of AD/DC module is over the specification. (Latch)	1. The input power is abnormal. 2. The AC/DC module measurement circuit 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.

AD_VRS_UVP(*) AD_VTR_UVP(*) AD_VST_UVP(*)	Means the line transient input voltage of AD/DC module is under the specification. (Latch)	1. The input power is abnormal. 2. The AC/DC module input fuse is broken. 3. The AC/DC module measurement circuit is abnormal.	1. Check if the input power meets the rated value. 2. Measure the AC/DC module input fuse and replace it. 3. Check and replace the AC/DC module board that has protection occurred.
AD_VAC_UBL(*)	Means the line input of the AD/DC module is unbalanced or phase loss. (Latch)	1. The input power is connected wrong (the line voltage difference is 10%). 2. The input power is disconnected (phase loss). 3. The AC/DC module fuse is damaged. 4. The measurement circuit of AC/DC module is abnormal.	1. Check if the 3-phase input line voltage meets the rated value. 2. Measure the AC/DC module fuse and replace it. 3. Check and replace the AC/DC module board that has protection occurred.
AD_FRE_ERR(*)	Means the line input frequency of the AD/DC module is out of specification. (Latch)	The mains frequency is abnormal.	Check if the mains frequency exceeds the range. (47Hz-63Hz)
AD_AC_STARTFAIL(*)	Means the AD/DC module has not reached the starting conditions and the DC BUS rectified voltage is out of specification. (Latch)	1. The input power is connected wrong. 2. The input power is disconnected. 3. The AC/DC module fuse is damaged. 4. The measurement circuit of AC/DC module is abnormal. 5. The drive signal of AC/DC module relay is abnormal or the relay is damaged. 6. The PWM drive signal of 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. 3. Check and replace the AC/DC module board that has protection occurred.

		7. The AC/DC power component is abnormal or damaged.	
AD_PFC_STARTFAIL(*)	Means the start of AD/DC module is failed and the DC BUS voltage is out of specification.(Latch)	1. The measurement circuit of AC/DC module is abnormal. 2. The drive signal of AC/DC module relay is abnormal or the relay is damaged. 3. The PWM drive signal of AC/DC module is abnormal. 4. The AC/DC power component is abnormal or damaged.	1. Check if the input power meets the rated value. 2. Measure the AC/DC module fuse and replace it. 3. Check and replace the AC/DC module board that has protection occurred.
AD_MODEL_RES_ERR(*)	Means the output terminal of the AD/DC module cannot be identified as a Buck or Inverter module. (Latch)	1. The GPIO pins are abnormal. 2. The hardware resistor is dropped or printed wrong.	1. Check and replace the AC/DC module board that has protection occurred.
AD_IR_OCP(*) AD_IT_OCP(*) AD_IS_OCP(*)	Means the transient input current of the AD/DC line is over the limit. (Latch)	1. The output transient power is too high (input line current is higher than 14Arms, 18kW; 12Arms, 12kW) 2. The measurement circuit of 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.
AD_VDC_OVP(*)	Means the DC BUS transient voltage of the AD/DC module is over the specification. (Latch)	1. The output transient power is too high (the VDC is over 850V that has protection occurred.) (Regen Mode) 2. The measurement circuit of 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.
AD_VDC_UVP(*)	Means the internal DC BUS transient voltage of the AD/DC module is under the	1. The output transient power is too high (the VDC is under 720V that	1. Remove the UUT and check if the operation is correct.

	specification. (Latch)	has protection occurred.) (Source Mode) 2. The measurement circuit of AC/DC module is abnormal. 3. The drive signal of AC/DC module relay is abnormal or the relay is damaged. 4. The PWM drive signal of AC/DC module is abnormal. 5. The AC/DC power component is abnormal or damaged.	2. Check and replace the AC/DC module board that has protection occurred.
AD_Vd_UVP(*)	Means the input voltage amplitude of the AD/DC module is under the specification. (Latch)	1. The input power is abnormal. 2. The AC/DC module fuse is damaged. 3. The measurement circuit of 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. 3. Check and replace the AC/DC module board that has protection occurred.
AD_Vd_OVP(*)	Means the input voltage amplitude of the AD/DC module is over the specification. (Latch)	1. The input power is abnormal. 2. The measurement circuit of 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. 3. Check and replace the AC/DC module board that has protection occurred.
AD_PWM_TOP_FAULT(*)	Means the internal power components of AD/DC module are shorted. (Latch)	The top power component on 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
AD_PWM_BOT_FAULT(*)	Means the internal power components	The bottom power component on the	

	of AD/DC module are shorted. (Latch)	AC/DC module is abnormal or damaged.	board that has protection occurred.
AD_HARD_ERR(*)	The front stage module in the device has triggered a protection. This message is used to stop the normal module from output. (Latch)	1. One of the AC/DC modules in the device has protection occurred. 2. A certain AC/DC module message or measured value cannot be found in the device.	1. Check and replace the AC/DC module board that has protection occurred.
AD_MEM_ERR(*)	Means the DSP memory on AC/DC module digital board is abnormal. (Latch)	The AC/DC module digital board DSP memory is abnormal.	Check and replace the digital board.
DD_LLC_STARTFAIL(*)	Means the start of DC/DC (front) module is failed, and the DC BUS voltage is out of specification. (Latch)	1. The measurement circuit of the DC/DC (front) module is abnormal. 2. The PWM drive signal of DC/DC (front) module is abnormal. 3. The power components of DC/DC (front) module are 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.
DD_SHORT(*)	Means the primary side transient of DC/DC module has over current. (Latch)	1. The LC board is unlocked or not secured. 2. The output terminal of the DC/DC module is shorted. 3. The top and bottom leg of secondary side switch on DC/DC module are shorted.	1. Check if the LC board is fully locked. 2. Check if the AD module output or the back-end UUT is shorted. 3. Measure if the MOS switch of the DC/DC module is broken.
DD_IP_OCP(*)	Means the internal transient of DC/DC (front) module has over current.(Latch)	1. The output transient power is too high (the IO module is over 51A peak that has protection occurred.) (Source/Regen	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC (front) module board that

		Mode) 2. The measurement circuit of the DC/DC (front) module is abnormal. 3. The PWM drive signal of DC/DC (front) module is abnormal. 4. The power components of DC/DC (front) module are abnormal or damaged.	has protection occurred.
DD_IO_SRC_OCP(*)	Means the internal transient of DC/DC (front) module has over current.(Latch)	1. The output transient power is too high (the IO module is over 12Arms, 18kW; 7.5A, 12kW that has protection occurred.) (Source Mode) 2. The measurement circuit of the DC/DC (front) module is abnormal. 3. The power components of DC/DC (front) module are abnormal or damaged.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC (front) module board that has protection occurred.
DD_IO_REG_OCP(*)	Means the internal transient of DC/DC (front) module has over current.(Latch)	1. The output transient power is too high (the IO module is over 10Arms, 18kW; 7A, 12kW that has protection occurred.) (Regen Mode) 2. The measurement circuit of the DC/DC (front) module is abnormal. 3. The power components of DC/DC (front)	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC (front) module board that has protection occurred.

		module are abnormal or damaged.	
DD_VO_OVP_F(*)	Means the DC BUS transient voltage of DC/DC (front) module is over the specification. (Latch)	1. The output transient power is too high (the DC BUS is over 900V that has protection occurred.) (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 DC/DC (front) module board that has protection occurred.
DD_VO_UVP_S(*)	Means the DC BUS transient voltage of DC/DC (front) module is under the specification. (Latch)	1. The transient power of DC/DC module is too high (the DC BUS is under 651V that has protection occurred.) (Source mode) 2. The measurement circuit of the DC/DC module is abnormal. 3. The drive signal of DC/DC module relay is abnormal or the relay is damaged. 4. The PWM drive signal of DC/DC module is abnormal. 5. The power components of DC/DC (front) module are abnormal or damaged.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC module board that has protection occurred.
DD_VO_UVP_F(*)	Means the DC BUS transient voltage of DC/DC (front) module is under the specification. (Latch)		

The table below lists the protections of rear stage module:

Message	Protection	Possible Cause	Troubleshooting
OVP(*)	Means the output voltage of the DD/DC (rear) module circuit is over the specification.	1. The power components of the DC/DC (rear) module are abnormal or damaged. 2. The measurement circuit of the	1. Check if the output active load meets the rated value. 2. Check and replace the DC/DC (rear) module board

		DC/DC (rear) module is abnormal.	that has protection occurred.
SOCP(*)	Means the Source Mode output current of the DC/DC (rear) module is over the limit.	1. The output current is too high (protection occurs when the module current is over 44A.) (Source Mode) 2. The measurement circuit of the DC/DC (rear) module is abnormal.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC (rear) module board that has protection occurred.
LOCP(*)	Means the Regen Mode input current of the DC/DC (rear) module is over the limit.	1. The input current is too high (protection occurs when the module current is over 44A.). (Regen Mode) 2. The measurement circuit of the DC/DC (rear) module is abnormal.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC (rear) module board that has protection occurred.
IL_SHARE(*)	Means the current flow in the DC/DC (rear) module is uneven.	1. The difference between the measured current the DC/DC (rear) module is 5A 2. The measurement circuit of the DC/DC (rear) module is abnormal.	1. Remove the UUT and check if the operation is correct. 2. Check and replace the DC/DC (rear) module board that has protection occurred.
SENSE_FAULT(*)	Means the output voltage of the DC/DC (rear) module is detected abnormally.	1. The DC/DC (rear) module output voltage sense is reversed. 2. It occurs when the load line loss is over 30V. 3. The measurement circuit of the DC/DC (rear) module is abnormal.	1. Remove the UUT and confirm if the voltage sense wiring of output terminal is correct. 2. Check if the load line loss is over the limit. 3. Check and replace the DC/DC (rear) module board that has protection

			occurred.
MODULE_ERR(*)	Means the model identification of 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 (rear) module board that has protection occurred.
AD_ERR(*)	Means the AC/DC and DC/DC (front) modules are abnormal, and notify the DC/DC (rear) module..	The AC/DC and DC/DC (front) module will notify the DC/DC (rear) module if there is any alarm.	Check and replace the AC/DC and DC/DC (front) module board that has protection occurred.
OTP(*)	Means the internal temperature of the power component in DC/DC (rear) module is too high.	1. The operating environment temperature is over the temperature 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. 3. Check the abnormal fan circuit board and sensing wire, and replace them.
UTP(*)	Means the internal temperature of the power component in DC/DC (rear) module is too low.	1. The operating environment temperature is under the temperature 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. 3. Check the abnormal fan circuit board and sensing wire, and replace them.
MOS_SHORT(*)	Means the PWM output signal of the DC/DC (rear) module is abnormal.	1. The DSP components output abnormal PWM signals. 2. FPGA detects circuit malfunction	Check and replace the DC/DC (rear) module board that has protection occurred.
HOST_SYNC(*)	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 circuit.	Check and replace the module that has protection occurred.
DB_FAULT(*)	The internal power	1. The power	1. Remove the UUT

PWM_CH1_WARN PWM_CH2_WARN PWM_CH3_WARN	components of the DC/DC (rear) module are short-circuited.	component of a certain phase in the DC/DC module is abnormal or damaged. 2. The power component of a certain phase in the DC/DC module detects over current analog.	and check if the operation is correct. 2. Check and replace the DC/DC (rear) module board that has protection occurred.
AUX_FAULT(*)	Means the auxiliary power of the DC/DC (rear) module is abnormally low.	1. The circuit detection function is abnormal. 2. The auxiliary power of the DC/DC (rear) module is abnormally low.	Check and replace the DC/DC (rear) module board that has protection occurred.

Notice

The protection message is marked _F(FAST) and _S(SLOW) by transient and steady state.
The protection point varies by the measurement error, thus protection circuits may act before reaching the protection point set.
DC/DC module is divided into DC/DC(front) module and DC/DC (rear) module.

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