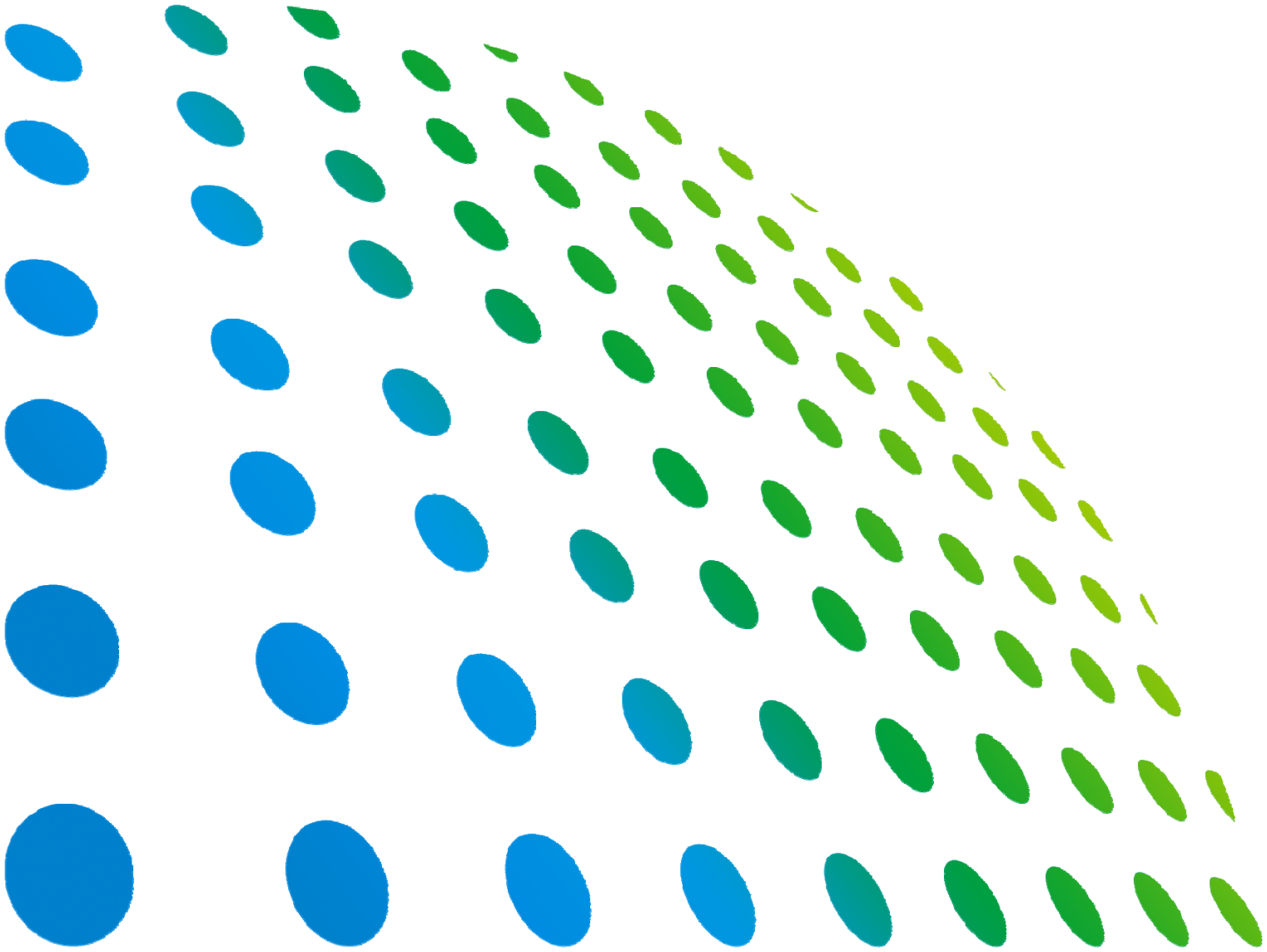
Chroma

Programmable DC Power Supply

62000H Series

Operating & Programming Manual



Programmable DC Power Supply
62000H Series
Operating & Programming Manual

Version 1.5
July 2013

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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
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
PCBA	O	O	O	O	O	O
CHASSIS	O	O	O	O	O	O
ACCESSORY	O	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

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

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

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with 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
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

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

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

1. Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product's specification.

Disposal

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

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Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62050H-40, 62050H-450, 62050H-600, 62075H-30, 62100H-40, 62100H-450, 62100H-600, 62100H-1000, 62100H-30, 62150H-40, 62150H-450, 62150H-600, 62150H-1000

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2004/108/EC) and Low-voltage Directive (2006/95/EC). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2006 Class A

EN 61010-1:2010 (Third Edition)

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

CHROMA ATE INC.

(Company Name)

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

(Company Address)

Person responsible for this declaration:

Mr. Benjamin Huang

(Name, Surname)

Division Vice President

(Position/Title)

Taiwan	**2013.05.28**	Benjamin Huang
(Place)	(Date)	(Legal Signature)

Safety Summary

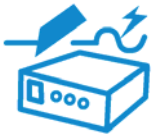
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the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

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 Touching the output terminal on the rear panel when the power or current is set and outputting may result in personal injury or death.

Safety Symbols

	**DANGER –** High voltage.
	**Explanation:** To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.
	**High temperature:** This symbol indicates the temperature is now higher than the acceptable range of human. Do not touch it to avoid any personal injury.
	**Protective grounding terminal:** To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.
WARNING	The **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.
CAUTION	The **CAUTION** sign denotes a hazard. It may result in personal injury or death if not noticed timely. It calls attention to procedures, practices and conditions.
Notice	The **Notice** sign denotes important information in procedures, applications or the areas that require special attention. Be sure to read it carefully.

Revision History

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

Date	Version	Revised Sections
Sep. 2009	1.0	Complete this manual.
Feb. 2010	1.1	Add standard voltage/current settings of some specifications for test conditions.
May 2010	1.2	Modifiy the followings: – The description in Note for specification. – The description, figure and pin assignments of the Analog Interface signal connector on the rear panel. – The setting of BRIGHTNESS.
May 2011	1.3	Modify Note and Caution in the section of "*Specifications*".
Sep. 2012	1.4	Update the following: – Value of Input Specification in "*Other Specifications*"section – Notice in "*Checking the Package*" section – Notice in "*SERIES/PARALLEL*" section – Notice in "*Assembling Series/Parallel Communication Interface*" section Add "*D/D FAULT Protection*" section in the chapter of "*Manual Operation*"
Jul. 2013	1.5	Add 62100H-1000 and 62150H-1000 two models Update the following: - "*Specification*" in the chapter of "*Overview*" - "*Preparation for Use*" section in the chapter of "*Installation*" - "*Setting DC_ON*" and "*SERIES/PARALLEL*" sections in the chapter of "*Manual Operation*"

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1. Overview

1.1 Introduction

Chroma 62000H Series are high power density DC Power Supplies that can provide stable DC output and accurate measurement for voltage and current.

The features of 62000H Series DC Power Supply are:

(1) Voltage mode with two loops control ➡ able to provide stable and quick responded output, also to set the slew rate of output voltage and current.
(2) High power density output ➡ the maximum output power can up to 15kW under 3U height.
(3) 16-bit ADC/16-bit DAC ➡ provides excellent resolution.
(4) Lower transient spike and transient response time ➡ makes the unit under test gets the most stable output and the best protection under the circumstance of load variation
(5) Editing mode (Programming Mode) for output waveform ➡ provides multiple output voltage and current combinations in real time for long period test.
(6) Rotary knob and keyboard control on the front panel ➡ to set the output voltage and current.
(7) VFD panel ➡ gives users a high brightness and wide view angle interface for operation.
(8) Via GPIB/Ethernet (option), USB, RS-232/RS-485 or APG (analog programmable interface) interface ➡ to do remote control.

1.2 System Functions

1.2.1 Operation Mode

(1) Local operation is performed by the keyboard and rotary knob on the front panel.
(2) Remote control is done via GPIB/Ethernet (option), USB or RS-232/RS-485 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) Free temperature control for fan speed.

1.2.3 Output/Indication

(1) Auxiliary power output (12Vdc/10mA).
(2) Analog monitors (V/I Monitor) the output signal instantaneously. This allows signals to be easily monitored by external instruments (DMM, Oscilloscope, etc). Able to set the output level indication (DC ON) signal.
(3) Output indicator (DC ON) signal.
(4) Protection state indication (OVP/OCP/OPP /FAN LOCK/AC FAULT, etc).
(5) Over temperature (OTP) protection signal.
(6) CV/CC status indicators.
(7) Output status indicators.

1.2.4 Input Control Signals

(1) Remote sense input for voltage drop compensation.
(2) Analog reference voltage (APG) input in which the setting of voltage and current can be set by the voltage source, current source and resistance that adjusted for the panel setting.
(3) Remote inhibit control signal (TTL)

1.2.5 Measuring & Editing

(1) Measurement for voltage, current and power.
(2) 10 programs and 100 sequences to edit voltage/current waveform output.
(3) One run time voltage program that can be set for long hour.

1.3 Specifications

Chroma 62000H Series High Power Density DC Power Supplies contain 5KW (62050H), 10KW (62100H) and 15KW (62150H) 3 models by the output power and the power supply of each model has various output specifications. Table 1-1, Table 1-2 and Table 1-3 list the output specifications of 62000H Series DC POWER SUPPLY 5KW, 10KW and 15KW. (It is suggested to warm up 10 minutes or above before performing the test items. The test condition is 25 ± 5°C and under resistance load.)

Table 1-1 62000H Series 5KW Operating Specification

Model	**62050H-40**	**62050H-450**	**62050H-600**
Output Ratings			
Output Voltage[1]	0-40V	0-450V	0-600V
Output Current [2]	0-125A	0-11.5A	0-8.5A
Output Power	5000W	5000W	5000W
Voltage Measurement			
Range	8V / 40V	90V / 450V	120V / 600V
Accuracy	0.05% + 0.05%F.S.		
Current Measurement			
Range	25A / 125A	2.3A / 11.5A	1.7A / 8.5A
Accuracy	0.1% + 0.1%F.S.		
Output Noise & Ripple			
Voltage Noise(P-P)[3]	60 mV	300 mV	350 mV
Voltage Ripple(rms)	15 mV	450 mV	600 mV
Current Ripple(rms)[4]	50 mA	20 mA	15 mA
Programming Response Time			
Rise Time: Full Load	8 ms	60 ms	60 ms
Rise Time: No Load	8 ms	60 ms	60 ms
Fall Time: Full Load	8 ms	60 ms	60 ms
Fall Time: 10% F.S. CC Load	100 ms	250 ms	250 ms
Fall Time: No Load	1 s	2.5 s	2.5 s
Slew Rate Control			
Voltage slew rate range[5]	0.001V/ms – 5V/ms	0.001V/ms – 7.5V/ms	0.001V/ms – 10V/ms
Current slew rate range	0.001A – 1A/ms, or INF	0.001A – 0.1A/ms, or INF	0.001A – 0.1A/ms, or INF
Minimum transition time	0.5 ms		
Operating Temperature Rage	0°C ~ 50°C		

Table 1-2 62000H Series 10KW Operating Specification

Model	**62075H-30**	**62100H-40**	**62100H-450**	**62100H-600**	**62100H-1000**[17]
Output Ratings					
Output Voltage[1]	0-30V	0-40V	0-450V	0-600V	0-1000V
Output Current[2]	0-250A	0-250A	0-23A	0-17A	0-10A
Output Power	7500W	10000W	10000W	10000W	10000W
Voltage Measurement					
Range	6V / 30V	8V / 40V	90V / 450V	120V / 600V	200V/1000V
Accuracy	0.05% + 0.05%F.S.				
Current Measurement					
Range	50A / 250A	50A / 250A	4.6A / 23A	3.2A / 17A	4A / 10A
Accuracy	0.1% + 0.1%F.S.				
Output Noise & Ripple					
Voltage Noise (P-P)[3]	60 mV	60 mV	300 mV	350 mV	2550 mV
Voltage Ripple (rms)	15 mV	15 mV	450 mV	600 mV	1500 mV
Current Ripple (rms)[4]	100 mA	100 mA	40 mA	30 mA	180 mA
Programming Response Time					
Rise Time: Full Load	6 ms	8 ms	60 ms	60 ms	25 ms (30%F.S. CC Load)
Rise Time: No Load	6 ms	8 ms	60 ms	60 ms	25 ms
Fall Time: Full Load	6 ms	8 ms	60 ms	60 ms	25 ms (50%F.S. CC Load)
Fall Time: 10% F.S. CC Load	100 ms	100 ms	250 ms	250 ms	120 ms
Fall Time:No Load	1 s	1 s	2.5 s	2.5 s	3 s
Slew Rate Control					
Voltage slew rate range[5]	0.001V/ms − 5V/ms	0.001V/ms − 5V/ms	0.001V/ms − 7.5V/ms	0.001V/ms − 10V/ms	0.001V/ms − 40V/ms
Current slew rate range	0.001A − 1A/ms, or INF	0.001A − 1A/ms, or INF	0.001A − 0.1A/ms, or INF	0.001A − 0.1A/ms, or INF	0.001A − 0.1A/ms, or INF
Minimum transition time	0.5 ms				
Operating Temperature Rage	0°C ~ 50°C				0°C ~ 40°C

Table 1-3 62000H Series 15KW Operating Specification

Model	**62100H-30**	**62150H-40**	**62150H-450**	**62150H-600**	**62150H-1000**[17]
Output Ratings					
Output Voltage[1]	0-30V	0-40V	0-450V	0-600V	0-1000V
Output Current[2]	0-375A	0-375A	0-34A	0-25A	0-15A
Output Power	11250W	15000W	15000W	15000W	15000W
Voltage Measurement					
Range	6V / 30V	8V / 40V	90V / 450V	120V / 600V	200V / 1000V
Accuracy	0.05% + 0.05%F.S.				
Current Measurement					
Range	75A / 375A	75A / 375A	6.8A / 34A	5A / 25A	6A / 15A
Accuracy	0.1% + 0.1%F.S.				
Output Noise & Ripple					
Voltage Noise(P-P)[3]	60 mV	60 mV	300 mV	350 mV	2550 mV
Voltage Ripple(rms)	15 mV	15 mV	450 mV	600 mV	1500 mV
Current Ripple(rms)[4]	150 mA	150 mA	60 mA	45 mA	270 mV
Programming Response Time					
Rise Time: Full Load	6 ms	8 ms	60 ms	60 ms	25 ms (50%F.S. CC Load)
Rise Time: No Load	6 ms	8 ms	60 ms	60 ms	25 ms
Fall Time: Full Load	6 ms	8 ms	60 ms	60 ms	25 ms (50%F.S. CC Load)
Fall Time: 10% F.S. CC Load	100 ms	100 ms	250 ms	250 ms	80 ms
Fall Time:No Load	1 s	1 s	2.5 s	2.5 s	3 s
Slew Rate Control					
Voltage slew rate range[5]	0.001V/ms − 5V/ms	0.001V/ms − 5V/ms	0.001V/ms − 7.5V/ms	0.001V/ms − 10V/ms	0.001V/ms − 40V/ms
Current slew rate range	0.001A − 1A/ms, or INF	0.001A − 1A/ms, or INF	0.001A − 0.1A/ms, or INF	0.001A − 0.1A/ms, or INF	0.001A − 0.1A/ms, or INF
Minimum transition time	0.5 ms				
Operating Temperature Rage	0°C ~ 50°C				0°C ~ 40°C

1.3.1 Other Specifications

Table 1-4 lists the other specifications of 62000H.

Table 1-4 62000H Other Specifications

Model	**62000H Series**			
Line Regulation[6]				
Voltage	+/- 0.01% of full scale			
Current	+/- 0.05% of full scale			
Load Regulation[7]				
Voltage	+/- 0.02% of full scale(62000H-1000: +/- 0.05% of full scale)			
Current	+/- 0.1% of full scale			
OVP Adjustment Range				
Range	0-110% programmable from front panel, remote digital inputs.			
Accuracy	+/- 1% of full-scale output			
Efficiency [8]	62050H : 0.87 (Typical) 62100H : 0.87 (Typical) 62150H : 0.87 (Typical) 62100H-1000 :0.85(Typical)			
Drift (30 minutes) [9]				
Voltage	0.04% of Vmax			
Current	0.06% of Imax			
Drift (8 hours) [10]				
Voltage	0.02% of Vmax			
Current	0.04% of Imax			
Temperature Coefficient[11]				
Voltage	0.04% of Vmax/°C			
Current	0.06% of Imax/°C			
Transient Response Time[12]	Recovers within 1ms to +/- 0.75% of steady-state output for a 50% to 100% or 100% to 50% load change(1A/us)			
Programming Resolution				
Voltage (Front Panel)	10 mV(62000H-1000:100mV)			
Current (Front Panel)	10 mA(62000H-1000:1mA)			
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			
Measurement Resolution				
Voltage (Front Panel)	V_o <10V	10V ≤ V_o <100V	100V ≤ V_o	V_o =1000V
	0.1mV	1mV	10mV	100mV
Current (Front Panel)	I_o <10A	10A ≤ I_o <100A	100A ≤ I_o < 1000A	
	0.1mA	1mA	10mA	
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
RS232	Standard
RS485	Standard
GPIB[13]	Optional
Ethernet[13]	Optional
System bus(CAN)	Standard for master/slave control
Programming Accuracy	
Voltage (Front Panel and Digital Interface)	0.1% of Vmax
Current (Front Panel and Digital Interface)	0.3% of Imax
GPIB Command Response Time	
Vout setting	GPIB send command to DC source receiver <20ms
?Volt , ? Current	Under GPIB command using Measure <25ms
Analog Interface (I/O)	
Voltage and Current Programming inputs (I/P)	0-10Vdc / 0-5Vdc / 0-5k ohm / 4-20 mA of F.S.
Voltage and Current monitor output (O/P)	0-10Vdc / 0-5Vdc / 4-20mA of F.S.
External ON/OFF (I/P)	TTL: Active Low or High (Selective)
DC_ON Signal (O/P)	Level by user define (Time delay= 1 ms 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
Auxiliary power supply (O/P)	Nominal supply voltage : 12Vdc / Maximum current sink capability: 10mA
Safety interlock (I/P)	Time accuracy: <100ms
Remote inhibit (I/P)	TTL: Active Low
Analog Interface Accuracy	
Programming	
Voltage	0.2% of F.S.
Current	0.3% of F.S.
Measurement	
Voltage	0.5% of F.S.
Current	0.75% of F.S.
Series & Parallel Operation[14]	Master / Slave control via CAN for 10 units up to 150KW. (Series: two units / Parallel: ten units)
Auto Sequencing (List mode)	
Number of program	10
Number of sequence	100

Dwell time Range	5ms – 15000S
Trig. Source	Manual / Auto / External
Auto Sequencing (Step mode)	
Start voltage	0 to Full scale
End voltage	0 to Full scale
Run time	hh : mm : ss.ss (00 : 00 : 00.01 to 99 : 59 : 59.99)
Trig. Source	Auto
Input Specification	
AC input voltage 3phase , 3 wire + ground[15]	200/220 Vac(operating range 180 -242 Vac)* 380/400 Vac(operating range 342 - 440 Vac) 440/480 Vac(operating range 396 - 528 Vac)* *Call for Availability
AC frequency range	47-63 Hz
Power factor	62050H : 0.5 (200/220Vac) 0.5 (380/400Vac) 0.5 (440/480Vac) 62100H : 0.55 (200/220Vac) 0.55 (380/400Vac) 0.55 (440/480Vac) 62150H : 0.6 (200/220Vac) 0.6 (380/400Vac) 0.6 (440/480Vac)
General Specification	
Maximum Remote Sense Line Drop Compensation	<100V model: 5% of full scale voltage per line(10% total) ; >100V model :2% of full scale voltage per line (4% total)
Weight	62050H : < 23 kg 62100H : < 29 kg 62150H : < 35 kg
Dimensions (HxWxD) mm[16]	132.8 x 428 x 610 mm
Storage Temperature Rage	-40°C ~ +85°C

All specifications are subject to change without prior notice.

NOTE

1. Minimum output voltage <0.5% of rated voltage.
2. Minimum output current <0.2% of rated current.
3. It uses the BNC cable and a 50 (Ohm) terminal load oscilloscope for confirmation (20k Hz ~ 20M Hz.)
4. The output voltage range is from 10% to 100% and the output current is measured under the condition of full load.
5. This setting is only valid when there is output and the voltage as well as the current settings are larger than 1. & 2. Please be noted that the fall slew rate of output voltage is varied with the power of output load.
6. ± 10% variation under rated voltage.
7. For 0-100% load step with nominal line voltage (after warmed-up for 30 minutes). It is 0.04%FS when in cold.
8. Under the maximum output power condition of rated voltage.
9. The maximum drift of output power during 30 minutes test period when the input, loading and ambient temperature are fixed.

10. The maximum drift of output power after warmed up for 30 minutes and 8 hours test period when the input, loading and ambient temperature are fixed.
11. The change caused by the ambient temperature per centigrade when the input and loading are fixed.
12. Over 50% of maximum output voltage and the loading slew rate is 1A/us for rise and fall.
13. Either Ethernet or GPIB can be selected when shipping.
14. Please consult with the manufacturer.
15. Varied by local voltage regulation, all models in the 62000H Series 5kW, 10kW, 15kW have 200/220 Vac, 380/400 Vac and 440/480 Vac 3 types of input voltage for selection. Users can follow the local voltage regulation to select a proper voltage spec. The Power Supply is set with the required input voltage when shipped and when the input voltage is not within the range, it will show AC_fault protection and shut down the output.
16. It is the chassis size without any accessories.
17. The output voltage for operating the power supply should be larger than 5% Full-scale.

CAUTION

1. If it is applied to battery charge or inductance load such as motors, the output port needs to connect a diode in series to prevent the load current from backwash and damage the device interior, see Figure 1-1
2. For switchable power load applications, if the output load cable is longer (>20cm) it is suggested to strand the load cable and parallel the capacitance at the load power input to prevent any unexpected oscillation from occurring, see Figure 1-2

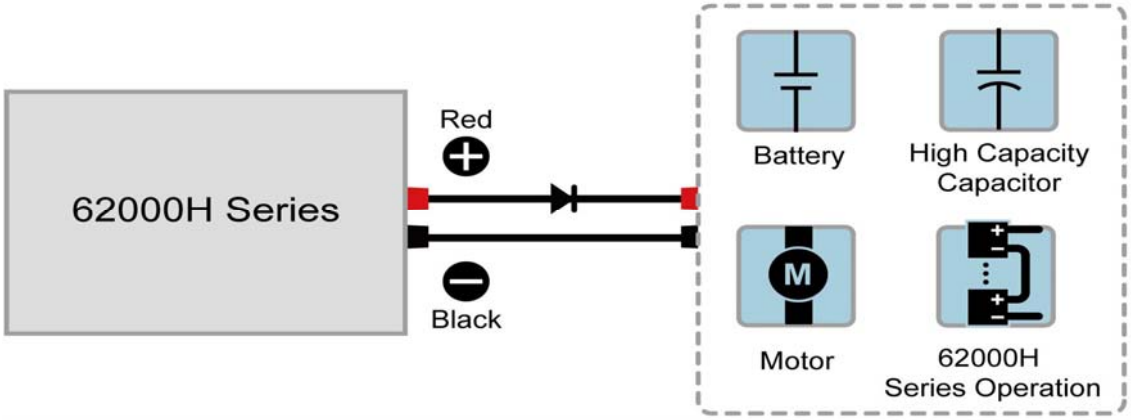


Figure 1-1

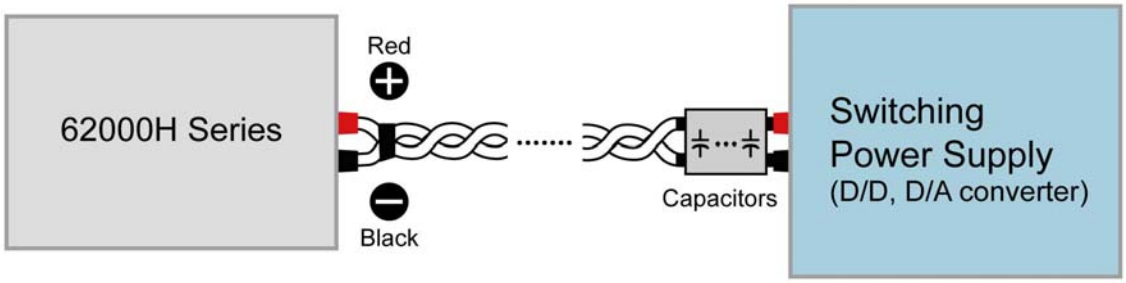


Figure 1-2

⚠WARNING Voltage from the two output terminals to earth varies with the 62000H Series Models as Table 1-5 shows below:

Table 1-5

Model	Max. Voltage (Vdc) Difference between Output Terminal and Earth
62075H-30	±250
62050H-40	±250
62050H-450	±1200
62050H-600	±1200
62100H-30	±250
62100H-40	±250
62100H-450	±1200
62100H-600	±1200
62100H-1000	±1200
62150H-40	±250
62150H-450	±1200
62150H-600	±1200
62150H-1000	±1200

If the voltage exceeds the above range it may result damage to the DC Power Supply.

1.4 Function Keys

1.4.1 Front Panel

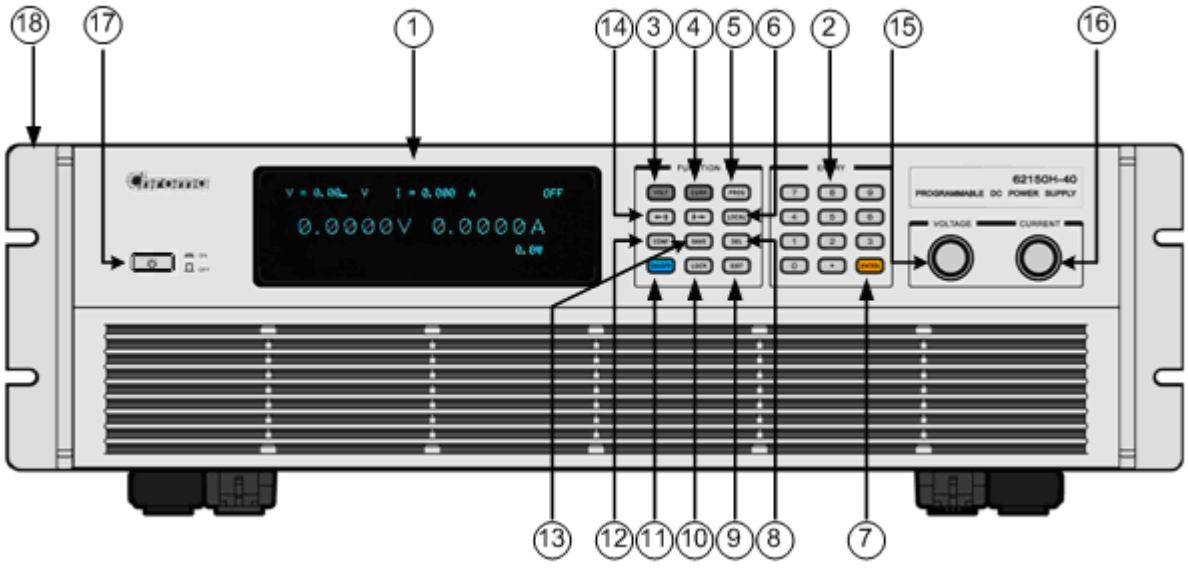
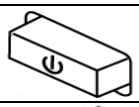
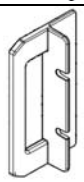


Figure 1-3 Front Panel of 62000H

Table 1-6 Description of Front Panel

Item	Symbol	Description
1		***Display:*** VFD Display: it shows the output settings and measured result.
2	0 to 9 and ●	***Numeric and Decimal Point:*** Users can use the numeric keys and the decimal point key to enter digital data.
3	VOLT	***Voltage Setting Key:*** Enters voltage setting mode. Users can use numeric keys or voltage rotary knob ( ) to input voltage values
4	CURR	***Current Setting Key:*** Enters current limit setting mode. Users can use numeric keys or current rotary knob ( ) to input current limit values.
5	PROG	***PROGRAM Key:*** Press this key to skip to “Program Function Page” for setting waveform editing mode.
6	LOCAL	***LOCAL Key:*** Press this key to switch the control mode from remote control back to manual operating mode.
7	ENTER	***ENTER Key:*** Press this key to confirm the parameter settings.
8	DEL	***Delete Key:*** Press this key to delete the input value.

Item	Symbol	Description
9	EXIT	***EXIT Key:*** Press this key to go to previous screen. If this key is pressed before "SAVE" is pressed, the screen will go back to "MAIN PAGE" and the data will not be saved.
10	LOCK	***LOCK Key:*** Press this key to lock all keys and rotary knob. To unlock ➡ press "LOCK" for 3 seconds to release it.
11	ON/OFF	***ON/OFF Key:*** Press this key to control the output to "ON" or "OFF".
12	CONF	***CONFIG Key:*** Press this key to skip to "Config Choose Page" for setting various functions.
13	SAVE	***SAVE Key:*** Press this key to save the settings in "Program and Config Function Page".
14	← ↑ ↓ →	***Cursor Movement Keys:*** Use "← ↑" and "→ ↓" keys to move the cursor to the parameter to be modified.
15		***Voltage Rotary Knob:*** Users can turn the knob "◯" to input data or select item.
16		***Current Rotary Knob:*** Users can turn the knob "◯" to input data or select item.
17		***Main Power Switch:*** It switches the power on or off.
18		***Rack Bracket:***(Option) Use the left (right) bracket to fit the Power Supply on Rack.

1.4.2 Rear Panel

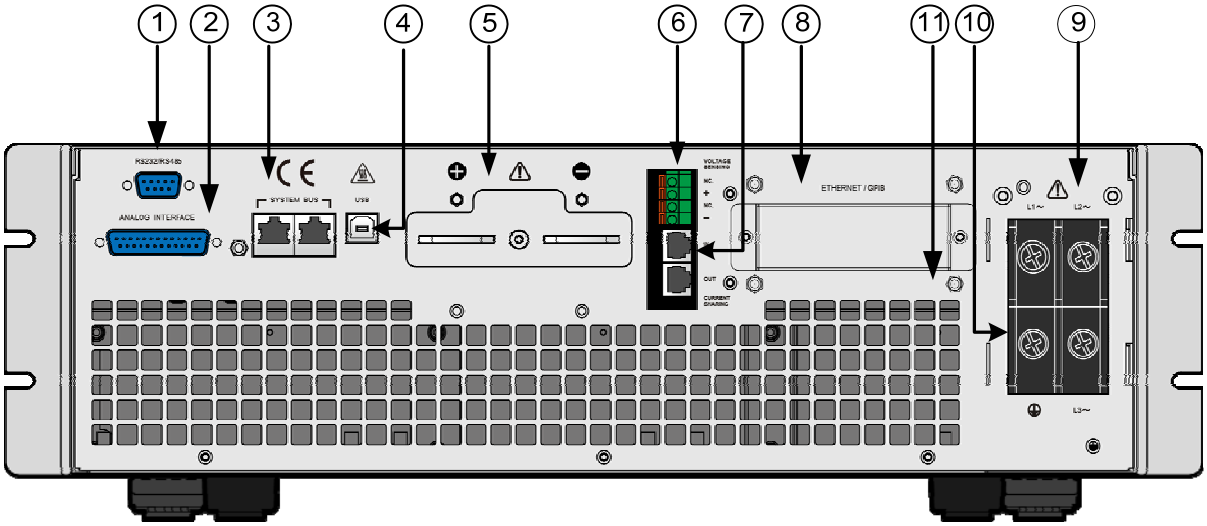


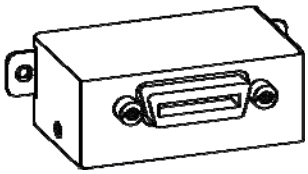
Figure 1-4 Rear Panel of 62000H

Table 1-7 Description of Rear Panel

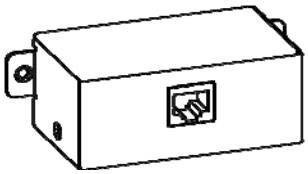
Item	Name	Description
1	RS-232C /RS-485	It is a 9-pin D type male connector. The control commands are transmitted between remote and PC for remote control.
2	ANALOG INTERFACE Signal Connecting Terminal	There are 25 pins signals that include APG input/output terminals and system status signal terminals. See *Appendix A* for detail pin assignments.
3	System Bus	It is for serial/parallel data transmission.
4	USB	The remote controller uses USB connector to connect to PC for remote operation.
5	Output terminal	The output terminals of DC Power Supply.
6	Remote 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 and “–” connector to the negative output terminal. Do not connect the remote sense connector to the “+”, “–” output terminal reversely.
7	Current Sharing Connector	It shares the output current equally when connecting in parallel and it has to be removed when connecting in series for use.
8	GPIB/ETHERNET Connector (Option)	The GPIB/ETHERNET bus used by remote controller is connected to PC via this connector for remote control.
9	AC Power Connector	It inputs AC power through power line and connects to input stage through this connector.
10	Functional Ground	This terminal is for user to refer to Earth Ground easily.
11	Fan Mask	Avoid touching the fan and do not block the fan mask to avoid accumulating heat inside the machine.

Notice

The callout 8 in Figure 1-4 is the cover plate for standard configuration. When GPIB/ETHERNET interface is selected as shipping default, it will be installed before shipment as Figure 1-5 (a) & (b) shows.



(a) GPIB Interface



(b) ETHERNET Interface

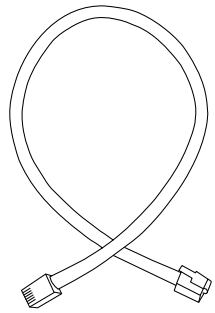
Figure 1-5

2. Installation

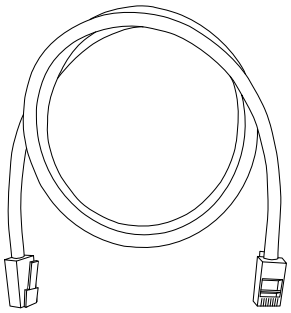
2.1 Checking the Package

(1) Check if there is any damage or any missing accessories after unpacking it.
(2) Should any damage is found, contact “Chroma RMA” immediately to request return shipment.

Figure 2-1 (a) & (b) shows the accessories.



(a) cable for current sharing



(b) cable for system bus

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 the accessories 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 a co-worker for assistance.

2.1.1 Maintenance & Cleaning

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

2.2 Preparation for Use

(1) Remove the iron holder of the front panel as Figure 2-2 shows and keep it in case the Power Supply is required for return service.
(2) Be sure the Power Supply is connected to the AC line input that meets the specification.
(3) The instrument must be installed in an air-circulated area to avoid the internal temperature getting too high.

(4) The ambient temperature does not exceed 50°C (40°C for models of 1000V).

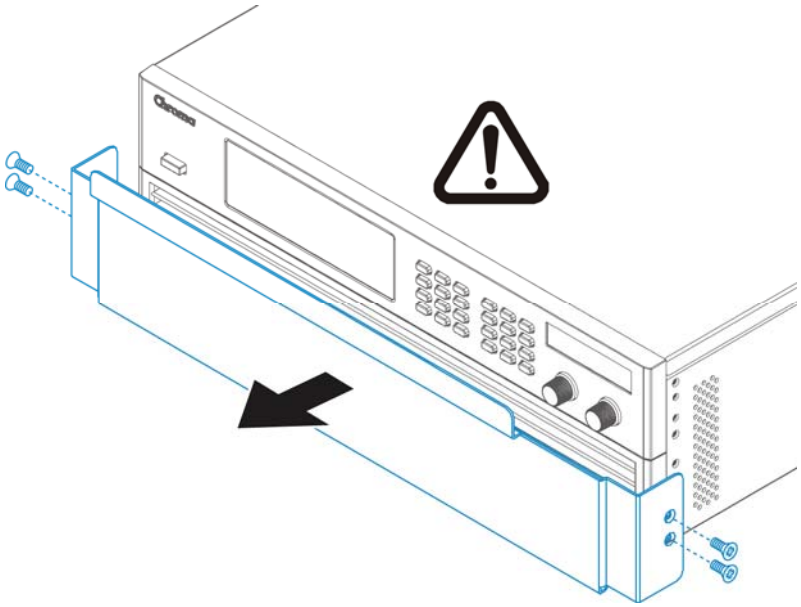


Figure 2-2

CAUTION If the iron holder on the front panel is not removed, it may cause OTP or damage on the hardware due to poor ventilation.

2.2.1 Normal Environment Conditions

(1) In door use.
(2) Altitude up to 2000 meters.
(3) Temperature 0°C to 50°C.
(4) Maximum relative humidity is 65% at 25°C and increasing linearly to 90% relative humidity for temperature up to 50°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

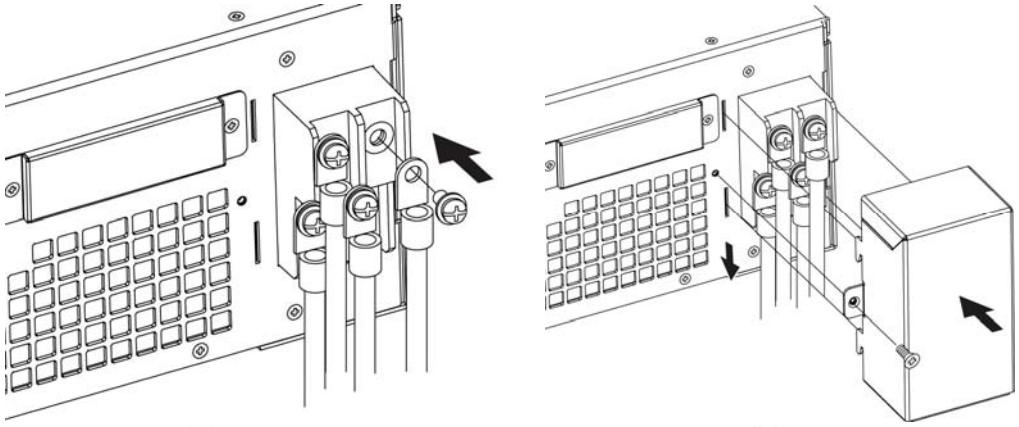
2.3.1 Ratings

(1) Model 62050H-xxx
Maximum input power: 12 kVA
(2) Model 62100H-xxx
Maximum input power: 21 kVA
(3) Model 62150H-xxx
Maximum input power: 29 kVA

Model / Vin	62050H-xxx	62100H-xxx	62150H-xxx	
200/220	39 A	69 A	93 A	Current of each phase
380/400	22 A	37 A	50 A	
440/480	19 A	32 A	44 A	

2.3.2 Input Connection

(1) The input connector board is located at the right of rear panel.
(2) The power line must be 85°C rated at least.
(3) The power cable width must be within 6AWG~8AWG.
(4) To assemble 62000H ➡ see Figure 2-3 (a), (b) and execute the following steps:
   a. Remove the input terminal safety cover from the rear panel of DC Power Supply.
   b. Scrape off the skin of power cable tip (the bare portion is about 1cm) and use an O type terminal to crimp it.
   c. Secure the power cable and input terminal with a Phillips screwdriver with suggested range of lock torque in 30~40 (kg-cm).
   d. Lock the safety cover to avoid electric shock.
   e. Secure the safety cover latch and safety cover to prevent the cable from falling or the electric terminal from exposing.



(a) (b)

Figure 2-3

Notice

1. Connect the green or green/yellow metal wire to ⏚ terminal.
2. Connect the black or brown metal wire to “L1, L2, L3” terminal.
3. Figure 2-4 shows the suggested specification of O type terminal.

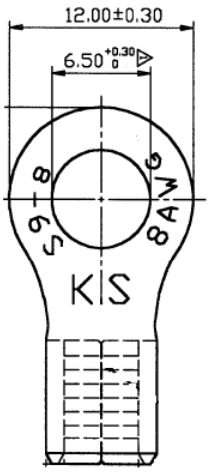


Figure 2-4

⚠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.

Table 2-1 is the cable specification of PVC (105°C) with the ambient temperature at 30°C for reference.

Table 2-1 PVC (105°C) Cable Specification

Conductor Area Sectional Area mm²	Safe Current (A)	
	Copper Conductor	Lead 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

2.4 Remote Sensing

2.4.1 Correct Connection

1. Connecting remote sensing wire correctly can ensure the output voltage is the set voltage. The DC Power Supply is able to compensate maximum 4-10% of F.S. line voltage drop.
2. Figure 2-5 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 30AWG and its withstand voltage should be within the specification.
3. Though remote sensing is able to compensate the voltage drop; however, if the line loss is too large (see specification) it will cause protection on remote sensing as Figure 2-6 shows and is unable to compensate voltage drop correctly.

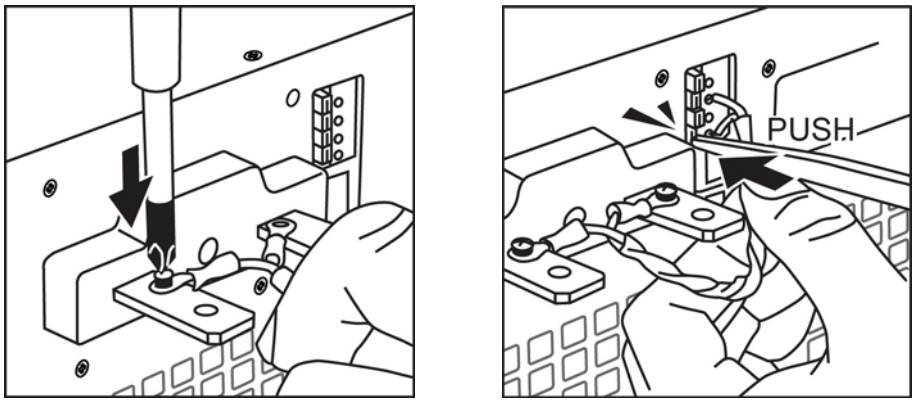


Figure 2-5

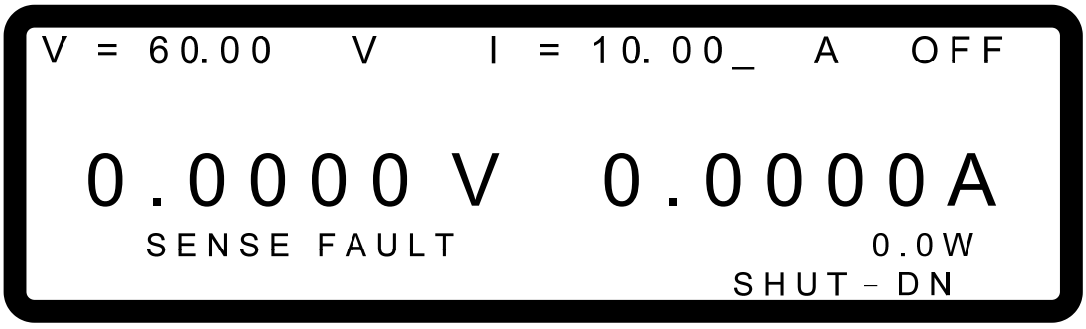


Figure 2-6

2.4.2 Disconnecting Remote Sensing Wire

If the remote sensing wire is disconnected (means the two cables are open), it still works however the error range will be wider. The voltage measured from the output terminal is about 2% of F.S.; therefore it is necessary to connect the remote sensing wire correctly. Please connect the remote sensing wire to output terminal even if the line voltage drop can be ignored in actual practice.

2.4.3 Reverse Connection of Remote Sensing Wire Polarity

The polarity of remote sensing wire must be connected correctly, that is the "+" terminal is connected to the "+" of output terminal or to the connecting wire of the terminal, while the "–" terminal is connected to the "–" of output terminal or to the connecting wire of the terminal. If the polarity is connected reversely, the output will drop to 0V and prompt an error message "SENSE FAULT" as Figure 2-6 shows.

Notice

The DC Power Supply does not burn down due to reverse connection of polarity. Do the following step to reset it:

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

CAUTION

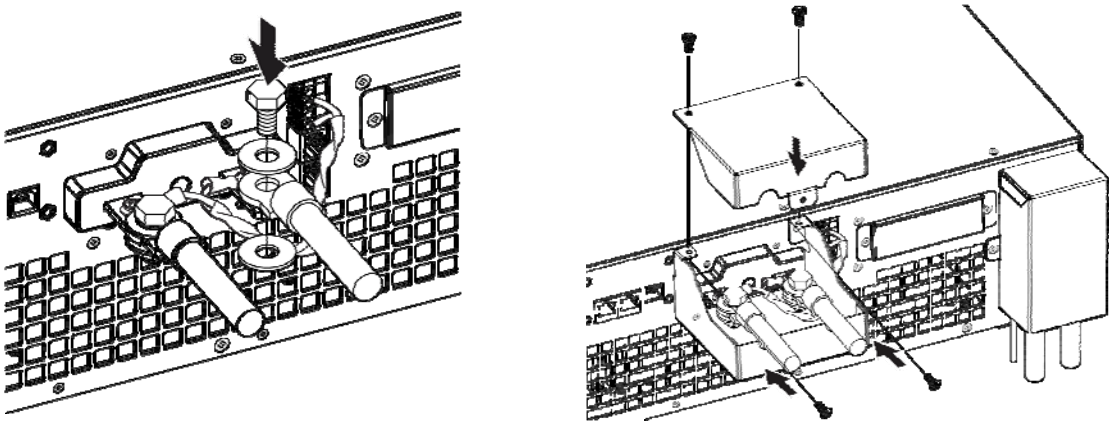
1. If there is voltage on the Power Supply output, do not reverse connect the Remote sense to it or to the UUT to avoid damaging the Power Supply.
2. The voltage of Remote Sense and local output needs to be smaller than 10% V_MAX to avoid damaging the Power Supply.

2.5 Output Connection

The output connector of 62000H 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 85°C rated at least.
(3) Assembly ➡ see Figure 2-7 (a) & (b) and execute the steps below:
   a. Scrape off the skin 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.

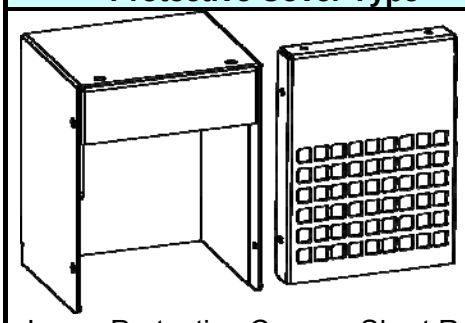
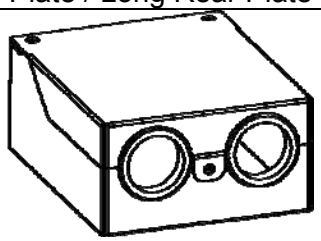
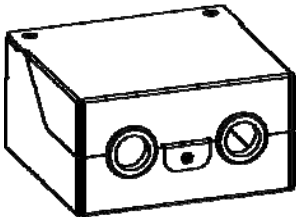


(a) (b)

Figure 2-7

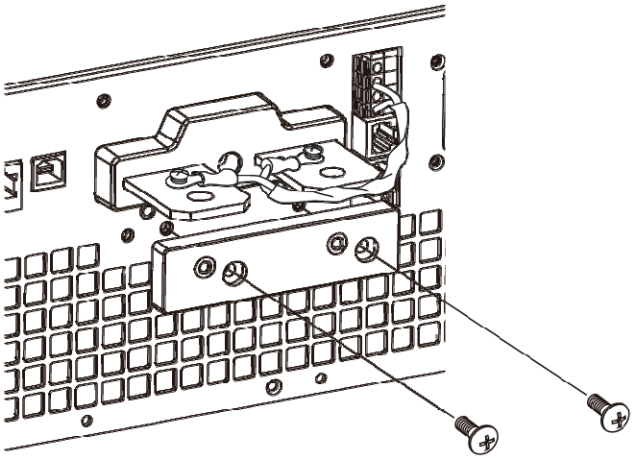
The output protective covers are varied by different output currents. Table 2-2 lists the types of various protective covers.

Table 2-2 Types of Protective Covers

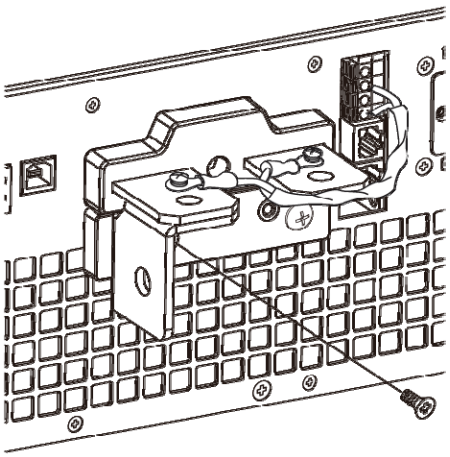
Protective Cover Type	Current Range	Applicable Model
 Large Protective Cover – Short Rear Plate / Long Rear Plate	I_O >250A	62100H-30 62150H-40
 Medium Protective Cover	100A≤ I_O ≤250A	62075H-30 62050H-40 62100H-40
 Small Protective Cover	I_O < 100A	62050H-450 62100H-450 62150H-450 62050H-600 62100H-600 62150H-600 62100H-1000 62150H-1000

For the models require large protective cover, the cable with wider diameter is needed. To ensure the output terminal has enough stress, it is necessary to add a secondary copper. Figure 2-8 shows the assembly. First secure an insulation board as Figure 2-8 (a) shows and then follow the steps to install the secondary copper and secure the cable as Figure 2-8 (b) ~

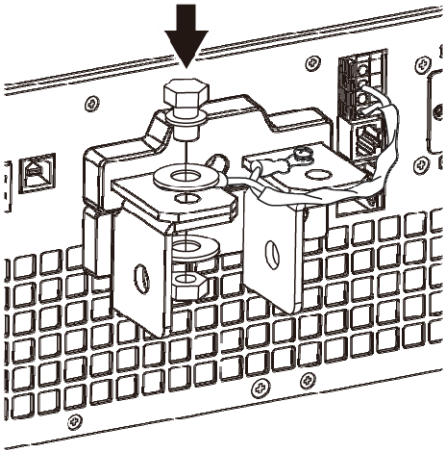
(d) show. Next, secure the large protective cover as Figure 2-8 (e) shows and last secure the cover plate as Figure 2-8 (f) or (g) shows based on the way the cable is extended.



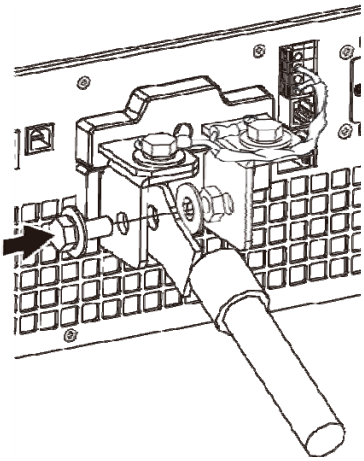
(a)



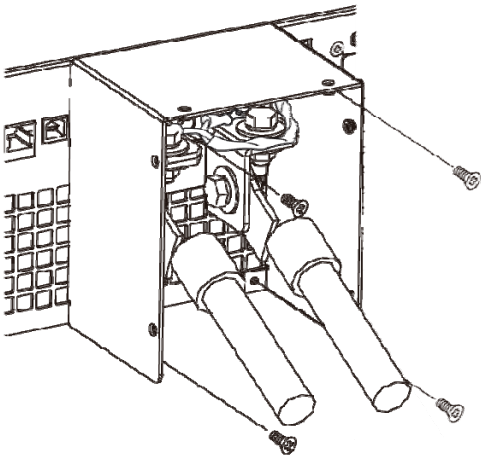
(b)



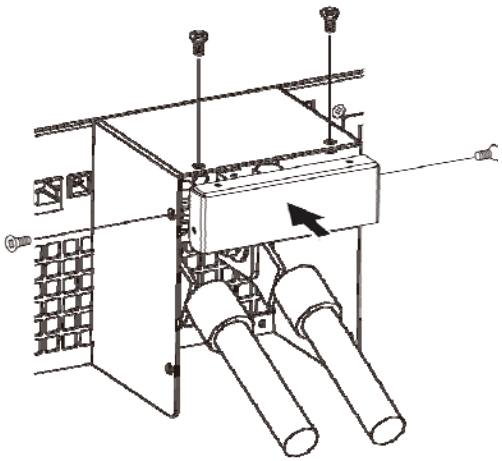
(c)



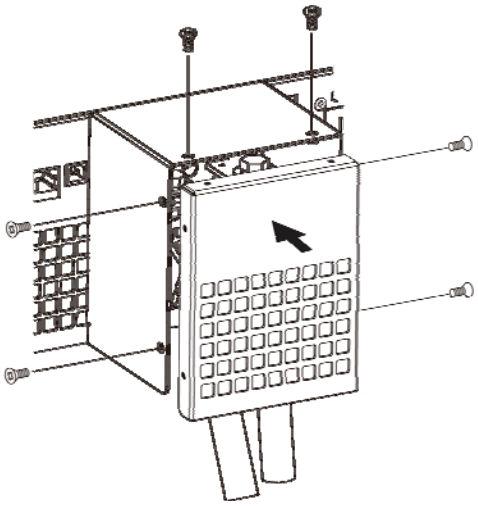
(d)



(e)



(f)



(g)

Figure 2-8

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.

WARNING

For safety reason, do not exceed rated current (different from 62000H Series) for the output current to avoid any danger.

2.5.2 Specification of Connecting Wire

The maximum inductance of connecting wire to the source is 2μH (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 2μH.
2. Do not use the wire with extra thin diameter to avoid overheating and causing hazard.

2.5.3 Specification of Parallel Capacitance

The parallel capacitance for output varies with the 62000H Series Models as Table 2-3 shows.

Table 2-3

Model	Max. Parallel Capacitance for Output (uF)
62075H-30	10000
62050H-40	10000
62050H-450	1350
62050H-600	1350
62100H-30	20000
62100H-40	20000

62100H-450	2700
62100H-600	2700
62100H-1000	1350
62150H-40	30000
62150H-450	4050
62150H-600	4050
62150H-1000	1350

CAUTION

1. To ensure the system's stability, the capacitance should not exceed the value listed in Table 2-3.
2. Be aware of the polarity and its withstand voltage when paralleling capacitance.

2.5.4 Installing the Handle

Use M4X12 flat head screws to secure the handle to the rack mounting kit as shown in Figure 2-9.

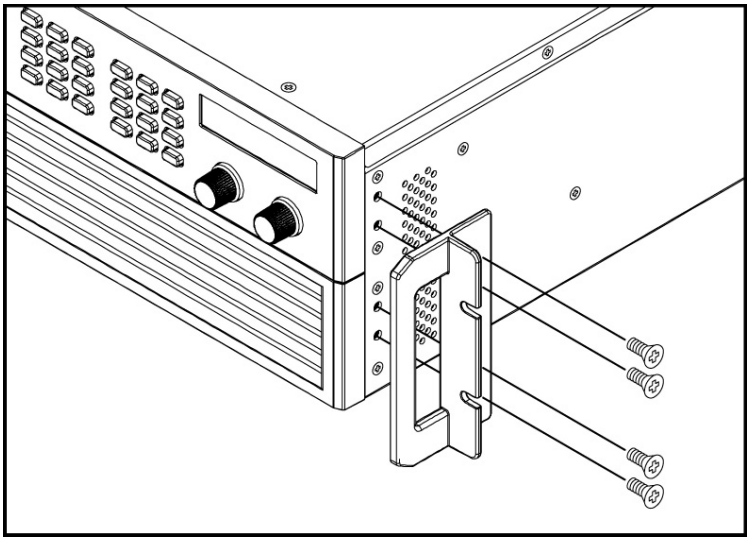


Figure 2-9 Installing the Handle

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 VFD on the front panel will light up and show as below:

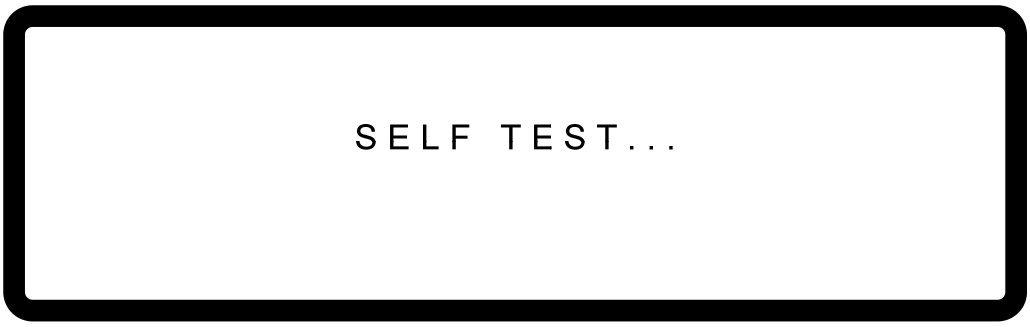


Figure 2-10

Meanwhile, the DC Power Supply will run self-tests for memory, data and communication. Once the routine of self-tests are done, the model no. and serial no. will show on the screen and prompt "*OK*" at the right of the test item if passed. When self-test is done the display shows as below:

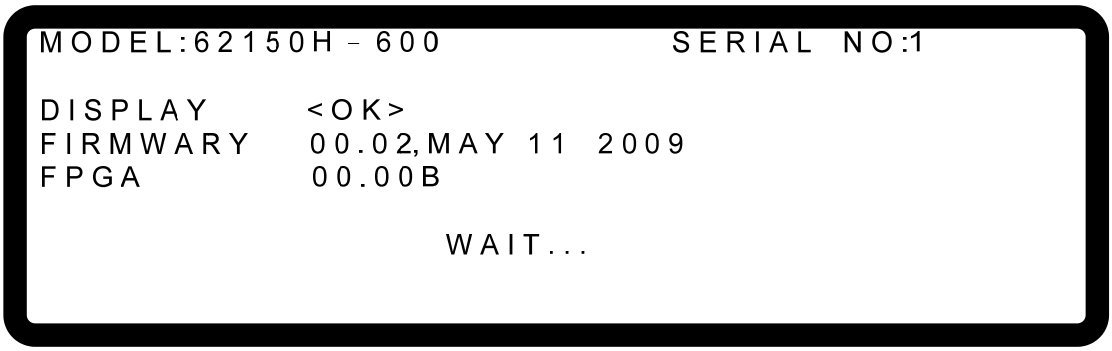


Figure 2-11

When the self tests of memory, data and communication are done, the screen turns to the MAIN PAGE automatically as shown below:

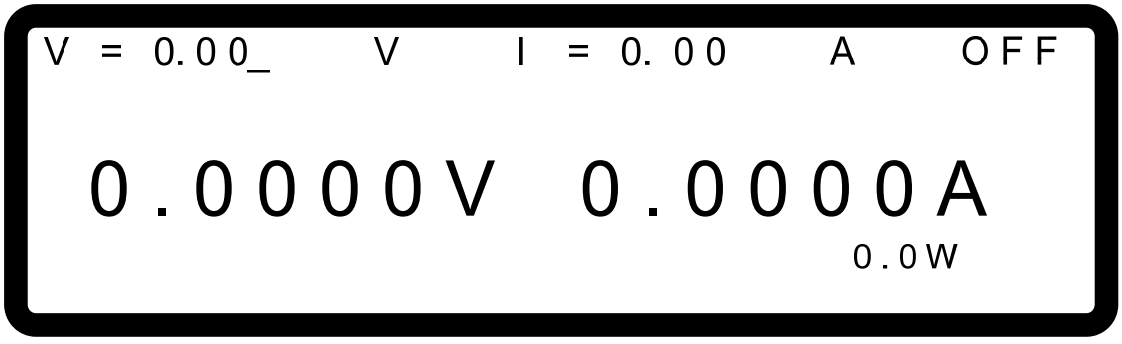


Figure 2-12

⚠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 in any interrupted grounding and

⋮ could injure personnel.

3. Manual Operation

3.1 Introduction

DC Power Supply can be operated manually or remotely via GPIB/ETHERNET (option) or USB or RS-232/RS-485 or APG interface which is described in Chapter 5 and section 3.3.1.1. The manual operation for using the front panel keyboard or rotary knobs to input the data is described in this chapter.

Notice If the operation mode is not saved before the user powers the instrument off, the operation mode is manual (default) when power it on next time.

3.2 Setting Voltage & Current

There are two ways to set the output voltage (CV MODE) as Figure 3-1 shows:

Method 1:

1. Press "VOLT", the cursor for V on MAIN PAGE blinks.
2. Use the numeric keys (1~9) to set the value and press "ENTER" to complete the voltage setting or turn the "Rotary" ( ) knob to adjust the set value.
3. Press "ON/OFF" 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. Press "VOLT", the cursor for V on MAIN PAGE blinks.
2. When using "Rotary" ( ) knob for setting, the " " and " " keys can be used to move the cursor to individual digit, and then turn the rotary knob to increase or decrease the minimum unit of the set value.
3. Press "ON/OFF" 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.)

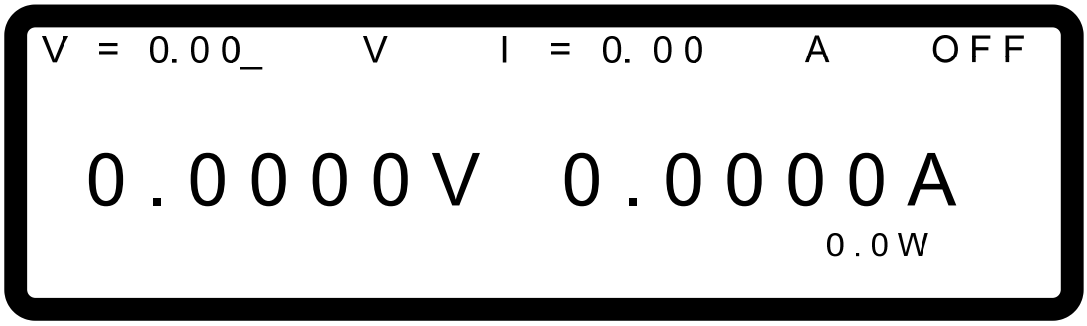


Figure 3-1

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

Press "CURR" and the rest settings are same as voltage as Figure 3-2 shows. (Be noted that in order to remain the output in CC mode the voltage setting must be larger than the load voltage; otherwise the output current will not equal to the set current.)

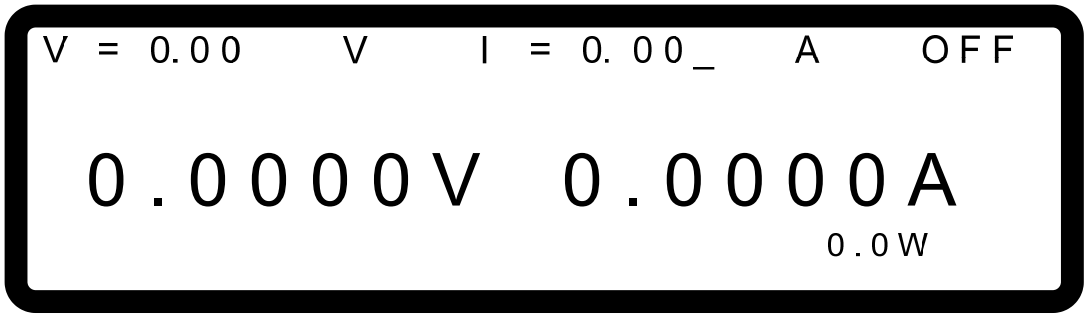


Figure 3-2

3.3 Setting Configuration

The configuration setting function allows users to set the system functions for the DC Power Supply. The system functions that can be edited by the configuration are:

1. System Setup : To set various system parameters including GPIB address.
2. Output Setup : To set various output parameters including voltage/current slew rate and etc.
3. Series/Parallel : To set the parameters for series or parallel mode.
4. Display : To set the parameter arrangement on panel.
5. Protection : To set the parameters for each protection functions.
6. Factory Setting : To set the production information and settings.
7. Calibration : To calibrate the DC Power Supply.
8. Remote Setting : To set the system parameters for GPIB address and etc.

Following explains the way to set the configuration.

Press "CONF" to enter into the config setting screen as Figure 3-3 shows.

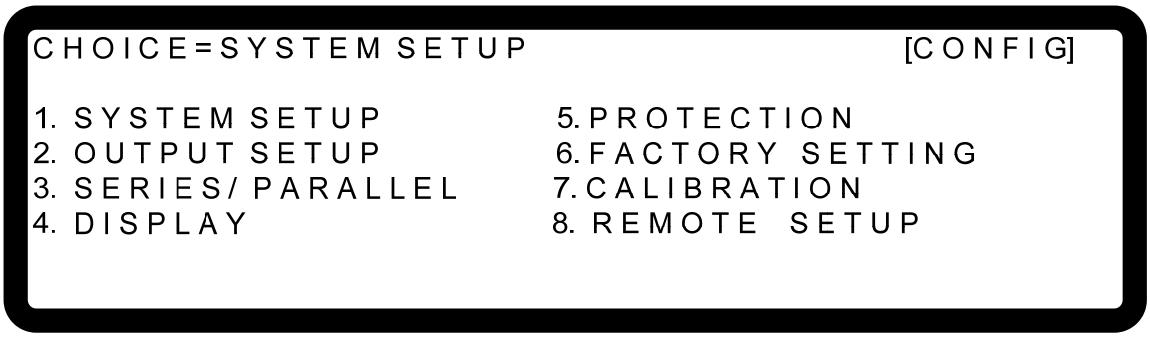


Figure 3-3

1. Use the numeric (1 ~ 8) keys or “Rotary” ( ) knob to select the item to be set.
2. Press “ ENTER ” to confirm.
3. Press “ EXIT ” to return to the MAIN PAGE.

Notice

1. To cancel the setting, press “ EXIT ” to return to the MAIN PAGE.
2. Press “ VOLT ” or “ CURR ” in any page can return to the MAIN PAGE.

Figure 3-4 shows the tree structure of CONFIG PAGE.

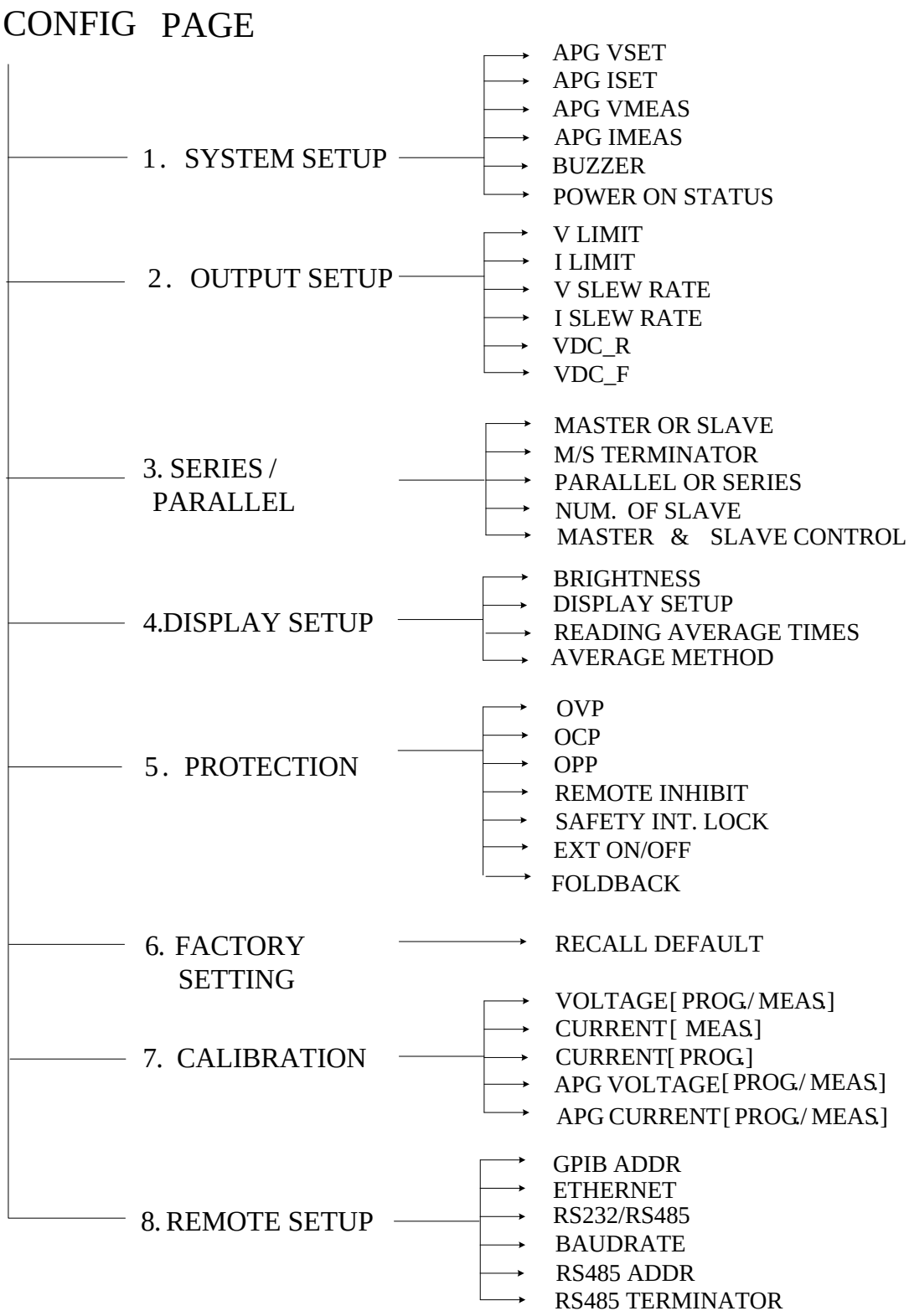

CONFIG PAGE
1. SYSTEM SETUP
APG VSET
APG ISET
APG VMEAS
APG IMEAS
BUZZER
POWER ON STATUS
2. OUTPUT SETUP
V LIMIT
I LIMIT
V SLEW RATE
I SLEW RATE
VDC_R
VDC_F
3. SERIES / PARALLEL
MASTER OR SLAVE
M/S TERMINATOR
PARALLEL OR SERIES
NUM. OF SLAVE
MASTER & SLAVE CONTROL
4.DISPLAY SETUP
BRIGHTNESS
DISPLAY SETUP
READING AVERAGE TIMES
AVERAGE METHOD
5. PROTECTION
OVP
OCP
OPP
REMOTE INHIBIT
SAFETY INT. LOCK
EXT ON/OFF
FOLDBACK
6. FACTORY SETTING
RECALL DEFAULT
7. CALIBRATION
VOLTAGE[PROG./ MEAS.]
CURRENT[MEAS.]
CURRENT[PROG.]
APG VOLTAGE[PROG./ MEAS.]
APG CURRENT[PROG./ MEAS.]
8. REMOTE SETUP
GPIB ADDR
ETHERNET
RS232/RS485
BAUDRATE
RS485 ADDR
RS485 TERMINATOR

Figure 3-4

3.3.1 SYSTEM SETUP

1. In Config setup page, press "1" and "ENTER" will display the screen of Figure 3-5. Use " ←↑ ", " ↓→ " keys to move the cursor to desired selection.

```
                                    [SYSTEM SETUP]
APG VSET              = NONE_
APG I SET             = NONE
APG VMEAS             = NONE
APG IMEAS             = NONE
BUZZER                = ON
POWER ON STATUS =  DEFAULT
```

Figure 3-5

3.3.1.1 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 separately as described below.

1. Use " ←↑ ", " ↓→ " keys to move the cursor to the column to be set as Figure 3-6 shows.

```
                                    [SYSTEM SETUP]
APG VSET              = NONE_
APG I SET             = NONE
APG VMEAS             = NONE
APG IMEAS             = NONE
BUZZER                = ON
POWER ON STATUS =  DEFAULT
```

Figure 3-6

2. For **APG VSET**, use the numeric keys "0" ~ "4" or "Rotary" (◎) to set the mode. There are 5 selections for APG VSET which are NONE / Vref(0-5V) /Vref(0-10V) / Iref(4-20mA)/ Rref(0-5KOhm), where:

   NONE: It means not using the programming function.
   Vref(0-5V): It means using the external voltage source as the programming setting.
   Vref(0-10V): It means using the external voltage source as the programming setting.
   Iref(4-20mA): It means using the external voltage current source as the programming setting.

Rref(0-5KOhm): It means using the external resistance as the programming setting.

3. Press "ENTER" to confirm.

4. For **APG ISET**, use the numeric keys 0 ~ 4 or "Rotary" ( ) to set the mode. There are 5 selections for APG ISET which are NONE / Vref(0-5V) /Vref(0-10V) / Iref(4-20mA)/ Rref(0-5KOhm), where:

   NONE: It means not using the programming function.
   Vref(0-5V): It means using the external voltage source as the programming setting.
   Vref(0-10V): It means using the external voltage source as the programming setting.
   Iref(4-20mA): It means using the external voltage current source as the programming setting.
   Rref(0-5KOhm): It means using the external resistance as the programming setting.

5. Press "ENTER" to confirm.

6. For **APG VMEAS,** use the numeric keys 0 ~ 3 or "Rotary" ( ) to set the mode. There are 4 selections for APG VMEAS which are NONE / Vref(0-5V) /Vref(0-10V) / Iref(4-20mA), where:

   NONE: It means not using the measurement function.
   Vref(0-5V): It means using the power supply output voltage source as the measurement result.
   Vref(0-10V): It means using the power supply output voltage source as the measurement result.
   Iref(4-20mA): It means using the power supply output current source as the measurement result.

7. Press "ENTER" to confirm.

8. For **APG IMEAS**, use the numeric keys 0 ~ 3 or "Rotary" ( ) to set the mode. There are 4 selections for APG IMEAS which are NONE / Vref(0-5V) /Vref(0-10V) / Iref(4-20mA), where:

   NONE: It means not using the measurement function.
   Vref(0-5V): It means using the power supply output voltage source as the measurement result.
   Vref(0-10V): It means using the power supply output voltage source as the measurement result.
   Iref(4-20mA): It means using the power supply output current source as the

9. Press "ENTER" to confirm.

10. Press "EXIT" to return to the MAIN PAGE.

Notice

1. **APG VSET/APG ISET** has 5 selections which are NONE / Vref(0-5V) /Vref(0-10V) / Iref(4-20mA)/Rref(0-5KOhm), where：
   a. When selecting Vref=5V ➡ it means the DC Power Supply's output 0V ~ 600V/0A ~ 25A will map to 0~5V as Figure 3-7(a) shows.

b. When selecting Vref=10V ➡ it means the DC Power Supply's output 0V ~ 600V/0A ~ 25A will map to 0~10V as Figure 3-7 (b) shows.
c. When selecting Iref=4-20mA ➡ it means the DC Power Supply's output 0V ~ 600V/0A ~ 25A will map to 4-20mA as Figure 3-7 (c) shows.
d. When selecting Vref=5KOhm ➡ it means the DC Power Supply's output 0V ~ 600V/0A ~ 25A will map to 0~5KOhm as Figure 3-7 (d) shows.

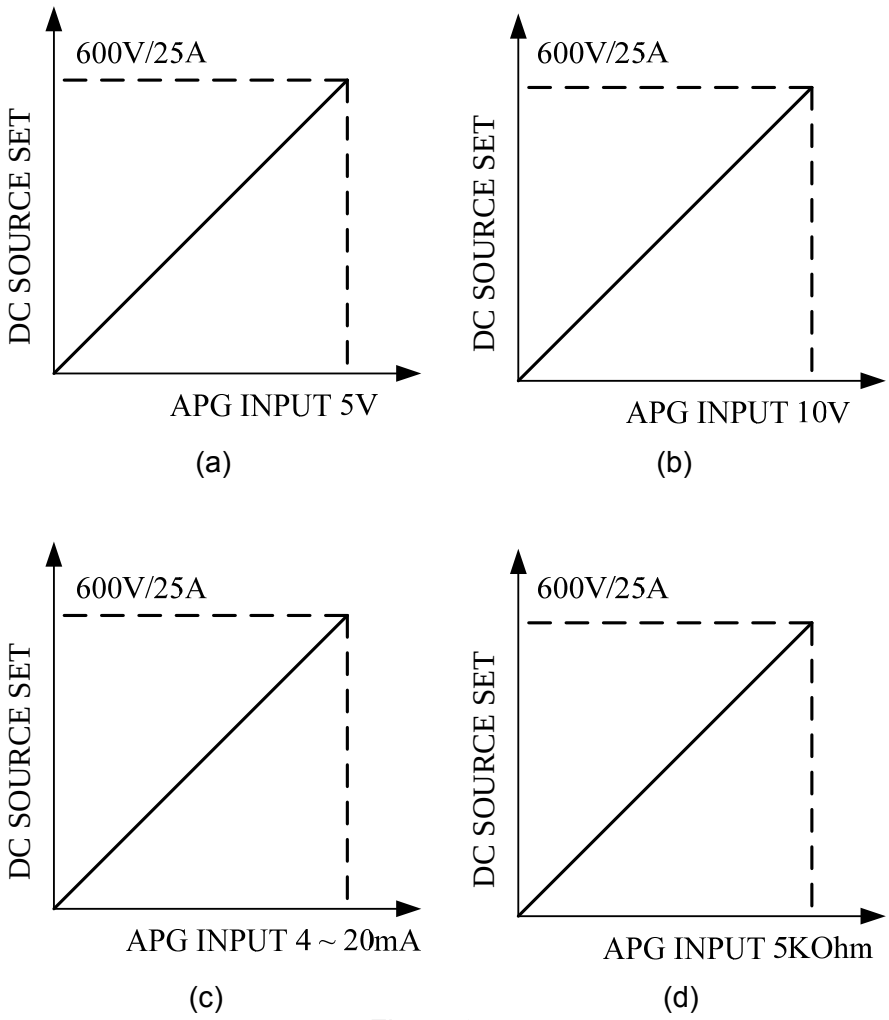


Figure 3-7

2. **APG VMEAS/APG IMEAS** has 4 selections which are NONE / Vref(0-5V) /Vref(0-10V) / Iref(4-20mA) where:
   a. When selecting Vref=5V ➔ it means the DC Power Supply's measurement output 0 ~ 600V/0A ~ 25A will map to 0~5V as Figure 3-8 (a) shows.
   b. When selecting Vref=10V ➔ it means the DC Power Supply's measurement output 0 ~ 600V/0A ~ 25A will map to 0~5V as Figure 3-8 (b) shows.
   c. When selecting Iref=4~20mA ➔ it means the DC Power Supply's measurement output 0 ~ 600V/0A ~ 25A will map to 4mA~20mA as Figure 3-8 (c) shows.

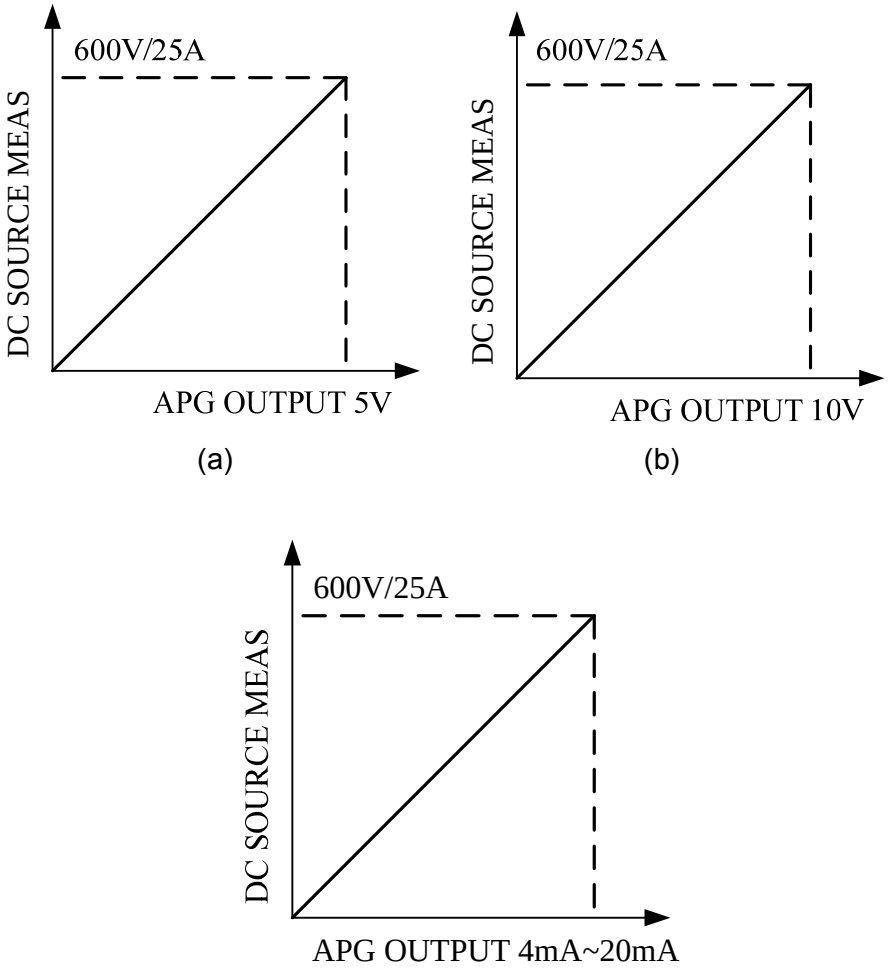


Figure 3-8

3. When using APG, in case the error is too large be sure to calibrate the APG settings and measurements first.
4. When setting the APG VMEAS/APG IMEAS to Iref(4-20mA) mode, to ensure the DC Power Supply can output correctly, the series resistance cannot exceed 500Ω. Also it is necessary to attention to the resistor wattage to avoid damaging the resistor.

3.3.1.1.1 Pin Assignment of APG Control

APG control is an output of external analog signal and its connector is located at the rear panel and its pin assignments are shown as Figure 3-9 and Figure 3-10.

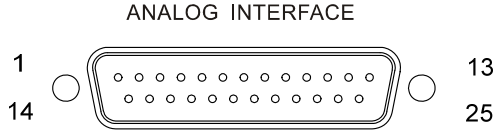


Figure 3-9

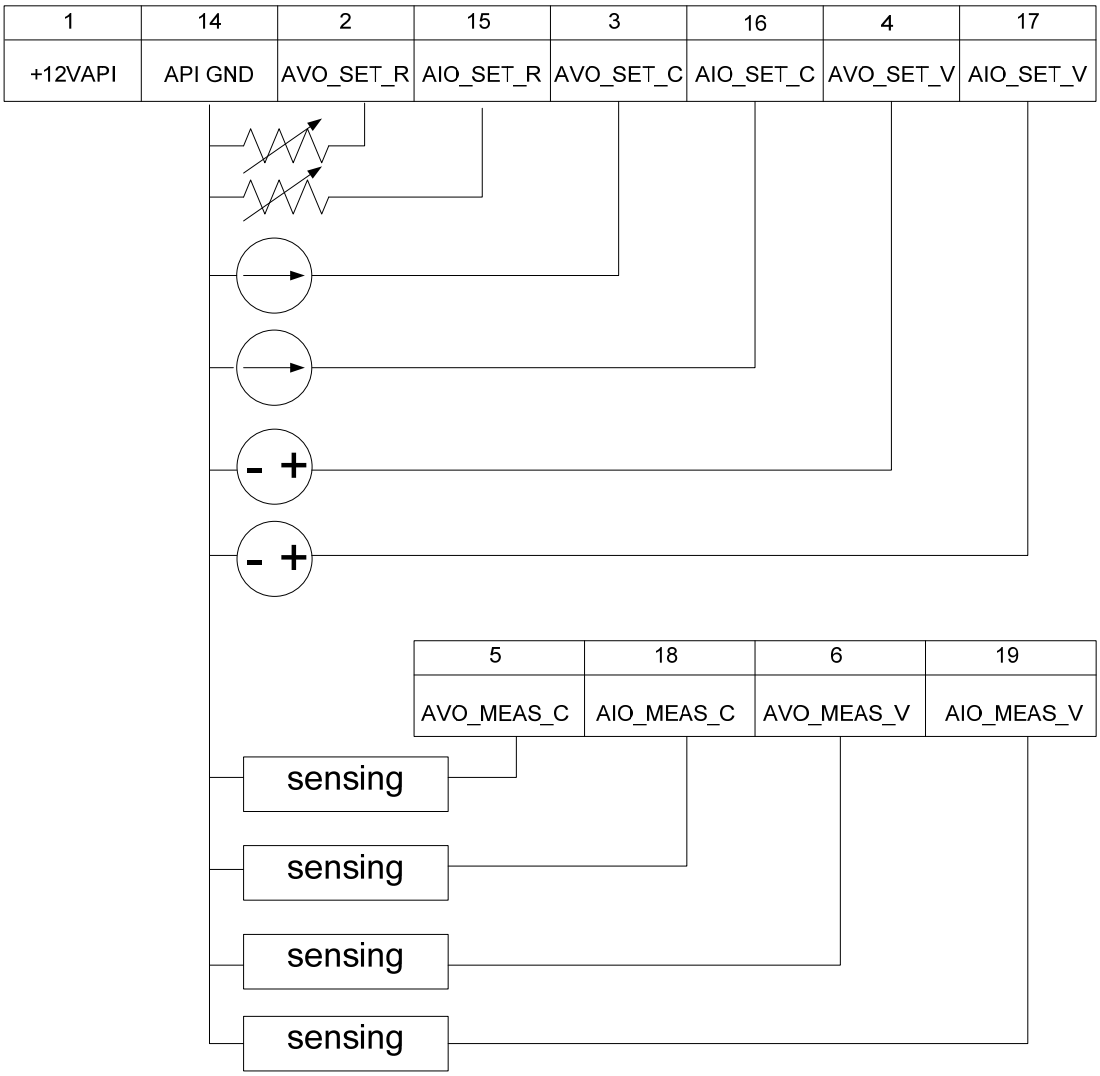


Figure 3-10

Following lists the definition of each pin:

1. Auxiliary power Vcc: This pin outputs a +12Vdc power with maximum output current 10mA (output port.)
2. Voltage programming: It inputs the resistance (0-5K Ohm) from this pin and APIGND that can control the output voltage (CV mode) linearly.
3. Voltage programming: It inputs the analog current (4-20mA) from this pin to APIGND that can control the output voltage (CV mode) linearly.
4. Voltage programming: It inputs the analog voltage (0-10Vdc or 0-5Vdc) from this pin to APIGND that can control the output voltage (CV mode) linearly.
5. Voltage measurement: This pin will output the voltage in analog signal 4mA-20mA for users to monitor it.
6. Voltage measurement: This pin will output the voltage in analog signal 0-5V or 0-10V for users to monitor it.

14. APIGND: This contact is the reference potential of APG interface. The potential is separated for APG and chassis, and the maximum tolerance of voltage differential is 70Vdc.
15. Current programming: It inputs the resistance (0-5K Ohm) from this pin and APIGND that can control the output current (CC mode) linearly.

16. Current programming: It inputs the analog current (4-20mA) from this pin to APIGND that can control the output current (CC mode) linearly.
17. Current programming: It inputs the analog voltage (0-10Vdc or 0-5Vdc) from this pin to APIGND that can control the output current (CC mode) linearly.
18. Current measurement: This pin will output the current in analog signal 4mA-20mA for users to monitor it.
19. Current measurement: This pin will output the current in analog signal 0-5V or 0-10V for users to monitor it.

3.3.1.2 BUZZER

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

1. Use " ◄▲ ", " ▼► " keys to move the cursor to the column to be set as Figure 3-11 shows.

```
                                    [SYSTEM SETUP]
APG VSET              =  NONE_
APG I SET             =  NONE
APG VMEAS             =  NONE
APG IMEAS             =  NONE
BUZZER                =  ON
POWER ON STATUS       =  DEFAULT
```

Figure 3-11

2. Use the numeric (0 ~ 1) keys or "Rotary"(◎) knob to select "ON" or "OFF" mode.
3. Press " ENTER " to confirm.
4. Press " EXIT " to return to the MAIN PAGE.

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.

3.3.1.3 POWER ON STATUS

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

1. Use “ ”, “ ” keys to move the cursor to the column to be set as Figure 3-12 shows.

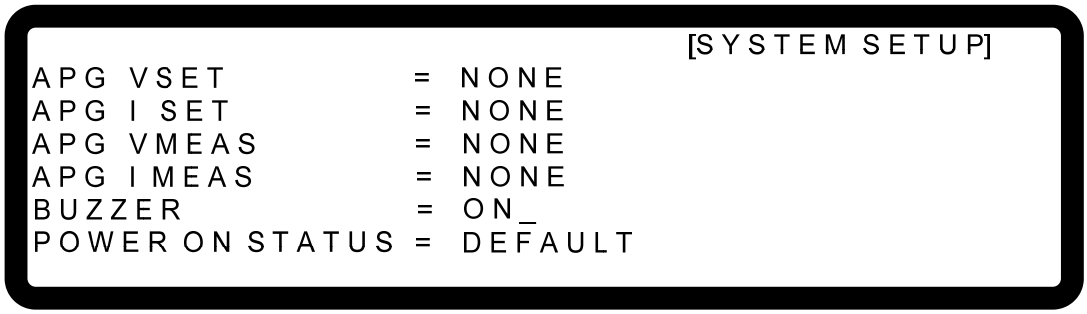


Figure 3-12

2. Press “0” or “2” to set the value, or use ““Rotary” ( ) knob to set it.

   POWER ON STATUS has three options: DEFAULT / LAST TURN OFF STATUS / USER DEFINITION.

   When it is set to DEFAULT, it means the output state is not defined specifically, which is V = 0.00V ; I = 0.00A ; OUTPUT = OFF.

   When it is set to LAST TURN OFF STATUS, the instrument will log the command voltage, command current and output state before powering it off, so that the state before powered off can be obtained for next power-on.

   Ex.: In Figure 3-13, the voltage setting is 60.00V, current setting is 10.00A and output setting is ON. When it powers on again, the instrument will remain the previous state by setting the voltage to 60.00V, current to 10.00A and output to ON.

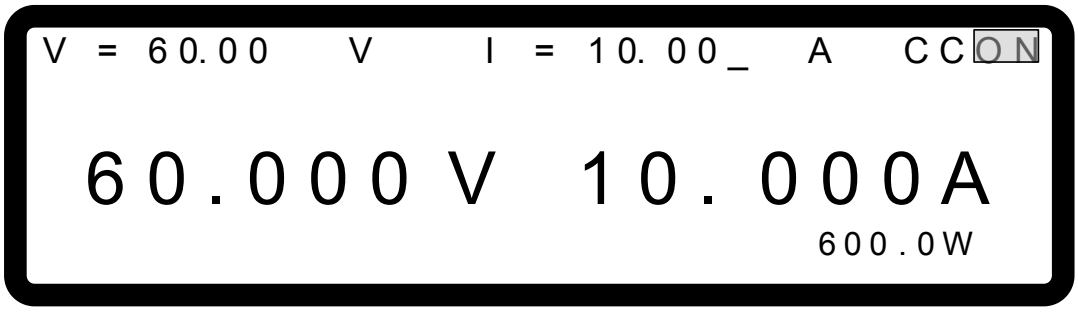


Figure 3-13

When set to USER DEFINITION a setting line will prompt beneath the POWER ON STATUS line as Figure 3-14 shows for the user to set the default power-on state including voltage (V_SET), current (I_SET) and OUTPUT=ON/OFF.

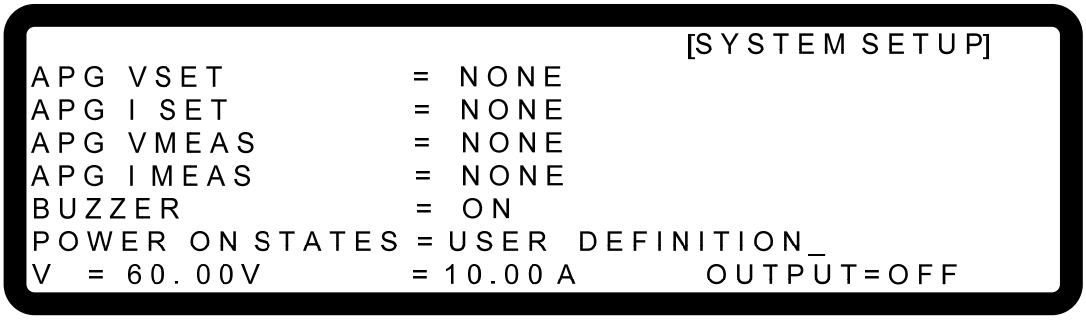


Figure 3-14

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

3.3.2 OUTPUT SETUP

1. In Config Setup page, press "2" key and "ENTER" to enter into the Output Setup screen as Figure 3-15 shows.
2. Press.
3. Press " ", " " keys to move the cursor to the column to be set.
4. Press "EXIT" to return to the MAIN PAGE.

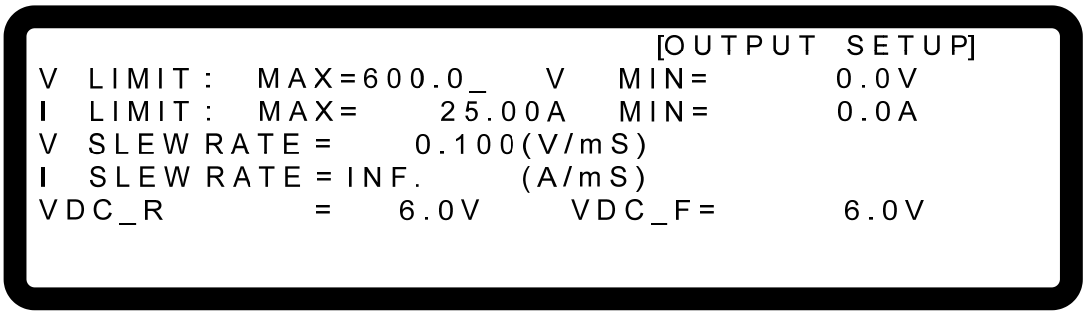


Figure 3-15

Notice The values in Figure 3-15 are the default settings of 62150H-600.

Following introduces the options of OUTPUT SETTING.

3.3.2.1 VOLTAGE LIMIT SETTING

1. Use “ ◄—▲ ”, “ ▼—► ” keys to move the cursor to the column to be set as Figure 3-16 shows.

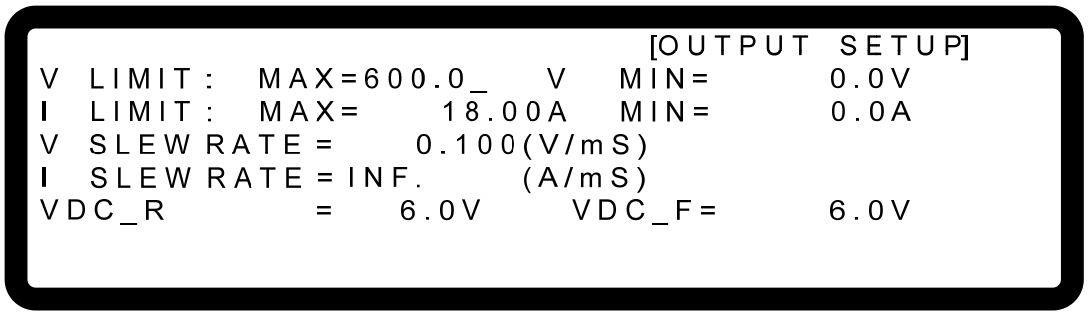


Figure 3-16

2. Use the numeric (0 ~ 9) keys or “Rotary” (◎) knob to set the value.
   Use this option can narrow down its range by setting the MIN and MAX. When “ VOLT ” is pressed to set the output voltage, the DC Power Supply allows setting the voltage within the range of [MIN value ≤ user-defined value ≤ MAX value]. Take example by 62150H-600, the 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 prompt a warning message automatically as shown in Figure 3-17 below.

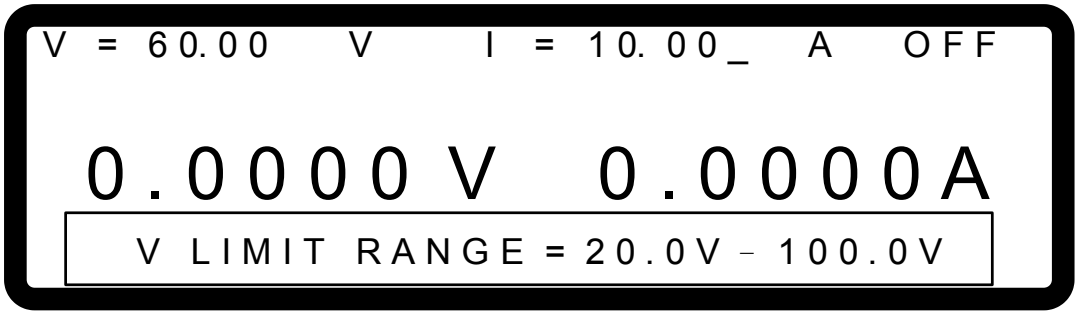


Figure 3-17

3. Press “ ENTER ” to confirm.
4. Press “ EXIT ” to return to the MAIN PAGE.

3.3.2.2 CURRENT LIMIT SETTING

1. Use “ ◄▲ ”, “ ▼► ” keys to move the cursor to the column to be set as Figure 3-18 shows.

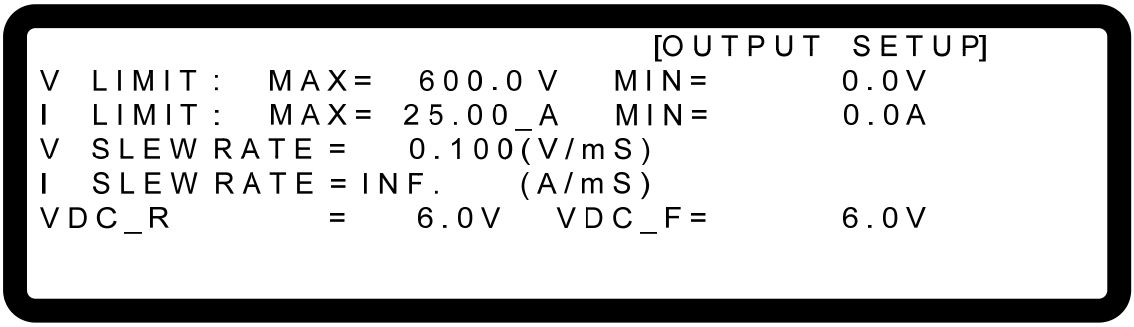


Figure 3-18

2. Use the numeric (0 ~ 9) keys or “Rotary” (◎) knob to set the value.

   Use this option can narrow down its range by setting the MIN and MAX. When “ CURR ” is pressed to set the output current, the DC Power Supply allows setting the current within the range of [MIN value ≤ user-defined value ≤ MAX value]. Take example by 62150H-600, the V 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 prompt a warning message automatically as shown in Figure 3-19 below.

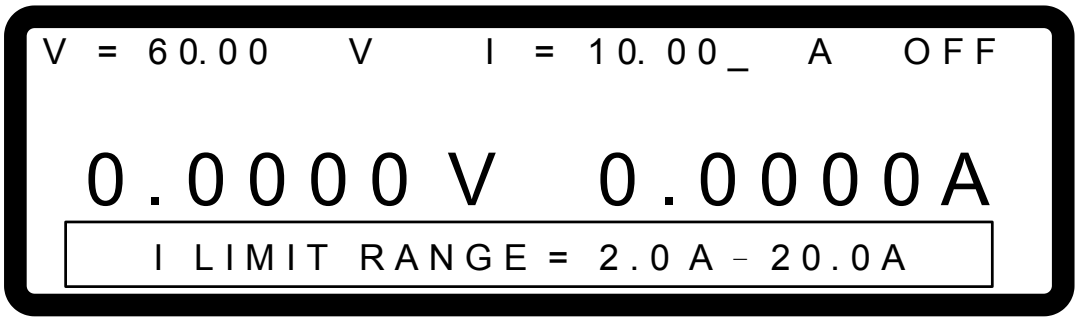


Figure 3-19

3. Press “ ENTER ” to confirm.
4. Press “ EXIT ” to return to the MAIN PAGE.

3.3.2.3 VOLTAGE SLEW RATE

1. Use “ ◄▲ ”, “ ▼► ” keys to move the cursor to the column to be set as Figure 3-20 shows.

```
                                        [OUTPUT SETUP]
V LIMIT:  MAX=     600.0V  MIN=       0.0V
I LIMIT:  MAX=      18.00A MIN=       0.0A
V SLEW RATE =   0.100_ (V/mS)
I SLEW RATE = INF.     (A/mS)
VDC_R       =    6.0V    VDC_F=       6.0V
```

Figure 3-20

2. Use the numeric (0 ~ 9) keys or “Rotary” (◎) knob to set the value. Take example by 62150H-600, the output voltage slew rate of the DC Power Supply is set as Figure 3-21 shows. The maximum input Slew Rate is 10V/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.

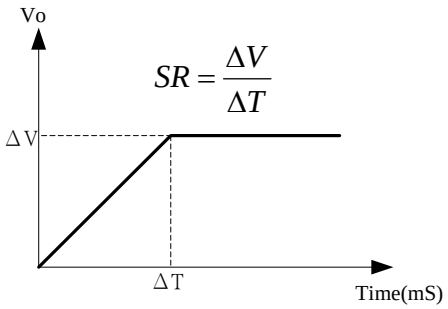


Figure 3-21

3. Press “ ENTER ” to confirm.
4. Press “ EXIT ” to return to the MAIN PAGE.

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

3.3.2.4 CURRENT SLEW RATE SETTING

1. Use " ◄▲ ", " ▼► " keys to move the cursor to the column to be set.

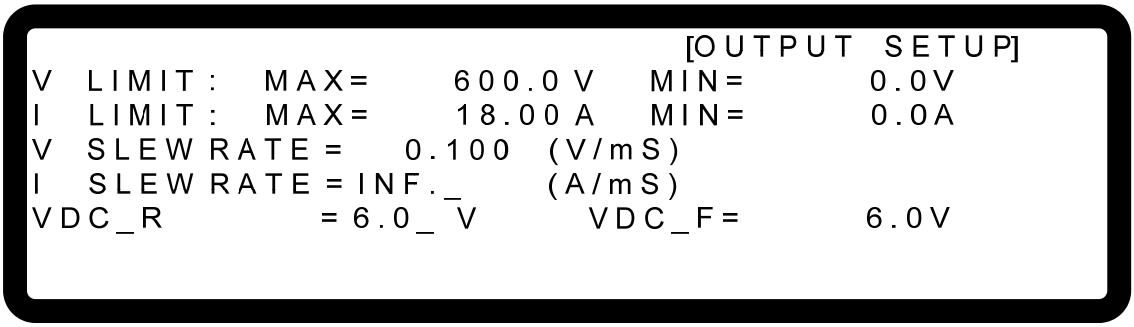


Figure 3-22

2. Use the numeric (0 ~ 9) keys or "Rotary" ( ) knob to set the value. Take example by 62150H-600, the output current slew rate of the DC Power Supply is set as Figure 3-23 shows. The maximum input Slew Rate is 0.1A/mS and the minimum is 0.001A/mS. If the input is larger than 0.1A/mS, the current Slew Rate will be set to INF. and change with maximum slew rate (near infinite). The output of DC Power Supply will follow the slew rate to rise to the set output current.

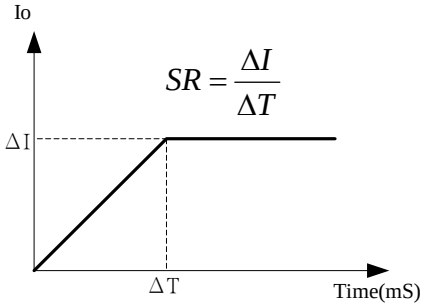


Figure 3-23

3. Press " ENTER " to confirm.
4. Press " EXIT " to return to the MAIN PAGE.

3.3.2.5 Setting DC_ON

There are two methods to set DC_ON. One is 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 pin10 DCOUT_ON of the ANALOG INTERFACE on the rear panel will turn to LOW. The other is when the DC power supply is ON, the pin10 DCOUT_ON of the ANALOG INTERFACE on the rear panel will turn to HIGH; also when the DC power supply is OFF, the pin10 DCOUT_ON of ANALOG INTERFACE on the rear panel will turn to LOW，as Figure 3-24 shows:

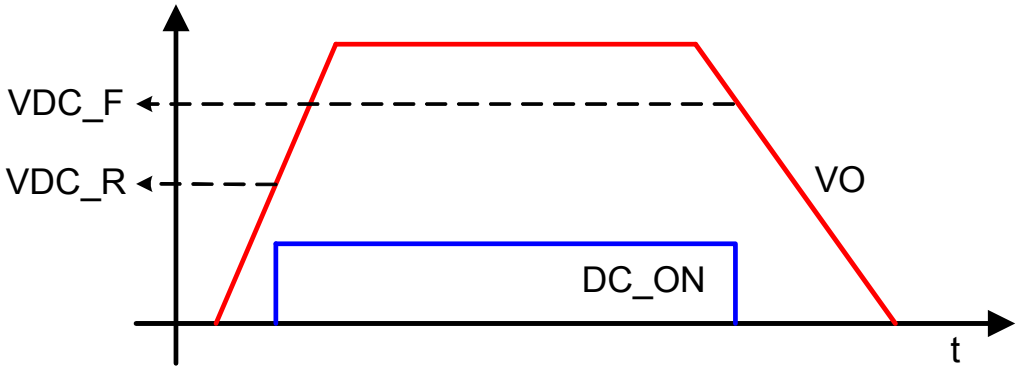


Figure 3-24

Set DC_ON as described below:

1. Method 1: Use “ ←↑ ”, “ ↓→ ” keys to move the cursor to the column to be set as Figure 3-25 shows.

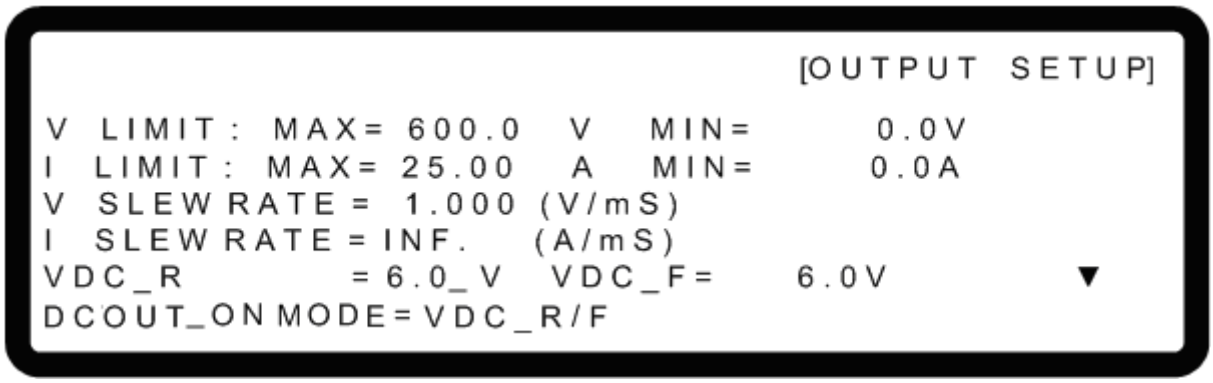


Figure 3-25

2. Use the numeric keys (0 ~ 9) or “Rotary” ( ) knob to set the value, the lower limit is 1%Vmax and upper limit is 99%Vmax. For instance, the lower limit of DC_ON is 6V and the upper limit is 594V for 62150H-600.
3. Method 2: Use “ ←↑ ”, “ ↓→ ” keys to move the cursor to the column to be set as Figure 3-26 shows.

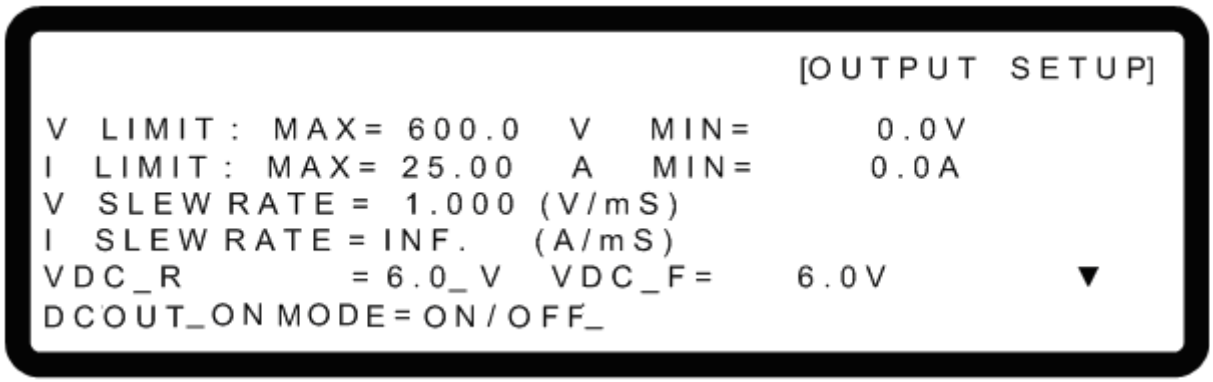


Figure 3-26

4. Use the numeric kesy (0 ~ 1) or “Rotary” ( ) knob to set the DCOUT ON MODED to ON/OFF and make the pin 10 of ANALOG INTERFACE take the command from the OUTPUT button on the front panel.

3.3.3 SERIES/PARALLEL

62000H Series DC Power Supplies are able to operate in series or parallel. The voltage is up to 1200V if connecting in series and the current is up to 3750A if connecting in parallel.

Notice

1. Series/Parallel cannot be mixed in use.
2. The maximum output voltage or current is 1200V or 3750A when operating the 62000H Series in series or parallel. Table 3-1 lists the examples of 62150H-40, 62150H-450, 62150H-600 and 62150H-1000.

Table 3-1

62000H Series Model	Serial		Parallel	
	Max. Devices	Max. Output Voltage (V)	Max. Devices	Max. Output Current (A)
62150H-40	2	80	10	3750
62150H-450	2	900	10	340
62150H-600	2	1200	10	250
62150H-1000	2	1200	10	150

3. Different model is unable to be operated in parallel or serial.
4. Be sure the breaker capacity is enough and the earth wire is grounded to earth ground when series/parallel is in use.
5. When the devices to be paralleled are over 5 sets (>5), please contact the Service Center or agent of CHROMA.
6. Please configure the DC Power Supplies up and down stack for parallel connection. The standard CURRENT SHARING cable is unable to use if placing the devices lateral for parallel configuration. It is necessary to purchase another optional CURRENT SHARING (100CM) cable for use. Please contact CHROMA Service Center or local agent for further information. Also, be noted that the paralleled

3.3.3.1 Connecting Series/Parallel Output Cable

Figure 3-27 and Figure 3-28 show the connections of serial and parallel output cables.

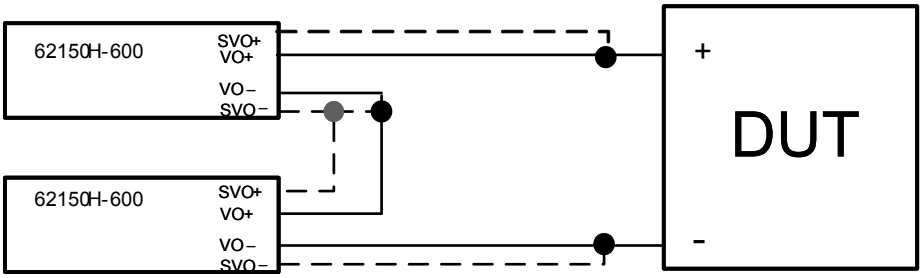


Figure 3-27

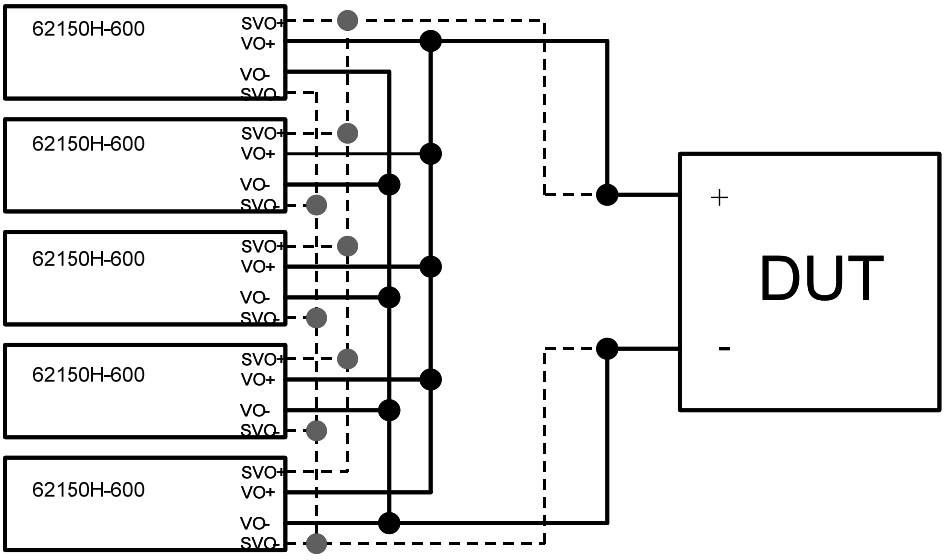


Figure 3-28

3.3.3.2 Assembling Series/Parallel Communication Interface

1. When the DC Power Supply is connecting in series for operation, the SYSTEM BUS connectors on the rear panel must be connected as Figure 3-29 shows.

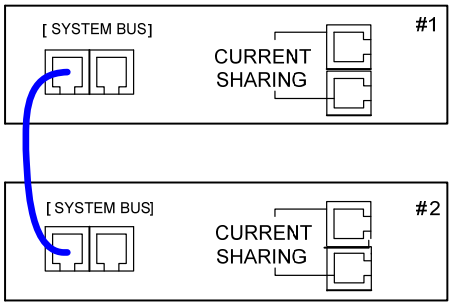


Figure 3-29

2. When the DC Power Supply is connecting in parallel for operation, besides the SYSTEM BUS connectors on the rear panel need to be connected, the CURRENT SHARING connectors have to be connected as well as Figure 3-30.

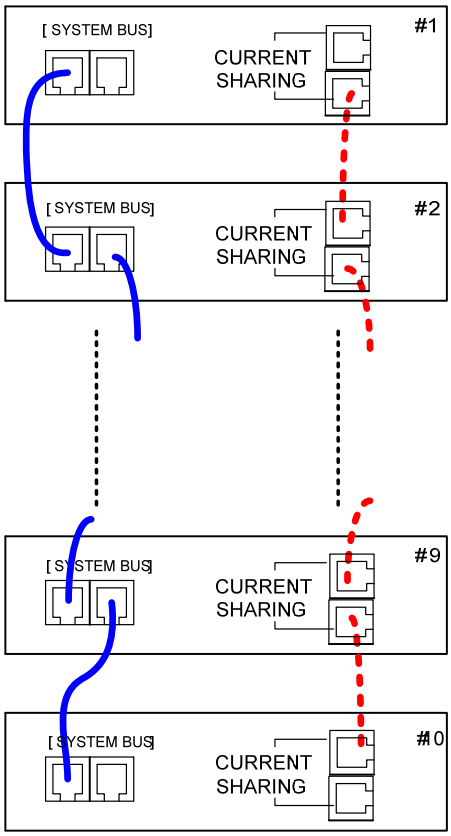


Figure 3-30

Notice

1. Each DC Power Supply has two RS485 interface female connectors. They need to be connected either in series or parallel operation. There is no difference between left and right; just to connect one after another as Figure 3-29 or Figure 3-30 shows in solid line.
2. Each DC Power Supply has two CURRENT SHARING connecting terminals. Connect the output terminal of the first Power Supply to the input terminal of the second Power Supply and so forth as Figure 3-30 shows in dot line. Be sure to use the CURRENT SHARING communication cable provided by CHROMA.
3. The CURRENT SHARING communication cable must be well connected when in parallel operation, or it may cause the DC Power Supply to run abnormally or poor result in CURRENT SHARING.
4. If it is necessary to return to single unit operation mode, be sure to remove the SYSTEM BUS, CURRENT SHARING signal cables to avoid operation error.

⚠WARNING

1. The DC Power Supply might be burned-out if the CURRENT SHARING input and output terminals are connected incorrectly when in parallel mode.
2. Do not connect the CURRENT SHARING cable when in series operation or it might be burned-out.

3.3.3.3 Setting Series/Parallel Operation Mode

3.3.3.3.1 Setting SLAVE

CAUTION It is necessary to set SLAVE first and MASTER last when operating 62000H Series DC Power Supply in series or parallel mode, or it may not be able to operate due to communication error.

When MASTER OR SLAVE sets to SLAVE, it has to set the SLAVE to SLAVE1 ~ SLAVE9 and M/S TERMINATOR selection. Set the SLAVE in sequence starting from SLAVE1.

1. In Config Setup page, press "3" and "ENTER" to select PARALLEL /SERIES and display Figure 3-31.
2. Use " ", " " keys to move the cursor to the PARALLEL OR SERIES selection column.

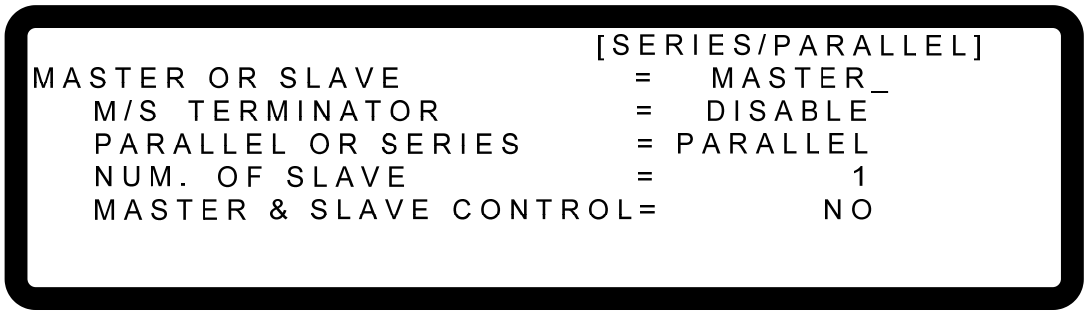


Figure 3-31

3. Use the numeric (1~0) keys or "Rotary" ( ) knob to set SLAVE1~SLAVE9 as Figure 3-32 shows.

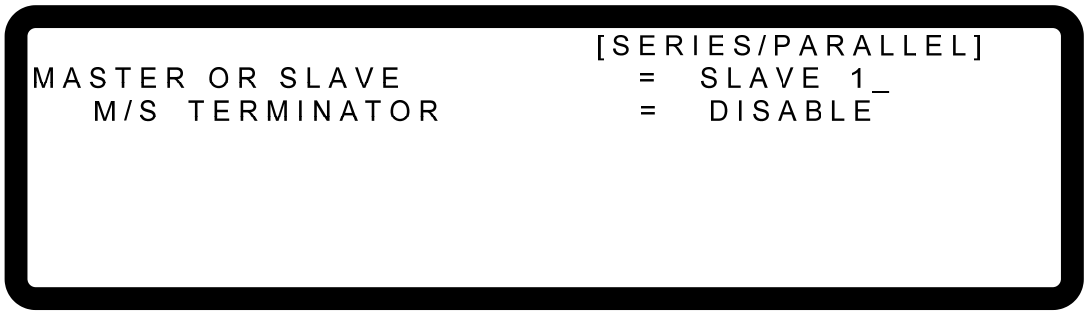


Figure 3-32

4. Press "ENTER" to confirm and press "EXIT" to return to the MAIN PAGE.
5. Use the numeric (1 ~ 0) key or "Rotary" ( ) knob to ENABLE or DISABLE the TERMINATOR as Figure 3-32 shows.
6. Press "ENTER" to confirm.
7. Press "EXIT" to return to the MAIN PAGE.

3.3.3.3.2 Setting MASTER

If MASTER OR SLAVE is set to MASTER, it has to set M/S TERMINATOR, PARALLEL OR SERIES and NUM. OF SLAVE selections. See the description of PARALLEL OR SERIES in section 0 and NUM. OF SLAVE in section 3.3.3.3.4.

MASTER has two main functions:

(1) It issues commands to all SLAVE, such as voltage setting, current setting, protection setting and etc., which means all settings in SALVE are from MASTER. The original settings in SLAVE are temporary invalid.

(2) It accepts all measurement values and protection signals from SLAVE. The MASTER calculates all measurement values and displays them in the main page. Moreover, when protection is occurred in one SLAVE, the MASTER will notify other SLAVE to set off the protection and show in the MASTER's main page.

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.

Set MASTER as described below:

1. In Config Setup page, press "3" and ENTER to select PARALLEL/SERIES.
2. Use the numeric (0) key or "Rotary" ( ) knob to set MASTER as Figure 3-33 shows.

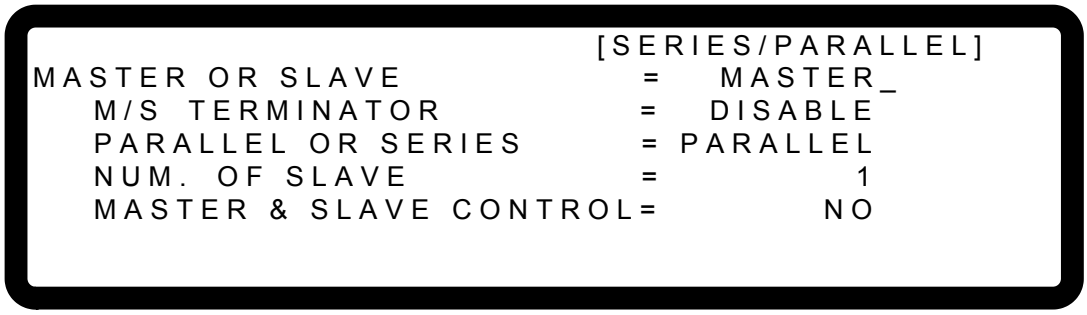


Figure 3-33

3. Use " ", " " keys to move the cursor to the M/S TERMINATOR selection item.
4. Use the numeric (1 ~ 0) key or "Rotary" ( ) knob to ENABLE or DISABLE the TERMINATOR as Figure 3-33 shows.
5. Press "ENTER" to confirm.

Notice

Description of M/S TERMINATOR

When the 62000H Series Models are operating in MASTER OR SLAVE mode, please be aware of the M/S TERMINATOR setting. Assuming the connection is as Figure 3-34 shows, the M/S TERMINATOR of the first and last devices must be ENABLED with 120Ω internal resistance.

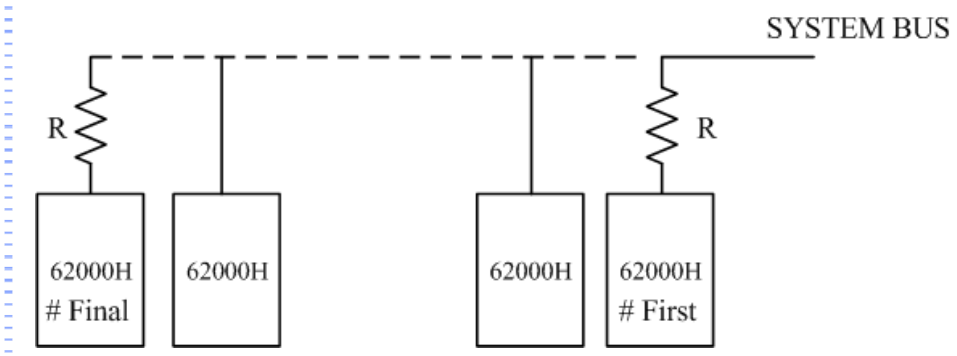


Figure 3-34

3.3.3.3.3 Setting PARALLEL or SERIES

This option is to set the Power Supply to be operated in Series or Parallel mode as Figure 3-35 shows. There are two selections: PARALLEL and SERIES.

1. Use " ◄—▲ ", " ▼—► " keys to move the cursor to the column to be set.

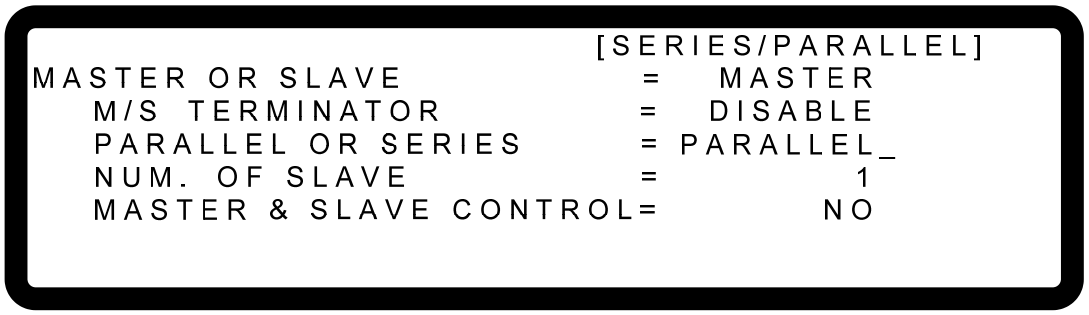


Figure 3-35

2. Use the numeric (0 ~ 1) keys or "Rotary" (◎) knob to set PARALLEL or SERIES.

   Connect the cables on the rear panel as Figure 3-29 shows when set to SERIES and as Figure 3-30 shows when set to PARALLEL.

   Select SERIES will prompt the following window as Figure 3-36 shows to remind the user to disconnect the CURRENT SHARING cable on the rear panel.

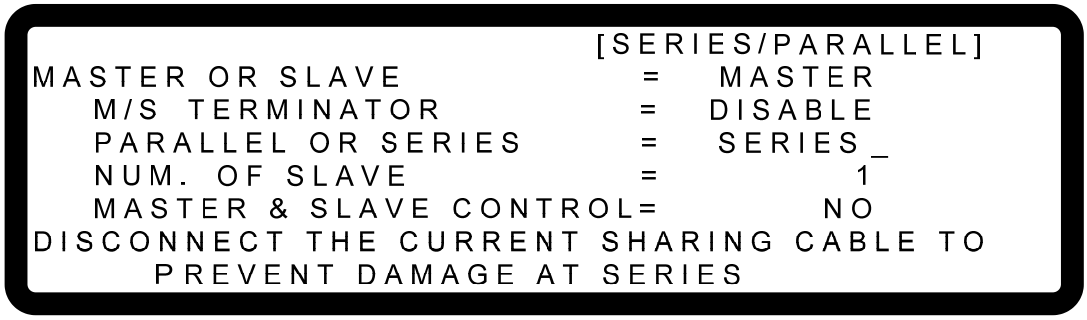


Figure 3-36

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

3.3.3.3.4 Setting NUM. OF SLAVE

Take example by 62150H-600, when the DC Power Supply is set to MASTER, the controlled number that is the SLAVE number has to be set as well. If the controlled sets are 4, then set NUM. OF SLAVE = 4 as Figure 3-37 shown below.

1. Use "◄▲", "▼►" keys to move the cursor to the column to be set.
2. Use the numeric (0 ~1) keys or "Rotary" (◎) knob to set the number of SLAVE.

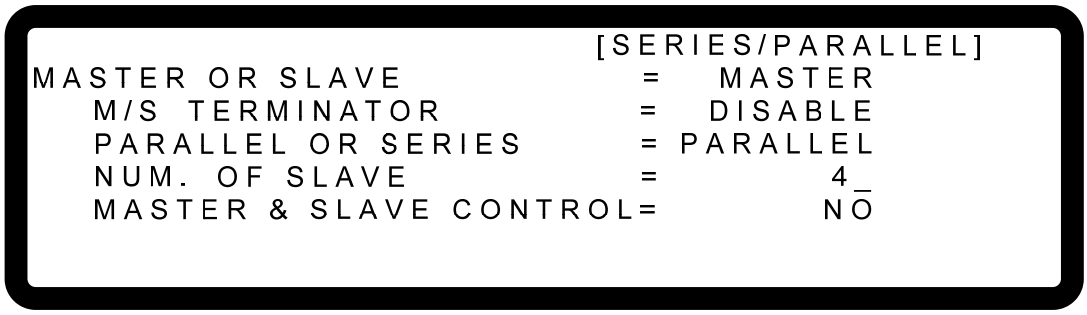


Figure 3-37

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

Notice

Take example by 62150H-40:

1. If there are 5 sets connected in parallel and 40V/1000A is set, the setting of each set is 40V/200A and the total output will be 40V/1000A.
2. If there are 2 sets connected in series and 80V/375A is set, the setting of each set is 40V/375A and the total output will be 80V/375A.
3. The total sets for connecting in series are 2; therefore, the maximum number of NUM. OF SLAVE is 1.
4. The total sets for connecting in parallel are 10; therefore, the maximum number of NUM. OF SLAVE is 9.

3.3.3.3.5 Activating MASTER & SLAVE CONTROL

When PARALLEL OR SERIES, NUM. OF SLAVE are set for MASTER, it is able to use MASTER to activate the series/parallel control as described below:

1. Use " ◄—▲ ", " ▼—► " keys to move the cursor to the column to be set as Figure 3-38 shows.
2. Use the numeric (1) key or "Rotary" ( ) knob to set YES ◦

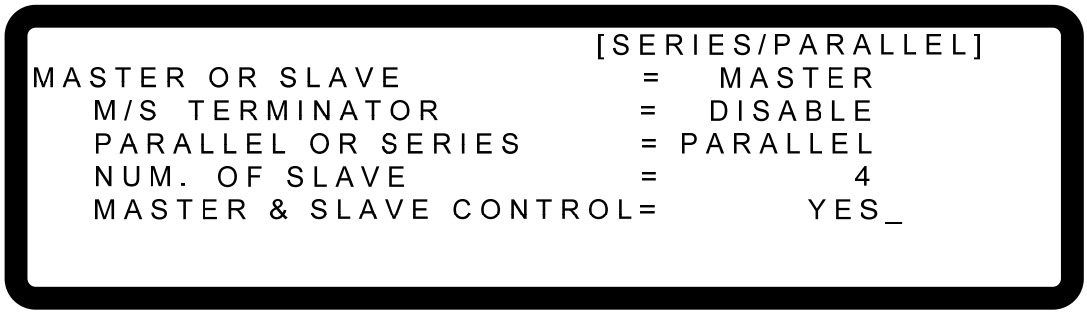


Figure 3-38

3. Press "ENTER" to confirm, it will skip to the series/parallel MASTER page automatically as Figure 3-39 shows.

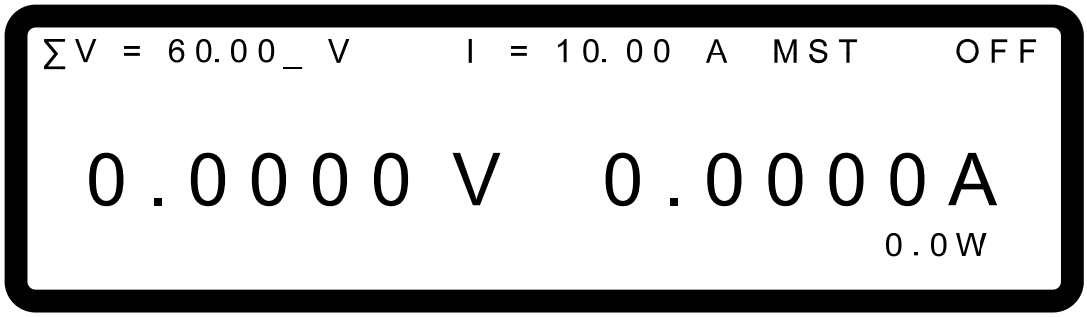


Figure 3-39

4. The SLAVE page will skip to Figure 3-40 automatically.

Figure 3-40

5. Start the series/parallel usage.

CAUTION Communication error will occur if the SLAVE settings are the same (such as SLAVE 1 & SLAVE 1). The MAIN PAGE of MASTER will show as

1. Figure 3-41. When this type of error occurs, exit the series/parallel operation first and then change the SLAVE setting to resume the operation.

Figure 3-41

2. Once the series/parallel is set, the settings can be saved. After all machines are powered off, turn on the SLAVE first and MASTER the last, it will set series/ parallel operation automatically.

3.3.3.4 Setting Series Parameters

When the software communication and hardware settings for series are completed, the settings of following windows are introduced in the sections underneath - (1) MAIN PAGE, (2) SYSTEM SETUP, (3) OUTPUT SETUP and (4) PROTECTION.

3.3.3.4.1 Setting MAIN PAGE

MAIN PAGE is mainly used to set voltage (V) and current (I). The difference between single unit and series operation is that the voltage set will increase following the number connected in series. The voltage set is indicated by ΣV for easy identification. When set to MASTER, MST will appear at the window's upper right corner as Figure 3-42 shows below.

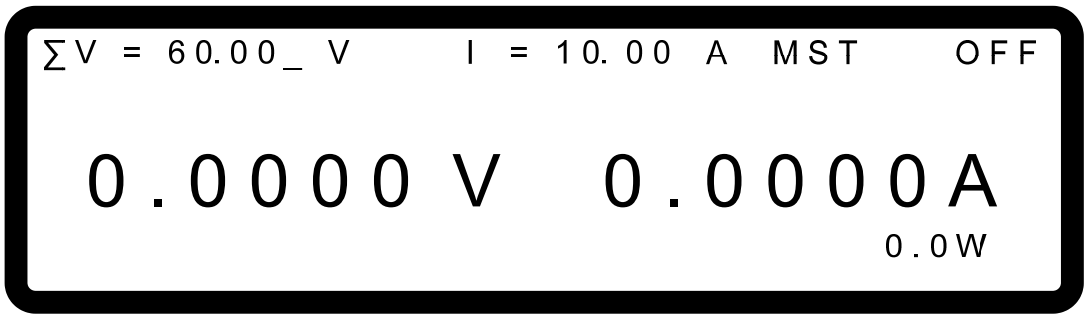


Figure 3-42

3.3.3.4.2 Setting SYSTEM SETUP for Series

The operation of POWER ON STATUS in SYSTEM SETUP for series is the same as single unit; only the output voltage will increase following the number of machines set in series. For example if there are 2 sets of 62150H-600 in series, the maximum output voltage can be set is 1200V, and the maximum output current is 25A as Figure 3-43 shows below:

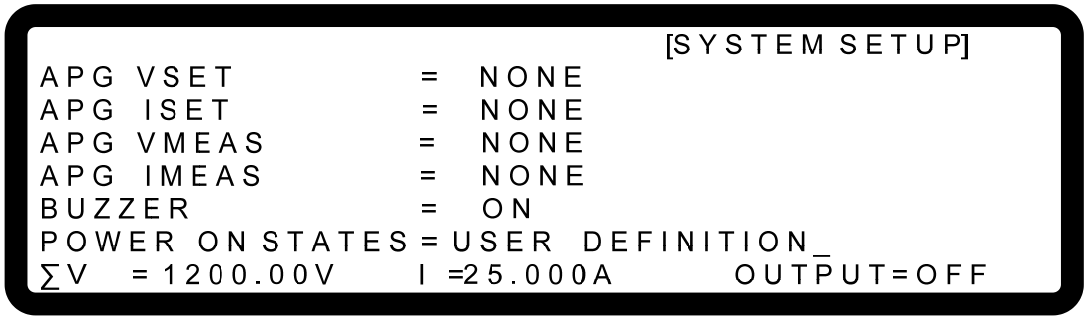


Figure 3-43

Notice It will return to single unit mode once the POWER ON STATUS is set in series mode. The POWER ON STATUS sets the output voltage and current to 0 and OUTPUT to OFF automatically.

3.3.3.4.3 Setting OUTPUT SETUP for Series

The V LIMIT MAX in OUTPUT SETUP of MASTER for series connection will increase following the number connected in series. It is indicated by ΣV LIMIT MAX: for easy identification as Figure 3-44 shows below. Furthermore, the setting range of ΣV SLEW RATE will increase following the number connected in series too.

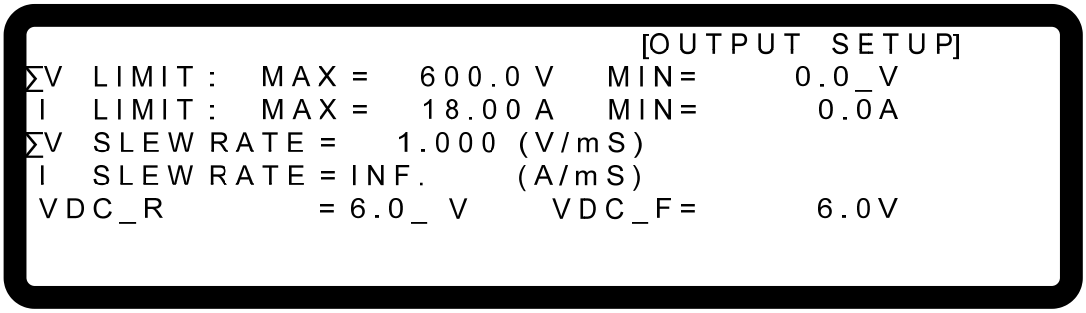


Figure 3-44

3.3.3.4.4 Setting PROTECTION for Series

The OVP and OPP in PROTECTION of MASTER for series connection will increase following the number connected in series. It is indicated by ΣOVP and ΣOPP for easy identification as Figure 3-45 shows below.

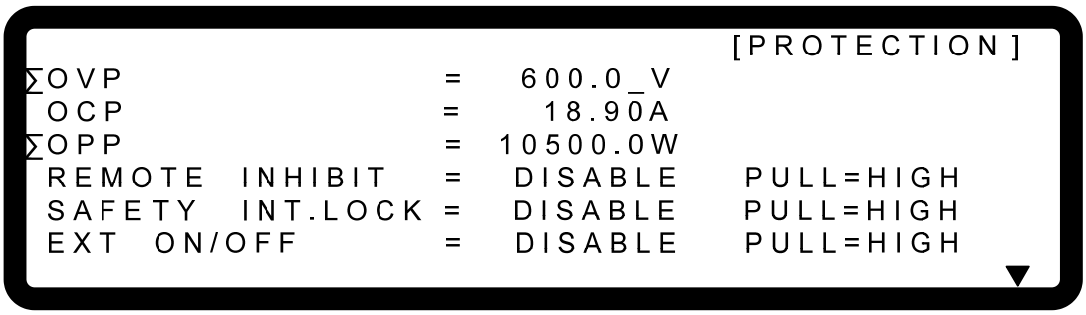


Figure 3-45

3.3.3.5 Setting Parallel Parameters

When the software communication and hardware settings for parallel are completed, the settings of following windows are introduced in the sections underneath - (1) MAIN PAGE, (2) SYSTEM SETUP and (3) OUTPUT SETUP.

3.3.3.5.1 Setting MAIN PAGE

MAIN PAGE is mainly used to set voltage (V) and current (I). The difference between single unit and parallel operation is that the current set will increase following the number connected in parallel. The current set is indicated by ΣI for easy identification. When set to MASTER, MST will appear at the window's upper right corner as Figure 3-46 shows below.

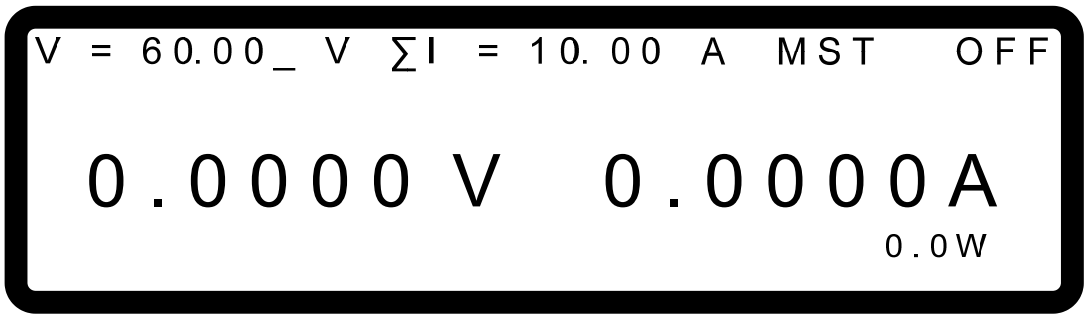


Figure 3-46

3.3.3.5.2 Setting SYSTEM SETUP for Parallel

The operation of POWER ON STATUS in SYSTEM SETUP for parallel is the same as single unit; only the output current will increase following the number of machines set in parallel. For example if there are 5 sets of 62150H-600 in parallel, the maximum output voltage can be set is 600V, and the maximum output current is 125A as Figure 3-47 shows below:

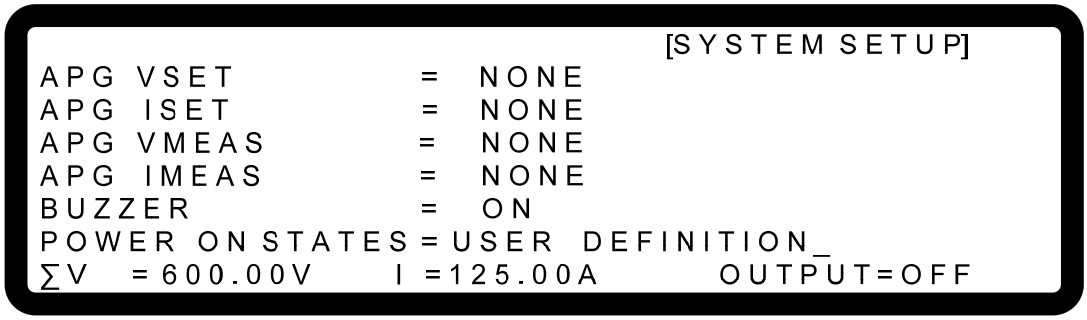


Figure 3-47

Notice It will return to single unit mode once the POWER ON STATUS is set in parallel mode. The POWER ON STATUS sets the output voltage and current to 0 and OUTPUT to OFF automatically.

3.3.3.5.3 Setting OUTPUT SETUP for Parallel

The I LIMIT MAX in OUTPUT SETUP of MASTER for parallel connection will increase following the number connected in parallel. It is indicated by ΣI LIMIT MAX: for easy identification as Figure 3-48 shows below. Furthermore, the setting range of ΣI SLEW RATE will increase following the number connected in parallel too.

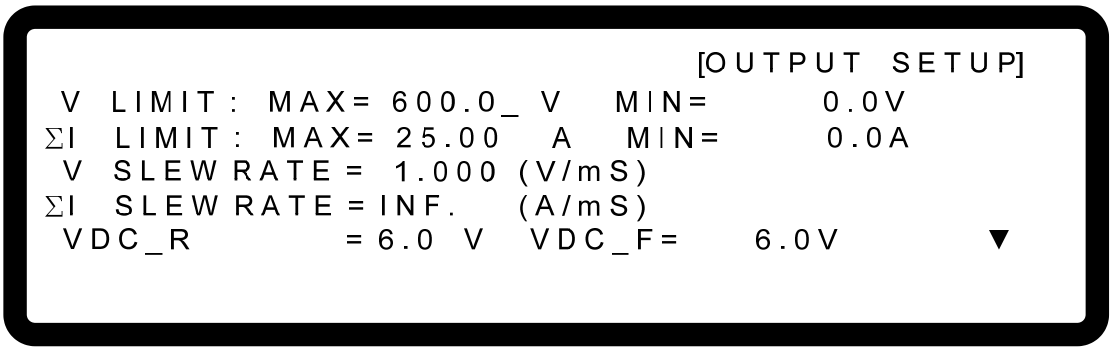


Figure 3-48

3.3.3.5.4 Setting PROTECTION for Parallel

The OCP and OPP in PROTECTION of MASTER for parallel connection will increase following the number connected in parallel. It is indicated by ΣOCP and ΣOPP for easy identification as Figure 3-49 shows below.

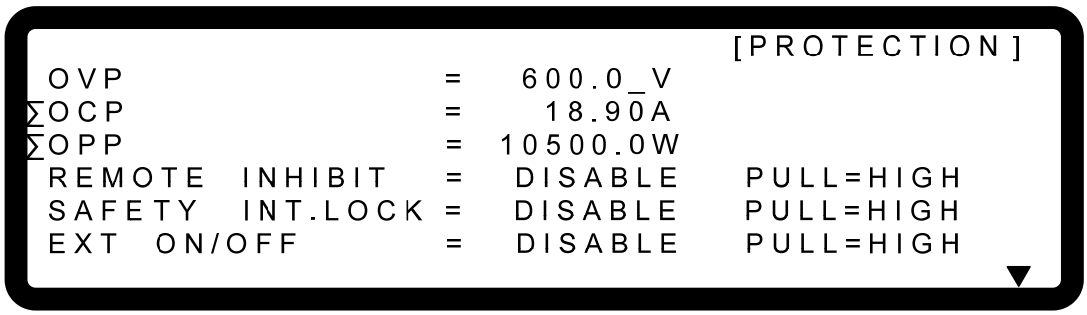


Figure 3-49

3.3.3.6 Setting Procedure for APG in Series or Parallel

3.3.3.6.1 Series Setting

To connect 2 sets of 62150H-600 DC Power Supplies in series for operation and set the APG option to APG VSET/APG ISET = Vref(0-5V), the MAIN PAGE of MASTER will show as Figure 3-50.

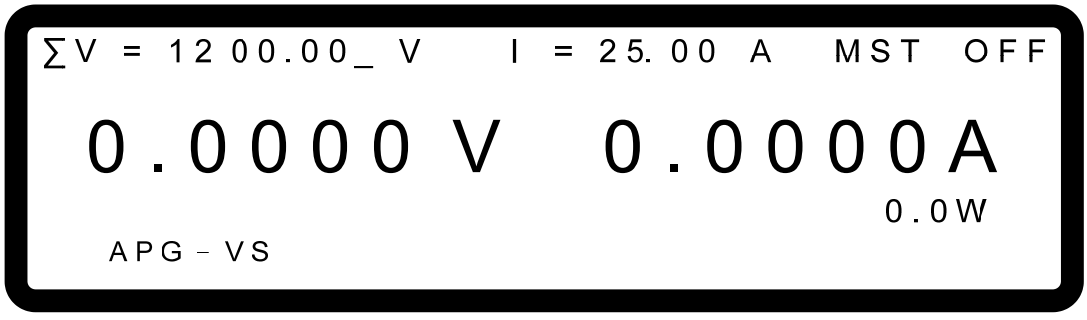
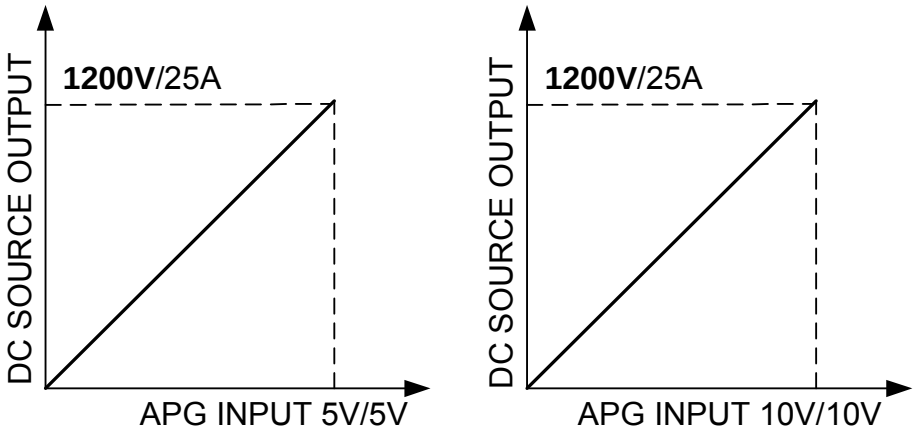


Figure 3-50

As to the voltage setting, the inputted analog voltage 0~5V maps to the actual output voltage 0~1200V; and for the current setting, the inputted analog voltage 0~5V maps to the actual output current 0~25A as Figure 3-51(a) shows. Set the APG option to APG VSET/APG ISET = Vref(0-10V) means the inputted analog voltage 0~10V maps to the actual output 0~1200V for APG voltage also maps to the actual output 0~25A for APG current as Figure 3-51(b) shows. For the above voltage/current setting method, the analog voltage (0~5V or 0~10V) has to be inputted to the devices connected in series respectively in order to have the effect of serial operation in APG mode.



(a) (b)

Figure 3-51

3.3.3.6.2 Parallel Setting

To connect 5 sets of 62150H-600 DC Power Supplies in parallel for operation and set the APG option to APG VSET/APG ISET = Vref(0-5V), the MAIN PAGE of MASTER will show as Figure 3-52.

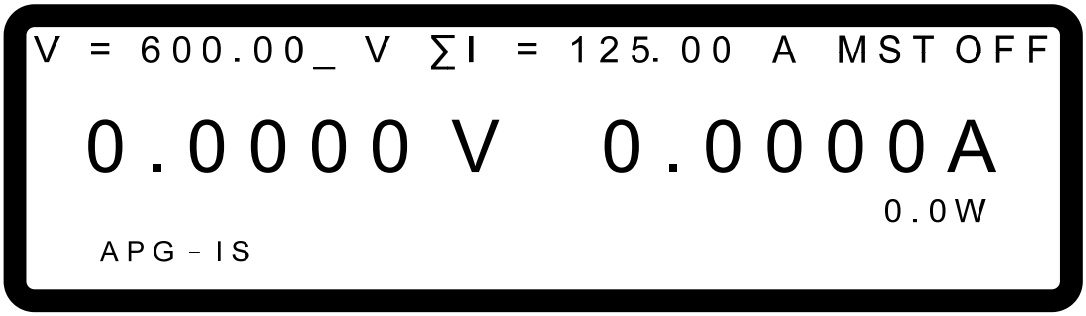
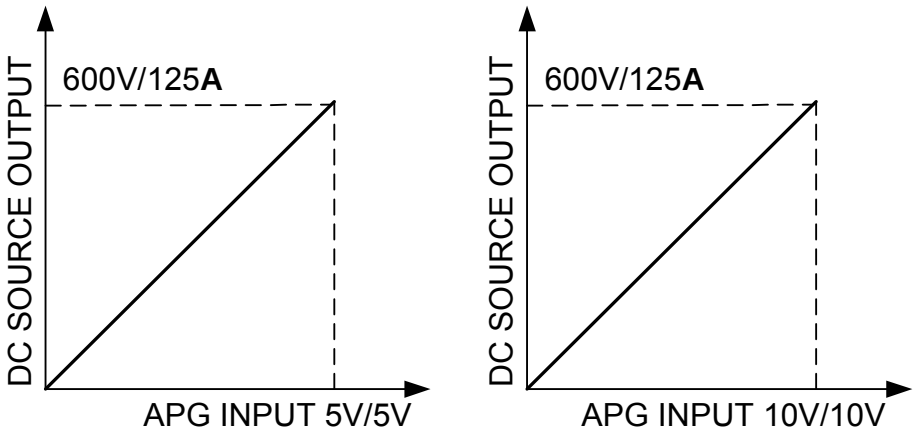


Figure 3-52

As to the voltage setting, the inputted analog voltage 0~5V maps to the actual output voltage 0~600V; and for the current setting, the inputted analog voltage 0~5V maps to the actual output current 0~125A as Figure 3-53(a) shows. Set the APG option to APG VSET/APG ISET = Vref(0-10V) means the inputted analog voltage 0~10V maps to the actual output 0~600V for APG voltage also maps to the actual output 0~125A for APG current as Figure 3-53(b) shows. For the above voltage/current setting method, the analog voltage (0~5V or 0~10V) has to be inputted to the devices connected in series respectively in order to have the effect of serial operation in APG mode.



(a) (b)

Figure 3-53

3.3.4 DISPLAY

DISPLAY setting has 4 options: (1) BRIGHTNESS (2) DISPLAY SELECTION (2) READING AVERAGE TIMES (4) AVERAGE METHOD.

3.3.4.1 BRIGHTNESS

This option sets the backlight panel brightness of the VFD on the front panel. There are 4 types of backlight brightness for selection (including turn off the backlight) for use in various occasions.

1. Use " ", " " keys to move the cursor to the column to be set as Figure 3-54 shows.

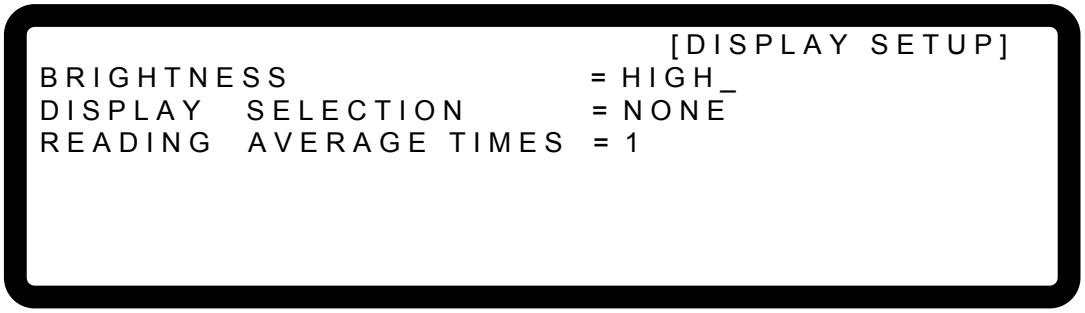


Figure 3-54

2. Use the numeric keys (0 ~ 3) or "Rotary" ( ) to select the VFD backlight brightness.
3. Press " ENTER " to confirm.
4. Press " EXIT " to return to the MAIN PAGE.

Notice

1. There are 3 selections for BRIGHTNESS: **HIGH /NORMAL/ DIMMED**, the default is **HIGH**.
2. Shortcuts and brightness description:
   a. Press "0", BRIGHTNESS = HIGH.
   b. Press "1", BRIGHTNESS = NORMAL.
   c. Press "2", BRIGHTNESS = DIMMED.
3. 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.

3.3.4.2 DISPLAY SELECTION

The setting of DISPLAY is to show the internal settings on the last line of MAIN PAGE for easy identification without entering the setting page. There are 4 options available for displaying on the MAIN PAGE: (1) NONE, (2) V/I LIMIT, (3) V/I/P PROTECT and (4) V/I SLEWRATE.

1. In Config setting page, press "4" to display the screen and "ENTER" to enter into DISPLAY SELECTION as Figure 3-55 shows.

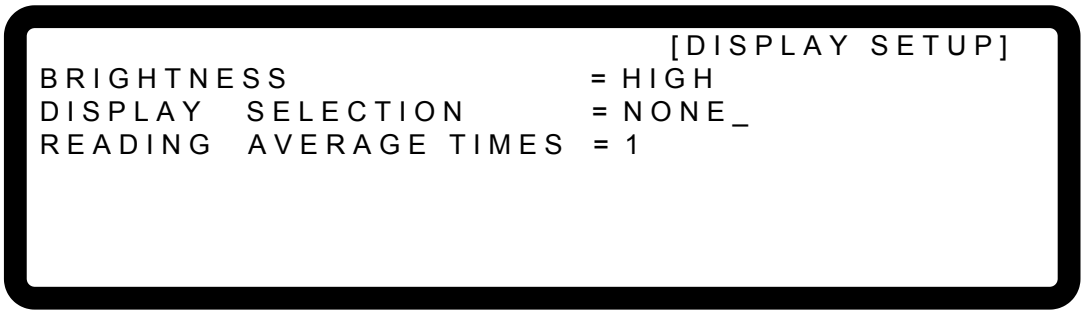


Figure 3-55

2. Use "◄▲", "▼►" keys to move the cursor to the column to be set as Figure 3-55 shows.
3. Use the numeric keys (0 ~ 3) or "Rotary" (◎) knob to select the desired setting. There are 4 selections on the MAIN PAGE：(1)NONE, (2)V/I LIMIT, (3)V/I/P PROTECT and (4)V/I SLEWRATE. The system default is NONE.

   When the selection is set to NONE, the MAIN PAGE does not show any message on the last line.

   When it is set to V/I LIMIT, the MAIN PAGE last line will show the range set by V LIMIT and I LIMIT in OUTPUT SETUP as Figure 3-56 shows. See section 3.3.2.1 and 3.3.2.2 for detail description.

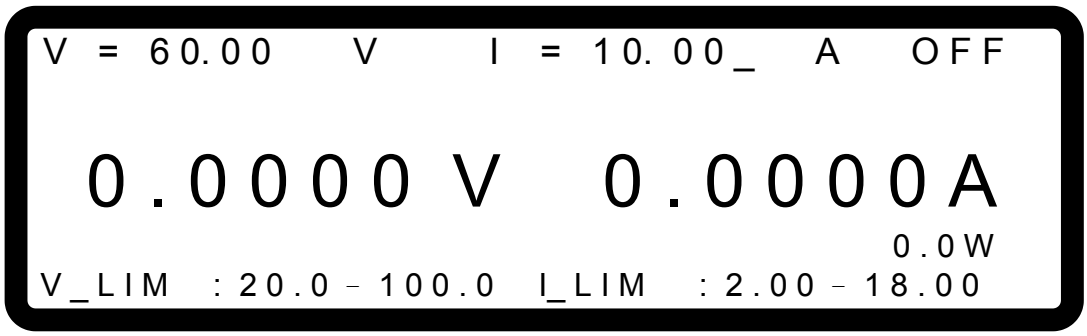


Figure 3-56

When the selection is set to V/I /P PROTECT, the MAIN PAGE last line will show the OVP, OCP and OPP settings in the PROTECTION as Figure 3-57 shows. See sections 3.3.5.1 ~3.3.5.3 for detail description.

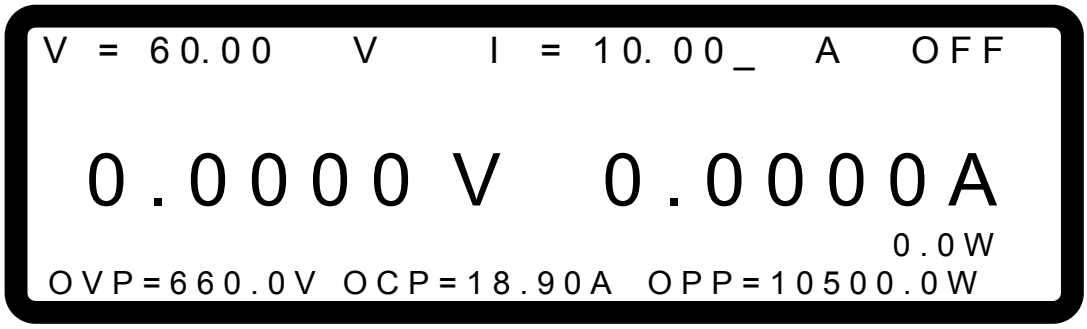


Figure 3-57

When the selection is set to V/I SLEW, the MAIN PAGE last line will show the settings of V SLEWRATE and I SLEWRATE in OUTPUT SETUP as Figure 3-58 shows. See section 3.3.2.3 and 3.3.2.4 for detail description

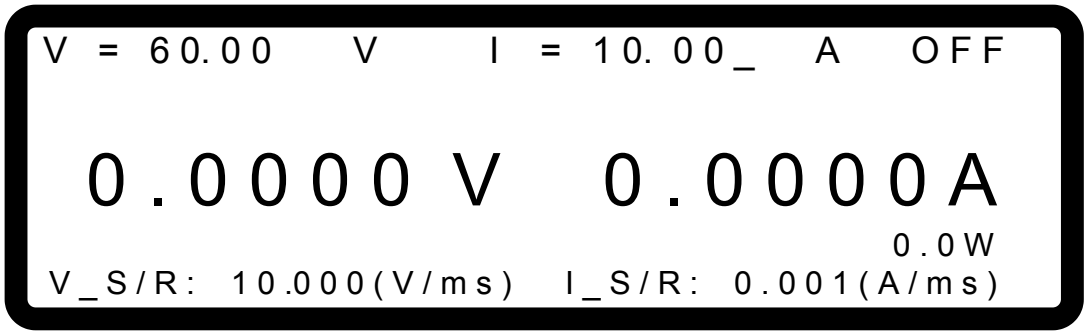


Figure 3-58

3.3.4.3 READING AVERAGE TIMES

READING AVERAGE TIMES option can set the average times the MAIN PAGE displays. The default is 2 as Figure 3-59 shows. When changing the READING AVERAGE TIMES default, the average method can be changed.

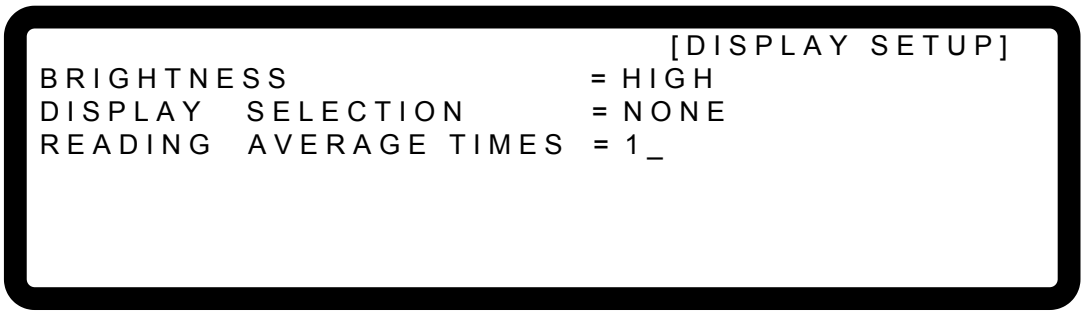


Figure 3-59

Follow the steps below to change the average times and method:

1. Use " ◄▲ ", " ▼► " keys to move the cursor to the column to be set as Figure 3-60 shows.

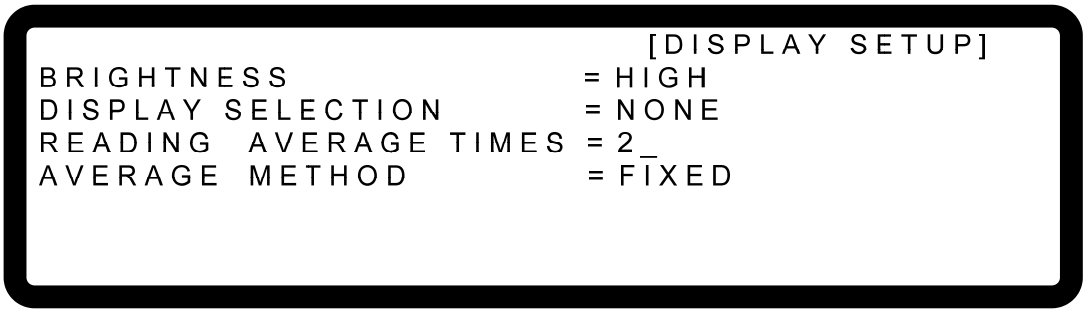


Figure 3-60

2. Use numeric keys 0 ~ 3 or "Rotary" ( ) to select the desired average times. READING AVERAGE TIME can be set to 1, 2, 4 and 8.
3. Move the cursor to AVERAGE METHOD and use numeric keys (0 ~ 1) or "Rotary" ( ) to select the desired average method. AVERAGE METHOD has FIXED and MOVING 2 types.

Notice

1. Assuming setting the READING AVERAGE TIME = 8, AVERAGE METHOD: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 3-61 shows.

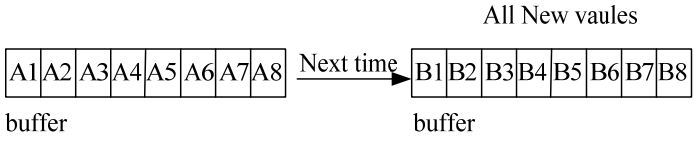


Figure 3-61

2. Assuming setting the READING AVERAGE TIME = 8, AVERAGE METHOD: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 3-62 shows.

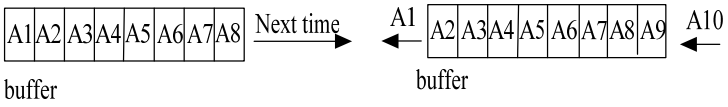


Figure 3-62

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

3.3.5 PROTECTION

Chroma 62000H 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.

To enter into the Protection mode:

1. Press “ CONF ” to the Config Setup page.
2. In Config Setup page, press “ 5 ” and “ ENTER ” to enter into PROTECTION selection page as Figure 3-63 shows.

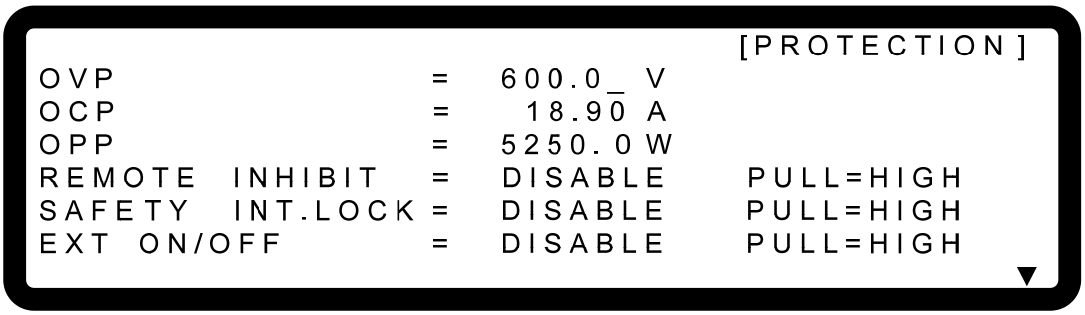


Figure 3-63

Notice When in the selection page, use “ ◄▲ ”, “ ▼► ” keys to move the cursor to the column to be set.

3.3.5.1 OVP Protection

1. Use “ ”, “ ” keys to move the cursor to the column to be set as Figure 3-64 shows.

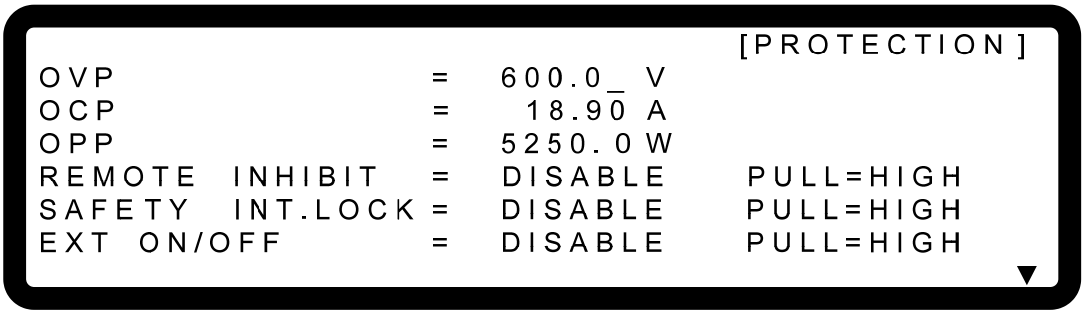


Figure 3-64

2. Use the numeric keys (0~9) or “Rotary” ( ) knob to set the value.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to the MAIN PAGE.

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 3-2 shows the voltage range of OVP.

Table 3-2 OVP Range

Model	Min. OVP (V)	Max. OVP (V)
62xxxH-xxx	0	1.10 x Vo_MAX

When OVP occurs the main page will prompt a protection message as Figure 3-65 shows:

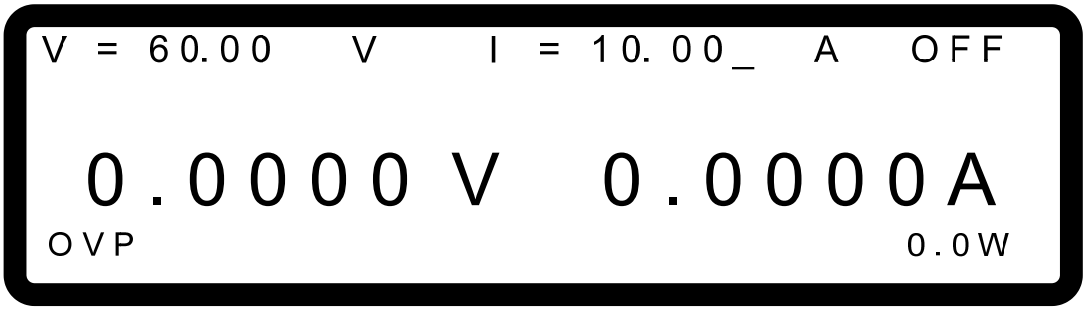


Figure 3-65

3.3.5.2 OCP Protection

1. Use “ ”, “ ” keys to move the cursor to the column to be set as Figure 3-66 shows.

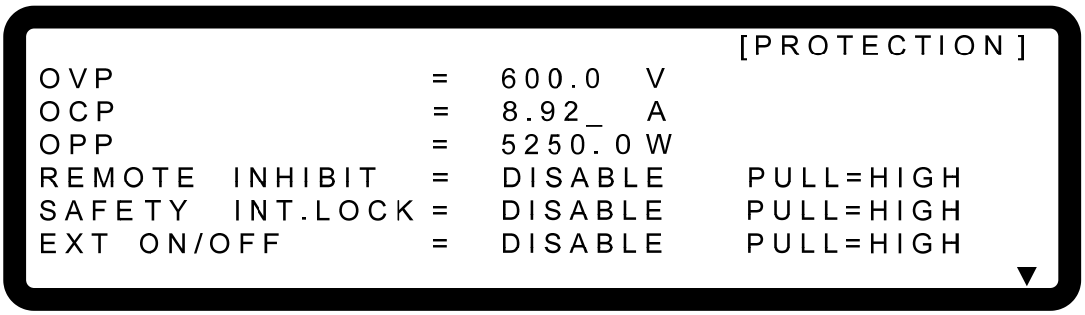


Figure 3-66

2. Use the numeric (0~9) keys or “Rotary” ( ) knob to set the value.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to the MAIN PAGE.

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.

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

Table 3-3

Model	Min. OCP (A)	Max. OCP (A)
62xxxH-xxx	0	1.05 x Io_MAX

When OCP occurs the main page will prompt a protection message as Figure 3-67 shows below:

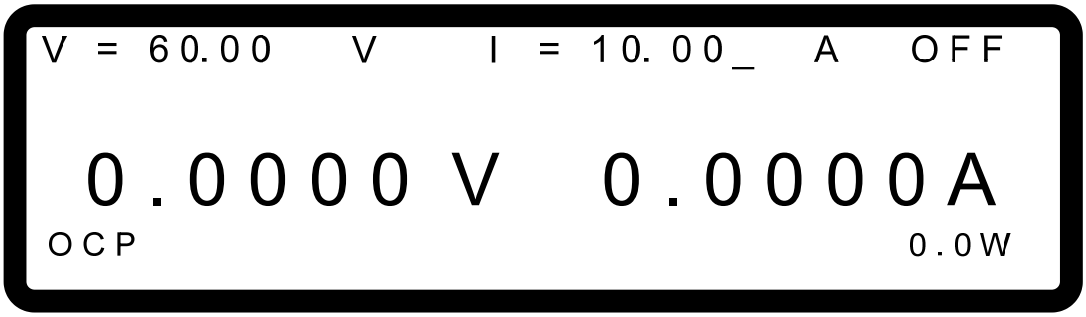


Figure 3-67

3.3.5.3 OPP Protection

1. Use “ ”, “ ” keys to move the cursor to the column to be set as Figure 3-68 shows.

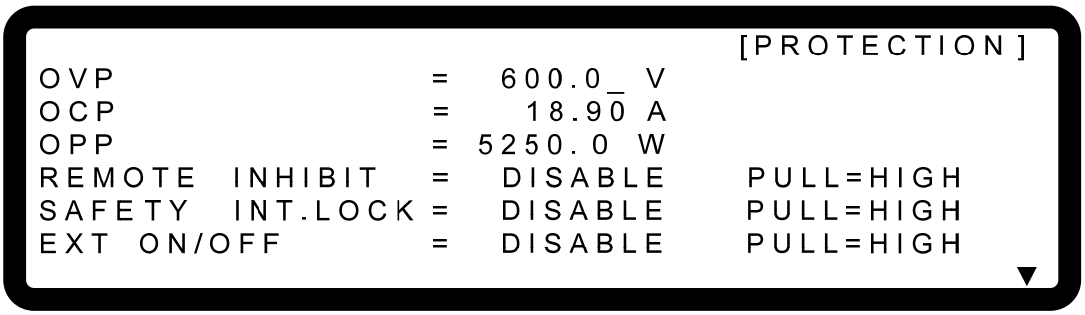


Figure 3-68

2. Use the numeric (0~9) keys or “Rotary” ( ) knob to set the value.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to the MAIN PAGE.

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

1. Table 3-4 shows the power range of OPP.

Table 3-4

Model	Min. OPP (W)	Max. OPP (W)
62xxxH-xxx	0	1.05 x Po_MAX

2. The OPP protection point is based on the comparison of calculated power of output current and remote sense voltage.

When OPP occurs the main page will prompt a protection message as Figure 3-69 shows:

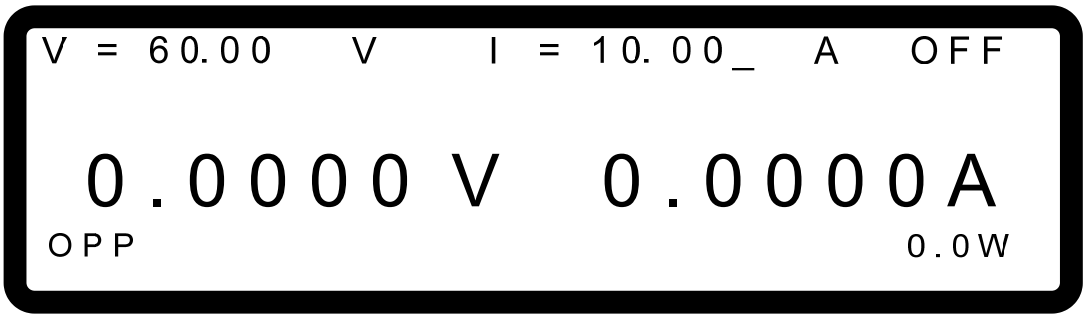


Figure 3-69

3.3.5.4 REMOTE INHIBIT

This function allows users to close the outputting power supply or control the power supply's ON/OFF directly through the PIN9 _INHIBIT in APG & SYSTEM STATUS.

1. Use " ◄▲ " & " ▼► " keys to move the cursor to the column to be set as Figure 3-70 shows.

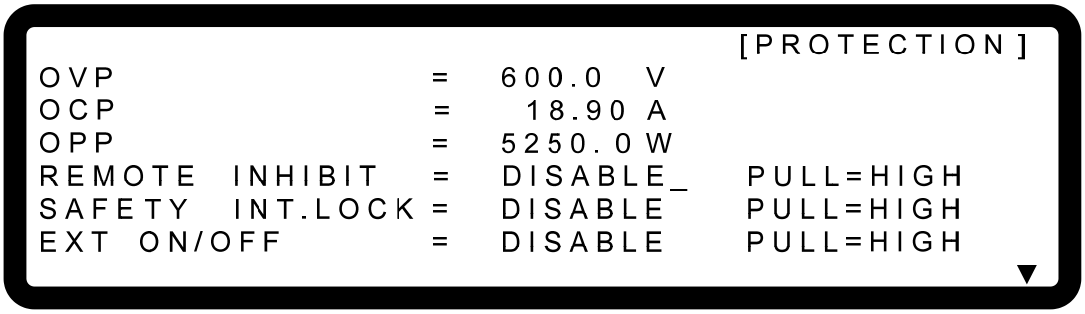


Figure 3-70

2. Use numeric keys [0] ~ [1] or "Rotary" (◎) to set REMOTE INHIBIT mode. There are DISABLE and EXT. ON/OFF two options.

   1. Selecting DISABLE: It closes the function.
   2. Selecting ENABLE: It sets the REMOTE INHIBIT to ENABLE. The DC Power Supply's ON/OFF is still controlled by "[ON/OFF]" key. When Pin 9 (_INHIBIT) of ANALOG INTERFACE is triggered by Low Level that equals to press the "[ON/OFF]" key 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/OFF]" will be off.) It cannot use Pin 9 (_INHIBIT) of ANALOG INTERFACE to release the protection.
   3. Press "[ENTER]" to confirm.
   4. Press "[EXIT]" to return to the MAIN PAGE.

3. When protection occurs to REMOTE INHIBIT the main page will appear the protection message as Figure 3-71 shows.

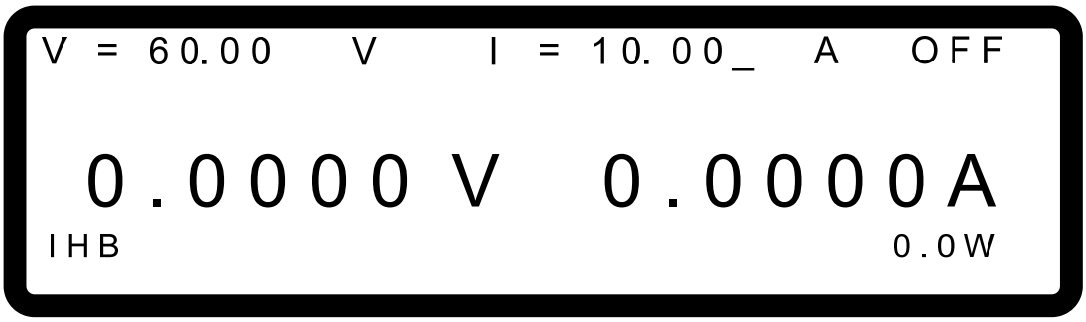


Figure 3-71

4. Furthermore, Pin 9 is the input pin of TTL Level and is able to set the initial state to PULL=HIGH or PULL=LOW.

5. When the DC Power Supply is set to OUTPUT = ON, the detail actions of REMOTE INHIBIT are shown in Figure 3-72.

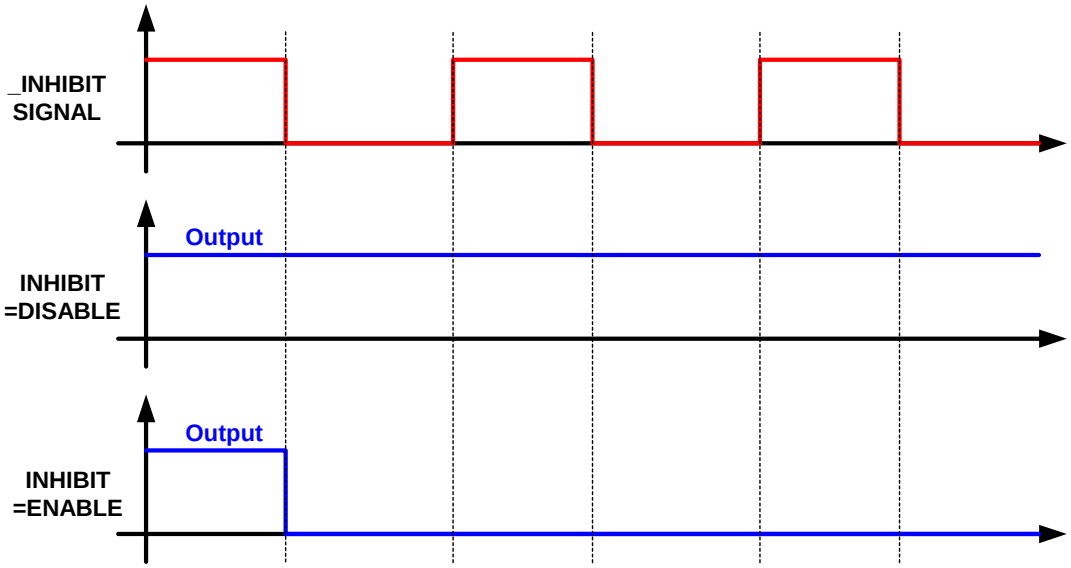


Figure 3-72

3.3.5.5 SAFETY INT.LOCK

This function allows users to control the DC Power Supply to be OFF temporary through the Pin 21 (INTERLOCK of ANALOG INTERFACE.

1. Use " ◄▲ " & " ▼► " keys to move the cursor to the column to be set as Figure 3-73 shows.

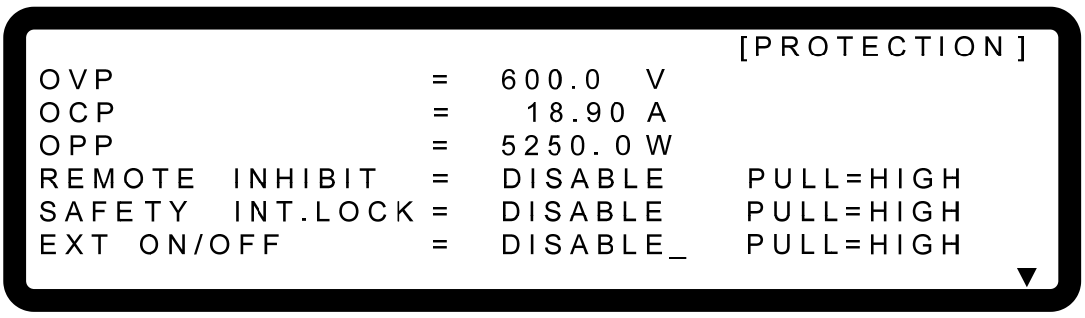


Figure 3-73

2. Use the numeric kesy 0 ~ 1 or the "Rotary" ( ) knob to set SAFETY INT.LOCK mode. There are DISABLE and ENABLE two options.

1. Selecting DISABLE: It closes this function.
2. Selecting ENABLE: It sets SAFETY INT.LOCK to ENABLE. The DC Power Supply's ON/OFF is still controlled by "OUTPUT". When the PIN 21 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 "ON/OFF" is still on) and issues protection signal. Once the Pin 21 of ANALOG INTERFACE is returned to low level, the DC Power Supply will continue to output normally.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

3. When protection occurs to SAFETY INT.LOCK the main page will appear the protection message as Figure 3-74 shows.

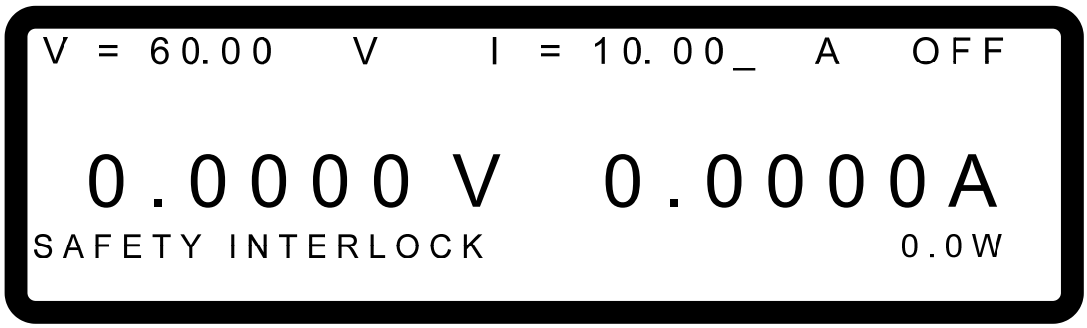


Figure 3-74

4. Furthermore, Pin 21 is the input pin of TTL Level and is able to set the initial state to PULL=HIGH or PULL=LOW.

5. When the DC Power Supply is set to OUTPUT = ON, the detail actions of SAFETY INT.LOCK are as shown in Figure 3-79.

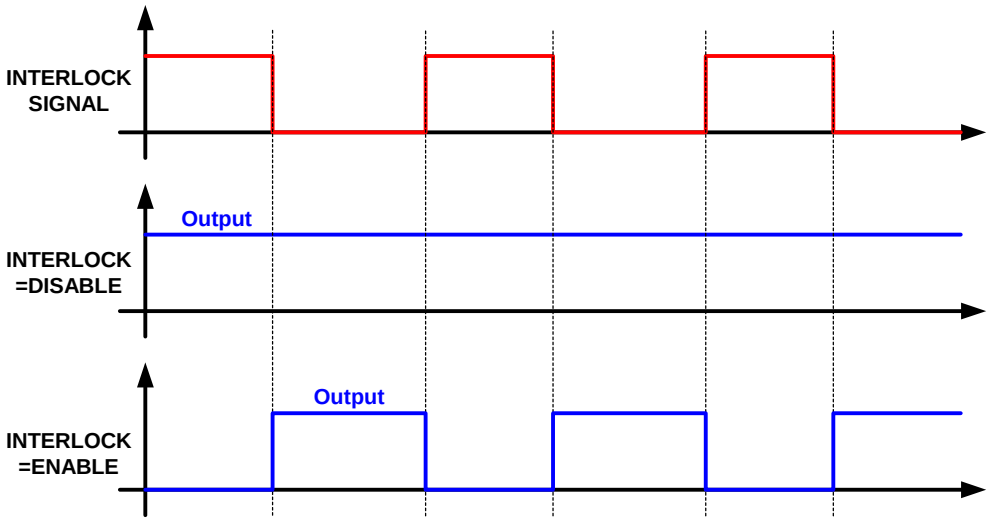


Figure 3-75

3.3.5.6 EXTERNAL ON/OFF

This function allows users to control the DC Power Supply's ON/OFF through the Pin 22 (_EXT_ON) of ANALOG INTERFACE.

1. Use " ◄─▲ ", " ▼─► " keys to move the cursor to the column to be set as Figure 3-76 shows.

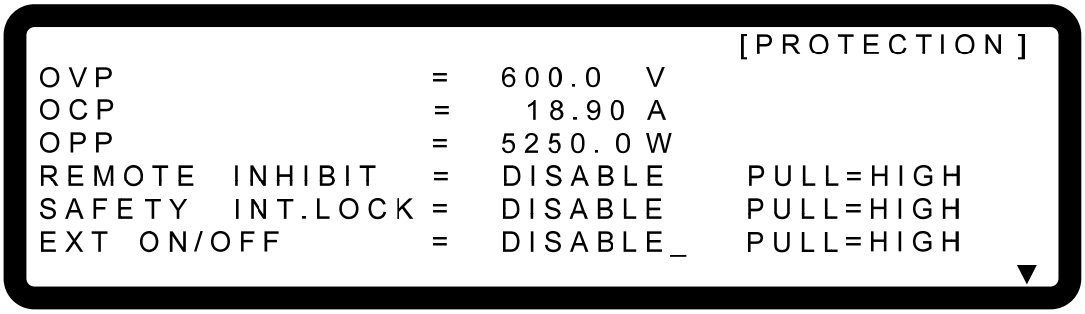


Figure 3-76

2. Use the numeric keys [0] ~ [9] or "Rotary" (◎) to set the EXTERNAL ON/OFF mode. This function has DISABLE and ENABLE two selections.

   1. Selecting DISABLE: It closes this function.
   2. Selecting ENABLE: It sets EXTTERNAL ON/OFF to ENABLE and make the "[ON/OFF]" invalid, also the Pin 22 (_EXT_ON) replaces the "[ON/OFF]" to control the Power Supply's ON/OFF. When the Pin 22 (_EXT_ON) voltage level of ANALOG INTERFACE turns to HIGH, the Power Supply is unable to output, that is OUTPUT = OFF. When the Pin18 (_EXT_ON) voltage level turns to LOW, the DC Power Supply outputs normally, that is OUTPUT = ON.
   3. Press "[ENTER]" to confirm.
   4. Press "[EXIT]" to return to the MAIN PAGE.

3. When the EXT. ON/OFF is enabled, the MAIN PAGE will appear the EXT message as Figure 3-77 shows.

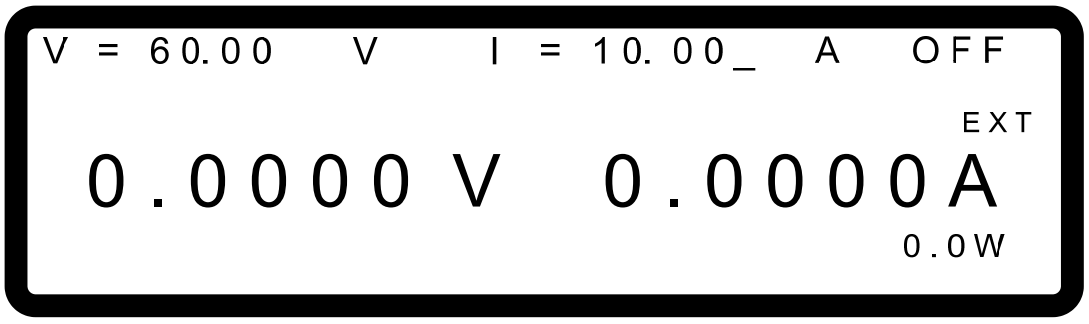


Figure 3-77

4. Furthermore, Pin 22 is the input pin of TTL Level and is able to set the initial state to PULL=HIGH or PULL=LOW.

5. When the DC Power Supply is set to OUTPUT = ON, the detail actions of EXTERNAL ON/OFF are as shown in Figure 3-78.

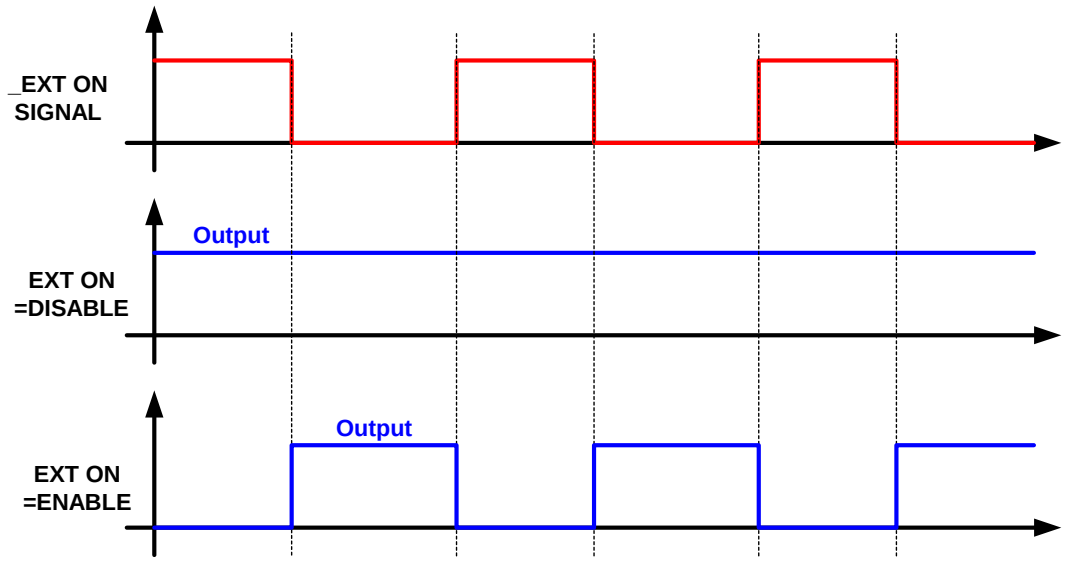


Figure 3-78

3.3.5.7 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.

1. Use " ↑ ", " ↓ " keys to move the cursor to the column to be set as Figure 3-79 shows.

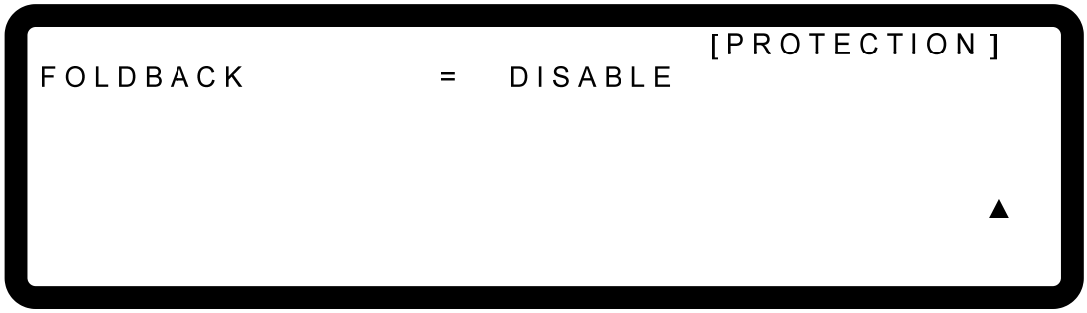


Figure 3-79

2. Use the numeric keys (0 ~ 2) or "Rotary" ( ) knob to set the 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 work mode changed 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 work mode changed 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 time delayed for protection after changed the mode as Figure 3-80 shows.

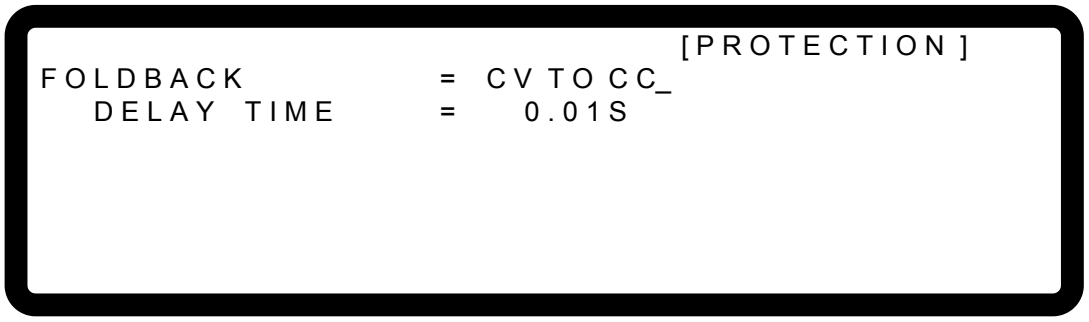


Figure 3-80

When FOLDBACK protection occurs the main page will prompt a protection message as Figure 3-81 shows:

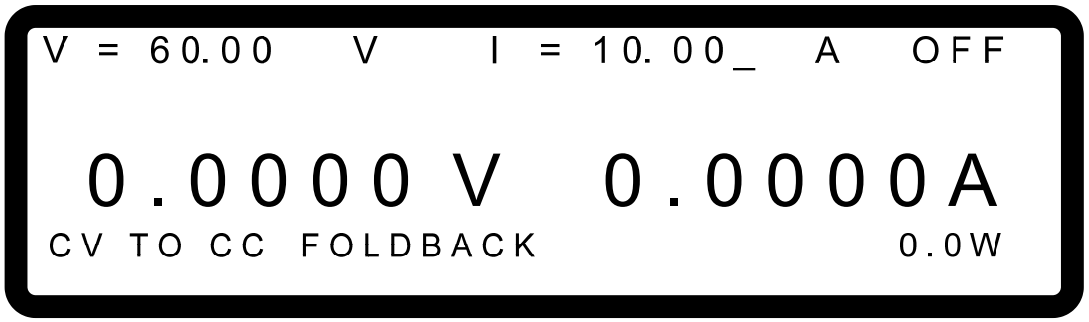


Figure 3-81

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 it original state and FOLDBACK protection will not occur as Figure 3-82 shows.

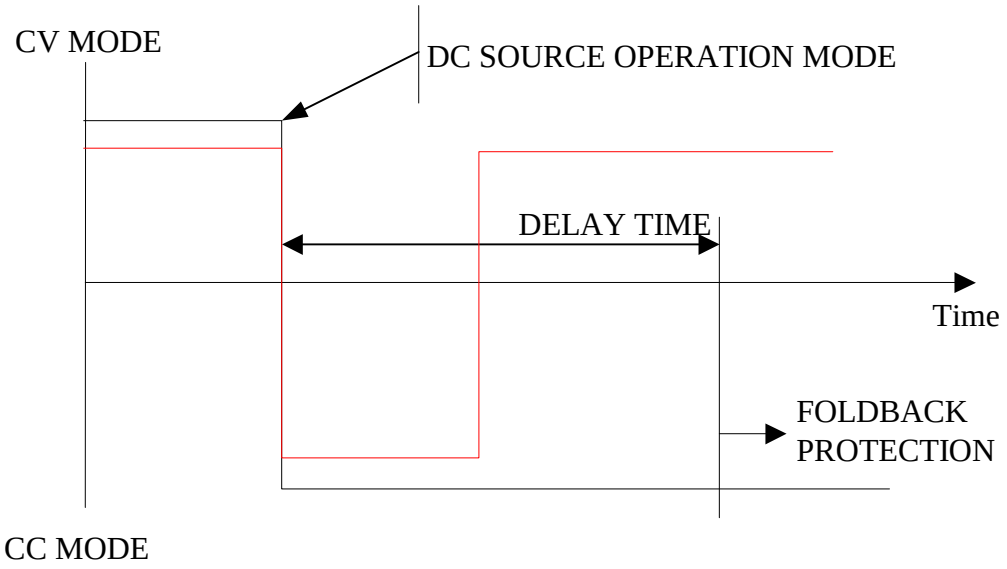


Figure 3-82

Assuming the FOLDBACK is set to CV TO CC, the solid line in Figure 3-82 will create Foldback protection while the dot line will not.

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

3.3.5.8 OTP

The OTP protection will activate when the internal temperature reaches the high limit and the output will be turned off that is OUTPUT = OFF for protection.

When OTP occurs the main page will prompt a protection message as Figure 3-83 shows:

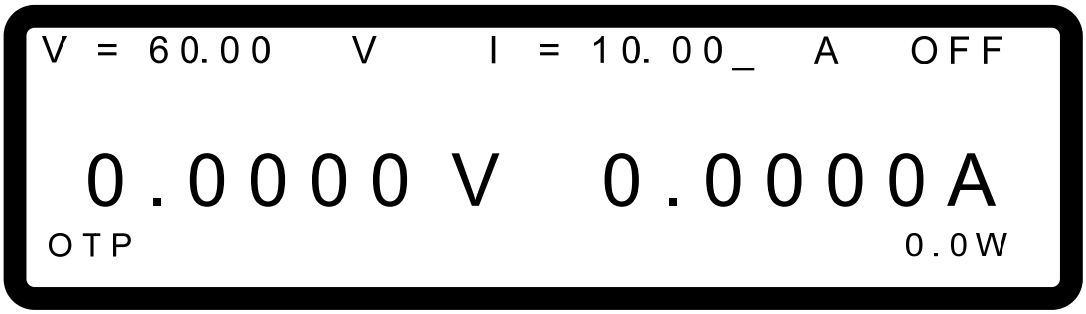


Figure 3-83

Notice

1. User is unable to change the OTP setting.
2. The output will turn off when OTP occurs and won't be on again that is OUTPUT = ON until the internal temperature drops to a certain set value.

3.3.5.9 AC FAULT

The AC FAULT protection will activate when the internal input voltage is not within the model's range, or when a certain input voltage is having under voltage. The output will turn off that is OUTPUT = OFF for protection.

When AC FAULT occurs the main page will prompt a protection message as Figure 3-84 shows:

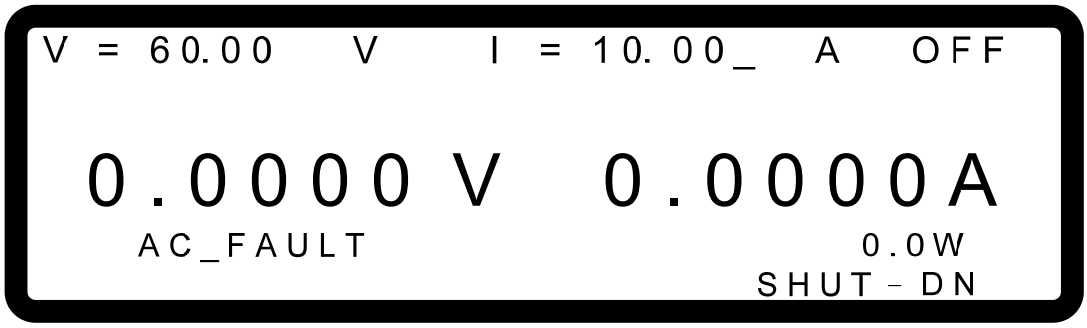


Figure 3-84

Notice

1. The table below lists the typical value of AC FAULT for 62000H Series:

Line to Line Rated Voltage	Lower than (Vac)	High than (Vac)
200/220Vac	180	242
380/400Vac	342	440
440/480Vac	396	528

Table 3-5 AC FAULT Range

2. Once the AC FAULT is activated, the output is turned off that is OUTPUT = OFF. Power off the device and then power it on again after the input voltage spec and connection are confirmed. If the any of the voltage spec or connection is incorrect, AC FAULT protection will occur continuously.
3. Be aware that the diameter of input wire cannot be too thin, or the line loss generated may cause the input voltage out of SPEC and AC FAULT may occur. See section 2.3.2 for the spec of wire diameter.

3.3.5.10 SENSE FAULT Protection

The remote sense is located at the rear panel near to output terminal. See section 2.4.1 for correct connection. When the connection is correct it can adjust the UUT's voltage to be consistent with the panel set voltage without affecting by the voltage drop of load wire.

(1) When the connection is wrong, for instance the VOLTAGE SENSING polarity is reversed that means the UUT's "–" terminal is connected to the "+" of output terminal, and UUT's "+" terminal is connected to the "–" of output terminal.

(2) When the voltage drop of load wire is exceeding the full scale of output voltage for 4%, for instance taking the example by 62150H-600, the protection will occur when the load wire voltage drop > 600 x 0.04=24V.

SENSE FAULT protection will occur when these two situations are encountered. The output will turn off that is OUTPUT = OFF for protection. It is necessary to connect the REMOTE SENSING wires correctly and reboot to remove the protection.

When SENSE FAULT occurs the main page will prompt a protection message as Figure 3-85 shows.

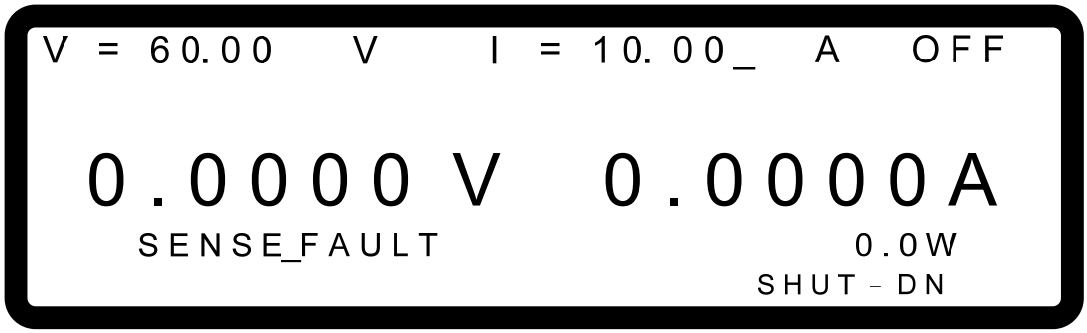


Figure 3-85

3.3.5.11 FANLOCK Protection

Fans are built-in inside the DC Power Supply to ventilate the heat generated by components. If one of the fans is fail (not running), FANLOCK protection will occur and the output will turn off that is OUTPUT = OFF for protection.

When FANLOCK occurs the main page will prompt a protection message as Figure 3-86 shows:

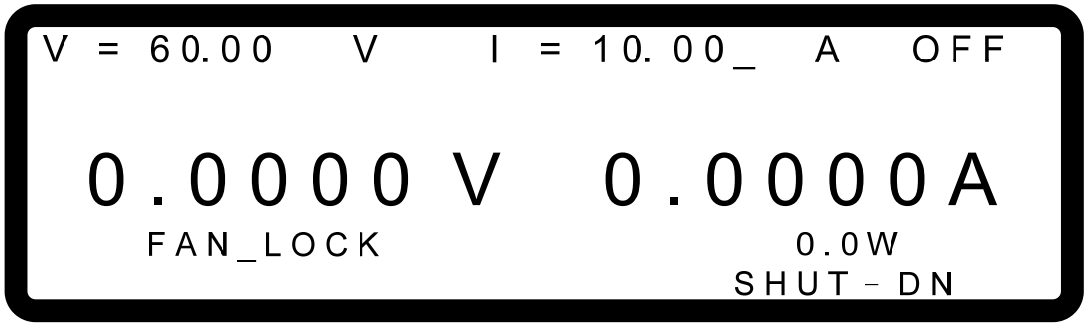


Figure 3-86

CAUTION

1. Troubleshooting:
   (1) When FANLOCK protection occurs, power off the instrument first and then power it on again to see if it is caused by error action.
   (2) If FANLOCK protection occurs again, please contact sales

agent for repair services.

2. Keep the two sides and the rear of DC Power Supply clear when in loading state to prevent Over Temperature Protection from occurring.

3.3.5.12 D/D FAULT Protection

If the Stage which is the internal output main circuit (DC TO DC Stage) is having error, a D/D FAULT protection signal will generate and the output will be shutdown that is OUTPUT = OFF to protect the DC Power Supply.

When D/D FAULT protection occurs, the main screen will prompt a protection message as shown below.

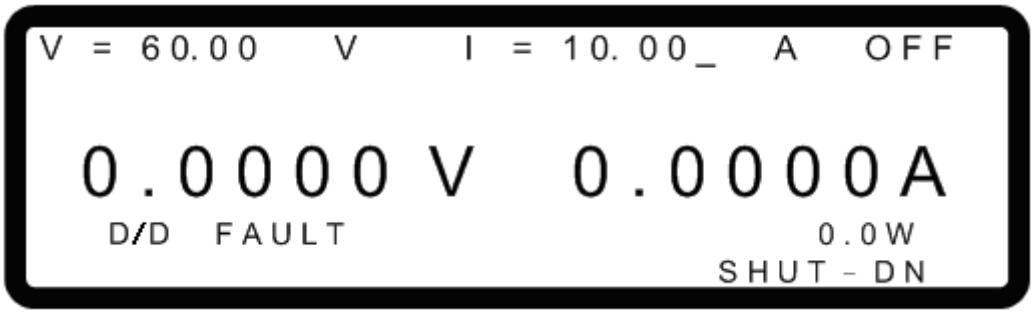


Figure 3-87

Notice

Troubleshooting:

(1) When D/D FAULT protection occurs, please turn off the Power Supply first, remove the load and check if the connections are correct and then power it on again.

(2) If D/D FAULT protection happens again, please contact the local agent of Chroma to return it for repair.

3.3.6 FACTORY SETTING

This function lets users to reset the instrument to its factory default settings.

To enter it:

1. In Config Setup page, press "6" and ENTER to enter into FACTORY SETTING option as Figure 3-88 shows.

   FACTORY DEFAULT has two options: (1) NO and (2) YES.

   When set to FACTORY DEFAULT = NO the instrument will retain the last configuration saved by user. On the contrary, if it is set to FACTORY DEFAULT = YES all configuration settings will return to the factory default.

   In the mean time, the screen will display DEVICE MODEL, SERIAL NO., FIRMWARE VERSION, FPGA VERSION and MODULE VERSION 5 types of message.

DEVICE MODEL	:	Display the model no. **62150H-600** as Figure 3-88 shows.
SERIAL NO.	:	Display the serial no. **65535** as Figure 3-88 shows.
FIRMWARE VERSION	:	Display firmware version **00.54** and the released date July 20, 2009 as Figure 3-88 shows.
FPGA VERSION	:	Display the FPGA version no. **00.00B,00.00B** as Figure 3-88 shows.
MODULE VERSION	:	Display the module version no. **00.00B,00.00B,00.00B** as Figure 3-88 shows.

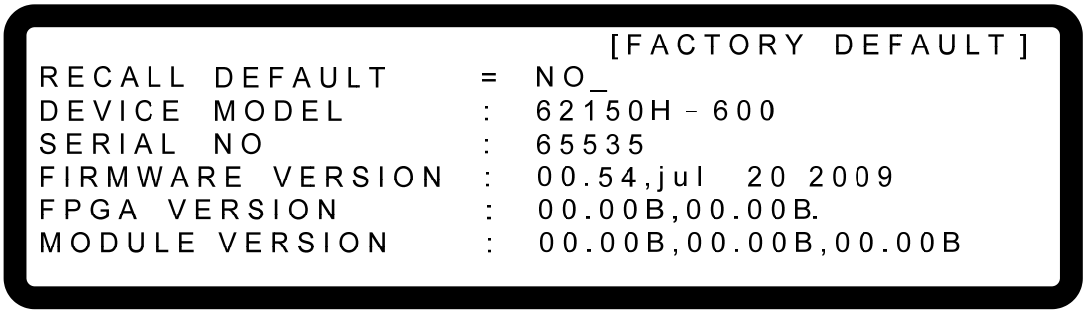


Figure 3-88

3.3.7 CALIBRATION

Chroma 62000H Series DC Power Supplies have 5 calibration functions:

(1) VOLTAGE: the actual voltage output (CV mode) and its measurement accuracy.
(2) CURRENT: the measurement accuracy of current.
(3) CURRENT: the actual current out (CC mode).
(4) APG VOLTAGE: the actual voltage output and its accuracy of analog V Monitor under analog voltage control mode.
(5) APG CURRENT: the actual current output and its accuracy of analog I Monitor under analog current control mode.

Follow the procedure below to enter into calibration mode:

1. In CONFIG Setup page, press "7" and press ENTER to enter into CALIBRATION option as Figure 3-89 shows.

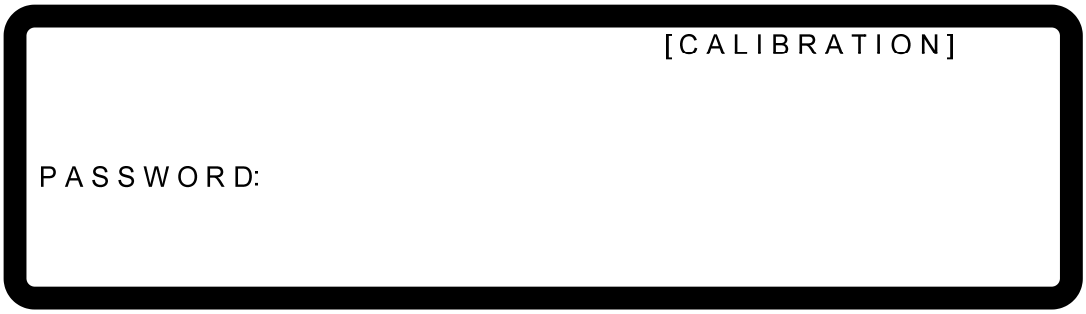


Figure 3-89

2. Enter the password and press "ENTER" to confirm. The screen will display 4 calibration options as Figure 3-90 shows. The calibration steps are described from section 3.3.7.1 to 3.3.7.5.
3. To abort CALIBRATION, press "EXIT" to return to the MAIN PAGE.

```
CHOICE =VOLTAGE    [ P/M]        [CALIBRATION]

1.VOLTAGE    [PROG.  /MEAS. ]
2.CURRENT    [MEAS.  ]
3.CURRENT    [PROG.  ]
4.APG  VOLTAGE    [PROG./MEAS.]
5.APG  CURRENT    [PROG./MEAS.]
```

Figure 3-90

Notice Password is required for CALIBRATION. The password is "3636".

3.3.7.1 Voltage Output & Measurement Calibration

3.3.7.1.1 Hardware Requirements

It is as Table 3-6 shows.

Table 3-6

Device	Suggested Model or Capacity
DVM	HP 34401A or equivalent DVM

3.3.7.1.2 SETUP

It is as Figure 3-91 shows.

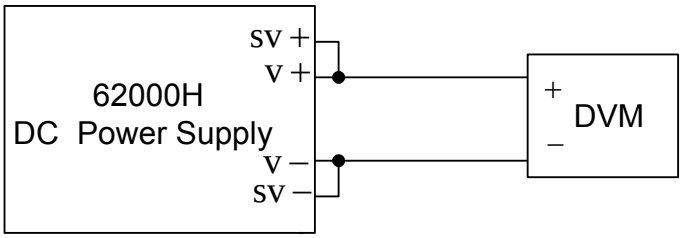


Figure 3-91

Notice

1. For the instrument that performs 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.

3.3.7.1.3 Calibration Procedure (Example: Model 62150H-600)

1. Enter into the page of Figure 3-90.
2. In CALIBRATION page, press "1" or turn "Rotary" ( ) knob to set CHOICE=1.
3. Press "ENTER" to confirm entering into voltage calibration options as Figure 3-92 shows.

```
                              [VOLTAGE CALIBRATION]
REMOVE EXTERNAL LOAD AND PRESS[ENTER]_
SETTING  OUTPUT VOLTAGE 8.00     V
ACTUAL   OUTPUT VOLTAGE=0.0000   V

SETTING  OUTPUT VOLTAGE 115.00   V
ACTUAL   OUTPUT VOLTAGE=0.0000   V
```

Figure 3-92

4. When in Voltage calibration page, press "ENTER" to confirm.
5. First does the low voltage range calibration, the instrument will output the voltage to 8.00V and the cursor is stopped at position [1] as Figure 3-93 shows. Enter the voltage measured by DVM to position [1] and press "ENTER" to confirm.
6. Press "↓→" again to do the low voltage range calibration for its second point, the instrument will output the voltage to 115.00V and the cursor is stopped at position [2] as Figure 3-93 shows. Enter the voltage measured by DVM to position [2] and press "ENTER" to confirm.

```
                              [VOLTAGE CALIBRATION]
REMOVE EXTERNAL LOAD AND PRESS[ENTER]
SETTING  OUTPUT VOLTAGE 8.00     V
ACTUAL   OUTPUT VOLTAGE=7.9998_  V  → [1]

SETTING  OUTPUT VOLTAGE 115.00   V
ACTUAL   OUTPUT VOLTAGE=114.98   V  → [2]
```

Figure 3-93

7. Press "↓→" to do the high voltage range calibration, the instrument will output the voltage to 150.00V first and the cursor is stop at position [3] as Figure 3-94 shows. Enter the voltage measured by DVM to position [3] and press "ENTER" to confirm.
8. Press "↓→" again to do the high voltage range calibration for its second point, the instrument will output the voltage to 525.00V and the cursor is stopped at position [4] as Figure 3-94 shows. Enter the voltage measured by DVM to position [4] and press "ENTER" to confirm.

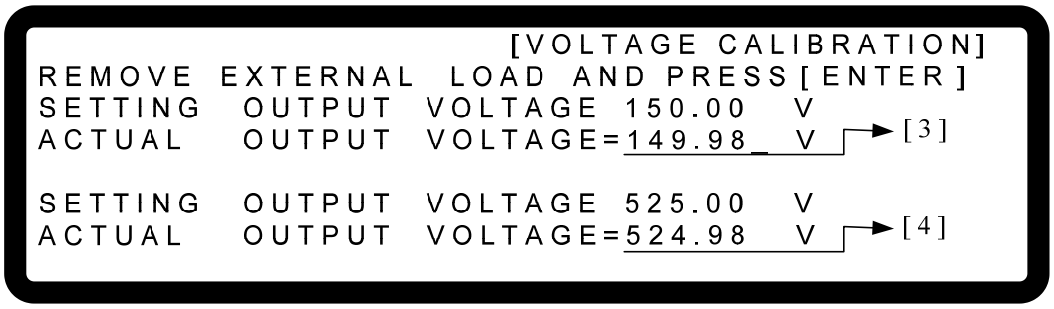


Figure 3-94

9. Now the voltage calibration is done. To save the calibration data, press "SAVE" will prompt a confirmation page as Figure 3-95 shows. Press "1" or "Rotary" ( ) to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

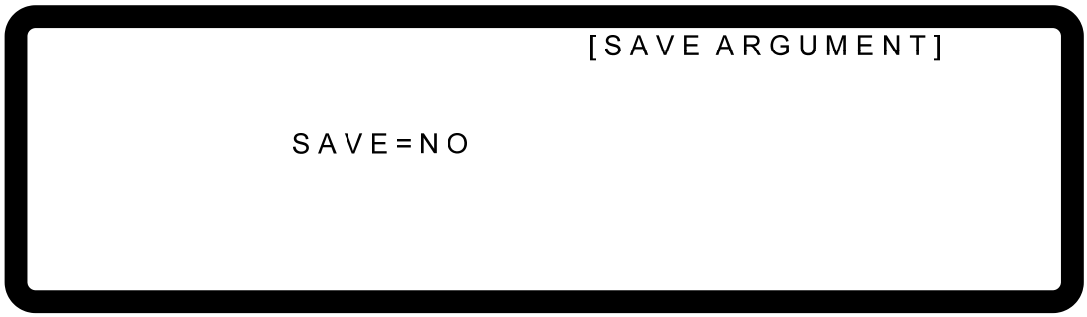


Figure 3-95

10. Press "EXIT" to return to the MAIN PAGE.

Notice

1. The calibration point may be different for other models (non 62150H-600), please operate it following the instructions displayed.
2. It is necessary to remove the output load when performing voltage calibration. The LCD panel will show the text as Figure 3-93 and once no load is confirmed for the output, press "ENTER" to start calibration.

3.3.7.2 Current Measurement Calibration

3.3.7.2.1 Hardware Requirements

Table 3-7 lists the hardware requirements for current measurement calibration.

Table 3-7

Device		Suggest Model or Capacity
DVM		HP 34401A or equivalent DVM
CURRENT SHUNT		Prodigit 7550 or equivalent
LOAD	ELECTRICAL LOAD	CHROMA 63204 or equivalent
	BREAKER	Capable current>=100A

CAUTION The table above lists the BREAKER capacity for 62150H-600 only. The applicable BREAKER for other models, please see the specifications of OUTPUT CURRENT in Table 1-1 to Table 1-3.

3.3.7.2.2 SETUP

Figure 3-96 is the diagram for connecting current calibration devices.

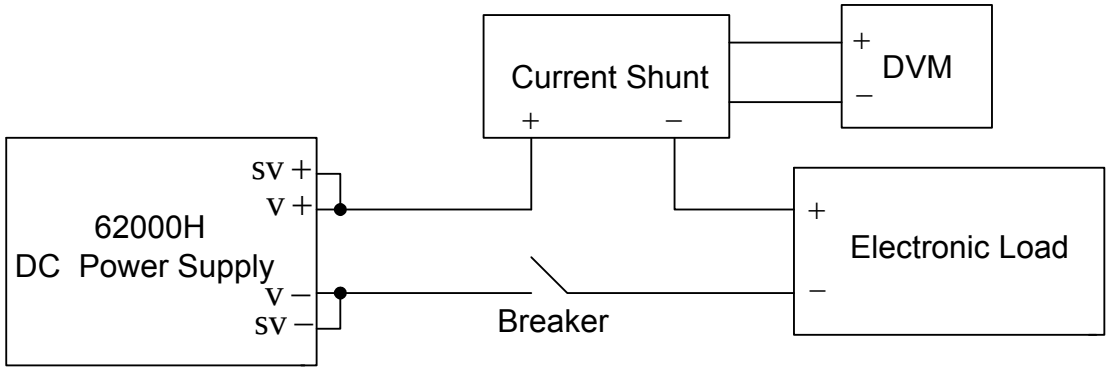


Figure 3-96

Notice When conducting the current calibration, each calibration point has to key in at least 5 Arabic numerals to ensure the Power Supply accuracy after calibration.

3.3.7.2.3 Calibration Procedure (Example: Model 62150H-600)

1. Enter into the page of Figure 3-90.
2. In CALIBRATION page, press "2" or turn "Rotary" ( ) knob to set CHOICE=2.
3. Press "ENTER" to confirm and entering into current calibration options as Figure 3-97 shows.

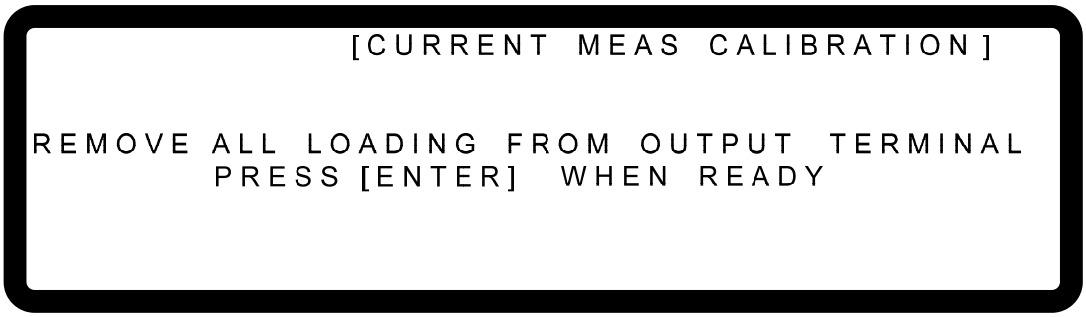


Figure 3-97

4. Open the Breaker to ensure the DC Power Supply has no load and press "ENTER" to confirm.
5. **It is important** to reconnect the DC Power Supply to current shunt whose rating is closest to but still cover 2A. For Prodigit 7550, use 2A shunt directly.

6. Then it will show Figure 3-98 and press "ENTER". First it will calibrate the low current range, the system outputs a fixed voltage and then sets the loading current of Electronic LOAD to 0.5A. The cursor is stopped at position [1] as Figure 3-98 shows. Enter the current read by Current Shunt (DVM) to position [1] and press "ENTER" to confirm and wait for it to end.

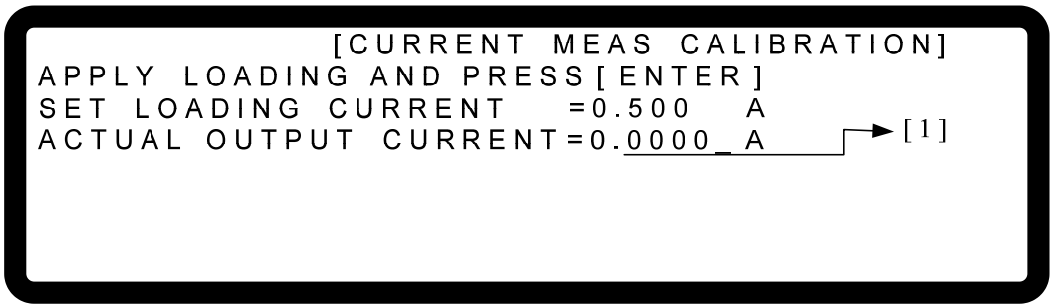


Figure 3-98

7. Once the 0.5A point was calibrated, **it is important** to turn the loading of Electronic Load off and reconnect the DC Power Supply to current shunt whose rating is closest to but still cover 2A. For Prodigit 7550, use 2A shunt directly.

8. Next, press "↓→" to do 1.5A calibration. The cursor will stop at position [2] as Figure 3-99 shows for setting the loading current of Electronic LOAD to 1.500A. Enter the current read by Current Shunt (DVM) to position [2] and press "ENTER" to confirm and wait for it to end. Use 0.5A and 1.5A for calibration, the system will calculate the calibration factor for the low current range.

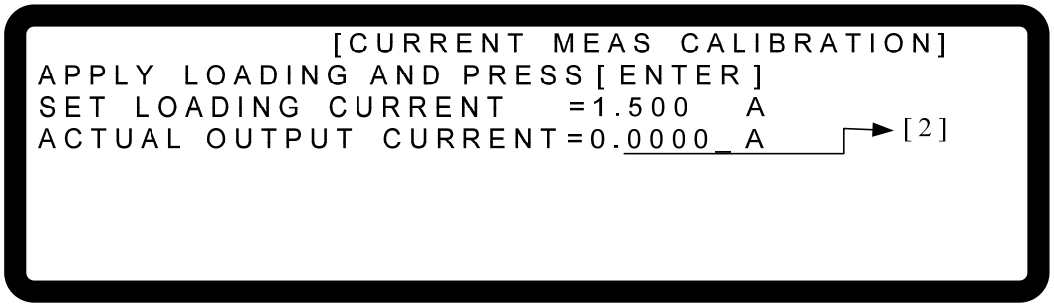


Figure 3-99

9. After the low current range was calibrated, **it is important** to turn the loading of Electronic Load off reconnect the DC Power Supply to current shunt whose rating is closest to but still cover 10A. For Prodigit 7550, use 10A shunt directly.

10. For high current range calibration, press "↓→" to perform 2.5A calibration. The cursor will stop at position [3] as Figure 3-100 shows for setting the loading current of Electronic LOAD to 2.500A. Enter the current read by Current Shunt (DVM) to position [3] and press "ENTER" to confirm and wait for it to end.

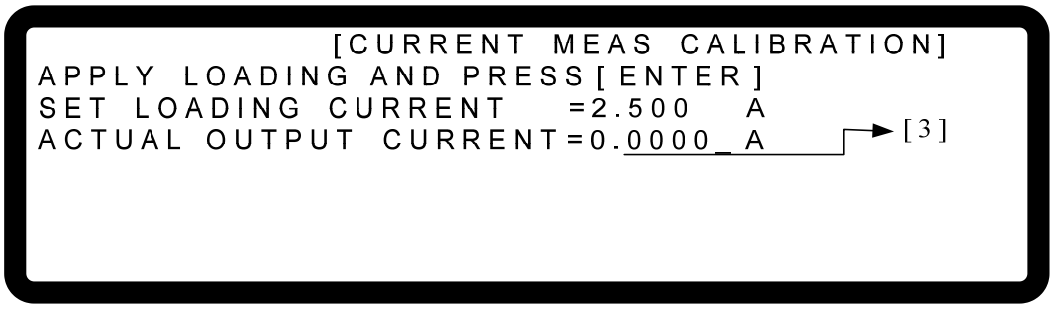


Figure 3-100

11. Once the 2.5A point was calibrated, **it is important** to turn the loading of Electronic Load off reconnect the DC Power Supply to current shunt whose rating is closest to but still cover 10A. For Prodigit 7550, use 10A shunt directly.
12. Press "↓→" to perform 6.5A calibration. The cursor will stop at position [4] as Figure 3-101 shows for setting the loading current of Electronic LOAD to 6.500A. Enter the current read by Current Shunt (DVM) to position [4] and press "ENTER" to confirm and wait for it to end. Use 2.5A and 6.5A for calibration, the system will calculate the calibration factor for the high current range.

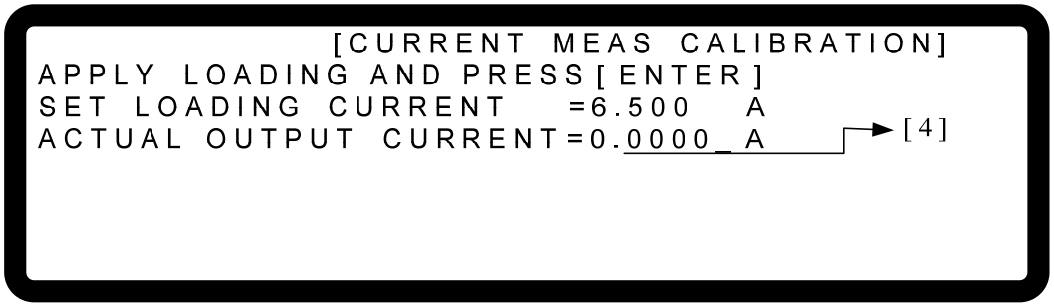


Figure 3-101

13. The current calibration is done once the above actions are completed. To save the calibration data, press "SAVE" will prompt a confirmation page as Figure 3-102 shows. Press "1" or "Rotary" (◎) to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

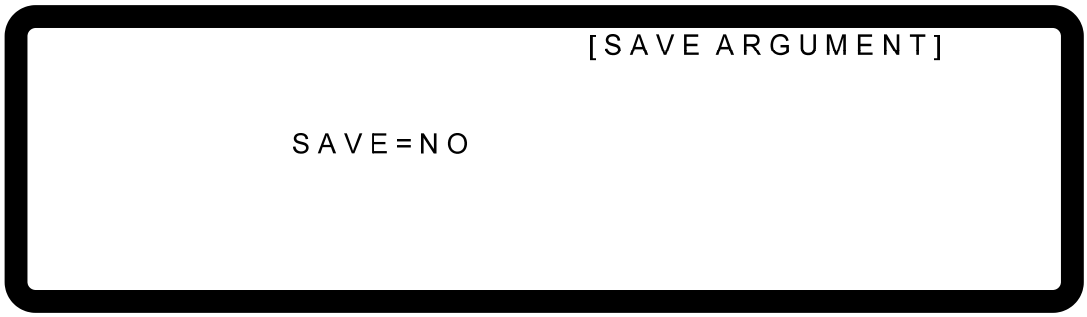


Figure 3-102

14. Press "EXIT" to return to the MAIN PAGE.

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

Notice The calibration point may be different for other models (non 62150H-600), please operate it following the instructions displayed.

3.3.7.3 Current Output (PROG.) Calibration

3.3.7.3.1 Hardware Requirements

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

Table 3-8

Device		Suggest Model or Capacity
DVM		HP 34401A or equivalent DVM
CURRENT SHUNT		Prodigit 7550 or equivalent
LOAD	ELECTRICAL LOAD	CHROMA 63204 or equivalent
	BREAKER	Capable current>=100A

CAUTION The table above lists the BREAKER capacity for 62150H-600 only. The applicable BREAKER for other models, please see the specifications of OUTPUT CURRENT in Table 1-1 to Table 1-3.

3.3.7.3.2 SETUP

Figure 3-103 shows the wire connection.

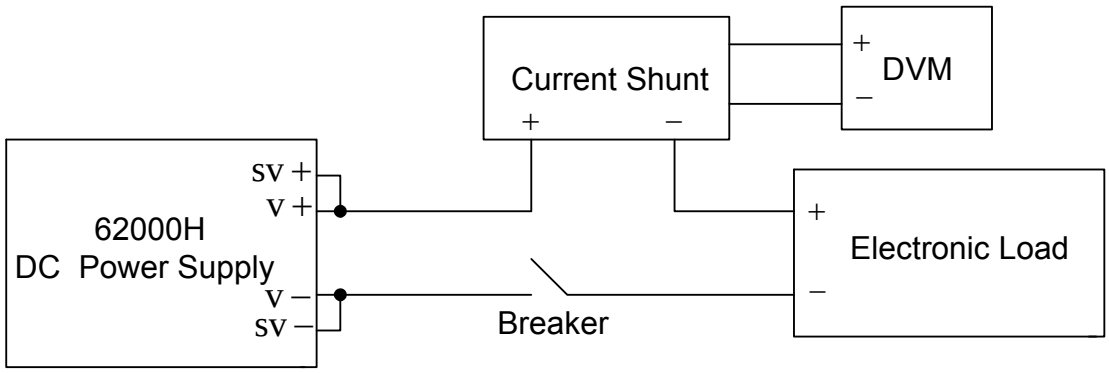


Figure 3-103

Notice When conducting the current calibration, each calibration point has to key in at least 5 Arabic numerals to ensure the Power Supply accuracy after calibration.

3.3.7.3.3 Calibration Procedure (Example: Model 62150H-600)

1. Set the Electronic Load to CV mode 5V.
2. In CALIBRATION page, press "3" or turn "Rotary" ( ) knob to set CHOICE=3.
3. Press "ENTER" to confirm and entering into current calibration options as Figure 3-104 shows.

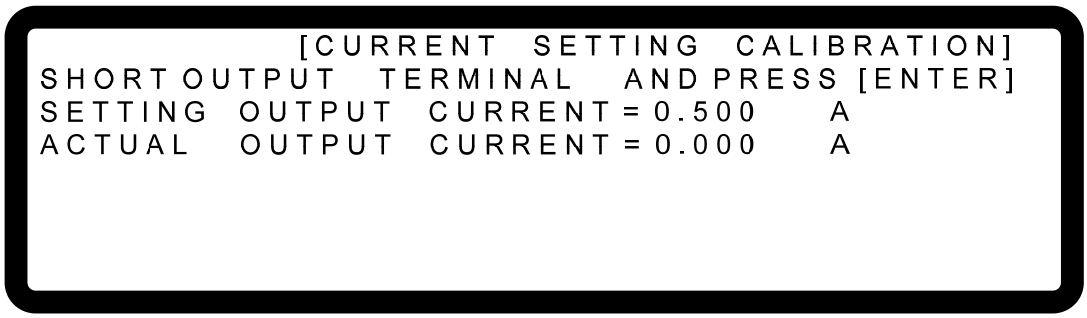


Figure 3-104

4. The output of the DC Power Supply will be off before user pressing ENTER. Next, set the Electronic LOAD to short as Figure 3-105 shows. Then, set the current shunt whose rating is closest to but still cover 2A. For Prodigit 7550, use 2A shunt directly.

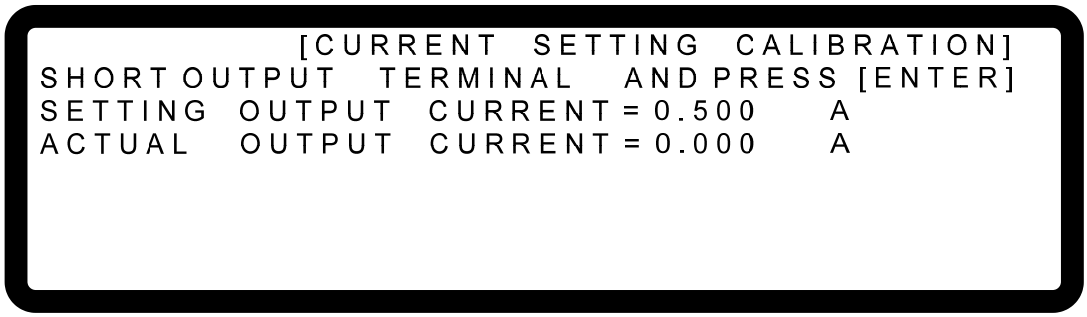


Figure 3-105

5. Press ENTER the system will set the output current to 0.500A automatically and the cursor will stop at position [1] as Figure 3-106 shows. Input the current read by Current Shunt (DVM) to position [1] and press "ENTER" to confirm.

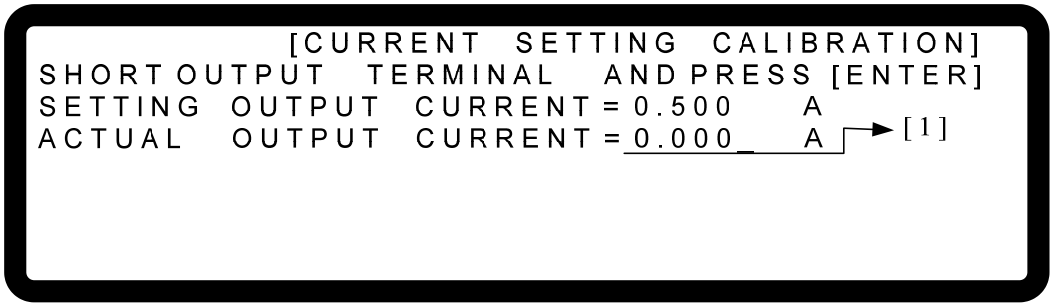


Figure 3-106

6. Now the DC Power Supply will be set to off again and a message will pop up to remind the user to reconnect to proper current shunt range. Set the current shunt whose rating is closest to but still cover 2A. For Prodigit 7550, use 2A shunt directly.

7. Press "↓→" will perform 1.5A calibration. The system will set the output current to 1.500A automatically and the cursor will stop at position [2] as Figure 3-107 shows. Input the current read by Current Shunt (DVM) to position [2] and press "ENTER" to

confirm. Use 0.5A and 1.5A for calibration, the system will calculate the calibration factor for the low current range.

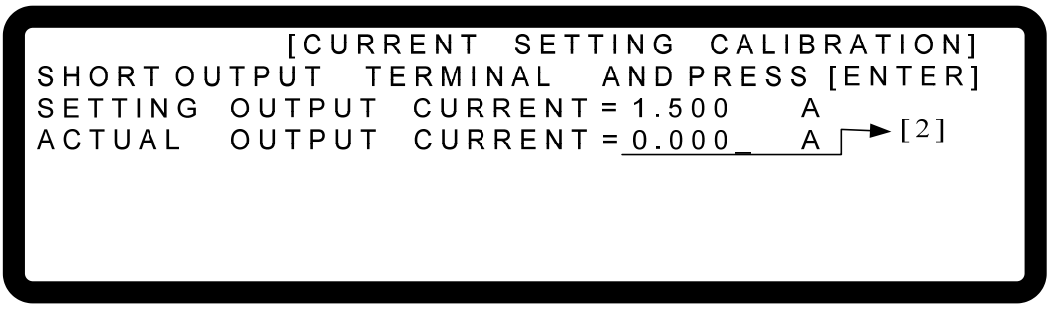


Figure 3-107

8. Now start the high current range calibration. Set the current shunt whose rating is closest to but still cover 10A. For Prodigit 7550, use 10A shunt directly.

9. Press "↓→" will perform 2.5A calibration. The system will set the output current to 2.500A automatically and the cursor will stop at position [3] as Figure 3-108 shows. Input the current read by Current Shunt (DVM) to position [3] and press "ENTER" to confirm.

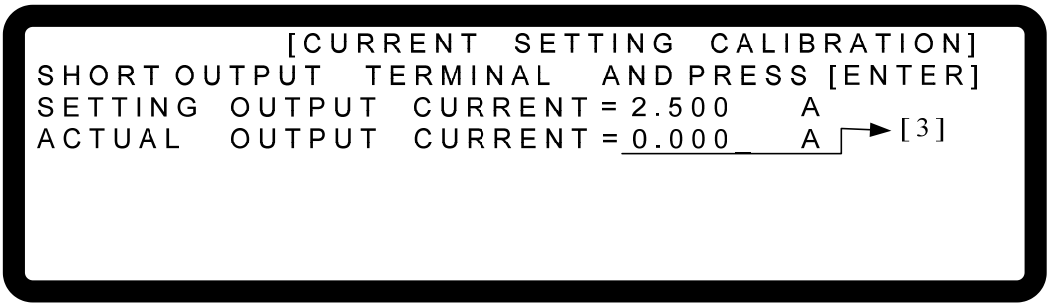


Figure 3-108

10. The DC Power Supply will be set to off again. Set the current shunt whose rating is closest to but still cover 10A. For Prodigit 7550, use 10A shunt directly.

11. Press "↓→" will perform 6.5A calibration. The system will set the output current to 6.500A automatically and the cursor will stop at position [4] as Figure 3-109 shows. Input the current read by Current Shunt (DVM) to position [4] and press "ENTER" to confirm.

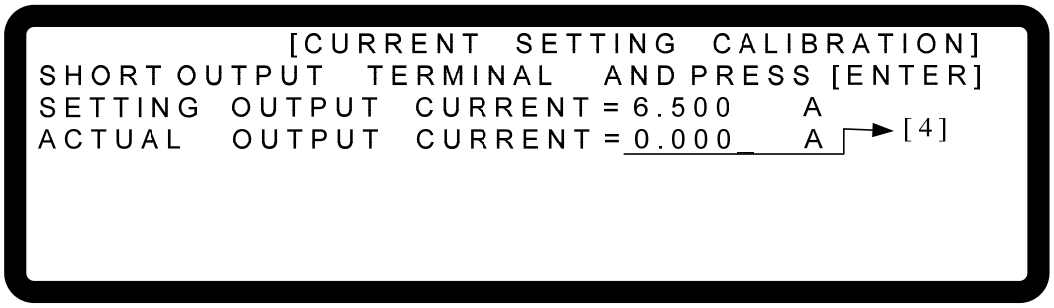


Figure 3-109

12. The current calibration is done once the above actions are completed and the DC Power Supply output will be turned off. To save the calibration data, press "SAVE" will prompt a confirmation page as Figure 3-110 shows. Press "1" or "Rotary" ( ) to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

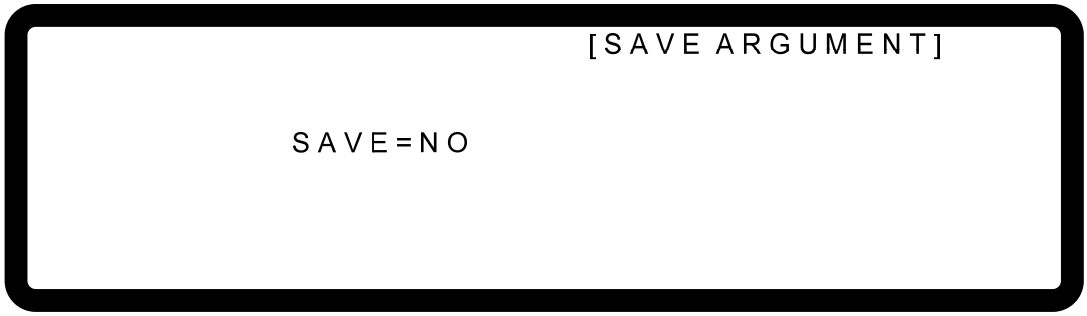


Figure 3-110

13. Press "EXIT" to return to the MAIN PAGE.

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

Notice The calibration point may be different for other models (non 62150H-600), please operate it following the instructions displayed.

3.3.7.4 APG Voltage Calibration

3.3.7.4.1 Hardware Requirements

Table 3-9 lists the hardware requirements for APG voltage 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 100mA.

3.3.7.4.2 SETUP

Figure 3-111 shows the wire connection for APG voltage calibration.

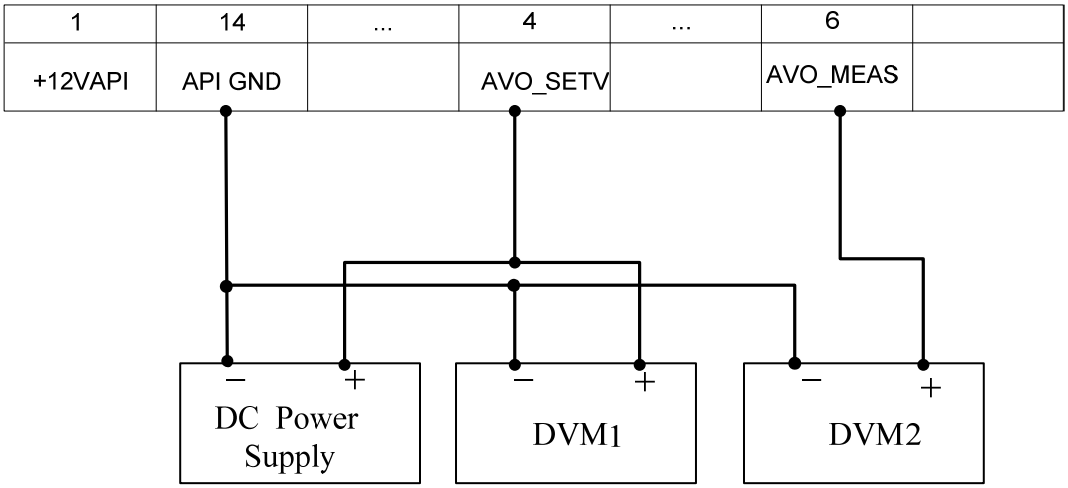


Figure 3-111

Notice When conducting the APG voltage calibration, each calibration point has to key in at least 4 Arabic numerals to ensure the Power Supply accuracy after calibration.

3.3.7.4.3 Calibration Procedure (Example: Model 62150H-600)

1. In CALIBRATION page, press "4" or turn "Rotary" ( ) knob to set CHOICE = 4.
2. Press "ENTER" to confirm entering into APG Voltage Calibration options as Figure 3-112 shows.

```
                    [APG VOLTAGE CALIBRATION]
CHECK APG CONNECTION AND PRESS [ENTER]_
(SET)INPUT VOLTAGE FOR SETTING=0.5V
      ACTUAL APG INPUT VOLTAGE=0.000_ V

(SET)INPUT VOLTAGE FOR SETTING=8.0V
      ACTUAL APG INPUT VOLTAGE=0.000_ V
```

Figure 3-112

Notice

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

3. When in the APG Voltage Calibration pages and the connection is correct, press "ENTER" to confirm.
4. It will ask the user to input about 0.5V voltage signal (Pin 4). The cursor stops at position [1] as Figure 3-113 shows after pressed "ENTER" for the above step. Adjust the Power Supply to 0.5V±0.2V and use DVM1 to measure the reading of Power Supply. Input the voltage read by DVM1 to position [1] and press "ENTER" to confirm.

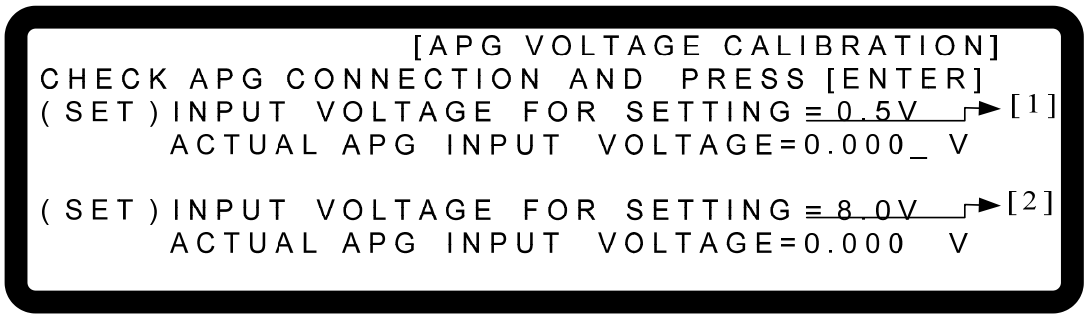


Figure 3-113

5. Press "[↓→]" again will ask the user to input about 8.0V voltage signal (Pin 4). The cursor stops at position [2] as Figure 3-113 shows after pressed "[ENTER]". Adjust the Power Supply to 8V±0.2V and use DVM1 to measure the reading of Power Supply. Input the voltage read by DVM1 to position [2] and press "[ENTER]" to confirm.
6. Press "[↓→]" again the system will set the output voltage of Pin 6 on the rear panel to 0.5V and the cursor stops at position [3] as Figure 3-114 shows. Input the voltage read by DVM2 to position [3] and press "[ENTER]" to confirm.

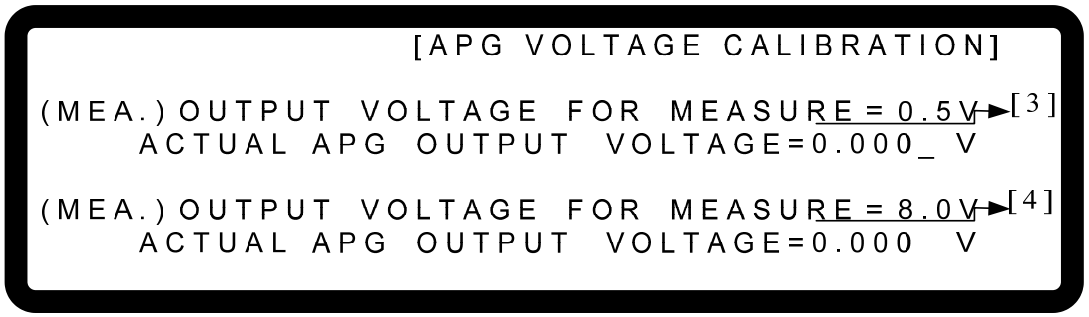


Figure 3-114

7. Press "[↓→]" again the system will set the output voltage of Pin 6 on the rear panel to 8.0V and the cursor stops at position [4] as Figure 3-114 shows. Input the voltage read by DVM2 to position [4] and press "[ENTER]" to confirm.
8. The APG Voltage calibration is done once the above actions are completed. To save the calibration data, press "[SAVE]" will prompt a confirmation page as Figure 3-115 shows. Press "[1]" or "Rotary" ( ) to set SAVE=YES and press "[ENTER]" to save it. If there is no need to save it, press "[EXIT]" to return to the Calibration screen.

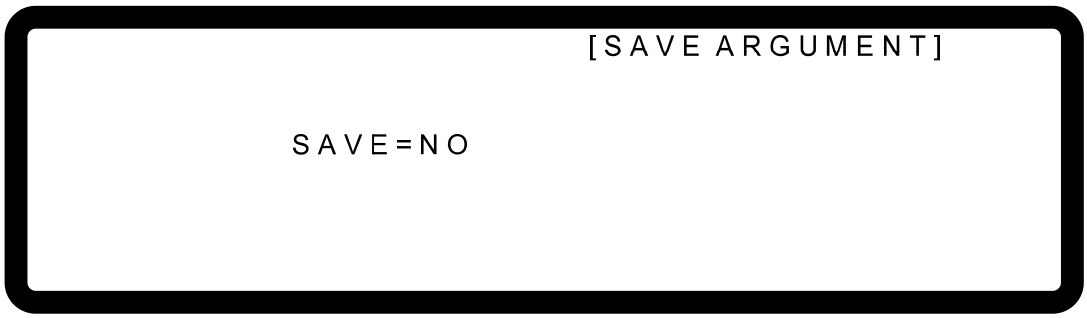


Figure 3-115

9. Press "EXIT" to return to the MAIN PAGE.

Notice The calibration point may be different for other models (non 62150H-600), please operate it following the instructions displayed.

3.3.7.5 APG Current Calibration

3.3.7.5.1 Hardware Requirements

Table 3-10 lists the hardware requirements for APG current 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 100mA.

3.3.7.5.2 SETUP

Figure 3-116 shows the wire connection for APG current calibration.

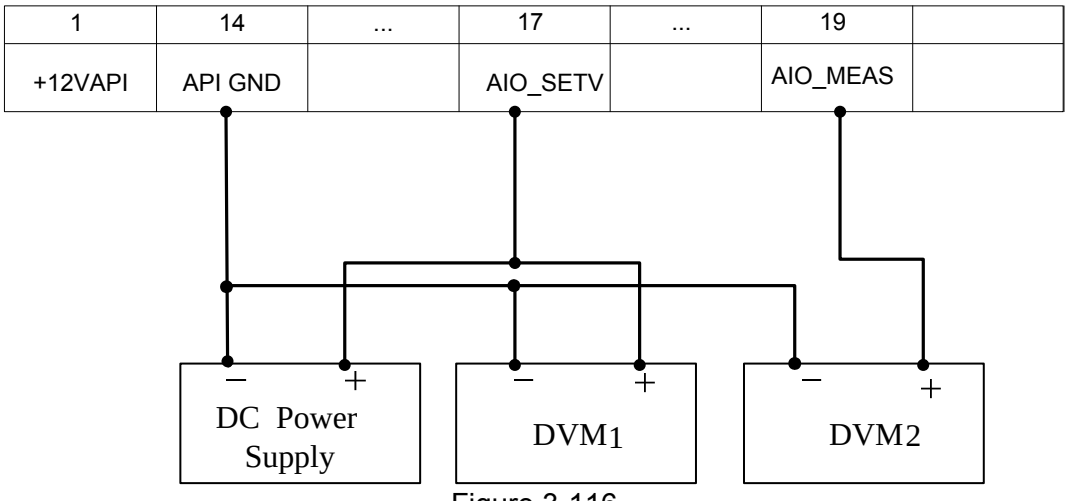


Figure 3-116

Notice When conducting the APG current calibration, each calibration point has to key in at least 4 Arabic numerals to ensure the Power Supply accuracy after calibration.

3.3.7.5.3 Calibration Procedure (Example: Model 62150H-600)

1. In CALIBRATION page, press "5" or turn "Rotary" ( ) knob to set CHOICE = 5.
2. Press "ENTER" to confirm entering into APG Voltage Calibration options as Figure 3-117 shows.

```
                    [APG CURRENT CALIBRATION]
CHECK APG CONNECTION AND PRESS [ENTER]_
(SET)INPUT VOLTAGE FOR SETTING=0.5V
      ACTUAL APG INPUT VOLTAGE=0.000  V

(SET)INPUT VOLTAGE FOR SETTING=8.0V
      ACTUAL APG INPUT VOLTAGE=0.000  V
```

Figure 3-117

Notice When entering into the CALILBRATION page, be sure to check the interface connection on the rear panel is correct and then press "ENTER" to start calibration.

3. When in the APG Current Calibration pages and the connection is correct, press "ENTER" to confirm.
4. It will ask the user to input about 0.5V voltage signal (Pin 17). The cursor stops at position [1] as Figure 3-118 shows after pressed "ENTER" in the above step. Adjust the Power Supply to 0.5V±0.2V and use DVM1 to measure the reading of Power Supply. Input the voltage read by DVM 1 to position [1] and press "ENTER" to confirm.

```
                    [APG CURRENT CALIBRATION]
CHECK APG CONNECTION AND PRESS [ENTER]
(SET)INPUT VOLTAGE FOR SETTING=0.5V      [1]
      ACTUAL APG INPUT VOLTAGE=0.000_ V

(SET)INPUT VOLTAGE FOR SETTING=8.0V      [2]
      ACTUAL APG INPUT VOLTAGE=0.000  V
```

Figure 3-118

5. Press "↓→" again will ask the user to input about 8.0V voltage signal (Pin 17). The cursor stops at position [2] as Figure 3-118 shows after pressed "ENTER" in the above step. Adjust the Power Supply to 8V±0.2V and use DVM1 to measure the reading of

Power Supply. Input the voltage read by DVM1 to position [2] and press "ENTER" to confirm.

6. Press " ↓→ " again the system will set the output voltage of Pin 19 on the rear panel to 0.5V and the cursor stops at position [3] as Figure 3-119 shows. Input the voltage read by DVM2 to position [3] and press "ENTER" to confirm.

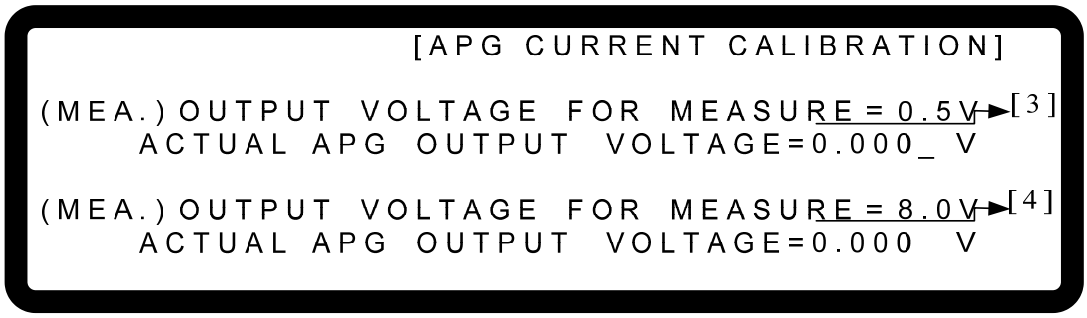


Figure 3-119

7. Press " ↓→ " again the system will set the output voltage of Pin 19 on the rear panel to 8.0V and the cursor stops at position [4] as Figure 3-119 shows. . Input the voltage read by DVM2 to position [4] and press "ENTER" to confirm.
8. The APG current calibration is done once the above actions are completed. To save the calibration data, press "SAVE" will prompt a confirmation page as Figure 3-120 shows. Press "1" or "Rotary" (◎) to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

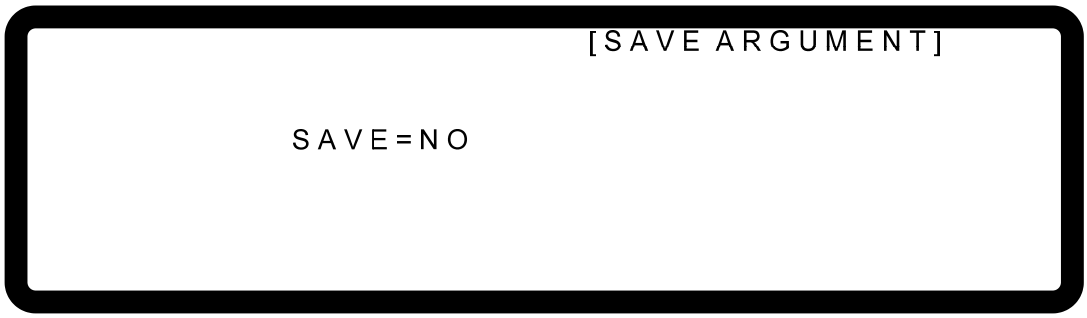


Figure 3-120

9. Press "EXIT" to return to the MAIN PAGE.

Notice The calibration point may be different for other models (non 62150H-600), please operate it following the instructions displayed.

3.3.8 REMOTE SETUP

3.3.8.1 GPIB ADDRESS

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

1. Use " ◄ ▲ ", " ▼ ► " keys to move the cursor to the column of GPIB ADDR as Figure 3-121 shows.

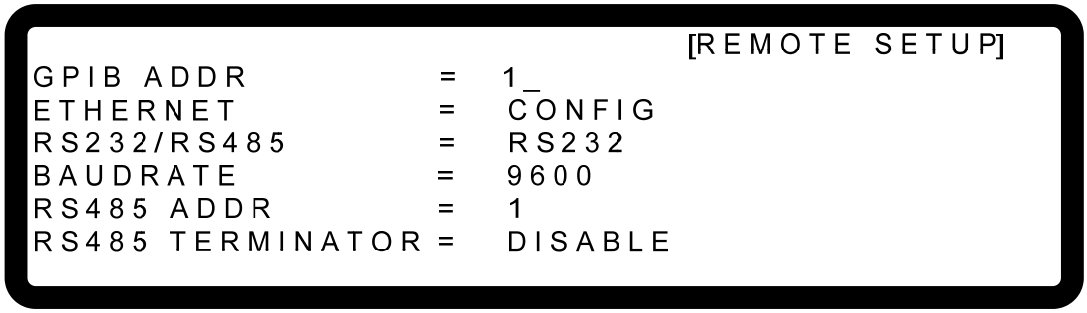


Figure 3-121

2. Use the numeric keys [1] ~ [0] or "Rotary" (◎) to set the address.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to the MAIN PAGE.

Notice The valid address range is 1~30.

3.3.8.2 ETHERNET

The DC Power Supply is able to operate remotely using the ETHERNET function. To operate remotely, it is necessary to get the ETHERNET IP address.

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 can clear the abnormal screen.

1. Use " ◄ ▲ ", " ▼ ► " keys to move the cursor to the column of ETHERNET as Figure 3-122 shows.
2. Press "[ENTER]" to enter into the ETHERNET IP address setting screen as Figure 3-123 shows.

Auto detection:
The DHCP default is ON and when entering the screen of Figure 3-123, the DC Power Supply will detect the external network IP address automatically.

Manual detection:

3. Move the cursor to DHCP and use numeric keys [0] ~ [1] or "Rotary" ( ) to set the DHCP to OFF.
4. Move the cursor to IP ADDRESS and use numeric keys [0] ~ [9] to set the IP address.
5. Move the cursor to GATEWAY ADDR and use numeric keys [0] ~ [9] to set the address.
6. Move the cursor to SUBNET MASK and use numeric keys [0] ~ [9] to set the IP address.
7. Move the cursor to APPLY and use numeric keys [0] ~ [1] or "Rotary" ( ) to set the APPLY to YES.
8. Press "[ENTER]" to confirm.
9. Press "[EXIT]" to return to the MAIN PAGE.

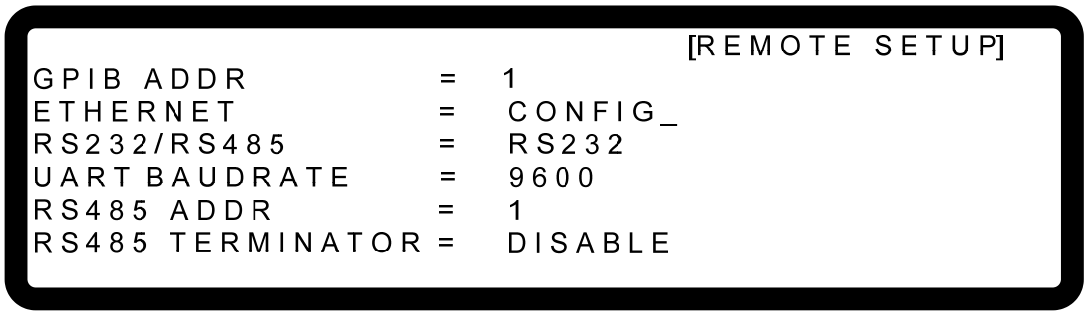


Figure 3-122

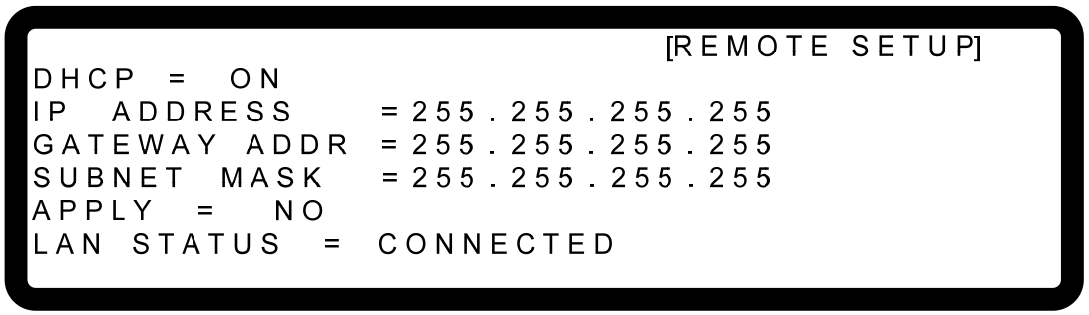


Figure 3-123

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 and press "ENTER" for the address to be in effect.

3.3.8.3 RS232/RS485

1. Use " ◄─┘ ", " ▼─► " keys to move the cursor to the column of RS232/RS485 as Figure 3-124 shows.

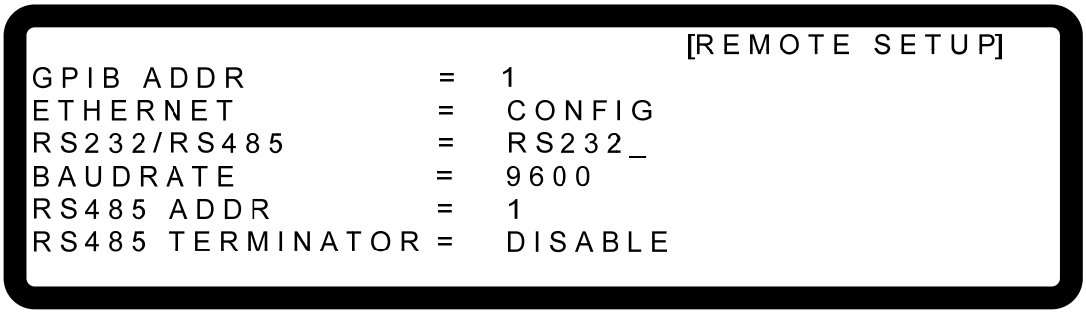


Figure 3-124

2. Use numeric keys 0 ~ 1 or "Rotary" ( ) to select RS232 or RS485.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

3.3.8.4 BAUDRATE

The DC Power Supply is also able to operate remotely via RS-232. Before use it is necessary to set the RS-232 baudrate.

1. Use " ◄─┘ ", " ▼─► " keys to move the cursor to the column of BAUDRATE as Figure 3-125 shows.

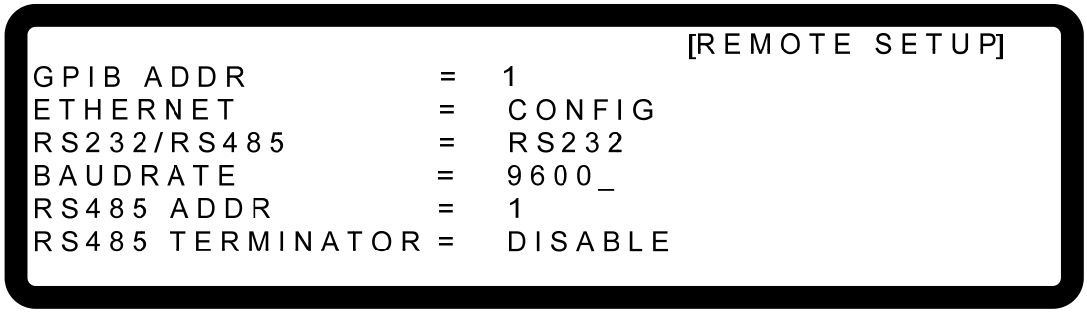


Figure 3-125

2. Use numeric keys [0] ~ [4] or "Rotary" ( ) to select BAUDRATE.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to the MAIN PAGE.

Notice There are 5 settings for BAUDRATE: 9600/19200/38400/57600/115200.

3.3.8.5 RS485 ADDR

The DC Power Supply also supports remote operation via RS485 function. It is necessary to set the RS485 address before operating remotely.

1. Use "[◄─▲]", "[▼─►]" keys to move the cursors to the column of RS485 as Figure 3-126 shows.

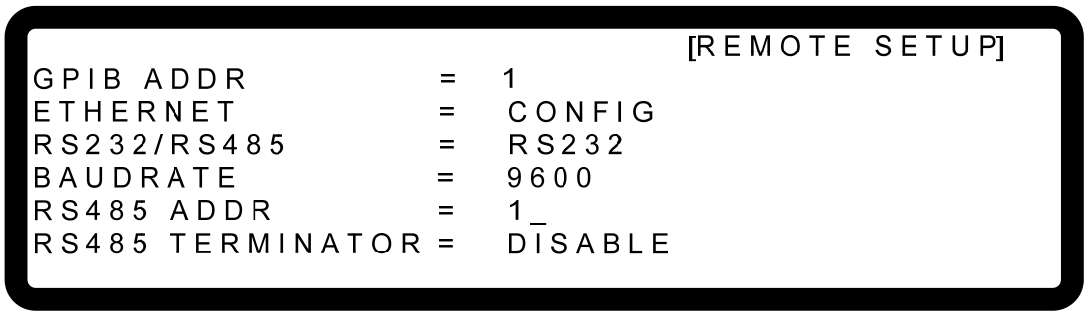


Figure 3-126

2. Use numeric keys [1] ~ [0] or "Rotary" ( ) to set the address.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to the MAIN PAGE.

Notice The valid address range is 1~30.

3.3.8.6 RS485 TERMINATOR

When using the remote operation via RS485 function, it needs to set the terminator status.

1. Use “ ”, “ ” keys to move the cursor to RS485 TERMINATOR column as Figure 3-127 shows.

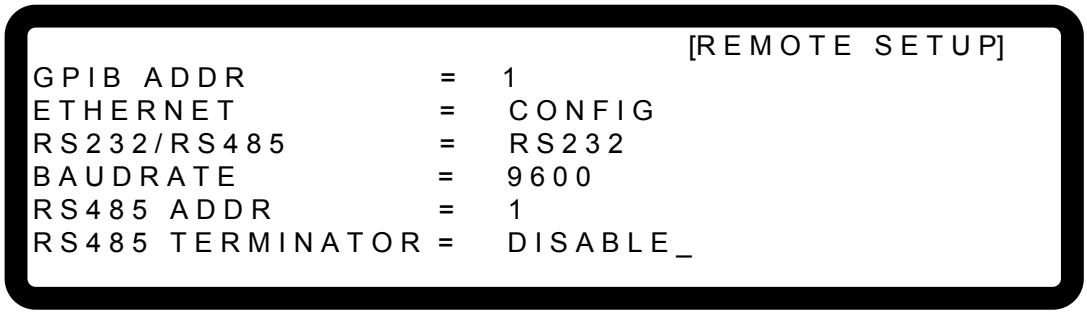


Figure 3-127

2. Use the numeric 0 ~ 1 keys or “Rotary” ( ) to enable or disable the RS485 TERMINATOR.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to the MAIN PAGE.

Notice The RS485 TERMINATOR internal resistance is 120Ω.

4. Program Sequence

62000H 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. V_STEP MODE provides a run time voltage program with the maximum of 99 hours 59 minutes and 59.99 seconds.

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.

1. Press "PROG" on the front panel.
2. It displays PROGRAM options as Figure 4-1 shows.
3. Use numeric keys 1 ~ 2 or "Rotary" ( ) knob to set the desired mode.
4. Press "ENTER" to confirm.
5. To quit PROGRAM, just press "EXIT" to return to the MAIN PAGE.

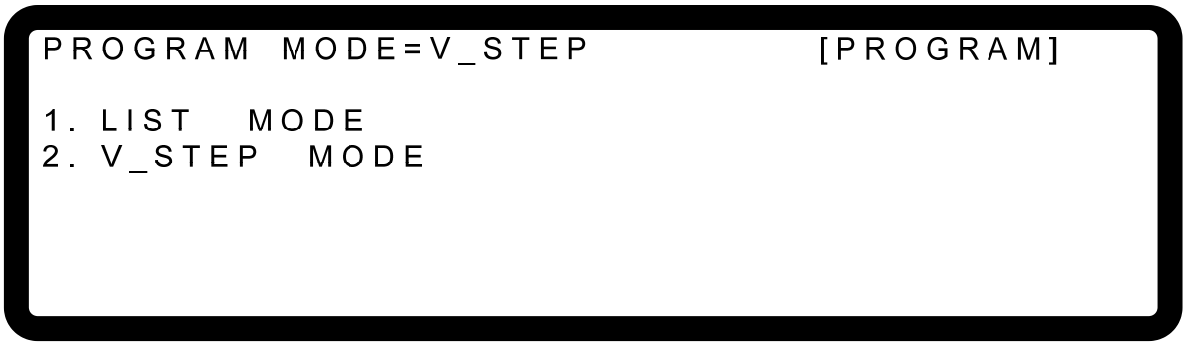


Figure 4-1

4.1 LIST MODE

In LIST MODE there are maximum 100 sequences that can be added liberally in one program. The sequence setting is described in section 4.1.2 and the complete program structure is listed in Figure 4-2.

```
EXT._TRIG PULL   =   HIGH                                  [ PROGRAM ]
PROG  NO.        =  1
RUN    COUNT     =  1
PROG    CHAIN    =  NO
CLEAR   PROG     =  NO
                                                           [ SEQUENCE ]
SEQ    NO.       =  1
SEQ    TYPE      =  AUTO                  TIME  =  0.000(S)
VOLTAGE          =  0.00V
V   S. R.        =  1.000(V/ms)
CURRENT          =  0.000A
I    S. R.       =  INF.  (A/ms)
                                                           [ SEQUENCE ]
SEQ    NO.       =  2
SEQ    TYPE      =  AUTO                  TIME  =  0.000(S)
VOLTAGE          =  0.00V
V   S. R.        =  1.000(V/ms)
CURRENT          =  0.000A
I    S. R.       =  INF.  (A/ms)
                                                           [ SEQUENCE ]
SEQ    NO.       =  3
SEQ    TYPE      =  AUTO                  TIME  =  0.000(S)
VOLTAGE          =  0.00V
V   S. R.        =  1.000(V/ms)
CURRENT          =  0.000A
I    S. R.       =  INF.  (A/ms)
                                                           [ SEQUENCE ]
SEQ    NO.       =  4
SEQ    TYPE      =  AUTO                  TIME  =  0.000(S)
VOLTAGE          =  0.00V
V   S. R.        =  1.000(V/ms)
CURRENT          =  0.000A
I    S. R.       =  INF.  (A/ms)

                                  ↓
                                  ↓
                                  ↓
```

Figure 4-2

4.1.1 Description of PROGRAM Settings

A PROGGRAM has 5settings: (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

1. Use “ ◄—▲ ”, “ ▼—► ” keys to move to the cursor to the column to be set as Figure 4-3 (1) shows.
2. Use numeric keys [0] ~ [1] or “Rotary” ( ) to set HIGH or LOW.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Figure 4-1.

Notice

1. When the EXT._TRIG PULL is set to HIGH, the user has to input a negative edge trigger signal (TTL level) from the Analog Interface PIN 8 on the rear panel to jump to the next sequence.
2. When the EXT._TRIG PULL is set to LOW, the user has to input a high level signal from the Analog Interface PIN 8 on the rear panel and change it to low level signal (negative edge trigger) to jump to the next sequence.

4.1.1.2 Setting PROG NO.

1. Use “ ◄—▲ ”, “ ▼—► ” keys to move the cursor to the column to be set as Figure 4-3 (2) shows.
2. Use the numeric ([0]~[9]) keys or “Rotary” ( ) knob to set the value.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Figure 4-1.

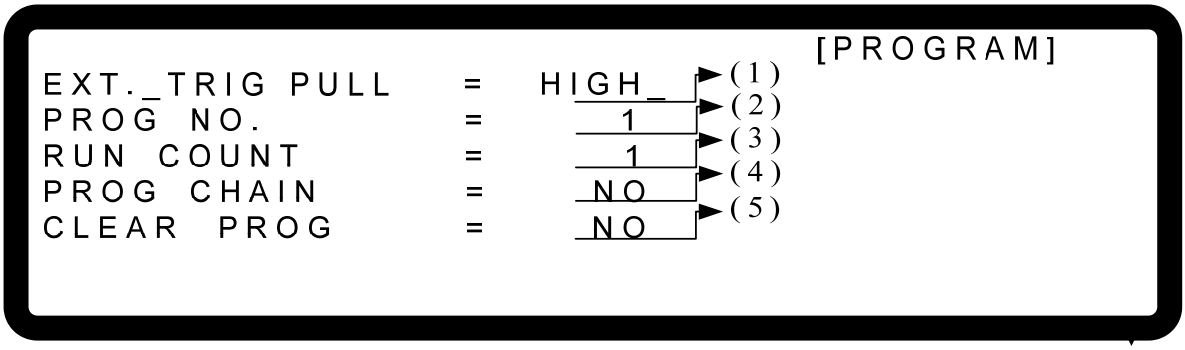


Figure 4-3

Since there are 10 programs for setting, the valid range of PROG NO. is 1 ~ 10.

4.1.1.3 Setting RUN COUNT

1. Use “ ◄—▲ ”, “ ▼—► ” keys to move the cursor to the column to be set as Figure 4-3 (3) shows.
2. Use numeric keys [0]~[9] or “Rotary” ( ) knob to set the value.

Each PROGRAM has a RUN COUNT that sets the execution number. Following table 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 #1 to NEXT TO PROG NO =3, RUN COUNT=2.
PROG #3 to NEXT TO PROG NO =0, RUN COUNT=3.
The program execution flow of RUN COUNT is listed as Figure 4-4 shows.

A1: Execution steps:
(1) When all PROG #1 SEQUENCES are done, return to PROG #1.
(2) Repeat step (1) twice and skip PROG #2 and return to PROG #3.
(3) When all PROG #3 SEQUENCES are done, return to PROG #3.
(4) Repeat step (3) for 3 times.
(5) End

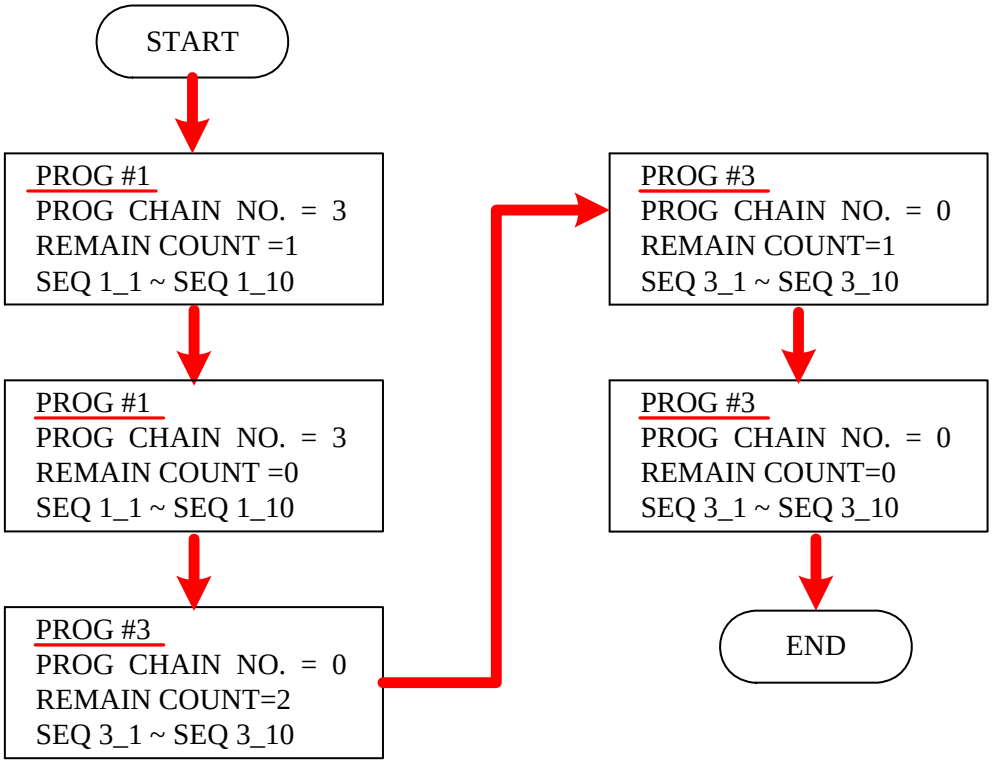


Figure 4-4

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to Figure 4-1.

4.1.1.4 Setting PROG CHAIN

1. Use “ ←↑ ”, “ ↓→ ” keys to move the cursor to the column to be set as Figure 4-3 (4) shows.
2. Use numeric keys 0~1 or “Rotary” ( ) knob to set YES or NO.

The PROGRAM CHAIN indicates the link among programs. YES must be set before executing different programs, and then select the PROGRAM to be executed next (NEXT TO PROG NO.).

The setting range is 0 ~ 10.

(1) Set NEXT TO PROG NO. to 0
When setting NEXT TO PROG NO., it means no program link.
(2) Set NEXT TO PROG NO. to non 0
When setting NEXT TO PROG NO. to non-0, it means to perform program link as the example listed below.

Ex.2: Link execution among programs
Set PROG #1 to NEXT TO PROG NO =3, RUN COUNT=1
PROG #3 to NEXT TO PROG NO =4, RUN COUNT=1
PROG #4 to NEXT TO PROG NO =6, RUN COUNT=1
PROG #6 to NEXT TO PROG NO =0, RUN COUNT=1
The program execution flow is listed as Figure 4-5 shows.

A2: Execution steps:
(1) When all PROG #1 SEQUENCES are done, skip PROG #2 and jump to PROG #3
(2) When all PROG #3 SEQUENCES are done, jump to PROG #4
(3) When all PROG #4 SEQUENCES are done, skip PROG #5 and jump to PROG #6
(4) End

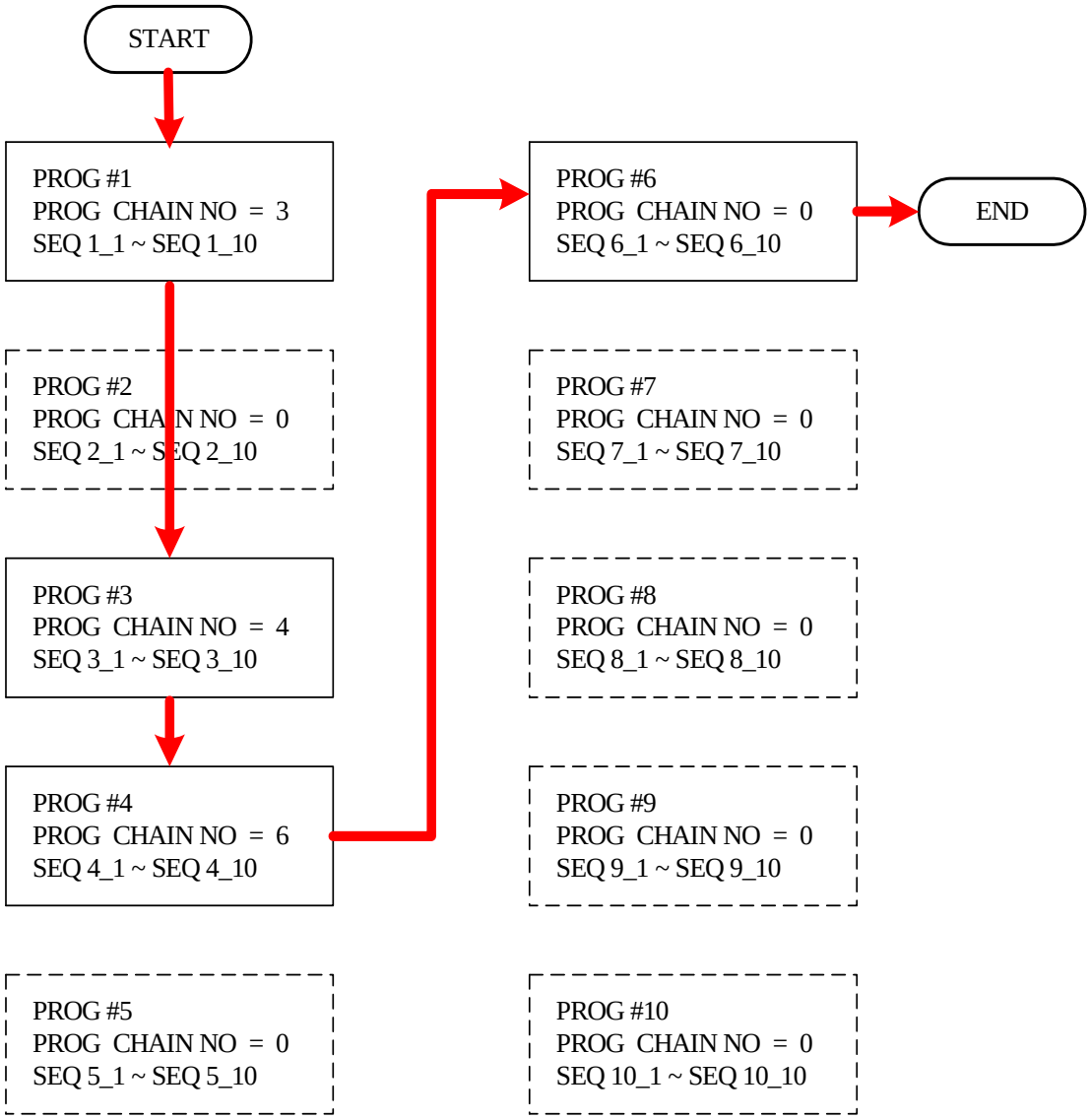


Figure 4-5

Ex. 3: Use a PROGRAM to form an infinite loop
Set PROG #1 to NEXT TO PROG NO =1, RUN COUNT=1
The program execution flow is listed as Figure 4-6 shows.

A3: Execution steps:

(1) When all PROG #1 SEQUENCES are done, jump to PROG #1.
(2) Rerun step (1).
(3) Form an infinite loop.

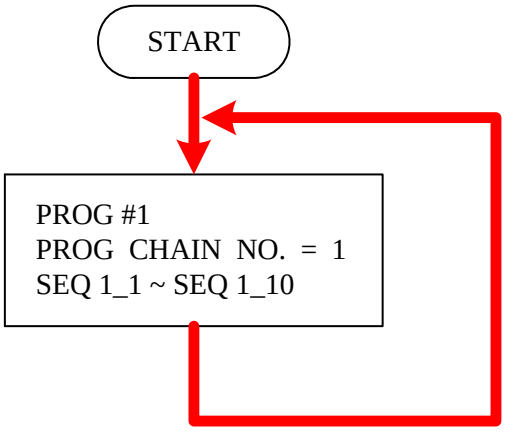


Figure 4-6

Ex.4: Use multiple PROGRAMS to form an infinite loop

Set PROG #1 to NEXT TO PROG NO =3, RUN COUNT=1
PROG #3 to NEXT TO PROG NO =4, RUN COUNT=1
PROG #4 to NEXT TO PROG NO =6, RUN COUNT=1
PROG #6 to NEXT TO PROG NO =1, RUN COUNT=1
The program execution flow is listed as Figure 4-7shows.

A4: Execution steps:

(1) When all PROG #1 SEQUENCES are done, skip PROG #2 and jump to PROG #3.
(2) When all PROG #3 SEQUENCES are done, jump to PROG #4.
(3) When all PROG #4 SEQUENCES are done, skip PROG #5 and jump to PROG #6.
(4) When all PROG #6 SEQUENCES are done, skip PROG #7~ PROG #10 and jump to PROG #1.
(5) Rerun step (1) ~ step (4).
(6) Form an infinite loop.

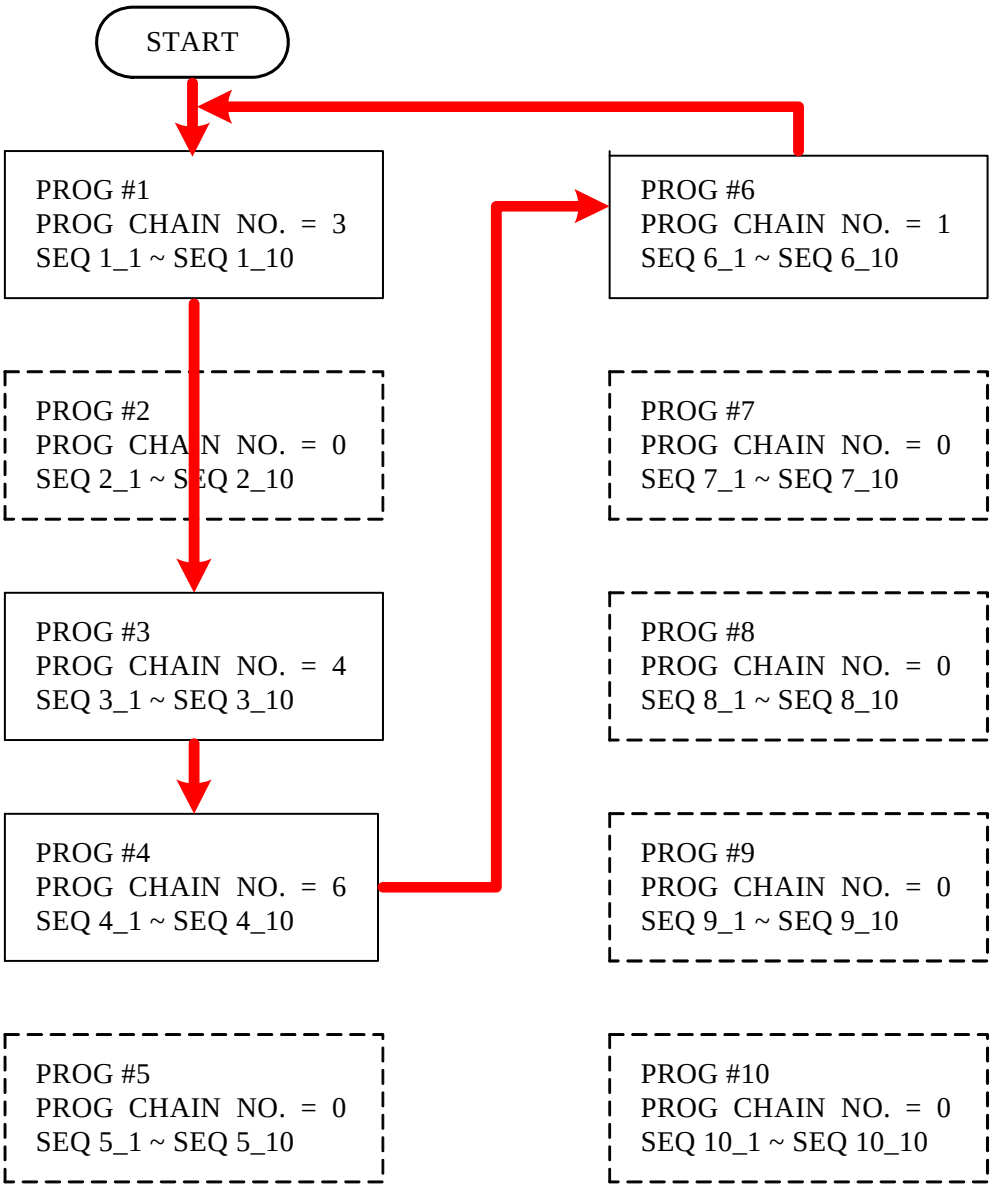


Figure 4-7

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to Figure 4-1.

Notice

If it skips to next PROGRAM, which has no SEQUENCE, all SEQUENCES will set top SKIP (see 4.1.2.2 SEQUENCE TYPE) and the PROGRAM will stop execution.

4.1.1.5 Setting CLEAR PROGRAM

1. Use " ", " " keys to move the cursor to the column to be set as Figure 4-3 (4) shows.
2. Use numeric keys 0~1 or "Rotary" ( ) knob to set the value.

Clear Program has two options, which are CLEAR PROG. = YES / NO. The main function of Clear Program is to clear all sequences in that program.

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to Figure 4-1.

4.1.2 Setting Sequence

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 PROGRAM page (Figure 4-3), if the PROGRAM has no SEQUENCE when the cursor is at (5), press "→" can add a new SEQUENCE. The page will skip to Figure 4-8.
   b. When the cursor is at (7) in Figure 4-8 as the SEQUENCE of a PROGRAM, press "→" can add a new SEQUENCE.

Notice

"→" function key is usually used as cursor movement key, only when in the above situations can be used for adding new SEQUENCE.

3. Use "↑", "→" keys to move the cursor to the column to be set as Figure 4-8 shows.
4. Use numeric keys 0~1 or "Rotary" ( ) knob to set the value.

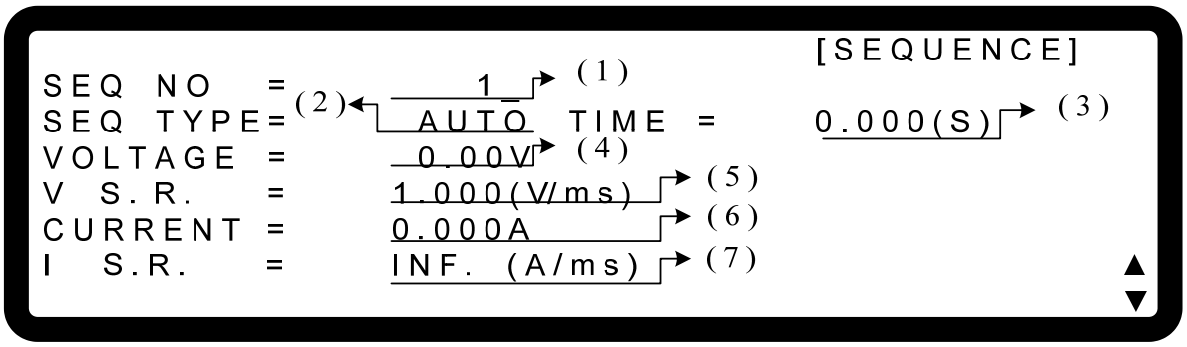


Figure 4-8

Each sequence has eight options: (1) SEQ NO., (2) SEQ. TYPE, (3) TIME, (4) VOLTAGE, (5) V S.R., (6) CURRENT and (7) I S.R. which are described as below.

5. Press "ENTER" to confirm.
6. Press "EXIT" to return to Program PAGE (Figure 4-3).

4.1.2.1 Setting Sequence Number

1. Use “ ←↑ ”, “ ↓→ ” keys to move the cursor to the column to be set as Figure 4-8 (1) shows.
2. When the cursor is in Figure 4-8 (7), press “ ↓→ ” can add a new SEQUENCE. Also it can use numeric keys 0~9 or “Rotary” ( ) knob to set the value and return to the previous set Sequence Number.

   A program has maximum 100 sequences, therefore the range of SEQ NO. is: 1~100.

3. Press “ ENTER ” to confirm.
4. Press “ EXIT ” to return to Program PAGE (Figure 4-3).

4.1.2.2 Setting Sequence Type

1. Use “ ←↑ ”, “ ↓→ ” keys to move the cursor to the column to be set as Figure 4-8 (2) shows.
2. Use numeric keys 0~3 or “Rotary” ( ) knob to set the Sequence Type.

   There are four Sequence Types, which are: (1) AUTO, (2) MANUAL, (3) TRIGGER, (4) SKIP.

   a. Setting Sequence Type to AUTO

   When SEQ TYPE = AUTO is set, the page shown as Figure 4-9 indicates the sequence will complete the execution automatically and skip to next sequence. TIME= will prompt at the lower left corner to ask users entering the time remained for this sequence.

Notice

1. Table 4-2 lists the range for setting the time remains (TIME =).

Table 4-2

TIME	Min. (Sec)	Max. (Sec)
	0.005	15000

2. When SEQ. TYPE = AUTO and TIME = 0 it indicates the program is done before setting TIME = 0 for previous Sequence.

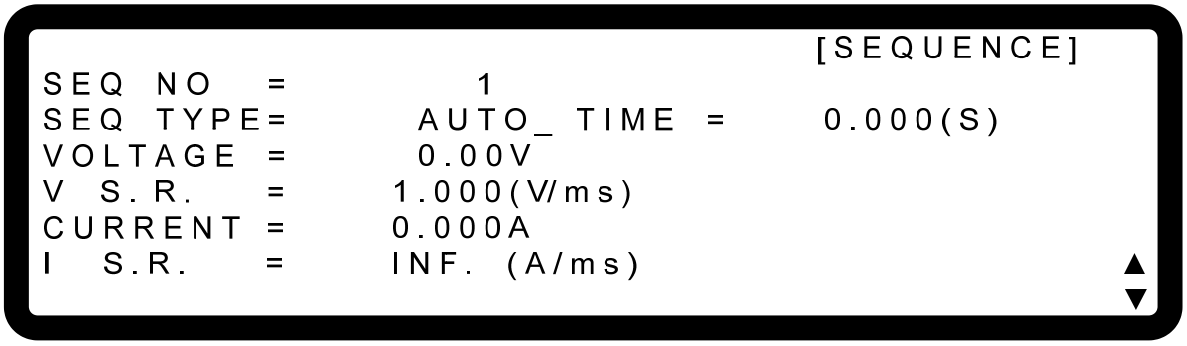


Figure 4-9

Ex. 5: Set Sequence Type to AUTO

If PROGRAM 1 is set as Figure 4-10 shows the output load is 10(Ω).

```
EXT._TRIG PULL  =  HIGH                                  [ PROGRAM ]
PROG NO.        =  1
RUN  COUNT      =  2
PROG  CHAIN     =  NO
CLEAR  PROG     =  NO
                                                         [ SEQUENCE ]
SEQ  NO.        =  1
SEQ  TYPE       =  AUTO                 TIME  =  5.000(S)
VOLTAGE         =  10.00V
V  S. R.        =  1.000(V/ms)
CURRENT         =  20.000A
I  S. R.        =   1.000 (A/ms)
                                                         [ SEQUENCE ]
SEQ  NO.        =  2
SEQ  TYPE       =  AUTO                 TIME  =  10.000(S)
VOLTAGE         =  30.00V
V  S. R.        =  10.000(V/ms)
CURRENT         =  20.000A
I  S. R.        =   1.000  (A/ms)
                                                         [ SEQUENCE ]
SEQ  NO.        =  3
SEQ  TYPE       =  AUTO                 TIME  =  0.000(S)
VOLTAGE         =  0.00V
V  S. R.        =  1.000(V/ms)
CURRENT         =  0.000A
I  S. R.        =   1.000(A/ms)

                                  ↓
                                  ↓
                                  ↓

                                                         [ SEQUENCE ]
SEQ  NO.        =  10
SEQ  TYPE       =  AUTO                 TIME  =  0.000(S)
VOLTAGE         =  0.00V
V  S. R.        =  1.000(V/ms)
CURRENT         =  0.000A
I  S. R.        =  INF.  (A/ms)
```

Figure 4-10

A5: Execution step:

(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 4-11 shows the output waveform:

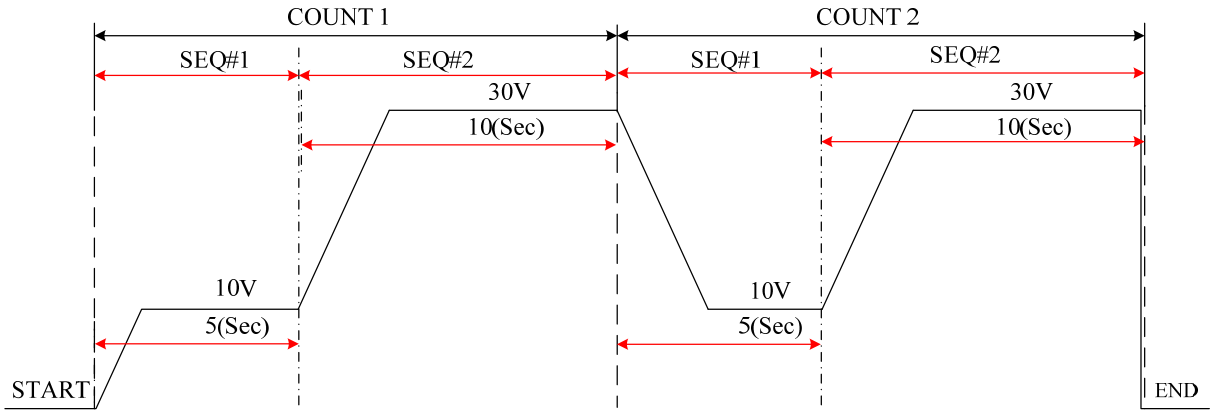


Figure 4-11

b. Setting Sequence Type to MANUAL

When SEQ TYPE = MANUAL is set, the Sequence page shown as Figure 4-12 indicates 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. It will not ask users to enter the time the sequence will remain when set to MANUAL.

Figure 4-12

c. Setting Sequence Type to TRIGGER

When SEQ TYPE = TRIGGER is set, the Sequence page shows as Figure 4-13 indicates the sequence will run automatically and stop at the setting of VOLTAGE or CURRENT without skipping to next sequence until inputting a singal from PIN 8 of Analog Interface on the rear panel. See section 4.1.1.1 for the input signal definition of Analog Interface PIN 8. It will not ask users to enter the time the sequence will remain when set to TRIGGER.

Figure 4-13

d. Set Sequence Type to SKIP

When SEQ TYPE = SKIP is set, the Sequence page shows as Figure 4-14 indicates the Sequence will skip automatically and jump to next SEQUENCE. This Sequence page will not ask users to enter the time sustained for this Sequence.

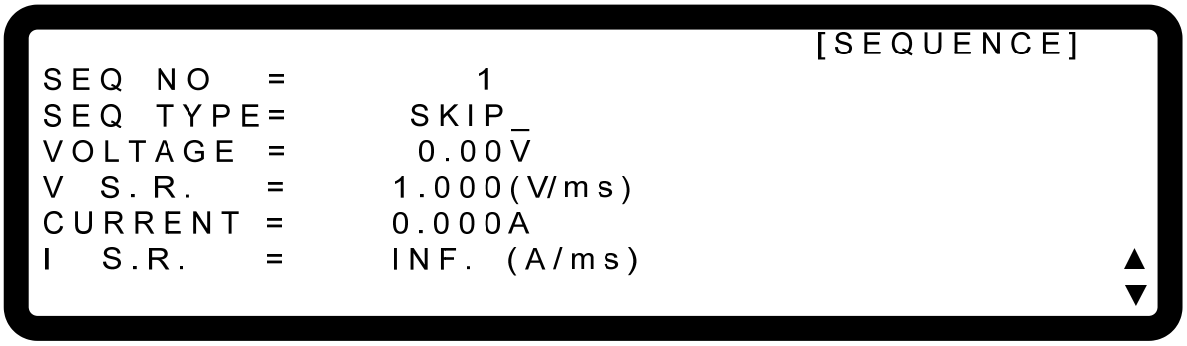


Figure 4-14

4.1.2.3 Setting Time

1. Use “ ◄─▲ ”, “ ▼─► ” keys to move the cursor to the column to be set as Figure 4-8 (3) shows.
2. Use numeric keys 0 ~ 9 or “Rotary” ( ) to set the value.
   This function is to set the time sustained. This setting TIME = only appears when SEQ. TYPE = AUTO.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Program PAGE (Figure 4-3).

4.1.2.4 Setting Voltage

1. Use “ ◄─▲ ”, “ ▼─► ” keys to move the cursor to the column to be set as Figure 4-8 (4) shows.
2. Use numeric keys 0~9 or “Rotary” ( ) knob to set the SEQ output voltage
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Program PAGE (Figure 4-3).

See section 3.2 for detail description.

4.1.2.5 Setting Voltage Slew Rate

1. Use “ ◄─▲ ”, “ ▼─► ” keys to move the cursor to the column to be set as Figure 4-8 (5) shows.
2. Use numeric keys 0~9 or “Rotary” ( ) knob to set the SEQ voltage conversion slew rate.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Program PAGE (Figure 4-3).

See section 3.3.2.3 for detail description.

4.1.2.6 Setting Current

1. Use “ ◄─▲ ”, “ ▼─► ” keys to move the cursor to the column to be set as Figure 4-8 (6) shows.
2. Use numeric keys 0~9 or “Rotary” ( ) knob to set the SEQ output current limit.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Program PAGE (Figure 4-3).

See section 3.2 for detail description.

4.1.2.7 Setting Current Slew Rate

1. Use “ ◄—▲ ”, “ ▼—► ” keys to move the cursor to the column to be set as Figure 4-8 (7) shows.
2. Use numeric keys [0]~[9] or “Rotary” ( ) knob to set the SEQ current conversion slew rate.
3. Press “[ENTER]” to confirm.
4. Press “[EXIT]” to return to Program PAGE (Figure 4-3).

See section 3.3.2.4 for detail description.

4.1.3 Execution in LIST MODE

When the sequences are finished for editing, press “[ON/OFF]” to start execution and press “[EXIT]” to abort it.

4.1.3.1 Running LIST MODE

1. Press “[ON/OFF]” will prompt a confirmation page as Figure 4-15 shows.

Figure 4-15

2. Press “[ON/OFF]” again to confirm the execution and go to the MAIN PAGE as Figure 4-16 shows. To quit the execution, press “[EXIT]” will return to the standby MAIN PAGE.

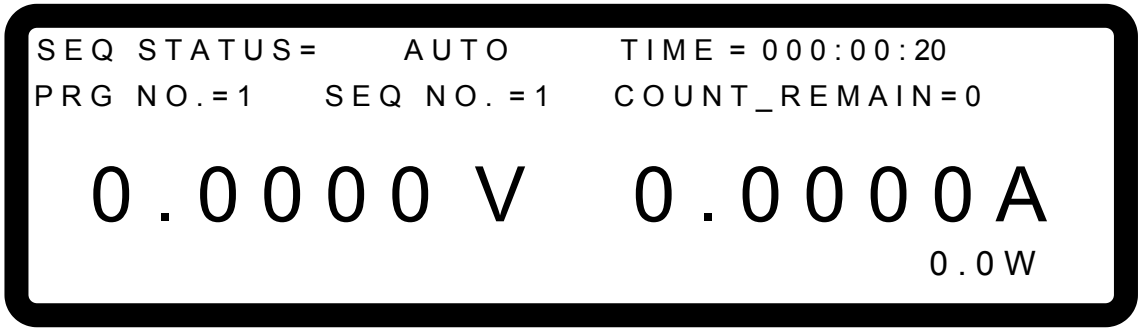


Figure 4-16

Notice

1. Press "ON/OFF" in Program page (Figure 4-3) or Sequence page (Figure 4-8) will prompt a confirmation page as Figure 4-15 shows.
2. Press "EXIT" can abort the executing program which means to stop the Power Supply from output.

4.1.3.2 Program List Mode Description

Figure 4-17 shows the main execution page of LIST MODE. Items (1)~(5) in the figure are explained below.

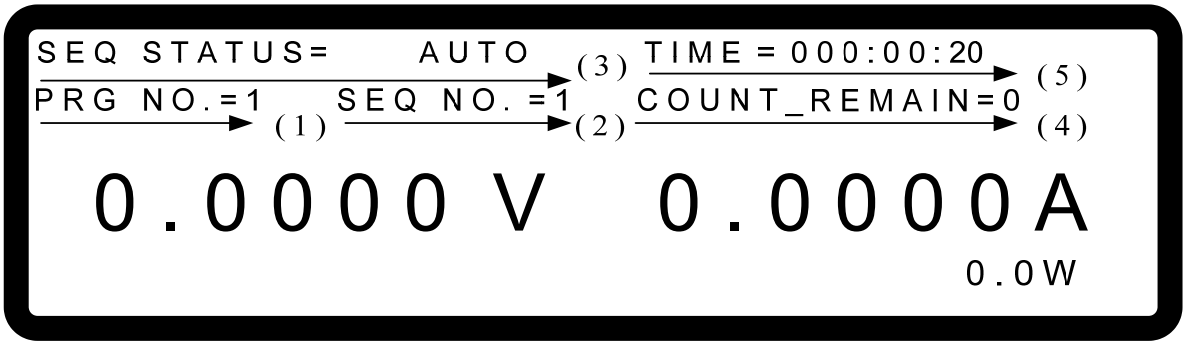


Figure 4-17

(1) Program Number: PRG NO. indicates the Program Number being executed at present.
(2) Sequence Number: SEQ NO. indicates the Sequence Number being executed at present.
(3) Sequence Status: SEQ STATUS indicates the Sequence state being executed at present.
(4) Count_Remain: COUNT_REMAIN indicates the numbers to be executed for the current Program.
(5) Running Time: TIME indicates the sum of time from the program is executed to the sequence is run on Main Page.

The time format is HOUR:MIN:SEC and the maximum display limit is 99 hours 59 minutes and 59 seconds. If the time accumulated exceeds the maximum display limit, it will reset to 0 and recount.

4.2 V_STEP MODE

It is able to set a run time program in V_STEP MODE. Figure 4-18 shows the screen when V_STEP MODE is selected.

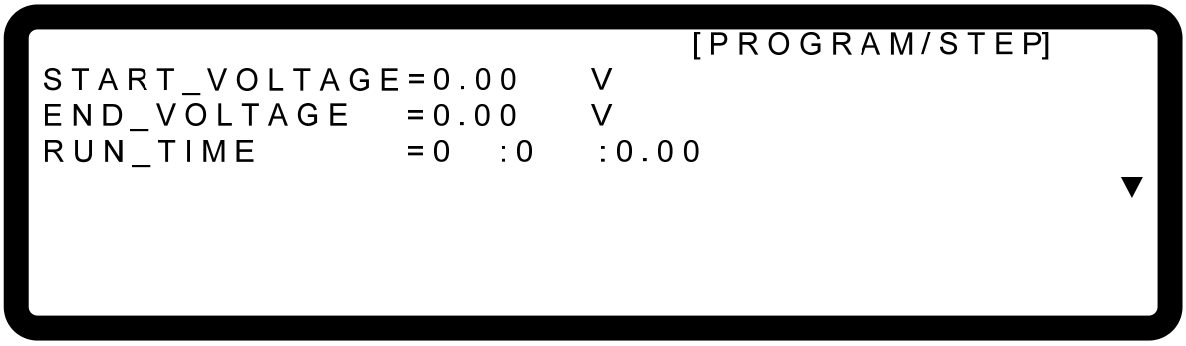


Figure 4-18

4.2.1 Setting V_STEP MODE

V_STEP MODE has 3 settings: (1) START_VOLTAGE, (2) END_VOLTAGE and (3) RUN_TIME.

4.2.1.1 Setting START_VOLTAGE

1. Use " ◄— ▲ ", " ▼ —► " keys to move the cursor to the column to be set as Figure 4-19 (1) shows. Set the start voltage of STEP MODE.
2. Use numeric keys 0 ~ 9 or "Rotary" ( ) knob to set the value.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to Figure 4-1.

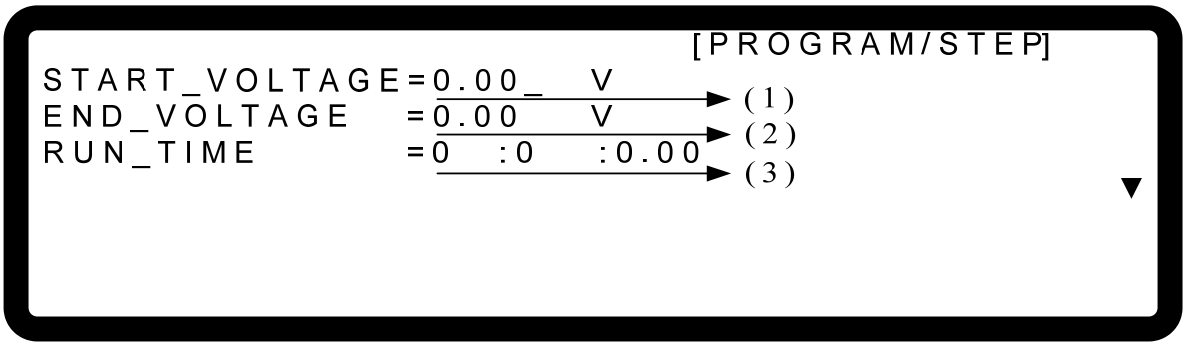


Figure 4-19

CAUTION The initial voltage of the hardware does not equal to the setting of START_VOLTAGE. There are two circumstances that may occur in V_STEP MODE: (1) The output voltage rises to the setting of START_VOLTAGE and the V SLEW RATE is 1V/mS, or (2) it falls to the setting of START_VOLTAGE and the falling time is calculated by 1V/mS while the actual V SLEW RATE is varied by load.

4.2.1.2 Setting END_VOLTAGE

1. Use “ ”, “ ” keys to move the cursor to the column to be set as Figure 4-19 (2) shows. Set the end voltage of STEP MODE.
2. Use numeric keys 0~9 or “Rotary” ( ) knob to set the value.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Figure 4-1.

4.2.1.3 Setting RUN_TIME

1. Use “ ”, “ ” keys to move the cursor to the column to be set as Figure 4-19(3) shows. Set the run time of STEP MODE. The time format is HOUR:MIN:SEC and the maximum setting is 99 hours 59 minutes and 59.99 seconds.
2. Use numeric keys 0~9 or “Rotary” ( ) knob to set the value.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Figure 4-1.

Notice When V_STEP MODE ends the hardware output voltage will remain at the setting of END_VOLTAGE.

Ex. 1: Set the START_VOLTAGE to 10V, END_VOLTAGE to 50V and RUN_TIME to 10 minutes.

CASE1: The hardware initial voltage is 0V and the output waveform is as Figure 4-20 shows.
CASE2: The hardware initial voltage is 10V and the output waveform is as Figure 4-21 shows.
CASE3: The hardware initial voltage is 20V and the output waveform is as Figure 4-22 shows.

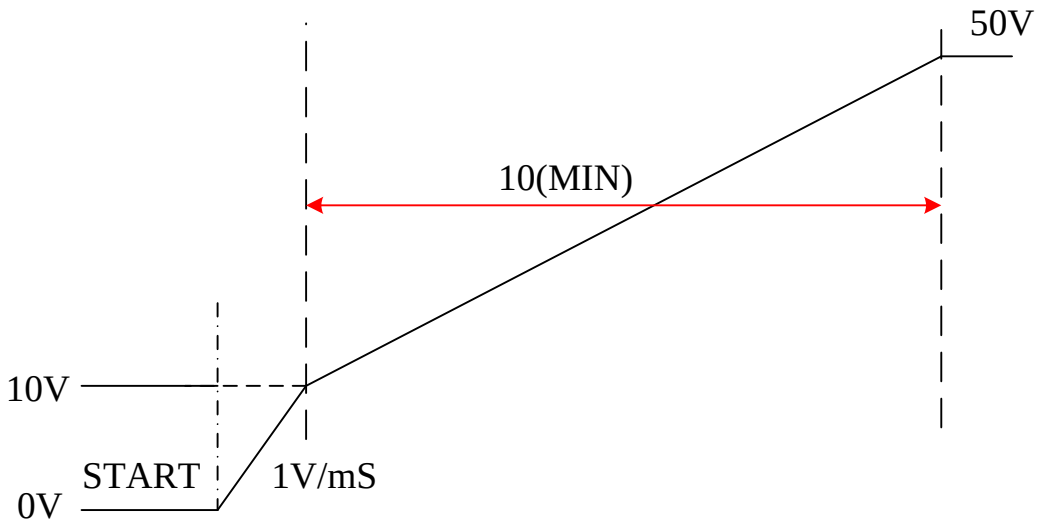


Figure 4-20

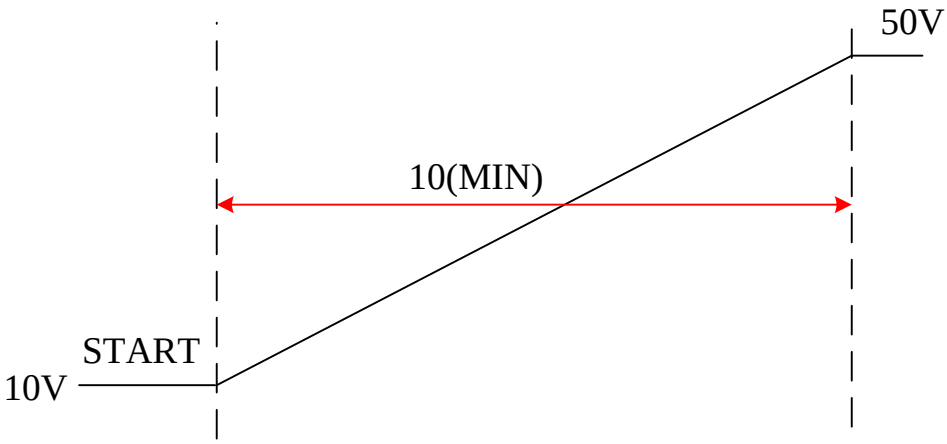


Figure 4-21

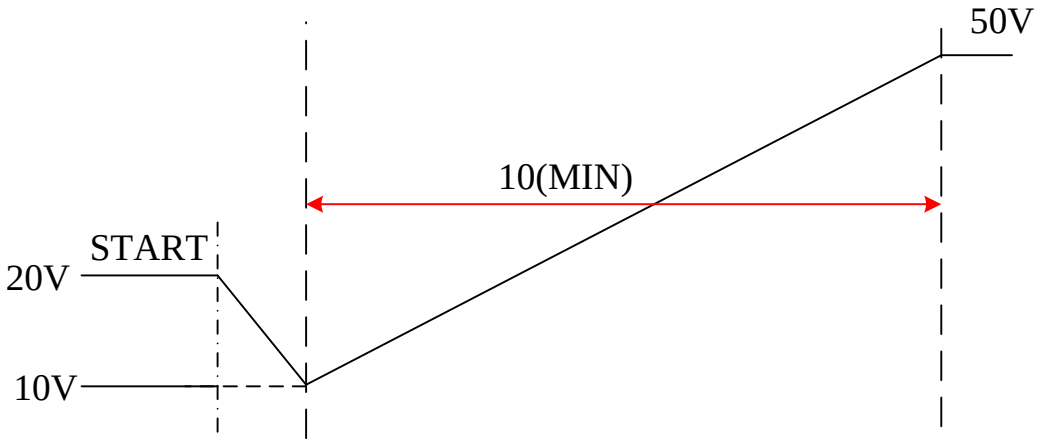


Figure 4-22

4.2.2 Execution of V_STEP MODE

After the setting is done, press "ON/OFF" to confirm and start the execution. To abort it, just press "EXIT".

4.2.2.1 Running V_STEP MODE

1. Press "ON/OFF" will appear a confirmation window as Figure 4-15 shows.
2. Press "ON/OFF" one more time to confirm the execution. It will skip to the MAIN PAGE during execution as Figure 4-23 shows. To quit the execution, press "EXIT" can return to the MAIN PAGE window at standby.

Notice Press "EXIT" can interrupt the Program execution forcibly that is the Power Supply stops output.

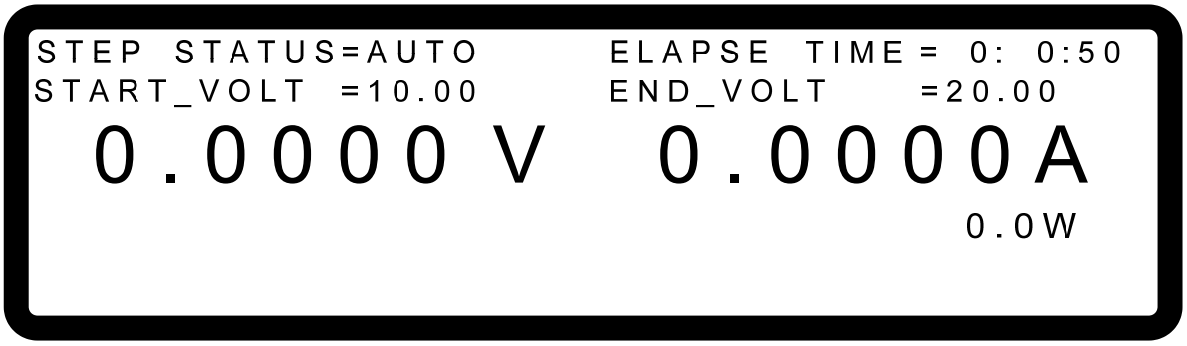


Figure 4-23

4.2.2.2 Description of Program V_Step Mode

When executing V_STEP MODE its main screen is as Figure 4-24 shows. The following explains the meaning of (1)~(4) in Figure 4-24.

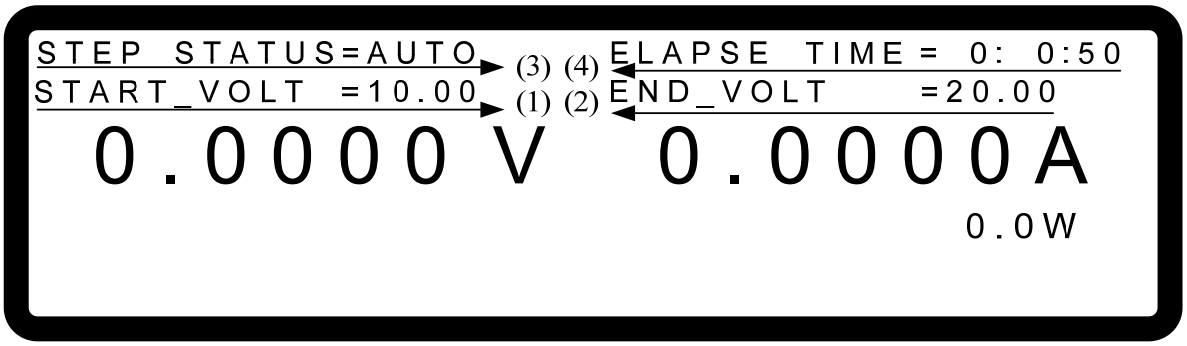


Figure 4-24

(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) STEP STATUS: It is the executing status of V_STEP MODE.
(4) 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 seconds.

5. Remote Operation

5.1 Overview

62000H Series DC Power Supply can be controlled remotely via USB, GPIB, Ethernet, RS-232 or RS-485 port.

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. RS-232C is a serial bus with less powerful functions; however, users can do remote control easily via simple programming.

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
(4)	Installing Driver:	62000H 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 OS 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 OS. The PC can communicate with 62000H Series via NI-VISA after using the USB cable to connect them.

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

5.1.2 Setting GPIB, Ethernet, RS-232C & RS-485 Parameters

See section 3.3.8.

5.1.3 Connecting RS-232C

The default baudrate of 62000H Series DC Power Supply is 115200 and the parity check is set to None. Only TxD and RxD signal can be used for data transmission. The connector of RS-232C is a 9-pin D type male connector. Table 5-1 lists the pins and signals of RS-232C connector.

Table 5-1

Pin No.	INPUT/OUTPUT	Description
1	---	"N.C."
2	INPUT	RxD
3	OUTPUT	TxD
4	---	DSR
5	---	GND
6	---	DTR
7	---	CTS
8	---	RTS
9	---	"N.C."

Table 5-2 lists the connection between PC (IBM compatible) and 62000H Series DC Power Supply.

Table 5-2

Pin No.	IBM PC	62000H
1	DCD	"N.C."
2	RX	RX
3	TX	TX
4	DTR	"N.C."
5	GND	DGND
6	DSR	"N.C."
7	RTS	"N.C."
8	CTS	"N.C."
9	"N.C."	"N.C."

Notice "N.C." stands for "Not Connected".

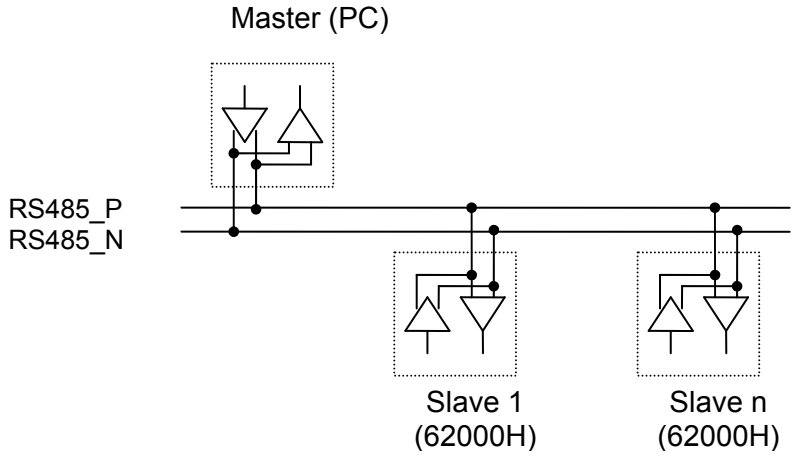
5.1.4 Connecting RS-485

The default transmission baudrate of 62000H Series is set to 115200 and the parity check is set to None. The RS-485 interface is a half-duplex two-wire differential signaling transmission and only RS485_P and RS485_N signals are required for data transmission. The connection is the same as RS-232C that is a 9-pin D type male connector. Table 5-3 lists the pin number and assigned signal of RS-485 connector.

Table 5-3

Pin No.	Description
1	---
2	---
3	---
4	RS485_P
5	---
6	---
7	---
8	---
9	RS485_N

Here is the connection:



5.1.5 Ethernet Remote Control

To remote program a DC Power Supply via a PC with Ethernet interface, it 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 2101.

5.2 GPIB Function of 62000H Series

Table 5-4

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 LOCAL. Press "LOCAL" can 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 table below lists the convention used in this section.

Table 5-5

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 62000H DC Power Supply is listed in Table 5-6. Numerical data can be added to the suffix to distinguish data while the multiplier can be placed prior the suffix. Table 5-7 lists the suffix used by 62000H DC Power Supply and Table 5-8 lists the multiplier.

Table 5-6 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 5-7

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

Table 5-8

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 <Boolean> 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 subsection 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 by 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 is 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 elements from one another 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, and <NL> for RS-232C.

5.4 Traversal of the 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 62000H 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 62000H DC Power Supply will affect the response of a coupled parameter to its programming.

5.6 Commands of DC Power Supply

This section describes the syntax and parameters of all commands for DC Power Supply.

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 62000H to identify itself.
Query Syntax: *IDN?
Query Example: *IDN?

String	Description
CHROMA ATE	Manufacturer
62150H-600	Model name
123456	Serial No.
01.00	Firmware version

Return Example: CHROMA ATE, 62150H-600,123456,01.00

***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”.)

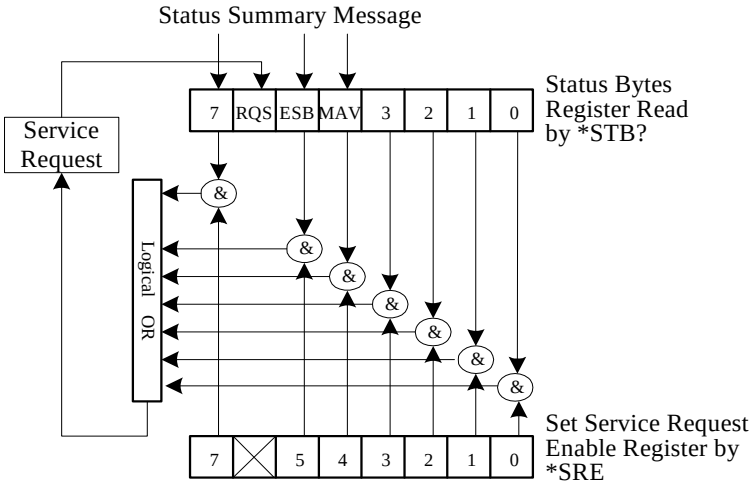


Figure 5-1

Table 5-9

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.

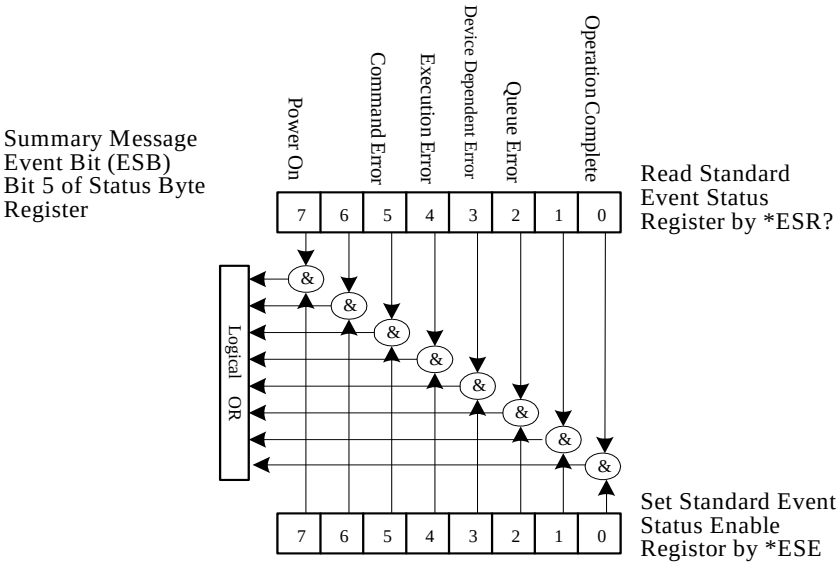


Figure 5-2

Table 5-10

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 62000H Series

5.6.2.1 ABORT Subsystem

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

5.6.2.2 CONFIGURE Subsystem

1. CONFigure:BEEPer
   Description: It sets the beeper to ON or OFF.
   Syntax: CONFigure:BEEPer ON
   CONFigure:BEEPer OFF
   Parameter: ON|OFF
   Example: CONF: BEEPer ON
   CONF: BEEPer OFF
   Query Syntax: CONFigure:BEEPer?
   Return Parameter: ON | OFF
   Query Example: CONF:BEEPer? It returns the beeper control status.
   Return Example: ON or OFF

2. CONFigure:REMote
   Description: It sets the remote control status (valid for RS232C only).
   Syntax: CONFigure:REMote ON
   CONFigure:REMote OFF
   Parameter: ON|OFF
   Example: CONF:REM OFF It disables remote control.

3. CONFigure:OUTPut
   Description: It sets the output voltage/current.
   Syntax: CONFigure:OUTPut ON
   CONFigure: OUTPut OFF
   Parameter: ON|OFF
   Example: CONFigure: OUTPut The power supply starts output.
   CONFigure: OUTPut OFF The power supply stops output.
   Query Syntax: CONFigure: OUTPut?
   Query Example: CONF: OUTPut?
   Return Example: ON or OFF

4. CONFigure:FOLDback
   Description: It sets the type of FOLDBACK PROTECT.
   Syntax: CONFigure:FOLDback DISABLE
   CONFigure:FOLDback CVTOCC
   CONFigure:FOLDback CCTOCV

Parameter: DISABLE|CVTOCC|CCTOCV
Example: CONFigure:FOLD DISABLE
CONFigure:FOLD CVTOCC
Query Syntax: CONFigure:FOLD?
Query Example: CONF:FOLD? It returns the status set.
Return Example: DISABLE or CVTOCC or CCTOCV

5. CONFigure:FOLDT
Description: It sets the delay time of FOLDBACK PROTECT
Syntax: CONFigure:FOLDT <NRf1>
Parameter: 0.01~600.00 (Unit : Sec)
Example: CONF:FOLDT 10
Query Syntax: CONF:FOLDT?
Return Parameter: <NRf1>
Query Example: CONF:FOLDT?
Return Example: 1.000000e+01

6. CONFigure:APGVSet
Description: It sets the action type of APG VSET.
Syntax: CONFigure:APGVSet NONE
CONFigure:APGVSet VREF5
CONFigure:APGVSet RREF
Parameter: NONE | VREF5 | VREF10 | IREF | RREF
Example: CONFigure:APGVSet VREF10
Query Syntax: CONFigure:APGVSet?
Query Example: CONFigure:APGVSet?
Return Example: VREF10

7. CONFigure:APGVMeas
Description: It sets the action type of APG VMEAS.
Syntax: CONFigure:APGVMeas NONE
CONFigure: APGVMeas VREF5
CONFigure: APGVMeas IREF
Parameter: NONE | VREF5 | VREF10 | IREF
Example: CONFigure:APGVMeas VREF10
Query Syntax: CONFigure: APGVMeas?
Query Example: CONFigure: APGVMeas?
Return Example: VREF10

8. CONFigure:APGISet
Description: It sets the action type of APG ISET.
Syntax: CONFigure:APGISet NONE
CONFigure:APGISet VREF5
CONFigure:APGISet RREF
Parameter: NONE | VREF5 | VREF10 | IREF | RREF
Example: CONFigure:APGISet VREF10
Query Syntax: CONFigure:APGISet?
Query Example: CONFigure:APGISet?
Return Example: VREF10

9. CONFigure:APGIMeas
Description: It sets the action type of APG IMEAS.
Syntax: CONFigure:APGIMeas NONE
CONFigure: APGIMeas VREF5

CONFigure: APGIMeas IREF
Parameter: NONE | VREF5 | VREF10 | IREF
Example: CONFigure:APGIMeas VREF10
Query Syntax: CONFigure:APGIMeas?
Query Example: CONFigure:APGIMeas?
Return Example: VREF10

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

11. CONFigure:AVG:METHod
Description: It sets the average method of AD for input voltage/current.
Syntax: CONFigure:AVG:METHOD <NR1>
Parameter: FIX/MOV
Example: CONFigure:AVG:METHOD FIX
CONFigure:AVG:METHOD MOV
Query Syntax: CONFigure:AVG:METHOD?
Return Parameter: FIX | MOV
Query Example: CONFigure:AVG:METHOD?
Return Example: FIX

12. CONFigure:BRIGhtness
Description: It sets the display brightness of panel.
Description: CONFigure:BRIGhtness
CONFigure: BRIGhtness DIM
Parameter: HIGH | NOR | DIM
Example: CONFigure: BRIGhtness HIGH
CONFigure: BRIGhtness NOR
CONFigure: BRIGhtness DIM
Query Syntax: : CONFigure: BRIGhtness?
Return Parameter: HIGH | NOR | DIM
Query Example: CONFigure: BRIGhtness ? It returns the brightness control status of panel.
Return Example: HIGH

13. CONFigure:MSTSLV:ID
Description: It sets to Master or Slave.
Syntax: CONFigure:MSTSLV:ID MASTER
CONFigure:MSTSLV:ID SLAVE1
Parameter: MASTER,SLAVE1,SLAVE2,SLAVE3…….SLAVE9.
Example: CONFigure:MSTSLV:ID MASTER
CONFigure:MSTSLV:ID SLAVE2

Query Syntax: CONFigure:MSTSLV:ID?
Return Parameter: MASTER | SLAVE1 | SLAVE2 | …… | SLAVE9
Query Example: CONF:MSTSLV:ID?
Return Example: MASTER or SLAVE1~SLAVE9

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

14. CONFigure:MSTSLV:PARSER
Description: It sets to series or parallel mode.
Syntax: CONFigure:MSTSLV:PARSER PARALLEL
CONFigure:MSTSLV:PARSER SERIES
Parameter: PARALLEL| SERIES
Example: CONFigure:MSTSLV:PARSER PARALLEL
CONFigure:MSTSLV:PARSER SERIES
Query Syntax: CONFigure:MSTSLV:PARSER?
Return Parameter: PARALLEL| SERIES
Query Example: CONF:MSTSLV:PARSER?
Return Example: PARALLEL

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

15. CONFigure:MSTSLV:NUMSLV
Description: It sets the number of SLAVE to be controlled.
Syntax: CONFigure:MSTSLV:NUMSLV <NR1>
Parameter: <NR1>
Example: CONFigure:MSTSLV:NUMSLV 1
CONFigure:MSTSLV:NUMSLV 2
Query Syntax: CONFigure:MSTSLV:NUMSLV?
Return Parameter: <NR1>
Query Example: CONF: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 9 slaves can be set when in parallel mode.

16. CONFigure:MSTSLV
Description: It executes the Master/Slave control.
Syntax: CONFigure:MSTSLV ON
CONFigure:MSTSLV OFF
Parameter: ON | OFF
Example: CONFigure:MSTSLV ON
CONFigure:MSTSLV OFF
Query Syntax: CONFigure:MSTSLV?
Return Parameter: ON| OFF
Query Example: CONF:MSTSLV?
Return Example: ON| OFF

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

Note 2: When Program RUN is executed, series/parallel control is not available.

17. CONFigure:INHibit
    Description: It executes the Remote Inhibit control.
    Syntax: CONFigure:INHibit <ARG>
    Parameter: DISABLE| ENABLE
    Example: CONFigure:INHibit DISABLE
    CONFigure:INHibit ENABLE
    Query Syntax: CONFigure:INHibit?
    Return Parameter: DISABLE | ENABLE
    Query Example: CONF:INH?
    Return Example: DISABLE

18. CONFigure:INHibit:PULL
    Description: It executes the Remote Inhibit input signal to enhance the resistance control.
    Syntax: CONFigure:INHibit:PULL <ARG>
    Parameter: LOW|HIGH
    Example: CONFigure:INHibit:PULL LOW
    CONFigure:INHibit:PULL HIGH
    Query Syntax: CONFigure:INHibit:PULL?
    Return Parameter: LOW | HIGH
    Query Example: CONF:INH:PULL?
    Return Example: LOW

19. CONFigure:INTERLOCK
    Description: It executes the Safety Interlock control
    Syntax: CONFigure:INTERLOCK <ARG>
    Parameter: DISABLE| ENABLE
    Example: CONFigure:INTERLOCK DISABLE
    CONFigure:INTERLOCK ENABLE
    Query Syntax: CONFigure:INTERLOCK?
    Return Parameter: DISABLE | ENABLE
    Query Example: CONF:INTERLOCK?
    Return Example: DISABLE

20. CONFigure:INTERLOCK:PULL
    Description: It executes the Safety Interlock input signal to enhance the resistance control.
    Syntax: CONFigure:INTERLOCK:PULL <ARG>
    Parameter: LOW|HIGH
    Example: CONFigure:INTERLOCK:PULL LOW
    CONFigure:INTERLOCK:PULL HIGH
    Query Syntax: CONFigure:INTERLOCK:PULL?
    Return Parameter: LOW | HIGH
    Query Example: CONF:INTERLOCK:PULL?
    Return Example: OW

21. CONFigure:EXTON
    Description: It executes the External ON/OFF control.
    Syntax: CONFigure: EXTON <ARG>
    Parameter: DISABLE| ENABLE
    Example: CONFigure: EXTON DISABLE
    CONFigure: EXTON ENABLE

Query Syntax: CONFigure: EXTON?
Return Parameter: DISABLE | ENABLE
Query Example: CONF: EXTON?
Return Example: DISABLE

22. CONFigure: EXTON:PULL
Description: It executes the External ON/OFF input signal to enhance the resistance control.
Syntax: CONFigure: EXTON:PULL <ARG>
Parameter: LOW|HIGH
Example: CONFigure: EXTON:PULL LOW
CONFigure: EXTON:PULL HIGH
Query Syntax: CONFigure: EXTON:PULL?
Return Parameter: LOW | HIGH
Query Example: CONF: EXTON:PULL?
Return Example: LOW

5.6.2.3 SOURCE Subsystem

1. SOURce:VOLTage
Description: It sets the output voltage.
Syntax: SOURce:VOLTage <NRf+>[suffix]
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?
Return Parameter: <NRf+> [Unit Volt]
Query Example: SOUR:VOLT? It returns the voltage.
Return Example: 8.000000e+01

2. SOURce:VOLTage:LIMit:{HIGH/LOW}
Description: It 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?
SOUR:VOLT:LIMIT:LOW?
Return Parameter: <NRf+> [Unit Volt]
Query Example: SOUR:VOLT:LIMIT:HIGH? It returns the maximum range set for voltage.
Return Example: 8.000000e+01

3. SOURce:VOLTage:PROTect:{HIGH}
Description: It 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?
Return Parameter: <NRf+> [Unit Volt]
Query Example: SOUR:VOLT:PROT:HIGH? It returns the high limit of voltage protection.
Return Example: 8.800000e+01

4. SOURce:VOLTage:SLEW
Description: It sets the rising or falling slew rate (volt/ms) of output voltage.
Syntax: SOURce:VOLTage:SLEW <NR1>[suffix]
SOURce:VOLTage:SLEW <NR1>[suffix]
Parameter: Refer to individual spec for valid numeric range.
Example: SOUR:VOLT:SLEW 0.01 It sets the output voltage slew rate to 0.01volt/mS
SOUR:VOLT:SLEW 10 It sets the output voltage slew rate to 10 volt/mS
Query Syntax: SOUR:VOLT:SLEW?
Return Parameter: <NR1> [Unit Volt/ms]
Query Example: SOUR:VOLT:SLEW? It returns the voltage slew rate.
Return Example: 1.000000e+01

5. SOURce: CURRent
Description: It sets the output current (ampere).
Syntax: SOURce:CURRent <NRf+>[suffix]
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?
Return Parameter: <NRf+> [Unit Amp]
Query Example: SOUR:CURR? It returns the current.
Return Example: 1.000000e+00

6. SOURce:CURRent:LIMit:{HIGH/LOW}
Description: It 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 set the low limit to 20A for current output protection.
Query Syntax: SOUR:CURR:LIMIT:HIGH?
SOUR:CURR:LIMIT:LOW?
Return Parameter: <NRf+> [Unit Amp]
Query Example: SOUR:CURR:LIMIT:HIGH? It returns the maximum range set for current.
Return Example: 6.000000e+01

7. SOURce:CURRent:PROTect:{HIGH }
Description: It 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?
Return Parameter: <NRf+> [Unit Amp]
Query Example: SOUR:CURR:PROT:HIGH? It returns the high limit of current protection.
Return Example: 6.000000e+01

8. SOURce:CURRent:SLEW
Description: It sets the rising or falling slew rate (amp/ms) of output current.
Syntax: SOURce:CURRent:SLEW <NR1>[suffix]
SOURce:CURRent:SLEW <NR1>[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:SLEW?
Return Parameter: <NR1> [Unit Amp/ms]
Query Example: SOUR:CURR:SLEW? It returns the current slew rate.
Return Example: 1.000000e+00

9. SOURce:CURRent:SLEWINF
Description: It sets the I Slewrate to INF.
Syntax: SOURce:CURRent:SLEWINF ENABLE
SOURce:CURRent:SLEWINF DISABLE
Parameter: ENABLE/DISABLE
Example: SOUR:CURR:SLEWINF ENABLE It sets the I Slewrate to INF.
SOUR:CURR:SLEWINF DISABLE It resets the I Slewrate and returns to 1A/ms.
Query Syntax: SOUR:CURR:SLEW?
Return Parameter: INF. Or <NRf+>[Unit = Ampere]
Query Example: SOUR:CURR:SLEW? It returns the setting.
Return Example: INF.

10. SOURce:POWer:PROTect:HIGH
Description: It sets the over power point (Watt) of output power.
Syntax: SOURce:POWer:PROTect:HIGH <NR1>[suffix]
Parameter: Refer to individual spec for valid numeric range.
Example: SOURce:POWer:PROTect:HIGH 1260 It sets the over power point 1260.
Query Syntax: SOURce:POWer:PROTect:HIGH?
Return Parameter: <NR1> [Watt]
Query Example: SOURce:POWer:PROTect:HIGH? It returns the over power setting value.
Return Example: 1.260000e+03

11. SOURce:DCON:{RISE/FALL}
Description: It 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?

SOUR:DCON:FALL?
Return Parameter: <NRf+> [Unit = Volt]
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 FETCH Subsystem

1. FETCh:VOLTage?
   Description: It 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: It measures the output of Power Supply and returns real time current.
   Query Syntax: FETCh:CURRent?
   Return Parameter: <NRf+> [Unit Amp]
   Query Example: FETC:CURR?
   Return Example: 2.000000e-04

3. FETCh:POWer?
   Description: It measures the output of Power Supply and returns real time power.
   Query Syntax: FETCh:POWer?
   Return Parameter: <NRf+> [Unit Amp]
   Query Example: FETC:POW?
   Return Example: 5.000000e+03

4. FETCh:STATus?
   Description: It returns the status code of Power Supply's state.
   Query Syntax: FETCh:STATus?
   Return Parameter: <Arg1><,><Arg2><,><Arg3>
   <Arg1>: return warning message 0~65535, 0: no warning, use binary for the rest and identify the cause of error.
   BIT 0: OVP
   BIT 1: OCP
   BIT 2: OPP
   BIT 3: Remote Inhibit
   BIT 4: OTP
   BIT 5: FAN_LOCK
   BIT 6: SENSE FAULT
   BIT 7: SERIES FAULT
   BIT 8: Reserved
   BIT 9: AC FAULT
   BIT 10: FOLD Back CV to CC
   BIT 11: FOLD Back CC to CV
   BIT 12: Reserved
   BIT 13: Reserved

BIT 14: Reserved
BIT 15: Reserved
<Arg2>: ON|OFF output status at present
<Arg3>: CV or CC status at present

5.6.2.5 MEASURE Subsystem

1. MEASure:VOLTage?
   Description: It returns the voltage measured at the output of Power Supply.
   Query Syntax: MEASure:VOLTage?
   Return Parameter: <NRf+> [Unit Voltage]
   Query Example: MEAS:VOLT?
   Return Example: 8.120000e+01

2. MEASure:CURRent?
   Description: It returns the current measured at the output of Power Supply.
   Query Syntax: MEASure:CURRent?
   Return Parameter: <NRf+> [Unit Amp]
   Query Example: MEAS:CURR?
   Return Example: 3.150000e+01

3. MEASure:POWer?
   Description: It returns the power measured at the output of Power Supply.
   Query Syntax: MEASure:POWer?
   Return Parameter: <NRf+> [Unit Amp]
   Query Example: MEAS:POW?
   Return Example: 5.000000e+03

5.6.2.6 PROGRAM Subsystem

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

2. PROGram:LINK
   Description: It links a program to another when ends.
   Syntax: PROGram:LINK <NR1>
   Parameter: 0 to10 (0 is not linked)
   Example: PROG:LINK 7
   Query Syntax: PROG:LINK?
   Return Parameter: <NR1>
   Query Example: PROG:LINK?
   Return Example: 7

3. PROGram:COUNT
   Description: It sets the program file to be executed in series.
   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

4. PROGram:RUN
   Description: It executes the program.
   Syntax: PROGram:RUN ON
   PROGram:RUN OFF
   Parameter: ON/1, OFF/0
   Example: PROG:RUN ON
   Query Syntax: PROGram:RUN?
   Return Parameter: <NR1>
   Query Example: PROGram:RUN?
   Return Example: 1

5. PROGram:SAVE
   Description: It saves the program.
   Syntax: PROGram:SAVE
   Parameter: None
   Example: PROG:SAVE

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

7. PROGram:SEQuence:SELected
   Description: It sets the execution sequence of a program.
   Syntax: PROGram:SEQuence:SELected <NR1>
   Parameter: 1 to 10
   Example: PROG:SEQ:SEL 3
   Query Syntax: PROGram:SEQuence:SELected?
   Return Parameter: <NR1>
   Query Example: PROG:SEQ:SEL?
   Return Example: 3

8. PROGram:SEQuence:TYPE
   Description: It sets the action type of sequence.
   Syntax: PROGram:SEQuence:TYPE TRI
   PROGram:SEQuence:TYPE AUTO
   PROGram:SEQuence:TYPE MANUAL

Parameter: SKIP, AUTO, MANUAL
Example: PROG:SEQ:TYPE TRI
PROG:SEQ:TYPE AUTO
PROG:SEQ:TYPE MANUAL
Query Syntax: PROG:SEQ:TYPE?
Return Parameter: SKIP, AUTO, MANUAL
Query Example: PROG:SEQ:TYPE?
Return Example: 1

9. PROGram:SEQuence:VOLTage
Description: It sets the sequence for voltage output.
Syntax: PROGram:SEQuence:VOLTage <NRf+>
Example: PROG:SEQ:VOLT 40.5
Query Syntax: PROG:SEQ:VOLT?
Return Parameter: <NRf+>
Query Example: PROG:SEQ:VOLT?
Return Example: 4.050000e+01

10. PROGram:SEQuence:VOLTage:SLEW
Description: It sets sequence for output voltage slew rate.
Syntax: PROGram:SEQuence:VOLTage:SLEW <NR1>
Parameter: 0.01 to 10.00
Example: PROG:SEQ:VOLT:SLEW 1
Query Syntax: PROG:SEQ:VOLT:SLEW?
Return Parameter: <NR1>
Query Example: PROG:SEQ:VOLT:SLEW?
Return Example: 1.000000e+01

11. PROGram:SEQuence:CURRent
Description: It sets sequence for output current.
Syntax: PROGram:SEQuence:CURRent <NRf+>
Example: PROG:SEQ:CURR 40.5
Query Syntax: PROG:SEQ:CURR?
Return Parameter: <NRf+>
Query Example: PROG:SEQ:CURR?
Return Example: 4.500000e+01

12. PROGram:SEQuence:CURRent:SLEW
Description: It sets sequence for output voltage slew rate.
Syntax: PROGram:SEQuence:CURRent:SLEW <NRf1>
Example: PROG:SEQ:CURR:SLEW 10
Query Syntax: PROG:SEQ:CURR:SLEW?
Return Parameter: <NR1>
Query Example: PROG:SEQ:CURR:SLEW?
Return Example: 1.000000e+00

13. PROGram:SEQuence:CURRent:SLEWINF
Description: It sets the slewrate of sequence current output to INF.
Syntax: PROGram:SEQuence:CURRent:SLEWINF ENABLE
PROGram:SEQuence:CURRent:SLEWINF DISABLE
Parameter: ENABLE/DISABLE
Example: PROGram:SEQuence:CURRent:SLEWINF ENABLE sets the Slewrate to INF

PROGram:SEQuence:CURRent:SLEWINF DISABLE releases the Slewrate INF and return to 1A/ms
Query Syntax: PROGram:SEQuence:CURRent:SLEW?
Return Parameter: INF. Or <NRf+>[Unit Amp]
Query Example: PROGram:SEQuence:CURRent:SLEW? It returns the settings.
Return Example: INF.

14. PROGram:SEQuence:TIME
Description: It sets the sequence for the duration of time.
Syntax: PROGram:SEQuence:TIME <NRf1>
Parameter: 0.005~15000 , 0 (0 means end)
Example: PROG:SEQ:TIME 10
Query Syntax: PROG:SEQ:TIME?
Return Parameter: <NR1>
Query Example: PROG:SEQ:TIME?
Return Example: 1.000000e+01

15. PROGram:CLEAR
Description: It clears the sequence.
Syntax: PROGram:CLEAR
Example: PROG:CLEAR

16. PROGram:ADD
Description: It adds a sequence.
Syntax: PROGram:ADD <NR1>
Parameter: 1~100 (based on the remaining SEQUENCE no. for configuration)
Example: PROG:ADD
Query Syntax: PROGram:ADD?
Return Parameter: <NR1>
Query Example: PROGram:ADD?
Return Example: 85 – it indicates the remaining no. is 85.

17. PROGram:MAX?
Description: It queries the sequence number of present program.
Syntax: PROGram:MAX?
Parameter:
Example: PROG:MAX?
Return Example: 2 means there are two sequences under the present program.

18. PROGram:SEQuence
Description: It sets the parameters of a single sequence.
Syntax: PROGram:SEQuence
<arg1><,><arg2><,><arg3><,><arg4><,><arg5><,><arg6><,><arg7>
Parameter:
Arg1: Sequence TYPE (NR1 0:Auto, 1:Manual, 2:EXT.Trig, 3:Skip)
Arg2: Sequence Voltage (NRf+ unit: voltage)
Arg3: Sequence Voltage Slewrate (NRf+ unit: voltage)
Arg4: Sequence Current (NRf+ unit: current)
Arg5: Sequence Current Slewrate (NRf+ unit: current) / INF –I Slewrate sets to INF
Arg6: Reserved (always 0)
Arg7: Sequence TIME (NRf+ unit: SEC, only valid when Sequence Type is AUTO)
Example: Set the Sequence

PROGram:SEQuence 0,80,10,15,1,0,10
Query Syntax: PROG:SEQ?
Return Parameter: 0,8.000000e+01,1.000000e+01,1.500000e+01,
1.000000e+00,0,1.000000e+01
Query Example: PROG:SEQ?
Return Example: 0,8.000000e+01,1.000000e+01,1.500000e+01,1.000000e+00,0,
1.000000e+010,80,10,15,1,0,1

19. PROGram:MODE
Description: It sets the Program Mode for output.
Syntax: PROGram:Mode LIST
PROGram:Mode STEP
Parameter: LIST | STEP
Example: It changes the Program Mode to STEP Mode.
PROGram:Mode STEP
Query Syntax: PROGram:Mode?
Return Parameter: LIST | STEP
Query Example: PROG:MODE?
Return Example: STEP

20. PROGram:STEP:STARTV
Description: It sets the Step Mode start voltage for output.
Syntax: PROGram:STEP:STARTV <NRf+>
Example: It changes the start voltage of STEP Mode to 20.0 V.
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: It sets the Step Mode end voltage for output.
Syntax: PROGram:STEP:ENDV <NRf+>
Example: It changes the end voltage of STEP Mode to 50.0 V.
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: It sets the execution time for Step Mode.
Syntax: PROGram:STEP:TIME <Hour><,><Minute><,><Second>
Parameter: Hour : <NR1> 0 ~ 99
Minute : <NR1> 0 ~ 59
Second : <NRf1> 0 ~ 59.99
Example: It changes the time for STEP Mode action to 1 hour 30 min. & 5 sec.
PROGram:STEP:TIME 1,30,5
Query Syntax: PROGram:STEP:TIME?
Return Parameter: <Hour><,><Minute><,><Second>
Query Example: PROGram:STEP:TIME?
Return Example: 1,30,5.000000e+00

5.6.2.7 SYSTEM Subsystem

1. SYSTem:ERRor?
   Description: It returns the 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 5-11

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"		

6. Theory of Operation

6.1 Overview

The 62000H Series DC Power Supply has A, C, D, E, F, G, H, I, K, L,NI,NO, O, R, S, U, Y and Z total 18 circuit boards in it.

- A board is the auxiliary power.
- C board is the output stage control circuits.
- D board is the main digital control board.
- E board is the EMI filter.
- F board is the input stage primary side.
- G board is the GPIB & Ethernet control board (optional).
- H board is the high voltage input rectifier.
- I board is the adapter of CAN and USB.
- K board has 24 (4*6) keys and an LED.
- L board is the low voltage input rectifier.
- NI board is the output noise board 1.
- NO board is the output noise board 2.
- O board is the output stage secondary side.
- R board is the adapter of Remote sense and current sharing.
- S board is the output stage secondary side snubber circuits.
- U board provides serial/parallel communication for CAN and external RS232/RS485 and USB interfaces.
- Y board is the converter of Ethernet and GPIB.
- Z board is the fan control circuits.

Figure 6-1 shows the system diagram.

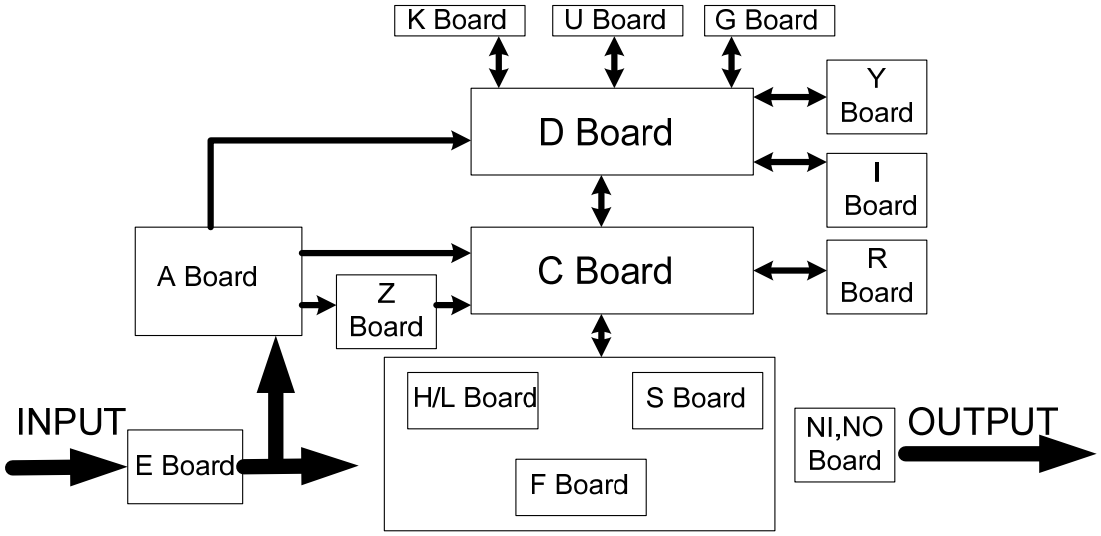


Figure 6-1

Figure 6-2 shows the input stage structure.

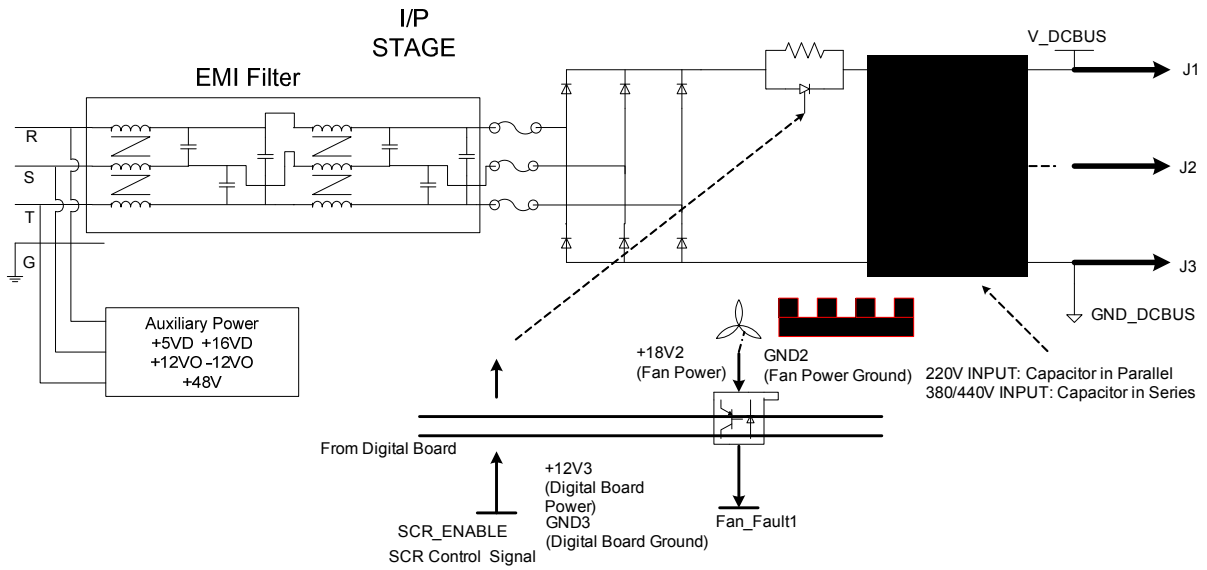


Figure 6-2

Figure 6-3 shows the output stage structure.

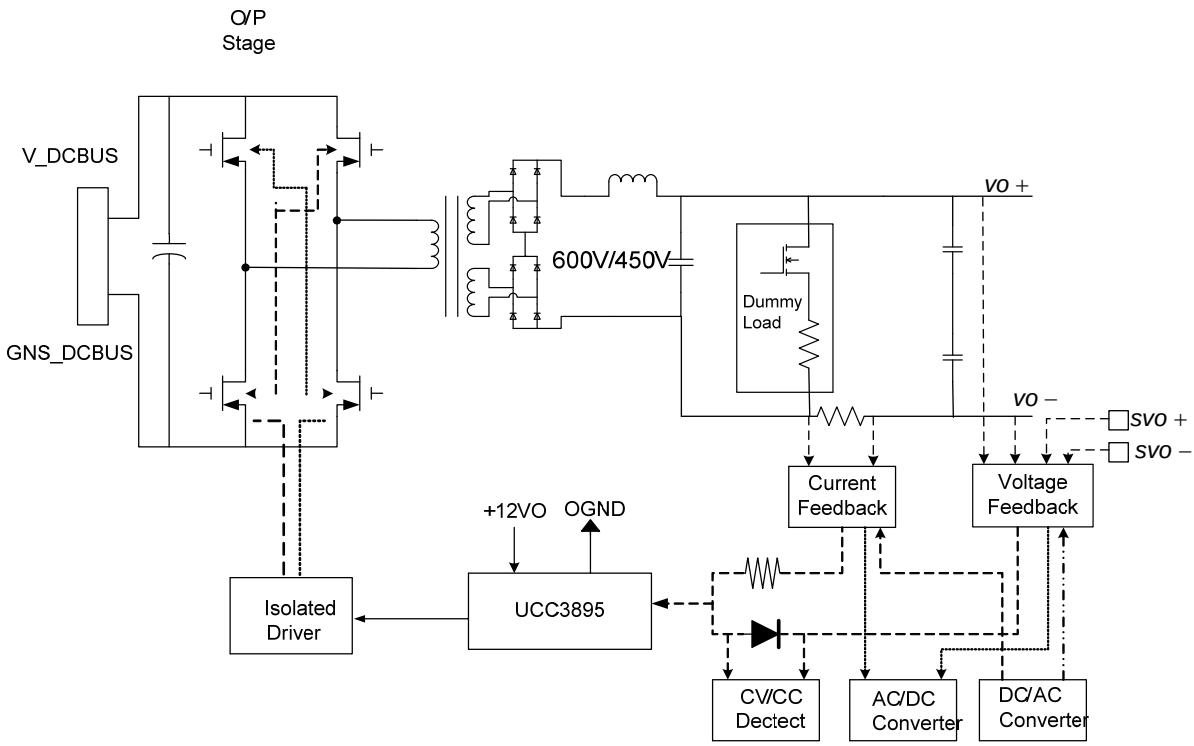


Figure 6-3

Figure 6-4 shows the digital stage structure.

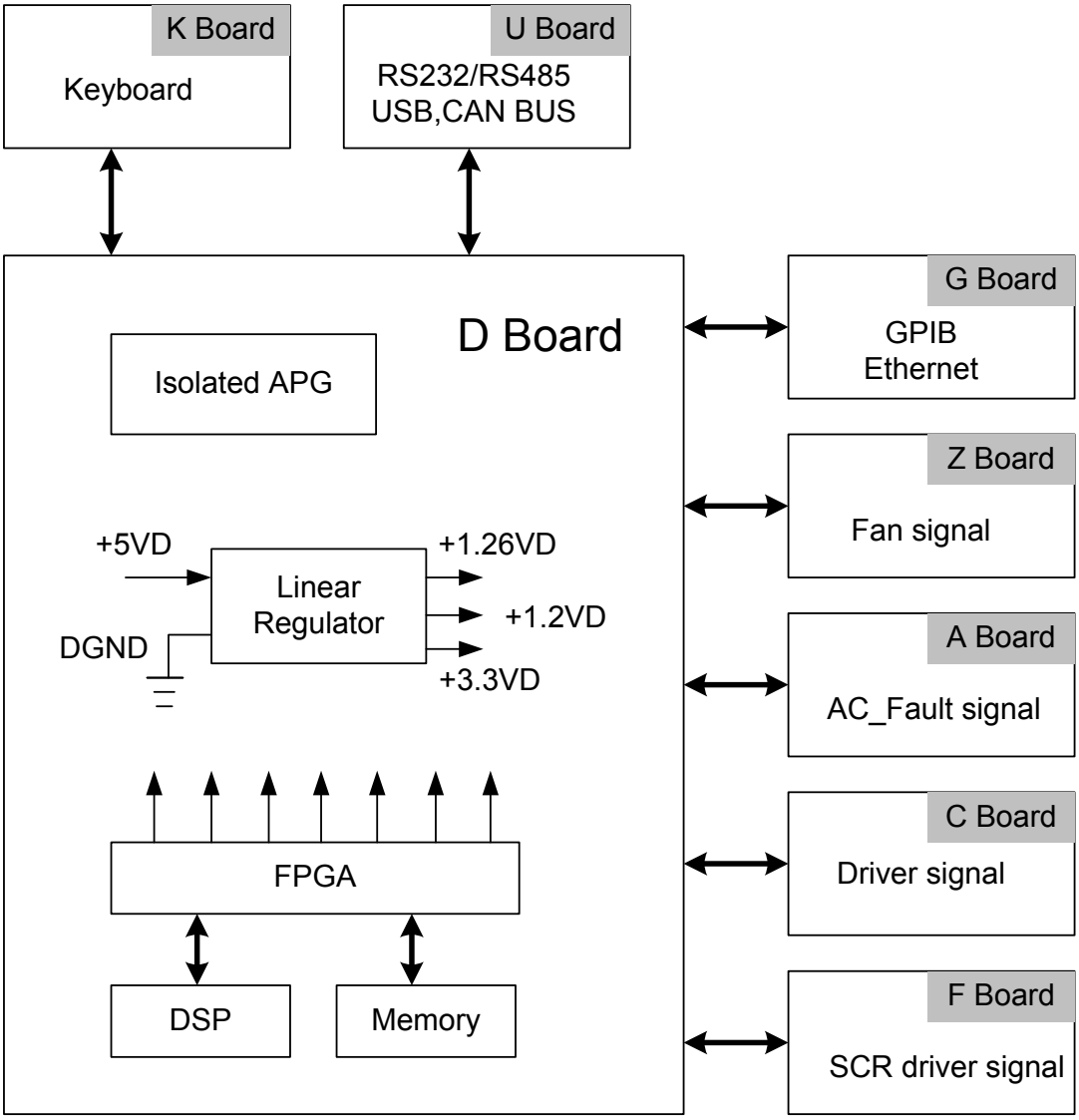


Figure 6-4

6.2 Function Description

6.2.1 I/P (PFC) Stage

1. The input stage is a bridge rectifier to rectify the 3-phase power source to DC.
2. The way input stage inhibits inrush current is to connect the input circuit to a 40Ω resistor in series during power-on to charge the input capacitor. Turn on the SCR after a few seconds and bypass this current limit resistor.

6.2.2 Auxiliary Power

1. The auxiliary power is the AC source input goes through the bridge rectifier and passes the flyback converter to get the desired output voltage. The PWM IC used is Unitrode UC3845.
2. The output of auxiliary power is divided into three types of isolate power and they are named FSGND, OGND and DGND based on their potential. The FSGND is the fan reference potential of output stage, while OGND is the reference potential of output stage and DGND is the reference potential of digital signal and communication interface.

6.2.3 Output Stage

1. The output stage structure is full bridge that uses Unitrode UC3895 as PWM IC and controlled under voltage mode.
2. There are two output modes -- Constant Voltage (CV Mode) and Constant Current (CC Mode) that switches automatically according to load state.

   In Constant Voltage mode, following controls the IC detecting signal:
   (1) Output voltage;
   (2) The load actual voltage (remote sense) through output line, in which the remote sense can be disconnected but the accuracy will drop.

   In Constant Current mode, following controls the IC detecting signal:
   (1) Output current.

3. The secondary side is one stage LC filter to lower down the ripple voltage and ripple current.
4. The action of Dummy load is Constant Current Source and the Dummy load current will adjust following the output voltage. Moreover, it will act if the programmed voltage is less than the present output. The output has OVP and when it exceeds the OVP voltage (16 bit DAC) set by the front panel, the output will be disabled.

6.2.4 Digital Circuit

1. The digital circuit control unit is composed of TMS320VC5501ZZZ300 with Lattice FPGA (LFXP2-8E-5FTN256C).
2. The power source 3.3V required by FPGA is got from +5VD.
3. The DSP required 3.3V and 1.26V power is got from +5VD.
4. The signal of analog program interface and digital circuit are isolated by the power source of +16VD with the free-run flyback converter and linear regulator.
5. The TTL output is +5V level and the internal digital signal is +3.3V level, therefore there are actions for level change.

7. Self Test & Troubleshooting

7.1 Overview

Follow the actions described in this chapter to inspect the instrument and troubleshoot the problem first when the 62000H Series DC Power Supply is unable to operate normally. Please consult the sales agent or distributor 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 3.3.7 Calibration.
Output is not within Accuracy SPEC.	Feature swings due to aged components.	It needs calibration periodically. See section 3.3.7 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 ~ 50°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 local sales agent if it is unable to reset the protection state.
Input Error Protection 1 AC AFULT	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 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.	Check the OVP settings. Consult 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.

Appendix A APG & System Status Pin Assignment

The 25-pin connector is located at rear panel in green as Figure A-1 shows.

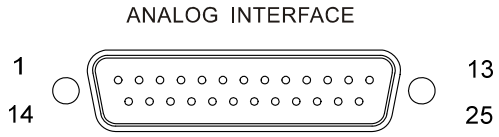


Figure A-1

PIN NO.	PIN Definition	PIN NO.	PIN Definition
1	+12VAPI	14	APIGND
2	AVO_SET_R	15	AIO_SET_R
3	AVO_SET_C	16	AIO_SET_C
4	AVO_SET_V	17	AIO_SET_V
5	AVO_MEAS_C	18	AIO_MEAS_C
6	AVO_MEAS_V	19	AIO_MEAS_V
7	N.C.	20	N.C.
8	PROG_TRIG	21	INTERLOCK
9	_INHIBIT	22	_EXT_ON
10	DCOUT_ON	23	_FAULT
11	CV_CC	24	_OTP
12	N.C.	25	N.C.
13	DGND		

(1) PIN 1: +12V API auxiliary power for APG only (maximum output current: 10mA), see section 3.3.1.1 for detail description.
(2) PIN 2: AVO_SET_R, voltage programming for APG only that allows users to set in “resistance form”, see section 3.3.1.1 for detail description.
(3) PIN 3: AVO_SET_C, voltage programming for APG only that allows users to set in “current form”, see section 3.3.1.1 for detail description.
(4) PIN 4: AVO_SET_V, voltage programming for APG only that allows users to set in “voltage form”, see section 3.3.1.1 for detail description.
(5) PIN 5: AVO_MEAS_C, voltage programming for APG only that allows users to set in “current form”, see section 3.3.1.1 for detail description.
(6) PIN 6: AVO_MEAS_V, voltage programming for APG only that allows users to set in “voltage form”, see 3.3.1.1 for detail description.
(7) PIN 7: N.C.
(8) PIN 8: PROG_TRIG, the external trigger signal (positive edge trigger) in program editing mode, see section 4.1.2.2 for detail description.
(9) PIN 9: _INHIBIT, this function allows users to use the Pin 9 of ANALOG INTERFACE to turn off the Power Supply when outputting, see section 3.3.5.4 for detail description.
(10) PIN 10: DCOUT_ON, when the DC Power Supply output is ON and the voltage exceeds VDC_R, the Pin 10 (DCOUT_ON) of SYSTEM STATUS on the rear panel will turn to HIGH. When the DC Power Supply output voltage is lower than the VDC_F setting, the Pin 10 (DCOUT_ON) of SYSTEM STATUS on the rear panel will turn to LOW. See 3.3.2.5 for detail description.
(11) PIN 11: CV_CC, this pin is HIGH when in CV mode and is LOW when in CC mode.

(12) PIN 12: N.C.
(13) PIN 13: DGND
(14) PIN 14: APIGND, +12V auxiliary power ground potential for APG only, see section 3.3.1.1 for detail description.
(15) PIN 15: AIO_SET_R, current programming for APG only that allows users to set in "resistance form", see section 3.3.1.1 for detail description.
(16) PIN 16: AIO_SET_C, current programming for APG only that allows users to set in "current form", see section 3.3.1.1 for detail description.
(17) PIN 17: AIO_SET_V, current programming for APG only that allows users to set in "voltage form", see section 3.3.1.1 for detail description.
(18) PIN 18: AIO_MEAS_C, current programming for APG only that allows users to set in "current form", see section 3.3.1.1 for detail description.
(19) PIN 19: AIO_MEAS_V, current programming for APG only that allows users to set in "voltage form", see 3.3.1.1 for detail description.
(20) PIN 20: N.C.
(21) PIN 21: INTERLOCK, this function allows users to use the Pin 21 of ANALOG INTERFACE to control the Power Supply for temporary OFF, see section 3.3.5.5 for detail description.
(22) PIN 22: _EXT_ON, this function allows users to use the Pin 22 of ANALOG INTERFACE to control the ON/OFF of Power Supply, see section 3.3.5.6 for detail description.
(23) PIN 23: _FAULT, this pin will turn to LOW when the protection signals described in section 3.3.5 occur.
(24) PIN 24: _OTP, this pin will turn to LOW when over temperature protection occurs.
(25) PIN 25: N.C.

Appendix B List of Protection

Protection	Message on Panel	Protection	Message on Panel
Over voltage protect	OVP	Input voltage abnormal protect	AC FAULT
Over current protect	OCP	Remote sense abnormal protect	SENSE FAULT
Over power protect	OPP	CV TO CC mode change protect	CV TO CC FOLDBACK
Over temperature protect	OTP	CC TO CV mode change protect	CC TO CV FOLDBACK
Fan fail protect	FANLOCK		

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