Programmable DC Power Supply
62000P Series
Operating & Programming Manual

Version 1.4
May 2009
P/N A11 001159

Legal Notices

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

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

CHROMA ATE INC.
66 Hwa-Ya 1st Rd., Hwa-Ya Technical Park, Kuei-Shan Hsiang, Taoyuan Hsien, Taiwan

Warranty

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

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

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

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

CHROMA ATE INC.
66 Hwa-Ya 1st Rd., Hwa-Ya Technical Park,
Kuei-Shan Hsiang, Taoyuan Hsien, Taiwan
Tel: 886-3-327-9999
Fax: 886-3-327-2886

http://www.chromaate.com

Material Contents Declaration

A regulatory requirement of The People's Republic of China defined by specification SJ/T 11364-2006 mandates that manufacturers provide material contents declaration of electronic products, and for Chroma products are as below:

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.

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. Only qualified service personnel can perform component replacement and internal adjustment.

WARNING
Touching the connected circuit or output terminal on the front or rear panel when power is on may result in death.

SAFETY SYMBOLS

	**DANGER** – High voltage.
	**Explanation:** To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.
	**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.

Revision History

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

Date	Version	Revised Sections
Sep. 2007	1.0	Complete this manual.
Jan. 2008	1.1	Add the description of a new model 62050P-100-100 in the chapters of "*Overview*", "*Installation*" and "*Manual Operation*."
May 2008	1.2	Add new specifications to the section of "*Other Specifications*."
Sep. 2008	1.3	Replace the model of 62012P-30-160 with 62012P-40-120 and update the related descriptions mentioned in the manual. Add two notes in the section of "*Specifications*" in the chapter of "*Overview*." Update the figures & descriptions in the section of "*Connecting Series/Parallel Output Cable*" in the chapter of "*Manual Operation*."
May 2009	1.4	Modify the related descriptions in the manual to add the following function: – Ethernet interface – New models: 62024P-40-120 and 62024P-600-8

Table of Contents

1. Overview

1.1 Introduction

Chroma 62000P Series are constant DC Power Supplies that can provide stable DC output and accurate measurement for voltage and current.

The features of 62000P 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) Constant power output ➡ users are able to get the rated power output within the maximum output voltage and current range (62012P-80-60: 80V-60A).
(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 time for long period test.
(6) Rotary knob and keyboard control on the front panel ➡ to set the output voltage and current.
(7) Large LCD panel ➡ gives users a complete operation state.
(8) Via GPIB, RS-232C, USB, Ethernet 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, RS-232C or USB interface.
(3) Through the APG input to control output via analog signal.

1.2.2 Protection

(1) Protections for abnormal input voltage, over output voltage, over current, over power, over temperature, fan fail, CV/CC fold back and etc. are available.
(2) Free temperature control for fan speed.

1.2.3 Output/Indication

(1) The output terminals are on the front and rear panels.
(2) Auxiliary power output (12Vdc/10mA).

(3) 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.
(4) Protection state indication (OVP/OCP/OPP/OTP/FAN LOCK/AC FAULT, etc).
(5) CV/CC status indicators.
(6) 8-bit TTL output signal.
(7) Output status indicators.

1.2.4 Input Control Signals

(1) Remote sense input for voltage drop compensation.
(2) Analog reference voltage (APG) input 0-10VDC or 0-5VDC, for voltage and current.
(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) A run time voltage program that can be set for long hour.

1.3 Specifications

The operating specifications of 62000P Series DC Power Supply are listed below. Besides the specifications specified particularly, all specifications are tested following the standard test procedure of Chroma (test condition: 25 ± 5°C and under resistance load).

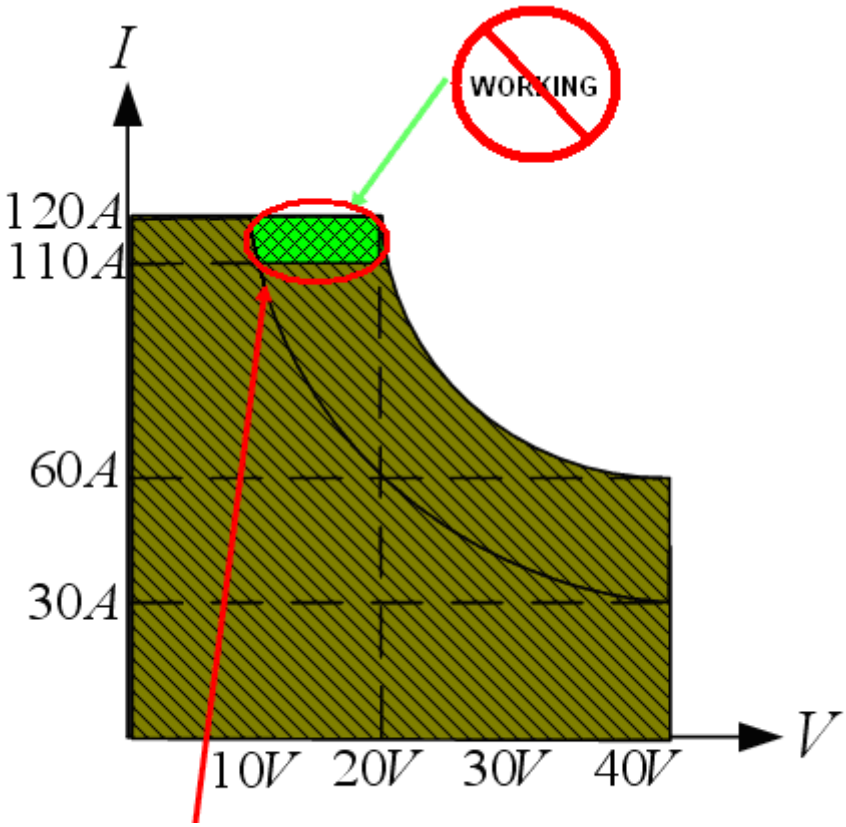
Model	62006P-30-80	62006P-100-25	62006P-300-8	62012P-40-120	62012P-80-60
Output Ratings					
Output Voltage [1]	0-30V	0-100V	0-300V	0-40V	0-80V
Output Current [2]	0-80A	0-25A	0-8A	0-120A	0-60A
Output Power	600W	600W	600W	1200W	1200W
Line Regulation [3]					
Voltage	0.01%+2mV	0.01%+6mV	0.01%+18mV	0.01%+2mV	0.01%+8mV
Current	0.01%+25mA	0.01%+5mA	0.03%+20mA	0.01%+25mA	0.01%+10mA
Load Regulation [4]					
Voltage	0.01%+3mV	0.01%+10mV	0.01%+50mV	0.01%+3mV	0.01%+12mV
Current	0.01%+10mA	0.01%+5mA	0.03%+40mA	0.01%+10mA	0.01%+20mA
Voltage Measurement					
Range	6V / 30V	20V / 100V	60V / 300V	8V / 40V	16V / 80V
Accuracy	0.05% + 0.05%F.S.				
Current Measurement					
Range	16A / 80A	5A / 25A	1.6A / 8A	24A / 120A	12A / 60A
Accuracy	0.1% + 0.2%F.S.	0.1% + 0.2%F.S.	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.
Output Noise (0-20MHz)					
Voltage (P-P) [5]	60 mV	85 mV	180 mV	90 mV	100 mV
Output Ripple (rms)	8 mV	10 mV	90 mV	10 mV	10 mV
Output Ripple (rms) [6]	60 mA	10 mA	60 mA	120 mA	30 mA
OVP Adjustment Range	110% of Vset to 110% of Vmax				
Slew Rate Range					
Voltage (with USB)	0.001V - 5V/ms	0.001V - 10V/ms	0.01V - 10V/ms	0.001V - 5V/ms	0.001V - 10V/ms
Current (with USB)	0.001A - 1A/ms	0.001A - 1A/ms	0.001A - 1A/ms	0.001A - 1A/ms	0.001A - 1A/ms
Programming Response Time (Typical)					
Rise Time (Full & No Load)	6 ms	10 ms	30 ms	8 ms	8 ms
Fall Time	350 ms(max)	300 ms(max)	2.5 s(max)	460 ms(max)	240 ms(max)
Efficiency [7]	0.75	0.75	0.75	0.8	0.8
Drift (8 hours) [8]					
Voltage	0.02% of Vmax				
Current	0.04% of Imax				
Temperature Coefficient					
Voltage	0.02% of Vmax/^{0}C				
Current	0.04% of Imax/^{0}C				
Transient response time	3 mS	3 mS	3 mS	3 mS	3 mS
10 % step change	150 mV	180 mV	600mV	150 mV	250 mV
Voltage limit @ Series Mode	150V	500V	800V	200V	400V
AC Line Input Voltage Ranges	95 to 250Vac	95 to 250Vac	95 to 250Vac	95 to 250Vac	95 to 250Vac
Weight	12kg/26.43lbs	12.1kg/26.65lbs	11.2kg/24.67lbs	12kg/26.43lbs	13kg/28063lbs
Operating Temperature	0 - 40^{0}C	0 - 40^{0}C	0 - 40^{0}C	0 - 40^{0}C	0 - 40^{0}C
Dimensions (HxWxD)	89 x 430 x 425 mm / 3.5 x 16.93 x 16.73 inch				

Model	**62012P-100-50**	**62012P-600-8**	**62024P-80-60**	**62024P-100-50**	**62050P-100-100**
Output Ratings					
Output Voltage [1]	0-100V	0-600V	0-80V	0-100V	0-100V
Output Current [2]	0-50A	0-8A	0-60A	0-50A	0-100A
Output Power	1200W	1200W	2400W	2400W	5000W
Line Regulation [3]					
Voltage	0.01%+10mV	0.01%+18mV	0.01%+8mV	0.01%+10mV	0.01%+8mV
Current	0.01%+12mA	0.03%+20mA	0.01%+10mA	0.01%+12mA	0.01%+24mA
Load Regulation [4]					
Voltage	0.01%+18mV	0.01%+50mV	0.01%+12mV	0.01%+18mV	0.01%+12mV
Current	0.01%+28mA	0.03%+40mA	0.01%+20mA	0.01%+28mA	0.01%+56mA
Voltage Measurement					
Range	20V / 100V	120V / 600V	16V / 80V	20V / 100V	20V / 100V
Accuracy	0.05% + 0.05%F.S.				
Current Measurement					
Range	10A / 50A	1.6A / 8A	12A / 60A	10A / 50A	20A / 100A
Accuracy	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.
Output Noise (0-20MHz)					
Voltage (P-P) [5]	100 mV	180 mV	100 mV	100 mV	50 mV
Output Ripple (rms)	15 mV	90 mV	10 mV	15 mV	15 mV
Output Ripple (rms) [6]	20 mA	60 mA	30 mA	20 mA	40 mA
OVP Adjustment Range	110% of Vset to 110% of Vmax				
Slew Rate Range					
Voltage (with USB)	0.001V - 10V/ms	0.01V - 10V/ms	0.001V - 10V/ms	0.001V - 10V/ms	0.001V - 10V/ms
Current (with USB)	0.001A - 1A/ms	0.001A - 1A/ms	0.001A - 1A/ms	0.001A - 1A/ms	0.001A - 2A/ms
Programming Response Time (Typical)					
Rise Time (Full & No Load)	10 ms	60 ms	8 ms	10 ms	10 ms
Fall Time	300 ms(max)	5 s(max)	240 ms(max)	300 ms(max)	850 ms(max)
Efficiency [7]	0.8	0.8	0.85	0.85	0.85
Drift (8 hours) [8]					
Voltage	0.02% of Vmax				
Current	0.04% of Imax				
Temperature Coefficient					
Voltage	0.02% of Vmax/^{0}C				
Current	0.04% of Imax/^{0}C				
Transient response time	3 mS	3 mS	3 mS	3 mS	3 mS
10 % step change	250 mV	600mV	250 mV	250 mV	250 mV
Voltage limit @ Series Mode	500V	800V	400V	500V	500V
AC Line Input Voltage Ranges	95 to 250Vac	95 to 250Vac	190 to 250Vac (Single phase)	190 to 250Vac (Single phase)	190 to 250Vac (3phase 4 wire, Delta connection) or 342 to 440Vac (3phase 5 wire, Y connection)
Weight	12.1kg/26.65lbs	11.2kg/24.67lbs	12.2kg/26.87lbs	13kg/28.63lbs	28kg/61.67lbs
Operating Temperature	0 - 40^{0}C	0 - 40^{0}C	0 - 40^{0}C	0 - 40^{0}C	0 - 40^{0}C
Dimensions (HxWxD)	89 x 430 x 425 mm / 3.5 x 16.93 x 16.73 inch				176 x 428 x 566 mm 6.93 x 16.85 x 22.8 inch

Model	**62024P-40-120**	**62024P-600-8**
Output Ratings		
Output Voltage [1]	0-40V	0-600V
Output Current [2]	0-120A	0-8A
Output Power	2400W	2400W
Line Regulation [3]		
Voltage	0.01%+2mV	0.01%+18mV
Current	0.01%+25mA	0.03%+20mA
Load Regulation [4]		
Voltage	0.01%+3mV	0.01%+50mV
Current	0.01%+10mA	0.03%+40mA
Voltage Measurement		
Range	8V / 40V	120V / 600V
Accuracy	0.05% + 0.05%F.S.	
Current Measurement		
Range	24A / 120A	1.6A / 8A
Accuracy	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.
Output Noise (0-20MHz)		
Voltage (P-P) [5]	90 mV	180 mV
Output Ripple (rms)	10 mV	90 mV
Output Ripple (rms) [6]	120 mA	60 mA
OVP Adjustment Range	110% of Vset to 110% of Vmax	
Slew Rate Range		
Voltage (with USB)	0.001V - 5V/ms	0.01V - 10V/ms
Current (with USB)	0.001A - 1A/ms	0.001A - 1A/ms
Programming Response Time (Typical)		
Rise Time (Full & No Load)	8 ms	60 ms
Fall Time	460 ms(max)	5 s(max)
Efficiency [7]	0.85	0.85
Drift (8 hours) [8]		
Voltage	0.02% of Vmax	
Current	0.04% of Imax	
Temperature Coefficient		
Voltage	0.02% of Vmax/^{0}C	
Current	0.04% of Imax/^{0}C	
Transient response time	3 mS	3 mS
10 % step change	150 mV	600mV
Voltage limit @ Series Mode	200V	800V
AC Line Input Voltage Ranges	190 to 250Vac (Single phase)	190 to 250Vac (Single phase)
Weight	13kg/28.63lbs	13kg/28.63lbs
Operating Temperature	0 - 40^{0}C	0 - 40^{0}C
Dimensions (HxWxD)	89 x 430 x 425 mm / 3.5 x 16.93 x 16.73 inch	

ⓘ NOTE

1. Minimum output voltage <0.15% of rate voltage.
2. Minimum output current <0.2% of rate current.
3. 95-250Vac with rated load. (62024P & 62050P:190-250 Vac)
4. For 0-100% load step with nominal line voltage.
5. Verified by scope with BNC cable and 50Ω termination.
6. At rated current with 10mΩ load.
7. Typical efficiency at nominal input voltage (230V) under maximum output voltage.
8. Test the drift volume for 30 minutes and 8 hours under rated power.
9. Change in output per 1 °C in ambient temperature with constant line and load.
10. Half load and above, the loading slew rate is 1A/us for rise and fall).
11. In order to meet the charge current required by V Slew rate enough I set needs to be set.
12. When model 62050P-100-100 in CV mode, the lowest I set value is 1.2% of Full scale to ensure it is not entering into the CC mode.
13. 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.
14. 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 (>100uF) at the load power input to prevent any unexpected oscillation from occurring.
15. The current of 62024P-40-120 is larger than or equal to 110A with maximum operation in 1200W as Figure 1-1 shows.



The current is larger than or equal to 110A with maximum operation in 1200W.

Figure 1-1

All specifications are subject to change without prior notice.

1.3.1 Other Specifications

Programming & Measurement Resolution	
Voltage (Front Panel)	10 mV
Current (Front Panel)	10 mA
Voltage (Remote Interface)	0.003% of Vmax
Current (Remote Interface)	0.002% of Imax
Voltage (Analog Programming Interface)	0.04% of Vmax
Current (Analog Programming Interface)	0.04% of Imax
Programming Accuracy	
Voltage Programming (Front Panel and Remote Interface)	0.1% of Vmax
Voltage Programming (Analog Programming Interface)	0.2% of Vmax
Current Programming (Front Panel and Remote Interface)	0.3% of Imax
Current Programming (Analog Programming Interface)	0.3% of Imax
Programming Response Time	
Rise Time: For a programmed 5% to 95% step in output voltage.(Full & No Load)	See Electrical Specification
Fall Time: For a programmed 95% to 5% step in output voltage. (The fall time will be affected by the external loading from UUT.)	See Electrical Specification
Vout setting (USB send command to DC source receiver)	10ms
?Volt , ? Current (under USB command using Fetch)	10ms
?Volt , ? Current (under USB command using Measure)	70ms
Analog Programming Interface	
Voltage and Current Programming inputs	0~10Vdc or 0~5Vdc of F.S.
Voltage and Current monitor	0~10Vdc or 0~5Vdc of F.S.
Isolation: Maximum working voltage of any analog programming signal with respect to chassis potential.	70Vdc
Auxiliary Power Supply	
Output Voltage	12Vdc
Maximum Current Source Capability	10mA
Remote inhibit function (I/O)	
Use to disable the output of DC power supply; Active Low	TTL
DC-ON Output Signal	
Indicate the output status; Active High	TTL
Fault output signal	
Indicate if there is a fault/protection occurred; Active Low	TTL
Series & Parallel operation function with Master / Slave control	
Voltage limit @ Series Mode	See Electrical Specification
Voltage limit @ Series Mode (Refer to Ground)	240 Volt
Number of DC Power Supplies allowed @ Master / Slave control mode	5
Auto Sequencing Programmable Function	
Number of program	10
Number of sequence	100
Time Range	5ms - 15,000S
TTL signal out	8 bits
TTL source capability	7 mA
Voltage Step Mode Programmable Function	
Start_Voltage Range	See each mode V range
End_Voltage Range	See each mode V range
Total Run Time Range (hhh:mm:ss.sss)	10ms - 99 hours

Slew Rate Control Function	
Voltage slew rate range (The fall slew rate will be affected by the discharge rate of the output capacitors especially under no load condition.)	See Electrical Specification
Current slew rate range	See Electrical Specification
Minimum transition time.	0.5 ms
Remote Sense	
Line loss compensation	5V

All specifications are subject to change without prior notice.

CAUTION

Voltage from the two output terminals to earth varies with the 62000P Series Models as shown below:

Model	Max. Voltage (Vdc) Difference between Output Terminal and Earth
62006P-30-80	±250
62006P-100-25	±250
62006P-300-8	±300
62012P-40-120	±250
62012P-80-60	±250
62012P-100-50	±250
62012P-600-8	±600
62024P-40-120	±250
62024P-80-60	±250
62024P-100-50	±250
62024P-600-8	±600
62050P-100-100	±250

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

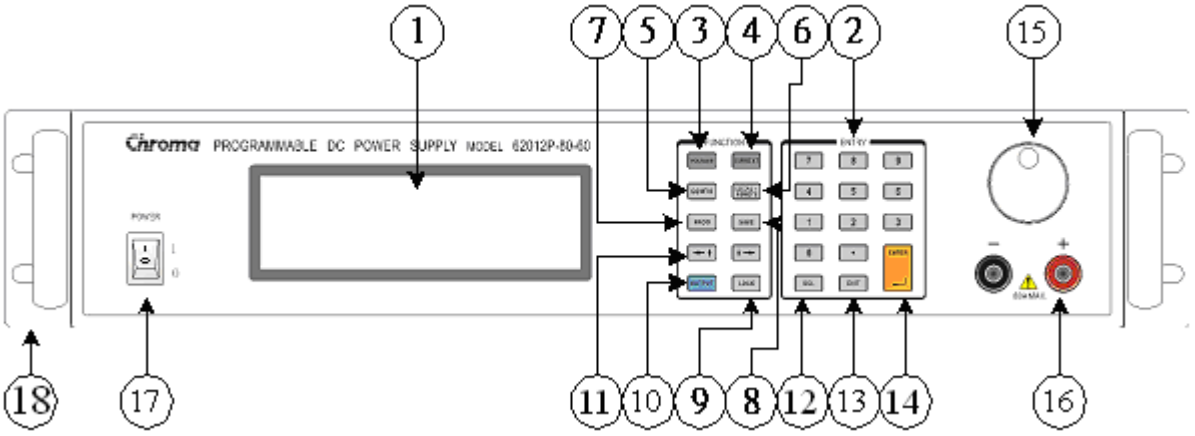


Figure 1-2 Front Panel of 62006P, 62012P and 62024P

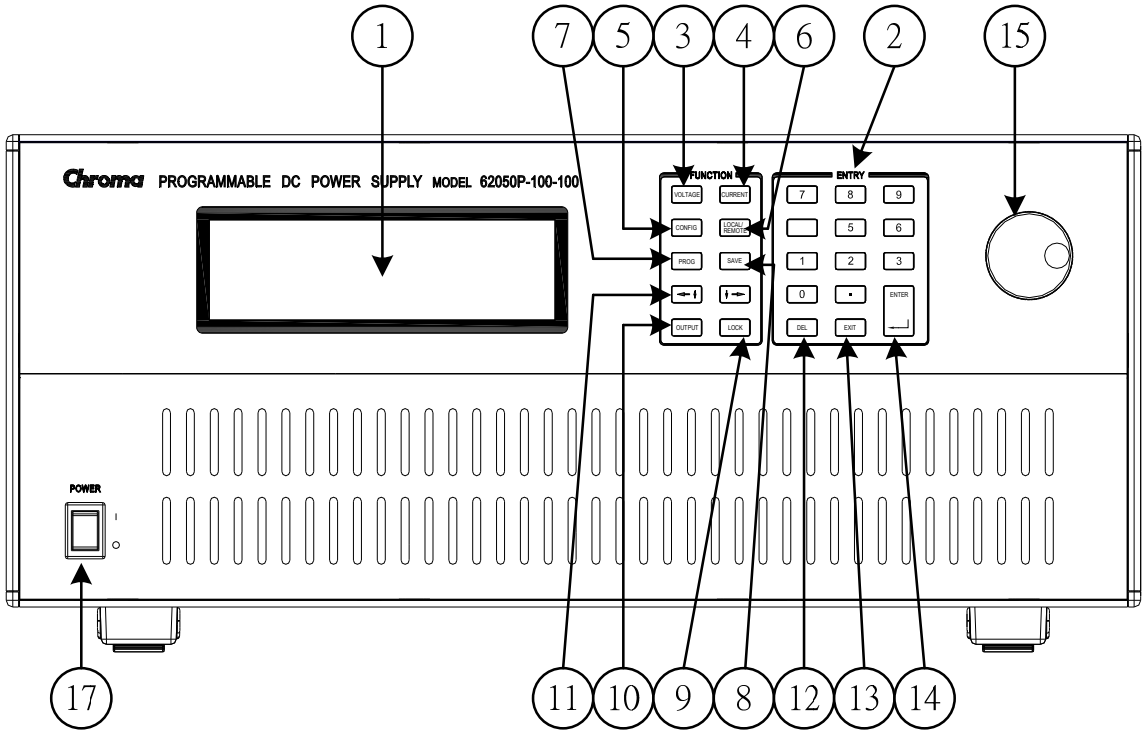


Figure 1-3 Front Panel of 62050P

Item	Symbol	Description
1		***DISPLAY:*** LCD 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	VOLTAGE	***Voltage Setting Key:*** Enters voltage setting mode. Users can use numeric keys or rotary knob to input voltage values
4	CURRENT	***Current Setting Key:*** Enters current limit setting mode. Users can use numeric keys or rotary knob to input current limit values.
5	CONFIG	***CONFIG Key:*** Press this key to skip to "Config Choose Page" for setting various functions.
6	LOCAL/ REMOTE	***LOCAL/REMOTE Switch Key:*** Press this key to switch the control mode to "Front Panel Input" or "Remote Control".
7	PROG	***PROGRAM Key:*** Press this key to skip to "Program Function Page" for setting waveform editing mode.
8	SAVE	***SAVE Key:*** Press this key to save the settings in "Program and Config Function Page"
9	LOCK	***LOCK Key:*** Press this key to lock all keys and rotary knob. To unlock ➡ press "LOCK" for 3 seconds to release it.
10	OUTPUT	***OUTPUT Key:*** Press this key to control the output to "ON" or "OFF".
11	← ↑ → ↓	***Cursor Movement Keys:*** Use "← ↑" and "→ ↓" keys to move the cursor to the parameter to be modified.
12	DEL	***Delete Key:*** Press this key to delete the input value.
13	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.
14	ENTER ↵	***ENTER Key:*** Press this key to confirm the parameter settings.
15		***ROTARY Knob:*** Users can turn the knob "◎" to input data or select item.

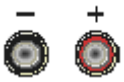
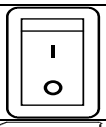
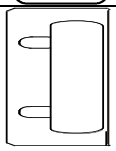
Item	Symbol	Description
16		***Output Terminal on Front Panel:*** The maximum output current differs from models when connected with the output terminals on the rear panel. **Note:** 30V, 40V, 300V and 600V Models have no front panel output terminal.
17		***Main Power Switch:*** It switches the power on or off.
18		***Rack Bracket:***(Option) Use the left (right) bracket to fit the Power Supply on Rack.

Table 1-1 Description of Front Panel

1.4.2 Rear Panel

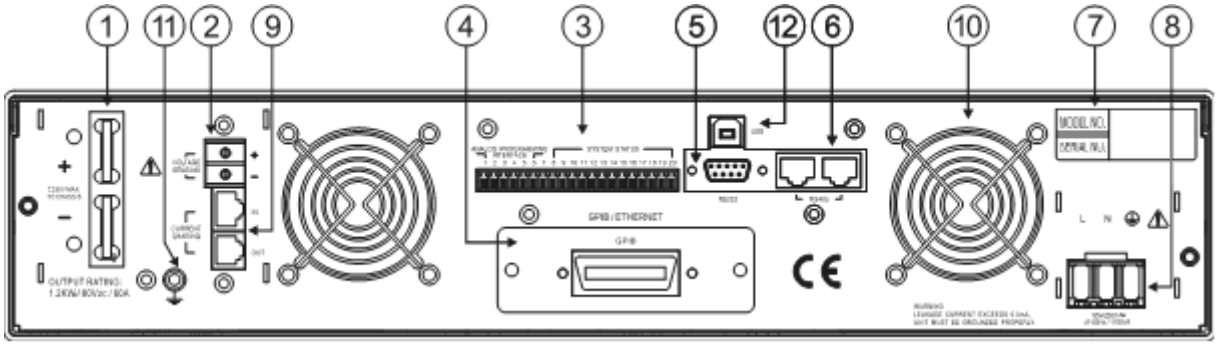


Figure 1-4 Rear Panel of 62006P, 62012P & 62024P Low/Middle Voltage (30V/40V/80V/100V)

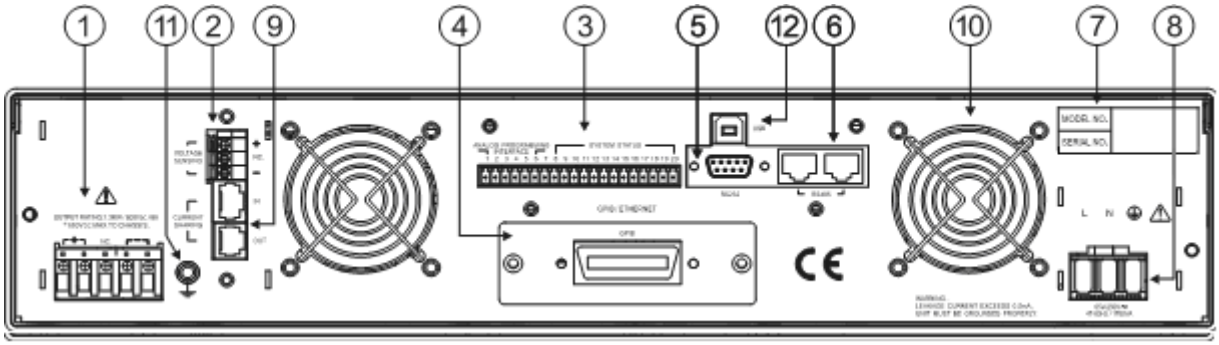


Figure 1-5 Rear Panel of 62006P, 62012P, 62024P High Voltage Model (300V/600V)

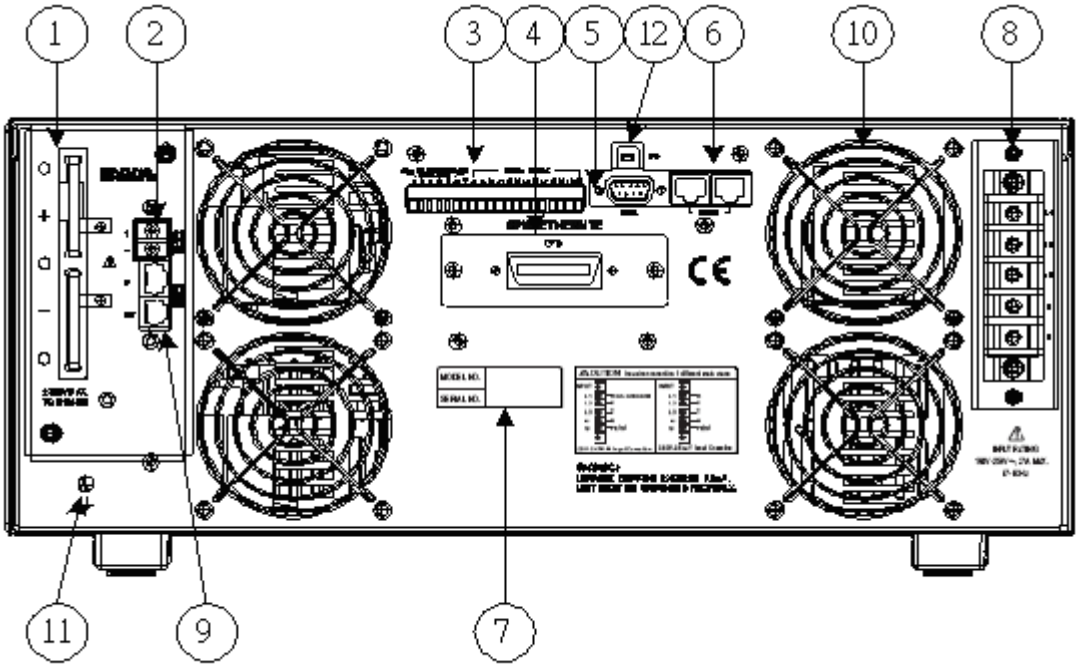


Figure 1-6 Rear Panel of 62050P Model

Item	Name	Description
1	Output terminal	The output terminals of DC Power Supply.
2	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.
3	APG & Status Signal Connecting Terminal	There are two sections for these 20 pins signals. Pin 1~6 are APG input/output terminals while pin 8~20 are system status signal terminals. See *Appendix A* for detail pin assignments. **Note:** This terminal is sensitive to ESD. Do not touch it during operation.
4	GPIB/ETHERNET Connector (Option)	The GPIB/ETHERNET bus used by remote controller is connected to PC via this connector for remote control.
5	RS-232C	It is a 9-pin 90° D type male connector. The control commands are transmitted between remote and PC for remote control.
6	RS-485	It is for serial or parallel data transmission use.
7	Label	The label has model no. and serial no. of DC Power Supply on it.
8	AC Power Connector	It inputs AC power through power line and connects to input stage through this connector.
9	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.
10	Fan Mask	Avoid touching the fan and do not block the fan mask to avoid accumulating heat inside the machine.
11	Functional Ground	This terminal is for user to refer to Earth Ground easily.
12	USB	The remote controller uses USB connector to connect to PC for remote operation.

Table 1-2 Description of Rear Panel

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.

The machine package is shown as below.

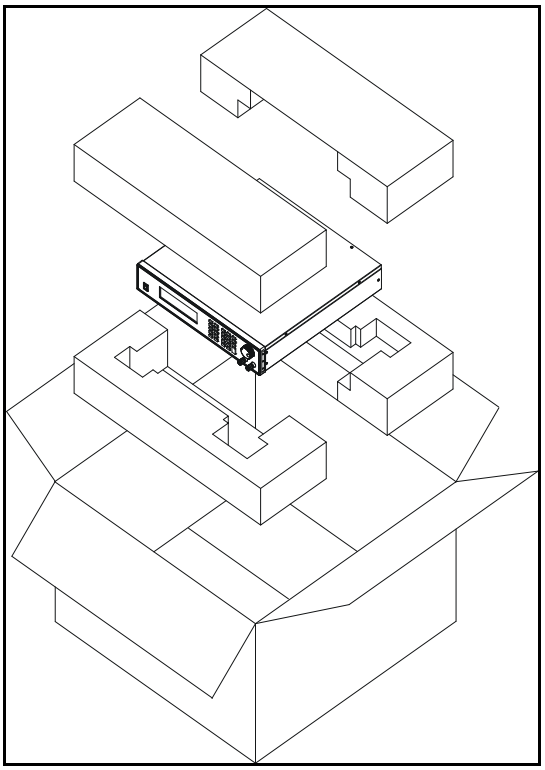


Figure 2-1

ⓘ 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.

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) Be sure the Power Supply is connected to the AC line input that meets the specification.
(2) The instrument must be installed in an air-circulated area to avoid the internal temperature getting too high.
(3) The ambient temperature does not exceed 40°C.

2.2.1 Normal Environment Conditions

(1) In door use.
(2) Altitude up to 2000m.
(3) Temperature 5°C to 40°C.
(4) Maximum relative humidity 80% for temperature up 31°C decreasing linearity to 50% relative humidity at 40°C.
(5) Input AC supply voltage fluctuations can up to +-10% of the rated voltage.
(6) Transient over voltage is impulse withstand CAT II. (**Note:** 62050P is CAT III.)
(7) Pollution degree II.

2.3 Requirements of Input Power

2.3.1 Ratings

(1) 62006P-xx-xx Model

Input Voltage Range	:	95 ~ 250 Vac, single phase
Input Frequency	:	47~ 63 Hz
Max. Input Power	:	1000VA

(2) 62012P-xx-xx Model

Input Voltage Range	:	95 ~ 250 Vac, single phase
Input Frequency	:	47~ 63 Hz
Max. Input Power	:	1700VA

(3) 62024P-xx-xx Model

Input Voltage Range	:	190 ~ 250 Vac, single phase
Input Frequency	:	47~ 63 Hz
Max. Input Power	:	2900VA

(4) 62050P-xx-xx Model

Input Voltage Range	:	190 ~ 250 V_{LL}, 3-phase 4-wireΔ;
	or	329 ~ 433 V_{LL}, 3-phase 5-wire Y
Input Frequency	:	47~ 63 Hz
Max. Input Power	:	6000VA
Max. Input Current (per phase)	:	16A (3-phase 5-wire Y), 27A (3-phase 4-wireΔ)

CAUTION

1. If the input voltage is not within the range as described above, the output will shut down automatically to protect the DC Power Supply.
2. 62050P can connect 220 V_{LL} 3-phase 4-wireΔand 380V_{LL} 3-phase 5-wire Y. Verify the power in use carefully before connection and select appropriate circuit breaker.

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 10AWG~12AWG. (**Note:** 62050P must be within 8AWG ~10AWG when connecting 3-phase 4-wireΔ.)
(4) To assemble 62006P, 62012P & 62024P ➡ see Figure 2-2 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 tin it.
   c. Insert the power terminal and secure it with a Phillips screwdriver.
   d. Lock the safety cover to avoid electric shock.
   e. Secure the safety cover latch to prevent the cable from falling or the electric terminal from exposing.

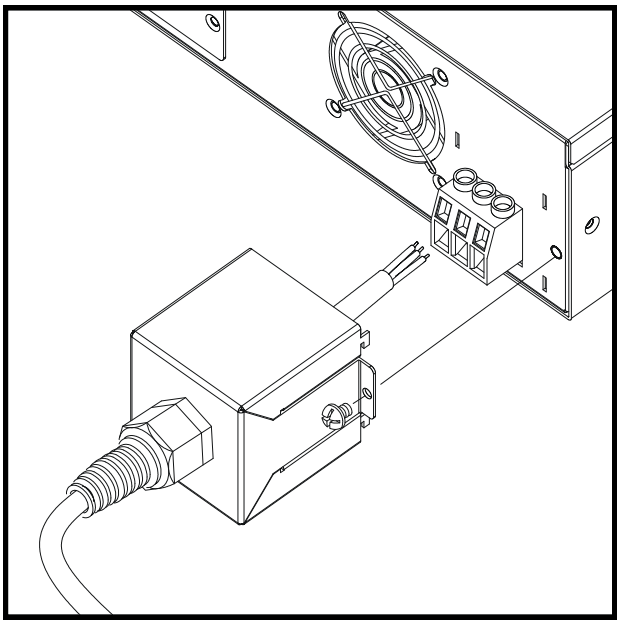


Figure 2-2

WARNING

1. Connect the green or green/yellow metal wire to ⏚ terminal.
2. Connect the white or blue metal wire to “N” terminal.
3. Connect the black or brown metal wire to “L” terminal.

(5) To assemble 62050P ➡ see Figure 2-3 & Figure 2-4
   a. Remove the input terminal safety cover from the rear panel of DC Power Supply.
   b. Insert the power terminal and secure it with a Phillips screwdriver.
   c. Lock the safety cover to avoid electric shock. See Figure 2-5 for assembling.

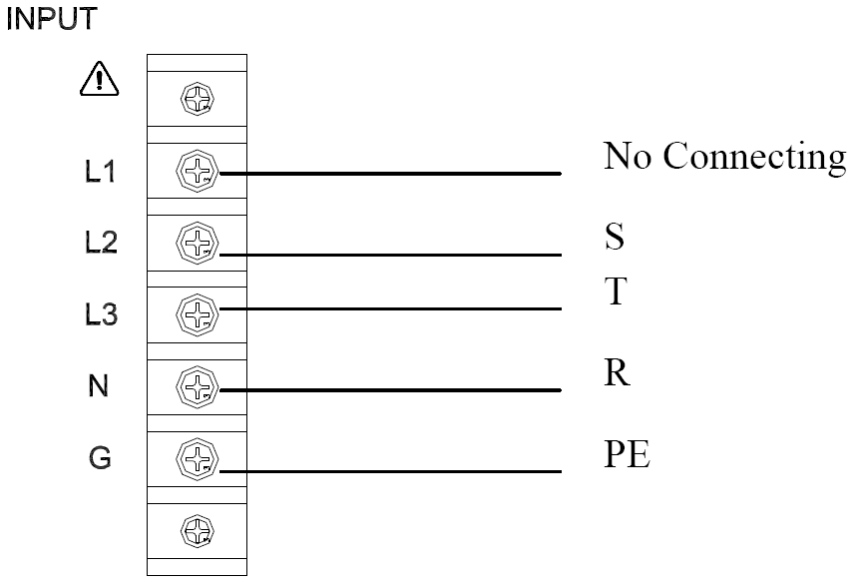


Figure 2-3 $220V_{LL}$, 3-phase 4-wireΔ Input Connection

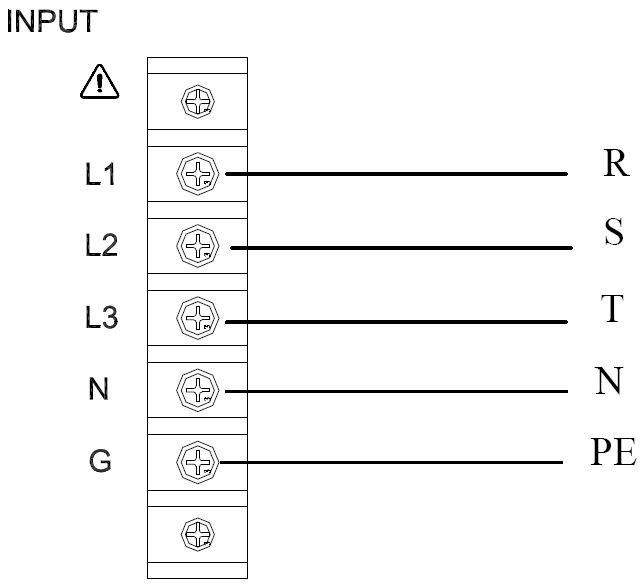


Figure 2-4 $380V_{LL}$, 3-phase 5-wire Y input connection

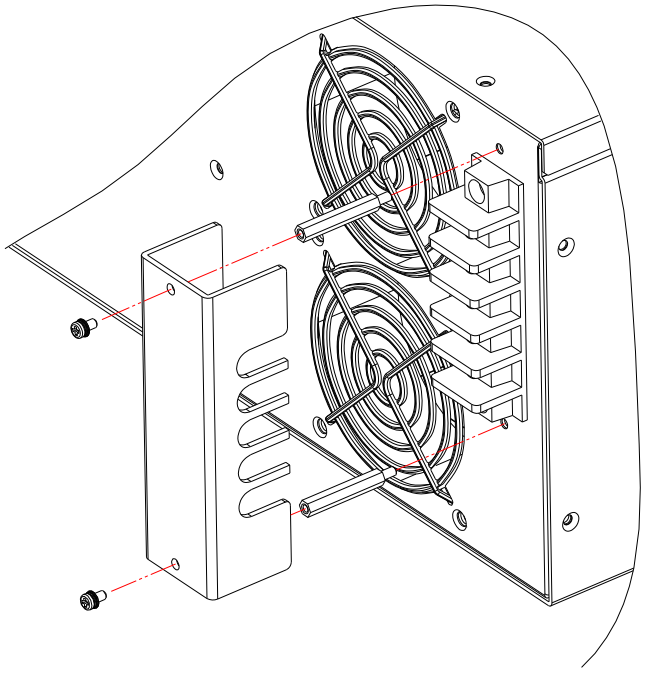


Figure 2-5 Assembling 62050P Input Terminal Safety Cover

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.

2.4 Output Connection

62000P Series DC Power Supply has two output connectors; one is located at the left on the rear panel while the other one is located at the right on the front panel. The load is connected to "＋" and "－" output terminal.

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.

2.4.1 Rear Panel Output

See Figure 2-6.

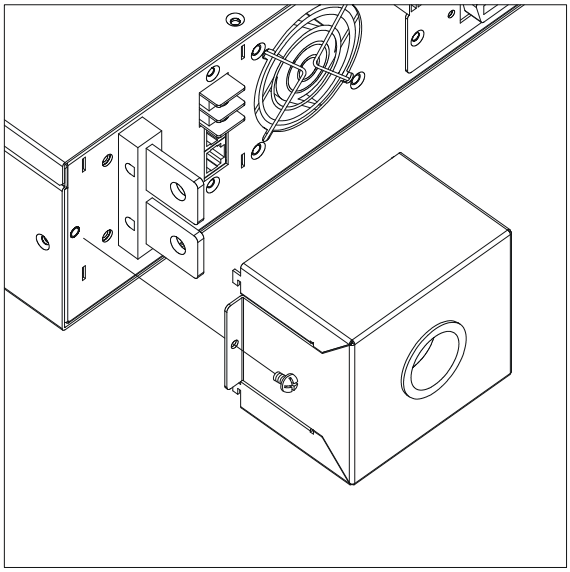


Figure 2-6 Assembling the Rear Safety Cover of 62006P, 62012P & 62024P

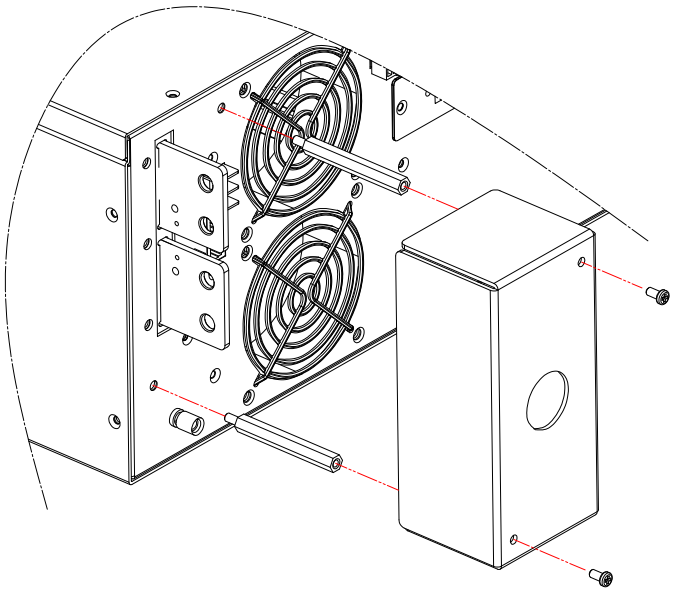


Figure 2-7 Assembling the Rear Safety Cover of 62050P

2.4.2 Front Panel Output

Except for low and high voltage models, the maximum current for front panel output differs from 62000P Series models. See Figure 2-8 for connection.

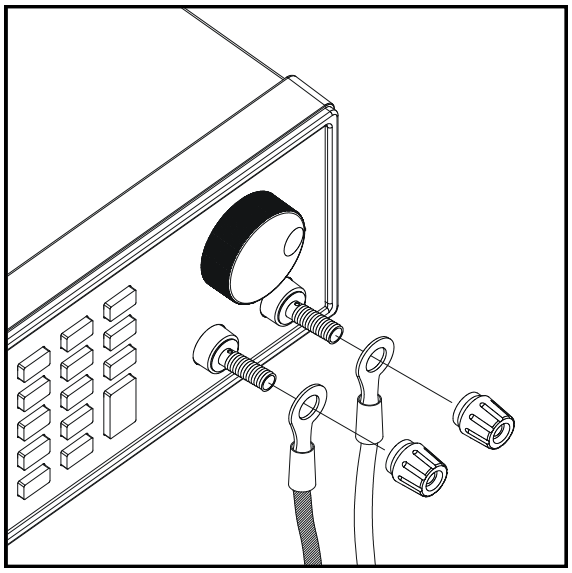


Figure 2-8

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

NOTICE
The maximum current for front panel output differs from 62000P Series models. The maximum current for front panel output can see table below.

Model	Max. Output Current (A)
62006P-100-25	25
62012P-80-60	60
62012P-100-50	50
62024P-80-60	60
62024P-100-50	50

2.4.3 Specification of Connecting Wire

The maximum output inductance of connecting wire to the source is 2μH (it is 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.

2.4.4 Specification of Parallel Capacitance

The parallel capacitance for output varies with the 62000P Series Models as shown below:

Model	Max. Parallel Capacitance for Output
62006P-30-80	70 mF
62006P-100-25	10 mF
62006P-300-8	1.35 mF
62012P-40-120	70 mF
62012P-80-60	10 mF
62012P-100-50	10 mF
62012P-600-8	1.35 mF
62024P-40-120	70 mF
62024P-80-60	10 mF
62024P-100-50	10 mF
62024P-600-8	1.35 mF
62050P-100-100	20mF

CAUTION

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

2.5 Remote Sensing

2.5.1 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 5V line voltage drop.
2. Figure 2-9 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 for 5V, the maximum output power of DC Power Supply is still rated (1200W for 62012P Series and 600W for 62006P Series, the output power is calculated by multiplying the voltage on output terminal and the current passed.) Therefore, if the power exceeds the DC Power Supply can provide, it is unable to compensate the voltage drop to 5V. The DC Power Supply will activate Over Power Protection (OPP).

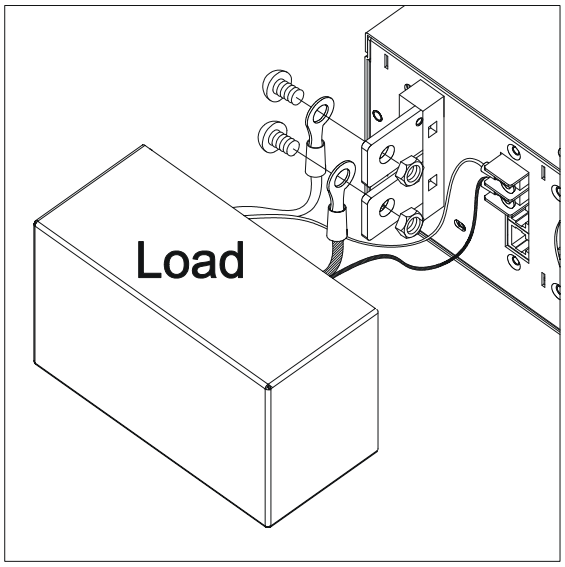


Figure 2-9

2.5.2 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% larger than the set value; therefore it is necessary to connect the remote sensing wire correctly. Please connect the remote sensing wire to output terminal as Figure 2-10shows even if the line voltage drop can be ignored in actual practice.

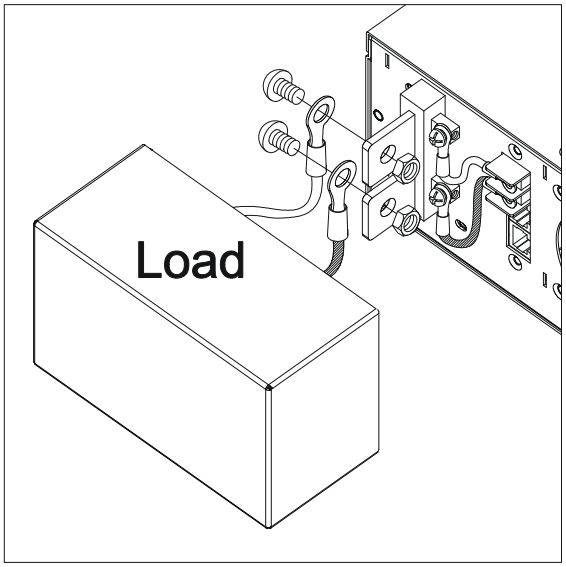


Figure 2-10

Figure 2-11 shows the Remote Sensing installation for high voltage model.

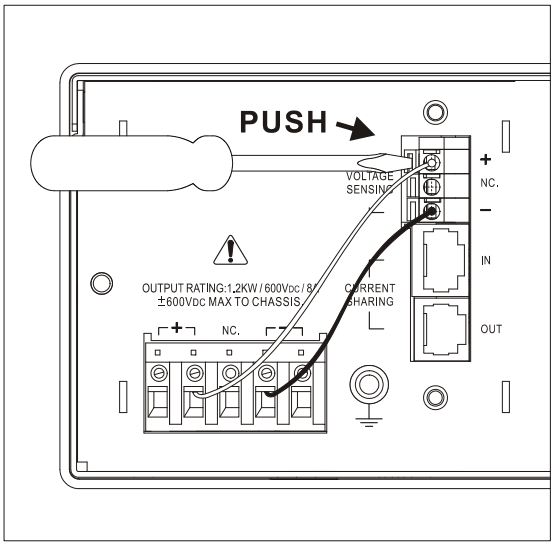


Figure 2-11

2.5.3 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 2-12 shows.

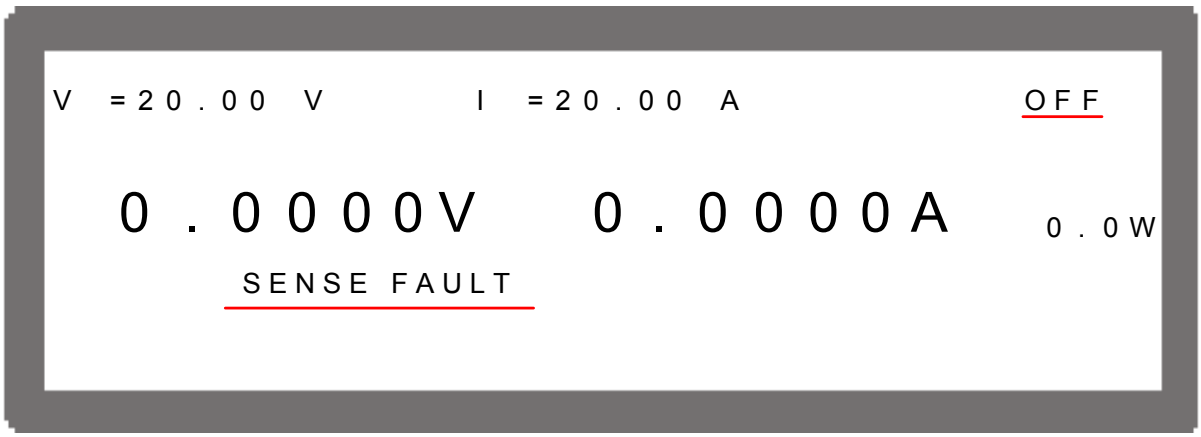


Figure 2-12

ⓘ 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.

2.5.4 Rack Mounting Kit & Handle Installation

Remove the sliver inlay from the plastic side frame and use M4X15 flat head screws to secure the rack mounting kit to the plastic side frame. If a handle is required for installation, use M4X9 flat head screws to secure it to the rack mounting kit as shown below.

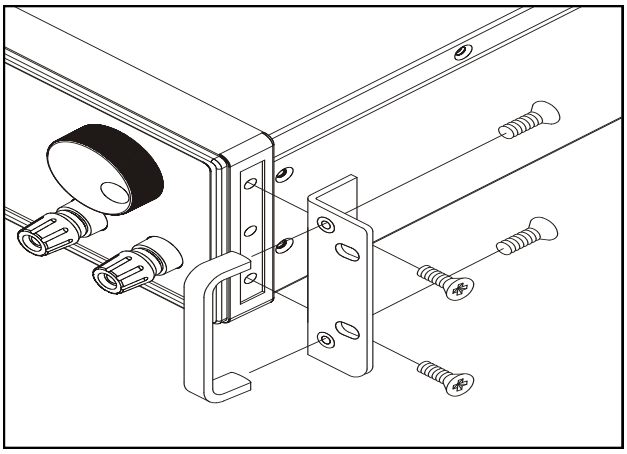


Figure 2-13 Installing the Rack Mounting Kit & Handle of 62006P, 62012P & 62024P

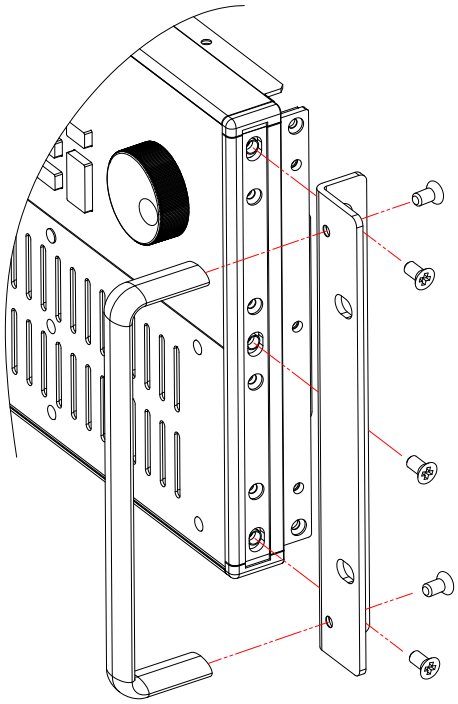


Figure 2-14 Installing the Rack Mounting Kit & Handle of 62050P

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 LCD on front panel will light up and show as below:

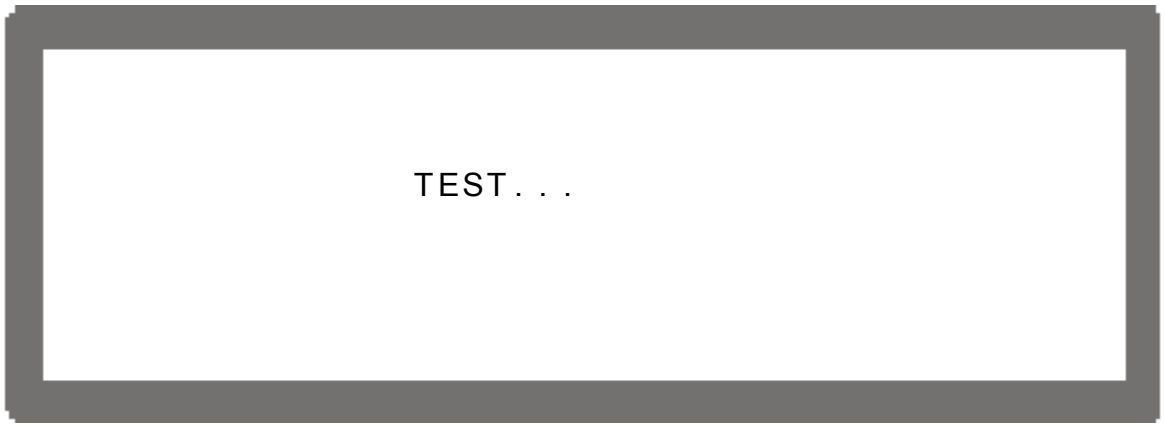


Figure 2-15

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:

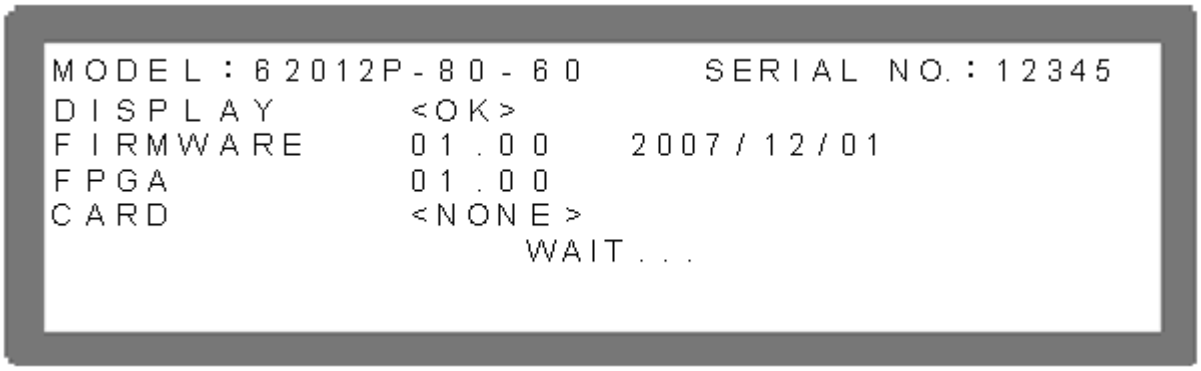


Figure 2-16

ⓘ NOTICE

1. If an item is failed during self-test, an "ERROR CODE" will prompt at its right side. See Section 7.2 for the error messages and troubleshooting.
2. When GPIB or ETHERNET shows <OK> it means the GPIB or ETHERNET is connected to the Power Supply for remote operation. On the contrary when CARD <NONE> appears it indicates the GPIB or ETHERNET card is not connected but still can be operated manually. See section 3.3.1.1 for detail information.
3. If the Power Supply beeps long and low during power on and the LCD has no screen display, it means the LCD is abnormal. Please turn the Power Supply off and on again to check if it is caused by any wrong action. If the long low beep still exists, contact your agent to return the hardware for repair service.

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

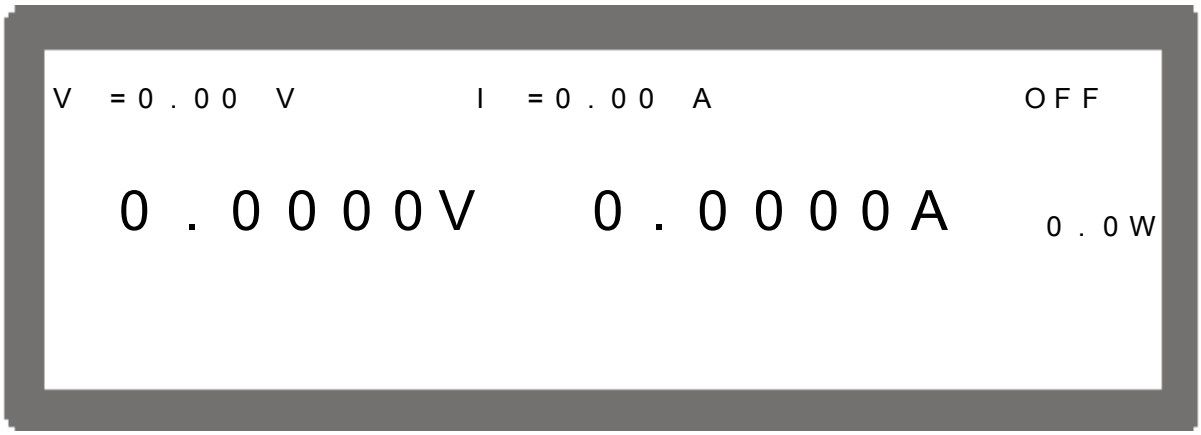


Figure 2-17

☞ WARNING

1. Users can diagnose if there is any NG during self-test at power-on. See section 7.2 for details.
2. 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.

2.7 I/O Connector (Option)

The GPIB or Ethernet interface I/O connector is available for purchase.

To assemble it ➡ Remove the cover plate of GPIB/ETHERNET card (Figure 2-18) and insert the GPIB or ETHERNET card then secure it with screws.

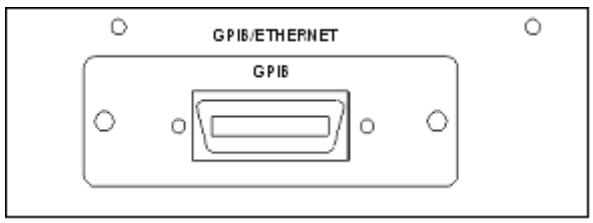


Figure 2-18

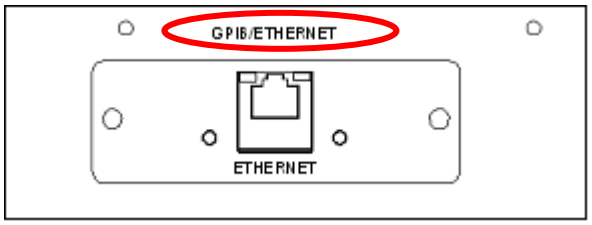


Figure 2-19

ⓘ NOTICE

Be sure there is “GPIB/ETHERNET” labeled on the rear panel and the firwmware version is 2.50 or above when purchasing an ETHERNET card. The ETHERNET card can be inserted directly if “GPIB/ETHERNET” is labeled and the firmware version is 2.50 or above; otherwise, please contact the local agent.

3. Manual Operation

3.1 Introduction

DC Power Supply can be operated manually or remotely via GPIB, ETHERNET controller or RS-232C or USB or APG interface which is described in Chapter 5 and section 3.3.1.3. The manual operation for using the front panel keyboard or rotary knob to input the data is described in this chapter.

ⓘ NOTICE
If the operation mode is not saved before users power 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 "VOLTAGE", the cursor for V on MAIN PAGE blinks.
2. Use the numeric keys (0~9) to set the value and press "ENTER" to complete the voltage setting or turn the "Rotary" ( ) knob to adjust the set value.
3. Press "OUTPUT" 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 "VOLTAGE", 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 "OUTPUT" 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.)

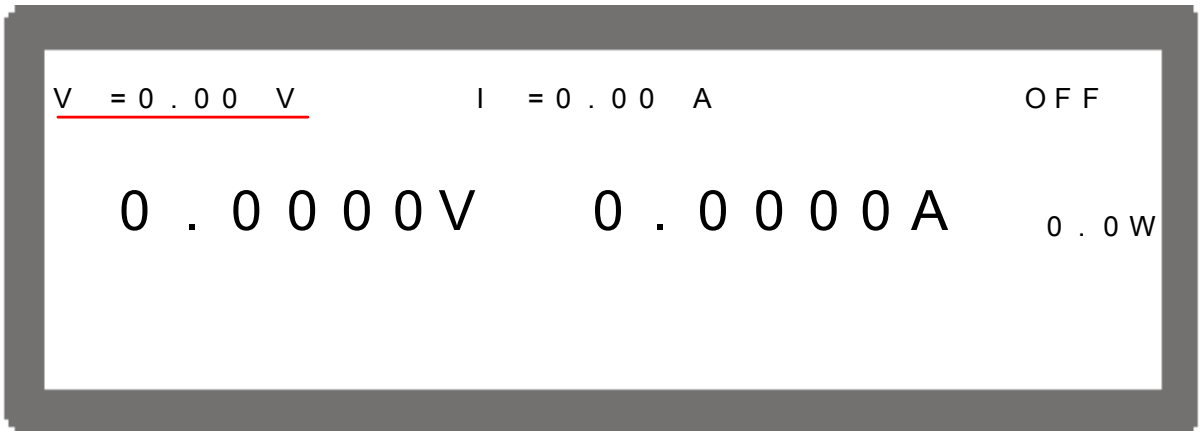


Figure 3-1

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

Press "CURRENT" 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 load current setting must be larger than the current, otherwise the output current will not equal to the set current.)

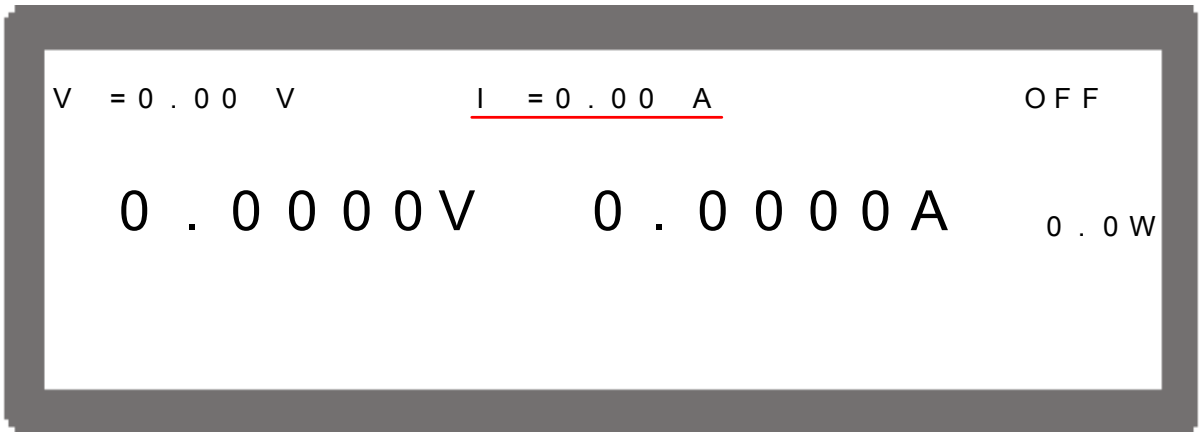


Figure 3-2

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.

Following explains the way to set the configuration.

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

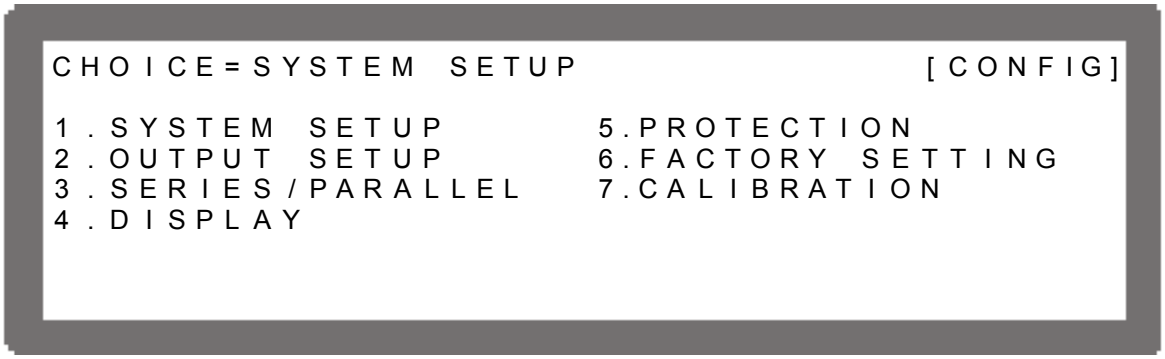


Figure 3-3

1. Use the numeric (1~7) keys or "Rotary" ( ) knob to select the item to be set.
2. Press "ENTER" to confirm.

NOTICE

1. To cancel the setting, press "EXIT" to return to MAIN PAGE.
2. Press "VOLTAGE" or "CURRENT" in any page can return to MAIN PAGE.

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

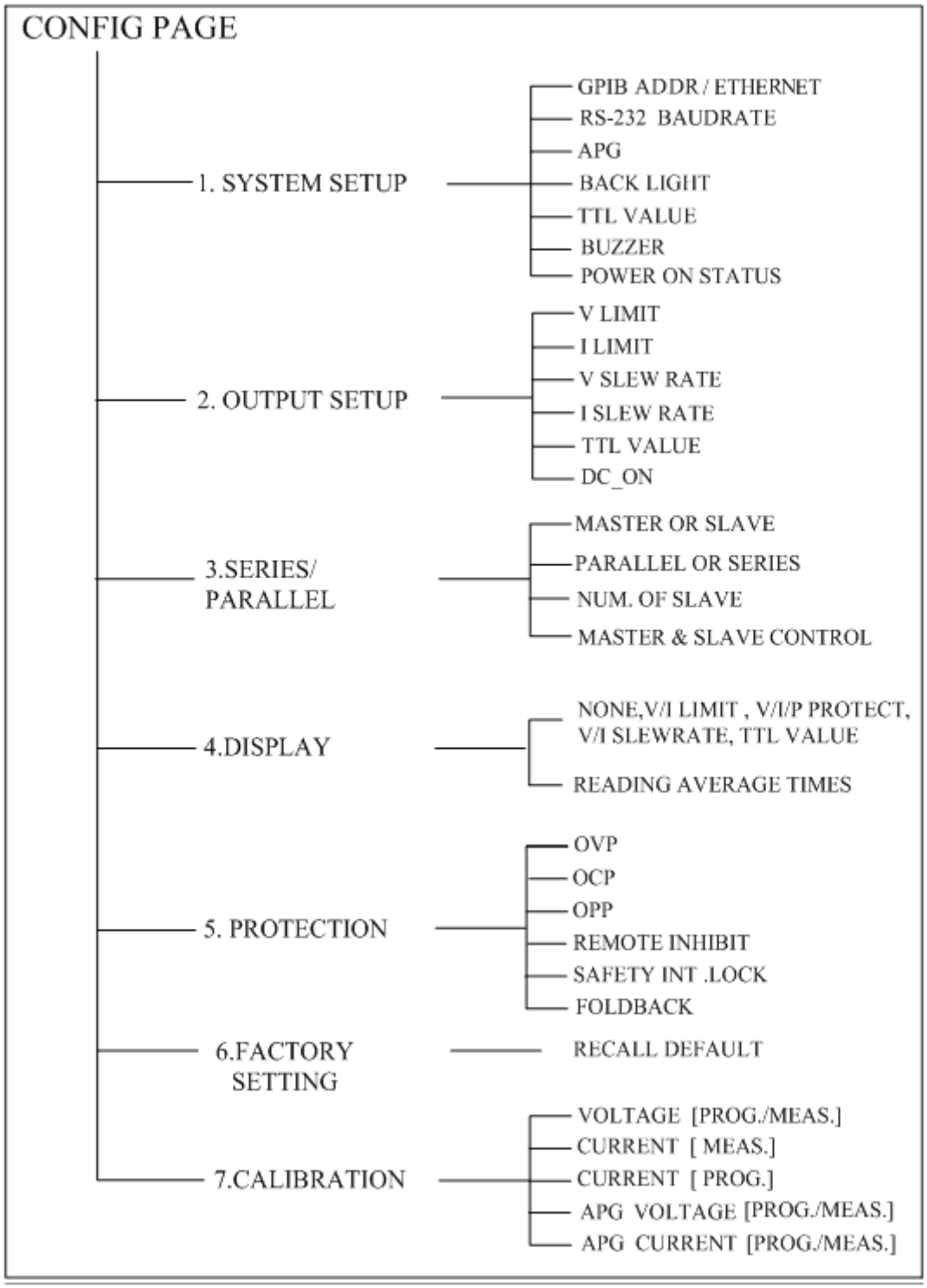


Figure 3-4

3.3.1 SYSTEM SETUP

1. In Config setup page, press "1" will display the screen of Figure 3-5.

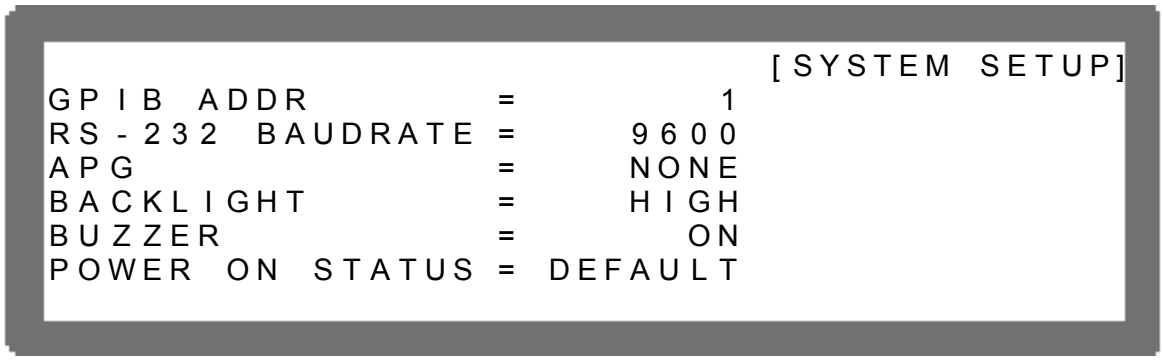


Figure 3-5

2. Press "ENTER" to edit the options in SYSTEM SETUP.

Following introduces the options of SYSTEM SETUP.

3.3.1.1 GPIB / ETHERNET ADDRESS

This instrument is available for remote operation. Be sure to set the GPIB/ETHERNET address before using it for remote control.

1. In GPIB mode, use "←↑", "→↓" keys to move the cursor to GPIB ADDR column.
2. Use the numeric (1~0) keys or the "Rotary" (◎) to set the GPIB address.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to SYSTEM SETUP PAGE.

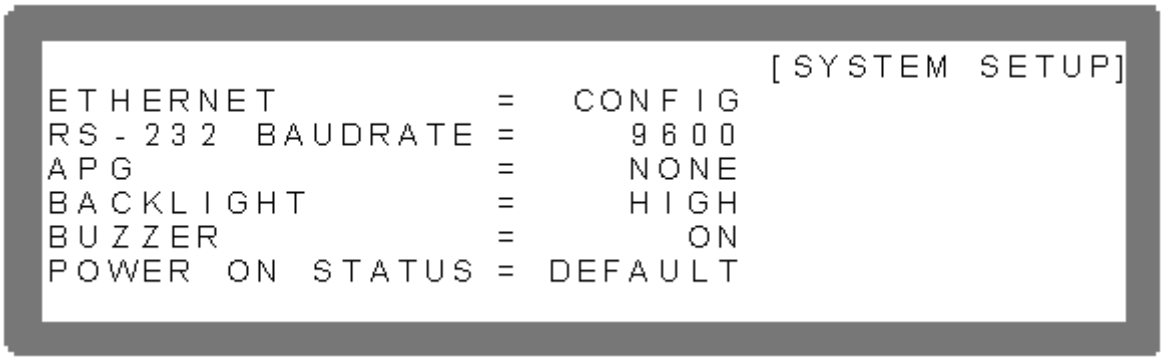


Figure 3-6

5. In ETHERNET mode, use "←↑", "→↓" keys to move the cursor to ETHERNET column as Figure 3-6 shows.
6. Press "ENTER" to confirm it and go to the submenu.
7. Use "←↑", "→↓" keys or the "numeric" (1~0) keys or the "Rotary" (◎) to set the ETHERNET address in LAN SETTING as Figure 3-7 shows.

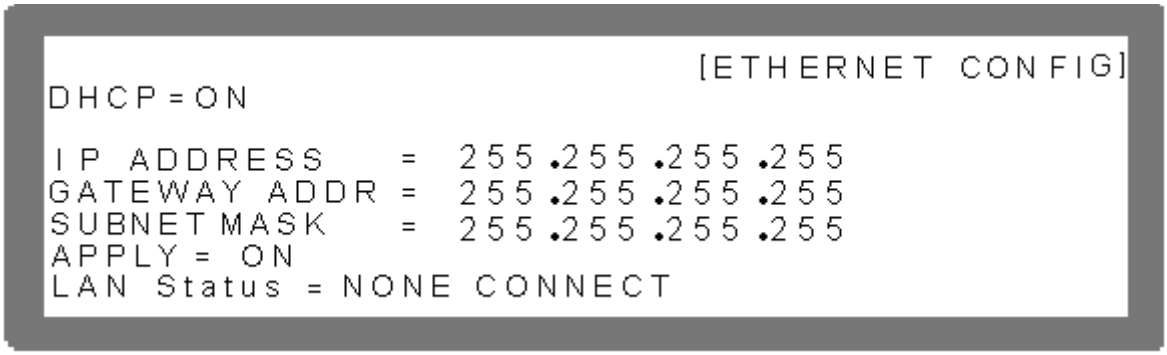


Figure 3-7

8. LAN STATUS will show automatically and there are 5 items to be displayed:
   CONNECTED: It indicates connected.
   CONNECTING. . . .: It indicates it is connecting.
   NONE CONNECT: It indicates there is no connection.
   SETTING. . . .: It indicates it is setting the network.
   ETHERNET MODULE FAIL: It indicates the network module is failed.
9. Press "ENTER" to confirm.
10. Press "EXIT" to return to SYSTEM SETUP PAGE.

ⓘ NOTICE
The GPIB address range is 0~30 and the network address range of ETHERNET is from 0~255. The setting DHCP=ON in ETHERNET grabs the address automatically and the address is set manually when DHCP=OFF. If the address is to be set manually, it needs to set APPLY=YES and press "ENTER" when the address setting is done, or the address won't be effective.

3.3.1.2 RS-232 BAUDRATE

This instrument is available for remote operation via RS-232. Be sure to set the RS-232 baudrate before using it for remote control.

1. Use "←↑", "→↓" keys to move the cursor to RS-232 BAUDRATE column.
2. Use "Rotary" (◎) knob to set the BAUDRATE.

ⓘ NOTICE
The RS-232 has 3 baudrates 9600/19200/38400 for setting.

3.3.1.3 APG

Analog Programming interface (APG) uses analog signal to control the output. This option decides whether or which APG control function is in use, and no matter what option is selected the APG measurement functions are available.

1. Use “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set.

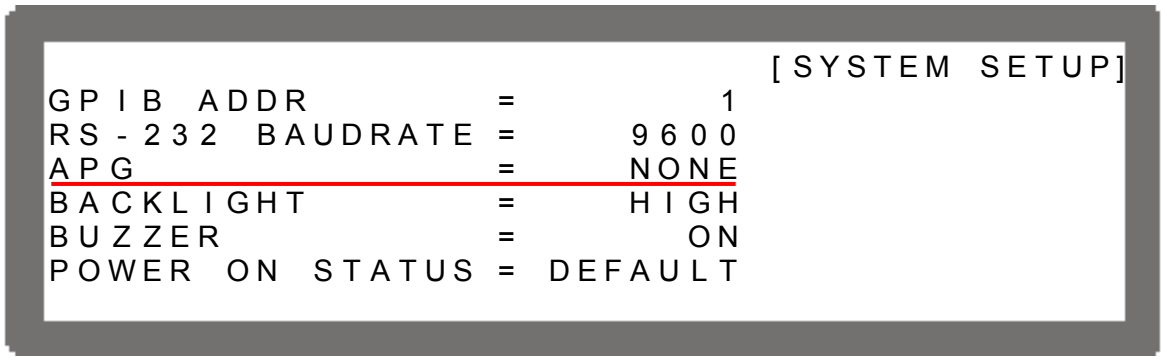


Figure 3-8

2. Use “Rotary” ( ) to set the mode. APG has 4 options: **NONE / V / I / V&I,** where:
   NONE: It indicates not using the programming function for voltage and current.
   V: It indicates using voltage programming but not current programming function.
   I: It indicates using current programming but not voltage programming function.
   V&I: It indicates using both voltage and current programming function.
3. Press “ ENTER ” to confirm.
4. A reference potential option will prompt at the right for selection when the APG function is enabled.

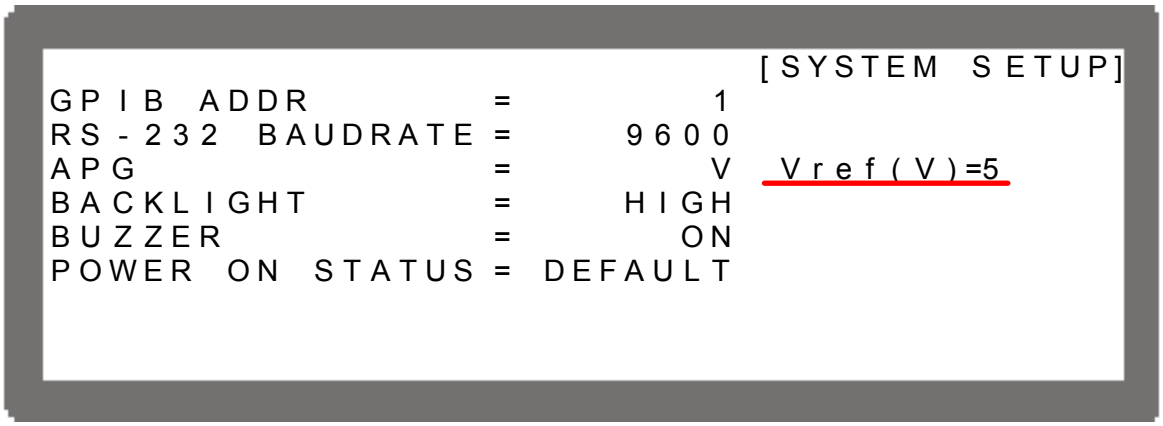


Figure 3-9

5. Use “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set.
6. Press “ 0 ” or “ 1 ” to set the value, or use “Rotary” ( ) knob to select the control voltage range.
7. Press “ ENTER ” to confirm.

8. Press "EXIT" to return to MAIN PAGE.

ⓘ NOTICE

1. APG has two reference voltage level: V_ref(V)=5 / 10. Take the example of 62012P-80-60:
   a. When selecting Vref=5V ➡ it means the DC Power Supply's output 0V/0A~80V/60A will map to 0~5V (programming or measurement) as Figure 3-10(a) shows.
   b. When selecting Vref=10V ➡ it means the DC Power Supply's output 0V/0A~80V/60A will map to 0~10V (programming or measurement) as Figure 3-10(b) shows.

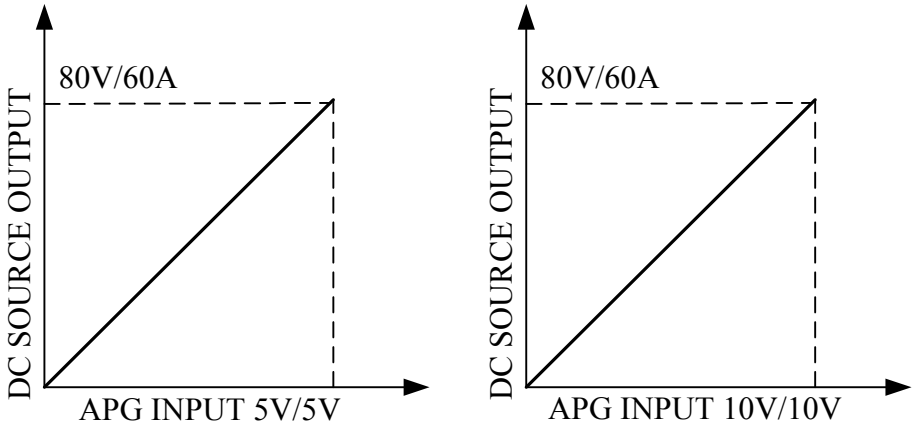


Figure 3-10

2. Short key description:
   a. "0" = 5V
   b. "1" = 10V

3.3.1.3.1 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 3-11 and Figure 3-12.

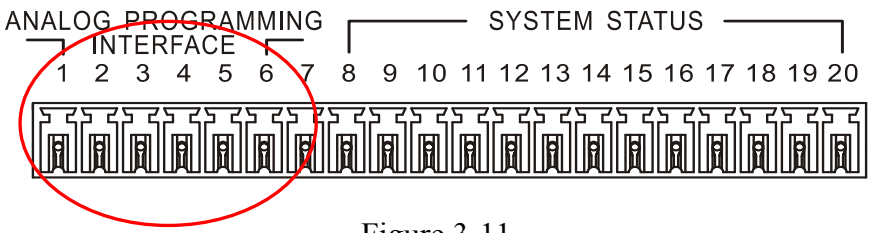


Figure 3-11

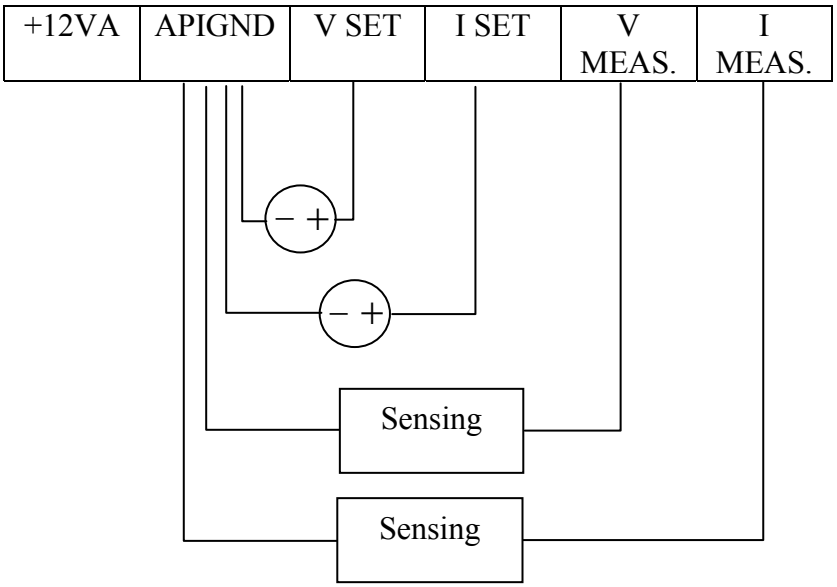


Figure 3-12

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. 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.
3. Voltage programming (input port): The input analog voltage (0-10Vdc or 0-5Vdc) of this pin and APIGND. It can control the output voltage (CV mode) linearly.
4. Current programming (input port): The input analog voltage (0-10Vdc or 0-5Vdc) of this pin and APIGND. It can control the output current (CC mode) linearly.
5. Voltage measurement (output port): This pin will output the voltage in analog signal 0 – 10Vdc or 0 – 5Vdc of Full scale for users to monitor it.
6. Current measurement (output port): This pin will output the current in analog signal 0 – 10Vdc or 0 – 5Vdc of Full scale for users to monitor it.

3.3.1.4 BACKLIGHT

This option sets the brightness of LCD backlight on the front panel. There are four kinds of backlight brightness for selection (including off).

1. Use “ ”, “ ” keys to move the cursor to the column to be set.

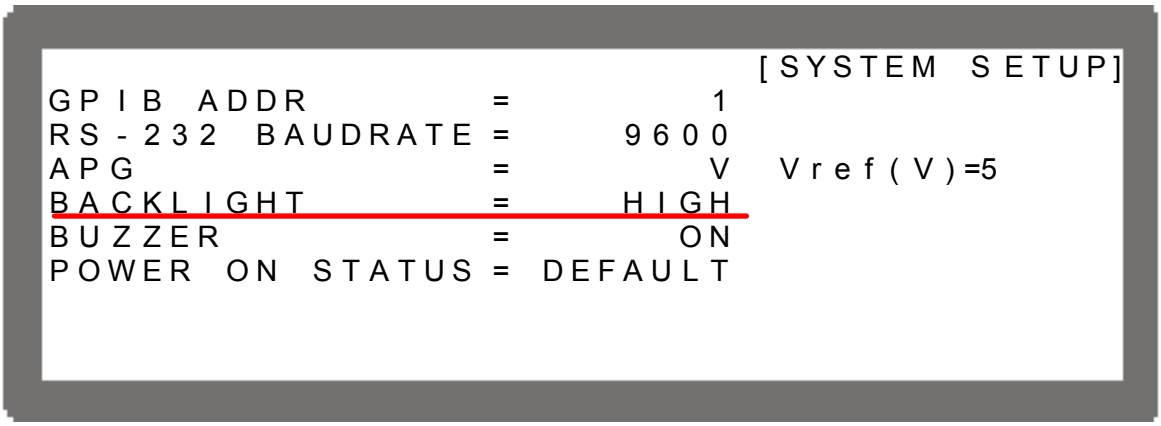


Figure 3-13

2. Press "0" ~ "3" "" to set it, or use "Rotary" ( ) to select the brightness of LCD backlight.

NOTICE

1. BACKLIGHT has 4 options: **HIGH / NORMAL/ DIMMED / OFF**, where the option OFF will turn off the LCD backlight.
2. Short key and brightness description:
   a. Press "0", BACKLIGHT = HIGH.
   b. Press "1", BACKLIGHT = NORMAL.
   c. Press "2", BACKLIGHT = DIMMED.
   d. Press "3", BACKLIGHT = OFF.
3. The darker the backlight is the longer life the panel will be; therefore, if the instrument is in use during burn-in, it is suggested to set the backlight to OFF to prolong the LCD's life.

3.3.1.5 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.

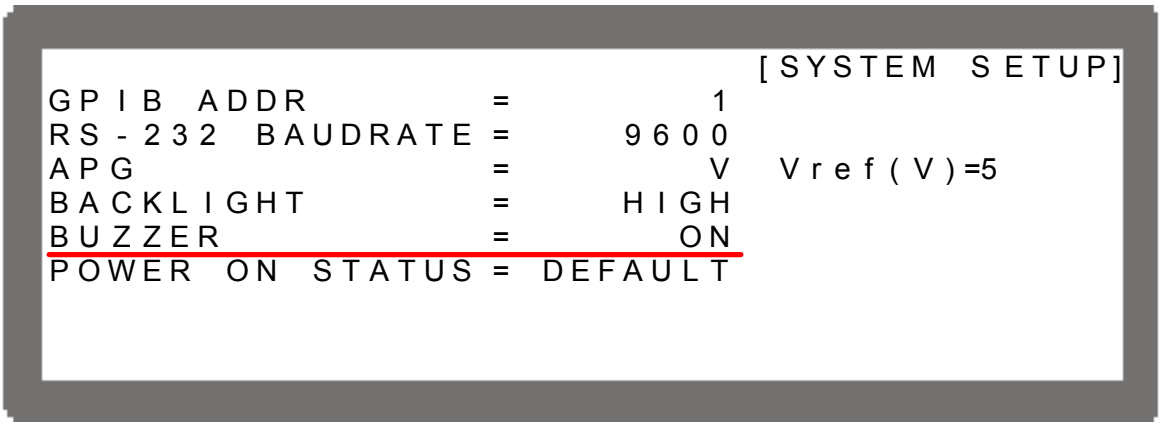


Figure 3-14

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 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.

3.3.1.6 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.

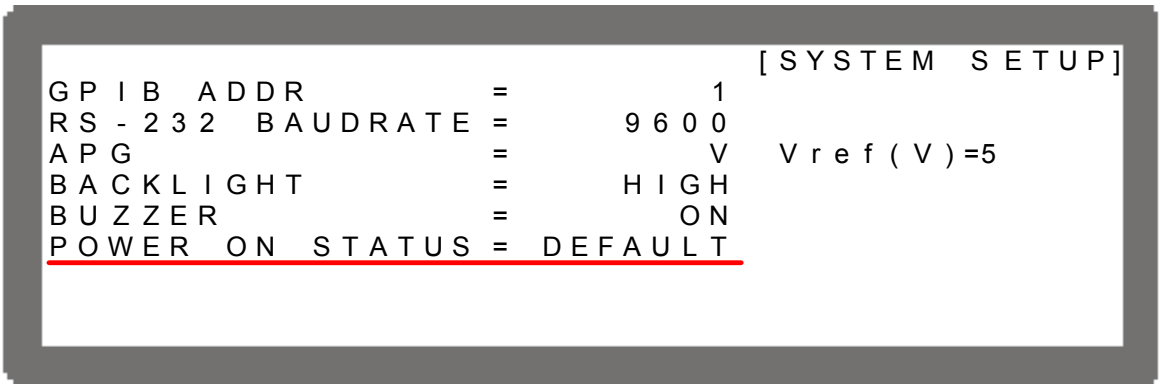


Figure 3-15

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 3-16, the voltage setting is 80.00V, current setting is 15.00A and output setting is ON. When it powers on again, the instrument will remain the previous state by setting the voltage to 80.00V, current to 15.00A and output to ON.

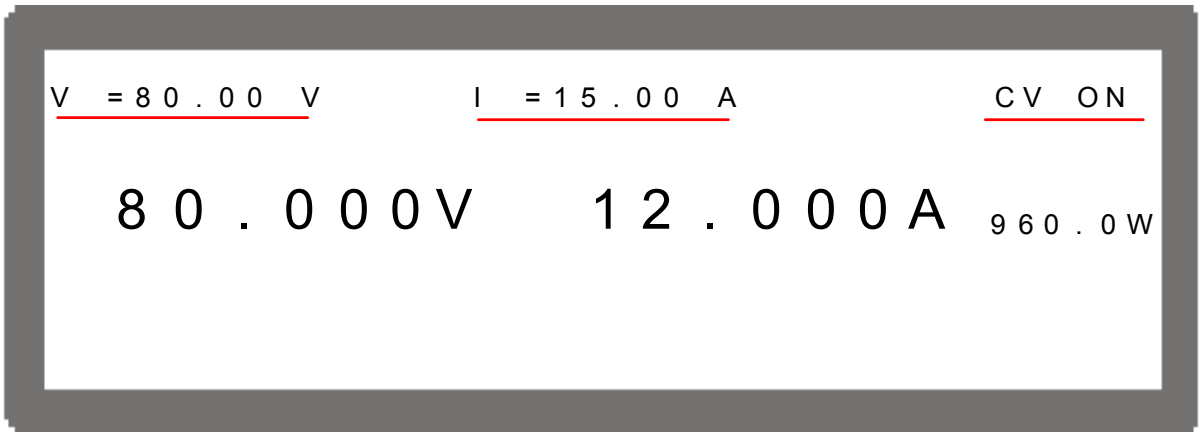


Figure 3-16

When set to USER DEFINITION a setting line will prompt beneath the POWER ON STATUS line for users to set the default power-on state including voltage (V), current (I) and OUTPUT=ON/OFF.

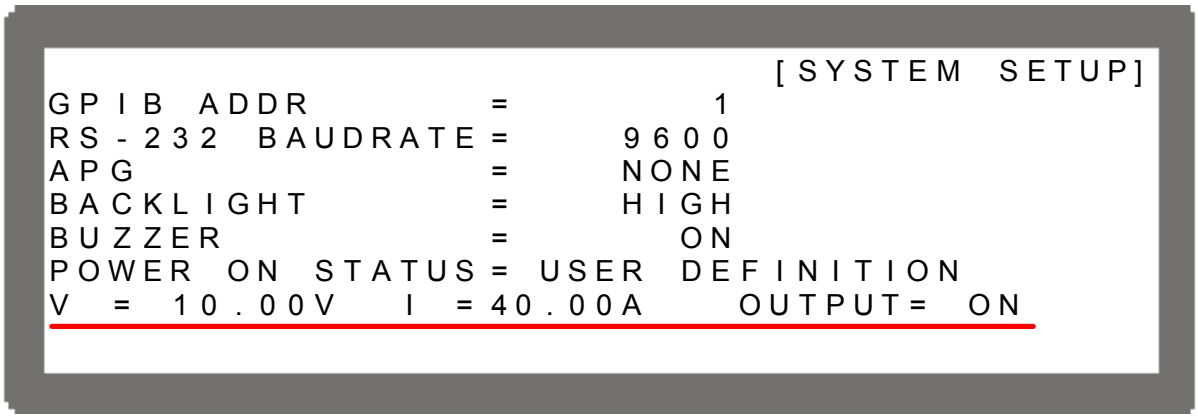


Figure 3-17

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

3.3.2 OUTPUT SETUP

1. In Config Setup page, press "2" key to display the screen of Figure 3-18.
2. Press "ENTER", to enter into Output Setup.
3. Press "←↑", "→↓" keys to move the cursor to the column to be set.
4. Press "EXIT" to return to MAIN PAGE.

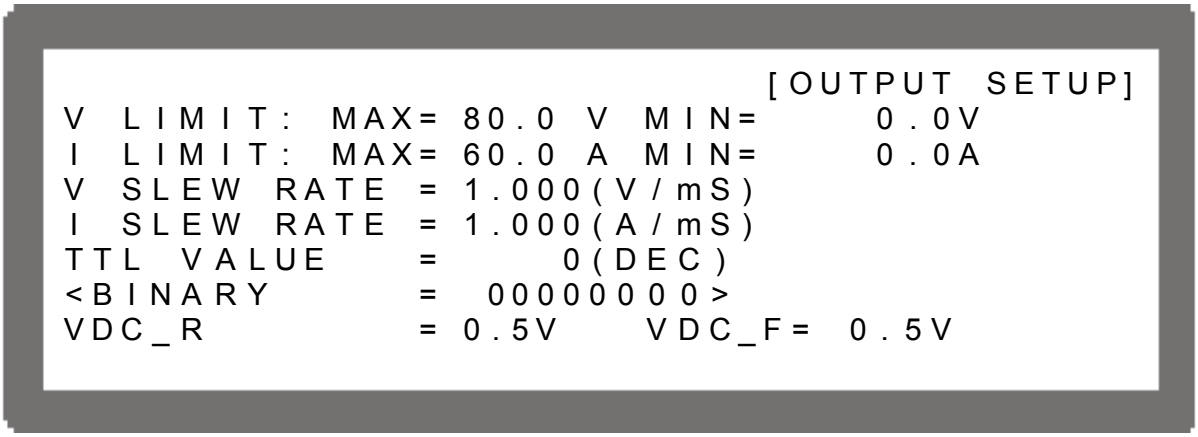


Figure 3-18

ⓘ NOTICE
The values in Figure 3-18 are the default settings of 62012P-80-60.

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.

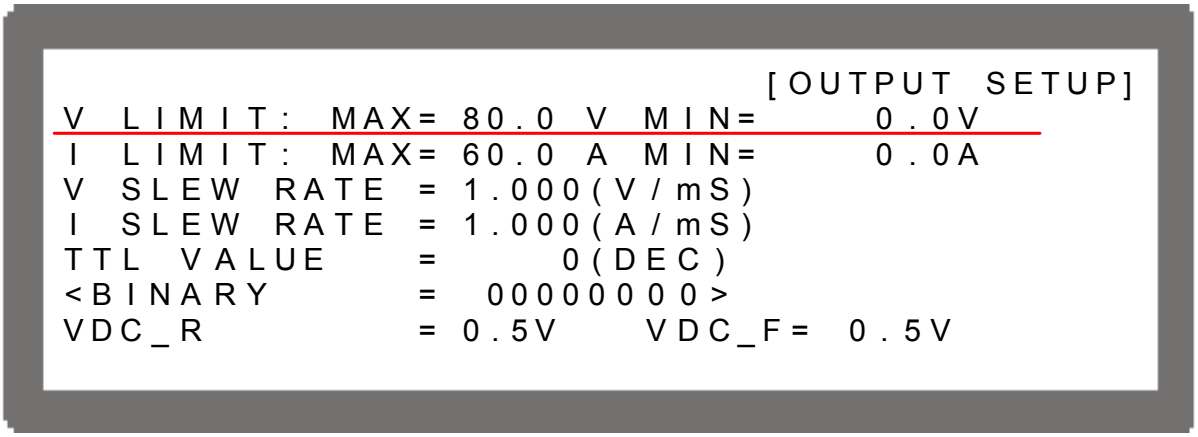


Figure 3-19

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

Take example by 62012P-80-60, the output voltage range is 0~80V and use this option can narrow down its range by setting MIN and MAX.

When "VOLTAGE" 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]. If the setting exceeds the range, the BUZZER will beep (if BUZZER is set to ON) and the main screen will prompt a warning message automatically as shown below.

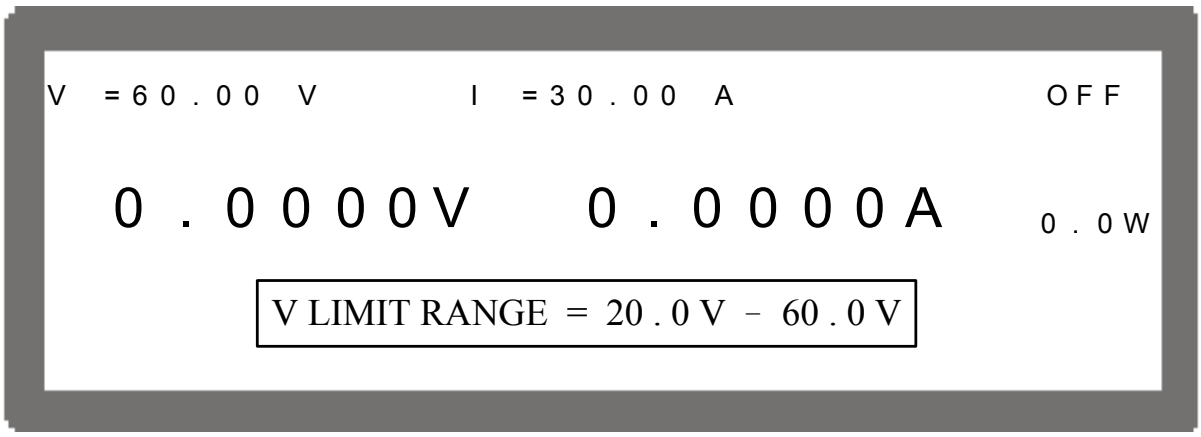


Figure 3-20

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

3.3.2.2 CURRENT LIMIT SETTING

1. Use "◄↑", "►↓" keys to move the cursor to the column to be set.

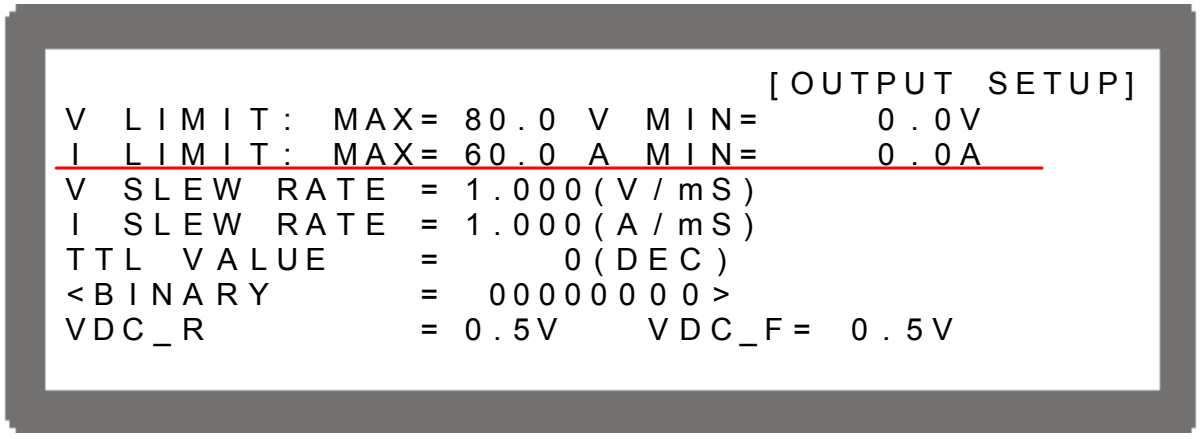


Figure 3-21

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

Take example by 62012P-80-60, the output current range is 0~60A, but using this option can narrow down its range by setting MIN and MAX.

When "CURRENT" 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]. If the setting exceeds the range, the BUZZER will beep (if BUZZER is set to ON) and the main screen will prompt a warning message automatically as shown below.

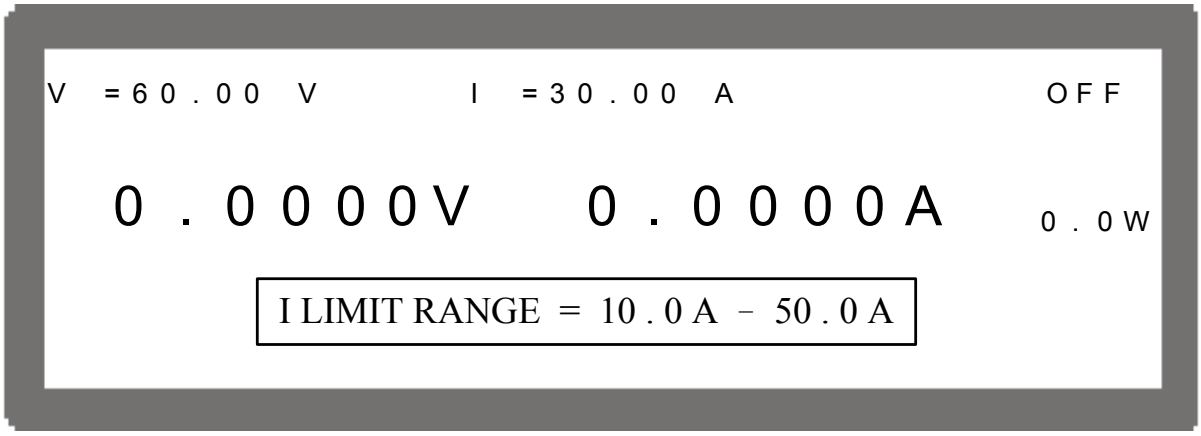


Figure 3-22

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

3.3.2.3 VOLTAGE SLEW RATE

1. Use "←↑", "→↓" keys to move the cursor to the column to be set.

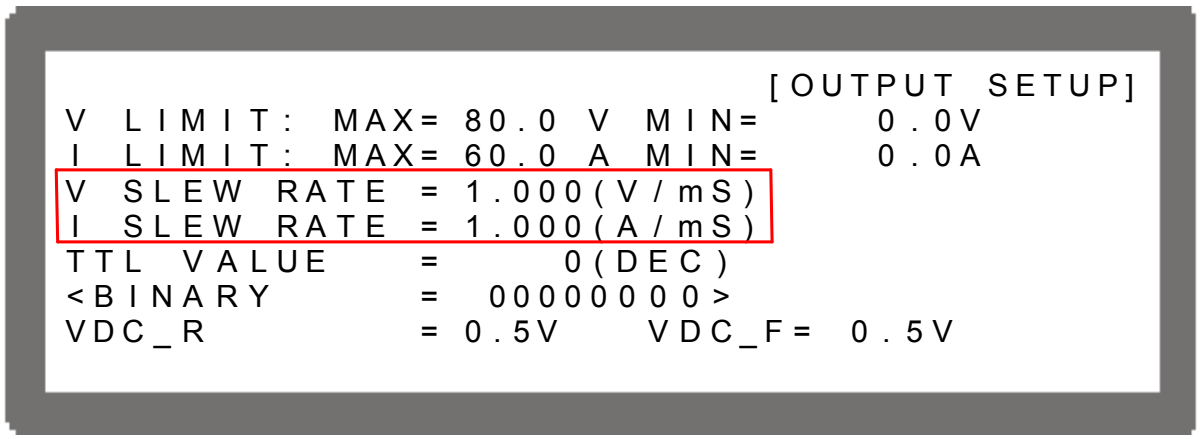


Figure 3-23

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

Take example by 62012P-80-60, the output voltage slew rate is set as Figure 3-24 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 down slew rate is limited by load.

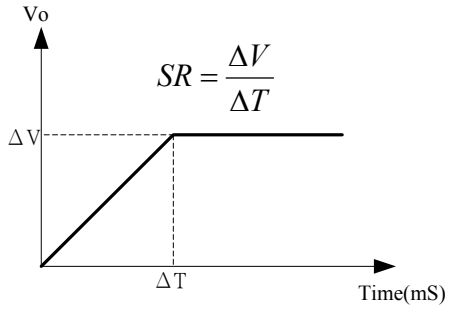


Figure 3-24

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

3.3.2.4 CURRENT SLEW RATE SETTING

1. Use "←↑", "→↓" keys to move the cursor to the column to be set.
2. Use the numeric (0 ~9) keys or "Rotary" ( ) knob to set the value.

Take example by 62012P-80-60, the output current slew rate is set as Figure 3-25 shows. The maximum input Slew Rate is 1A/mS and the minimum is 0.001A/mS. If the input is larger than 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.

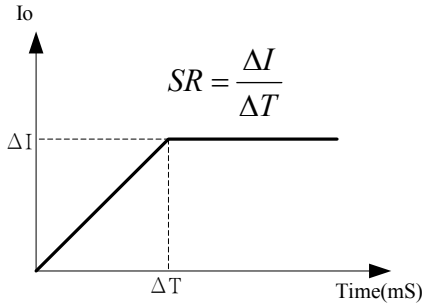


Figure 3-25

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

3.3.2.5 TTL Option

When the DC Power Supply is outputting, its SYSTEM STATUS connector on the rear panel offers 8 BIT digital signals for other purpose use. The TTL VALUE range is from ***0*** to ***255***, in addition the system will convert it by binary automatically for easy identification.

1. Use “ [←↑] ”, “ [→↓] ” keys to move the cursor to the column to be set.

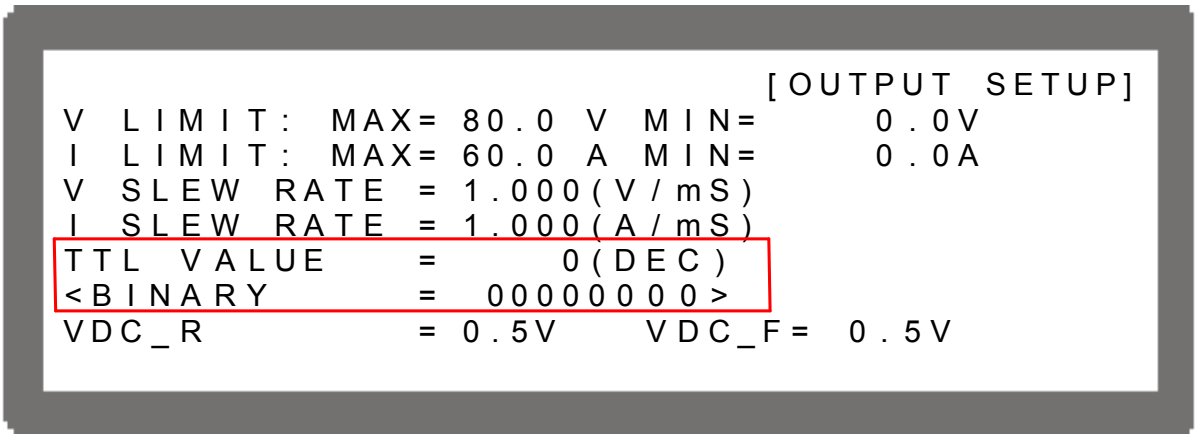


Figure 3-26

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

   The setting range of TTL VALUE is ***0 ~ 255***, in addition the system will convert it to binary automatically for easy identification.

   Figure 3-27 shows the SYSTEM STATUS pin no. on rear panel, where TTL0~TTL7 is located at PIN12 ~PIN19, and PIN20 is the signal reference point of PIN8~PIN19 (GND).

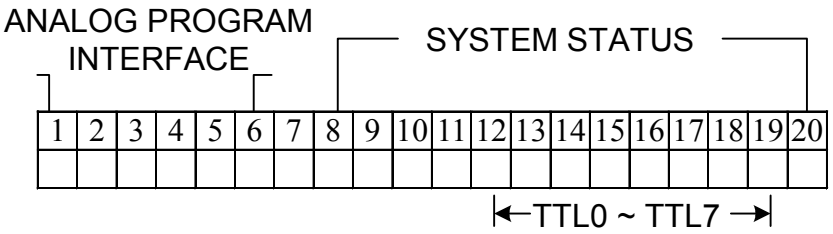


Figure 3-27

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

ⓘ NOTICE

1. The TTL signal can be set PROGRAM.
2. Table 3-1 shows the TTL pin definition of SYSTEM STATUS.

PIN NO.	PIN DEFINITION
12	TTL0
13	TTL1
14	TTL2
15	TTL3
16	TTL4
17	TTL5
18	TTL6
19	TTL7
20	GND

Table 3-1

3. TTL is digital signal, which is positive logic system (5V system).

The table shows the output specification.

OUTPUT STATE	MIN	TYP	MAX	CURRENT
H (HIGH)	4.18	4.80V		7mA (Source)
L (LOW)		0.16V	0.26V	-7mA (Sink)

Table 3-2

3.3.2.6 Setting DC_ON

When the output of DC power supply is ON and the voltage is over VDC_R, the pin10 DC_ON of SYSTEM STATUS on the rear panel will turn to HIGH. When the output voltage of DC power supply is lower than the setting of VDC_F, the pin10 DC_ON of SYSTEM STATUS on the rear panel will turn to LOW for other usages as shown below:

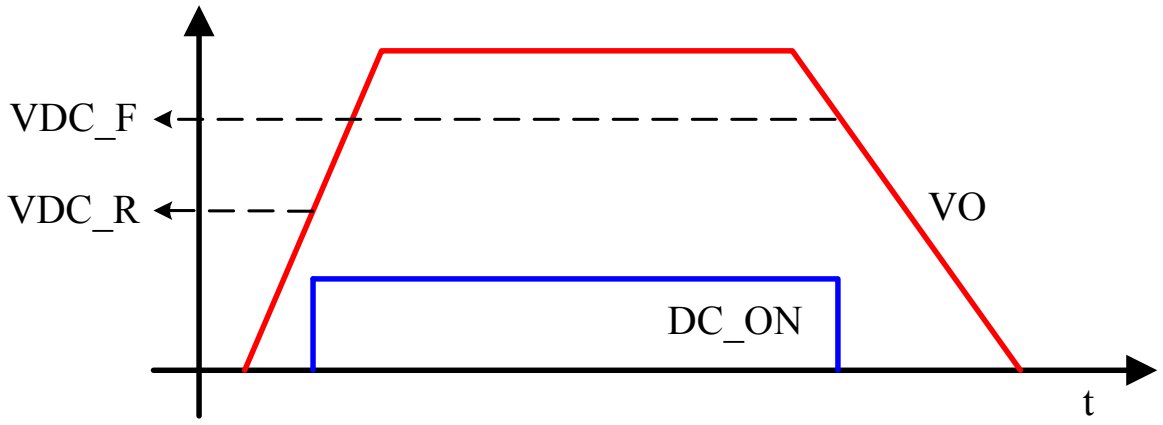


Figure 3-28

Set DC_ON as described below:

1. Use " ", " " keys to move the cursor to the column to be set.

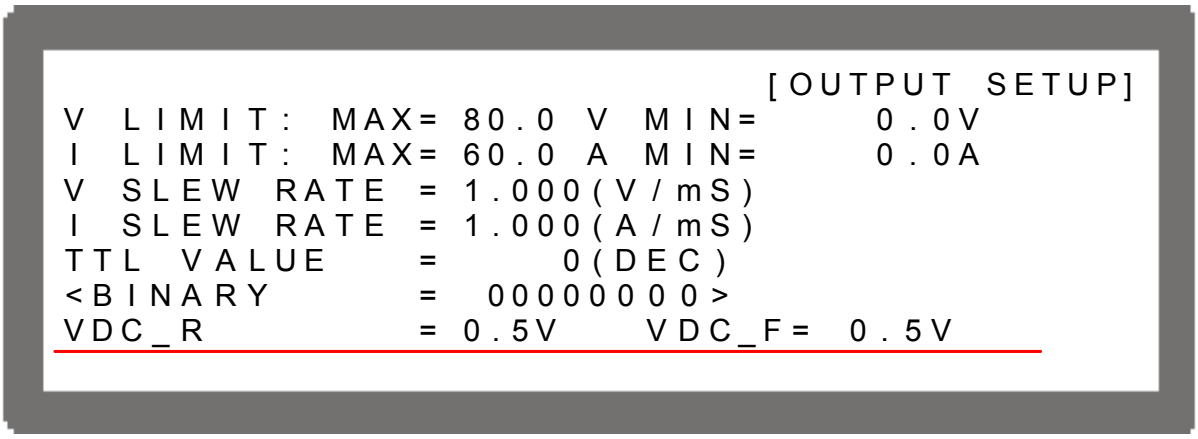


Figure 3-29

2. Use the numeric ([0] ~[9]) keys or "Rotary" ( ) knob to set the value. Take the example of 62012P-80-60, the lower limit of DC_ON is 0.5V and upper limit is 79.5V.

3.3.3 SERIES/PARALLEL

62000P Series DC Power Supplies are able to operate in series or parallel. Take example by 62012P-80-60, the voltage is up to 400V if connecting 5 sets in series, and the current is up to 300A if connecting 5 sets in parallel.

ⓘ NOTICE

1. Series/Parallel cannot be mixed in use.
2. Table 3-3 lists the maximum connecting numbers, voltage and current in series/parallel operation for 62000P Series Power Supplies.

62000P Series Model	Serial		Parallel	
	Max. Devices	Max. Output Voltage (V)	Max. Devices	Max. Output Current (A)
62006P-30-80	5	150	5	400
62006P-100-25	5	500	5	125
62006P-300-8	5	800	5	40
62012P-40-120	5	200	5	600
62012P-80-60	5	400	5	300
62012P-100-50	5	500	5	250
62012P-600-8	5	800	5	40
62024P-40-120	5	200	5	600
62024P-80-60	5	400	5	300
62024P-100-50	5	500	5	250
62024P-600-8	5	800	5	40
62050P-100-100	5	500	5	500

Table 3-3

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.

3.3.3.1 Connecting Series/Parallel Output Cable

The following figures show the connections of serial/parallel output cables.

1. Figure 3-30 is the series connection.
2. Figure 3-31 is the parallel connection. For 62006P-30-80, 62012P-40-120 & 62024P-40-120, it is suggested to use the connection of Figure 3-32

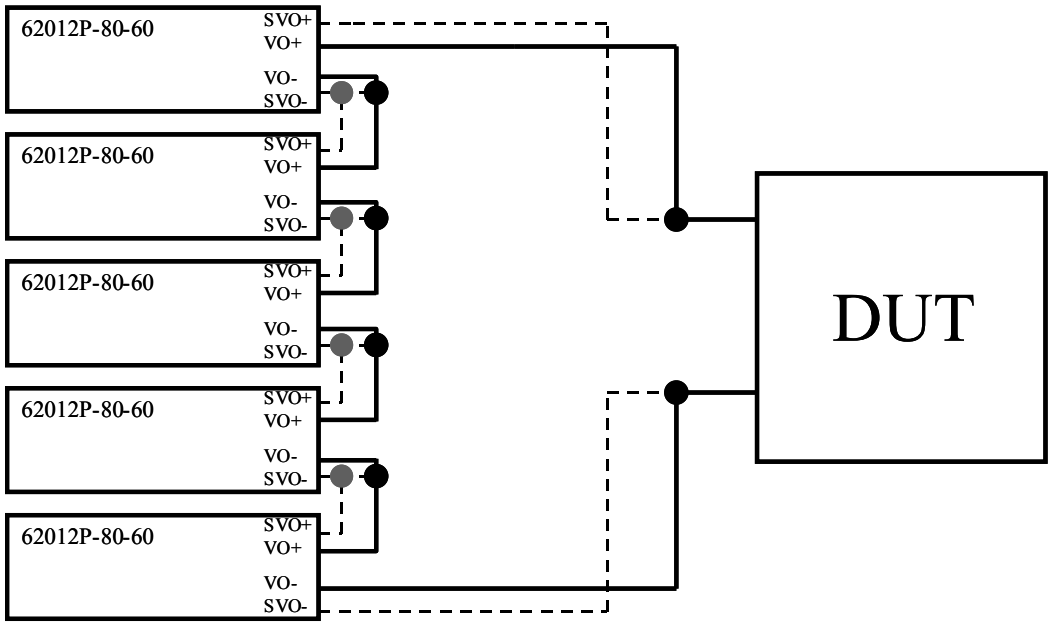


Figure 3-30

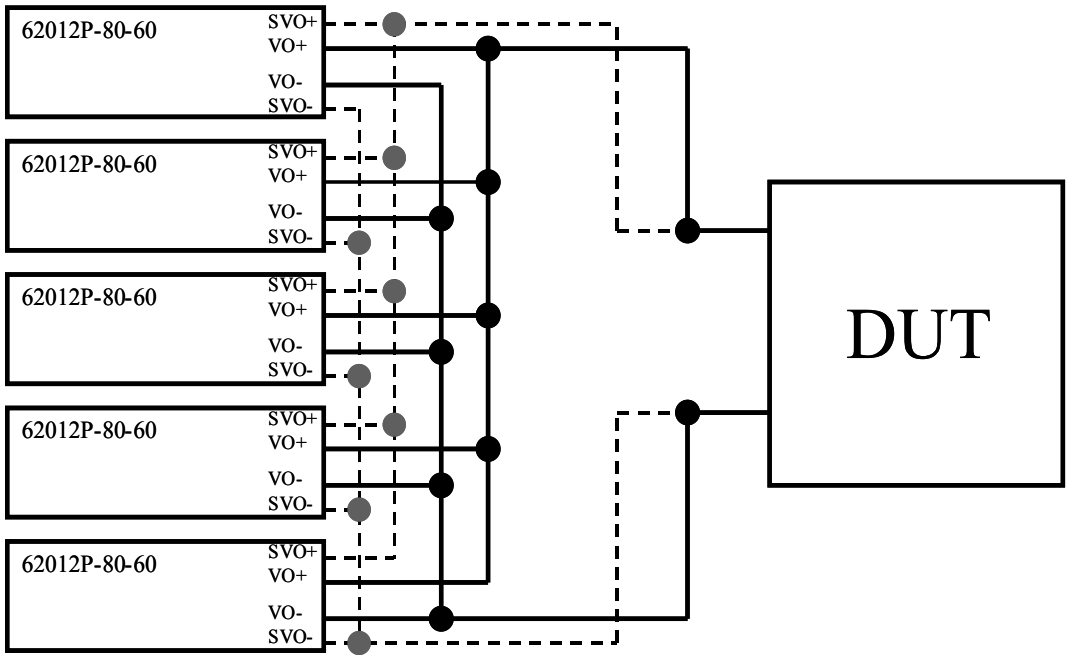


Figure 3-31

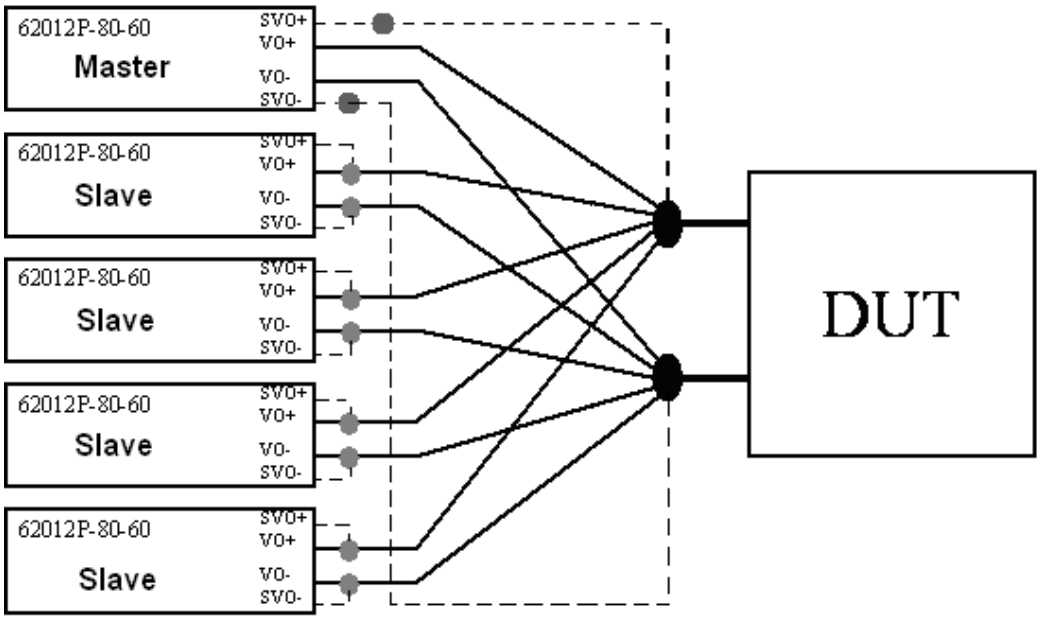


Figure 3-32

3.3.3.2 Assembling Series/Parallel Communication Interface

1. To operate the Power Supply in series, connect the RS-485 connectors on the rear panel as Figure 3-34 shows. If it is APG control, the PIN3, 4, 7, 9 & 20 of the green signal connector on the rear panel have to connect to the green connector of next device as Figure 3-34 shows.

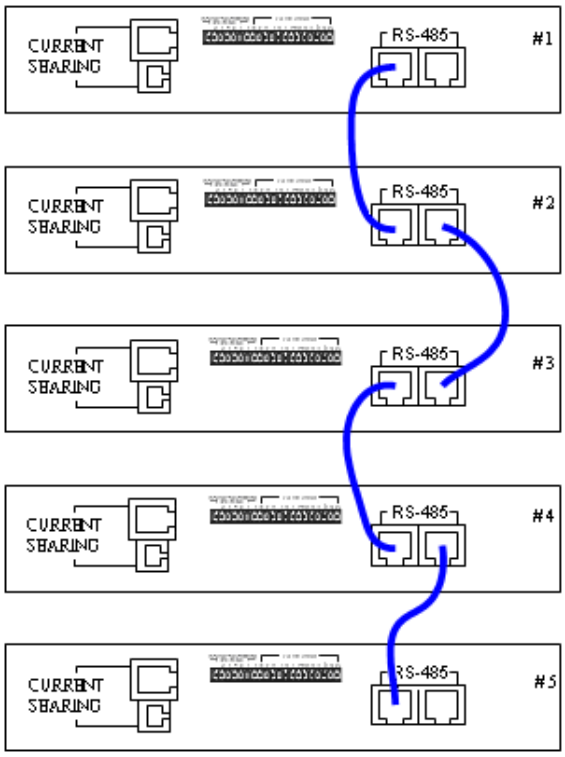


Figure 3-33

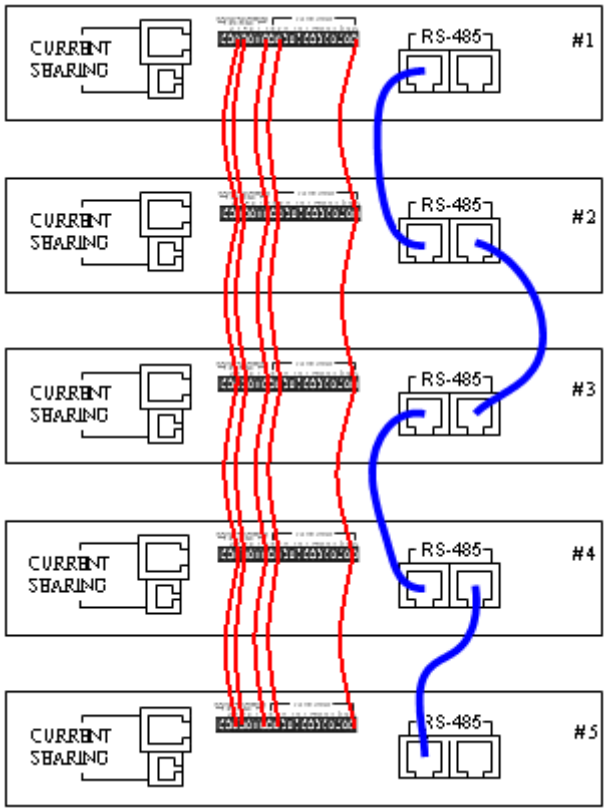


Figure 3-34

2. To operate the Power Supply in parallel, besides connecting the RS-485 connectors on the rear panel the CURRENT SHARING connector has to be connected as well as Figure 3-35 shows. If it is APG control, the PIN3, 4, 7, 9 & 20 of the green signal connector on the rear panel have to connect to the green connector of next device as Figure 3-36 shows.

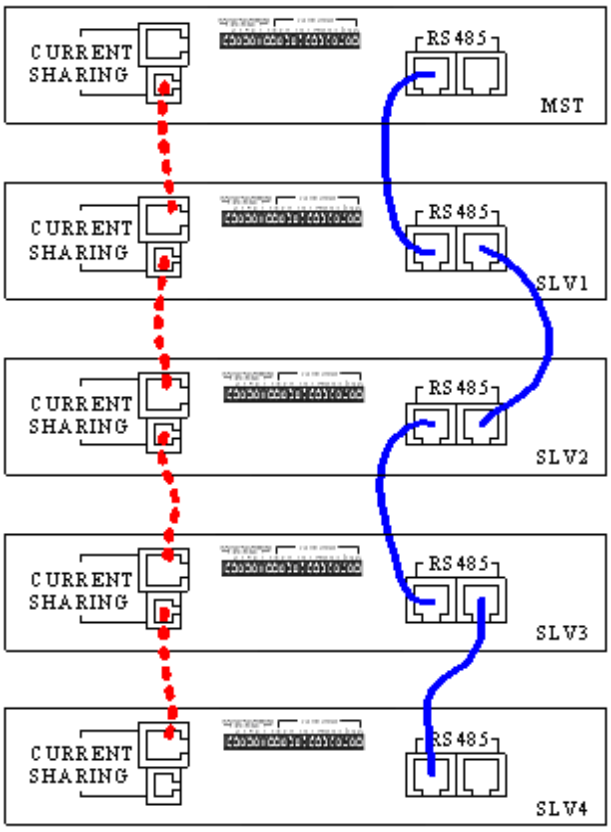


Figure 3-35

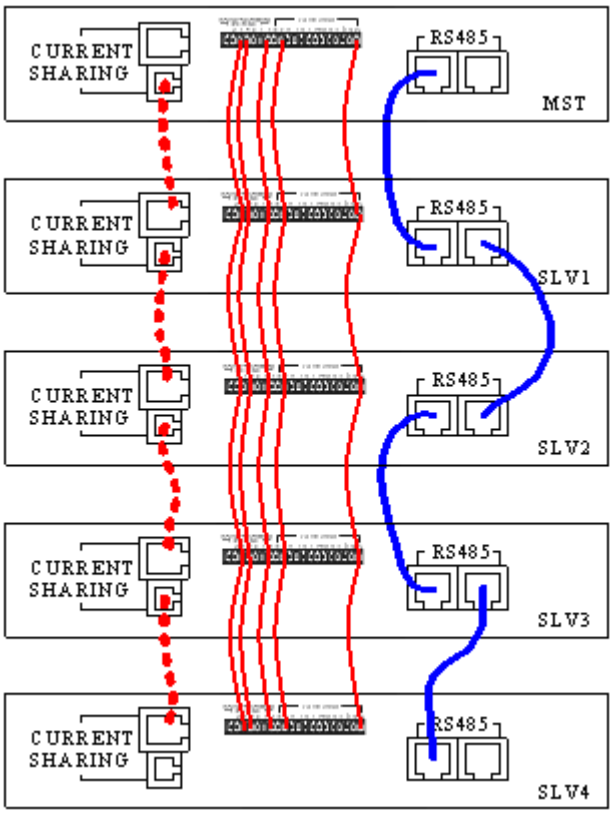
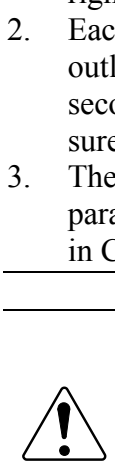


Figure 3-36

ⓘ 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 3-33 or Figure 3-35 shows in solid line.
2. Each DC Power Supply has two CURRENT SHARING connecting terminals in different outline. Connect the output terminal of the first Power Supply to the input terminal of the second Power Supply and so forth as Figure 3-35 and Figure 3-36 shown 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.



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. The DC Power Supply will detect if the CURRENT SHARING cable is connected. SERIES FAULT will occur as shown below when connected.

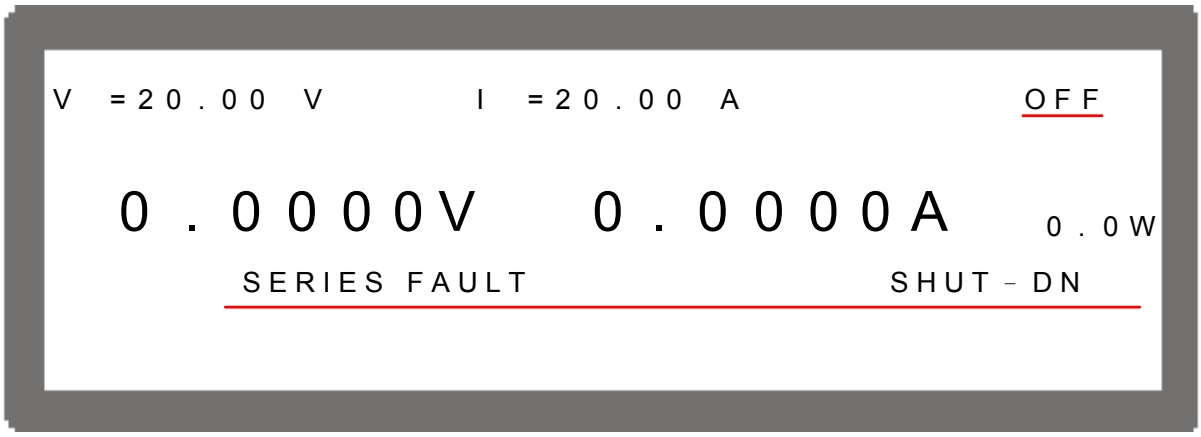


Figure 3-37

3.3.3.3 Setting Series/Parallel Operation Mode

3.3.3.3.1 Setting SLAVE

ⓘ NOTICE

1. It is necessary to set SLAVE first and MASTER last when operating 62000P Series DC Power Supply in series or parallel mode, or it may not be able to operate due communication error.
2. There are SLAVE1~ SLAVE4 available for setting starting from SLAVE1.

1. In Config Setup page, press "3" and "ENTER" to select PARALLEL /SERIES and display Figure 3-38.

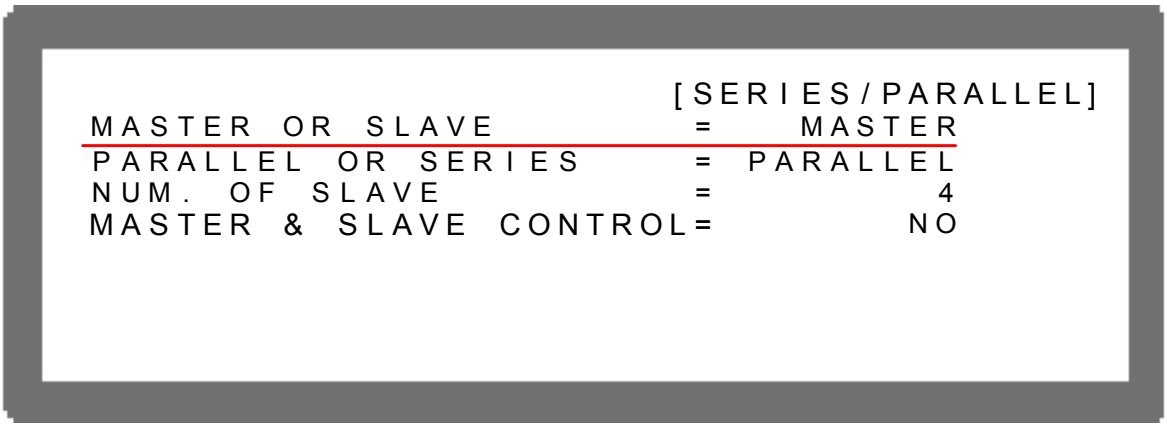


Figure 3-38

2. Use the numeric (1~4) keys or "Rotary" ( ) knob to set SLAVE1~SLAVE4 as Figure 3-39 shows.

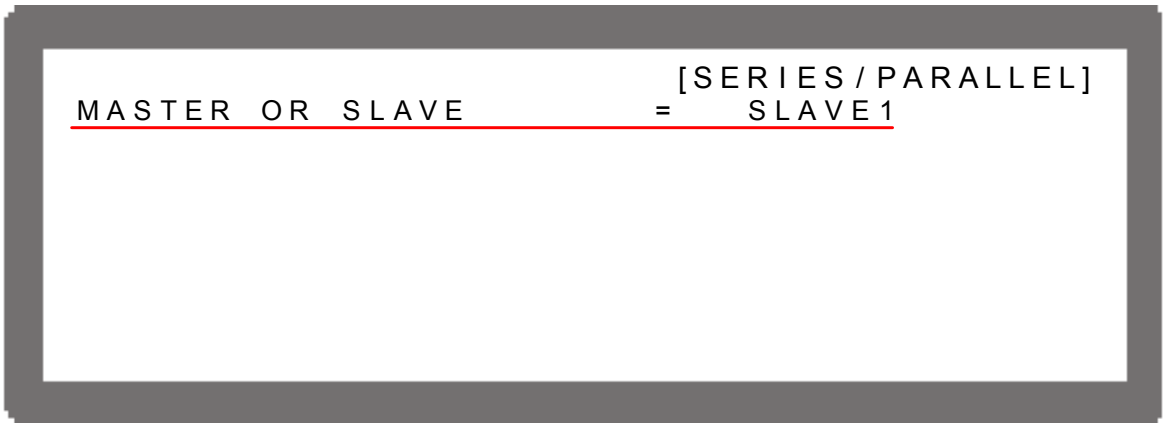


Figure 3-39

3. Press "ENTER" to confirm and press "EXIT" the MAIN PAGE will return to single unit.

3.3.3.3.2 Setting MASTER

If MASTER OR SLAVE is set to MASTER, a MASTER setup window will prompt for PARALLEL OR SERIES and NUM. OF SLAVE selections. See the description of PARALLEL OR SERIES in section 3.3.3.3.3 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 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 3-40 shows.

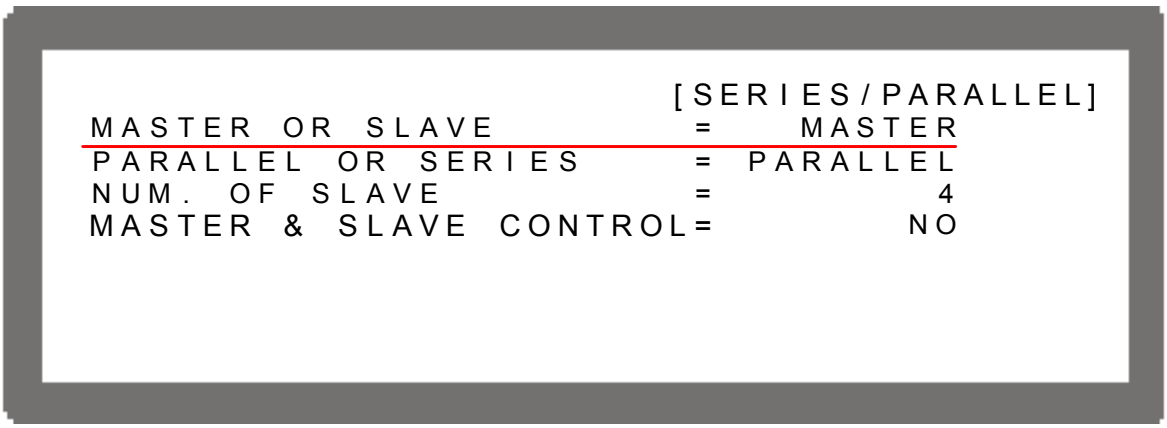


Figure 3-40

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 3-41 shows. There are two selections: PARALLEL and SERIES.

1. Use "←↑", "→↓" keys to move the cursor to the column to be set.

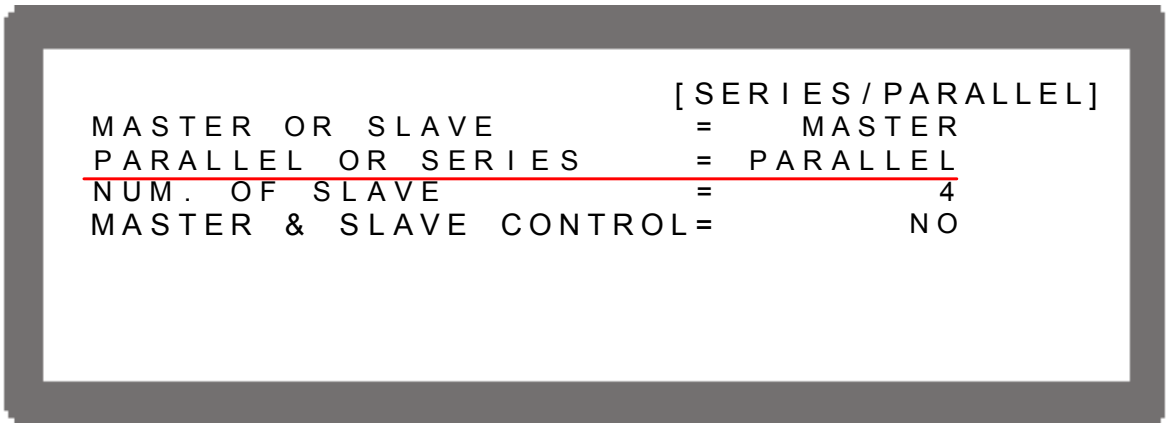


Figure 3-41

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

Connect the cables on the rear panel as Figure 3-33 and Figure 3-34 show when set to SERIES, and as Figure 3-35 and Figure 3-36 show on the rear panel when set to PARALLEL.

Select SERIES will prompt the following window and remind the user to disconnect the CURRENT SHARING cable on the rear panel.

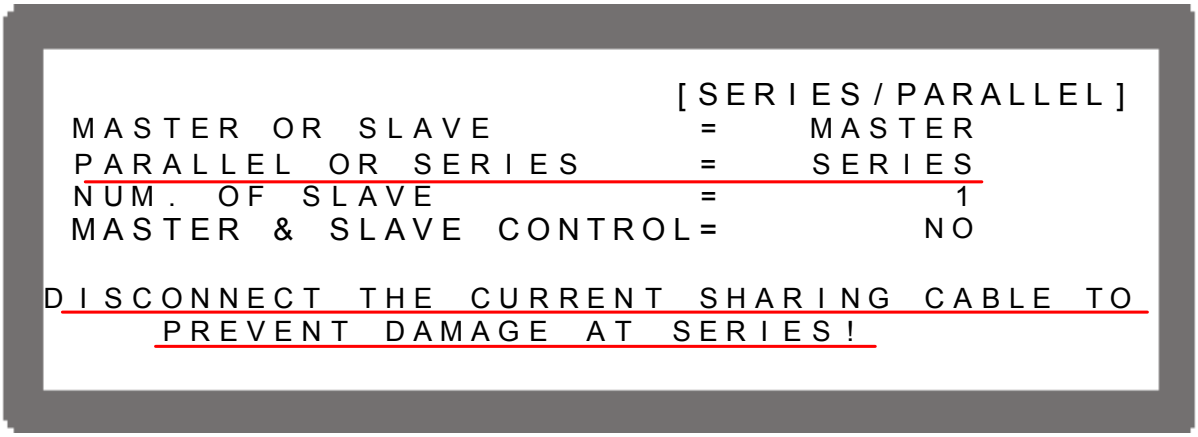


Figure 3-42

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

3.3.3.3.4 Setting NUM. OF SLAVE

Take example by 62012P-80-60, when the DC Power Supply is set to MASTER (see section 3.3.3.3.1), the controlled number, that is the SLAVE number, has be to be set. If the controlled sets are 4, then set NUM. OF SLAVE = 4 as shown below.

1. Use "←↑", "→↓" keys to move the cursor to the column to be set.
2. Use the numeric (0 ~4) keys or "Rotary" ( ) knob to set the number of SLAVE.

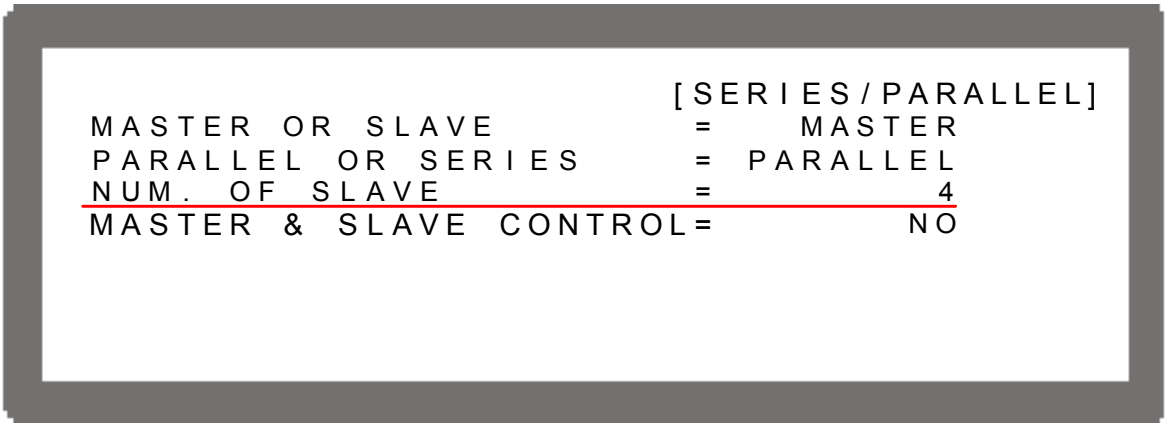


Figure 3-43

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

ⓘ NOTICE

Take example by 62012P-80-60:

1. If there are 5 sets connected in parallel and 80V/300A is set, the setting of each set is 80V/60A and the total output will be 80V/300A.
2. If there are 5 sets connected in series and 400V/60A is set, the setting of each set is 80V/60A and the total output will be 400V/60A.
3. The total sets for connecting 62012P-80-60 in series or parallel are 5; therefore, the maximum number of NUM. OF SLAVE is 4.

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.
2. Use the numeric (1) key or "Rotary" (◎) knob to set YES。

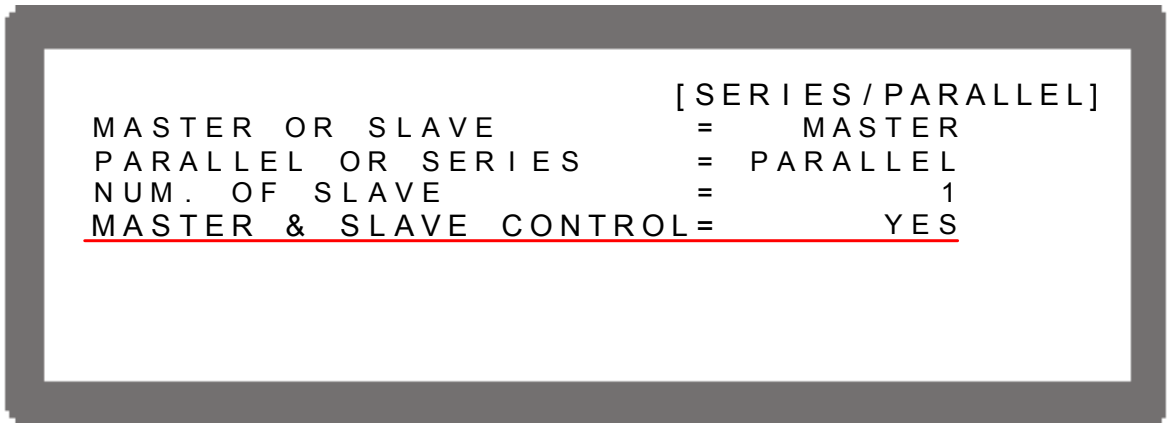


Figure 3-44

3. Press "ENTER" to confirm, it will skip to the series/parallel MASTER page automatically as Figure 3-45 shows.

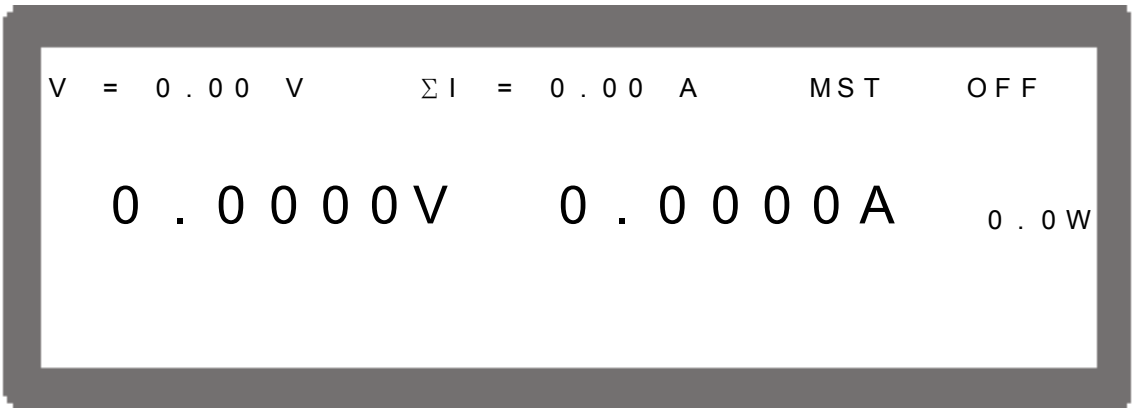


Figure 3-45

4. The SLAVE page will skip to Figure 3-46 automatically.

Figure 3-46

5. Start the series/parallel usage.

ⓘ NOTICE

1. 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 Figure 3-47. When this type of error occurs, exit the series/parallel operation first and then change the SLAVE setting to resume the operation.

Figure 3-47

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, (4) PROTECTION and (5)PROGRAM.

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 the figure shows below.

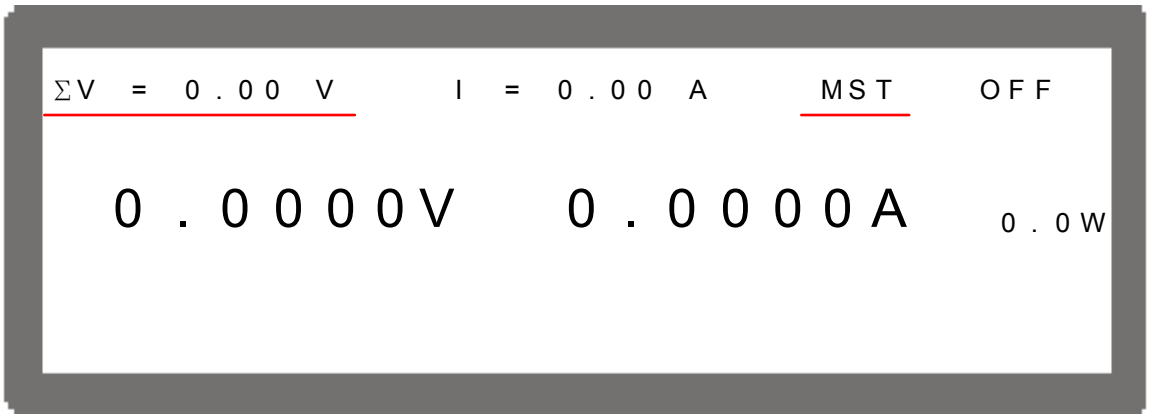


Figure 3-48

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 5 sets of 62012P-80-60 in series, the maximum output voltage can be set is 400V, and the maximum output current is 60A as shown below:

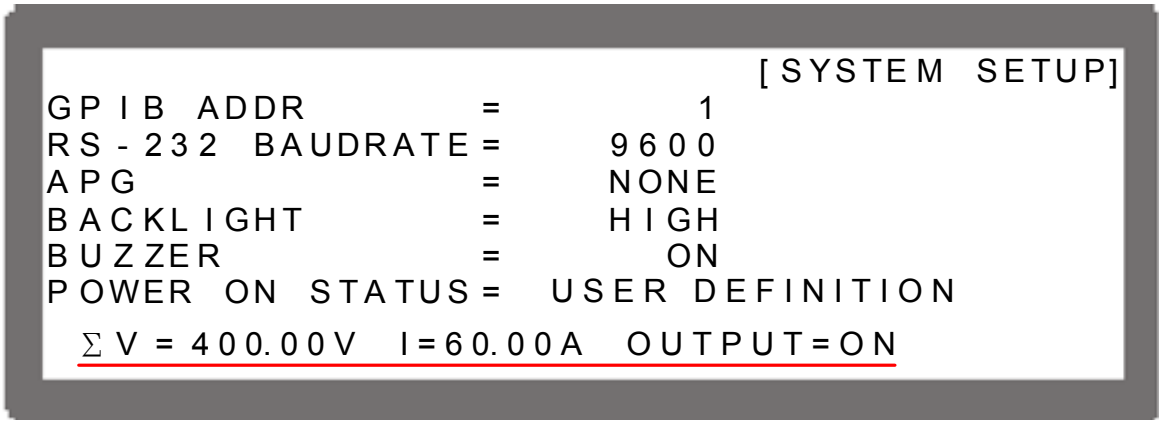


Figure 3-49

ⓘ 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 the figure shows below. Furthermore, the setting range of ΣV SLEW RATE will increase following the number connected in series too.

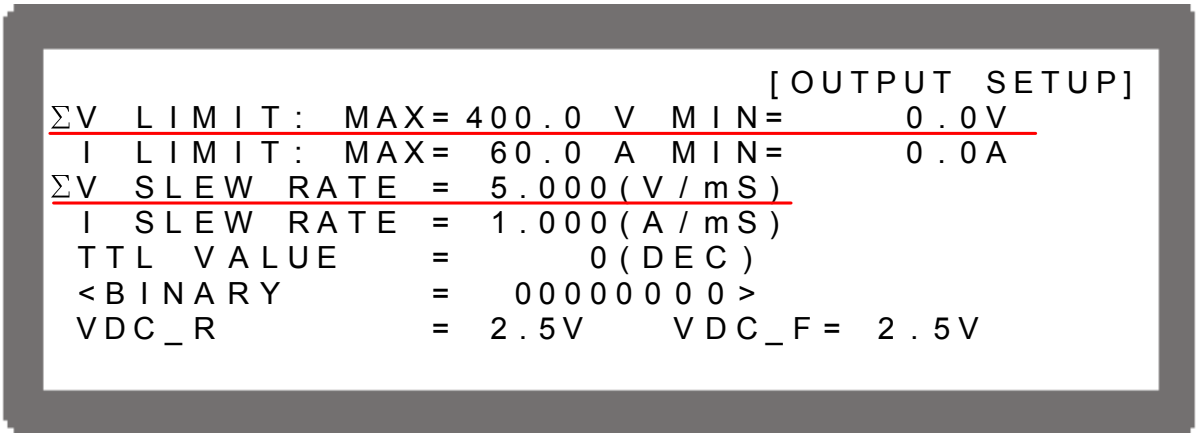


Figure 3-50

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 the figure shows below.

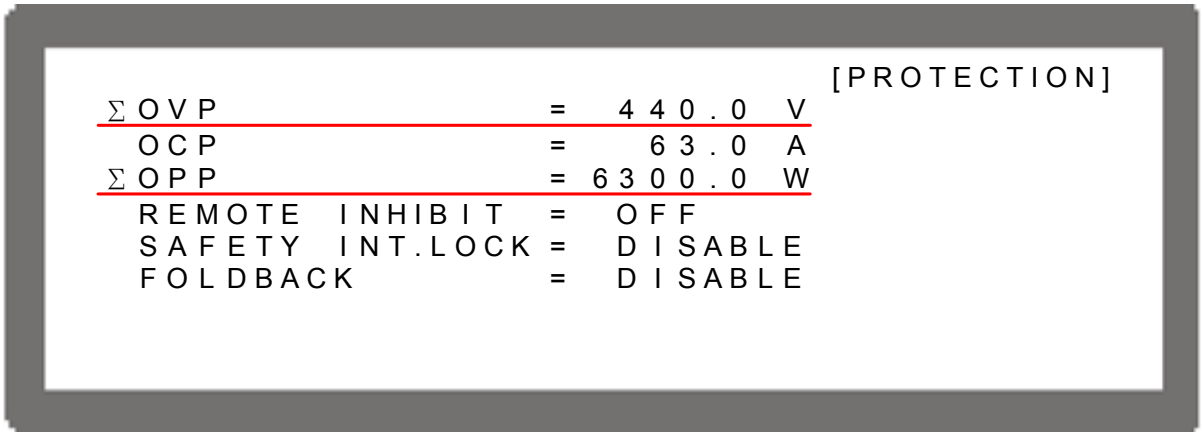


Figure 3-51

3.3.3.4.5 Setting PROGRAM for Series

The LIST MODE and V_STEP MODE in PROGRAM can also be applied for series operation. The operation of PROGRAM for series is the same as single unit, see Chapter 4 *Program Sequence*. LIST MODE is indicated by ΣVOLTAGE for easy identification and the [SEQUENCE] screen is shown as Figure 3-52. Moreover, the setting range of ΣV S. R. will increase following the number connected in series too. The start and end voltages of V_STEP MODE are indicated by ΣSTART_VOLTAGE and ΣEND_VOLTAGE as Figure 3-53 shows.

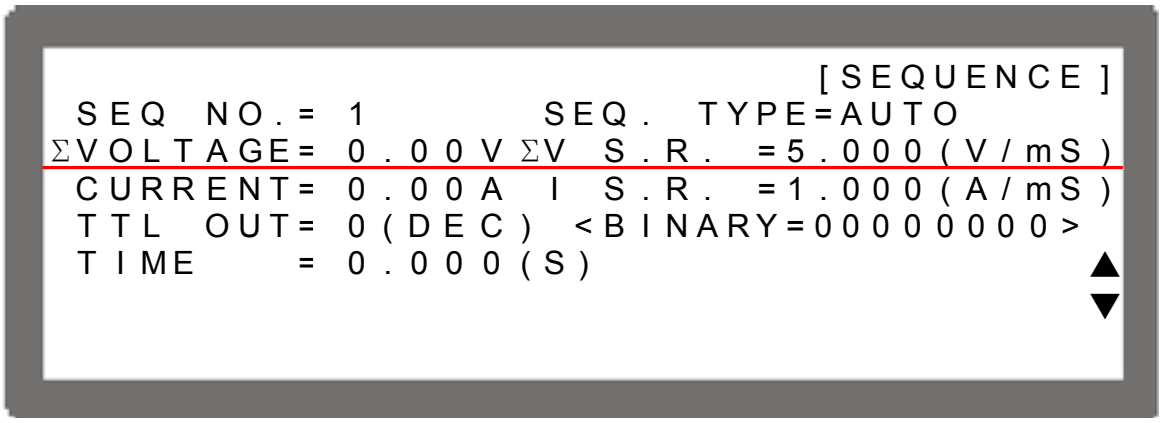


Figure 3-52

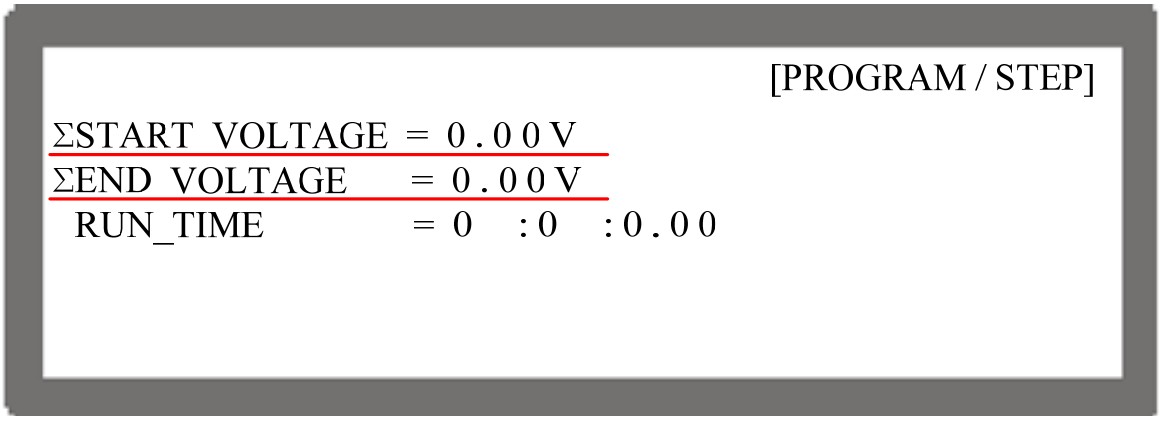


Figure 3-53

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, (3) OUTPUT SETUP, (4) PROTECTION and (5) PROGRAM.

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 the figure shows below.

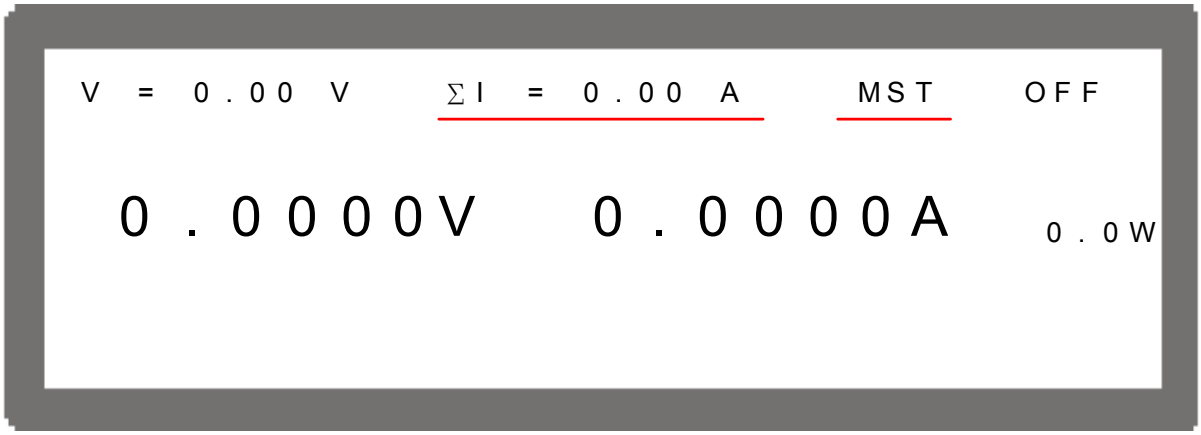


Figure 3-54

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 62012P-80-60 in parallel, the maximum output voltage can be set is 80V, and the maximum output current is 300A as shown below:

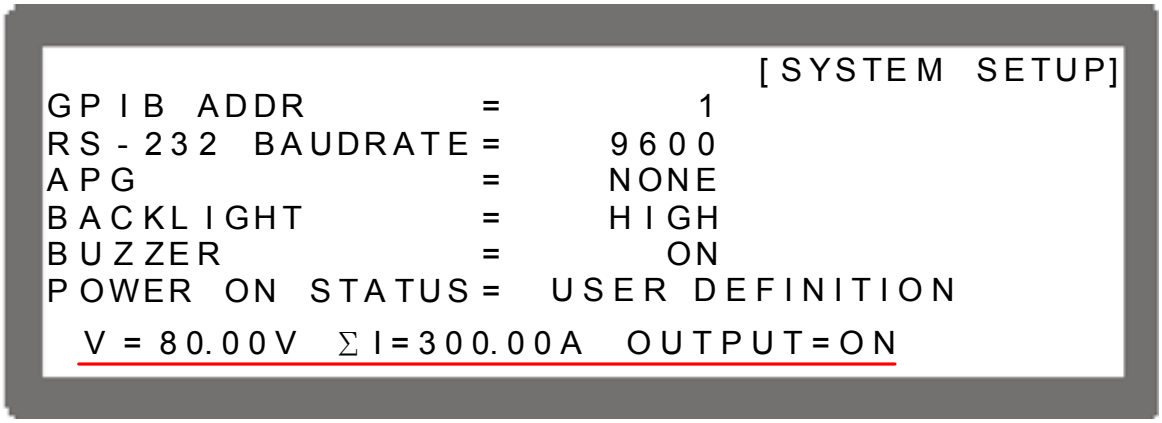


Figure 3-55

ⓘ 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 the figure shows below. Furthermore, the setting range of ΣI SLEW RATE will increase following the number connected in parallel too.

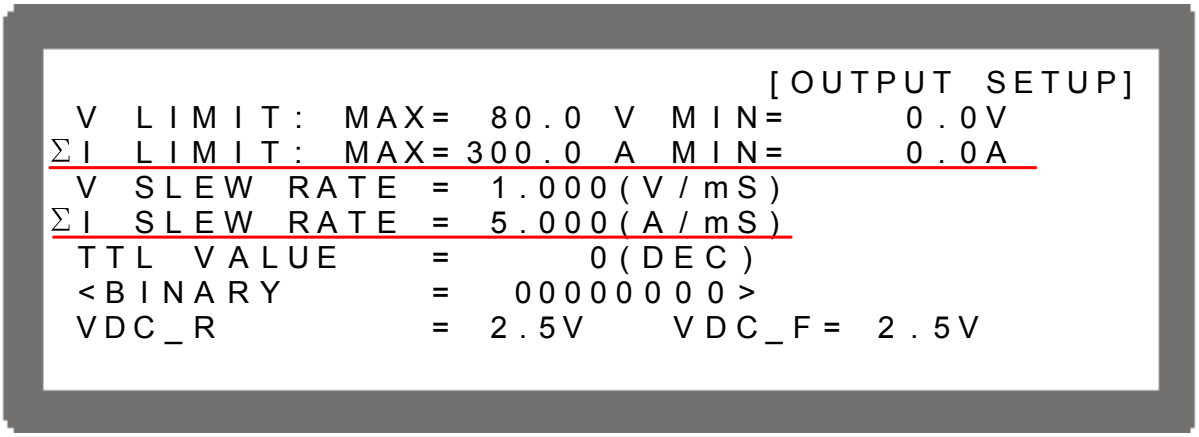


Figure 3-56

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 the figure shows below.

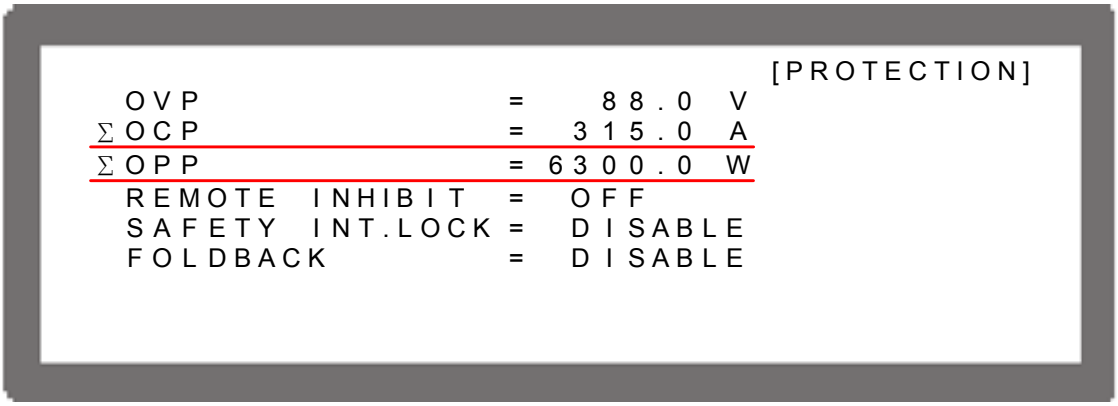


Figure 3-57

3.3.3.5.5 Setting PROGRAM for Parallel

The LIST MODE and V_STEP MODE in PROGRAM can also be applied for parallel operation. The operation of PROGRAM for parallel is the same as single unit, see Chapter 4 *Program Sequence*. LIST MODE is indicated by ΣCURRENT for easy identification and the [SEQUENCE] screen is shown as Figure 3-58. Moreover, the setting range of ΣI S. R. will increase following the number connected in series too. V_STEP MODE has no current setting so the screen is the same as the single Power Supply as Figure 3-59 shows.

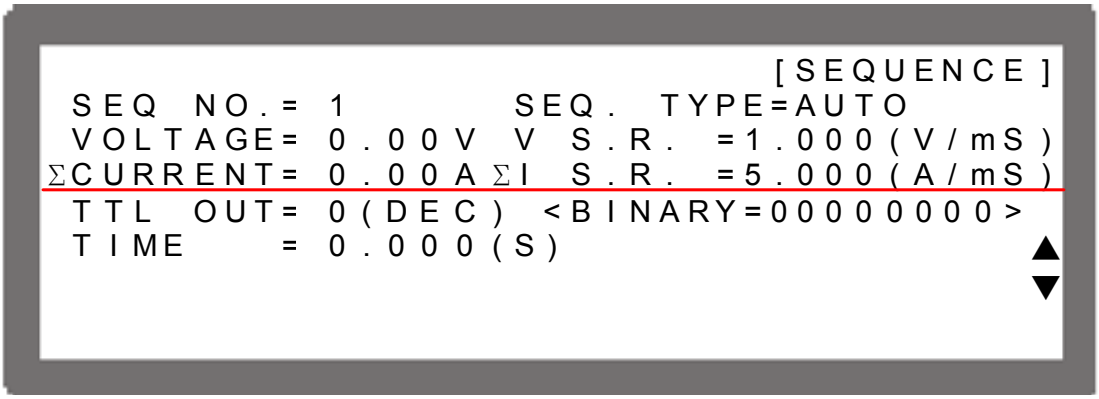


Figure 3-58

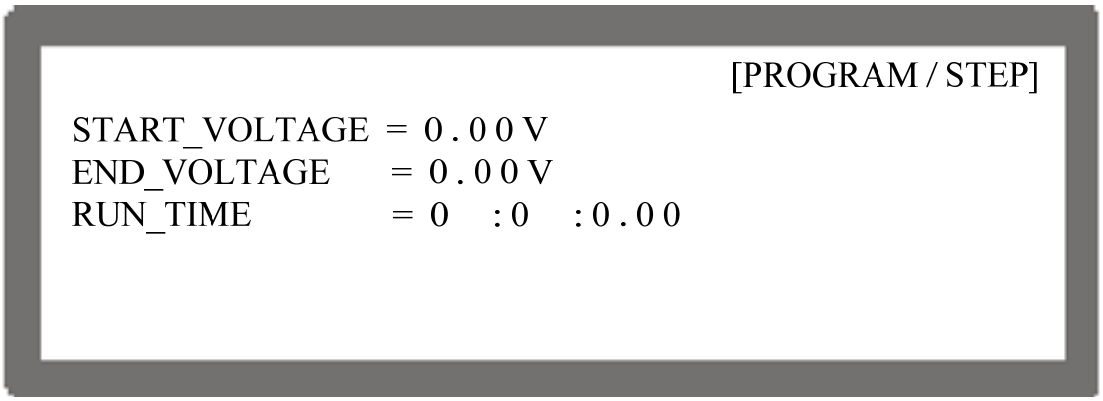


Figure 3-59

3.3.3.6 Setting Procedure for APG in Series or Parallel

Operation in series and parallel can also be applied via APG. See section 3.3.1.3 and 3.3.3.1 to 3.3.3.6 for detail information.

3.3.3.6.1 Series Setting

To connect 5 62012P-80-60 DC Power Supplies in series for operation and set the APG option to APG = V &I and Vref(V) = 5, the MAIN PAGE of MASTER will show as Figure 3-60.

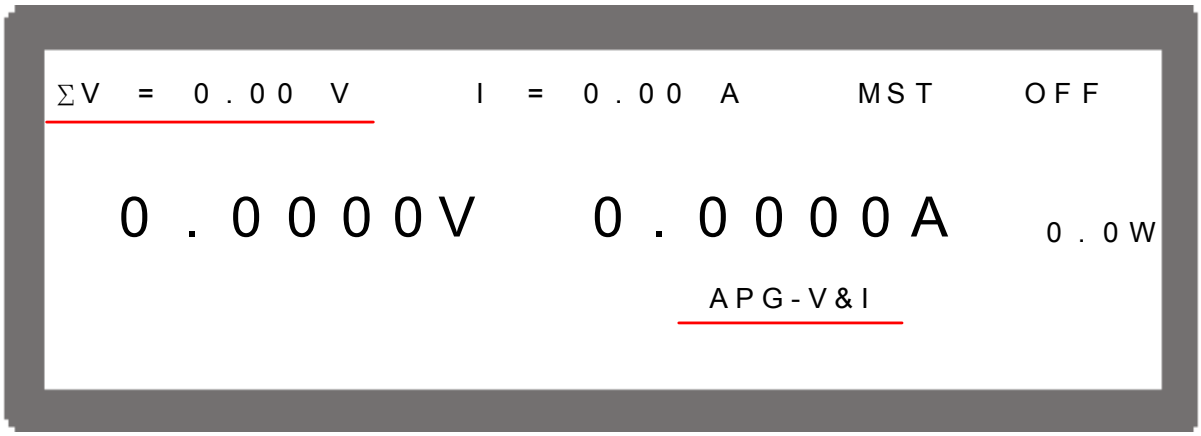


Figure 3-60

As to the APG voltage setting (AVO_SET), the inputted analog voltage 0~5V maps to the actual output 0~400V; and for APG current setting (AIO_SET), the inputted analog voltage 0~5V maps to the actual output 0~60A as Figure 3-61(a) shows. Set the APG option to APG = V &I and Vref(V) = 10 means the inputted analog voltage 0~10V maps to the actual output 0~400V for APG voltage (AVO_SET) also maps to the actual output 0~60A for APG current (AIO_SET) as Figure 3-61(b) shows. The inputted analog voltage (0~5Vor 0~10V) for the above voltage/current setting has to be entered respectively for the devices in series to obtain the effect of serial operation in APG mode.

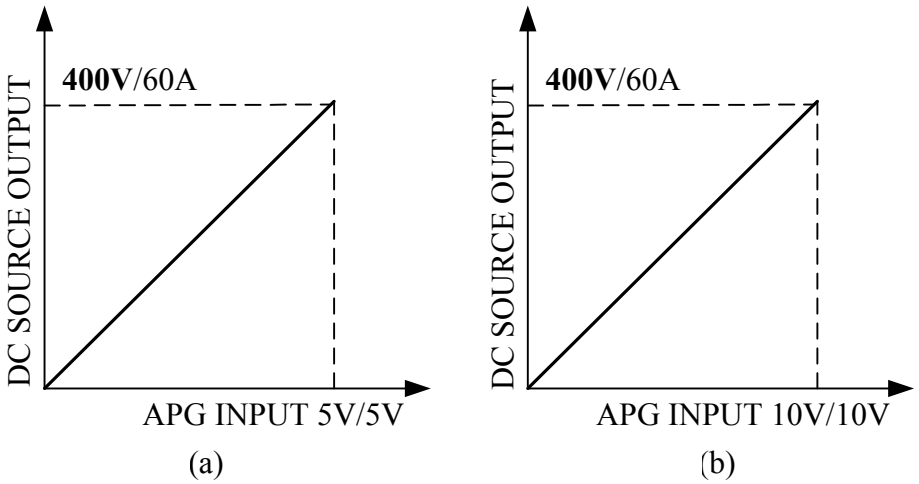


Figure 3-61

For APG voltage measurement (AVO_MEAS), the devices in series will output analog voltage 0~5 V respectively and add the total output of 5 sets 62012P-80-60 would get 0~25 V analog voltage that maps to the actual output voltage 0~400 V. For APG current measurement (AIO_MEAS), the devices output analog voltage 0~5 V respectively and the added total is 0~25 V analog voltage that maps to the actual output current 0~60 A as Figure 3-62(a) shows. Set the APG option to APG = V &I and Vref(V) = 10 means the devices in series will output analog voltage 0~10 V respectively for APG voltage measurement (AVO_MEAS); therefore, add the total output of 5 sets 62012P-80-60 analog voltage would get 0~50 V analog voltage that maps to the actual output voltage 0~400 V. As for APG current measurement (AIO_MEAS), the devices output analog voltage 0~10 V respectively and the added total is 0~50 V analog voltage that maps to the actual output current 0~60 A as Figure 3-62(b) shows.

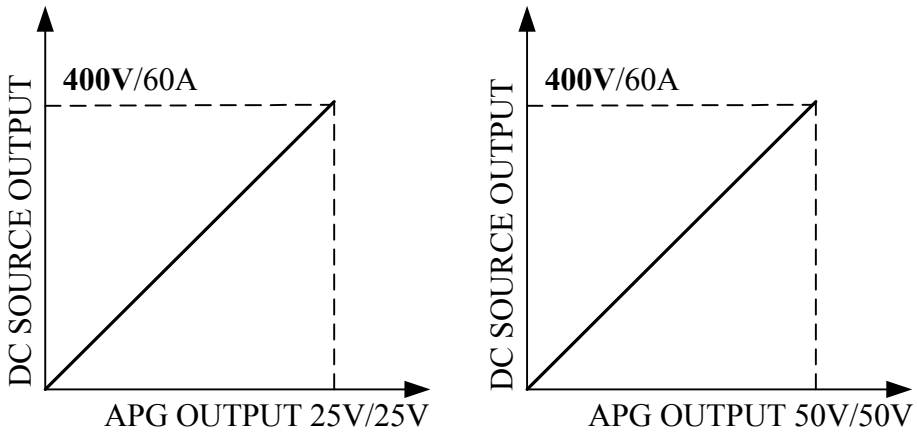


Figure 3-62

3.3.3.6.2 Parallel Setting

To connect 5 62012P-80-60 DC Power Supplies in parallel for operation and set the APG option to APG = V &I and Vref(V) = 5, the MAIN PAGE of MASTER will show as Figure 3-63.

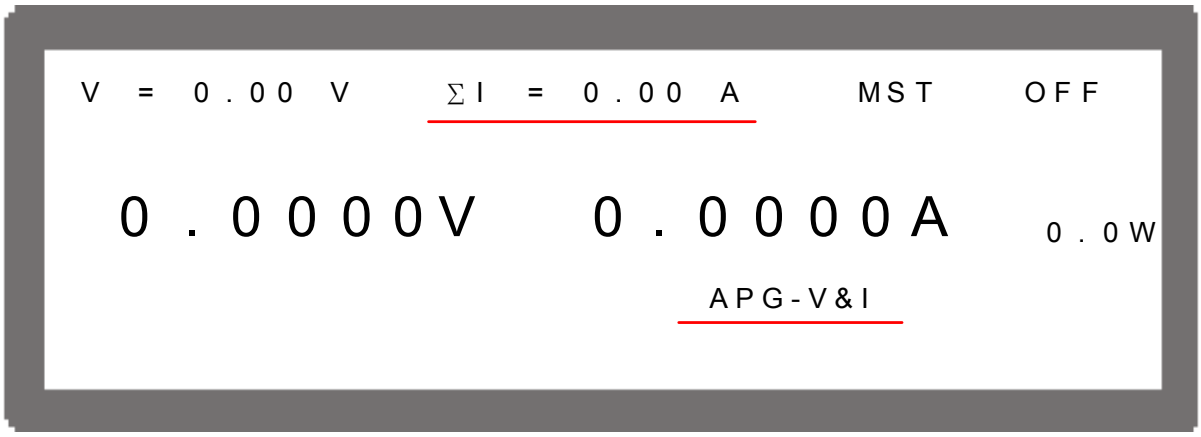


Figure 3-63

As to the APG voltage setting (AVO_SET), the inputted analog voltage 0~5 V maps to the actual output 0~80 V; and for APG current setting (AIO_SET), the inputted analog voltage 0~5 V maps to the actual output 0~300 A as Figure 3-64(a) shows. Set the APG option to APG = V &I and Vref(V) = 10 means the inputted analog voltage 0~10 V maps to the actual output 0~80 V for APG voltage (AVO_SET) also maps to the actual output 0~300 A for APG current (AIO_SET) as Figure 3-64(b) shows. The inputted analog voltage (0~5Vor 0~10V) for the above voltage/current setting has to be entered respectively for the devices in parallel to obtain the effect of parallel operation in APG mode.

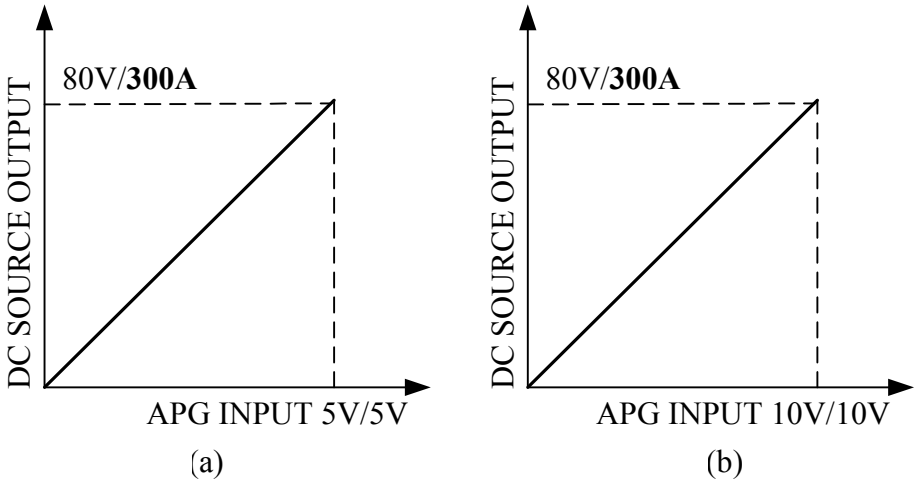


Figure 3-64

For APG voltage measurement (AVO_MEAS), the devices in parallel will output analog voltage 0~5 V respectively and add the total output of 5 sets 62012P-80-60 would get 0~25 V analog voltage that maps to the actual output voltage 0~80 V. For APG current measurement (AIO_MEAS), the devices output analog voltage 0~5 V respectively and the added total is 0~25 V analog voltage that maps to the actual output current 0~300 A as Figure 3-65(a) shows. Set the APG option to APG = V &I and Vref(V) = 10 means the devices in series will output analog voltage 0~10 V respectively for APG voltage measurement (AVO_MEAS); therefore, add the total output of 5 sets 62012P-80-60 analog voltage would get 0~50 V analog voltage that maps to the actual output voltage 0~80 V. As for APG current measurement (AIO_MEAS), the devices output analog voltage 0~10 V respectively and the add-up total is 0~50 V analog voltage that maps to the actual output current 0~300A as Figure 3-65(b) shows.

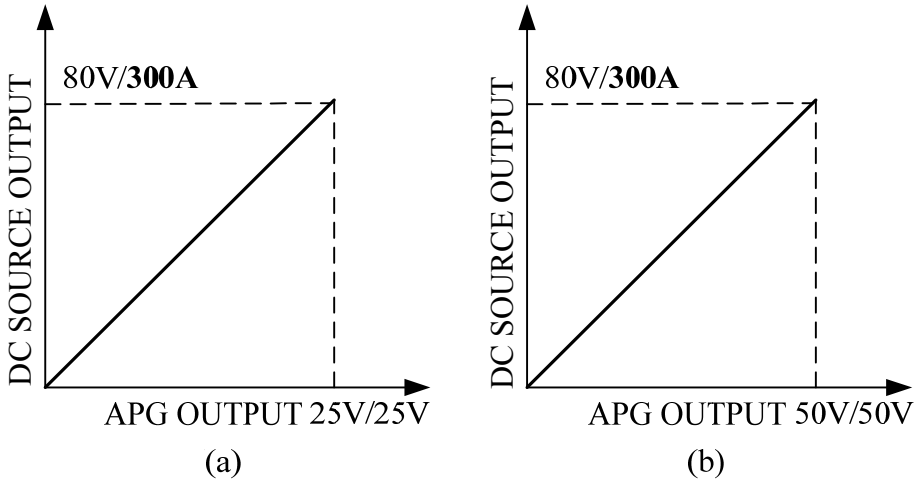


Figure 3-65

ⓘ NOTICE

For example, to connect 5 sets of 62012P-80-60 in series or parallel, the fixture circuit in Figure 3-66 can be referenced if expecting the relationship of APG total voltage/current measurements mapping to the actual output voltage/current is as Figure 3-67 shows.

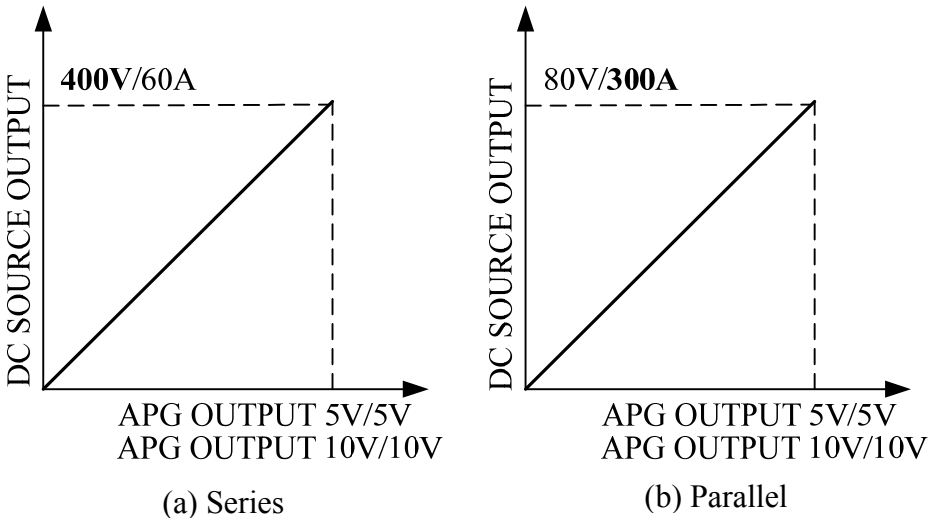


Figure 3-66

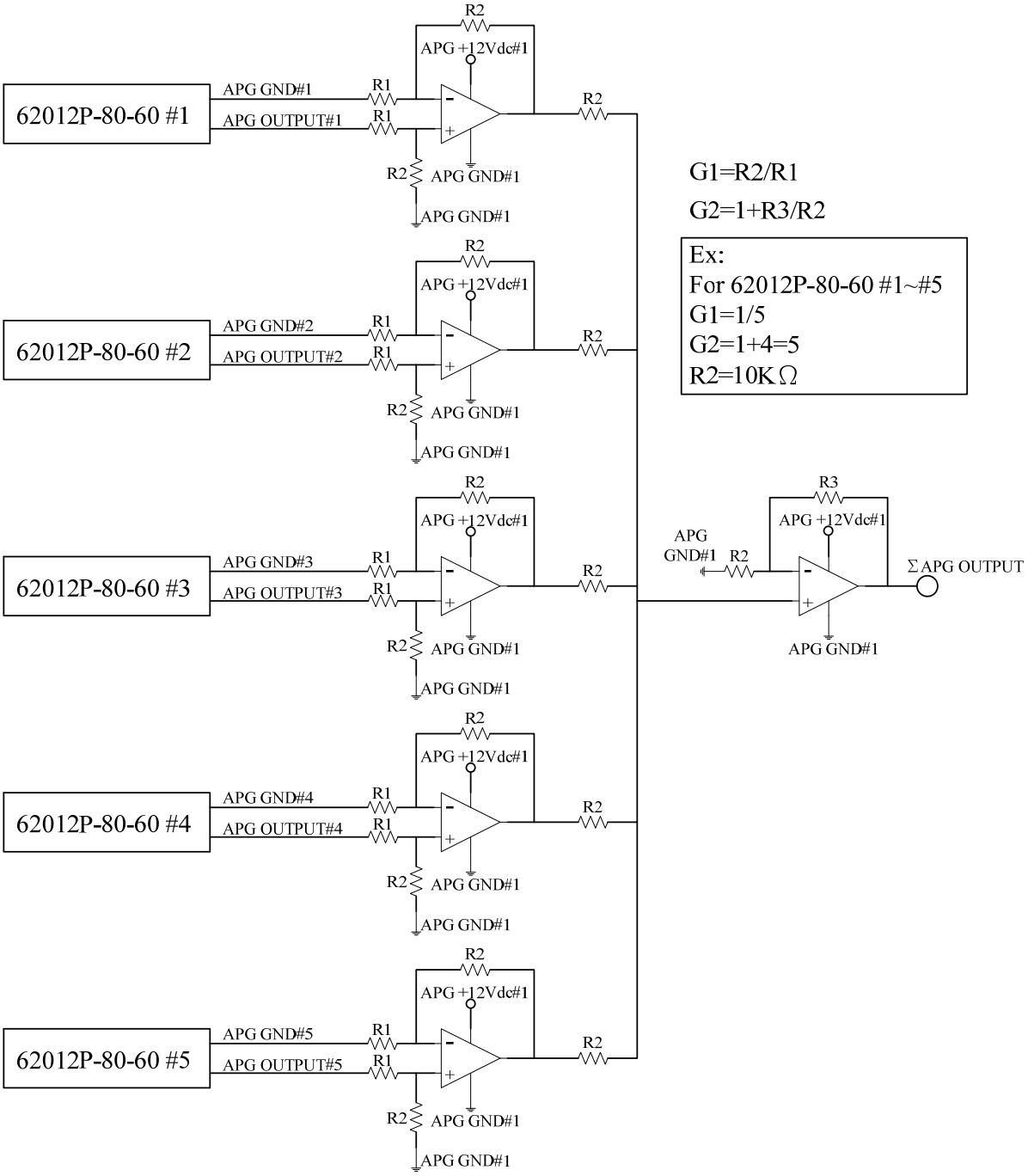


Figure 3-67

3.3.4 DISPLAY

DISPLAY setting has two options: (1) DISPLAY SELECTION and (2) READING AVERAGE TIMES.

3.3.4.1 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 five options available for displaying on MAIN PAGE: (1) NONE, (2) V/I LIMIT, (3) V/I/P PROTECT, (4) V/I SLEWRATE, (5) TTL VALUE. The system default is NONE.

1. In Config setting page, press "4" to display the screen.
2. Press "ENTER" to enter into DISPLAY SELECTION as Figure 3-68 shows.
3. Use the numeric (0~9) keys or "Rotary" ( ) knob to select the desired setting.

3.3.4.1.1 NONE

When this selection is set to NONE, the last line of MAIN PAGE will not show any message.

1. Use " ", " " keys to move the cursor to the column to be set as Figure 3-68 shows.
2. Press "ENTER" to confirm it.
3. Press "EXIT" to return to MAIN PAGE.

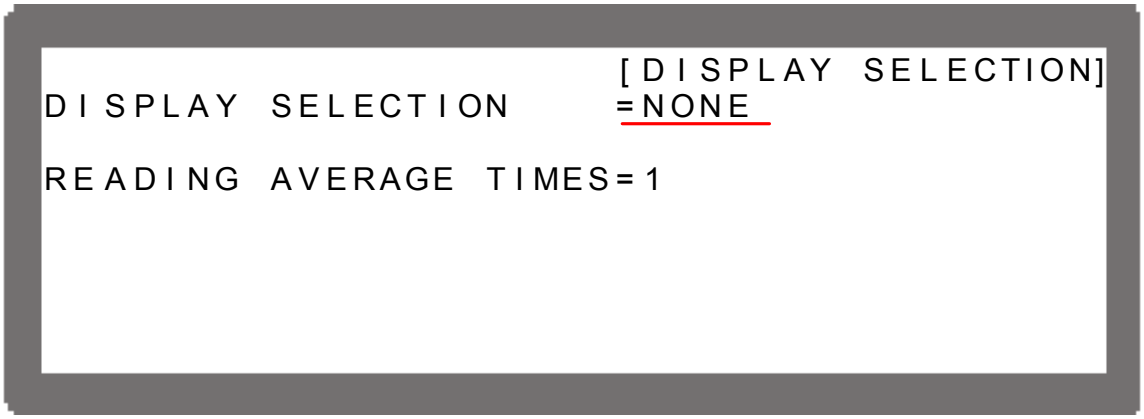


Figure 3-68

3.3.4.1.2 V/I LIMIT

When it is set to V/I LIMIT the last line on MAIN PAGE will show the set range of V LIMIT and I LIMIT in OUTPUT SETUP. See section 3.3.2.1 and 3.3.2.2 for detail information. The MAIN PAGE will show as below when the setting is completed.

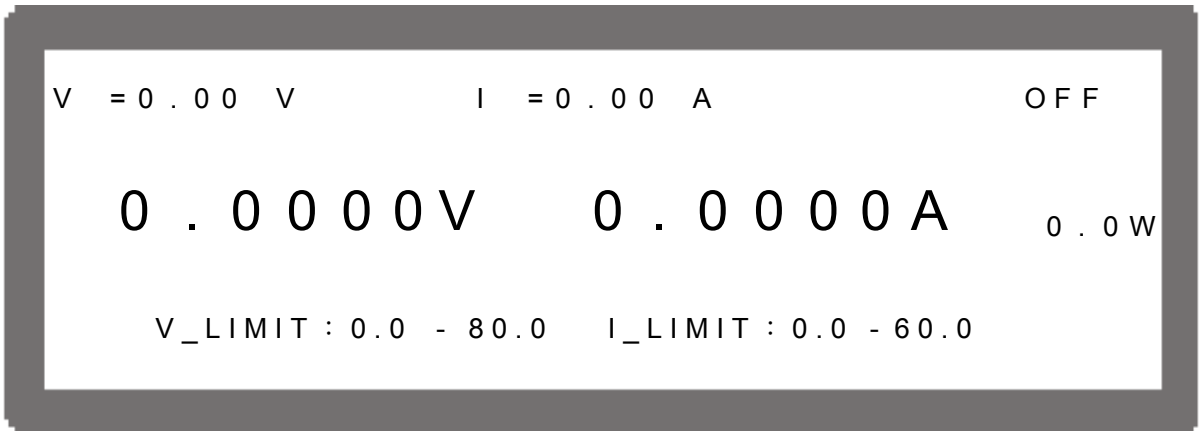


Figure 3-69

3.3.4.1.3 V/I/P PROTECT

When it is set to V/I /P PROTECT the last line on MAIN PAGE will show the OVP, OCP and OPP settings in PROTECTION. See section 3.3.5.1 to 3.3.5.3 for detail information.

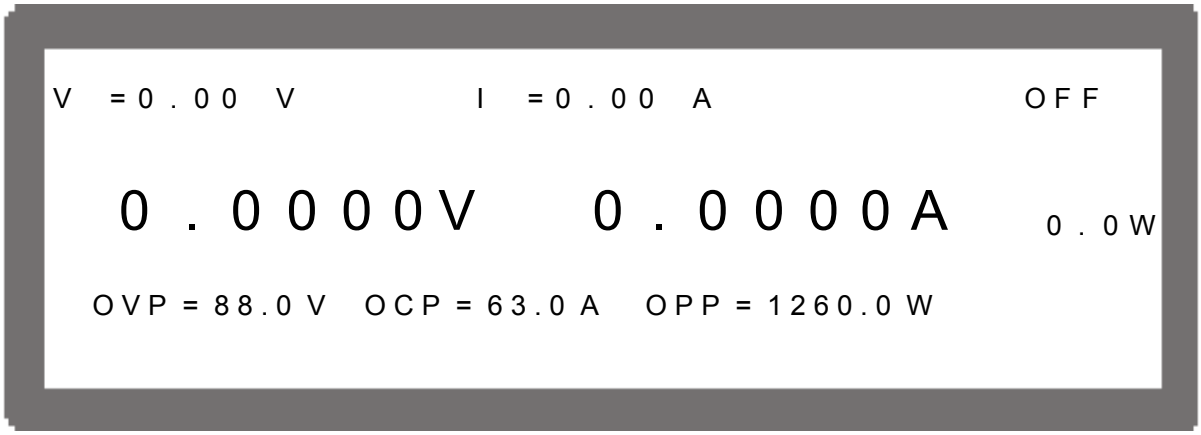


Figure 3-70

3.3.4.1.4 V/I SLEW RATE

When it is set to V/I SLEW RATE the last line on MAIN PAGE will show the V SLEWRATE and I SLEWRATE settings in OUTPUT SETUP. See section 3.3.2.3 and 3.3.2.4 for detail information.

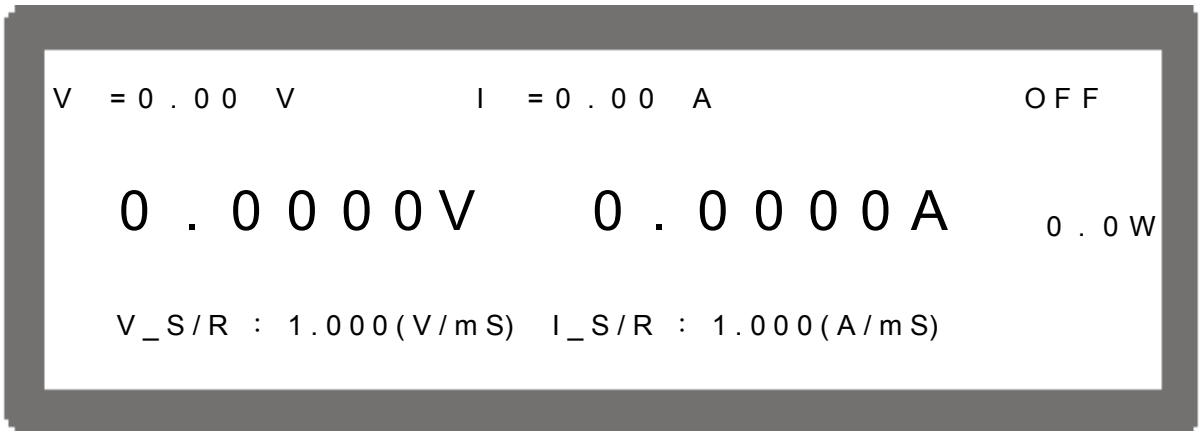


Figure 3-71

3.3.4.1.5 TTL VALUE

When it is set to TTL VALUE the last line on MAIN PAGE will show the TTL VALUE settings in OUTPUT SETUP. See section 3.3.2.5 for detail information.

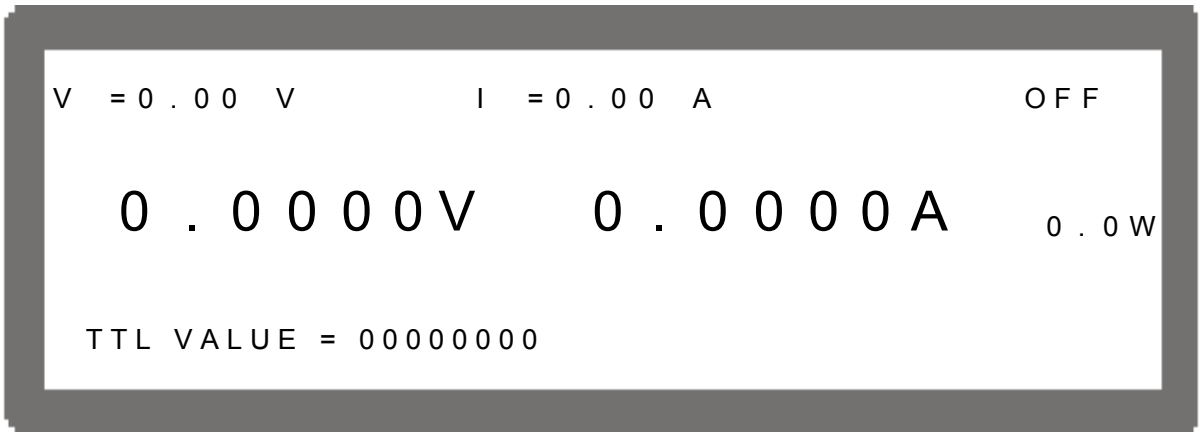


Figure 3-72

3.3.4.2 READING AVERAGE TIMES

The voltage and current readings displayed on the MAIN PAGE are five and half digits, and the option READING AVERAGE TIMES is able to set the average times for voltage and current readings. The bigger the average times are set, the slower the voltage and current are updated. The default setting is 1 as Figure 3-73 shows.

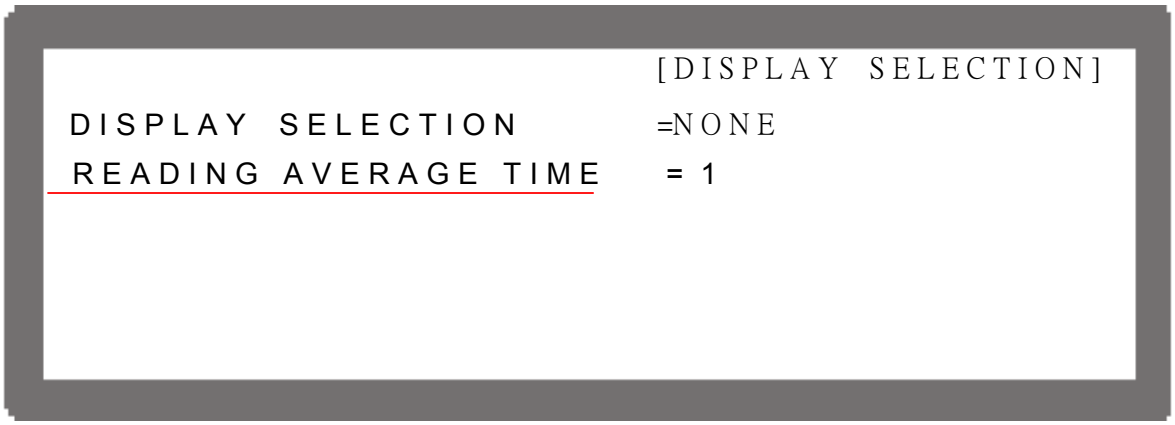


Figure 3-73

READING AVERAGE TIMES can be set to 1, 2, 4 and 8.

ⓘ NOTICE

1. The reading is averaged by ROLLING; therefore, when the actual output is changed dramatically and the average times are larger than 1, the displayed reading will reach for the actual output based on the average times gradually.
2. The panel reading is updated in the rate of 200mS.

3.3.5 PROTECTION

Chroma 62000P 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 it:

1. In Config Setup page, press "5" to show Figure 3-74.

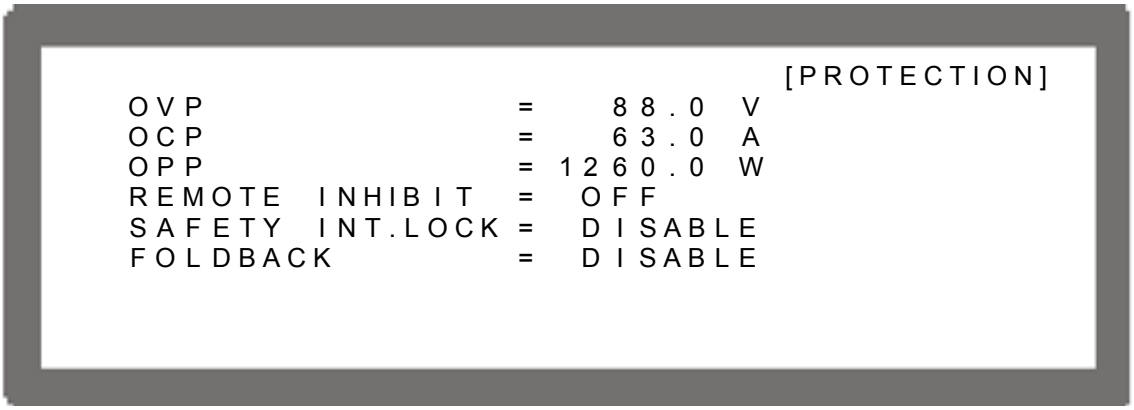


Figure 3-74

2. Press "ENTER" to enter into PROTECTION option.

NOTICE

1. When in the option page, use "←↑", "→↓" keys to move the cursor to the column to be set.
2. The value in Figure 3-74 is the default of 62012P-80-60.

3.3.5.1 OVP Protection

1. Use "←↑", "→↓" keys to move the cursor to the column to be set as Figure 3-75 shows.

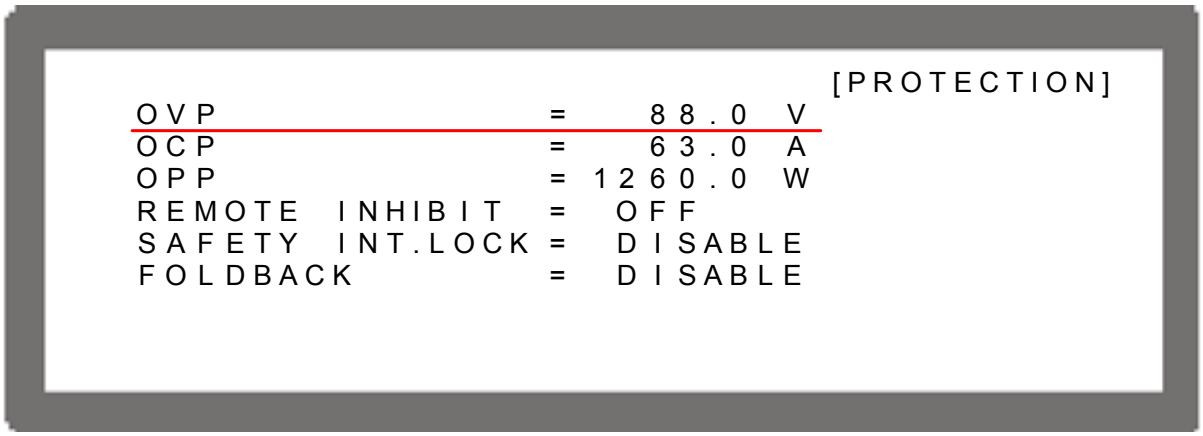


Figure 3-75

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 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

1. The table below is the voltage range of OVP.

Model	Min. OVP (V)	Max. OVP (V)
62000P-xx-xx	0	1.10 x Vo_MAX

Table 3-4 OVP Range

When OVP occurs the main page will prompt a protection message as shown below:

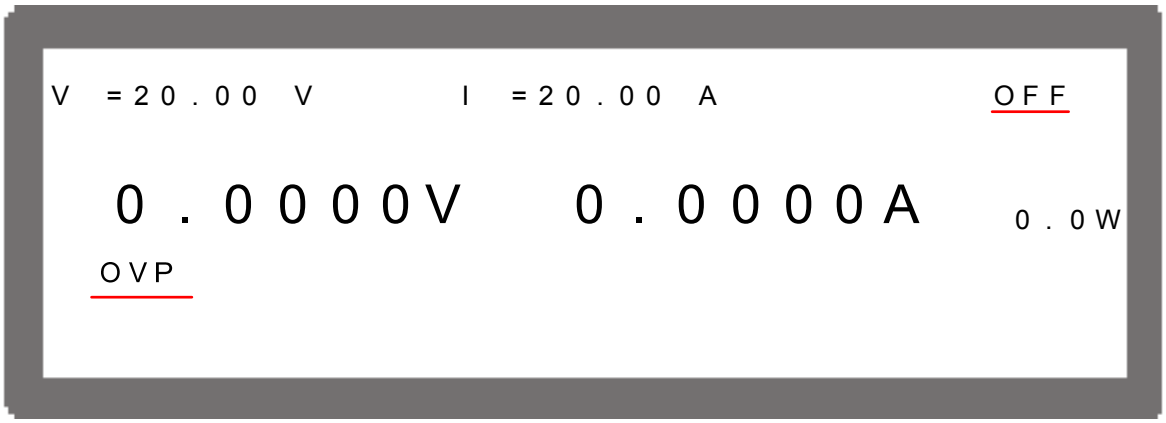


Figure 3-76

3.3.5.2 OCP Protection

1. Use "↑", "↓" keys to move the cursor to the column to be set as Figure 3-77 shows.

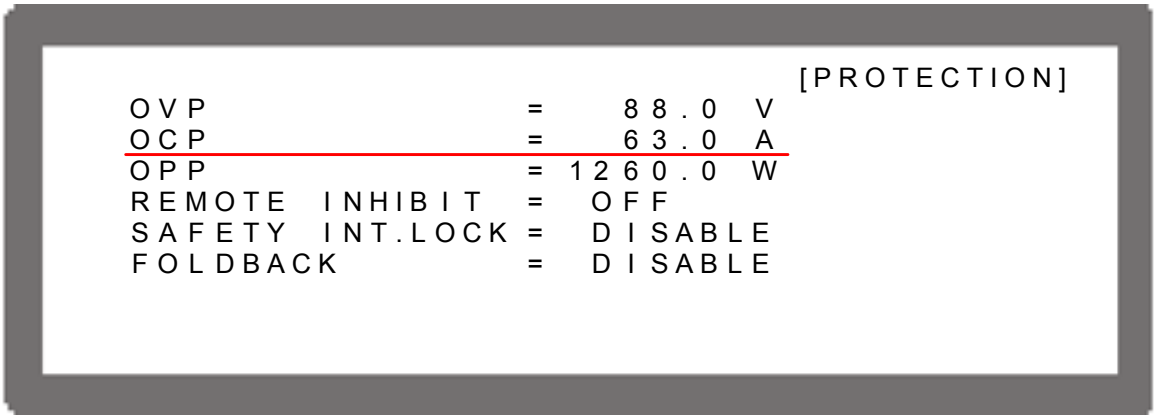


Figure 3-77

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 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

1. The table below is the current range of OCP.

Model	Min. OCP (A)	Max. OCP (A)
62000P-xx-xx	0	1.05 x Io_MAX

Table 3-5 OCP Range

When OCP occurs the main page will prompt a protection message as shown below:

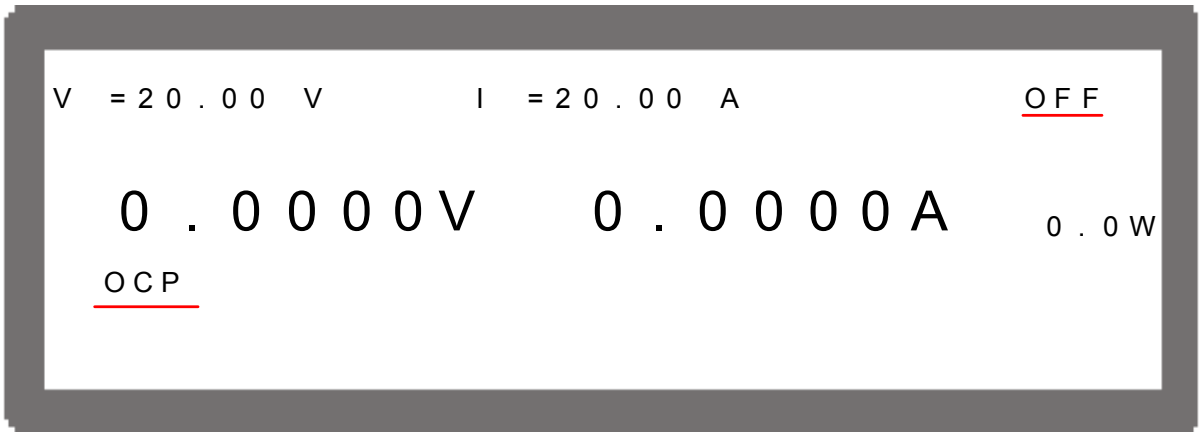


Figure 3-78

3.3.5.3 OPP Protection

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

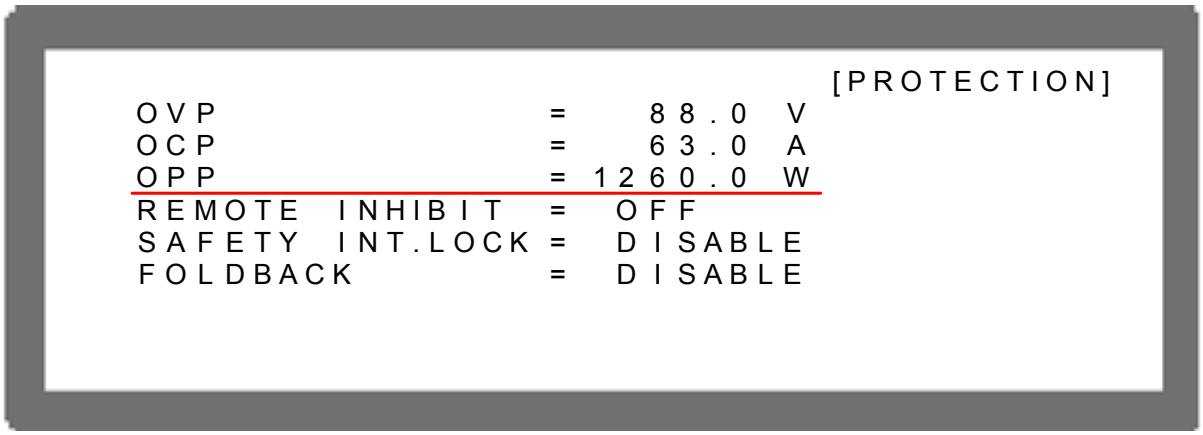


Figure 3-79

2. Use the numeric (0~9) keys or "Rotary" (◎) knob to set the value.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to 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. The table below is the power range of OPP.

Model	Max. OPP (W)
62006P-xx-xx	630
62012P-xx-xx	1260
62024P-xx-xx	2520
62050P-xx-xx	5250

Table 3-6 OPP Range

2. The OPP protection point is based on the comparison of calculated power of output current and remote sense voltage. However, if the power measured by the output terminal on rear panel is larger than the listed maximum output power in Table 3-6, the system will still prompt OPP and turn off the output.

When OPP occurs the main page will prompt a protection message as shown below:

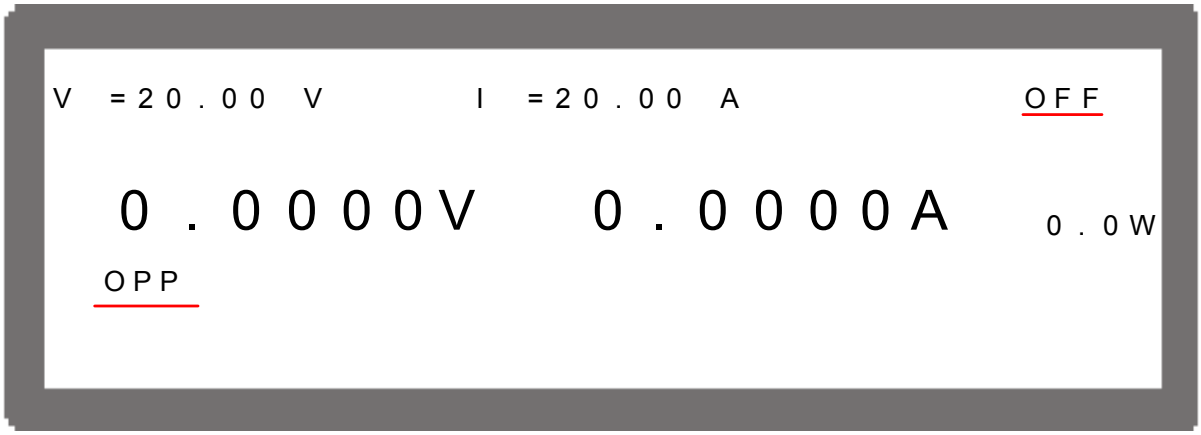


Figure 3-80

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 3-81 shows.

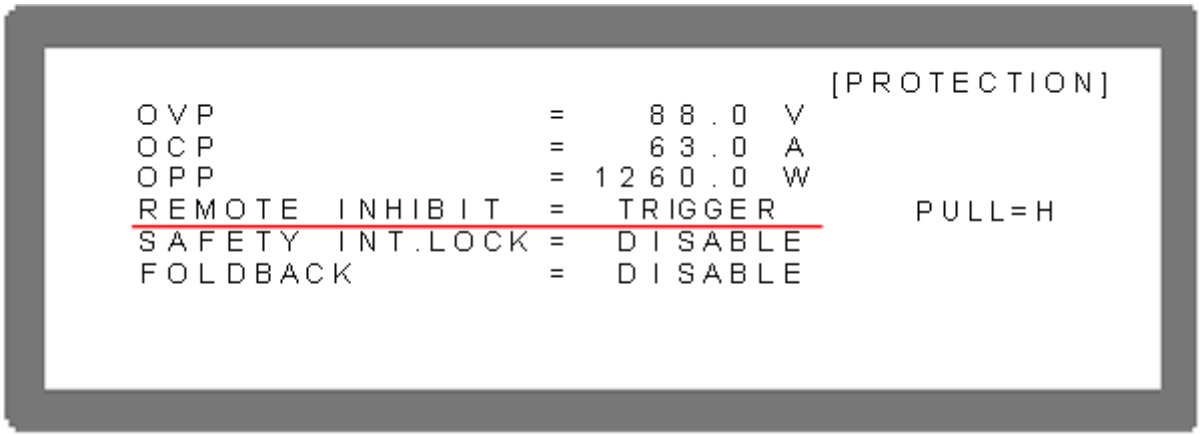


Figure 3-81

2. Use the "Rotary" ( ) knob to set REMOTE INHIBIT mode. There are OFF, TRIGGER and EXT. ON/OFF three options.

   1. Selecting OFF: It closes the function.
   2. Selecting TRIGGER: It sets the REMOTE INHIBIT to TRIGGER. When low level triggers the PIN9 _INHIBIT in APG & SYSTEM STATUS, it equals pressing "OUTPUT" key to set OUTPUT = OFF.
   3. Selecting EXT. ON/OFF: It sets the REMOTE INHIBIT to EXT. ON/OFF and replaces "OUTPUT" key by disabling it to control the activation of power supply. When the voltage level of PIN9 _INHIBIT in APG & SYSTEM STATUS turns to LOW, the power supply is unable to output. The power supply outputs normally when the voltage level of this pin turns to HIGH.
   4. Selecting PULL: This is APG & SYSTEM STATUS PIN9 level defined by user. There are H(HIGH) or L(LOW) for selection. The default of PIN9 is High level.

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

When protection occurs to REMOTE INHIBIT the main page will show the protection message as below.

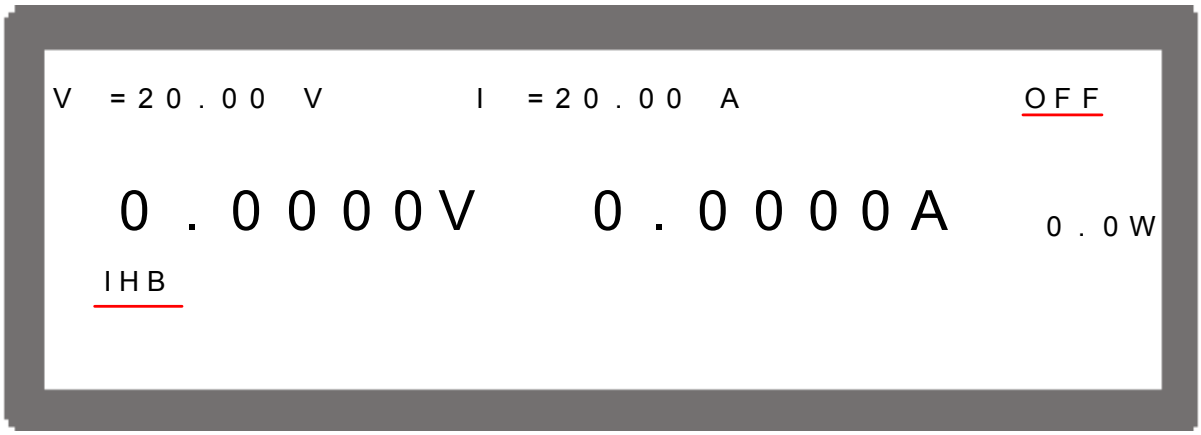


Figure 3-82

3.3.5.5 SAFETY INT.LOCK

This function allows users to control the ON/OFF of a power supply through the PIN7 of APG & SYSTEM STATUS.

1. Use "◄↑" & "►↓" keys to move the cursor to the column to be set as Figure 3-83 shows.

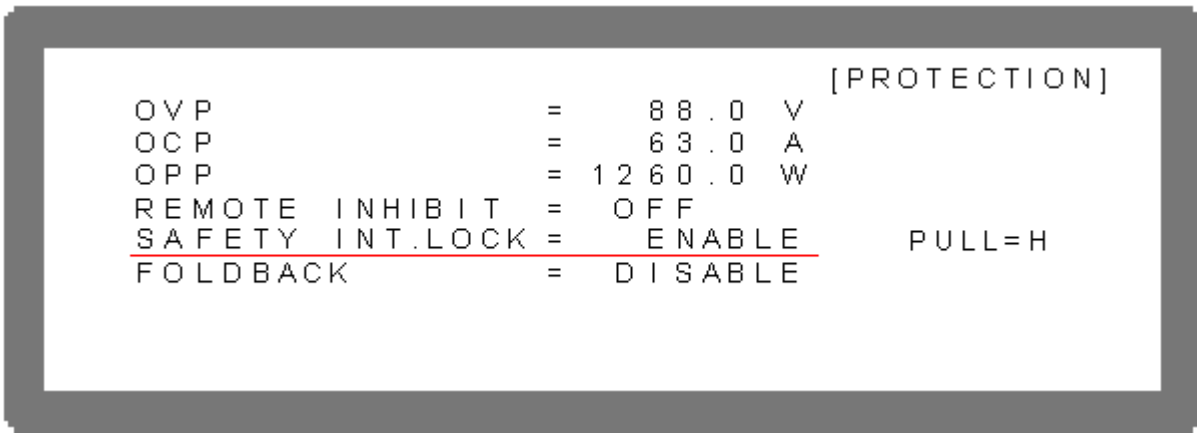


Figure 3-83

2. Use 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. When the PIN7 of APG & SYSTEM STATUS is at high level, it indicates the power supply is outputting normally and its ON/OFF is still controlled by "OUTPUT". When the PIN7 of APG & SYSTEM STATUS is at low level, it closes the power supply output directly and issues protection signal.

3. Selecting PULL: This is APG & SYSTEM STATUS PIN7 level defined by user. There are H(HIGH) or L(LOW) for selection. The default of PIN7 is High level.

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

When protection occurs to SAFETY INT.LOCK the main page will show the protection message as below.

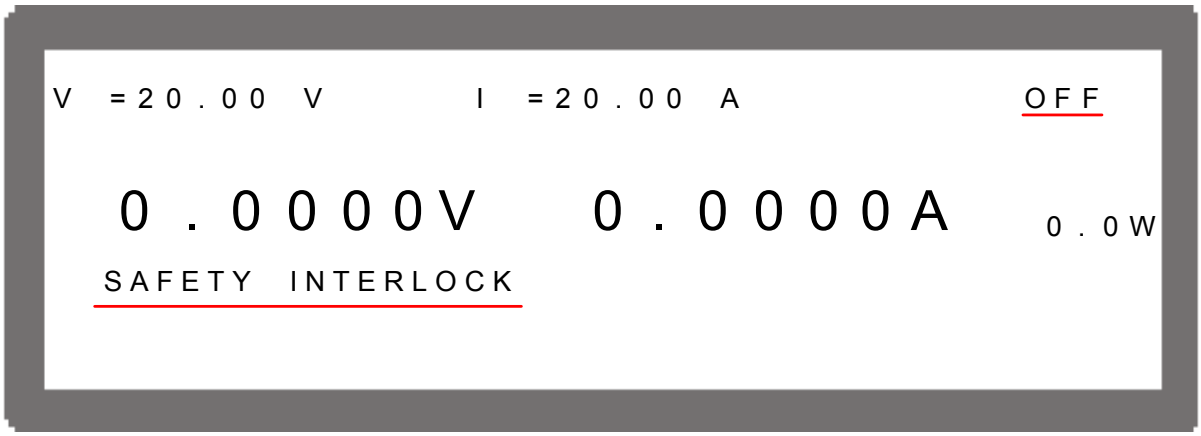


Figure 3-84

3.3.5.6 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 3-85 shows.

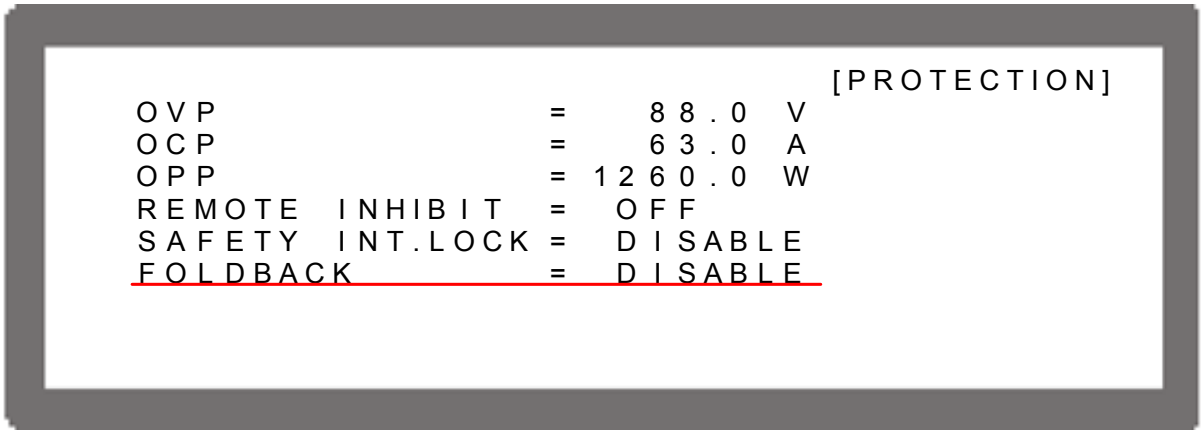


Figure 3-85

2. Use "Rotary" (◎) knob to set the protection 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 3-86 shows.

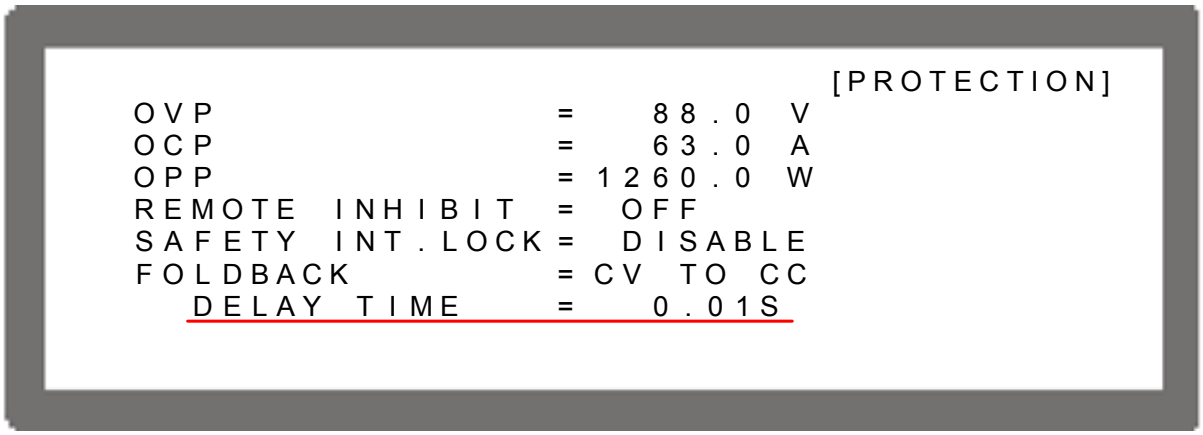


Figure 3-86

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

When FOLDBACK protection occurs the main page will prompt a protection message as shown below:

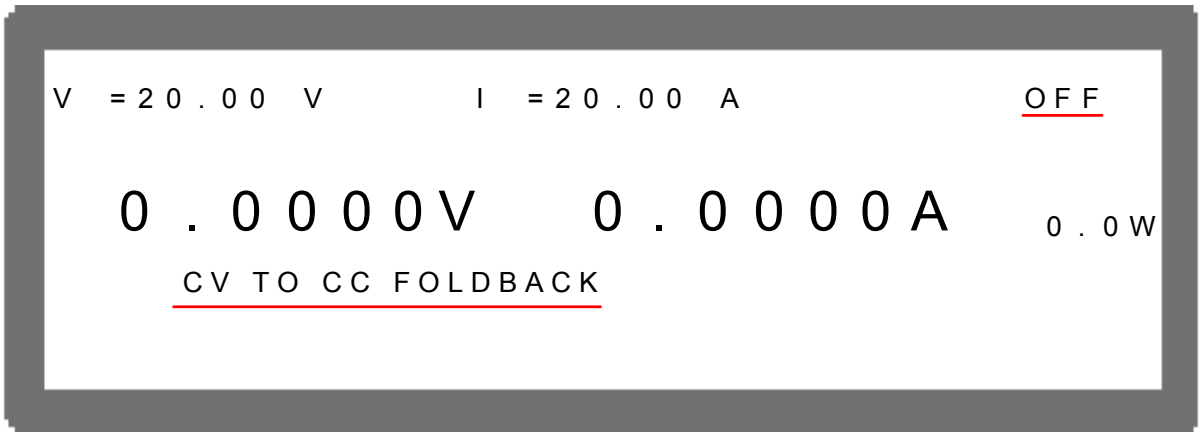


Figure 3-87

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 3-88 shows.

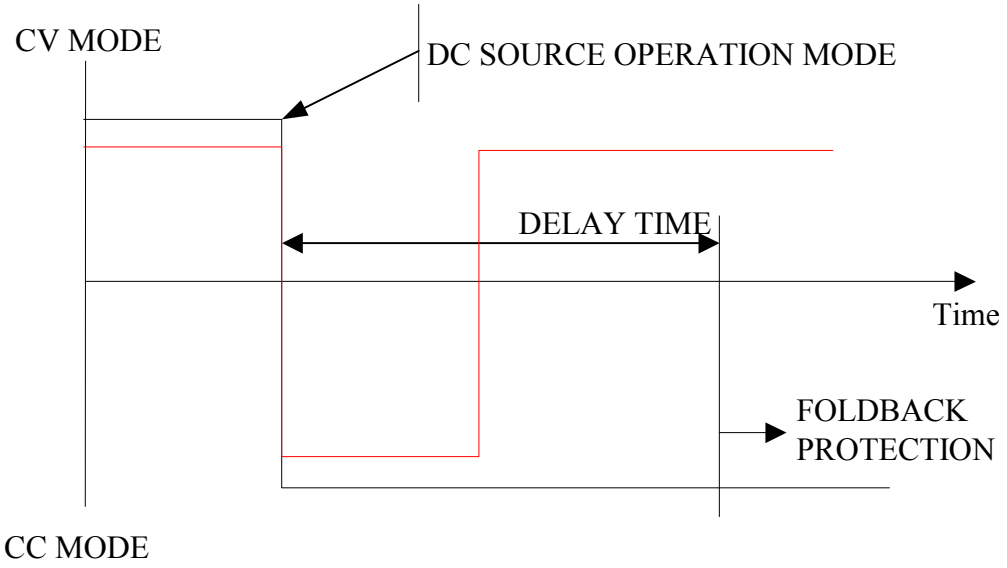


Figure 3-88

Assuming the FOLDBACK is set to CV TO CC, the solid line in Figure 3-88 will create Foldback protection while the dot line will not. It is vice versa for CC TO CV.

3.3.5.7 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 shown below:

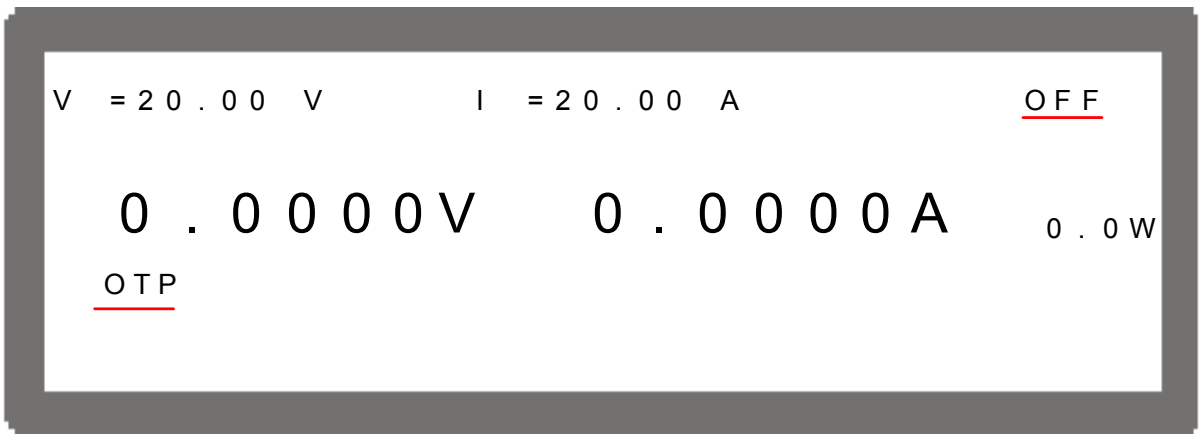


Figure 3-89

ⓘ 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.

3.3.5.8 AC FAULT

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

When AC FAULT occurs the main page will prompt a protection message as shown below:

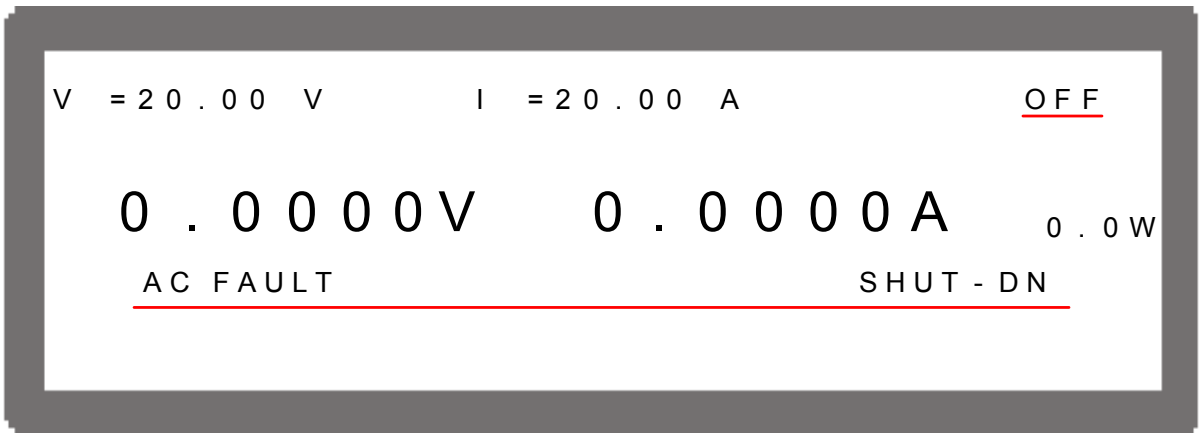


Figure 3-90

ⓘ NOTICE

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

	Less than (Vac)	More than (Vac)
62006P-xx-xx Input Voltage	80	286
62012P-xx-xx Input Voltage	80	286
62024P-xx-xx Input Voltage	160	285
62050P-xx-xx Input Voltage	160	285

Table 3-7 AC FAULT Range

2. Once the AC FAULT is activated, the output is turned off that is OUTPUT = OFF. It can be rebooted for use until the input voltage is within SPEC.
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.

3.3.5.9 SENSE FAULT Protection

The remote sense is located at the rear panel near to output terminal. See section 2.5.1 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.

When the connection is wrong for instance:

(1) VOLTAGE SENSING polarity is reversed that is the UUT's "—" terminal is connected to the "+" of output terminal, and UUT's "+" terminal is connected to the "—" of output terminal.
(2) One of the VOLTAGE SENSING wire polarity is connected reversely and the other is disconnected (fallen or broken).
(3) One of the VOLTAGE SENSING wire polarity is connected correctly but the other one is disconnected.

Wrong connections of the above three may cause SENSE FAULT protection. The output will turn off that is OUTPUT = OFF for protection. It is necessary to connect the REMOTE SENSING wires correctly and press "ENTER" to remove the protection.

When SENSE FAULT occurs the main page will prompt a protection message as shown below:

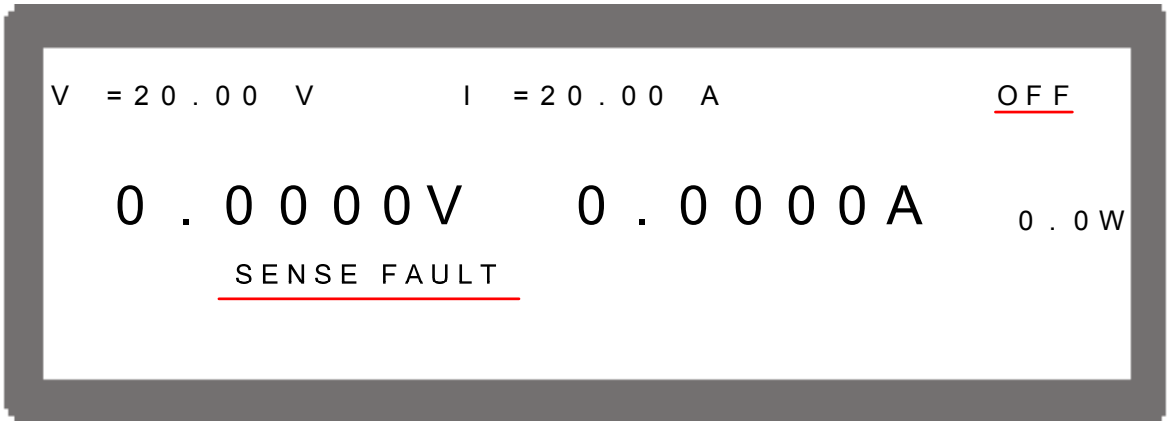


Figure 3-91

3.3.5.10 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 shown below:

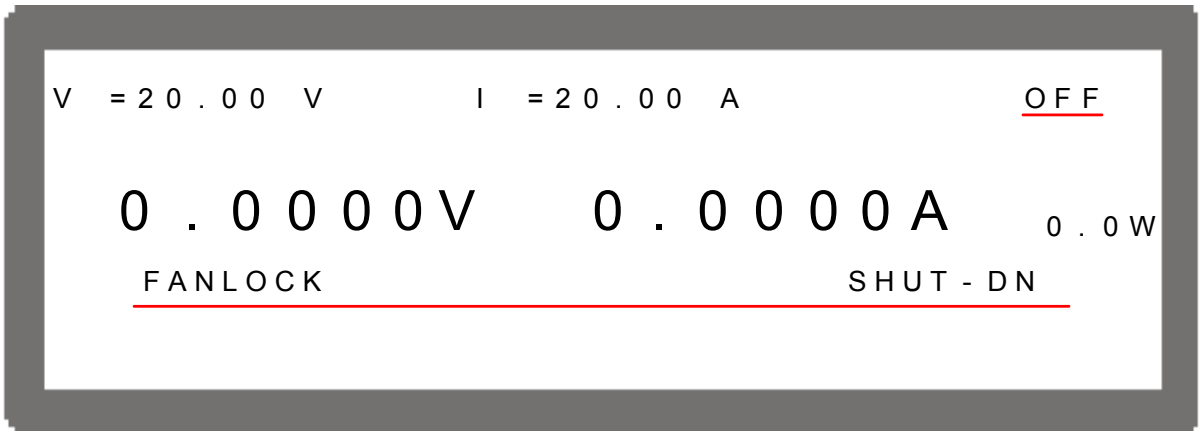


Figure 3-92

ⓘ NOTICE

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

3.3.5.11 BUSOVP Protection

The PFC stage of internal main circuit converts the AC mains voltage to DC voltage for the main circuit DC TO DC stage use. If the DC voltage is abnormal, the BUSOVP signal will occur and the output will turn off that is OUTPUT = OFF for protection.

When BUSOVP occurs the main page will prompt a protection message as shown below:

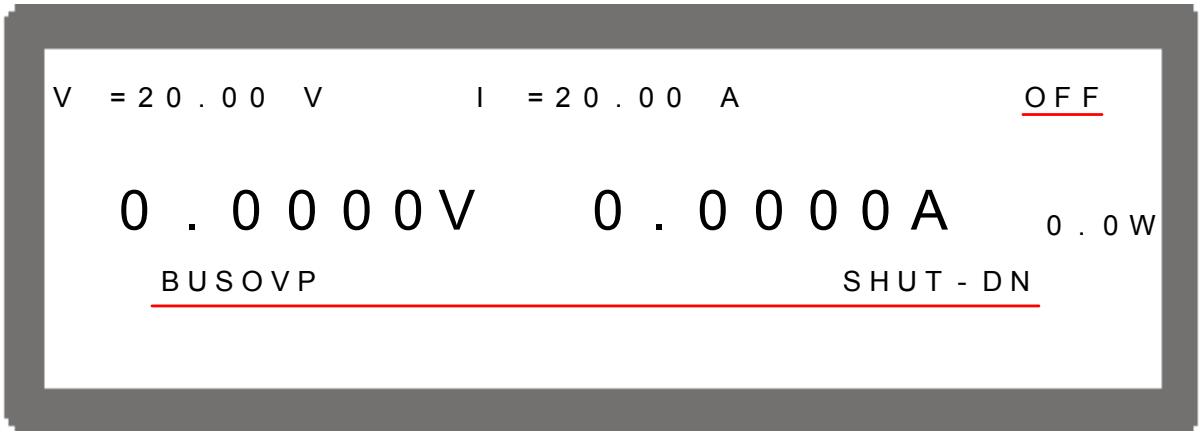


Figure 3-93

ⓘ NOTICE

1. Troubleshooting:
   (1) When BUSOVP occurs, power off the instrument first and then power it on again to see if it is caused by error action.

(2) If BUSOVP occurs again, please contact sales agent for repair services.

3.3.5.12 SERIES FAULT Protection

Do not connect the CURRENT SHARING cable when operating in series or it may blow up. The DC power supply will detect the connection of CURRENT SHARING in series mode. SERIES FAULT protection will occur if connected. Figure 3-94 shows when it is MASTER while Figure 3-95 shows the SLAVE:

Figure 3-94

Figure 3-95

NOTICE

1. Troubleshooting:
   (1) When SERIES FAULT protection occurs, power off the instrument first and remove the connecting cable of CURRENT SHARING and then power it on again.
   (2) If SERIES FAULT occurs again, please contact sales agent for repair services

3.3.6 FACTORY SETTING

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

To enter it:

1. In Config Setup page, press "6" to show Figure 3-96.
2. Press "ENTER" to enter into FACTORY SETTING option.

   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 the messages of DEVICE MODEL, SERIAL NO. and FIRMWARE VERSION.

   DEVICE MODEL : Display the model no. as **62012P-80-60** in the figure below.
   SERIAL NO. : Display the serial no. as **00001** in the figure below.
   FIRMWARE VERSION: Display firmware version as **1.00** and released date as 2005/01/01 in the figure below.

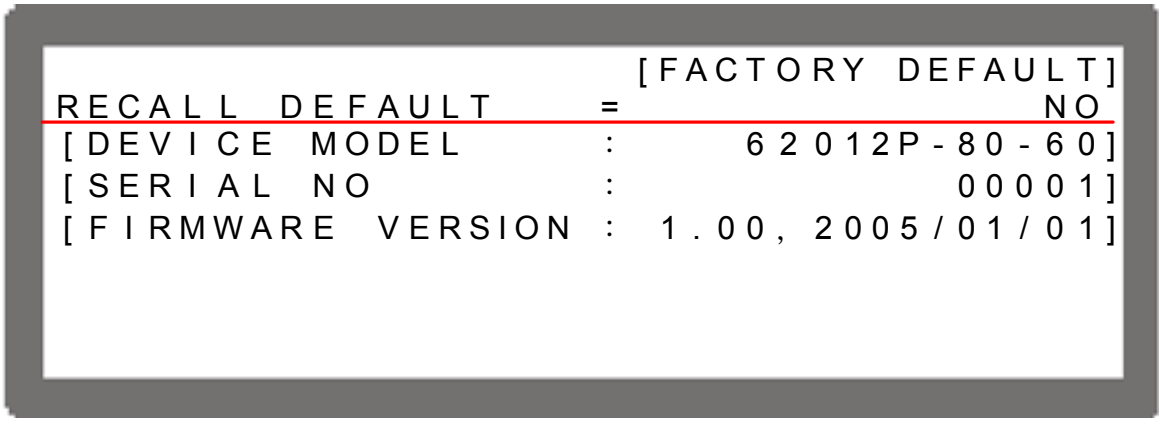


Figure 3-96

3.3.7 CALIBRATION

Chroma 62000P 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".
2. Press "ENTER" to enter into CALIBRATION option as Figure 3-97 shows.

Figure 3-97

3. Enter the password and press "ENTER" to confirm. The screen will display 4 calibration options as Figure 3-98 shows. The calibration steps are described from section 3.3.7.1 to 3.3.7.5.
4. To abort CALIBRATION, press "EXIT" to return to MAIN PAGE.

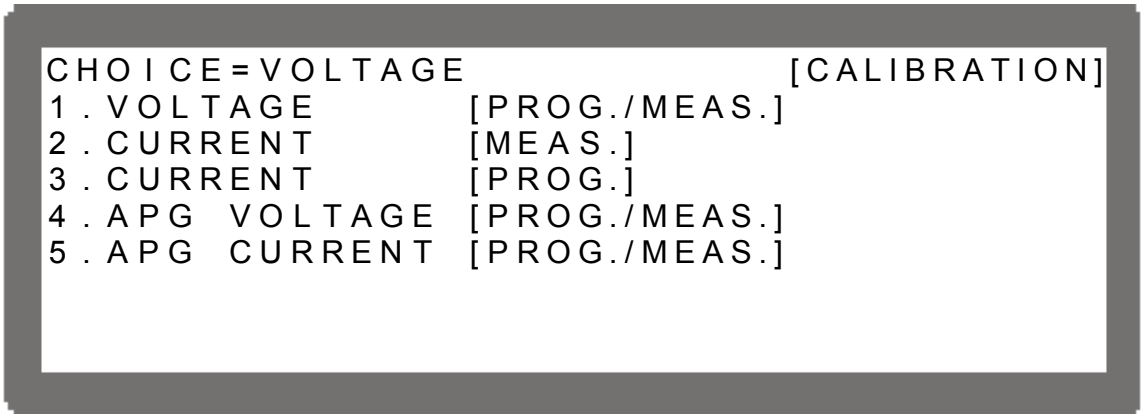


Figure 3-98

ⓘ 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

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

Table 3-8

3.3.7.1.2 SETUP

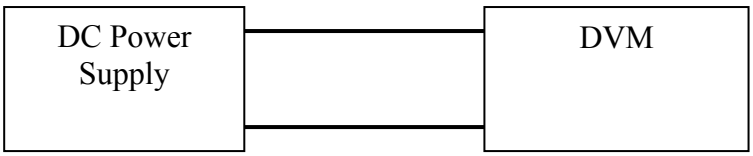


Figure 3-99

ⓘ NOTICE
For the instrument that performs calibration its accuracy has to be higher than the accuracy of spec.

3.3.7.1.3 Calibration Procedure (Example: Model 62012P-80-60)

(1) Enter into the page of Figure 3-98.
(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 3-100 shows.

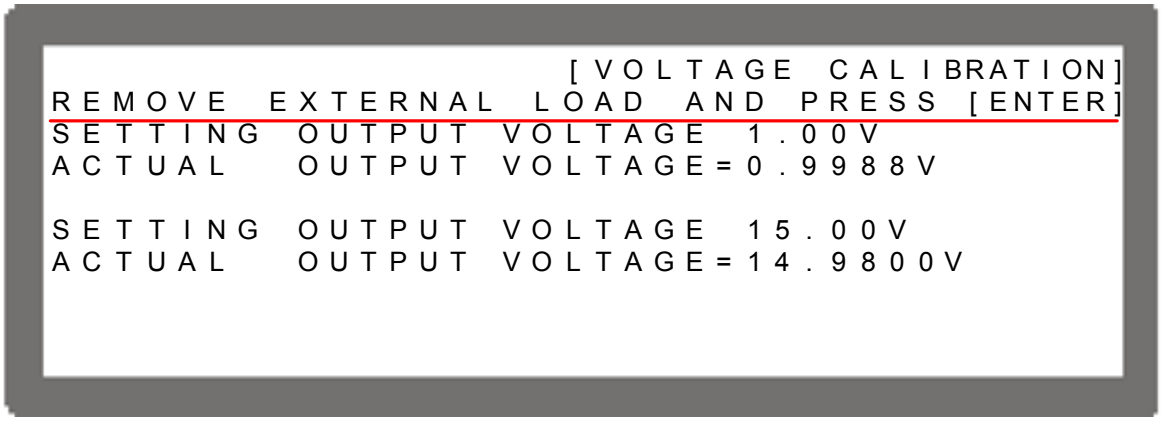


Figure 3-100

(4) When in Voltage calibration page, press "ENTER" to confirm.
(5) First does the low voltage range calibration (16V), the instrument will set the output voltage to 1.00V and the cursor is stopped at position [1] as Figure 3-101 shows. Enter

the voltage measured by DVM (4 digits after decimal point) and press "ENTER" to confirm.

(6) Press "→↓" again to do the low voltage range calibration for its second point, the instrument will set the output voltage to 15.00V and the cursor is stopped at position [2] as Figure 3-101 shows. Enter the voltage measured by DVM (4 digits after decimal point) and press "ENTER" to confirm.

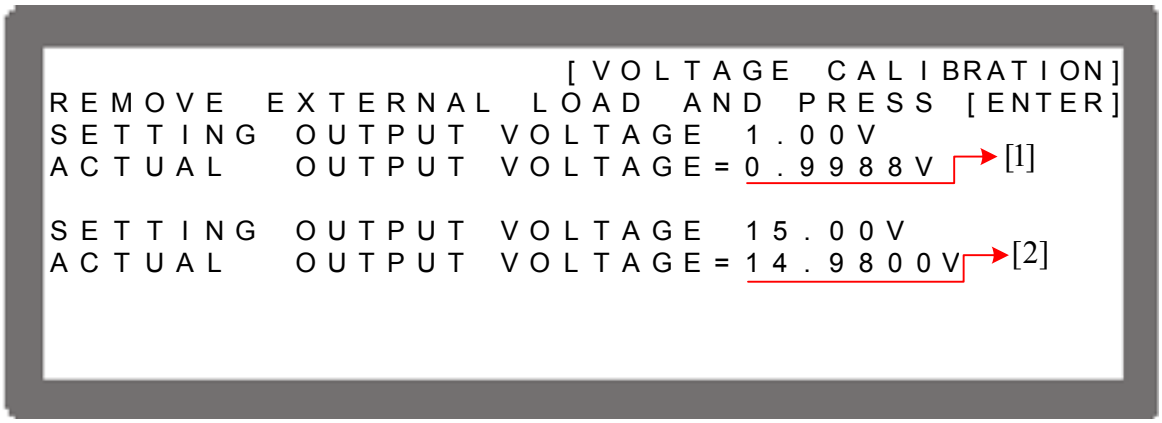


Figure 3-101

(7) Press "→↓" to do the high voltage range calibration (80V), the instrument will set the output voltage to 20.00V first and the cursor is stop at position [3] as Figure 3-102 shows. Enter the voltage measured by DVM (4 digits after decimal point) and press "ENTER" to confirm.

(8) Press "→↓" again to do the high voltage range calibration for its second point, the instrument will set the output voltage to 70.00V and the cursor is stopped at position [4] as Figure 3-102 shows. Enter the voltage measured by DVM (4 digits after decimal point) and press "ENTER" to confirm.

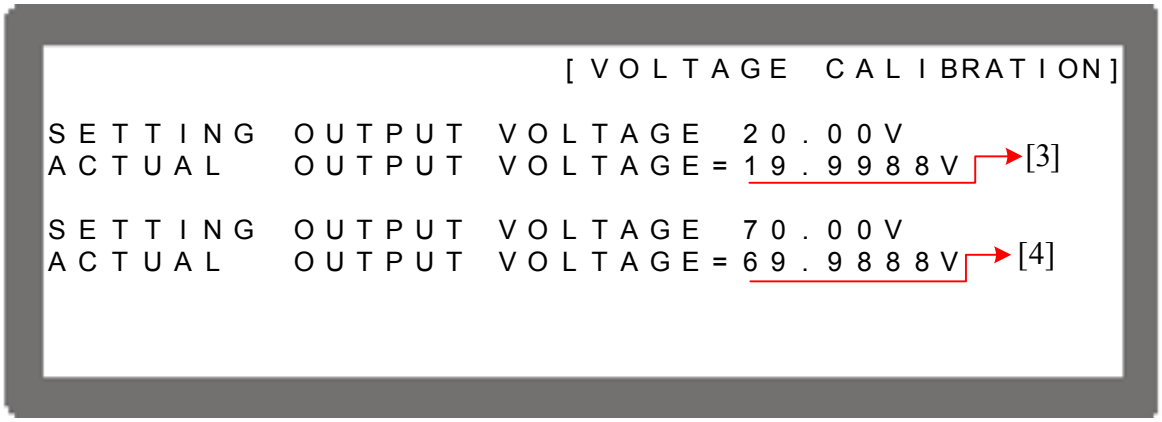


Figure 3-102

(9) Now the voltage calibration is done. To save the calibration data, press "SAVE" will prompt a confirmation page as Figure 3-103 shows, press "ENTER" to save it. Press "EXIT" to return to MAIN PAGE.

Figure 3-103

ⓘ NOTICE

1. The calibration point may be different for other models (non 62012P-80-60), 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 3-101 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

Device		Suggest Model or Capacity
DVM		HP 34401A or equivalent DVM
CURRENT SHUNT		Prodigit 7530 or equivalent
LOAD	ELECTRICAL LOAD	CHROMA 63204 or equivalent
	BREAKER	Capable current>=100A

Table 3-9

3.3.7.2.2 SETUP

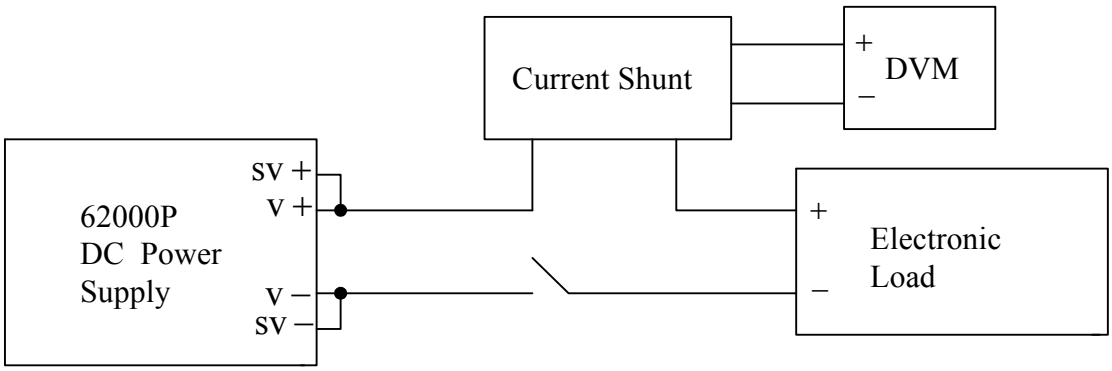


Figure 3-104

3.3.7.2.3 Calibration Procedure (Example: Model 62012P-80-60)

1. In CALIBRATION page, press "2" or turn "Rotary" ( ) knob to set CHOICE=2.
2. Press "ENTER" to confirm and entering into current calibration options as Figure 3-105 shows.

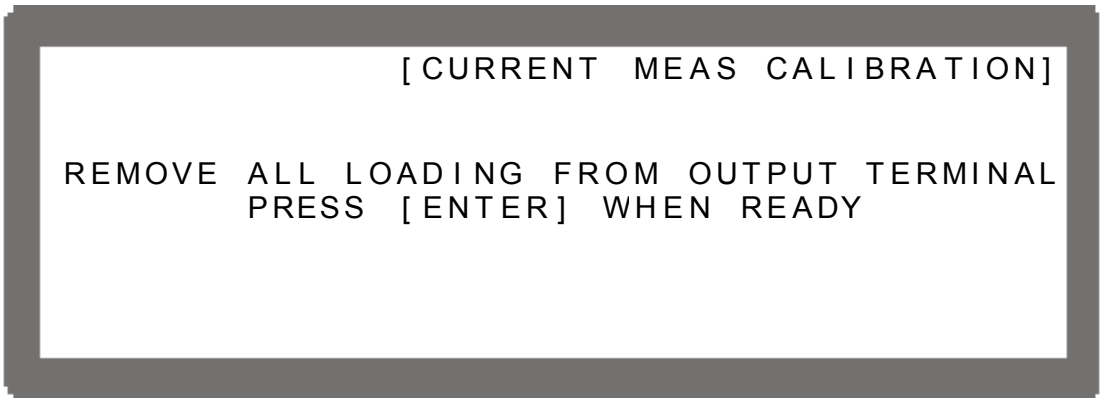


Figure 3-105

3. Open the Breaker to ensure the DC Power Supply has no load and press "ENTER" to confirm.
4. **It is important** to reconnect the DC Power Supply to current shunt whose rating is closest to but still cover 2A. For Prodigit 7530, use 2A shunt directly.
5. Then it will show Figure 3-106 and press "ENTER". First it will calibrate the low current range, the system outputs 5V voltage and then sets the loading current of Electronic LOAD to 2.00A. The cursor is stopped at position [1] as Figure 3-106 shows. Enter the current (4 digits after decimal point) read by Current Shunt (DVM) and press "ENTER" to confirm and wait for it to end.

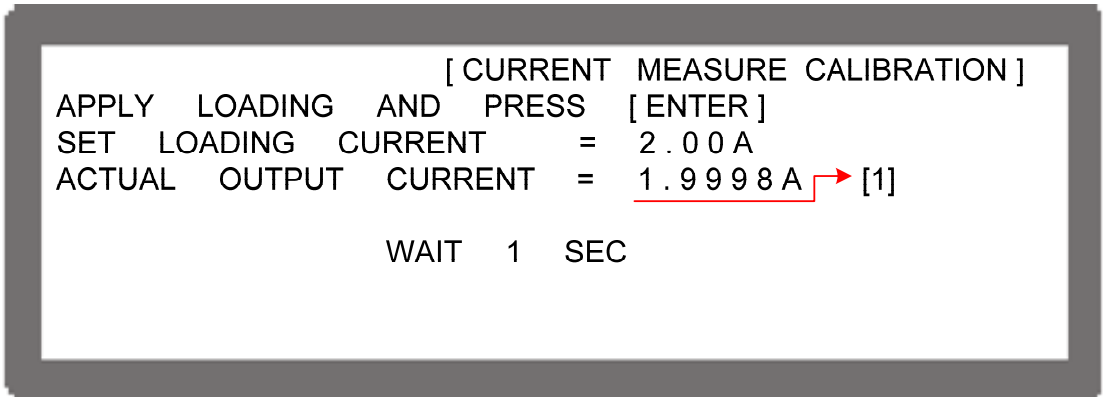


Figure 3-106

6. Once the 2A 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 10A. For Prodigit 7530, use 20A shunt directly.
7. Next, press "[→↓]" to do 10A calibration. The cursor will stop at position [2] as Figure 3-107 shows for setting the loading current of Electronic LOAD to10.00A. Enter the current (4 digits after decimal point) read by Current Shunt (DVM) and press "[ENTER]" to confirm and wait for it to end. Use 2A and 10A for calibration, the system will calculate the calibration factor for the low current range.

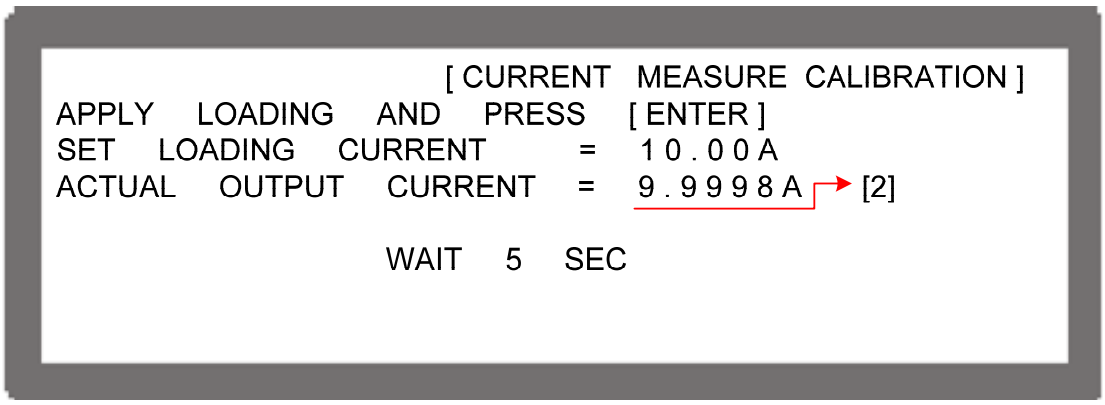


Figure 3-107

8. 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 20A. For Prodigit 7530, use 20A shunt directly.
9. For high current range calibration, press "[→↓]" to perform 20A calibration. The cursor will stop at position [3] as Figure 3-108 shows for setting the loading current of Electronic LOAD to 20.00A. Enter the current (4 digits after decimal point) read by Current Shunt (DVM) and press "[ENTER]" to confirm and wait for it to end.

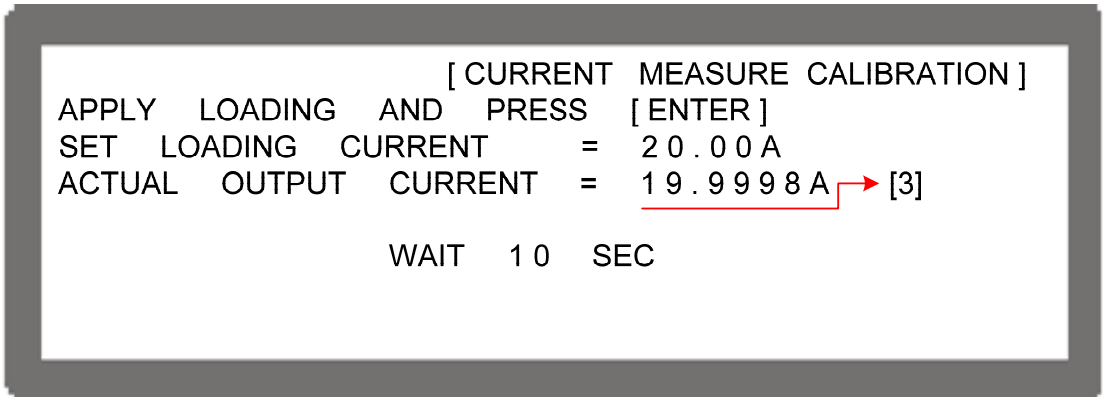


Figure 3-108

10. Once the 20A 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 50A. For Prodigit 7530, use 250A shunt directly.
11. Press "[→↓]" to perform 50A calibration. The cursor will stop at position [4] as Figure 3-109 shows for setting the loading current of Electronic LOAD to 50.00A. Enter the current (4 digits after decimal point) read by Current Shunt (DVM) and press "[ENTER]" to confirm and wait for it to end. Use 20A and 50A for calibration, the system will calculate the calibration factor for the high current range.

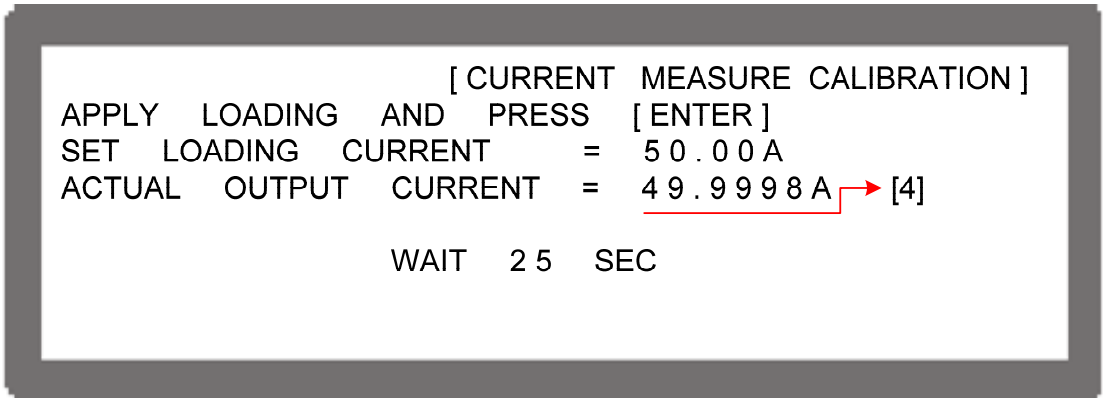


Figure 3-109

12. The current calibration is done once the above actions are completed. Remove the load of Electronic LOAD and press "[SAVE]" and "[ENTER]"to save the calibrated data as Figure 3-110 shows, or press "[EXIT]" to return to MAIN PAGE.

Figure 3-110

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

ⓘ NOTICE
The calibration point may be different for other models (non 62012P-80-60), please operate it following the instructions displayed.

3.3.7.3 Current Output (PROG.) Calibration

3.3.7.3.1 Hardware Requirements

Device		Suggest Model or Capacity
DVM		HP 34401A or equivalent DVM
CURRENT SHUNT		Prodigit 7530 or equivalent
LOAD	ELECTRICAL LOAD	CHROMA 63204 or equivalent
	BREAKER	Capable current>=100A

Table 3-10

3.3.7.3.2 SETUP

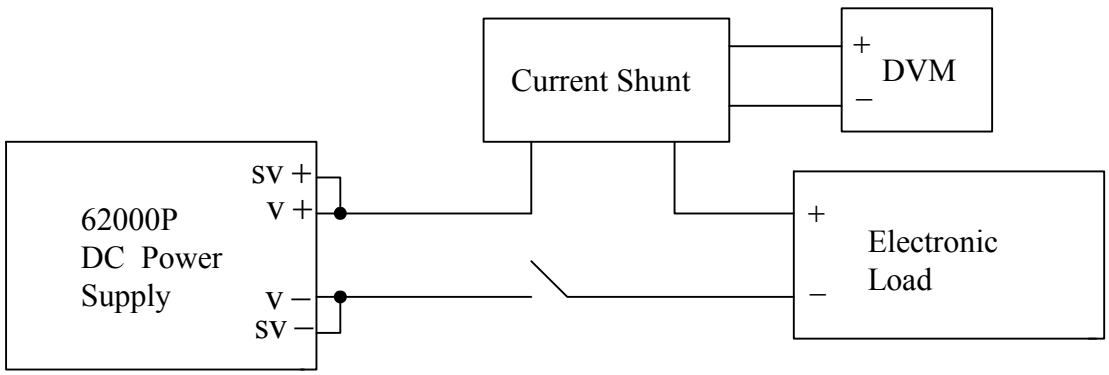


Figure 3-111

3.3.7.3.3 Calibration Procedure (Example: Model 62012P-80-60)

(1) Set the Electronic Load to CV mode 5V. Short the output terminal directly if there is no Electronic Load.

(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 3-112 shows.

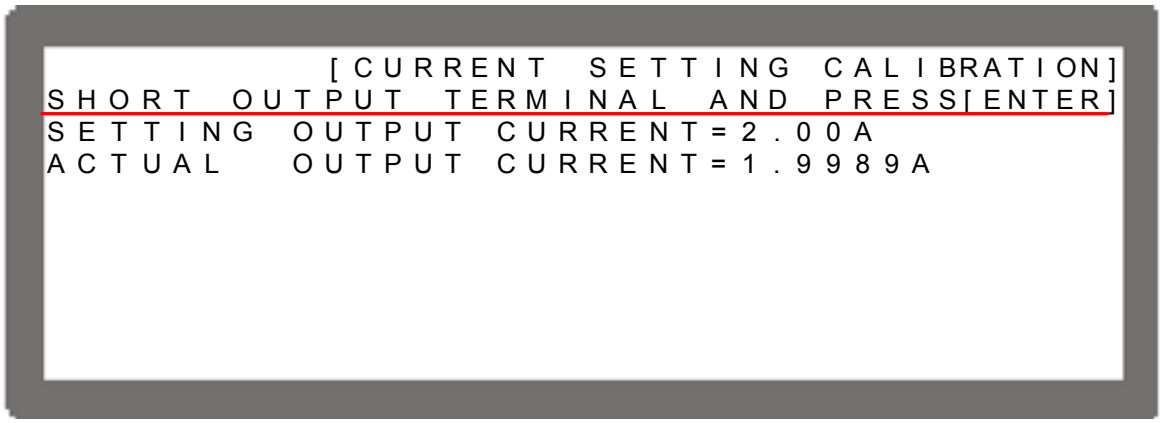


Figure 3-112

(4) The output of the DC Power Supply will be off before user pressing ENTER. Once ENTER is pressed, a message will pop up to remind users to connect to proper current shunt range. Set current shunt whose rating is closest to but still cover 2A. For Prodigit 7530, use 2A shunt directly.

(5) Press ENTER the system will set the output current to 2.00A automatically and appear second reading screen. Once the reading is done, the cursor will stop at position [1] as Figure 3-113 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press "ENTER" to confirm.

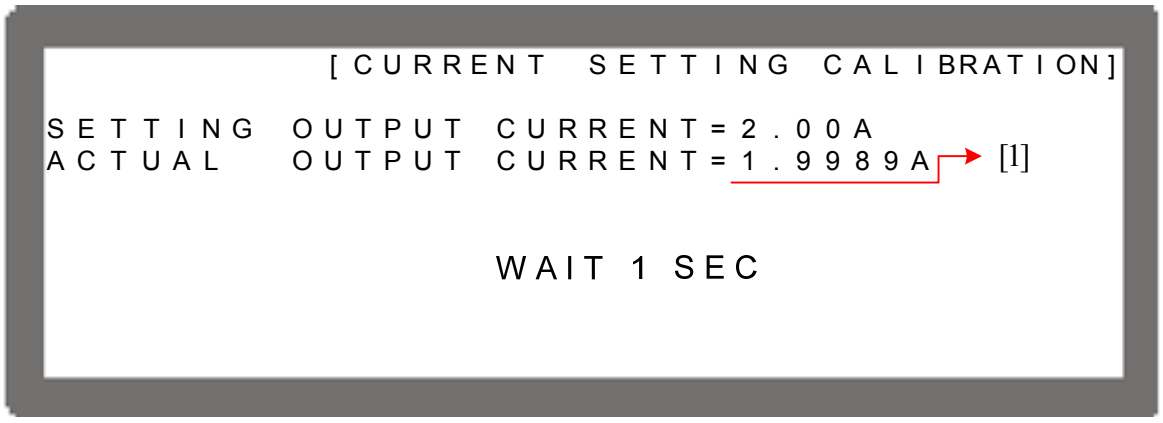


Figure 3-113

(6) Now the DC Power Supply will be set to off again and press " [→↓] " to do 10A calibration, a message will be popped up to remind user to reconnect to proper current shunt range. Set current shunt whose rating is closest to but still cover 10A. For Prodigit 7530, use 20A shunt directly.

(7) Press " [→↓] " will perform 10A calibration. The system will set the output current to 10.00A automatically and appear second reading screen. Once the reading is done, the cursor will stop at position [2] as Figure 3-114 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press " [ENTER] " to confirm. Use 2A and 10A for calibration, the system will calculate the calibration factor for the low current range.

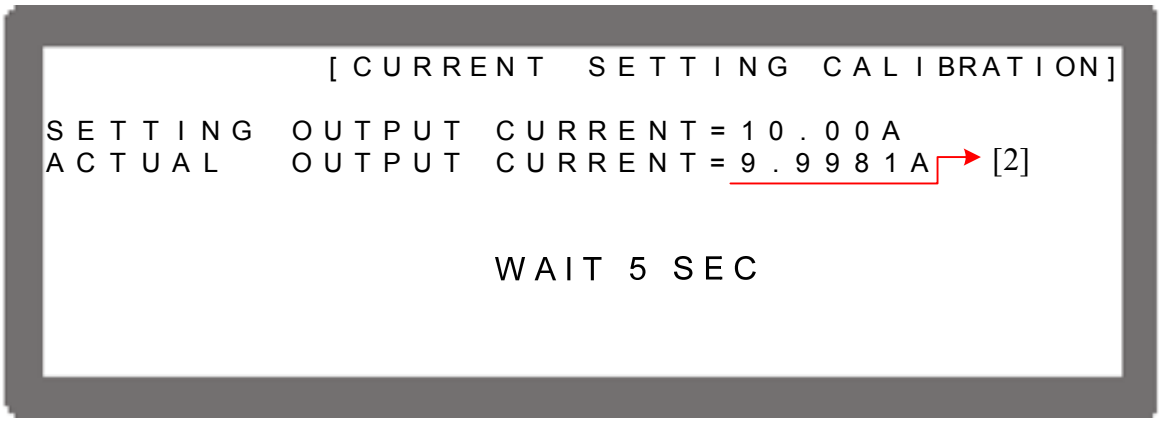


Figure 3-114

(8) Now the DC Power Supply will be set to off again and press " [→↓] " to do 20A calibration, a message will be popped up to remind user to reconnect to proper current shunt range and start high current range calibration. Set current shunt whose rating is closest to but still cover 20A. For Prodigit 7530, use 20A shunt directly.

(9) Press " [→↓] " will perform 20A calibration. The system will set the output current to 20.00A automatically and appear second reading screen. Once the reading is done, the cursor will stop at position [3] as Figure 3-115 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press " [ENTER] " to confirm.

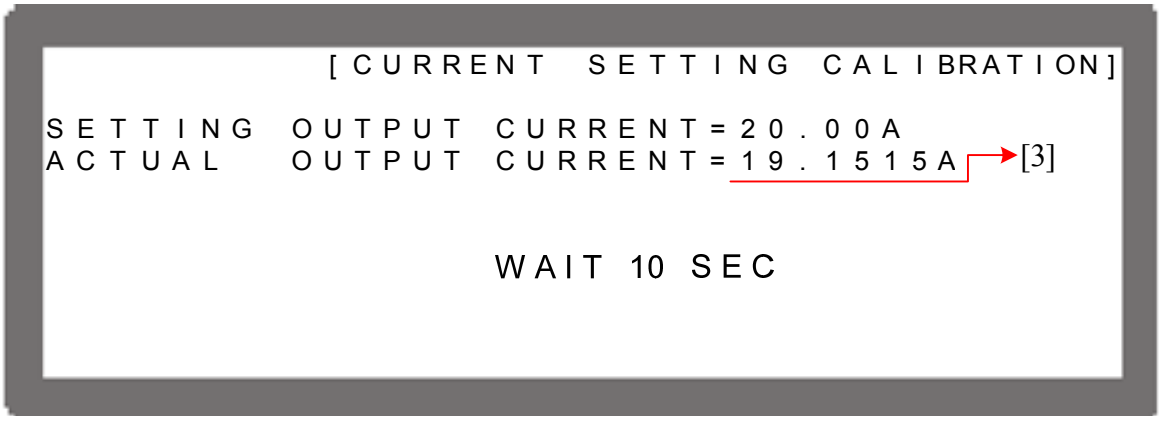


Figure 3-115

(10) Now the DC Power Supply will be set to off again and press "→↓" to do 50A calibration, a message will be popped up to remind user to reconnect to proper current shunt range. Set current shunt whose rating is closest to but still cover 50A. For Prodigit 7530, use 250A shunt directly.

(11) Press "→↓" will perform 50A calibration. The system will set the output current to 50.00A automatically and appear second reading screen. Once the reading is done, the cursor will stop at position [4] as Figure 3-116 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press "ENTER" to confirm.

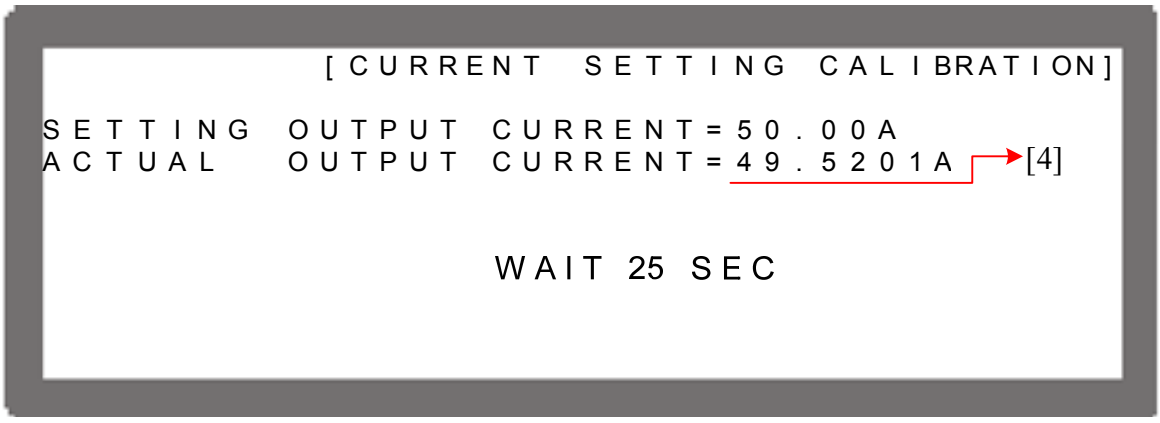


Figure 3-116

(12) The current calibration is done once the above actions are completed. Turn off the DC Power Supply output and press "SAVE" and "ENTER" to save the calibrated data as Figure 3-117 shows, or press "EXIT" to return to MAIN PAGE.

Figure 3-117

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

ⓘ NOTICE
The calibration point may be different for other models (non 62012P-80-60), please operate it following the instructions displayed.

3.3.7.4 APG Voltage Calibration

3.3.7.4.1 Hardware Requirements

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.

Table 3-11

3.3.7.4.2 SETUP

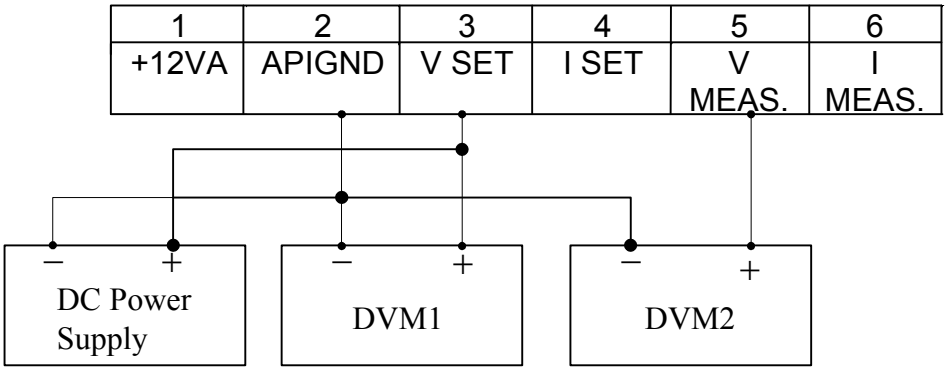


Figure 3-118

3.3.7.4.3 Calibration Procedure (Example: Model 62012P-80-60)

(1) In CALIBRATION page, press "4" or turn "Rotary" ( ) knob to set CHOICE = 3.

(2) Press "ENTER" to confirm entering into APG Voltage Calibration options as Figure 3-119 shows.

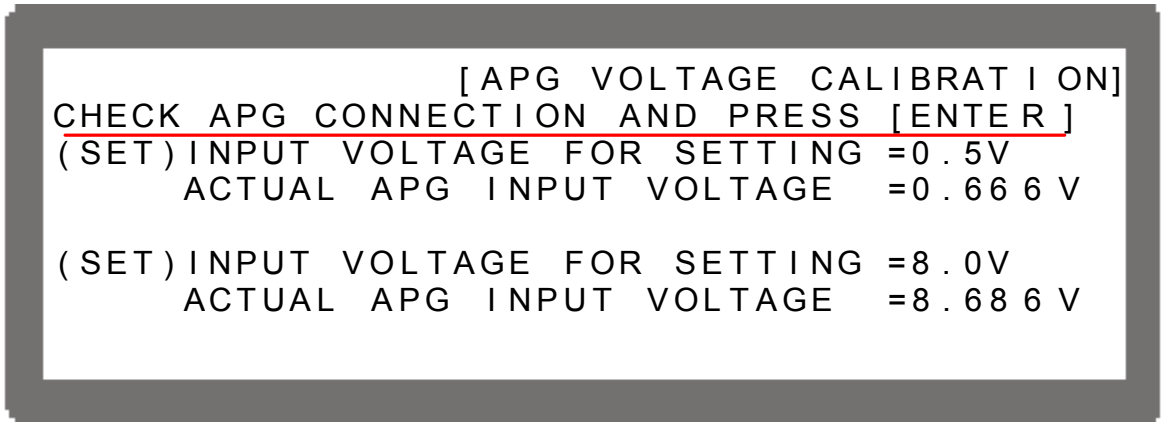


Figure 3-119

ⓘ 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 Agilent 34401 is used, the DVM1 and DVM2 can be connected to the front and rear measurement input terminal respectively.
3. Before doing APG voltage calibration, it is necessary to complete the voltage/current output and measurement calibration first.

(3) When in the APG Voltage Calibration pages and the connection is correct, press "ENTER" to confirm.

(4) It will ask users to input about 0.5V voltage signal (Pin 3). The cursor stops at position [1] as Figure 3-120 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 (3 digits after decimal point) read by DVM 1 to position [1] and press "ENTER" to confirm.

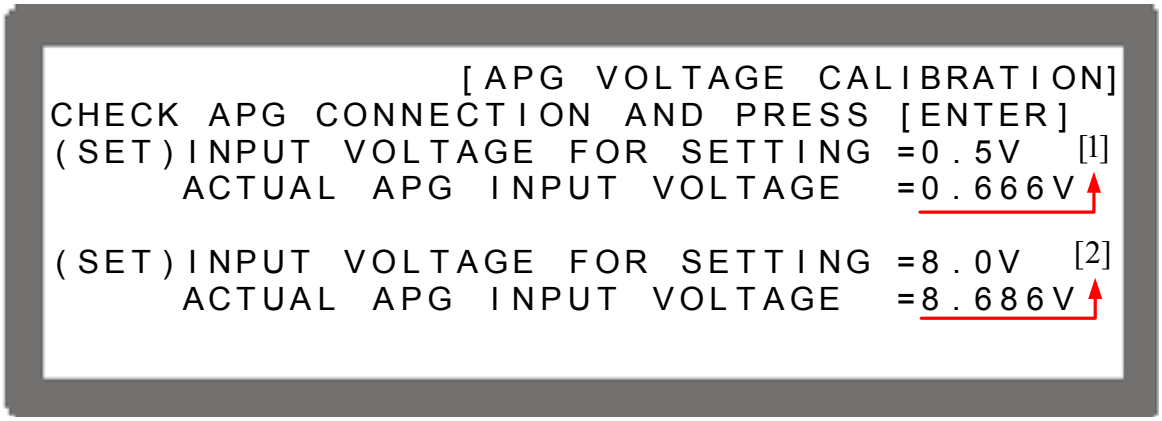


Figure 3-120

(5) Press "→↓" again will ask users to input about 8.0V voltage signal (Pin 3). The cursor stops at position [2] as Figure 3-120 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 (3 digits after decimal point) read by DVM 1 to position [2] and press "ENTER" to confirm.

(6) Press "→↓" again the cursor stops at position [3] as Figure 3-121 shows. Open the device cover to find VR402 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Make the DVM2 reading of Pin5 to be 0.00V±2.5mV by adjusting the resistance of VR402. Once the reading is adjusted correctly, press "ENTER" to confirm it.

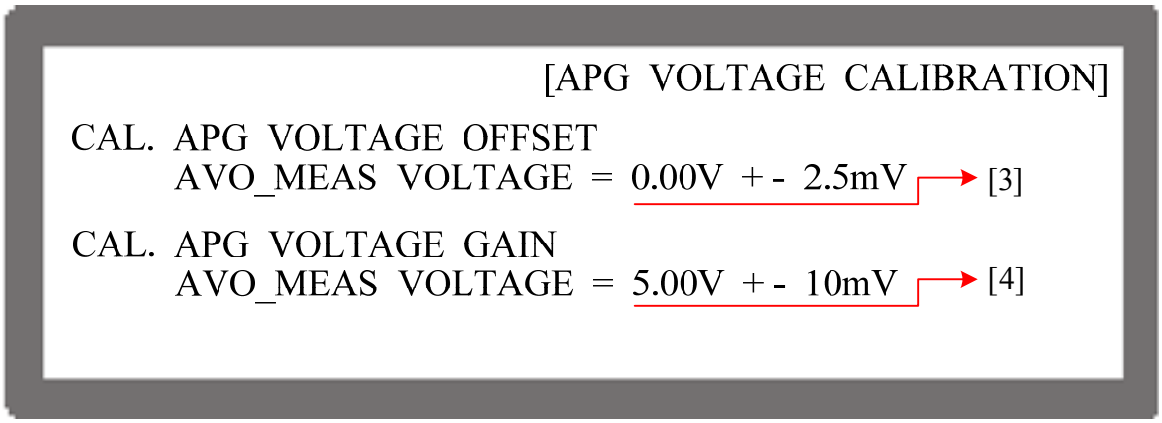


Figure 3-121

(7) Press "→↓" again the cursor stops at position [4] as Figure 3-121 shows. Open the device cover to find VR401 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Make the DVM2 reading of Pin5 to be 5.00V±10mV by adjusting the resistance of VR401. Once the reading is adjusted correctly, press "ENTER" to confirm it.

(8) The APG Voltage calibration is done once the above actions are completed. Press "SAVE" and "ENTER"to save the calibrated data as Figure 3-117 shows, or press "EXIT" to return to MAIN PAGE.

ⓘ NOTICE
The calibration point may be different for other models (non 62012P-80-60), please operate it following the instructions displayed.

3.3.7.5 APG Current Calibration

3.3.7.5.1 Hardware Requirements

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.
LOAD	ELECTRICAL LOAD	CHROMA 63204 or equivalent
	BREAKER	Capable current>=100A

Table 3-12

3.3.7.5.2 SETUP

(1) APG CURRENT PROGRAM

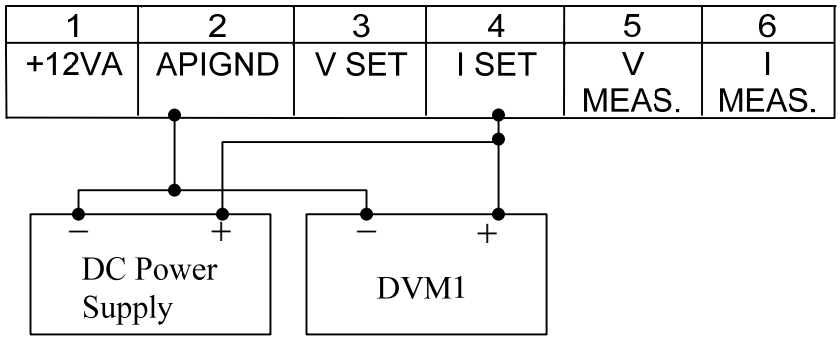


Figure 3-122

(2) APG CURRENT MEASUREMENT

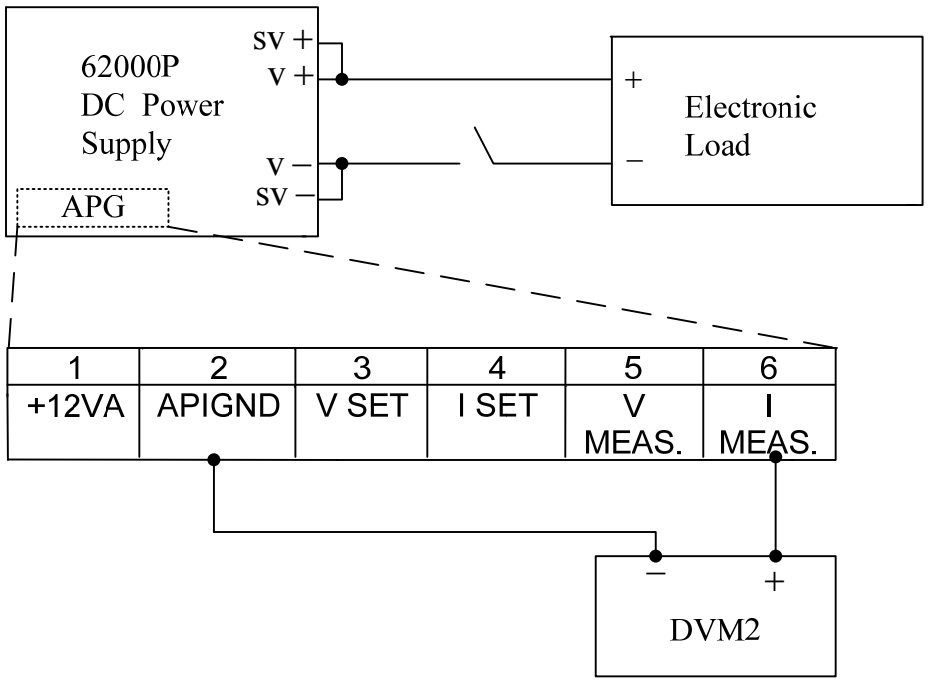


Figure 3-123

3.3.7.5.3 Calibration Procedure (Example: Model 62012P-80-60)

(1) In CALIBRATION page, press "5" or turn "Rotary" ( ) knob to set CHOICE = 4.

(2) Press "ENTER" to confirm entering into APG Voltage Calibration options as Figure 3-124 shows.

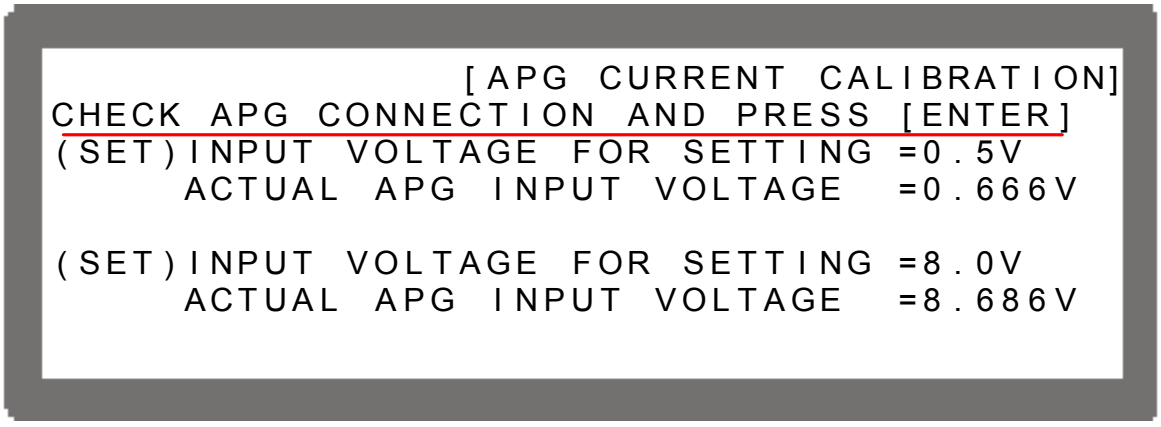


Figure 3-124

ⓘ 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. Before doing APG current calibration, it is necessary to complete the voltage/current output and measurement calibration.

(3) When in the APG Current Calibration pages and the connection is correct, press "ENTER" to confirm.

(4) It will ask users to input about 0.5V voltage signal (Pin 4). The cursor stops at position [1] as Figure 3-125 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 (3 digits after decimal point) read by DVM 1 to position [1] and press "ENTER" to confirm.

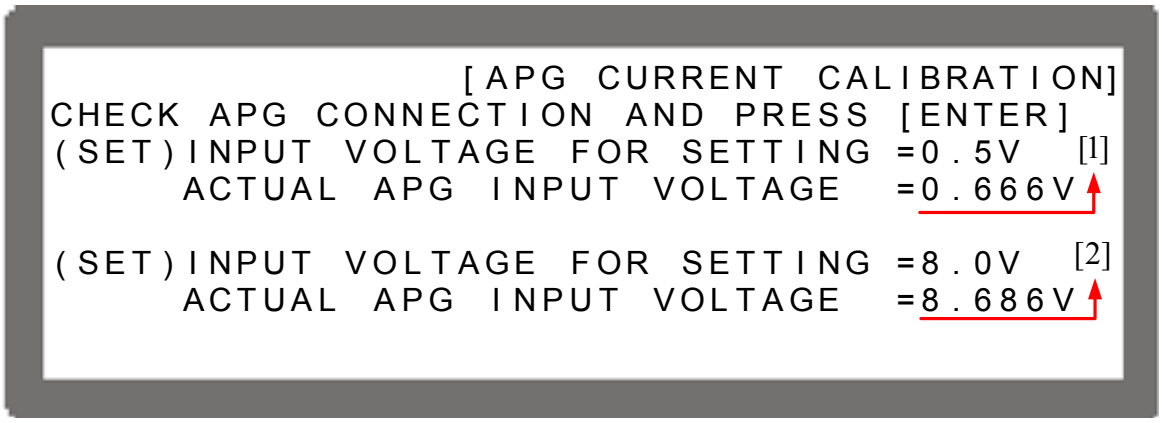


Figure 3-125

(5) Press "→↓" again will ask users to input about 8.0V voltage signal (Pin 4). The cursor stops at position [2] as Figure 3-125 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 (3 digits after decimal point) read by DVM 1 to position [2] and press "ENTER" to confirm.

(6) Press "→↓" again the cursor stops at position [3] as Figure 3-126 shows. Open the device cover to find VR404 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Make the DVM2 reading of Pin6 to be 0.00V±2.5mV by adjusting the resistance of VR404. Once the reading is adjusted correctly, press "ENTER" to confirm it.

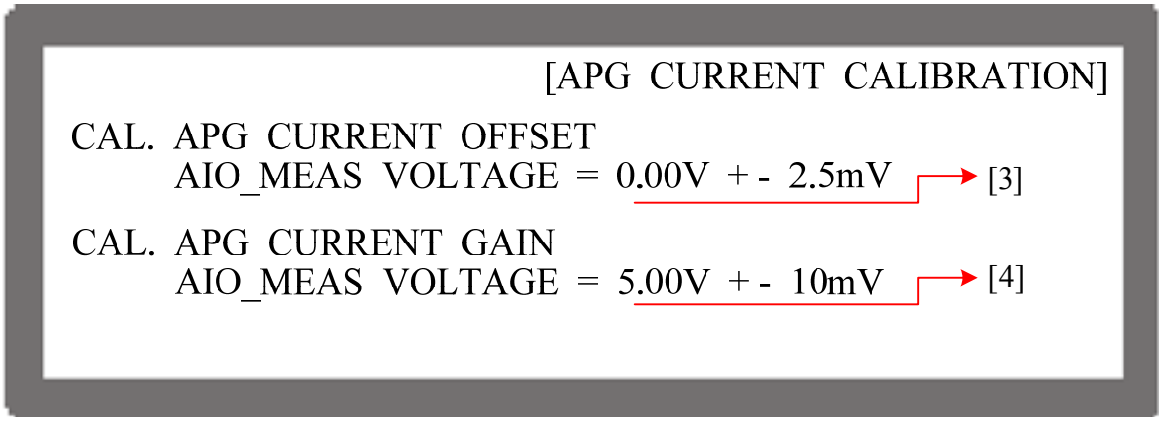


Figure 3-126

(7) Press "→↓" again the cursor stops at position [4] as Figure 3-126 shows. The Electronic Load should set to CV mode with 5V loading and then open the device cover to find VR403 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Make the DVM2 reading of Pin6 to be 5.00V±10mV by adjusting the resistance of VR403. Once the reading is adjusted correctly, press "ENTER" to confirm it and remove loading from the Electronic Load.

(8) The APG Voltage calibration is done once the above actions are completed. Press "SAVE", and "ENTER"to save the calibrated data as Figure 3-117 shows, or press "EXIT" to return to MAIN PAGE.

ⓘ NOTICE

The calibration point may be different for other models (non 62012P-80-60), please operate it following the instructions displayed.

4. Program Sequence

62012P-80-60 allows 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 with voltage setting, voltage slew rate, current setting, current slew rate, running time and trigger type. In addition it provides 8 Bit TTL signal outputs 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 the numeric (1 ~ 2) keys or "Rotary" ( ) knob to set the desired mode.
4. Press "ENTER" to confirm.
5. To quit PROGRAM, just press "EXIT" to return to MAIN PAGE.

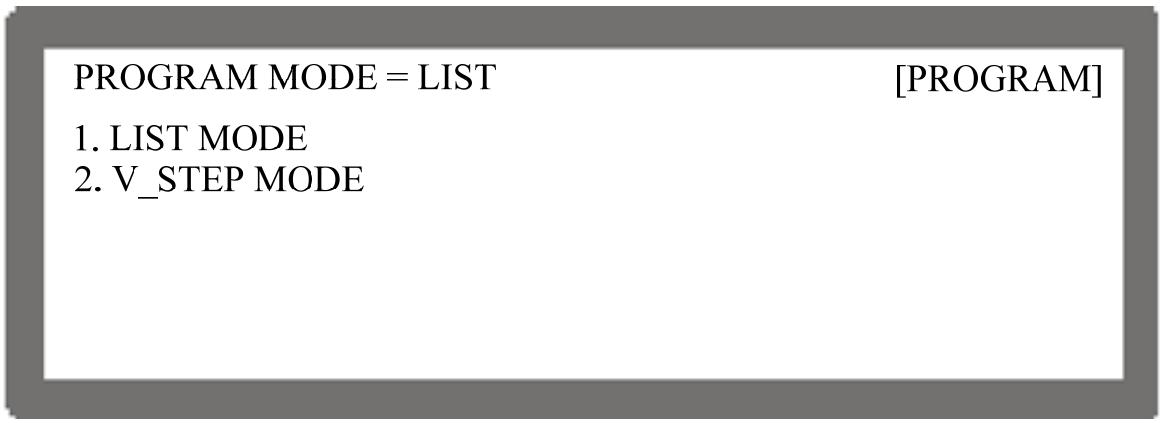


Figure 4-1

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.

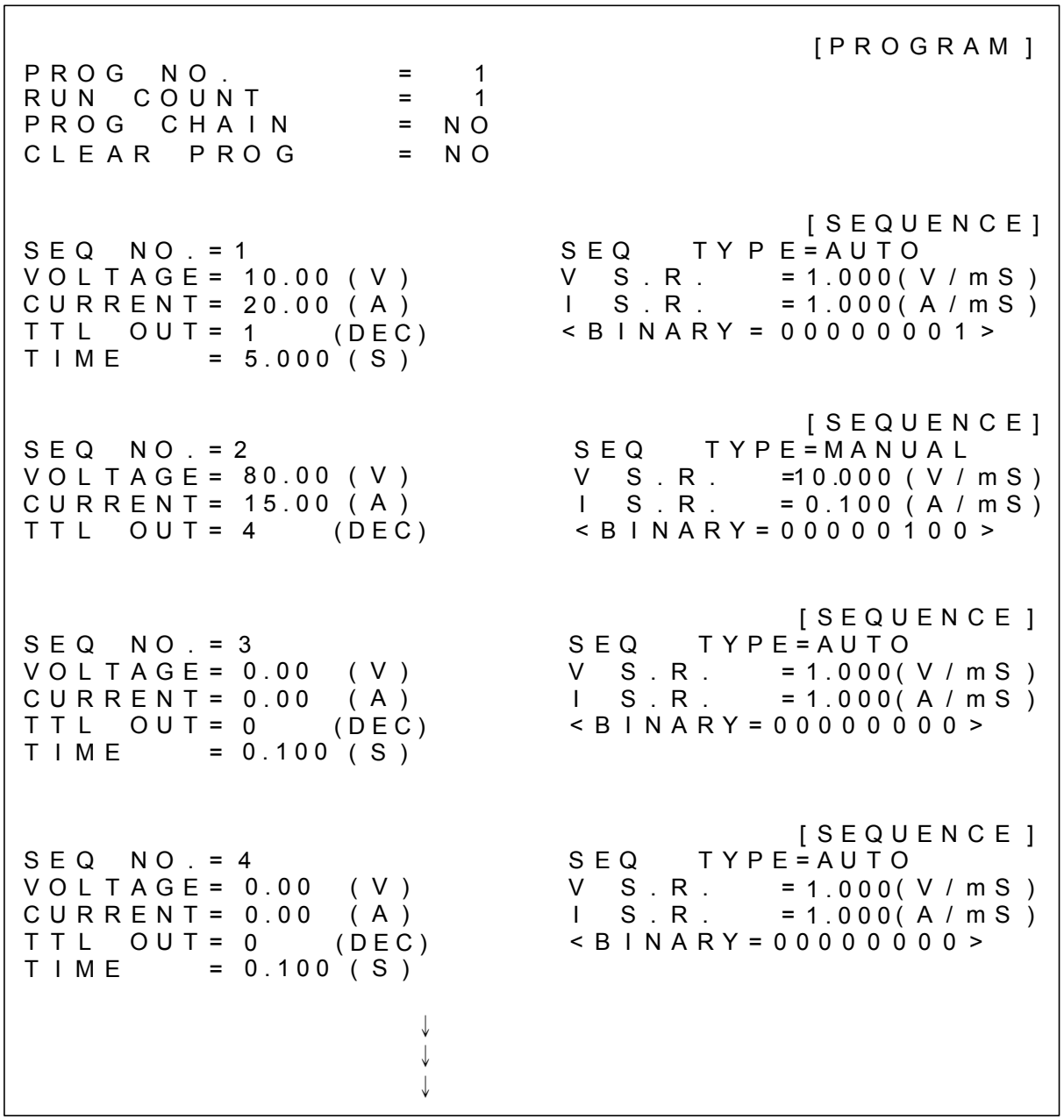


Figure 4-2

4.1.1 Description of PROGRAM Settings

A PROGGRAM has 4 settings: (1) PROG NO., (2) RUN COUNT, (3) PROG CHAIN, (4)CLEAR PROG.

4.1.1.1 Setting PROG NO.

1. PULL is able to select HIGH or LOW to control the PIN8 level in APG & SYSTEM STATUS.

2. Use “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as Figure 4-3 (1) shows.
3. Use the numeric (0 ~ 9) keys or “Rotary” ( ) knob to set the value.
4. Press “ ENTER ↵ ” to confirm.
5. Press “ EXIT ” to return to Figure 4-1.

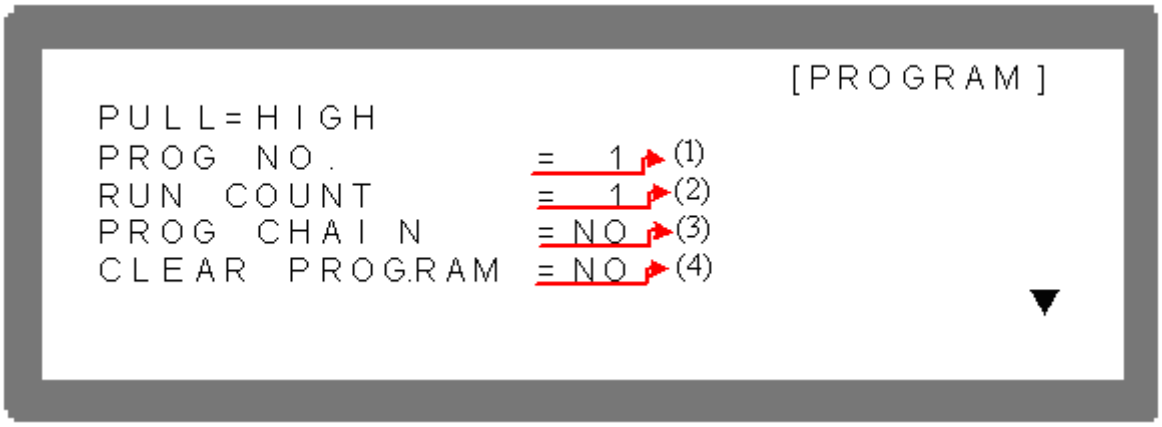


Figure 4-3

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

4.1.1.2 Setting RUN COUNT

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.

Each PROGRAM has a RUN COUNT that sets the execution number. Following table lists the RUN COUNT range:

RUN COUNT	MIN	MAX
TIMES	1	15000

Table 4-1

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

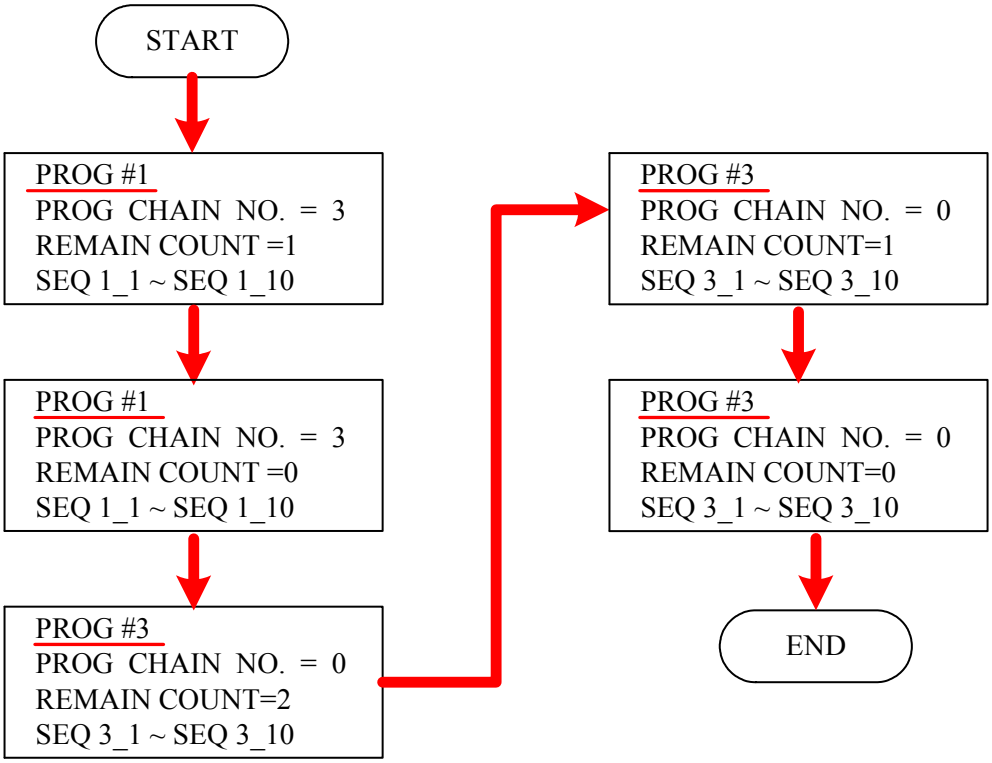


Figure 4-4

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

4.1.1.3 Setting PROG CHAIN

1. Use "←↑", "→↓" keys to move the cursor to the column to be set as Figure 4-3 (3) shows.
2. Use the numeric (0~9) keys 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

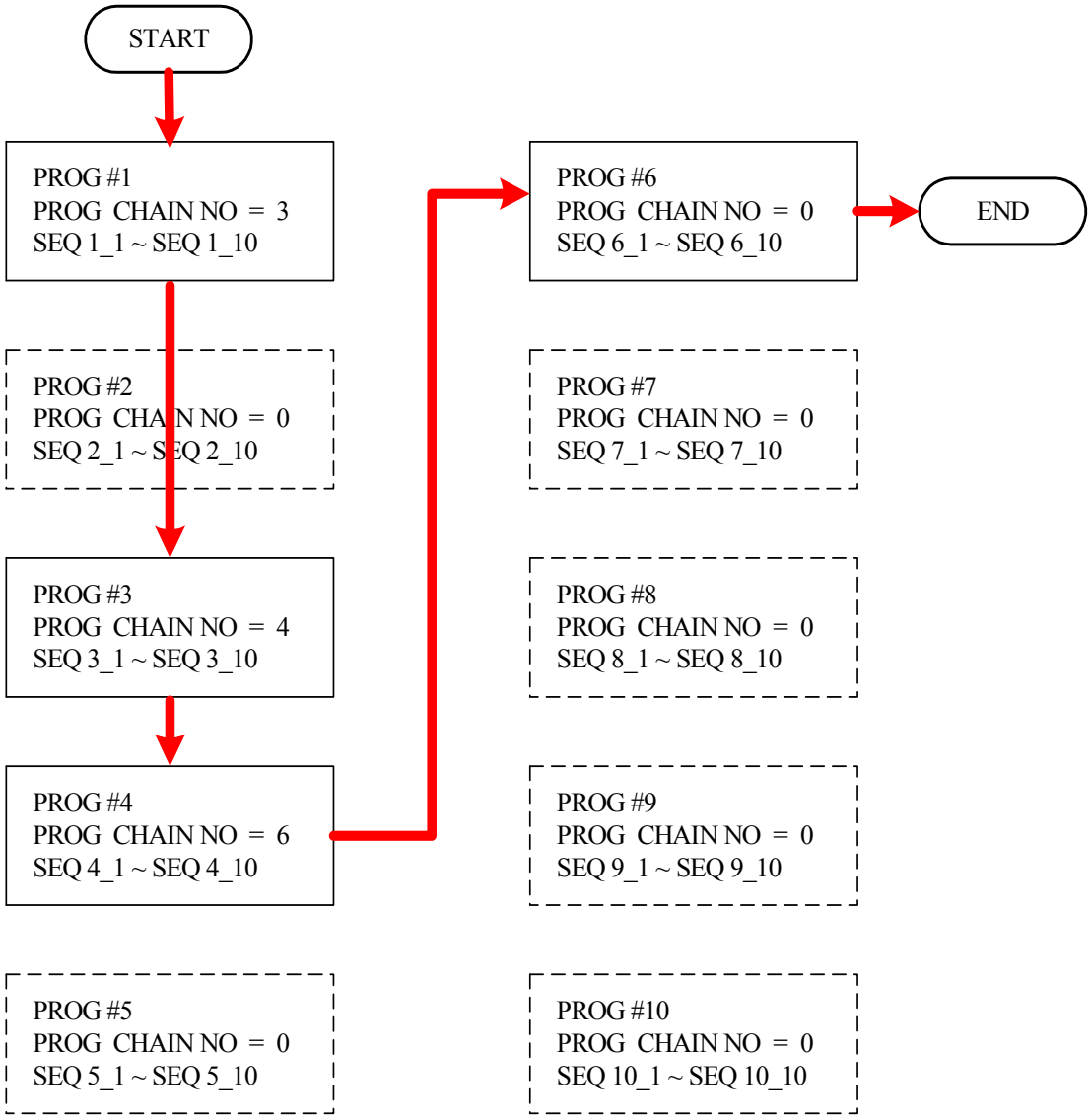


Figure 4-5

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.

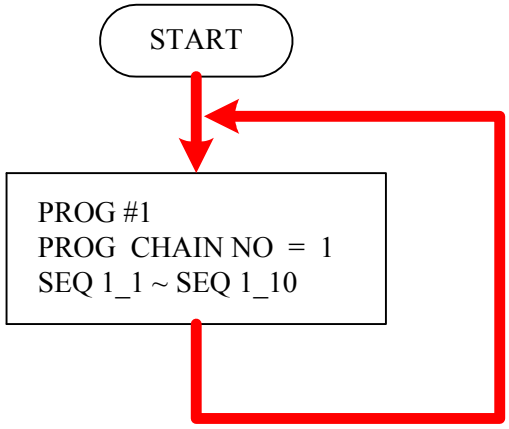


Figure 4-6

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.

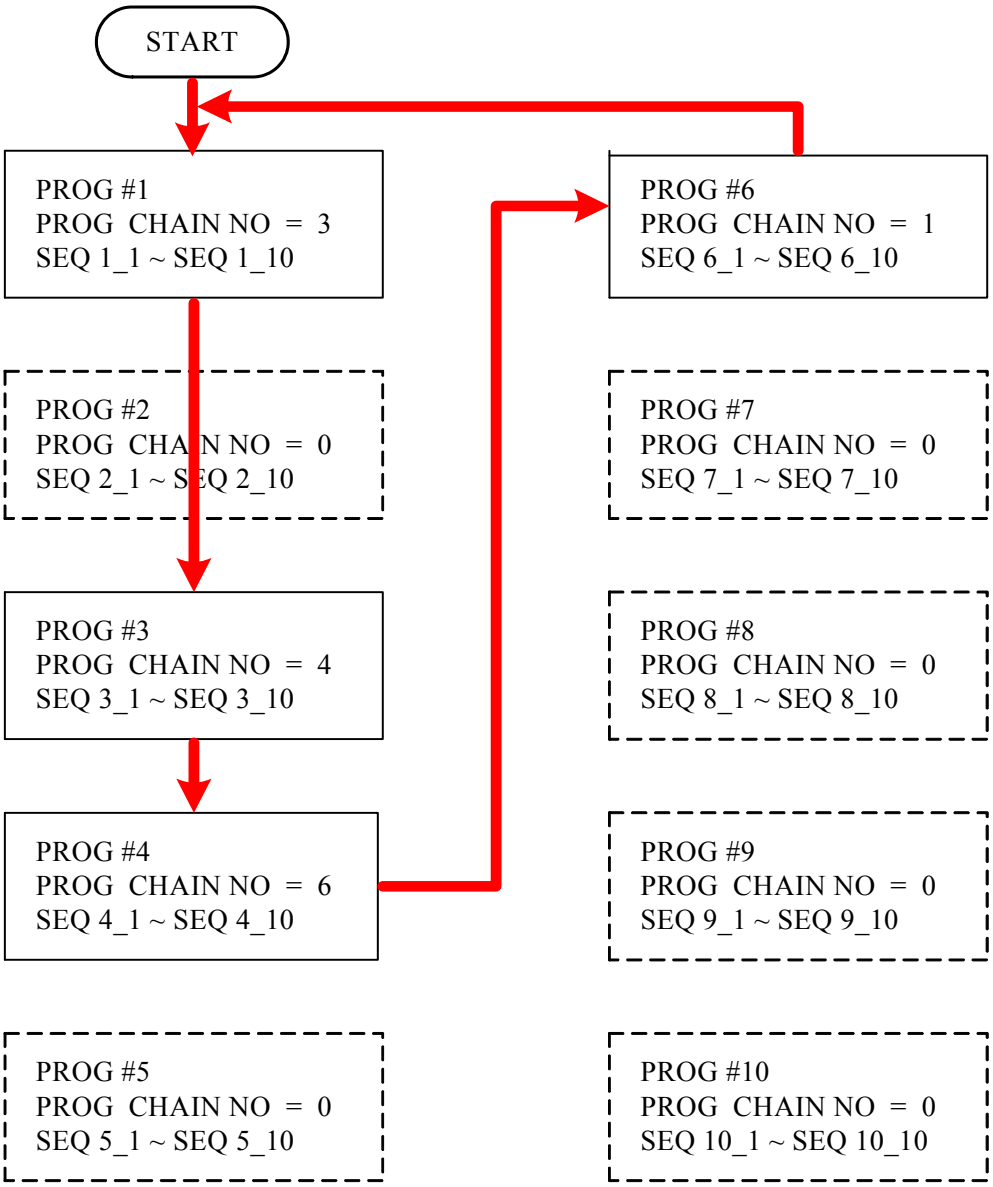


Figure 4-7

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.

4.1.1.4 Setting CLEAR PROGRAM

1. Use "←↑", "→↓" keys to move the cursor to the column to be set as Figure 4-3 (4) shows.
2. Use the numeric (0~1) keys 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 (4), press "→↓"can add a new SEQUENCE. The page will skip to Figure 4-8.
   b. When the cursor is at (8) 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 the numeric (0~1) keys or "Rotary" (◎) knob to set the value.

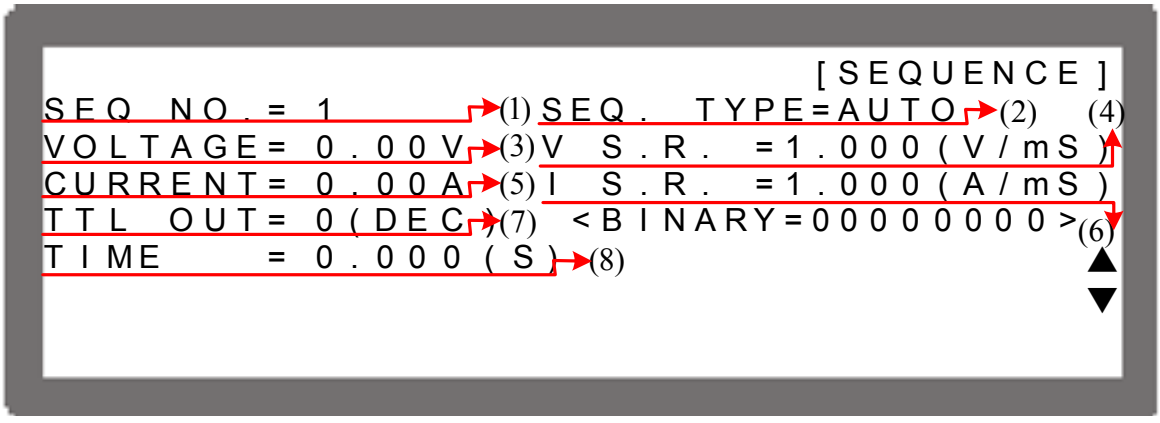


Figure 4-8

Each sequence has eight options: (1) SEQ NO., (2) SEQ. TYPE, (3) VOLTAGE, (4) CURRENT, (5) V S.R., (6) I S.R., (7) TTL OUT, and (8) TIME. They are described 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 (8), press "→↓" can add a new SEQUENCE. Also it can use the numeric (0~9) keys 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 the numeric (0~3) keys or "Rotary" ( ) knob to set the Sequence Type.

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

   (1) 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 =).

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

Table 4-2

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

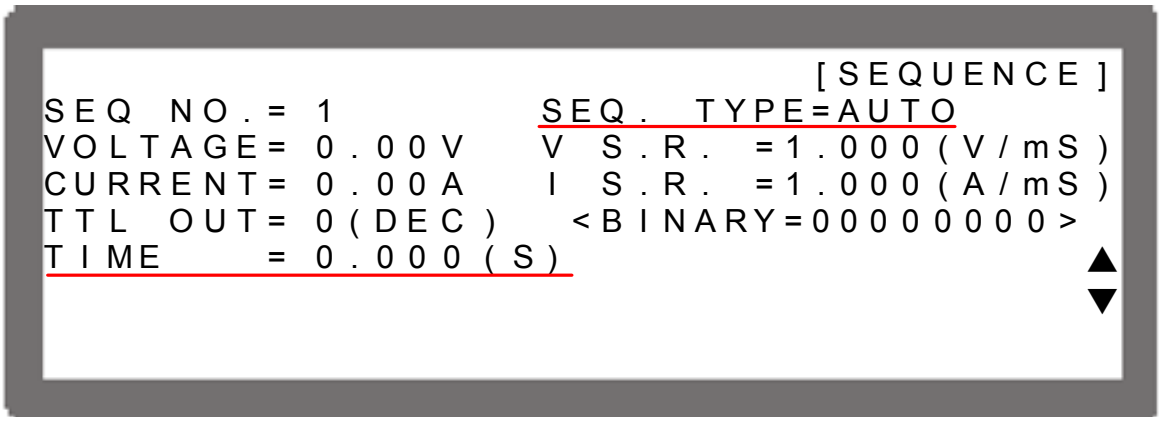


Figure 4-9

Ex. 5: Set Sequence Type to AUTO

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

```
                                                          [PROGRAM]
PROG NO.          =    1
RUN COUNT         =    2
PROG CHAIN        =  NO
CLEAR PROG        =  NO


                                                       [SEQUENCE]
SEQ NO.=1                          SEQ   TYPE=AUTO
VOLTAGE= 10.00 (V)                 V S.R.    =1.000(V/mS)
CURRENT= 20.00 (A)                 I S.R.    =1.000(A/mS)
TTL OUT= 1    (DEC)                <BINARY=00000001>
TIME    = 5.000 (S)


                                                       [SEQUENCE]
SEQ NO.=2                          SEQ   TYPE=AUTO
VOLTAGE= 30.00 (V)                 V S.R.    =10.000(V/mS)
CURRENT= 20.00 (A)                 I S.R.    =1.000(A/mS)
TTL OUT= 4    (DEC)                <BINARY=00000100>
TIME    =10.000 (S)


                                                       [SEQUENCE]
SEQ NO.=3                          SEQ   TYPE=AUTO
VOLTAGE= 0.00  (V)                 V S.R.    =1.000(V/mS)
CURRENT= 0.00  (A)                 I S.R.    =1.000(A/mS)
TTL OUT= 0    (DEC)                <BINARY=00000000>
TIME    = 0.000 (S)


                                        ↓
                                        ↓
                                        ↓

                                                       [SEQUENCE]
SEQ NO.=10                         SEQ   TYPE=AUTO
VOLTAGE= 0.00  (V)                 V S.R.    =1.000(V/mS)
CURRENT= 0.00  (A)                 I S.R.    =1.000(A/mS)
TTL OUT= 0    (DEC)                <BINARY=00000000>
TIME    = 0.000 (S)
```

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:

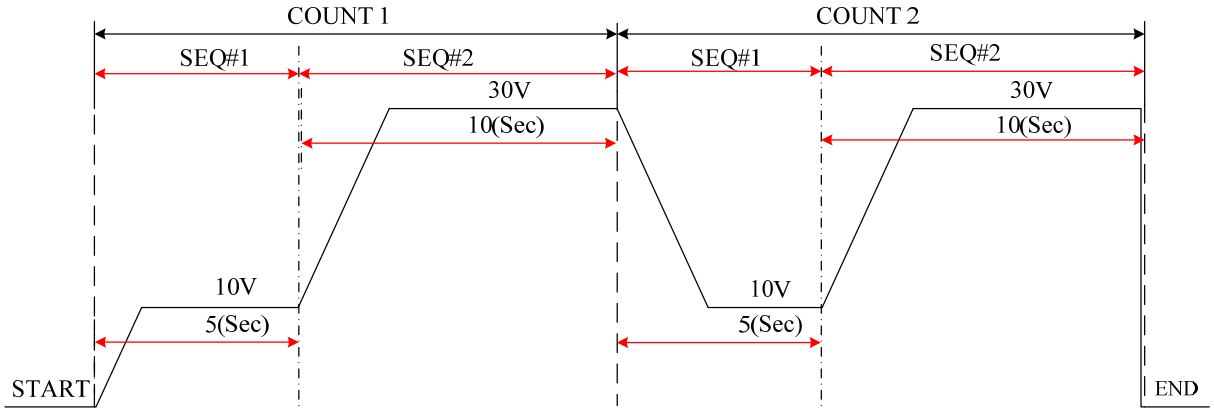


Figure 4-11

(2) 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.

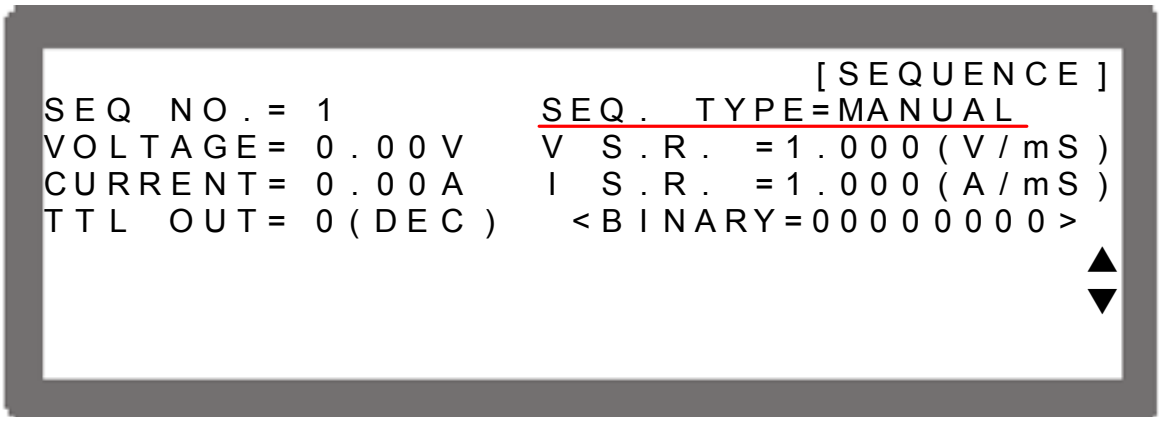


Figure 4-12

(3) 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 sine wave (positive edge triggered TTL level) from PIN 8 of Analog Interface on the rear panel. It will not ask users to enter the time the sequence will remain when set to TRIGGER.

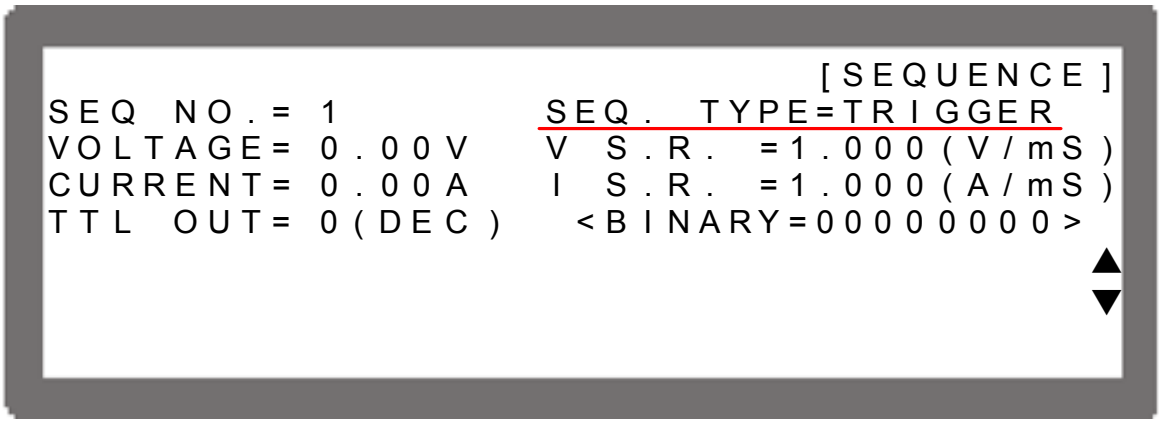


Figure 4-13

(4) 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.

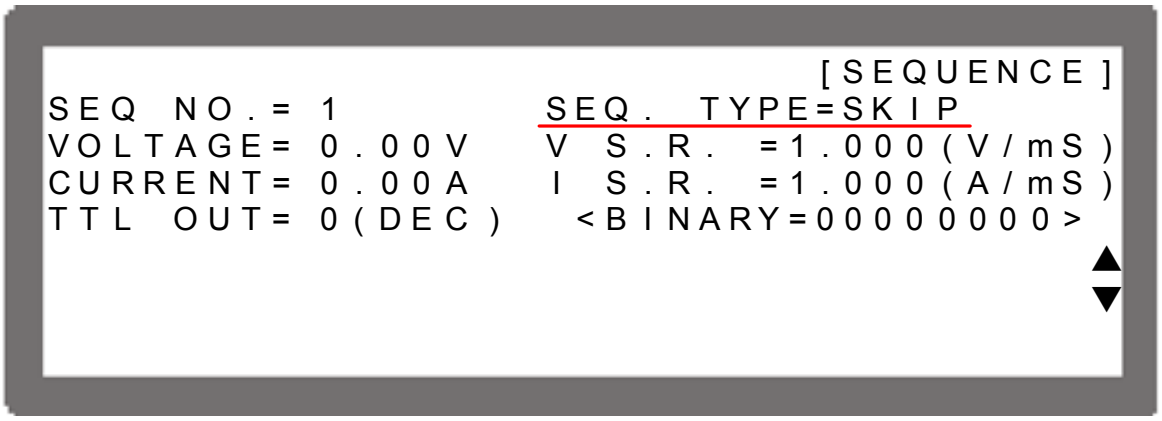


Figure 4-14

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

4.1.2.3 Setting Voltage

1. Use " ←↑ ", " →↓ " keys to move the cursor to the column to be set as Figure 4-8 (3) shows.
2. Use the numeric (0 ~ 9) keys 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 of settings.

4.1.2.4 Setting Current

1. Use " ←↑ ", " →↓ " keys to move the cursor to the column to be set as Figure 4-8 (5) shows.
2. Use the numeric (0 ~ 9) keys 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 of settings.

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 (4) shows.
2. Use the numeric (0 ~ 9) keys 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 of settings.

4.1.2.6 Setting Current Slew Rate

1. Use “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as Figure 4-8 (6) shows.
2. Use the numeric (0 ~ 9) keys 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 of settings.

4.1.2.7 Setting TTL OUT

1. Use “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as Figure 4-8 (7) shows.
2. Use the numeric (0 ~ 9) keys or “Rotary” (◎) knob to set the SEQ digital output state.
3. Press “ ENTER ” to confirm.
4. Press “ EXIT ” to return to Program PAGE (Figure 4-3).

See section 3.3.2.5 for detail description of settings.

4.1.2.8 Setting Time

1. Use “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as Figure 4-8 (8) shows.
2. Use the numeric (0 ~ 9) keys or “Rotary” (◎) knob 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).

4.1.3 Execution in LIST MODE

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

4.1.3.1 Running LIST MODE

1. Press "OUTPUT" will prompt a confirmation page as Figure 4-15 shows.

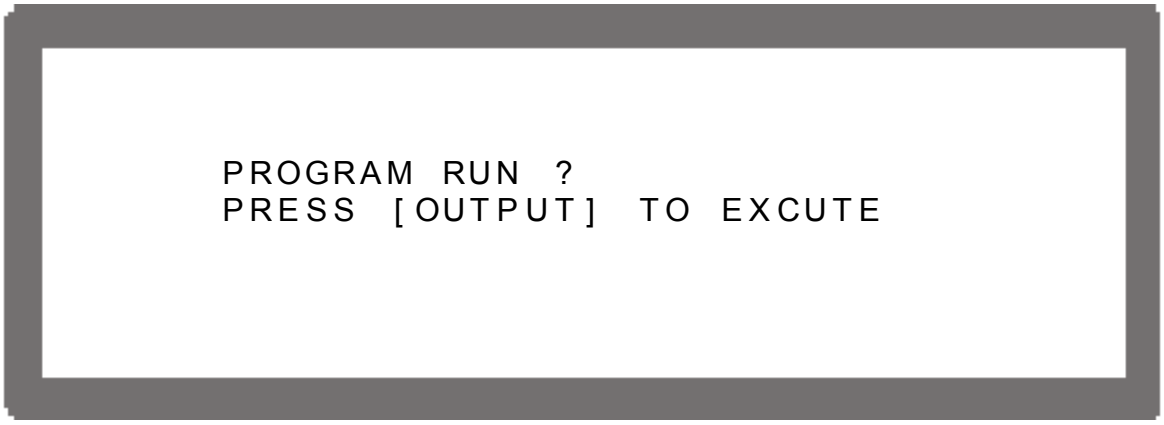


Figure 4-15

2. Press "OUTPUT" again to confirm the execution and go to MAIN PAGE as Figure 4-16 shows. To quit the execution, press "EXIT" will return to the standby MAIN PAGE.

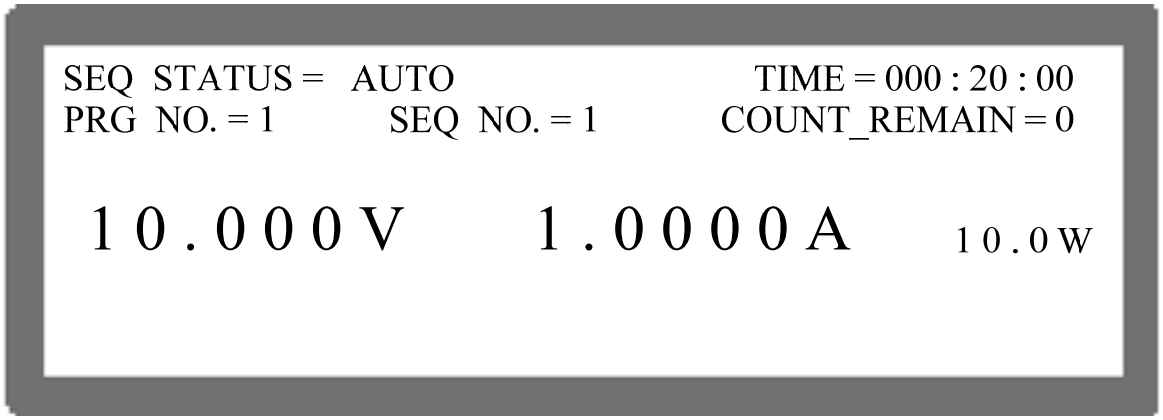


Figure 4-16

NOTICE

1. Press "OUTPUT" 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.

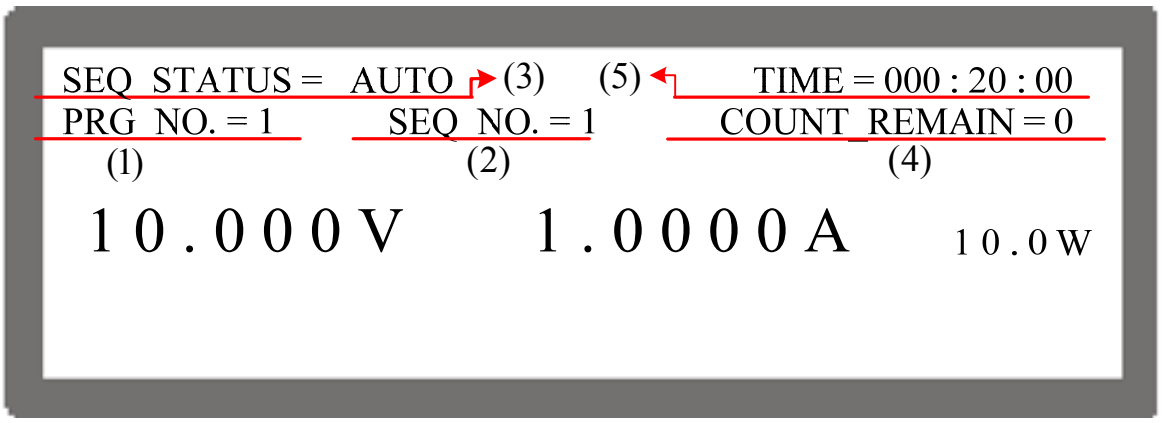


Figure 4-17

(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 999 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.

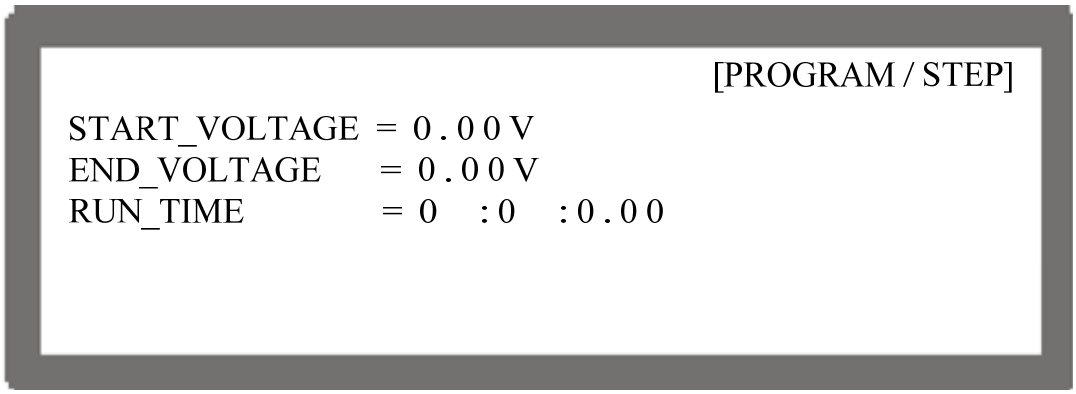


Figure 4-18

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 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.

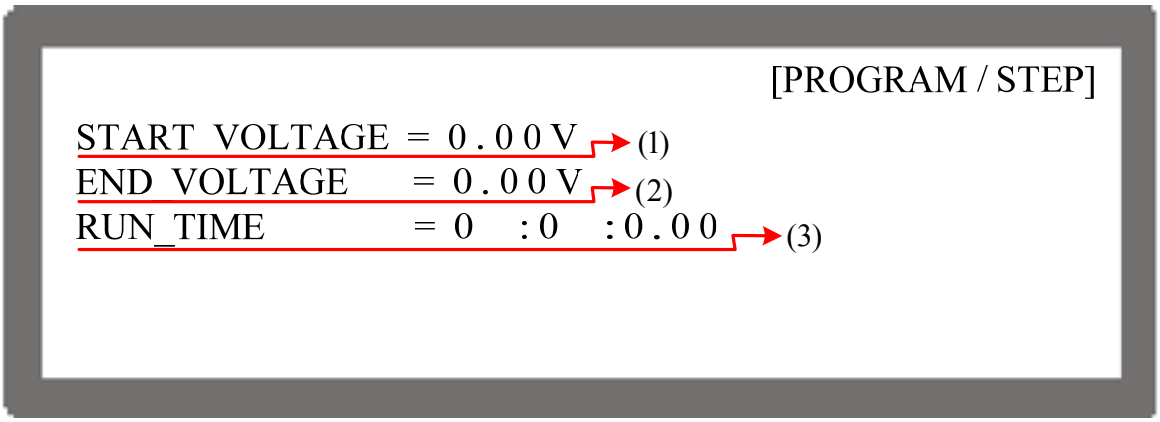


Figure 4-19

ⓘ NOTICE

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 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.

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 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.

ⓘ 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.

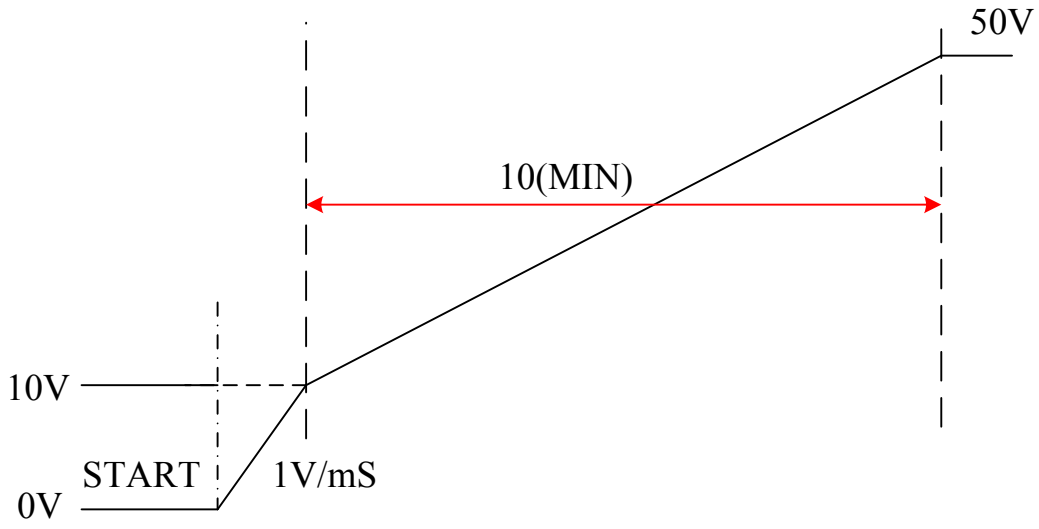


Figure 4-20

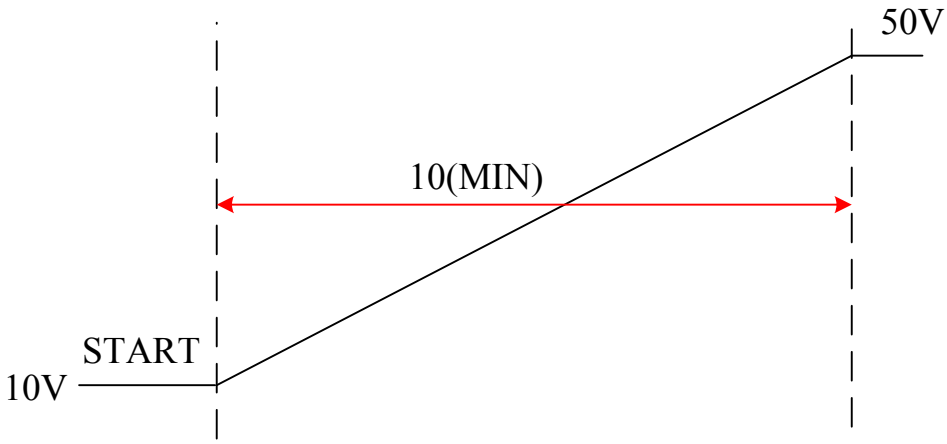


Figure 4-21

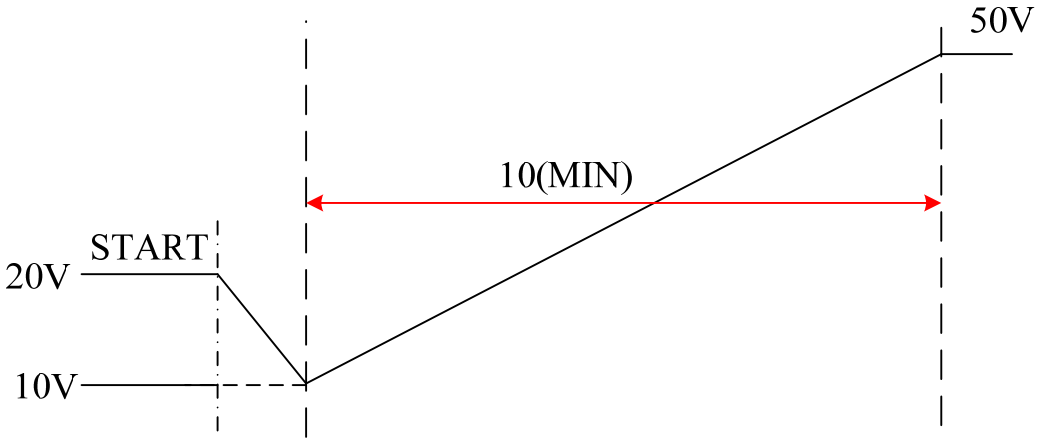


Figure 4-22

4.2.2 Execution of V_STEP MODE

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

4.2.2.1 Running V_STEP MODE

1. Press "OUTPUT" will appear a confirmation window as Figure 4-15 shows.
2. Press "OUTPUT" one more time to confirm the execution. It will skip to 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.

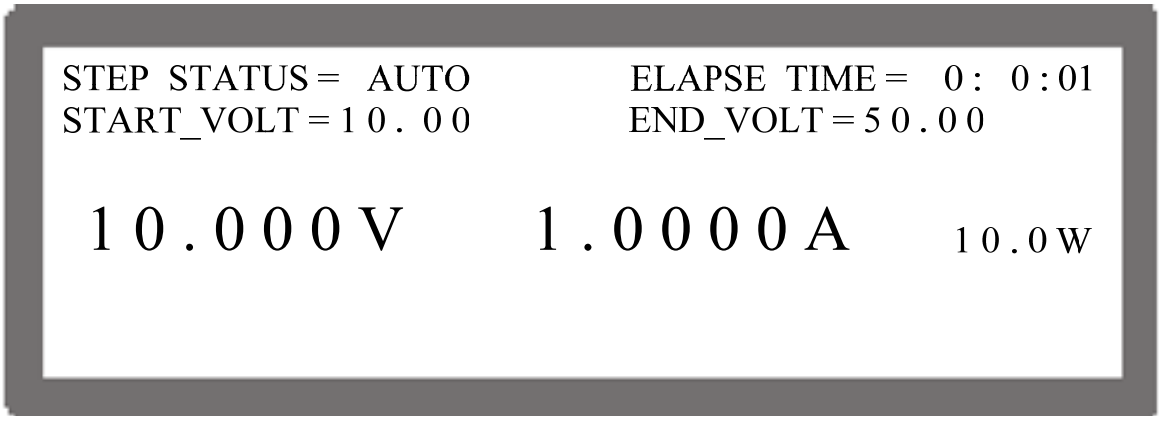


Figure 4-23

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.

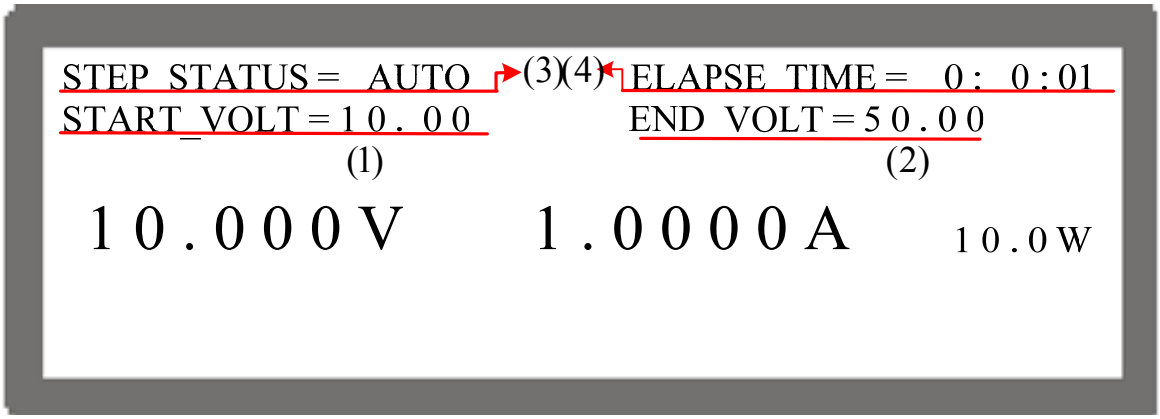


Figure 4-24

(1) START_VOLT: It is the start voltage setting of V_STEP MODE.
(2) END_VOLT: It is the end voltage setting ofV_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

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

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:	62000P 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 62000P 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 Address & RS-232C Parameters

See section 3.3.1.1 and 3.3.1.2.

5.1.3 Connecting RS-232C

The default baudrate of 62000P Series DC Power Supply is 9600 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 small female connector. Table 5-1 lists the pins and signals of RS-232C connector.

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 5-1

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

Pin NO.	IBM PC	62012P
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."

Table 5-2

ⓘ NOTICE
"N.C." stands for "Not Connected".

5.1.4 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 62000P Series

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 except [LOCAL/ REMOTE] are invalid. Press "[LOCAL/ REMOTE]" can return to local mode.

Table 5-3

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.

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.

Table 5-4

5.3.2 Numerical Data Formats

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

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 5-5 Format of Numerical Data

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

Table 5-6

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

Table 5-7

5.3.3 Boolean Data Format

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

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

String	Description
CHROMA	Manufacturer
62012P	Model name
01.00	Firmware version

2005/07/14 Date
Return Example: CHROMA 62012P-80-60, 01.00,2005/07/14

***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 62012P Series 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 <NRf>
Parameter: None
Example: *RCL

***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 single 62012P Series and the states of the current mode in a specified location in memory.
Syntax: *SAV
Example: *SAV

***SRE** **Service Request Enable Command/Query**
Type: Device status
Description: This command sets the condition of the Service Request Enable register, which determines which events of the Status Byte register (see *STB) are allowed to set the MSS (Master Status Summary) bit. A "1" in the bit position 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”.)

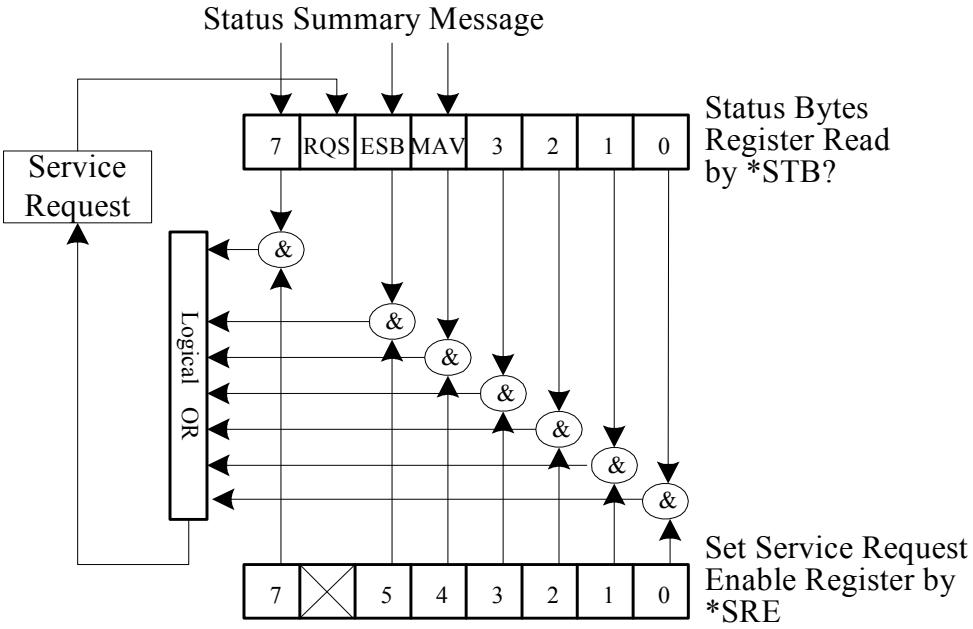


Figure 5-1

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.

Table 5-8

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.

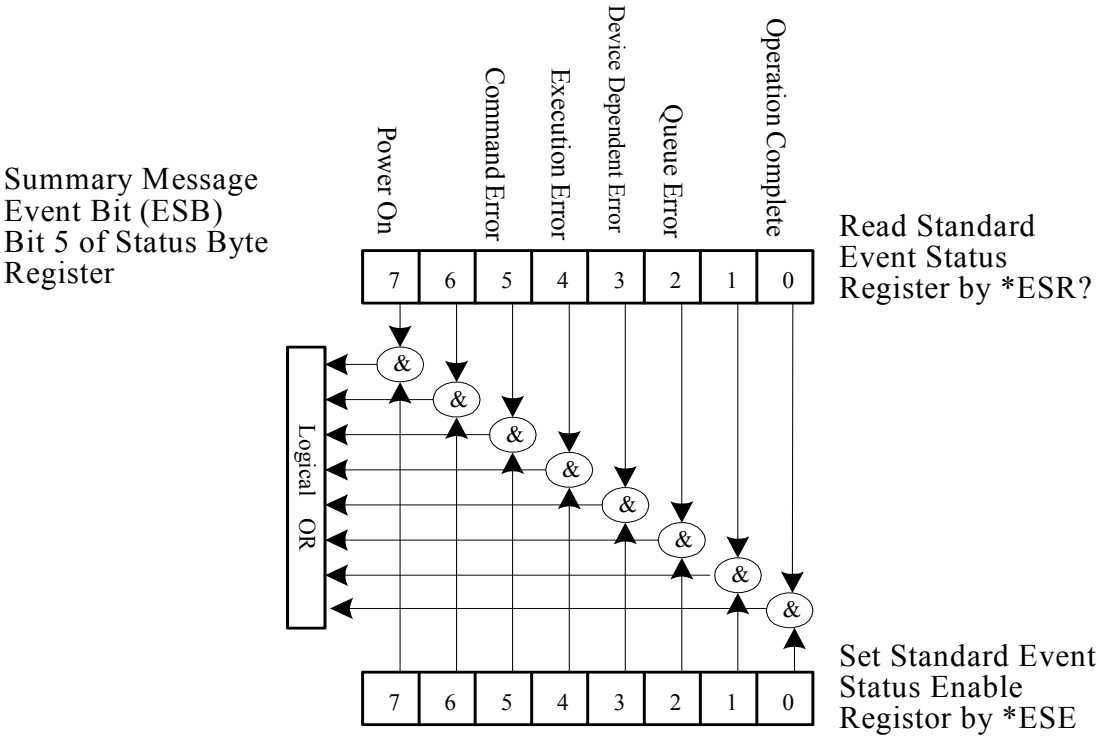


Figure 5-2

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	

Table 5-9

5.6.2 Specific Commands for 62000P 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: TTLport
Description: It sets the output value for TTL Port.
Syntax: CONFigure:TTL <NR1>
Parameter: <NR1>
Example: CONF:TTL 0
CONF:TTL 255
Query Syntax: CONFigure:TTL?
Return Parameter: <NR1>
Query Example: CONF:TTL? It returns the output value of TTL Port.
Return Example: 0 or 255

(2) 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

(3) 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.

(4) 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	

(5) 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	

(6) 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

(7) CONFigure:APGmode

Description:	It sets the type APG mode.	
Syntax:	CONFigure:APGmode V	
	CONFigure:APGmode I	
	CONFigure:APGmode VI	
Parameter:	NONE | V | I | VI	
Example:	CONF:APG VI	
Query Syntax:	CONFigure:APG?	
Query Example:	CONF:APG?	It returns the status set.
Return Example:	NONE | V | I | VI	

(8) CONFigure:APGV

Description:	It sets the APG reference voltage.
Syntax:	CONFigure:APGV FIVE
	CONFigure:APGV TEN
Parameter:	FIVE | TEN

Example: CONF:APGV FIVE
CONF:APGV TEN
Query Syntax: CONFigure:APGV?
Return Parameter: 5V | 10V
Query Example: CONF:APGV? It returns the status set.
Return Example: 5V or 10V

(9) CONFigure:MEASure:SPeed
Description: It sets the reading speed of AD for input voltage/current.
Syntax: CONFigure:MEASure:SPeed <NR1>
Parameter: <NR1>
0: 240SPS (0.25PLC)
1: 120SPS (0.5PLC)
2: 60SPS (1PLC)
3: 30SPS (2 PLC)
Example: CONFigure:MEASure:SPeed 0
CONFigure:MEASure:SPeed 1
Query Syntax: CONFigure:MEASure:SPeed?
Return Parameter: <NR1>
Query Example: CONFigure:MEASure:SPeed?
Return Example: 1

(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:BACKLight

Description:	It sets the LCD backlight.	
Syntax:	CONFigure:BACKLIGHT	
	CONFigure:BACKLIGHT OFF	
Parameter:	HIGH | NOR | DIM | OFF	
Example:	CONFigure:BACKLIGHT HIGH	
	CONFigure:BACKLIGHT NOR	
	CONFigure:BACKLIGHT DIM	
	CONFigure:BACKLIGHT OFF	
Query Syntax:	CONFigure:BACKLIGHT?	
Return Parameter:	HIGH | NOR | DIM | OFF	
Query Example:	CONFigure:BACKLIGHT?	It returns the LCD backlight state.
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, SLAVE4
Example:	CONFigure:MSTSLV:ID MASTER
	CONFigure:MSTSLV:ID SLAVE2
Query Syntax:	CONFigure:MSTSLV:ID?
Return Parameter:	MASTER | SLAVE1 | SLAVE2 | SLAVE3 | SLAVE4
Query Example:	CONF:MSTSLV:ID?
Return Example:	MASTER or SLAVE1 or SLAVE2 or SLAVE3 or SLAVE4

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

In addition, Master/Slave Control must be off when executing this command in Program: Run.

(17) CONFigure:INHibit
Description: It executes the Remote Inhibit control function.
Syntax: CONFigure:INHibit TRIG
Parameter: OFF| TRIG | LIVE
Example: CONFigure:INHibit OFF
CONFigure:INHibit TRIG
CONFigure:INHibit LIVE
Query Syntax: CONFigure:INHibit?
Return Parameter: OFF, TRIG, LIVE
Query Example: CONF:INH?
Return Example: OFF

Note: LIVE on the panel is External ON/OFF.

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:	8.000000e1	

(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:	80.0	

(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:	88.00	

(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 100 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:	10	

(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:	9.000000e1	

(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:	60.00	

(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:	50.00	

(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: 1.00

(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: 1260.00

(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: 79.5

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: 8.12

(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: 3.15

(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: 1100.00

(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: BUS OVP
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: 8.12

(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: 3.15

(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: 1000.00

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: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

(7) 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

(8) 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: 40.5

(9) 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

(10) 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: 40.5

(11) 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: 10

(12) 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.

(13) PROGram:SEQuence:TTLport
Description: It sets the sequence for TTL Port output
Syntax: PROGram:SEQuence:TTLport <NRf1>
Example: PROG:SEQ:TTL 10
Query Syntax: PROG:SEQ:TTL?
Return Parameter: <NR1>
Query Example: PROG:SEQ:TTL?
Return Example: 10

(14) PROGram:SEQuence:TIME
Description: It sets the sequence for the duration of time.
Syntax: PROGram:SEQuence:TIME <NRf1>
Example: PROG:SEQ:TIME 10
Query Syntax: PROG:SEQ:TIME?
Return Parameter: <NR1>
Query Example: PROG:SEQ:TIME?
Return Example: 6000

(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: Sequence TTL <NR1>
Arg7: Sequence TIME (NRf+ unit: SEC, only valid when Sequence Type is AUTO)

Example: Set the Sequence
PROGram:SEQuence 0,80,10,15,1,255,1

Query Syntax: PROG:SEQ ?
Return Parameter: 0,80,10,15,1,255,1
Query Example: PROG:SEQ?
Return Example: 0,80,10,15,1,255,1

(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: 20.0

(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: 50.0

(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

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”

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"		

Table 5-10

6. Theory of Operation

6.1 Overview

The 62000P Series DC Power Supply has A, B, C, D, G, I, K, M, N and S total 10 circuit boards in it.

- A board contains input stage and auxiliary power.
- B board is the output stage.
- C board is the digital control board.
- D board is the connecting board from digital board to LCD panel.
- G board is the GPIB control board (optional).
- I board connects the RS232, RS485, TTL and APG signals to rear panel.
- K board controls the keys connected to front panel.
- M board connects S board and B board. It is the control board connecting Current Sharing and Remote Sense wire in parallel for reverse protection.
- N board connects to the output copper bus to filter out the high frequency noise.
- O board that connected to the B board is DC_ON and the control board for hardware OPP protection.
- S board connects to M board and is used for processing current signal as well as receiving remote voltage signal in parallel.

Figure 6-1 shows the system diagram.

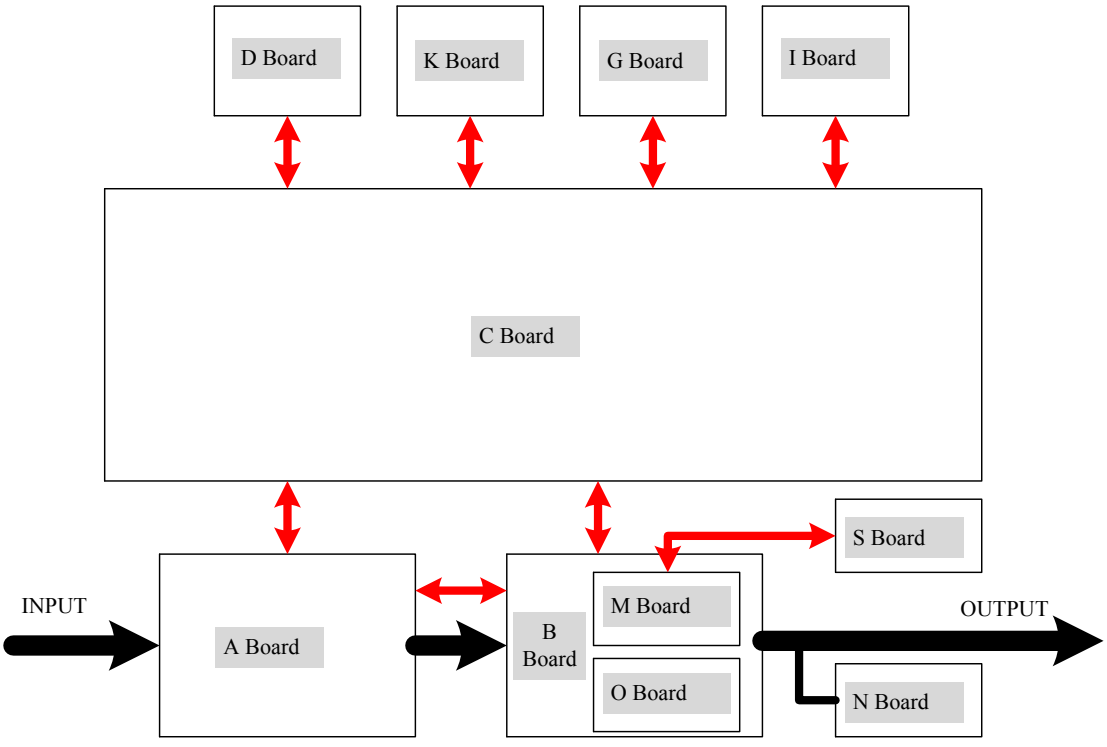


Figure 6-1

Figure 6-2 shows the input stage structure.

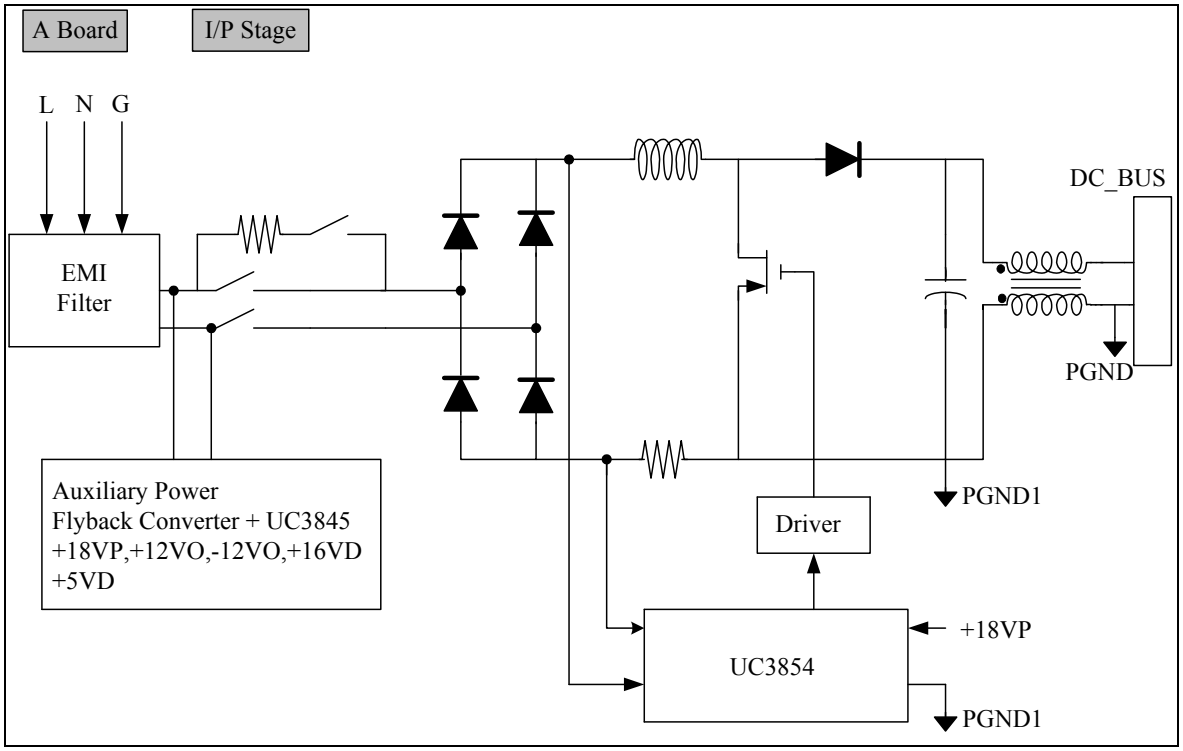


Figure 6-2

Figure 6-3 shows the output stage structure.

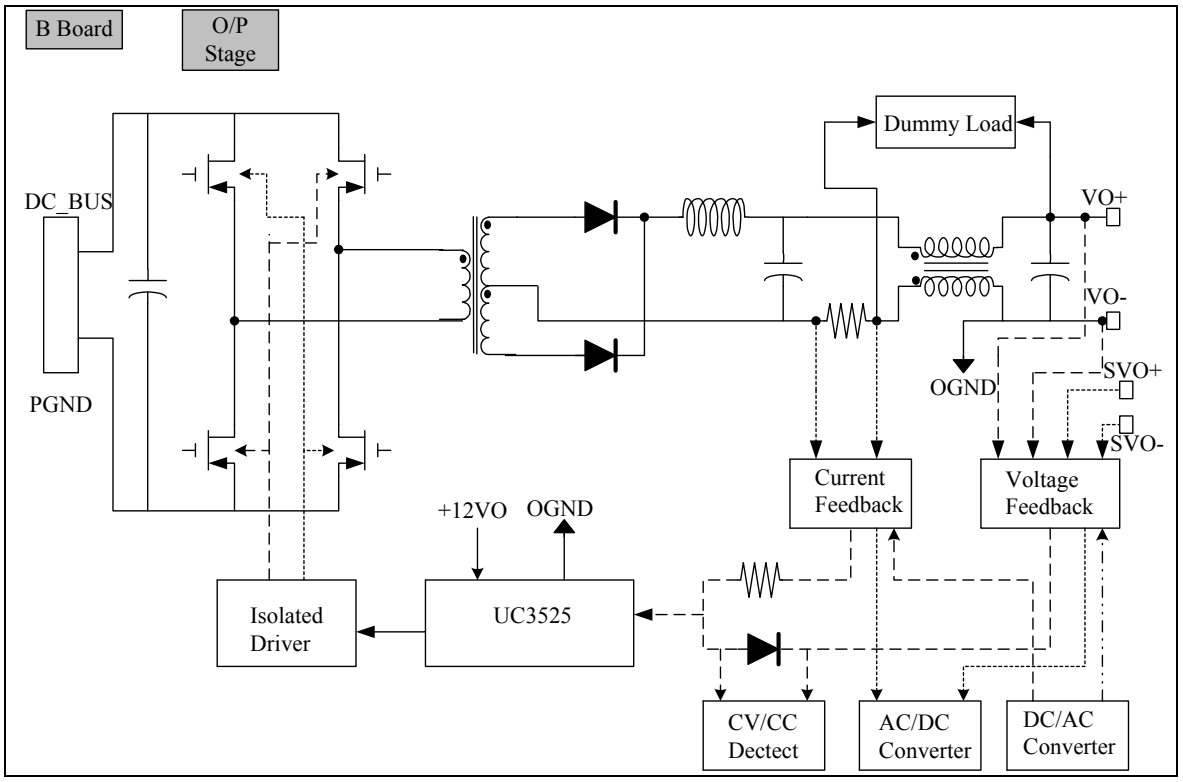


Figure 6-3

Figure 6-4 shows the digital stage structure.

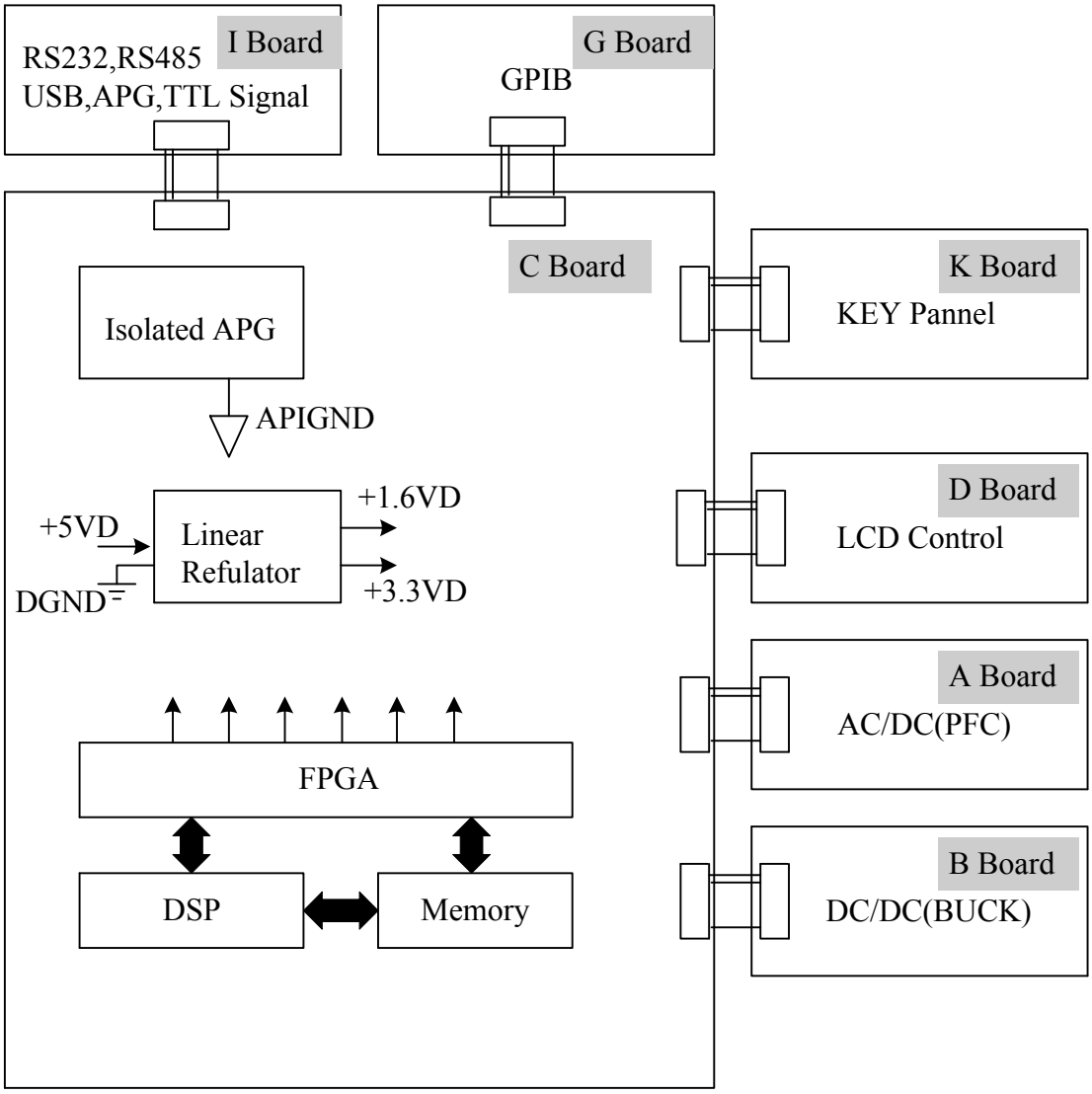


Figure 6-4

6.2 Function Description

6.2.1 I/P (PFC) Stage

1. The input stage is a bridge rectifier plus a boost converter with PFC function. The PWM IC is the UCC3854 of Unitrode and controlled by average current mode under the switch frequency of 30KHz.
2. The way input stage inhibits inrush current is to switch the relay to a series of 300~400Ω resistance during power-on to charge the PFC output capacitance. Turn on another relay after few seconds and bypass this current limit resistance then enable UCC3854.
3. The PFC output has over voltage protection. When the output voltage is set to high, it will disable UCC3854 and send signal back to CPU to shutdown the system.

6.2.2 Auxiliary Power

1. The input terminal of auxiliary power is AC source (after EMI filter but before PFC relay and fuse) 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 PGND, OGND and DGND based on their potential. The PGND is to input PFC and primary side reference potential of output stage, while OGND is the secondary side 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 UC3525 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 two stages LC filter to lower down 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 (12 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 TI TMS320VC5501PGF300 with Lattice FPGA (LFXP6C3QN208CES).
2. The power source 3.3V required by FPGA is got from +5VD.
3. The DSP required 3.3V and 1.6V power is got from +5VD.
4. The signal of analog program interface and digital circuit are isolated by the power source of +12VD 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 62000P 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 ~ 40°C. 2. Clear the vent.
Over Power Protection (OPP)	The output power exceeds the spec.	Remove the over load or enlarge the OPP settings.
Over Current Protection (OCP)	The output current exceeds the spec. or OCP settings.	Remove the over load or enlarge the OCP settings.
Fan Fail Protection (FAN LOCK)	1. The fan is out of order. 2. The feedback circuit is abnormal.	Consult local sales agent if it is unable to reset the protection state.
Input Error Protection 1 AC OFF	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.
Input Error Protection 1 BUS_OVP	1. The DC_BUS feedback is abnormal. 2. The control IC (UC3854) is out of order. 3. The AD power stage is damaged.	Consult local sales agent if it is unable to reset the protection state.
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.

Problem	Cause	Resolution
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.
Series Fault Protection	The Current Sharing cable is connected in series mode.	Remove the Current Sharing cable.
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 20-pin horizontal socket connector is located at rear panel in green.

PIN No.	PIN Definition	PIN No.	PIN Definition
1	+12VAPI	11	_FAULT
2	APIGND	12	TTL0
3	AVO_SET	13	TTL1
4	AIO_SET	14	TTL2
5	AVO_MEAS	15	TTL3
6	AIO_MEAS	16	TTL4
7	SAFETY INT.LOCK	17	TTL5
8	EXT. TRIGGER	18	TTL6
9	_INHIBIT	19	TTL7
10	DC_ON	20	DGND

(1) PIN 1: 12V auxiliary power; see section 3.3.1.3.
(2) PIN 2: Ground of 12V auxiliary power; see section 3.3.1.3.
(3) PIN 3: Voltage programming; see section 3.3.1.3.
(4) PIN 4: Current programming; see section 3.3.1.3.
(5) PIN 5: Voltage measurement; see section 3.3.1.3.
(6) PIN 6: Current measurement; see section 3.3.1.3.
(7) PIN 7: SAFETY INT.LOCK, see section 3.3.5.5.
(8) PIN 8: External trigger signal of Program mode; see section 4.1.2.2.
(9) PIN 9: When the voltage level of this pin turns to LOW, it inhibits the output of DC Power Supply. When REMOTE INHIBIT sets to OFF, the pin is invalid and when REMOTE INHIBIT sets to TRIGGER once the low level triggers it, it equals pressing "OUTPUT" key to set OUTPUT = OFF; and when REMOTE INHIBIT sets to EXT. ON/OFF when the voltage level turns to LOW, it equals pressing "OUTPUT" key to set OUTPUT = OFF; however, when the voltage level of this pin turns to HIGH the power supply returns to normal output. Figure A-0-1 shows the detail actions.
(10) PIN 10: When the DC power supply output is ON and the voltage is over VDC_R, the pin10 DC_ON of SYSTEM STATUS on the device rear panel will turn to HIGH. When the DC power supply output voltage is lower than VDC_F setting, the pin10 DC_ON of SYSTEM STATUS on the device rear panel will turn to LOW.
(11) PIN 11: When protection occurs as described in section 3.3.5, this will turn to LOW.
(12) PIN 12: Bit 0 of TTL signal output; see section 3.3.2.5 for detail setting.
(13) PIN 13: Bit 1 of TTL signal output; see section 3.3.2.5 for detail setting.
(14) PIN 14: Bit 2 of TTL signal output; see section 3.3.2.5 for detail setting.
(15) PIN 15: Bit 3 of TTL signal output; see section 3.3.2.5 for detail setting.
(16) PIN 16: Bit 4 of TTL signal output; see section 3.3.2.5 for detail setting.
(17) PIN 17: Bit 5 of TTL signal output; see section 3.3.2.5 for detail setting.
(18) PIN 18: Bit 6 of TTL signal output; see section 3.3.2.5 for detail setting.

(19) PIN 19: Bit 7 of TTL signal output; see section 3.3.2.5 for detail setting.
(20) PIN 20: Ground of TTL (digital) signal.

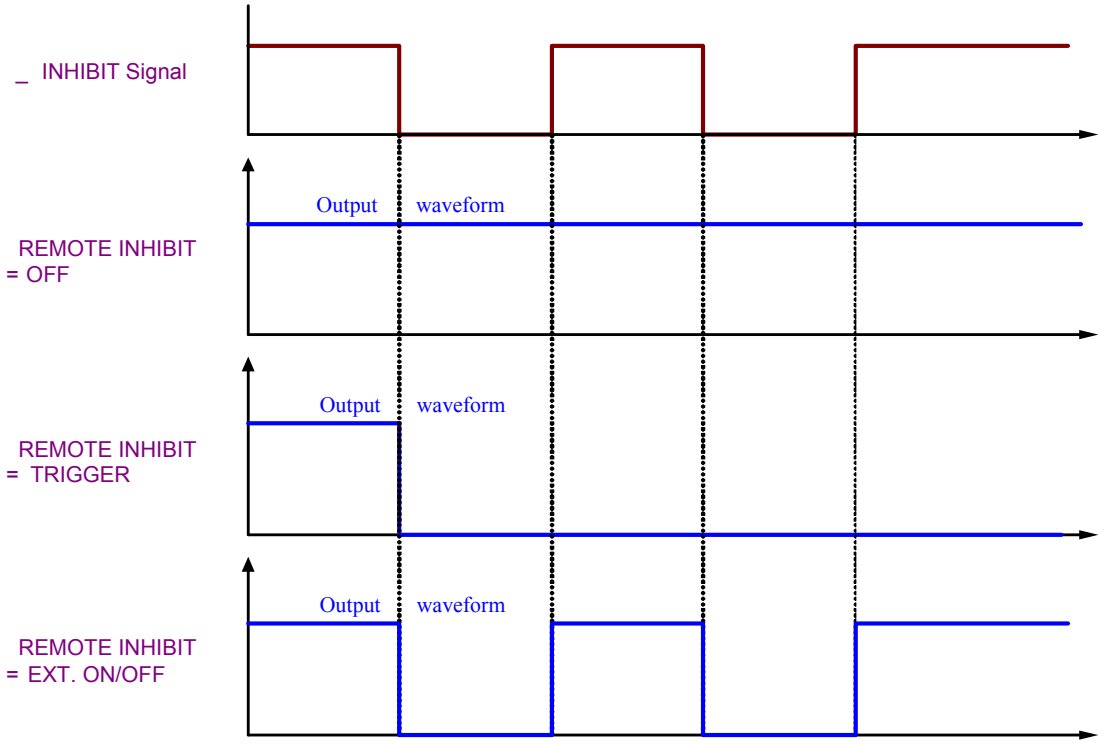


Figure A-0-1 Detail Actions of PIN9

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	Input stage over voltage protect	BUS_OVP
Over power protect	OPP	Remote sense reverse protect	SENSE FAULT
Over temperature protect	OTP	CV TO CC mode change protect	CV TO CC FOLDBACK
Fan fail protect	FANLOCK	CC TO CV mode change protect	CC TO CV FOLDBACK
Series Fault Protect	SERIES FAULT		