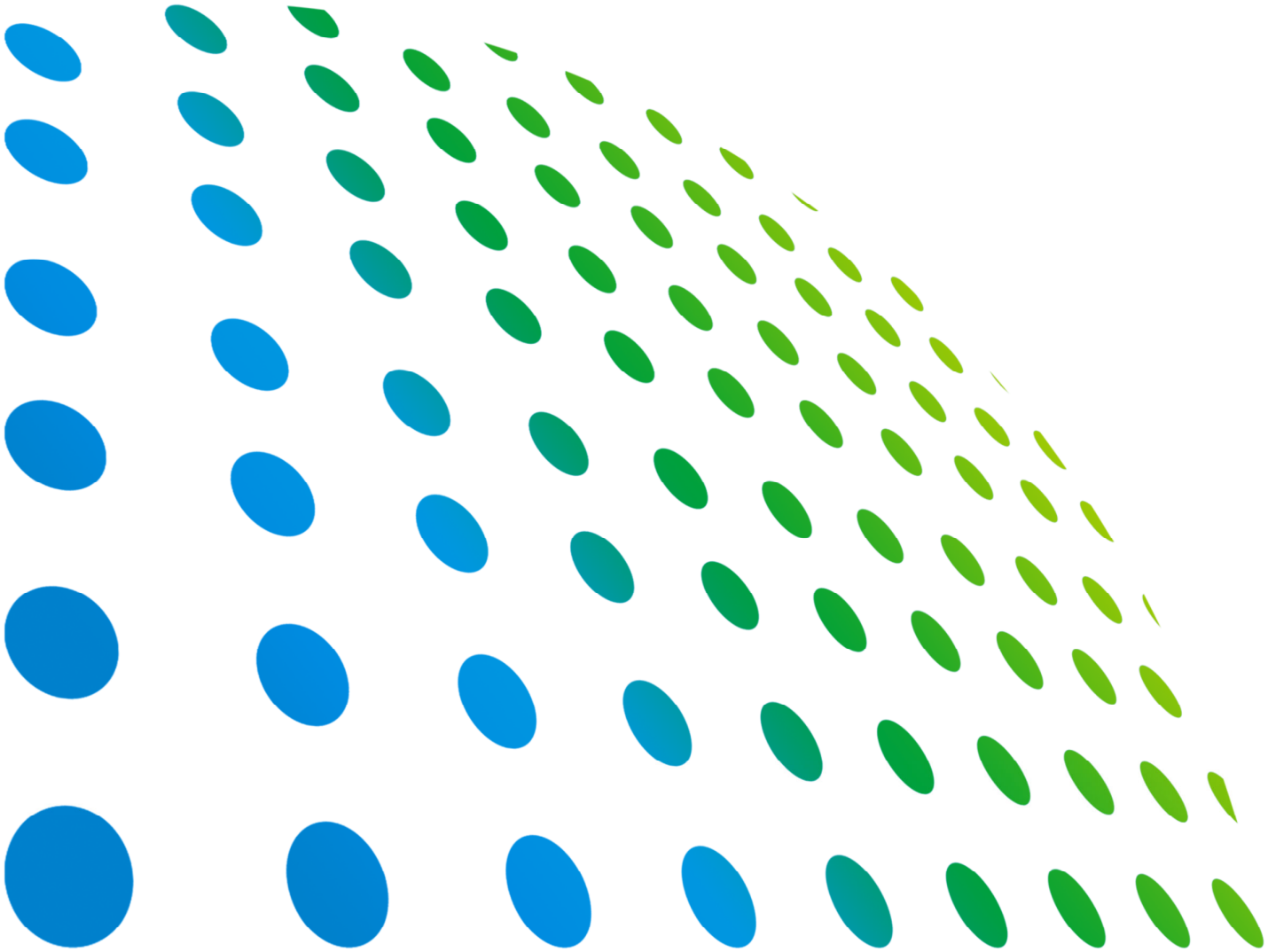
Chroma

Programmable DC Power Supply

62000P Series

Operating & Programming Manual



Programmable DC Power Supply
62000P Series
Operating & Programming Manual

Version 2.1
February 2018

Legal Notices

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

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

CHROMA ATE INC.
66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

Warranty

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

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

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

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

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http://www.chromaate.com

Material Contents Declaration

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


: See **<Table 1>**.


: See **<Table 2>**.

<Table 1>

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

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

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

Remarks: The CE marking on product is a declaration of product compliance with EU Directive 2011/65/EU.

Disposal

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

<Table 2>

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

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

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

1. Chroma has not fully transitioned to lead-free solder assembly at this time; 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 ones, the retailer is legally obligated to take back the old appliances for disposal free of charge.

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CE

Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62006P-30-80, 62012P-40-120, 62024P-40-120

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

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

EN 61326-1:2013 Class A, EN 61326-2-1:2013, EN 61000-3-2:2014, EN 61000-3-3:2013

EN 61326-1:2013(industrial locations)

EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010, EN 61000-4-4:2012,
EN 61000-4-5:2014, EN 61000-4-6:2014, EN 61000-4-8:2010, EN 61000-4-11:2004

EN 61010-1:2010

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

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

CHROMA ATE INC.

(Company Name)

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

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

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CE

Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62006P-100-25, 62012P-100-50, 62024P-100-50, 62012P-80-60, 62024P-80-60

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

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

EN 61326-1:2013 Class A, EN 61000-3-2:2014, EN 61000-3-3:2013

EN 61326-1:2013(industrial locations)

EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010, EN 61000-4-4:2012,
EN 61000-4-5:2014, EN 61000-4-6:2014, EN 61000-4-8:2010, EN 61000-4-11:2004

EN 61010-1:2010

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T&M BU Vice President

(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

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Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62006P-300-8, 62012P-600-8, 62024P-600-8

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

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

EN 61326-1:2013,Table 2, CISPR 11:2009+A1:2010 Group 1 Class A

EN 61000-3-2:2014,Class A, EN 61000-3-3:2013

IEC 61000-4-2:2008, IEC 61000-4-3:2006+A1:2007+A2:2010, IEC 61000-4-4:2012,
IEC 61000-4-5:2005, IEC 61000-4-6:2008, IEC 61000-4-8:2009, IEC 61000-4-11:2004

EN 61010-1:2010

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(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

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CE

Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62050P-100-100

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

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

EN 61326-1:2013 Class A, EN 61000-3-2:2014, EN 61000-3-3:2013

EN 61326-1:2013(industrial locations)

EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010, EN 61000-4-4:2012,
EN 61000-4-5:2006, EN 61000-4-6:2014, EN 61000-4-8:2010, EN 61000-4-11:2004

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Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	**2017.02.21**	Vincent Wu
(Place)	(Date)	(Legal Signature)

Safety Summary

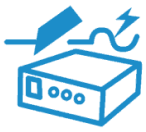
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the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

BEFORE APPLYING POWER

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

PROTECTIVE GROUNDING

Connect the protective grounding cables to a good earth ground to prevent an electric shock before turning on the power.



NECESSITY OF PROTECTIVE GROUNDING

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

FUSES

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

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. The instrument should only be used in an environment with good ventilation.

DO NOT REMOVE THE COVER OF THE INSTRUMENT

Operating personnel must not remove the cover of the instrument. Component replacement and internal adjustment should only be done by qualified service personnel.

⚠WARNING

1. Lethal voltage. AC source may output 426 V peak voltage.
2. 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, refer to the explanation in the instruction manual.
	**High temperature:** This symbol indicates the temperature is hazardous to human beings. To prevent personal injury, do not touch the object.
	**Protective grounding terminal:** This symbol indicates that the terminal must be connected to ground before operation of the equipment to protect against electrical shock in case of a fault.
	**Functional grounding:** To identify an earth (ground) terminal in cases where the protective ground is not explicitly stated. This symbol indicates the power connector does not provide grounding.
	**Frame or chassis:** To identify a frame or chassis terminal.
	**Alternating Current (AC)**
	**Direct Current (DC) / Alternating Current (AC)**
	**Direct Current (DC)**
	**Push-on/Push-off power switch**
	The **WARNING** sign highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.
	The **CAUTION** sign highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in damage to, or destruction of, equipment.
	The **Notice** sign highlights an essential operating or maintenance procedure, condition, or statement.

Revision History

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

Date	Version	Revised Sections
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
Jan. 2011	1.5	Add LXI function support.
May 2011	1.6	Add Pin 2 connection to the section of "*Assembling Series/Parallel Communication Interface*" and modify the figures.
Aug. 2012	1.7	Update the following: – Note 1 and 2 in the section of "*Specifications.*" – Notice in the section of "*Checking the Package.*" – Assembly of 62050P in the section of "*Input Connection.*" – Notice in the "*Assembling Series/Parallel Communication Interface.*" Add the following: – Cautions in the section of "*Reverse Connection of Remote Sensing Wire Polarity.*" – "*D/D FAULT Protection*" section.
Sep. 2014	1.8	Update the following: – "*Declaration of Conformity.*" – "*Specifications*" and Note in the chapter of "*Overview.*"
Jun. 2016	1.9	Modify the following: – "*Declaration of Conformity.*" – "*Specifications*" and Note in the chapter of "*Overview.*" – "*Requirements of Input Power*" and "*Specification of Parallel Capacitance*" in the chapter of "*Installation*." Add *"Appendix C Input Cable Selection Table*".
Apr. 2017	2.0	Update "*Material Contents Declaration*" and CE "*Declaration of Conformity.*"
Feb. 2018	2.1	Revised text throughout the manual.

Table of Contents

1. Overview

1.1 Introduction

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

62000P Series DC Power Supplies have the following features:

(1) Voltage mode with two control loops to provide a stable, quick response output, and to set the slew rates of the output voltage and current.
(2) Constant power output within the maximum output voltage and current range (62012P-80-60: 80V-60A).
(3) 16-bit ADC/16-bit DAC to provide excellent resolution.
(4) Lower transient spike and transient response time to insure the unit under test receives a stable output and the best protection under load variations.
(5) Editing mode (Programming Mode) for output waveforms to provide multiple output voltage and current combinations in real time for long time period tests.
(6) Rotary knob and keyboard controls on the front panel to set the output voltage and current.
(7) LCD panel: a high brightness, wide viewing angle interface for monitoring and setting functions.
(8) Remote control via GPIB/Ethernet (option), USB, RS-232/RS-485, or Analog Programmable (APG) interface.

1.2 System Functions

1.2.1 Operation Mode

(1) Local operation is performed using the keyboard and rotary knob on the front panel.
(2) Remote control is done via GPIB/Ethernet (option), USB or RS-232/RS-485 interface.
(1) Through the APG input to control the output using an analog signal.

1.2.2 Protection

(1) Protections for abnormal input voltage, output over-voltage, over-current, over-power, over-temperature, fan fail, CV/CC fold back, etc. are provided.
(2) Fan speed controlled by power supply internal temperature.

1.2.3 Output/Indication

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

(3) Analog monitors (V/I) continuously send an output signal. This allows signals to be easily monitored by external instruments (DMM, Oscilloscope, etc). Ability 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) One run time voltage program that can be set for up to 99 hours.

1.3 Specifications

The operating specifications for the 62000P Series DC Power Supplies are listed below. Warm up the instrument for at least 10 minutes before performing any test items. All specifications are tested using Chroma's standard test procedures at 25 ± 1°C, on a remote sense connection with a resistive load, unless specified otherwise.

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	580 mV	90 mV	100 mV
Output Ripple (rms)	8 mV	10 mV	80 mV	10 mV	10 mV
Output Ripple (rms) [6]	60 mA	10 mA	60 mA	120 mA	30 mA
OVP Adjustment Range	0V to 110% of Vmax				
Slew Rate Range					
Voltage (with USB) [7]	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 [8]	0.75	0.75	0.75	0.8	0.8
Drift (8 hours) [9]					
Voltage	0.02% of Vmax				
Current	0.04% of Imax				
Temperature Coefficient [10]					
Voltage	0.02% of Vmax/^{0}C				
Current	0.04% of Imax/^{0}C				
Transient response Time [11]	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	100-240Vac	100-240Vac	100-240Vac	100-240Vac	100-240Vac
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	580 mV	100 mV	100 mV	50 mV
Output Ripple (rms)	15 mV	140 mV	10 mV	15 mV	15 mV
Output Ripple (rms) [6]	20 mA	60 mA	30 mA	20 mA	40 mA
OVP Adjustment Range	0V to 110% of Vmax				
Slew Rate Range					
Voltage (with USB) [7]	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 (10A Loading)
Fall Time	300 ms(max)	5 s(max)	240 ms(max)	300 ms(max)	850 ms(max)
Efficiency [8]	0.8	0.8	0.85	0.85	0.85
Drift (8 hours) [9]					
Voltage	0.02% of Vmax				
Current	0.04% of Imax				
Temperature Coefficient [10]					
Voltage	0.02% of Vmax/^{0}C				
Current	0.04% of Imax/^{0}C				
Transient response Time [11]	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	100-240Vac	100-240Vac	200-240Vac (Single phase)	200-240Vac (Single phase)	200-240Vac(3phase 4 wire, Delta connection) or 380-400Vac(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	780 mV
Output Ripple (rms)	10 mV	200 mV
Output Ripple (rms) [6]	120 mA	120 mA
OVP Adjustment Range	0V to 110% of Vmax	
Slew Rate Range		
Voltage (with USB) [7]	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 [8]	0.85	0.85
Drift (8 hours) [9]		
Voltage	0.02% of Vmax	
Current	0.04% of Imax	
Temperature Coefficient [10]		
Voltage	0.02% of Vmax/^{0}C	
Current	0.04% of Imax/^{0}C	
Transient response time [11]	3 mS	3 mS
10 % step change	150 mV	600mV
Voltage limit @ Series Mode	200V	800V
AC Line Input Voltage Ranges	200-240Vac (Single phase)	200-240Vac (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	

All specifications are subject to change without prior notice.

Note

1. The minimum output voltage is <0.15% of rated voltage (<0.5% for the models with 600V & 300V output voltage.)
2. The minimum output current is <0.2% of rated current (<0.5% for the models with 600V & 300V output voltage.)
3. 100-240 Vac with rated load. (62024P & 62050P: 200-240 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. This setting is only valid when the power supply has output, and the voltage as well as current settings are larger than the one specified in Note 1 and 2. Note that the output voltage falling slew rate varies with the output load power. Moreover, the voltage slew rate decreases by the capacitance when the output is connected to the capacitor.
8. Typical efficiency at nominal input voltage (230V) under maximum output voltage.
9. Test the drift volume for 30 minutes and 8 hours under rated power.
10. Change in output per 1 °C in ambient temperature with constant line and load.
11. At half load and above, the loading slew rate is 1A/us for rise and fall.
12. In order to meet the charge current required by V Slew rate be sure to set enough current.
13. If the 62050P-100-100 is in CV mode, the lowest I set value is 1.2% of Full scale to ensure it does not go into the CC mode.
14. If the output port is connected to a battery or inductance load (like a motor), connect a diode in series to prevent the load current from flowing back and damaging the device (see Figure 1-1). **Do not** reverse the positive and negative connections. It could damage or short circuit the power supply.
15. For switching power load applications, if the output load cable is longer the 20cm, strand the load cable and parallel the capacitance (>100uF) at the load power input to prevent any unexpected oscillations from occurring (see Figure 1-2).
16. The current of 62024P-40-120 is larger than or equal to 110A with maximum operation in 1200W as shown in Figure 1-3.

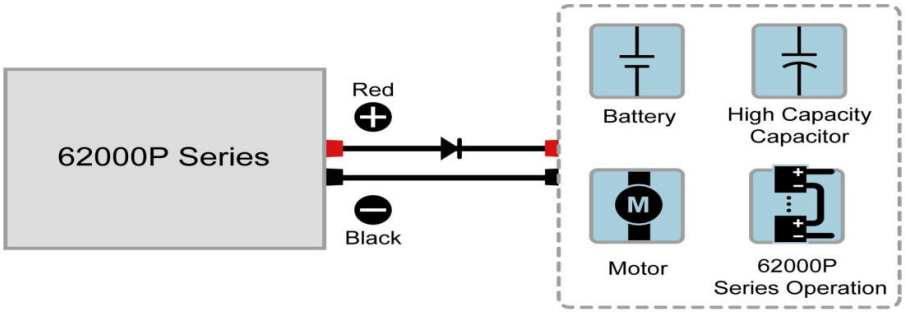


Figure 1-1

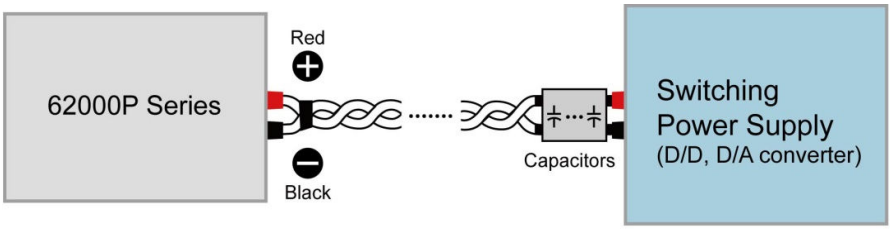
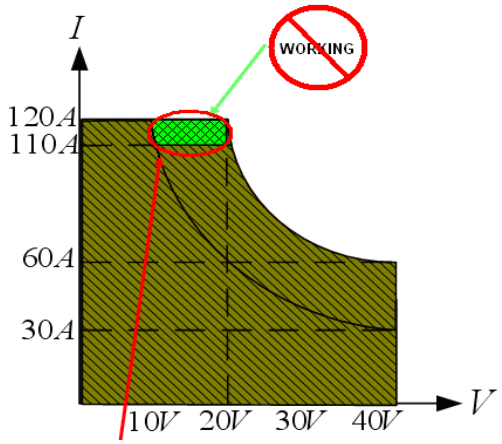


Figure 1-2



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

Figure 1-3

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	
Indicates if 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)	Output negative terminal to earth. The output voltage limit is the positive voltage listed in the table **[Max. Voltage (Vdc) Difference between Output Terminal and Earth]** below.
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	1ms - 60,000S
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 a 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 (2.5V for 30 and 40 Volt output models)

All specifications are subject to change without prior notice.

CAUTION The Max. Voltage (Vdc) difference between the Output Terminal and Earth varies depending on 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 in damage to the DC Power Supply.

1.4 Function Keys

1.4.1 Front Panel

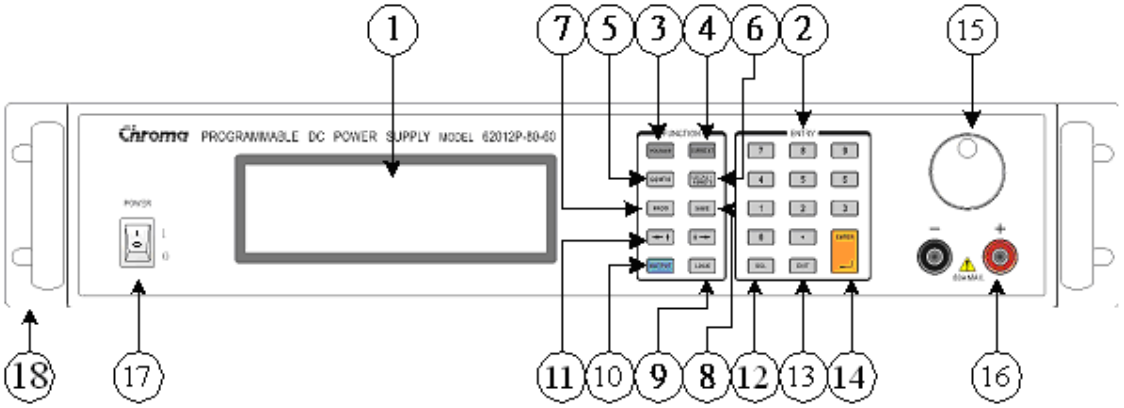


Figure 1-4 Front Panel of 62006P, 62012P and 62024P

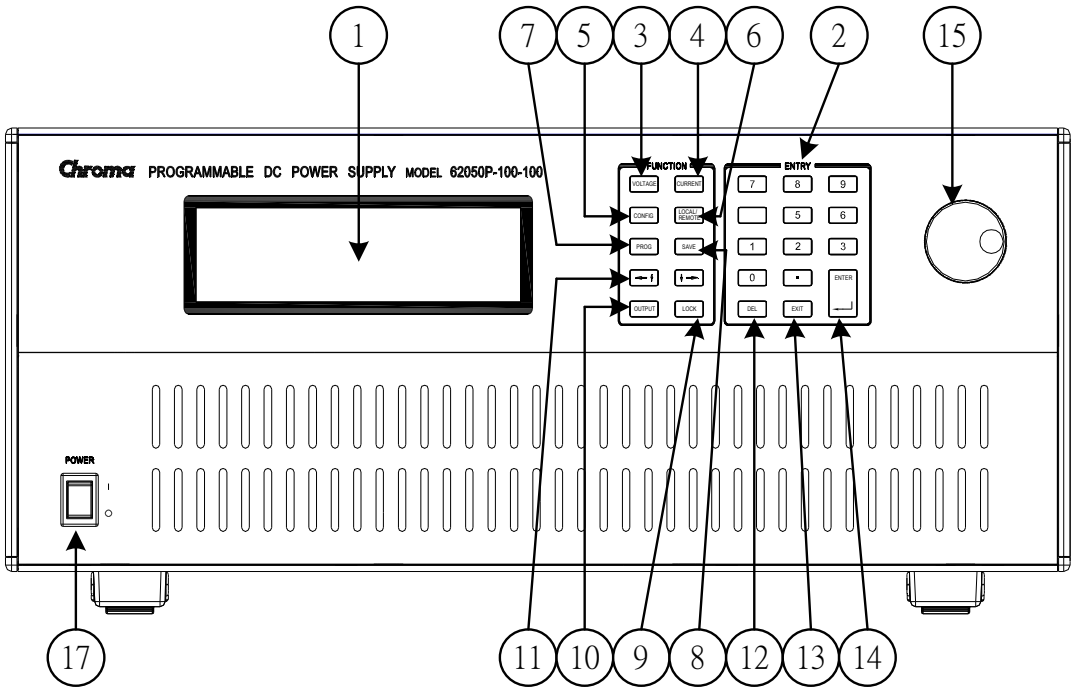
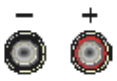


Figure 1-5 Front Panel of 62050P

Item	Symbol	Description
1		***DISPLAY:*** LCD Display: shows the output settings and measurement results.
2	0 to 9 and ●	***Numeric and Decimal Point:*** Use the numeric keys and the decimal point key to enter digital data.
3	VOLTAGE	***Voltage Setting Key:*** Enters voltage setting mode. Use the numeric keys or rotary knob to input voltage values
4	CURRENT	***Current Setting Key:*** Enters current limit setting mode. 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 toggle the control mode between “Front Panel Input” or “Remote Control”.
7	PROG	***PROGRAM Key:*** Press this key to skip to the “Program Function Page” for setting the waveform editing mode.
8	SAVE	***SAVE Key:*** Press this key to save the settings in the “Program and Config Function Page”
9	LOCK	***LOCK Key:*** Press this key to lock all the keys and rotary knob. To unlock, press “LOCK” for 3 seconds and release it.
10	OUTPUT	***OUTPUT Key:*** Press this key to toggle the output “ON” or “OFF”.
11	← ↑ → ↓	***Cursor Movement Keys:*** Use the “←↑” 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 the 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:*** Turn the knob “◯” to input data or select an item.
16		***Output Terminal on Front Panel:*** The maximum output current differs between models when connected with the output terminals on the rear panel. **Note:** 30V, 40V, 300V and 600V Models have no front panel output terminal.

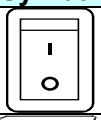
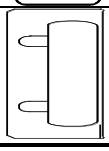
Item	Symbol	Description
17		***Main Power Switch:*** Switches the main AC power ON or OFF.
18		***Rack Bracket:***(Option) Use the left (right) bracket to attach the Power Supply to the Rack.

Table 1-1 Description of Front Panel

1.4.2 Rear Panel

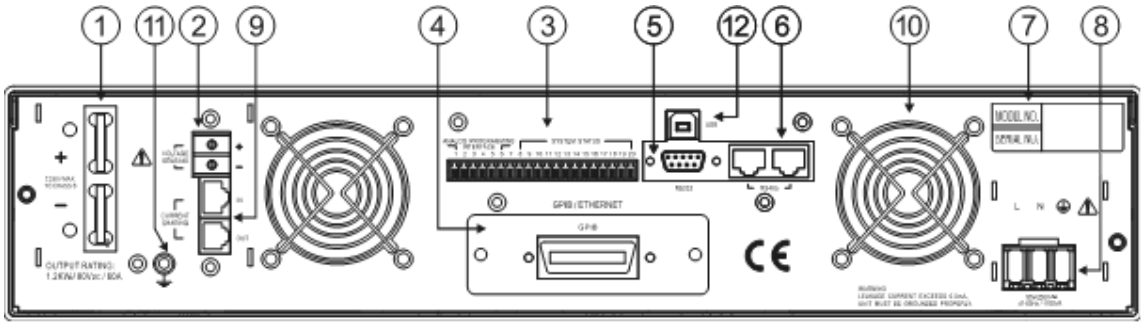


Figure 1-6 Rear Panel of 62006P, 62012P & 62024P Low/Middle Voltage (30V/40V/80V/100V)

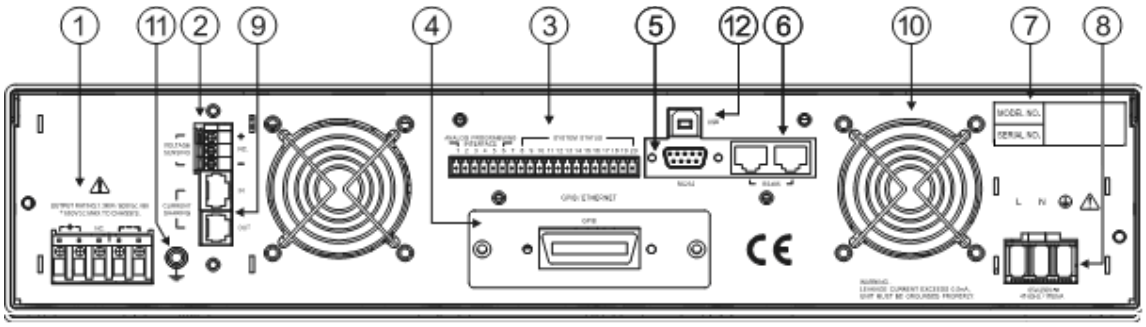


Figure 1-7 Rear Panel of 62006P, 62012P, 62024P High Voltage Model (300V/600V)

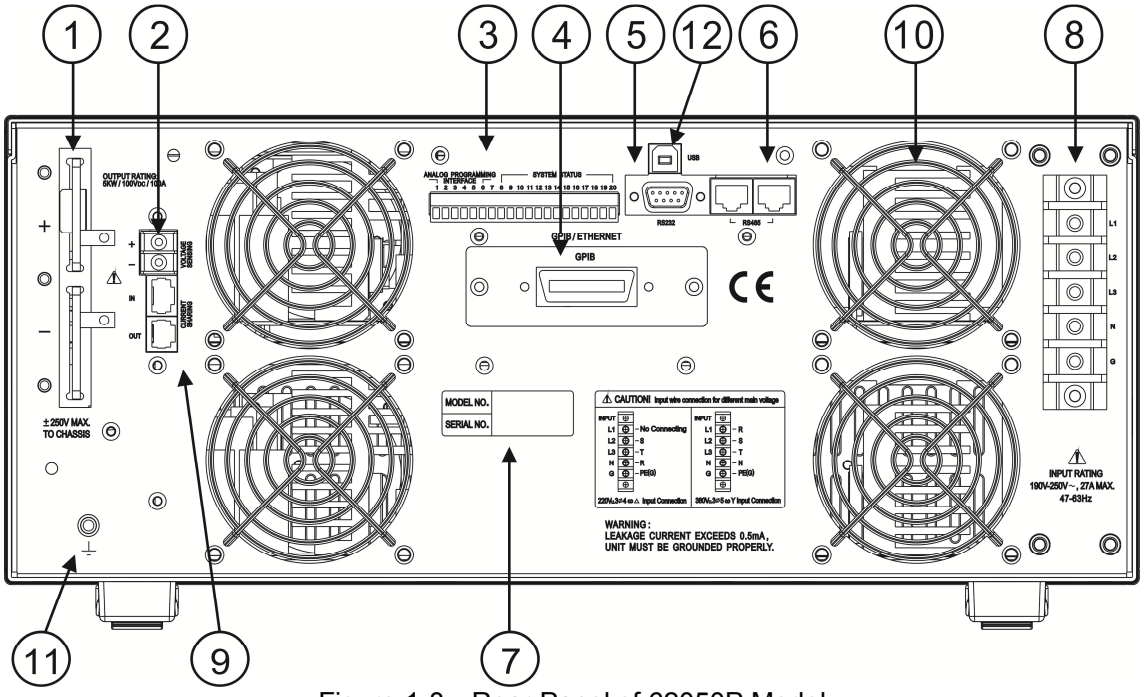


Figure 1-8 Rear Panel of 62050P Model

Item	Name	Description
1	Output terminal	The output terminals of the DC Power Supply.
2	Remote Sense Connector	This connector compensates for any voltage drop generated by the cable resistance. Be sure to connect the remote sense connector “+” to the positive output terminal and the “–” connector to the negative output terminal. Do not reverse the connections.
3	APG & Status Signal Connecting Terminal	There are two groups of pin signals. Pins 1-6 are APG input/output terminals while pins 8-20 are system status signal terminals. See *Appendix A* for the detailed 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 the remote controller is connected to the PC through this connector for remote control.
5	RS-232C	A 9-pin 90° D type male connector. The control commands are transmitted between the remote and PC for remote control.
6	RS-485	For serial or parallel data transmission.
7	Label	The label shows the model no. and serial no. of the DC Power Supply.
8	AC Power Connector	Inputs AC power through the power line and connects to the input stage.
9	Current Sharing Connector	Divides the output current equally when units are connected in parallel. It must be removed when they are connected in series.
10	Fan Mask	Avoid touching the fan and do not block the fan mask to avoid accumulating heat inside the unit.
11	Functional Ground	This terminal provides an easy Earth Ground.
12	USB	The remote controller uses the USB connector to connect to a PC for remote operation.

Table 1-2 Description of Rear Panel

2. Installation

2.1 Checking the Package

(1) Check for any damage or any missing accessories after unpacking.
(2) Should any damage be found, contact “Chroma RMA” immediately to request a return shipment.

The unit package is shown below:

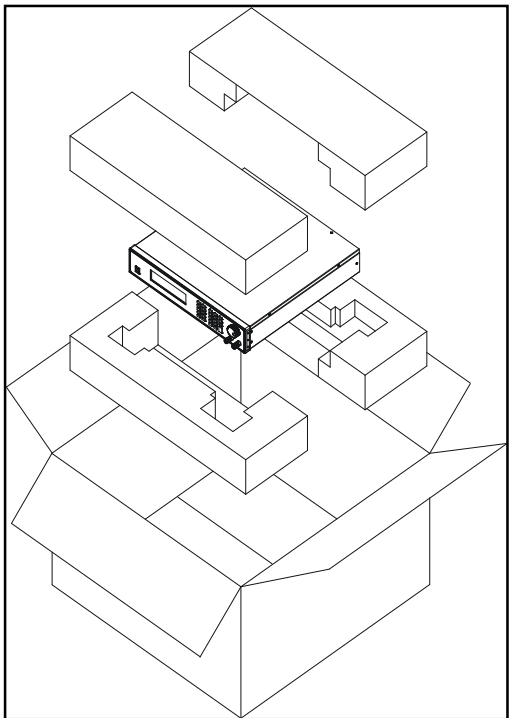


Figure 2-1

Notice

1. Keep all of the packing materials in case the unit has to be returned for repair.
2. Do not return the instrument to the factory without obtaining prior RMA approval from Chroma.
3. Insure all of the accessories on the packing list have been received.

2.1.1 Maintenance & Cleaning

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

2.2 Preparation for Use

(1) Insure the Power Supply is connected to the AC line input that meets the specification.
(2) The instrument must be installed in an area with good air circulation to avoid the internal temperature getting too high.
(3) The ambient temperature should not exceed 40°C.

2.2.1 Normal Environment Conditions

(1) For indoor use.
(2) Altitude up to 2000m.
(3) Temperature 5°C to 40°C.
(4) Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly 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 rated 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	:	100 – 240 Vac, single phase
Input Frequency	:	47 – 63 Hz
Max. Input Power	:	1000VA

(2) 62012P-xx-xx Model

Input Voltage Range	:	100 – 240 Vac, single phase
Input Frequency	:	47 – 63 Hz
Max. Input Power	:	1700VA

(3) 62024P-xx-xx Model

Input Voltage Range	:	200 – 240 Vac, single phase
Input Frequency	:	47 – 63 Hz
Max. Input Power	:	2900VA

(4) 62050P-xx-xx Model

Input Voltage Range	:	200 – 240 V_{LL}, 3-phase 4-wire Δ or 380 – 400 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 ranges described above, the output will shut down automatically to protect the DC Power Supply.
2. The 62050P can be connected 220 V_{LL} 3-phase 4-wire Δ and 380V_{LL} 3-phase 5-wire Y. Verify the power in use before connecting and select the appropriate circuit breaker.

2.3.2 Input Connection

(1) The AC input connector board is located on the right side of the rear panel.
(2) The power cable must be rated for at least 85°C.
(3) The power cable size must be within 10AWG-12AWG. (**Note:** the 62050P must be within 8AWG-10AWG when connecting 3-phase 4-wire Δ.)
(4) To assemble the 62006P, 62012P and 62024P see Figure 2-2 and perform the following steps:
   a. Remove the input terminal safety cover from the rear panel of the DC Power Supply.
   b. Scrape the coating off the power cable tips (the bare portion is about 1cm) and tin them.
   c. Insert the cable tips into the proper locations (see below).
   d. Attach the input terminal safety cover and secure it with a Phillips screwdriver.
   e. Secure the safety cover nut to prevent the cable from pulling out or the electric terminal from being exposed.

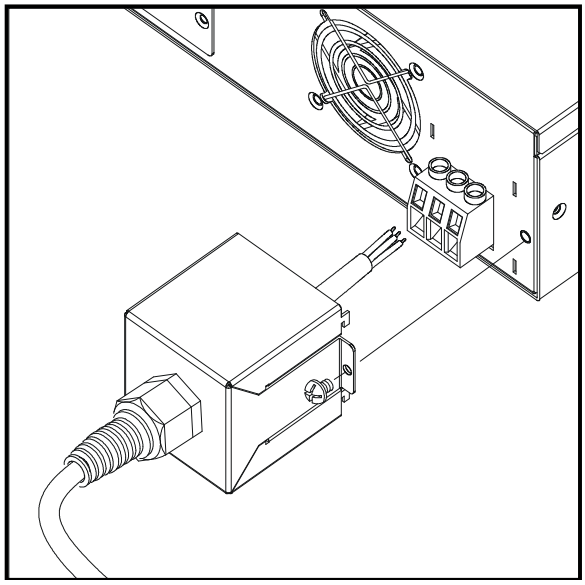


Figure 2-2

⚠WARNING

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

(5) To assemble the 62050P see Figure 2-3 through Figure 2-8.
   a. Remove the strain relief and insert the wires through the strain relief and safety cover as shown in Figure 2-5.
   b. Bend all of the wire terminals to 90° as shown in Figure 2-6.
   c. Install the 4 copper standoffs on the rear panel and secure the power terminal on the input terminal socket with Phillips screws as well as the safety cover as shown in Figure 2-7 to prevent an electric shock.
   d. Secure the strain relief as shown in Figure 2-8

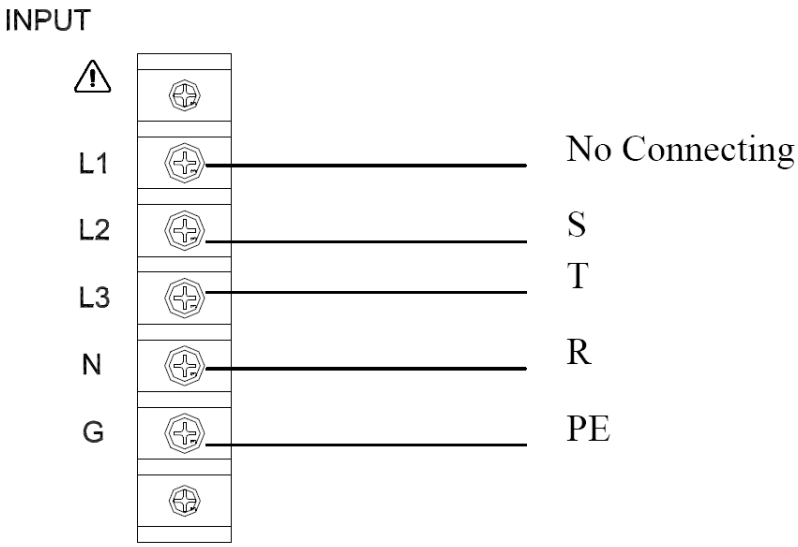


Figure 2-3 $220V_{LL}$, 3-phase 4-wire Δ Input Connection

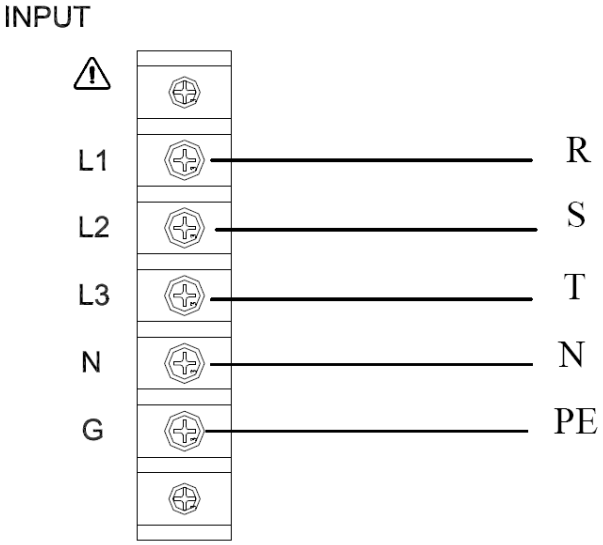


Figure 2-4 $380V_{LL}$, 3-phase 5-wire Y input connection

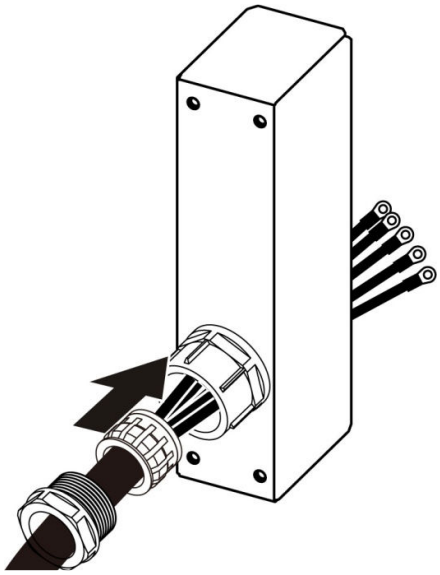


Figure 2-5 Assembling the 62050P Input Terminal Safety Cover - 1

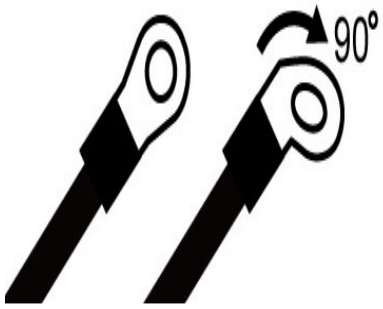


Figure 2-6 Assembling the 62050P Input Terminal Safety Cover - 2

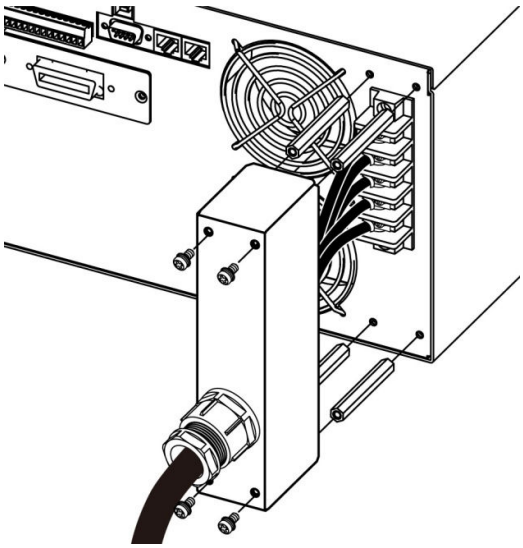


Figure 2-7 Assembling the 62050P Input Terminal Safety Cover - 3

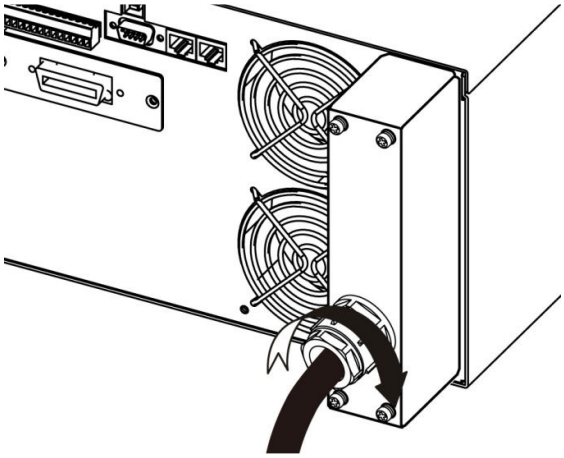


Figure 2-8 Assembling the 62050P Input Terminal Safety Cover - 4

⚠WARNING

1. To protect the operator, 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

The 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 the " + " and " - " output terminals.

⚡CAUTION

1. The safety cover must be tightly secured.
2. The diameter of the wire connected to the load must be able to carry the maximum applied current.

2.4.1 Rear Panel Output

See Figure 2-9 and Figure 2-10.

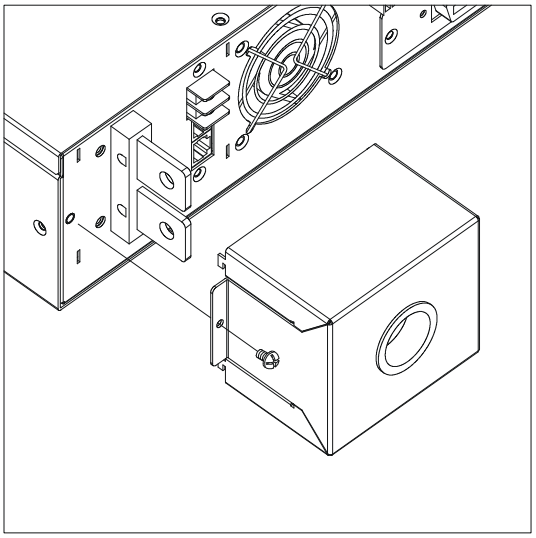


Figure 2-9 Assembling the Rear Safety Cover of the 62006P, 62012P and 62024P

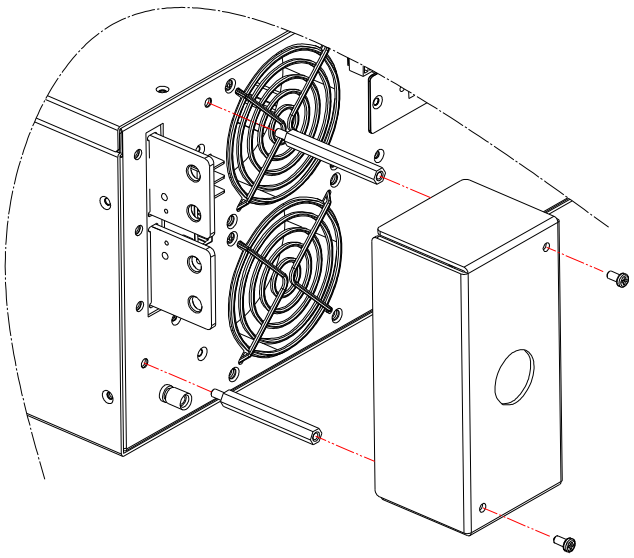


Figure 2-10 Assembling the Rear Safety Cover of the 62050P

2.4.2 Front Panel Output

The front panel maximum output current varies depending on the 62000P series model. To connect a cable, unscrew the front panel terminal and insert the Y type cable terminal from the bottom of the front panel terminal, making sure it touches the metal part of the load terminal. Use the customized wrench to tighten the connection as shown in Figure 2-11.

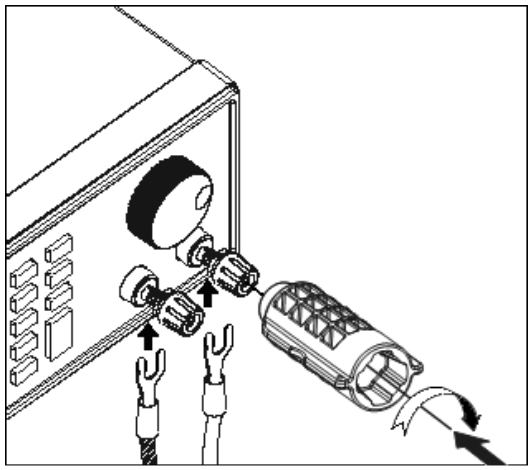


Figure 2-11

CAUTION Do not exceed the rated output current to avoid damage to the equipment.

Notice The front panel maximum output current varies depending on the 62000P series model. The maximum current is shown 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 the connecting wire to the source is 2μH (the total inductance of the two wires after twisting, including self-inductance and mutual inductance).

CAUTION
1. The cable inductance should not exceed 2μH to ensure system stability.
2. Use wire that is thick enough to prevent overheating.

2.4.4 Specification of Parallel Capacitance

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

Model	Max. Parallel Output Capacitance
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

Note The maximum voltage slew rate for the 300 and 600V models with paralleled capacitance is 2V/mS.

CAUTION

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

2.5 Remote Sensing

2.5.1 Correct Connection

1. Connecting the remote sensing wire correctly can ensure the output voltage is the same as the set voltage. The DC Power Supply is able to compensate for a 5V maximum line voltage drop.
2. Figure 2-12 shows the correct connection. Use two wires to connect the positive/negative connectors of the 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 for a voltage drop up to 5V, the maximum rated output power of the DC Power Supply is still the limit (1200W for 62012P Series and 600W for 62006P Series. The output power is calculated by multiplying the voltage on the output terminal and the current.) Therefore, if the power exceeds what the DC Power Supply can provide, it will be unable to compensate a voltage drop of 5V. The DC Power Supply will activate the Over Power Protection (OPP).

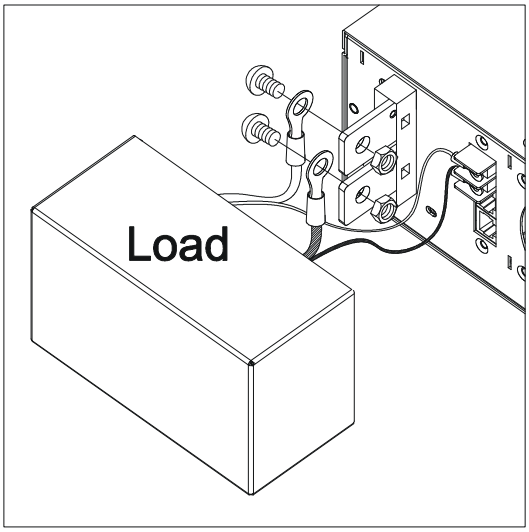


Figure 2-12

2.5.2 Disconnecting Remote Sensing Wire

If the remote sensing wire is disconnected, the error range will increase. The voltage measured at the output terminal is about 2% larger than the set value. Connect the remote sensing wire to the output terminal as shown in Figure 2-13 even if the line voltage drop can be ignored in actual practice.

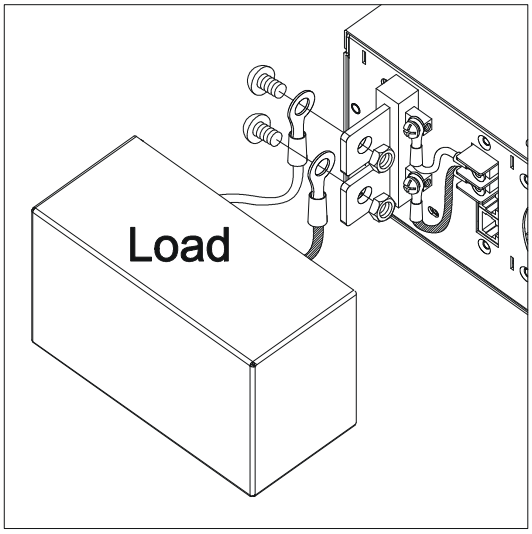


Figure 2-13

Figure 2-14 Remote Sensing installation for the high voltage model.

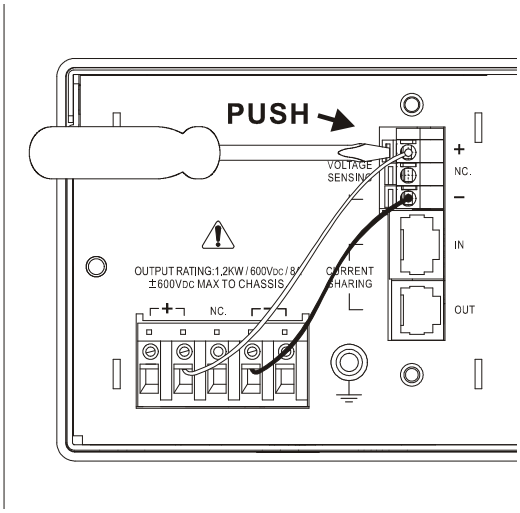


Figure 2-14

2.5.3 Reverse Connection of Remote Sensing Wire Polarity

The polarity of the remote sensing wire must be correct. The “+” terminal must be connected to the “+” of the output terminal or to the connecting wire of the terminal, the “–” terminal must be connected to the “–” of the output terminal or to the connecting wire of the terminal. If the polarity is reversed, the output will drop to 0V and the error message “SENSE FAULT” will be displayed as shown in Figure 2-15.

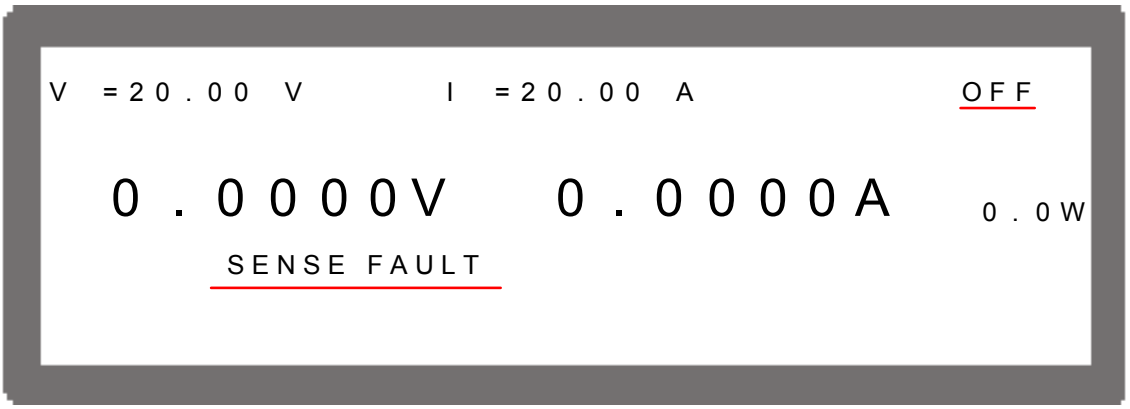


Figure 2-15

Notice

If the remote sense polarity is reversed, do the following to reset it:
1. Power the unit OFF.
2. Connect the remote sensing wires properly.
3. Restart the DC Power Supply.

CAUTION

1. Do not connect the Remote sense wires when there is voltage on the output terminal or UUT to avoid damaging the Power Supply.
2. The remote sensing voltage and local output voltage must be less than 10% V_MAX to avoid damaging the Power Supply.

2.5.4 Rack Mounting Kit & Handle Installation

Remove the silver 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.

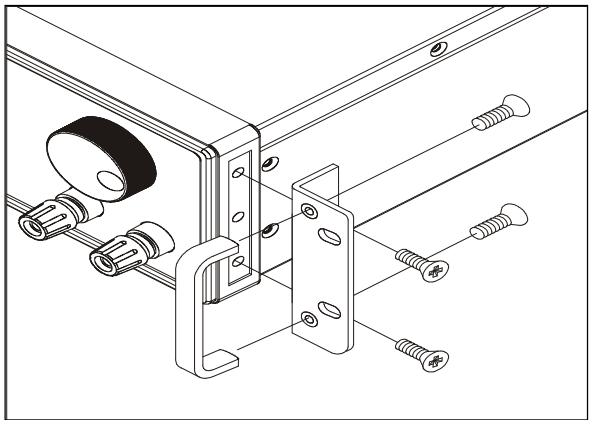


Figure 2-16 Installing the Rack Mounting Kit & Handle of 62006P, 62012P & 62024P

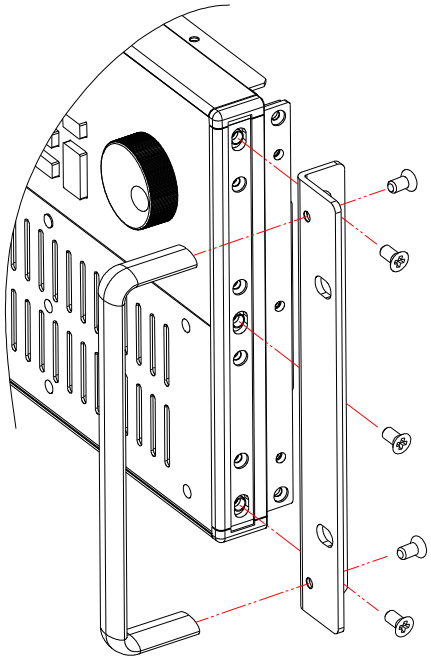


Figure 2-17 Installing the Rack Mounting Kit & Handle of 62050P

2.6 Power On Procedure

Plug in the power cord and turn on the power switch on the front panel. The DC Power Supply will run a series of self-tests. The LCD on the front panel will light up and show the following:

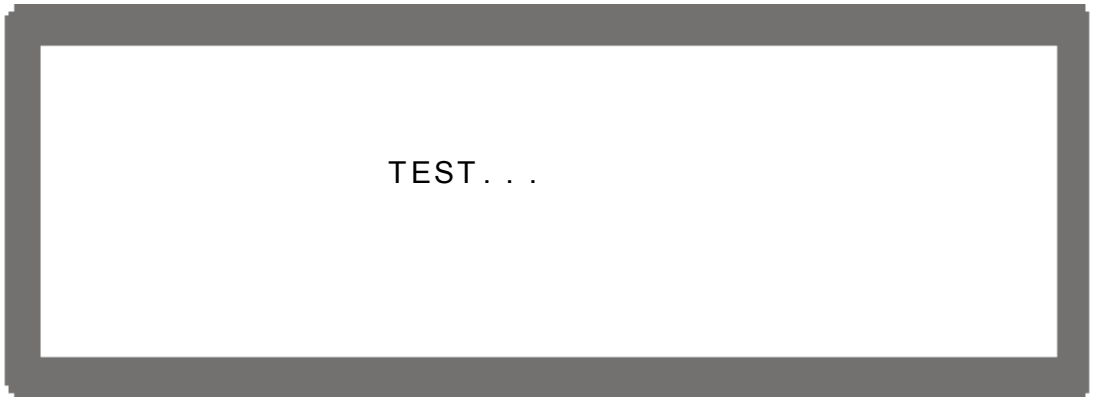


Figure 2-18

The DC Power Supply will run self-tests for memory, data and communication. Once the self-tests are done, the model no. and serial no. will show on the screen and an "<*OK*>" will appear to the right of the test item if it passed. When the self-test is done the display shows the following:

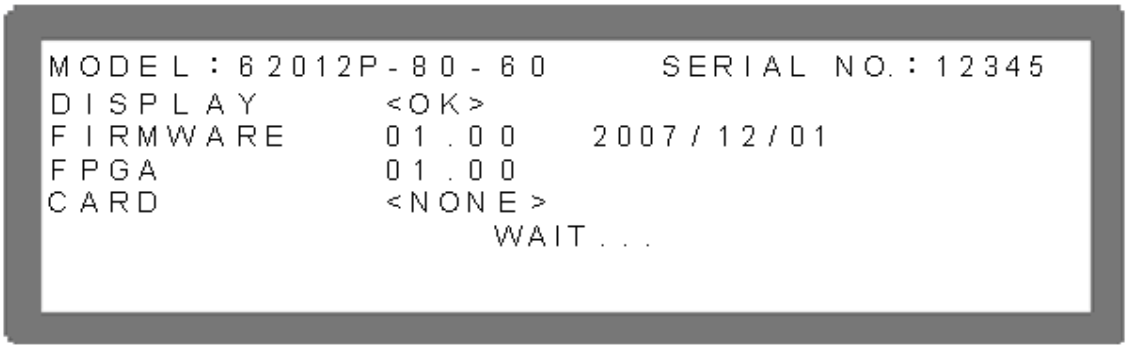


Figure 2-19

Notice

1. If an item fails during self-test, an "ERROR CODE" will appear to its right. See Section 8.2 for the error messages and troubleshooting.
2. When the GPIB or ETHERNET shows <OK> it means the GPIB or ETHERNET is connected to the Power Supply for remote operation. If "CARD <NONE>" appears it indicates the GPIB or ETHERNET card is not connected but can still be operated manually. See section 3.3.1.1 for detailed 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. 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 memory, data and communication self-tests are done, the screen goes to the MAIN PAGE automatically as shown below:

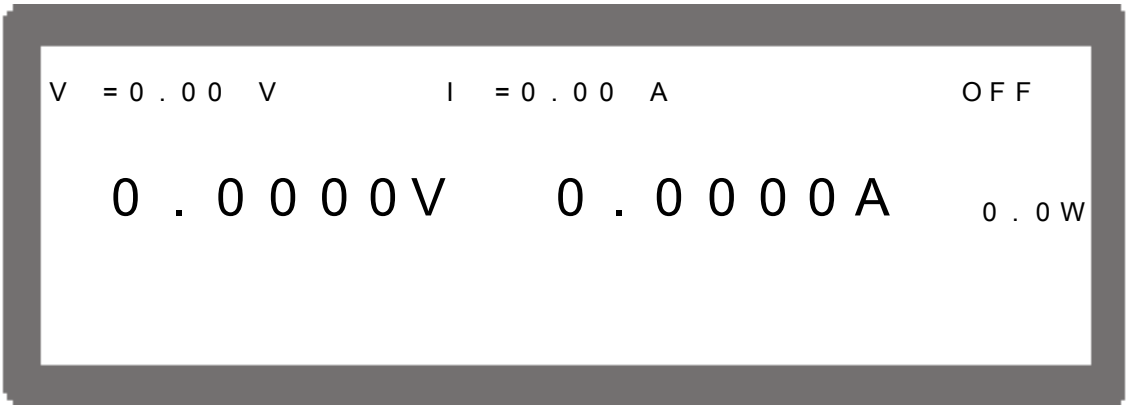


Figure 2-20

Notice

1. If a NoGo event occurs during self-test at power-on it may be possible to diagnose the problem. See section 8.2 for details.
2. The DC Power Supply internal circuit may not be able to reset if it is powered OFF and ON rapidly. Wait for 3 seconds after powering OFF before powering it ON again.

⚠WARNING

Before turning on the instrument, all protective grounding terminals, extension cords and devices must be connected to an earth ground.

A potential electric shock hazard may occur with any interrupted grounding that could injure personnel.

2.7 I/O Connector (Option)

The GPIB or Ethernet (with LXI function support) interface I/O connector is available for purchase.

To install it, remove the cover plate over the GPIB/ETHERNET card slot (Figure 2-21) and insert the GPIB or ETHERNET card then secure it with screws.

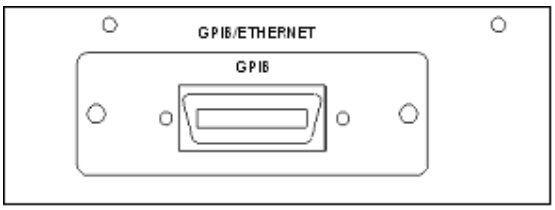


Figure 2-21

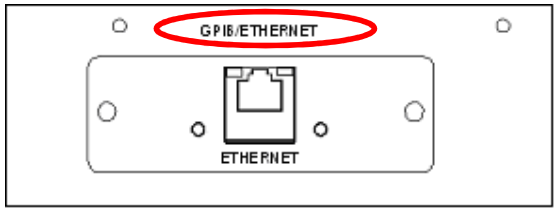


Figure 2-22

Notice

Be sure there is a “GPIB/ETHERNET” label on the rear panel and the firmware version is 3.0 or above before purchasing an ETHERNET card. The ETHERNET card can be inserted directly if the “GPIB/ETHERNET” label is present and the firmware version is 3.0 or above; if not, contact your local Chroma agent.

3. Manual Operation

3.1 Introduction

The DC Power Supply can be operated manually or remotely through the GPIB, ETHERNET, RS-232C, USB or APG interface (described in Chapter 5 and section 3.3.1.3). Manual operation 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 the instrument is powered off, the operation mode will be 'manual' (default) the next time it is powered on.

3.2 Setting Voltage & Current

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

Method 1:

1. Press "VOLTAGE", the cursor for V on the 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 set the value.
3. Press "OUTPUT" to output the set voltage. (In order for the output to remain in CV mode the current setting must be larger than the load current or the output voltage will not be equal to the set voltage.)

Method 2:

1. Press "VOLTAGE", the cursor for V on the MAIN PAGE blinks.
2. When using the "Rotary" ( ) knob for setting, use the " " and " " keys to move the cursor to the individual digit, and then turn the rotary knob to increase or decrease the value.
3. Press "OUTPUT" to output the set voltage. (In order for the output to remain in CV mode the current setting must be larger than the load current or the output voltage will not be equal to the set voltage.)

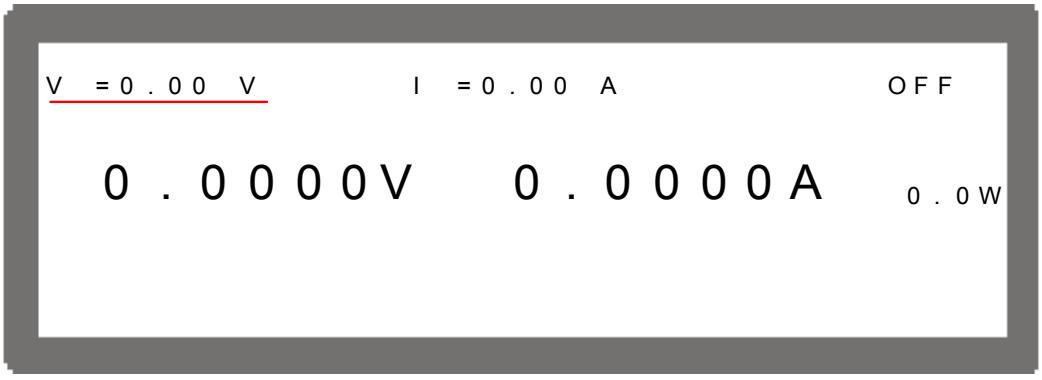


Figure 3-1

To set the current (CC MODE):

Press "CURRENT" and follow the steps for voltage above as shown in Figure 3-2. (In order for the output to remain in CC mode the load current setting must be larger than the actual current or the output current will not be equal to the set current.)

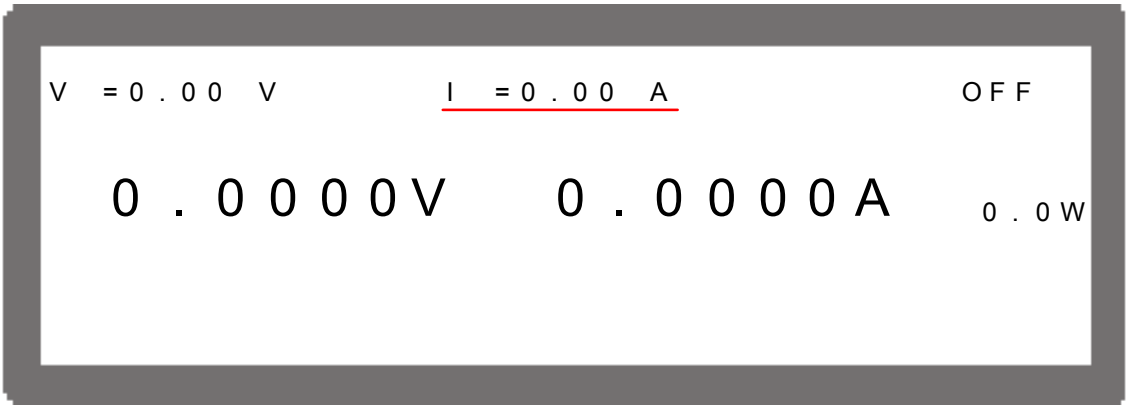


Figure 3-2

3.3 Setting Configuration

The configuration setting function sets the system functions for the DC Power Supply. The system functions that can be set during the configuration are:

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

To set the configuration:

Press "CONFIG" to enter into the CONFIG setting screen as shown in Figure 3-3:

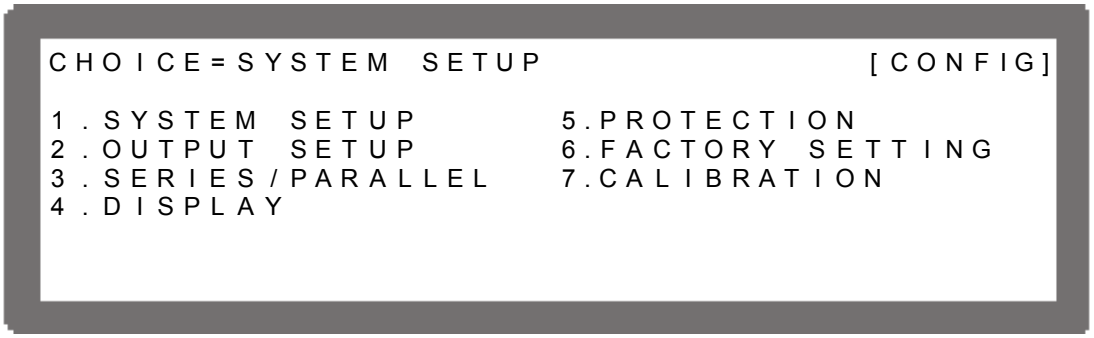


Figure 3-3

1. Use the numeric (1 - 7) keys or the “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 to return to MAIN PAGE.

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

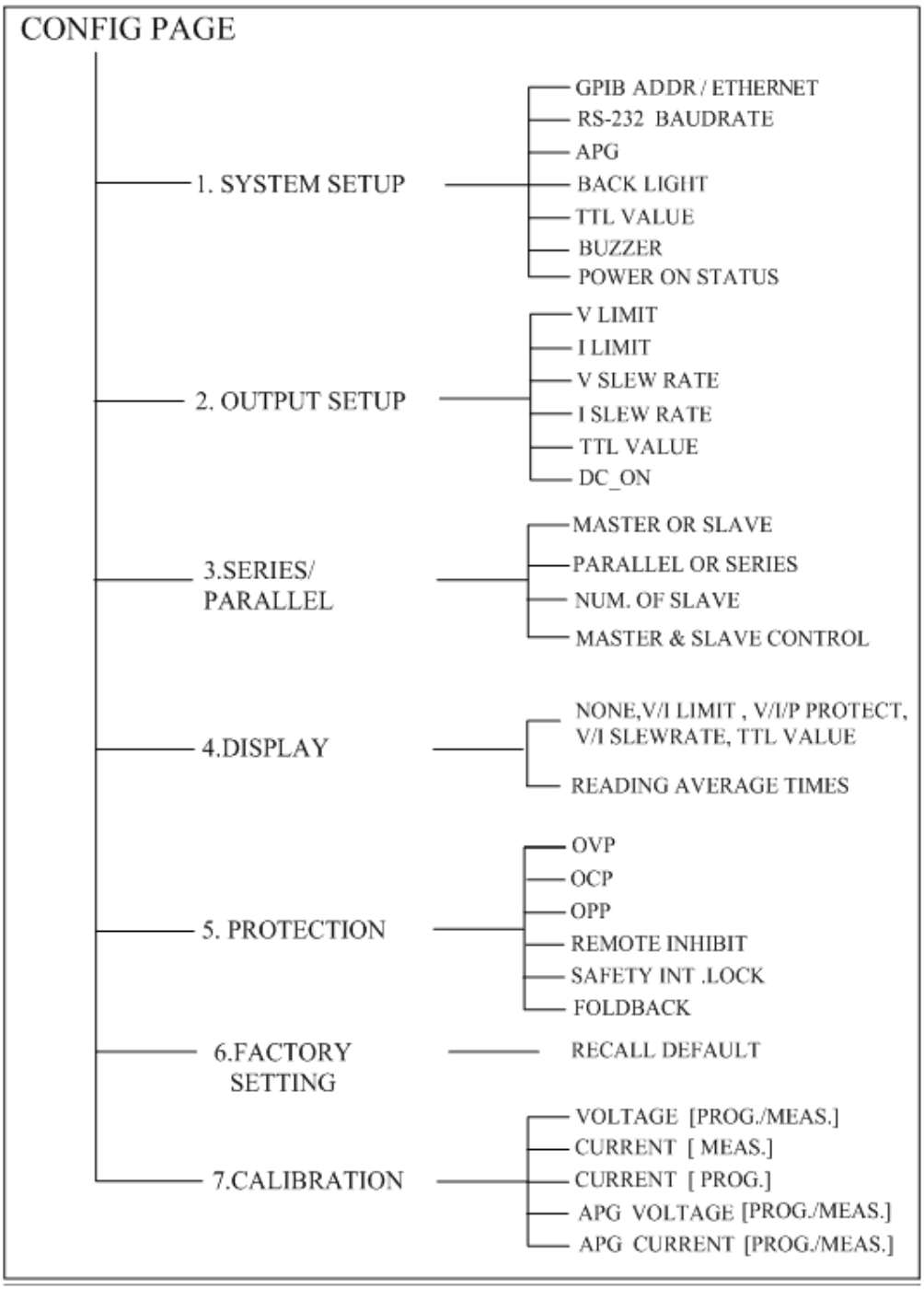


Figure 3-4

3.3.1 SYSTEM SETUP

1. In the CONFIG setup page, press "1" to display the SYSTEM SETUP screen (see Figure 3-5).

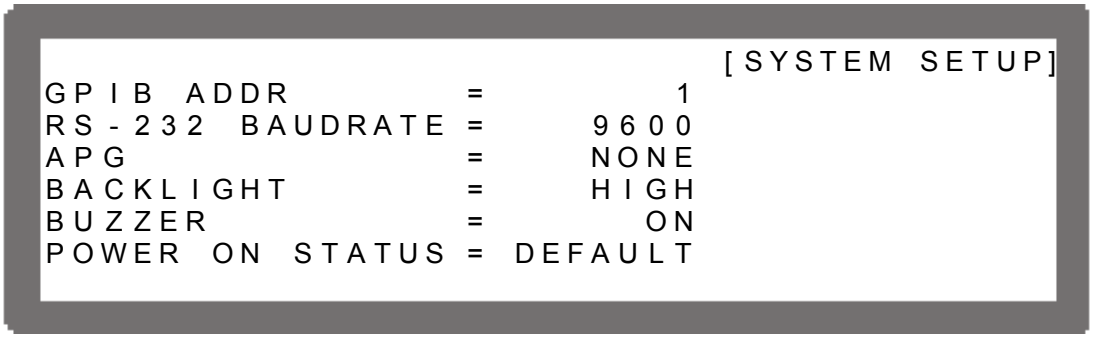


Figure 3-5

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

3.3.1.1 GPIB ADDRESS

Set the GPIB address before using it for remote control.

1. In GPIB mode, use the "◄↑", "►↓" keys to move the cursor to the GPIB ADDR column.
2. Use the numeric (1 - 0) keys or the "Rotary" (◎) to set the GPIB address.
3. Press "ENTER" to confirm.

Notice

1. Refer to the settings in section 3.3.1.1 for the GPIB card and see section 7.2.1 for the settings for the ETHERNET card.
2. The GPIB address range is 0-30.

3.3.1.2 RS-232 BAUD RATE

Set the RS-232 baud rate before using it for remote control.

1. Use the "◄↑", "►↓" keys to move the cursor to the RS-232 BAUD RATE column.
2. Use the "Rotary" (◎) knob to set the BAUD RATE.

Notice

The RS-232 has 3 baud rates: 9600/19200/38400

3.3.1.3 APG

The Analog Programming interface (APG) uses analog signals 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 the "◄↑", "►↓" keys to move the cursor to the column to be set.

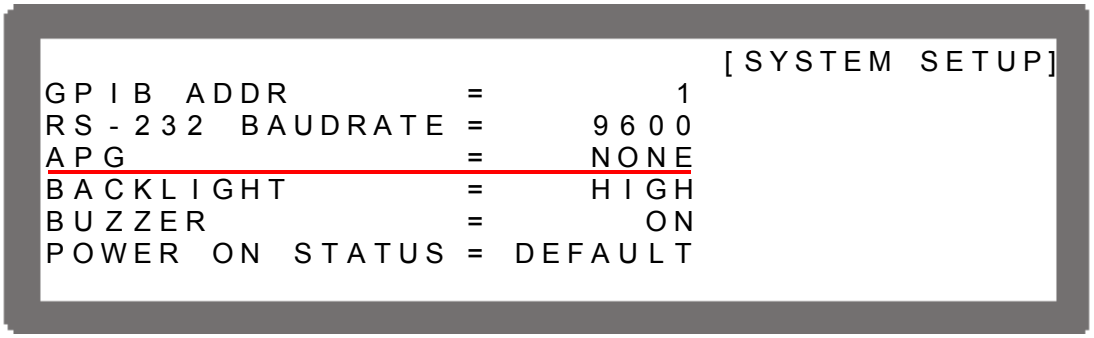


Figure 3-6

2. Use the "Rotary" (◎) knob to set the mode. APG has 4 options: **NONE / V / I / V&I,** where:
   NONE: does not use the programming functions for voltage and current.
   V: uses the voltage programming but not the current programming function.
   I: uses the current programming but not the voltage programming function.
   V&I: uses both voltage and current programming functions.
3. Press "ENTER" to confirm.
4. A prompt to set the reference potential option will be displayed to the right for selection when the APG function is enabled.

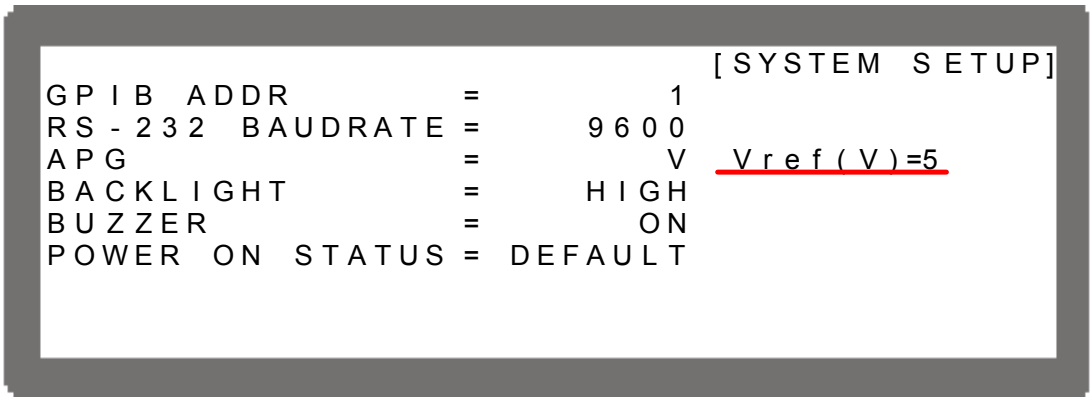


Figure 3-7

5. Use the "←↑", "→↓" keys to move the cursor to the column to be set.
6. Press "0" or "1" to set the value, or use the "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 levels: V_ref(V)=5 / 10. Using the example of the 62012P-80-60:
   a. When selecting Vref=5V, the DC Power Supply's output 0V/0A-80V/60A will map to 0-5V (programming or measurement) as shown in Figure 3-8(a).
   b. When selecting Vref=10V, the DC Power Supply's output 0V/0A-80V/60A will map to 0-10V (programming or

measurement) as shown in Figure 3-8(b).

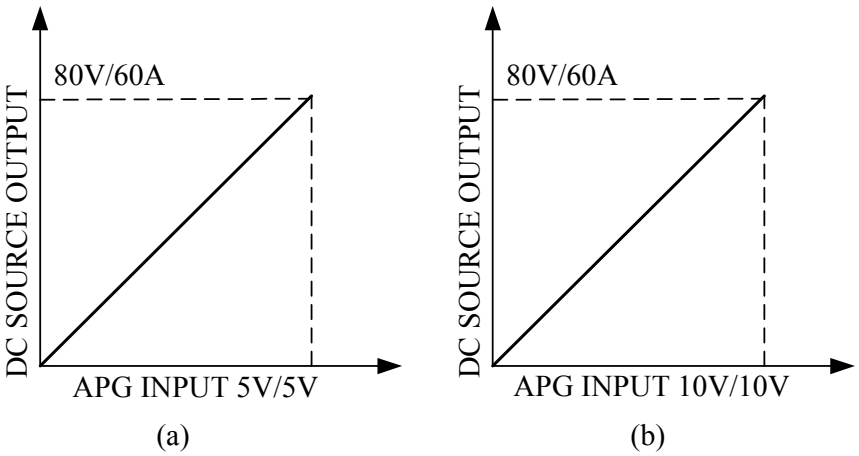


Figure 3-8

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 signals and its connector is located on the rear panel and its pin assignments are shown in Figure 3-9 and Figure 3-10.

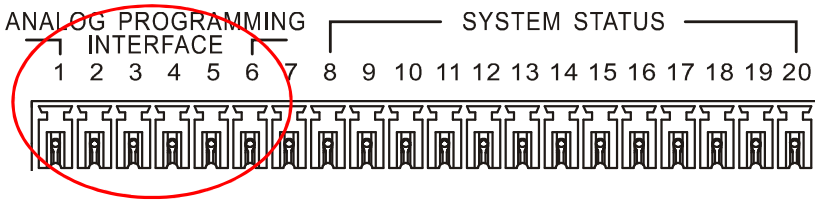


Figure 3-9

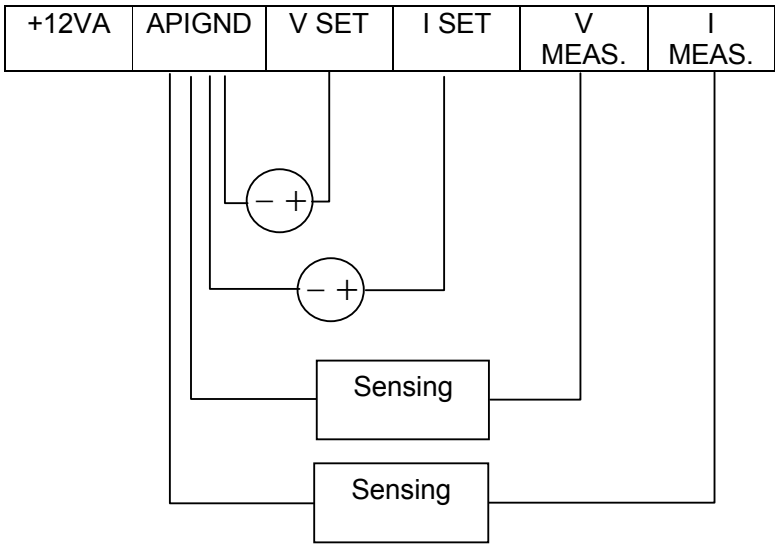


Figure 3-10

The pin definitions are as follows:

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 the LCD backlight on the front panel. There are four choices available.

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

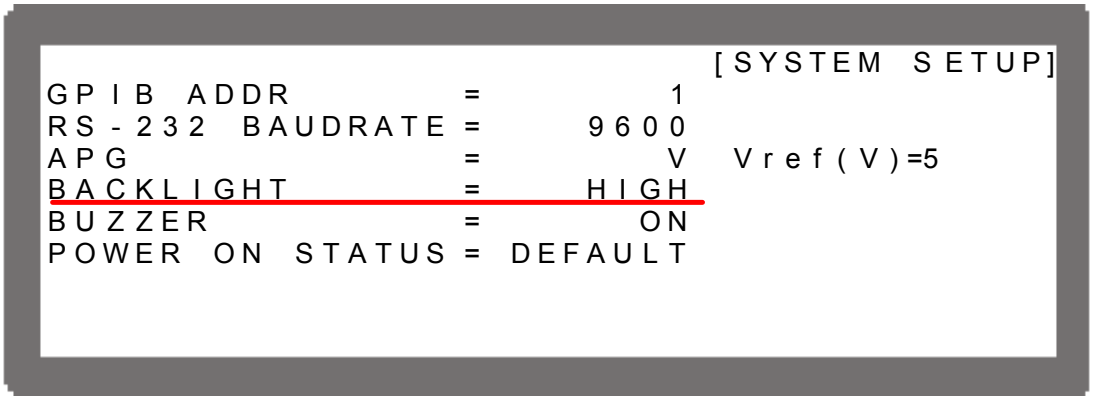


Figure 3-11

2. Press the "0" - "3" keys to set it, or use the "Rotary" ( ) knob to select the brightness of the 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 setting, the longer the life of the panel. If the instrument is in use during burn-in, 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 are pressed or turned. It can be turned off if it is not necessary. (The default is ON.)

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

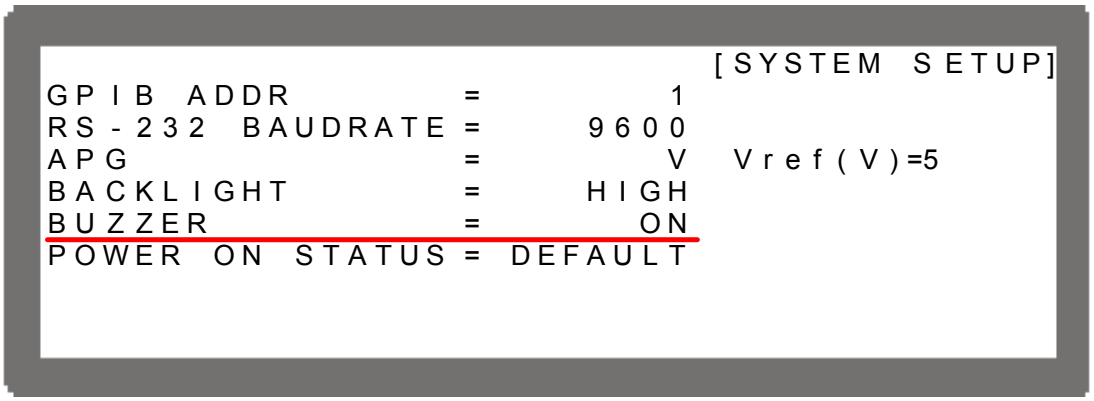


Figure 3-12

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

Notice

1. The BUZZER has two options: ON / OFF.
2. When the BUZZER is set to ON, pressing any key or turning the rotary knob will produce one beep.
3. When the BUZZER is set to ON the BUZZER will beep continuously if a system protection error occurs.
4. When the BUZZER is set to OFF it will not beep in any situation.

3.3.1.6 POWER ON STATUS

The DC Power Supply loads the default output status automatically after it is powered on, so that it does not have to be set again.

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

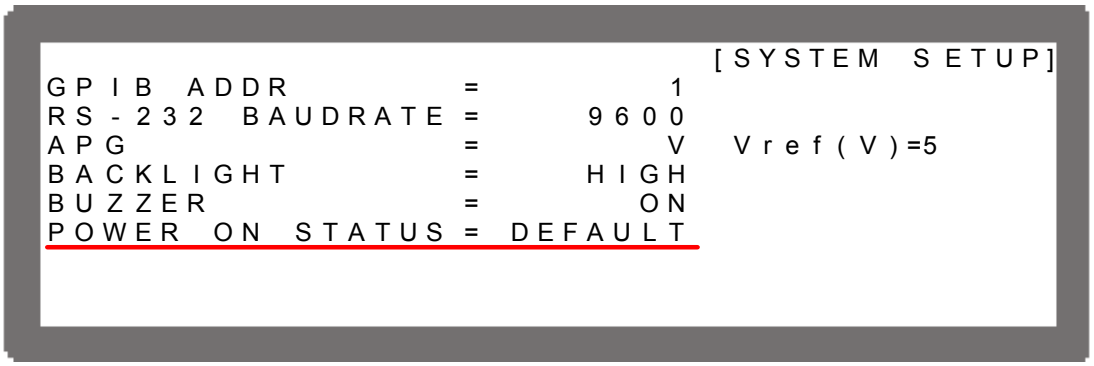


Figure 3-13

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

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

   When it is set to DEFAULT, the output state is set to V = 0.00V; I = 0.00A; OUTPUT = OFF.

   When it is set to LAST TURN OFF STATUS, the unit will log the command voltage, command current and output state before powering off, so that the state before powering off will be restored the next time the unit is turned on.

   Ex.: In Figure 3-14, the voltage setting is 80.00V, current setting is 15.00A and output setting is ON. When it powers on again, the unit will restore the previous state by setting the voltage to 80.00V, current to 15.00A and output to ON.

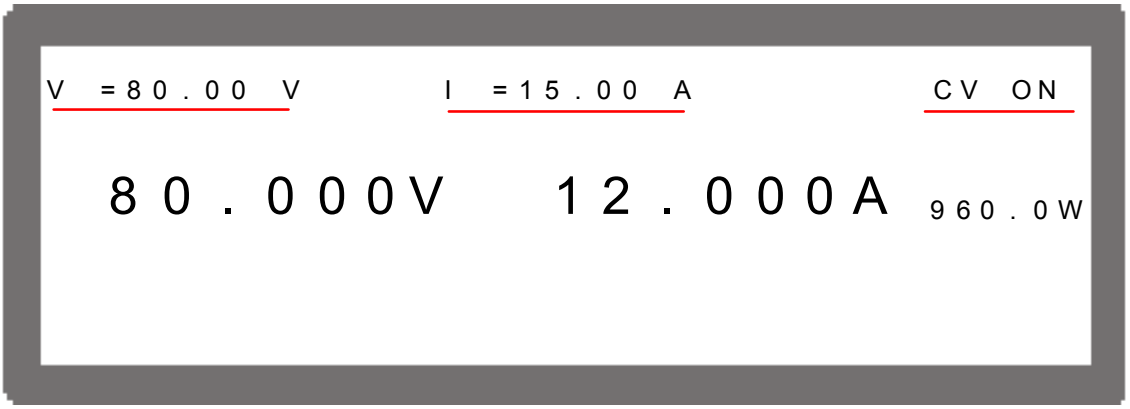


Figure 3-14

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

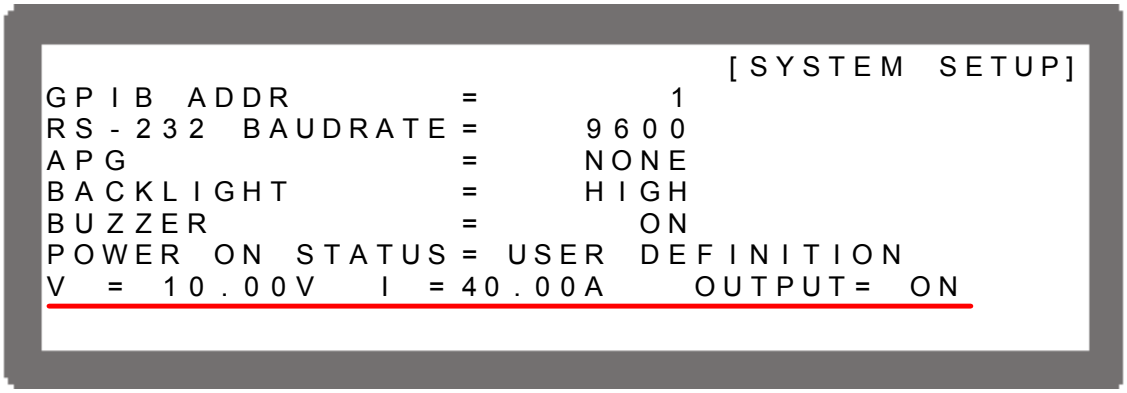


Figure 3-15

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

3.3.2 OUTPUT SETUP

1. In the Config Setup page, press the "2" key to display the screen shown in Figure 3-16.
2. Press "ENTER", to enter into OUTPUT SETUP.
3. Press the "←↑", "→↓" keys to move the cursor to the column to be set.
4. Press "EXIT" to return to MAIN PAGE.

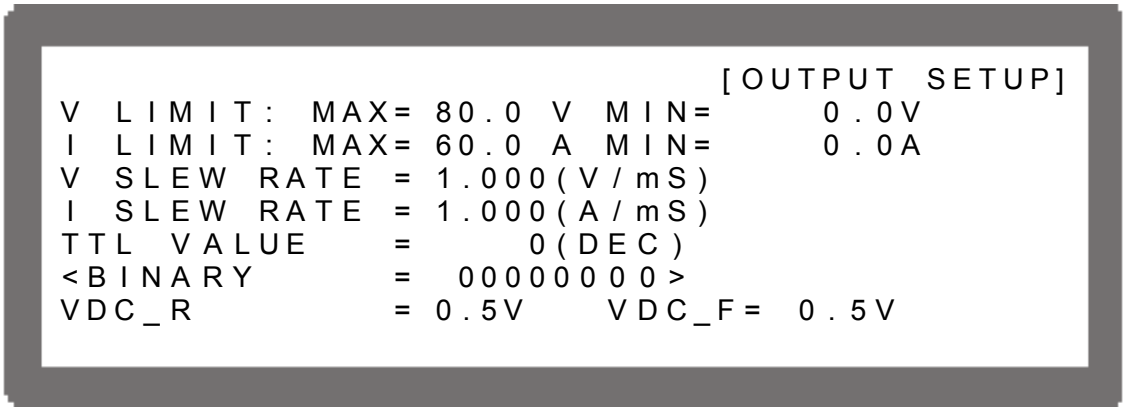


Figure 3-16

Notice The values in Figure 3-16 are the default settings for the 62012P-80-60.

3.3.2.1 VOLTAGE LIMIT SETTING

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

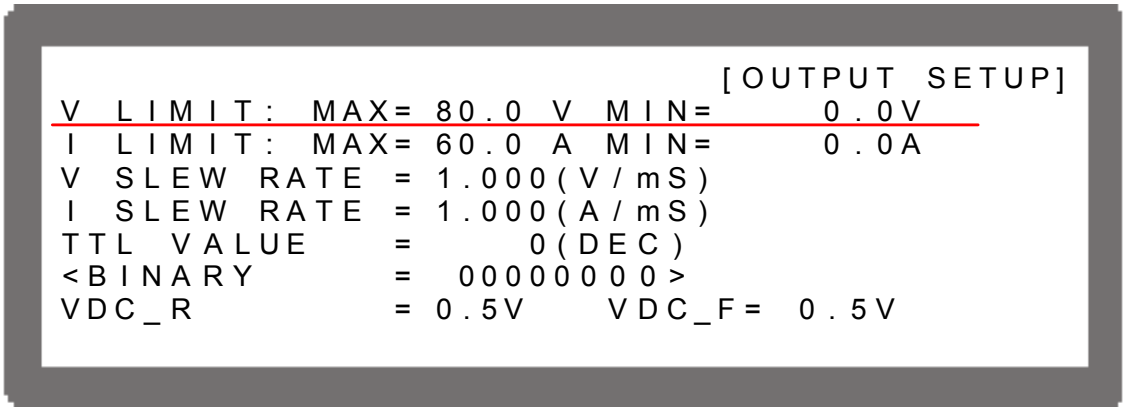


Figure 3-17

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

   For example, the default 62012P-80-60 output voltage range is 0-80V. Use this option to narrow down the default range by setting the MIN and MAX values.

   When "VOLTAGE" is pressed to set the output voltage, the DC Power Supply sets the voltage within the range of [MIN value ≤ user-defined value ≤ MAX value]. If the setting exceeds the range, the BUZZER will beep (if the BUZZER is set to ON) and the main screen will automatically prompt a warning message as shown below.

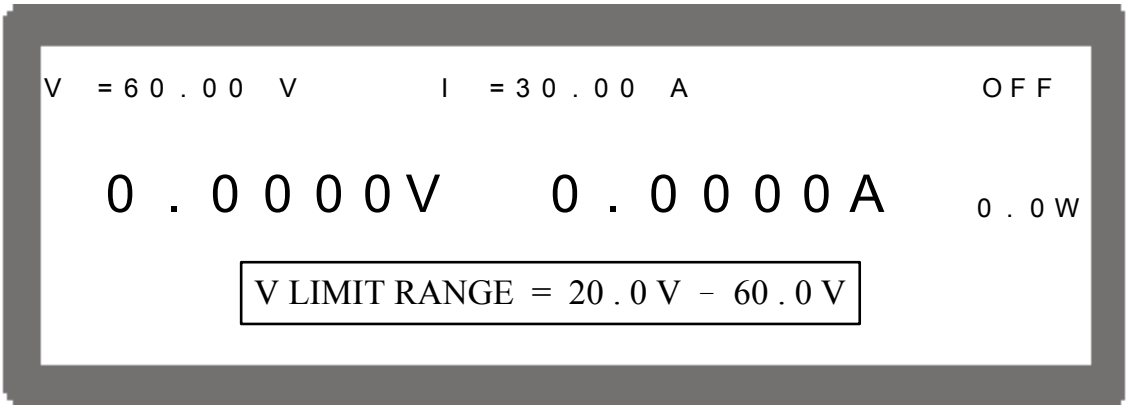


Figure 3-18

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

3.3.2.2 CURRENT LIMIT SETTING

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

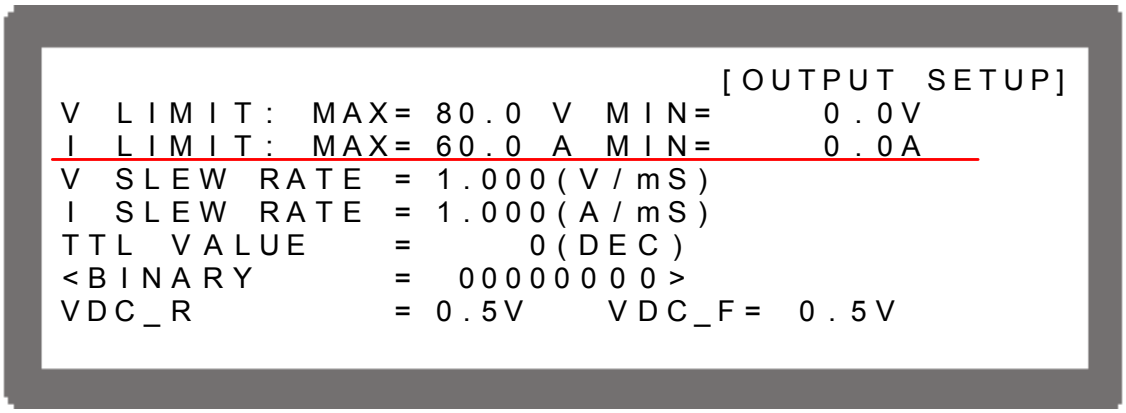


Figure 3-19

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

   For example, the default 62012P-80-60 output current range is 0-60A. Use this option to narrow down the default range by setting the MIN and MAX values.

   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.

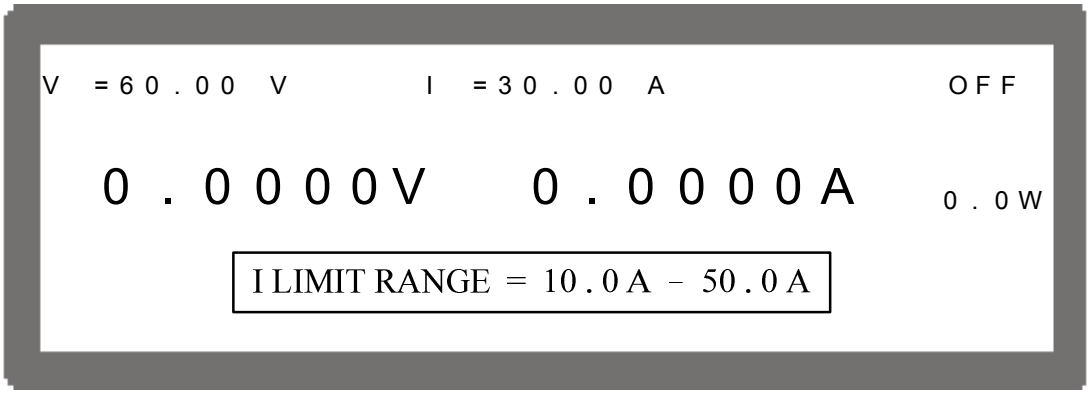


Figure 3-20

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

3.3.2.3 VOLTAGE SLEW RATE

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

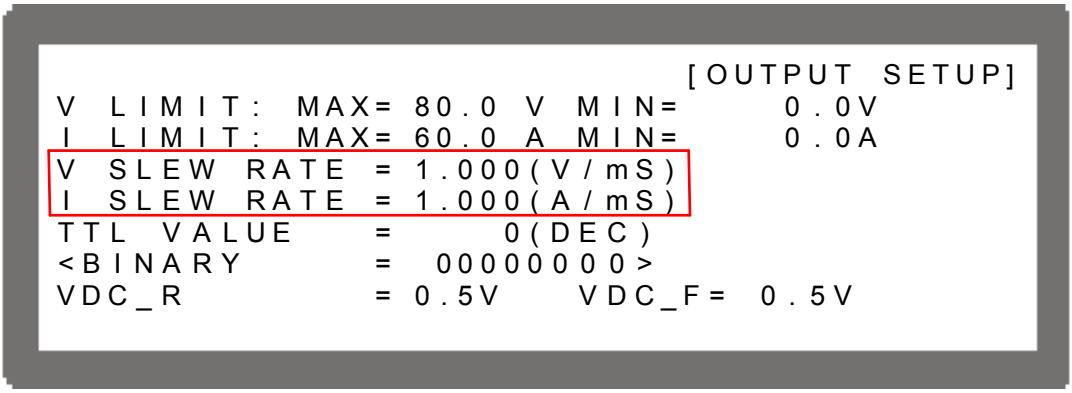


Figure 3-21

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

   For example, the default 62012P-80-60 output voltage slew rate is set as shown in Figure 3-22. The maximum input Slew Rate is 10V/mS and the minimum is 0.001V/mS. The output of the DC Power Supply will follow the rising slew rate to the set output voltage while the falling slew rate is limited by the load.

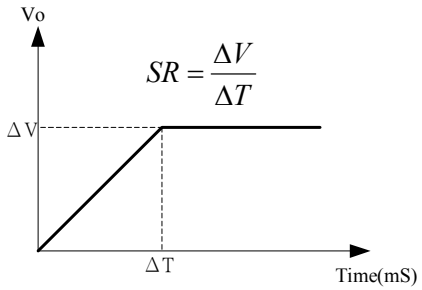


Figure 3-22

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

3.3.2.4 CURRENT SLEW RATE SETTING

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

   For example, the default 62012P-80-60 output current slew rate is set as shown in Figure 3-23. 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 the DC Power Supply will follow the rising slew rate to the set output current.

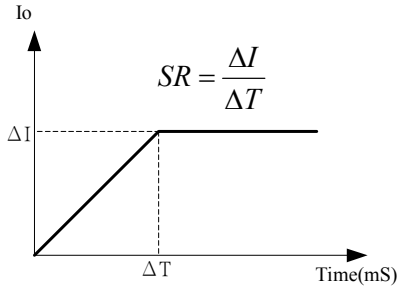


Figure 3-23

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, the SYSTEM STATUS connector on the rear panel provides 8 BIT digital signals for other purposes. The TTL VALUE range is from ***0*** to ***255***; in addition the system will automatically convert it to binary for easy identification.

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

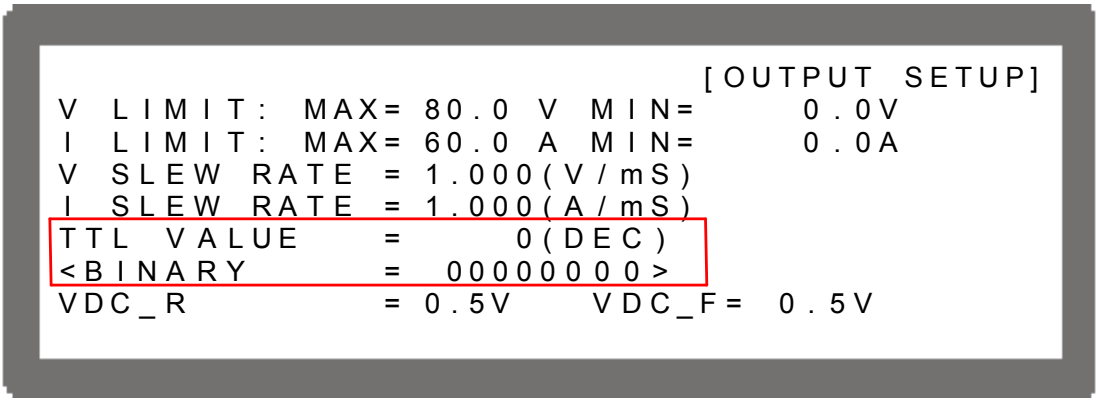


Figure 3-24

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

   The TTL VALUE range is from ***0*** to ***255***; in addition the system will automatically convert it to binary for easy identification. Figure 3-25 shows the SYSTEM STATUS pin no. on the rear panel, where TTL0-TTL7 is located on PIN12 -PIN19, and PIN20 is the signal reference point for PIN8-PIN19 (GND).

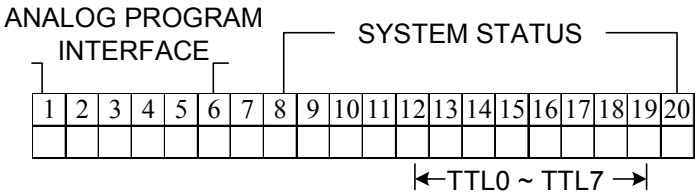


Figure 3-25

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

Notice

1. The TTL signal can be set in PROGRAM.
2. Table 3-1 shows the TTL pin definition for 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

The table shows the output specifications of the TTL signals.

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 the DC power supply is ON and the voltage is higher than VDC_R, pin10 DC_ON of SYSTEM STATUS on the rear panel will go HIGH. When the output voltage of the DC power supply is lower than VDC_F, pin10 DC_ON of SYSTEM STATUS on the rear panel will go LOW, as shown below:

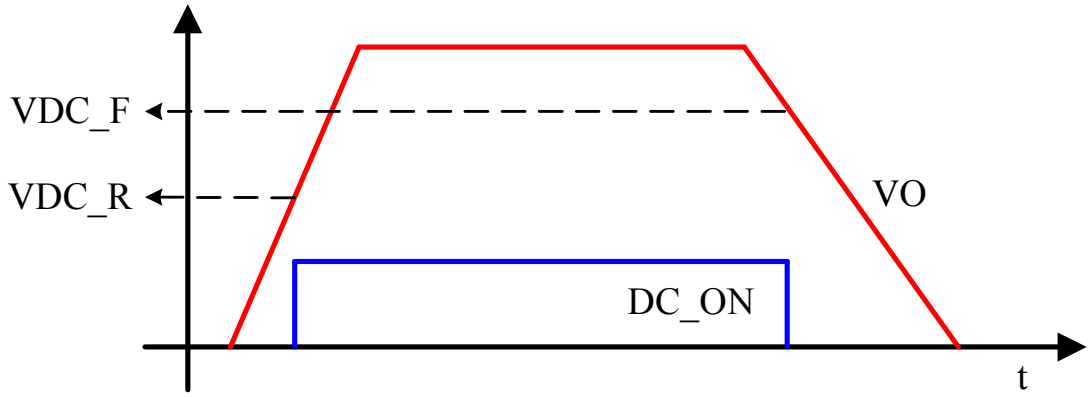


Figure 3-26

Set DC_ON as described below:

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

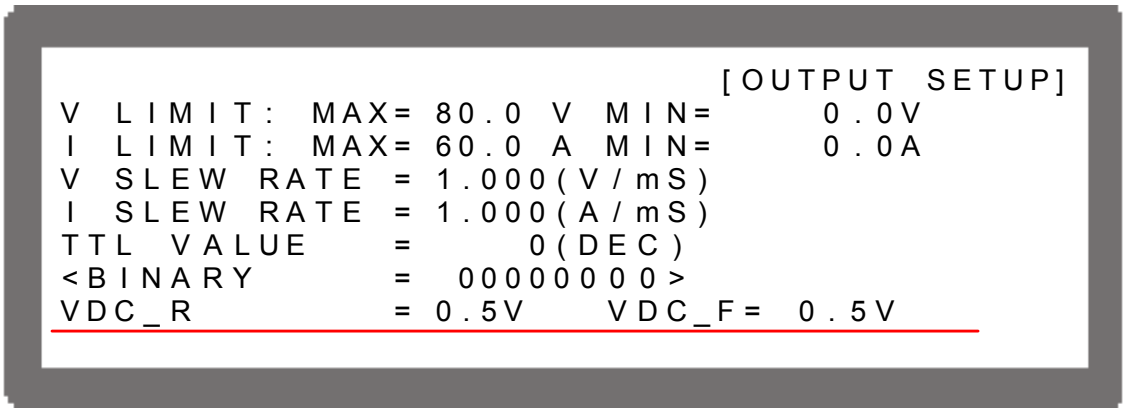


Figure 3-27

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

3.3.3 SERIES/PARALLEL

62000P Series DC Power Supplies can be connected in series or parallel. For example, the 62012P-80-60 voltage is up to 400V when connecting 5 sets in series, and the current is up to 300A when connecting 5 sets in parallel.

Notice

1. Series/Parallel cannot be used at the same time.
2. Table 3-3 lists the maximum number of devices that may be connected together and the voltage and current in series/parallel operation for the 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 models cannot be operated in parallel or serial together.
4. Be sure the breaker capacity is enough and the earth wire is grounded to earth when connecting in series/parallel.

3.3.3.1 Connecting Series/Parallel Output Cable

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

1. Figure 3-28 shows the series connections.
2. Figure 3-29 shows the parallel connections. For the 62006P-30-80, 62012P-40-120 and 62024P-40-120 models, use the connections shown in Figure 3-30.

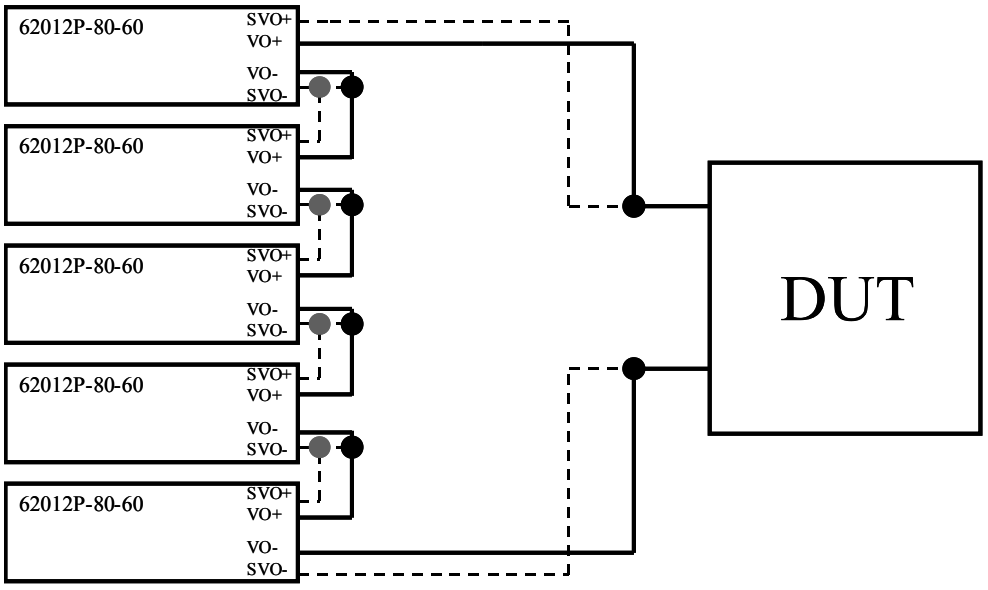


Figure 3-28

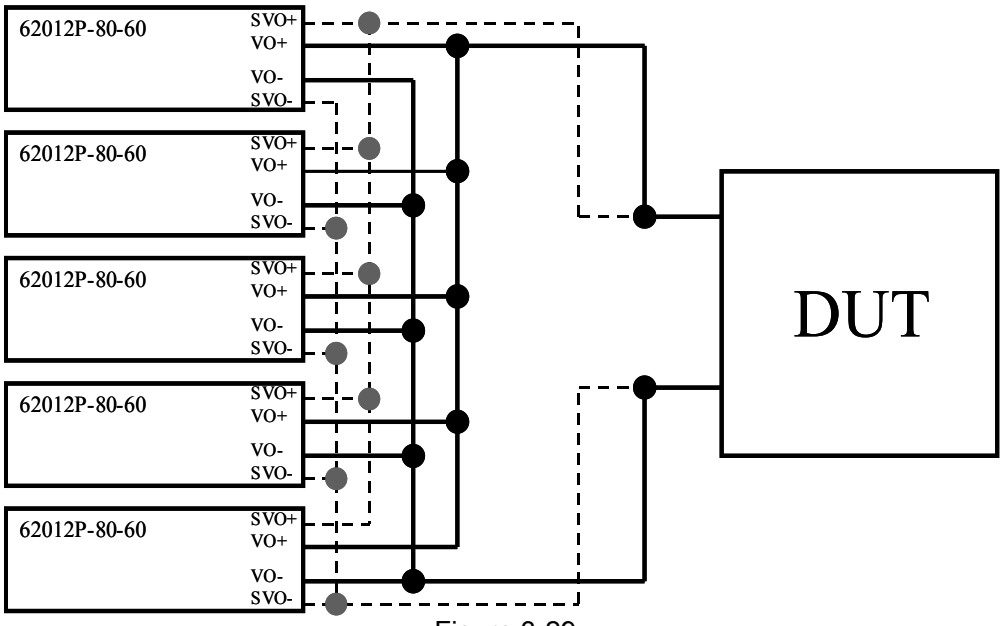


Figure 3-29

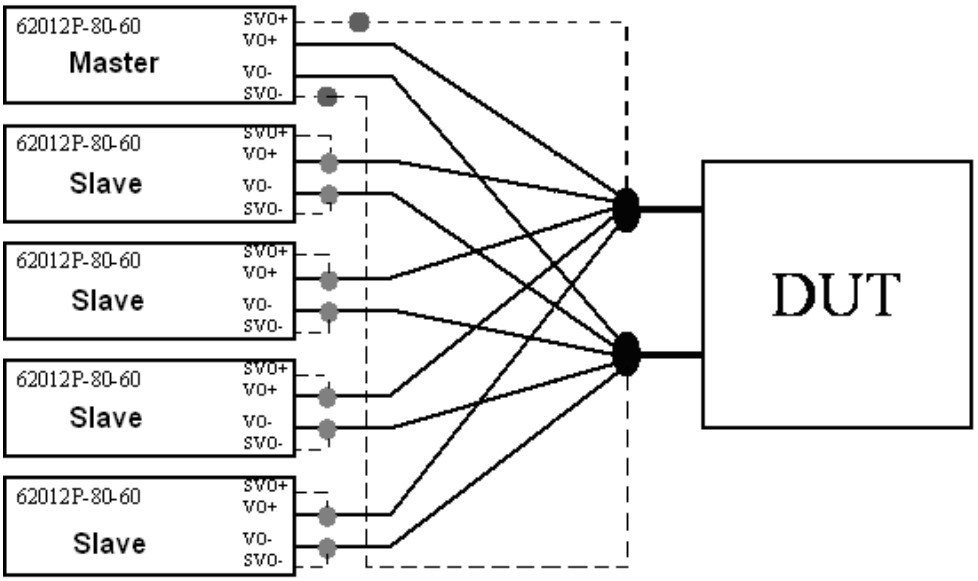


Figure 3-30

3.3.3.2 Assembling Series/Parallel Communication Interface

1. To operate the Power Supplies in series, connect the RS-485 connectors on the rear panel as shown in Figure 3-32. When using APG control, PINs 2, 3, 4, 7, 9 and 20 of the green signal connector on the rear panel must be connected to the green connector of the next device as shown in Figure 3-32.

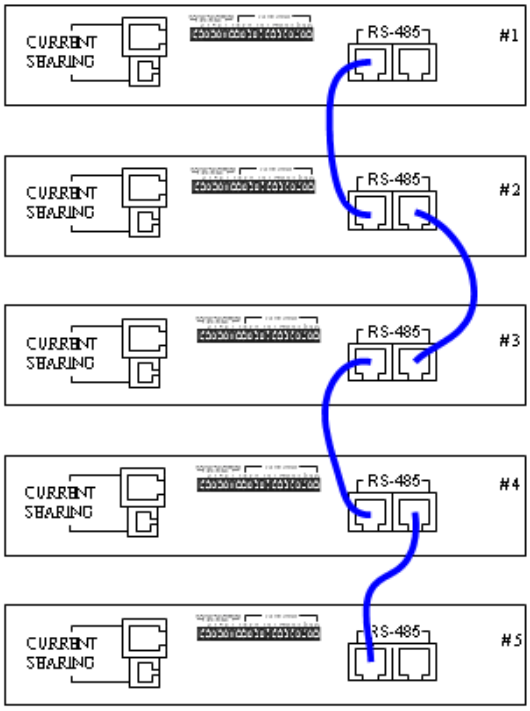


Figure 3-31

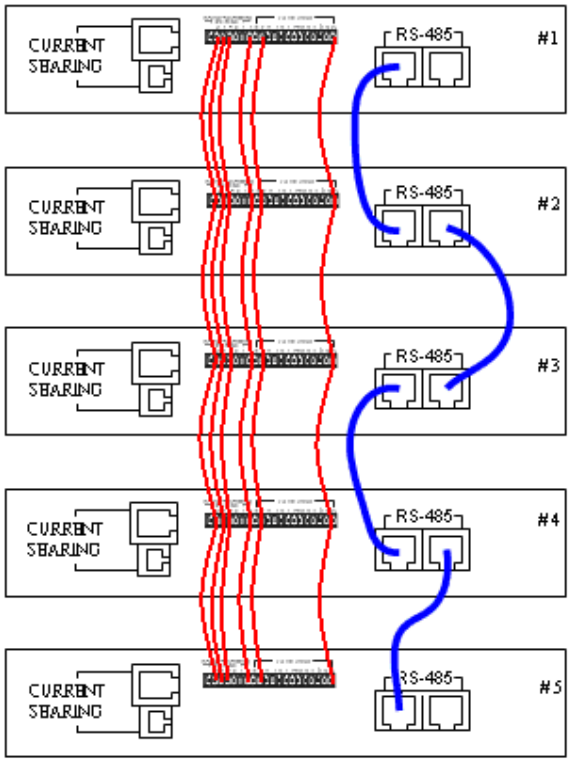


Figure 3-32

2. To operate the Power Supplies in parallel, besides connecting the RS-485 connectors on the rear panel, the CURRENT SHARING connector has to be connected as well, as shown in Figure 3-33. When using APG control, PINs 2, 3, 4, 7, 9 and 20 of the green signal connector on the rear panel must be connected to the green connector of the next device as shown in Figure 3-34.

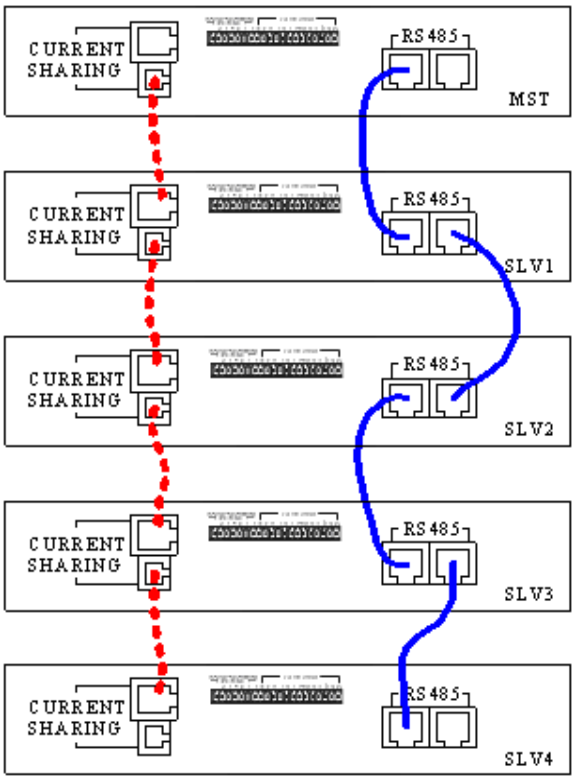


Figure 3-33

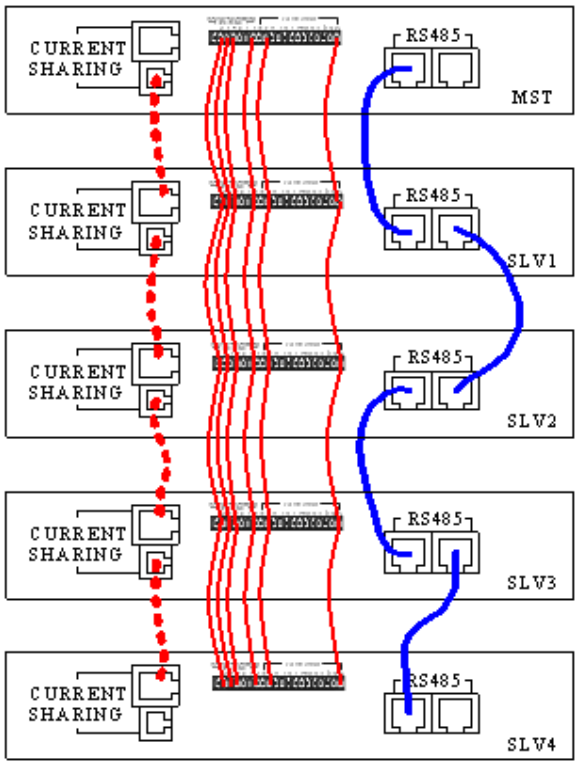


Figure 3-34

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 connect one after another as shown by the solid line in Figure 3-31 or Figure 3-33.
2. Each DC Power Supply has two CURRENT SHARING connecting terminals with different profiles. Connect the output terminal of the first Power Supply to the input terminal of the second Power Supply and so forth as shown by the dotted line in Figure 3-33 and Figure 3-34. Be sure to use the CURRENT SHARING communication cable provided by CHROMA.
3. The CURRENT SHARING communication cable must be securely connected when in parallel operation or it may cause the DC Power Supply to run abnormally or result in poor CURRENT SHARING.
4. When returning to single unit operation mode, be sure to remove the RS485, CURRENT SHARING and APG cables to avoid abnormal operation.

CAUTION

1. The DC Power Supply might be damaged if the CURRENT SHARING input and output terminals are connected incorrectly when in parallel mode.
2. To prevent damage to the unit, do not connect the CURRENT SHARING cable when in series operation. The DC Power Supply will detect if the CURRENT SHARING cable is connected incorrectly and display a SERIES FAULT as shown below.

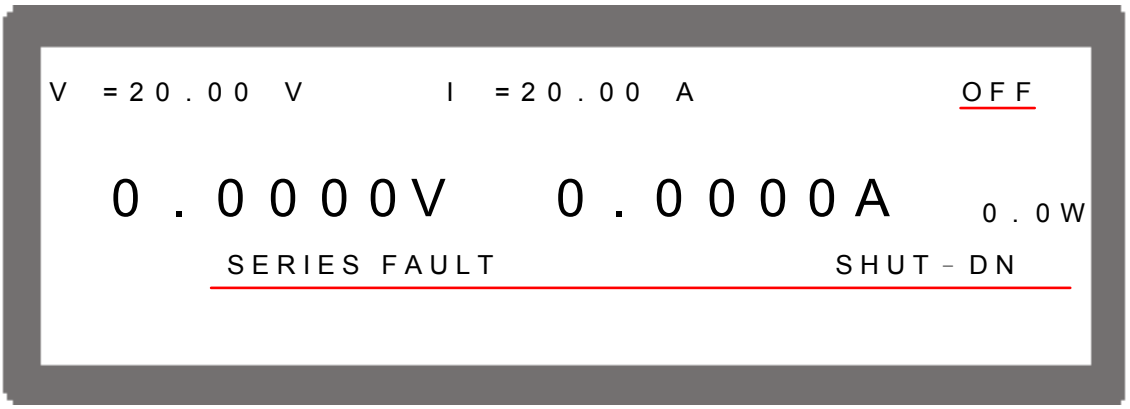


Figure 3-35

3.3.3.3 Setting Series/Parallel Operation Mode

3.3.3.3.1 Setting SLAVE

Notice

1. Set the SLAVE first and then the MASTER when operating the 62000P Series DC Power Supply in series or parallel mode, or it may not be able to operate due to a communication error.
2. Up to 4 units may be set as slaves (SLAVE1 - SLAVE4).

1. In the Config Setup, press "3" and "ENTER" to select PARALLEL /SERIES (see Figure 3-36).

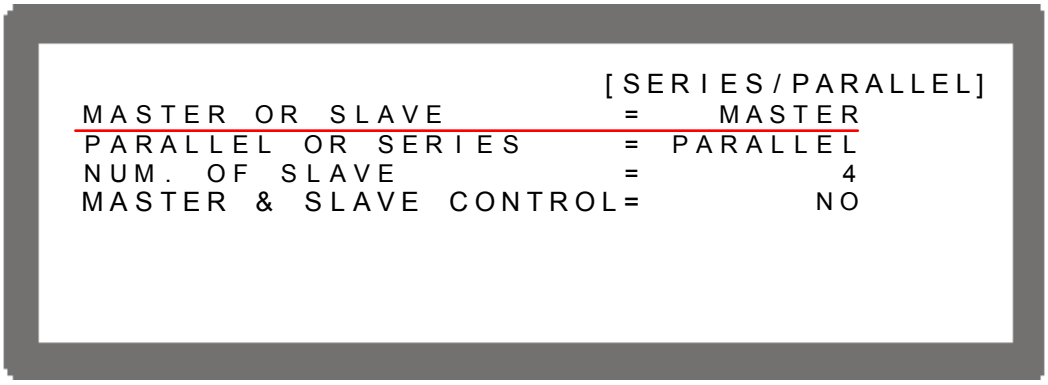


Figure 3-36

2. Use the numeric ([1] - [4]) keys or the "Rotary" ( ) knob to set SLAVE1-SLAVE4 as shown in Figure 3-37.

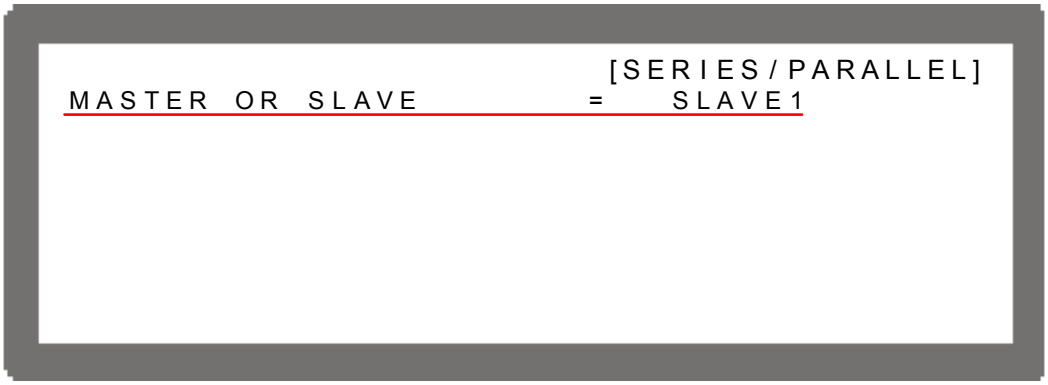


Figure 3-37

3. Press "[ENTER]" to confirm and press "[EXIT]" to return to single unit operation.

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 SLAVEs, such as voltage setting, current setting, protection setting, etc., which means all settings in a SLAVE come from the MASTER. The original settings in SLAVE are temporary invalid.

(2) It receives all measurement values and protection signals from the SLAVE. The MASTER calculates all measurement values and displays them in the main page. When protection occurs in one SLAVE, the MASTER will notify the other SLAVEs to trigger the protection and display in the MASTER's main page.

Notice When multiple DC Power Supplies are connected in series or parallel, only one DC Power Supply can be the MASTER and the rest must be set to SLAVE.

Set the MASTER as described below:

1. In Config Setup, press "3" and ENTER to select PARALLEL/SERIES.
2. Use the numeric (0) key or the "Rotary" ( ) knob to set MASTER as shown in Figure 3-38.

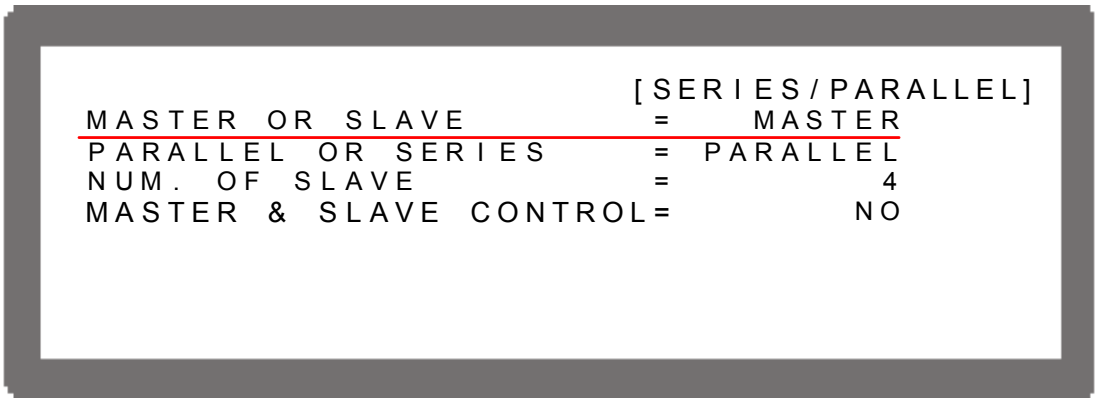


Figure 3-38

3.3.3.3.3 Setting PARALLEL or SERIES

This option sets the Power Supply to operate in Series or Parallel mode as shown in Figure 3-39. There are two selections: PARALLEL and SERIES.

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

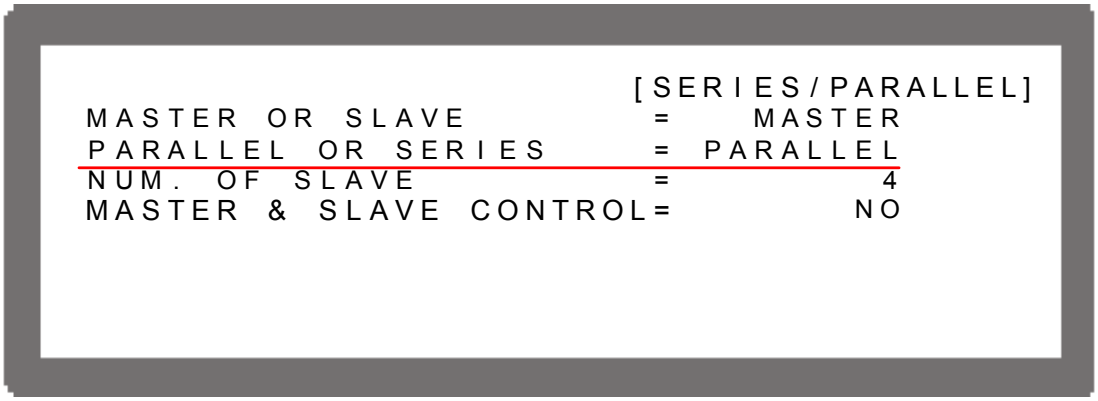


Figure 3-39

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

   Connect the cables on the rear panel as shown in Figure 3-31 and Figure 3-32 when set to SERIES, and as shown in Figure 3-33 and Figure 3-34 when set to PARALLEL.

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

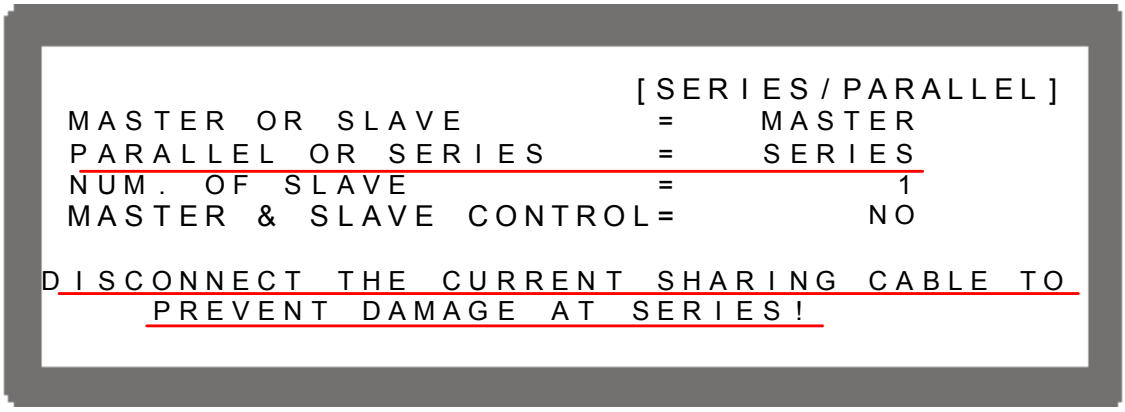


Figure 3-40

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

3.3.3.3.4 Setting NUM. OF SLAVE

When the DC Power Supply is set to MASTER (see section 3.3.3.3.1), the number of SLAVEs must be set. If there are 4 slaves, then NUM. OF SLAVE = 4 as shown below.

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

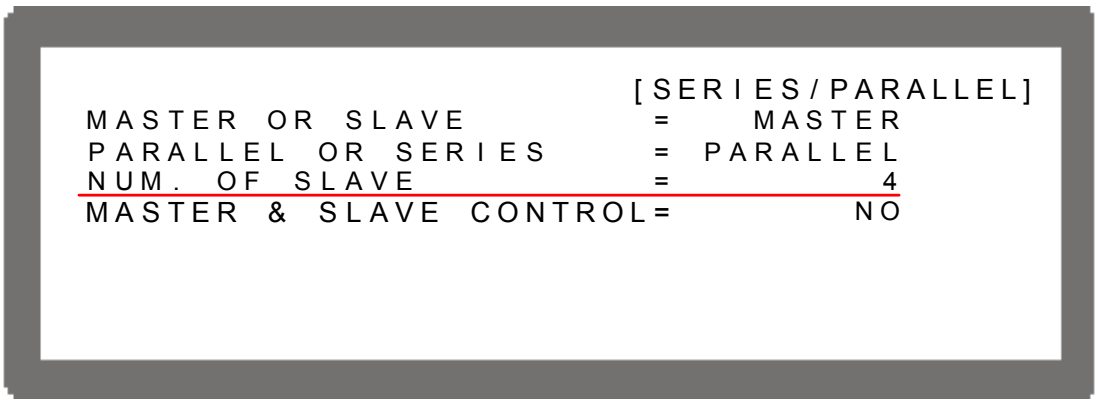


Figure 3-41

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

Notice

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

3.3.3.3.5 Activating MASTER & SLAVE CONTROL

When PARALLEL OR SERIES and NUM. OF SLAVE are set in the MASTER unit, use the MASTER to activate the series/parallel control as described below:

1. Use the “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set.
2. Use the numeric (1) key or the “Rotary” (◎) knob to set YES.

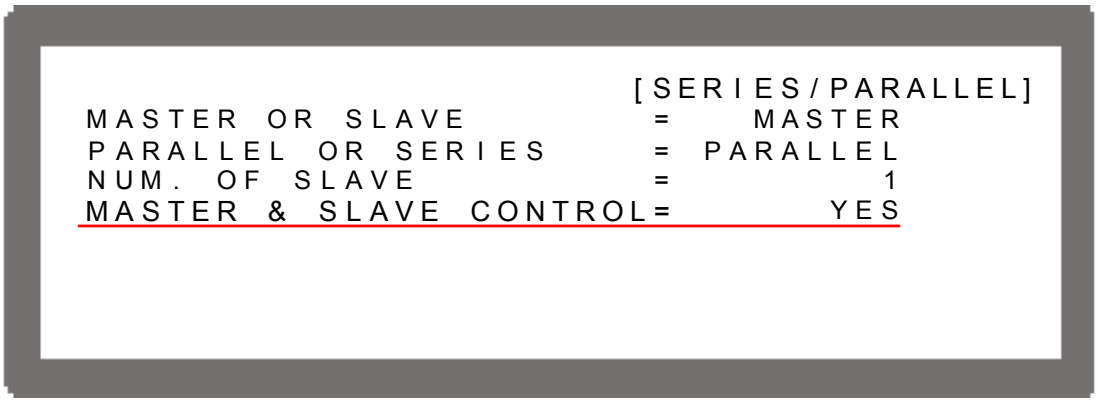


Figure 3-42

3. Press “ ENTER ↵ ” to confirm; it will skip to the series/parallel MASTER page automatically as shown in Figure 3-43.

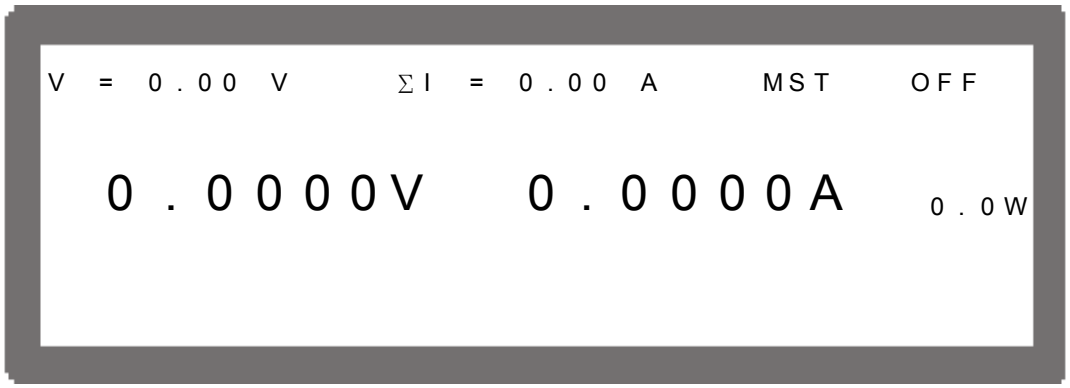


Figure 3-43

4. The SLAVE page will automatically skip to Figure 3-44.

Figure 3-44

5. Start operation in the series/parallel mode.

Notice

1. A communication error will occur if the SLAVE settings are the same (such as SLAVE 1 & SLAVE 1). The MAIN PAGE of the MASTER will display the error as shown in Figure 3-45. When this type of error occurs, exit the series/parallel operation first and then change the SLAVE setting to resume the operation.

Figure 3-45

2. Once the series/parallel settings have been completed, the settings can be saved. After all machines are powered off, turn on the SLAVEs first and the MASTER last. Series/ parallel operation wil be set automatically.

3.3.3.4 Setting Series Parameters

When the software communication and hardware settings for series operation have been completed, the following options are available for setting - (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 output voltage will increase based on the number of units connected in series. The set voltage is indicated by ΣV. When set to MASTER, MST will appear in the window's upper right corner as shown below.

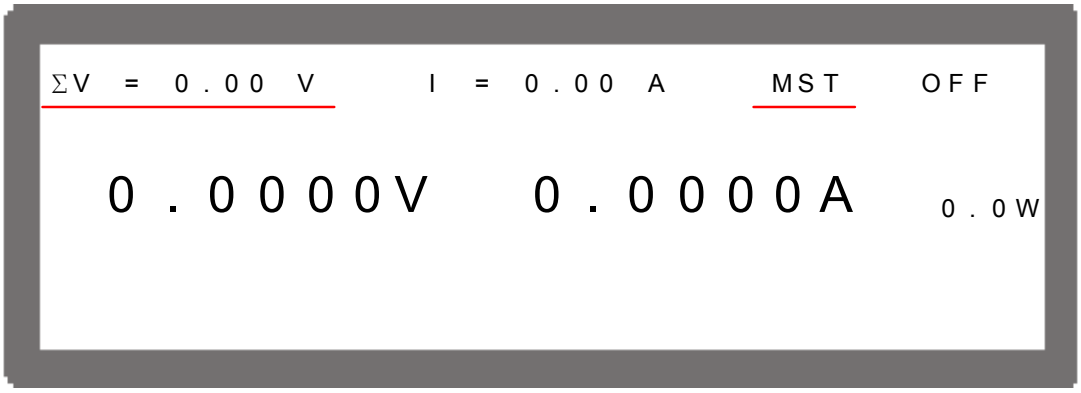


Figure 3-46

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 for a single unit; only the output voltage will increase based on the number of units in series. For example if there are 5 sets of 62012P-80-60 in series, the maximum output voltage that can be set is 400V, and the maximum output current is 60A, as shown below:

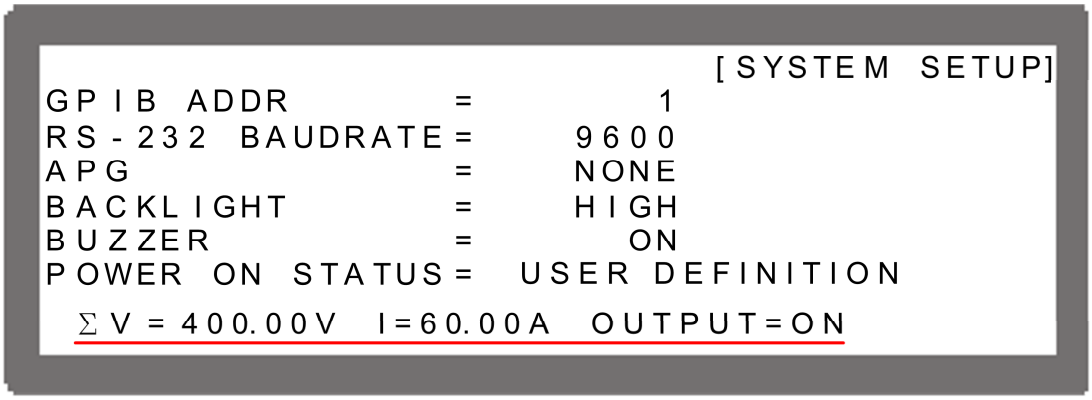


Figure 3-47

Notice

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

3.3.3.4.3 Setting OUTPUT SETUP for Series

The V LIMIT MAX in OUTPUT SETUP in the MASTER unit will increase based on the number of units connected in series. It is indicated by ΣV LIMIT MAX, as shown below. The setting range for ΣV SLEW RATE will increase based on the number of units connected in series as well.

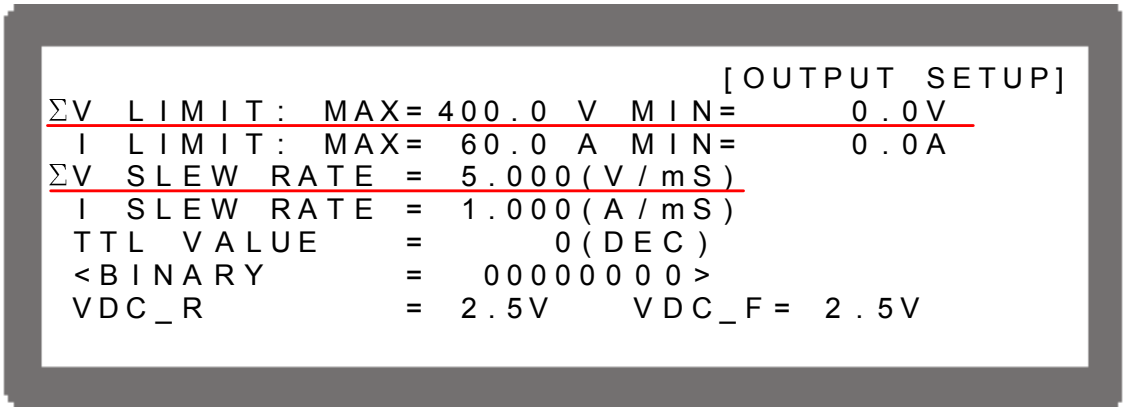


Figure 3-48

3.3.3.4.4 Setting PROTECTION for Series

The OVP and OPP in PROTECTION in the MASTER for series connection will increase based on the number of units connected in series. They are indicated by ΣOVP and ΣOPP, as shown below.

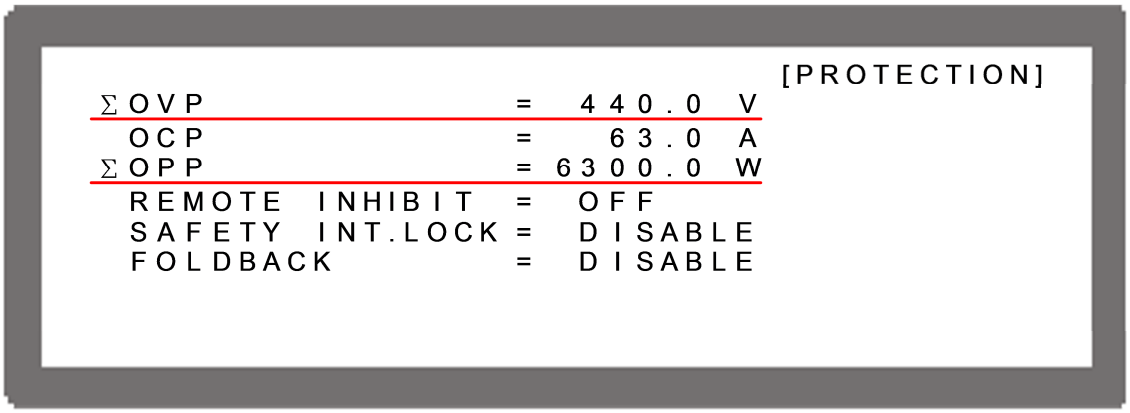


Figure 3-49

3.3.3.4.5 Setting PROGRAM for Series

The LIST MODE and V_STEP MODE in PROGRAM can also be set in series operation. The operation of PROGRAM in series is the same as for a single unit (see Chapter 4 *Program Sequence*). LIST MODE is indicated by ΣVOLTAGE in the [SEQUENCE] screen as shown in Figure 3-50. The setting range for ΣV S. R. will increase based on the number of units connected in series as well. The start and end voltages of V_STEP MODE are indicated by ΣSTART_VOLTAGE and ΣEND_VOLTAGE as shown in Figure 3-51.

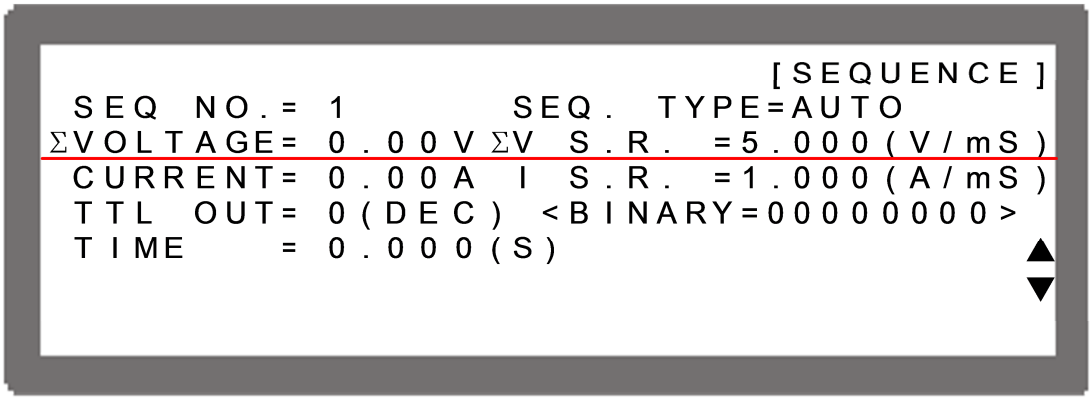


Figure 3-50

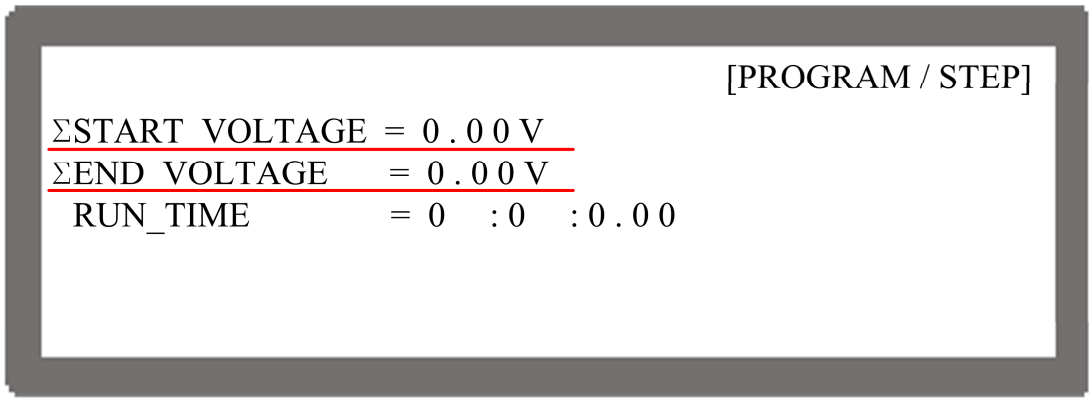


Figure 3-51

3.3.3.5 Setting Parallel Parameters

When the software communication and hardware settings for parallel operation have been completed, the following options are available for setting - (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 setting will increase based on the number of units connected in parallel. The current setting is indicated by ΣI. When set to MASTER, MST will appear in the window's upper right corner as shown below.

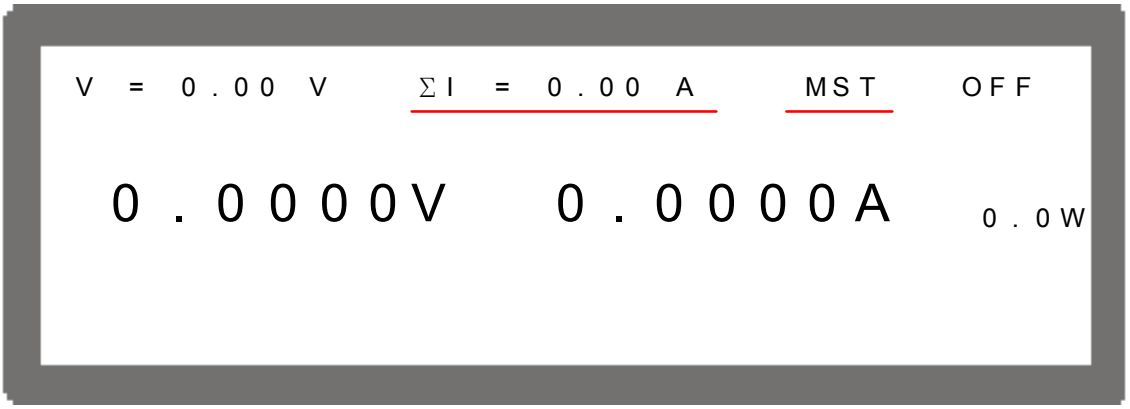


Figure 3-52

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 based on the number of machines set in parallel. For example if there are 5 sets of 62012P-80-60 in parallel, the maximum output voltage that can be set is 80V, and the maximum output current is 300A, as shown below:

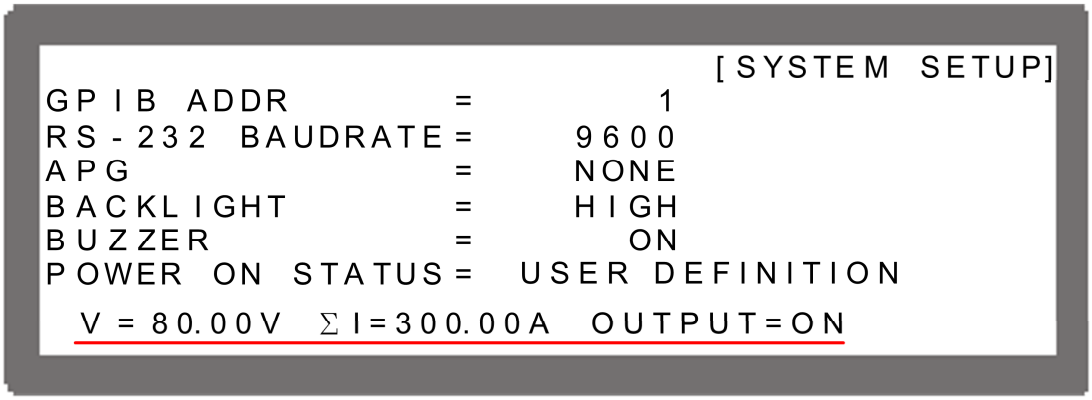


Figure 3-53

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

3.3.3.5.3 Setting OUTPUT SETUP for Parallel

The I LIMIT MAX in OUTPUT SETUP in the MASTER unit for parallel connection will increase based on the number of units connected in parallel. It is indicated by ΣI LIMIT MAX: as shown below. The setting range of ΣI SLEW RATE will increase based on the number of units connected in parallel as well.

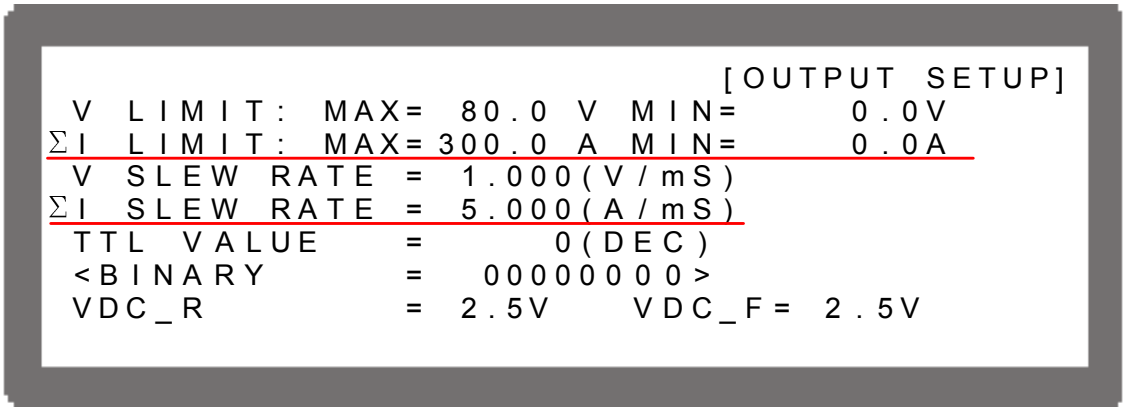


Figure 3-54

3.3.3.5.4 Setting PROTECTION for Parallel

The OCP and OPP in PROTECTION in the MASTER unit for parallel connection will increase based on the number of units connected in parallel. It is indicated by ΣOCP and ΣOPP, as shown below.

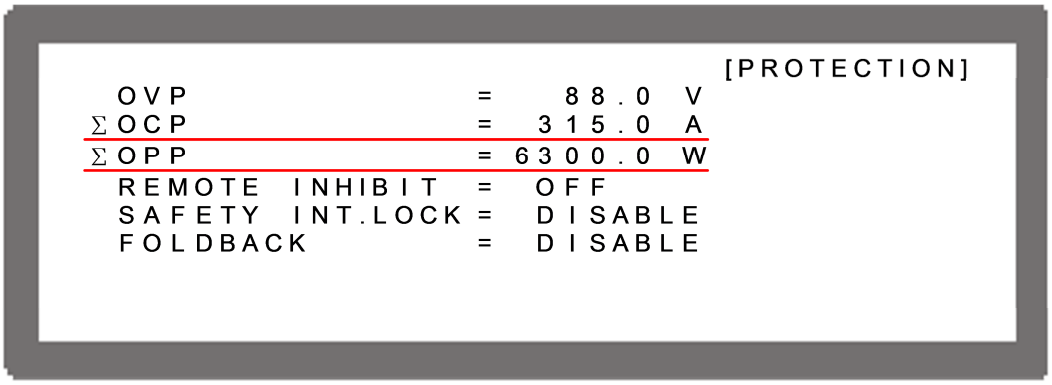


Figure 3-55

3.3.3.5.5 Setting PROGRAM for Parallel

The LIST MODE and V_STEP MODE in PROGRAM can also be set for parallel operation. The operation of PROGRAM in parallel is the same as for a single unit (see Chapter 4 *Program Sequence*). LIST MODE is indicated by ΣCURRENT. The [SEQUENCE] screen is shown in Figure 3-56. The setting range of ΣI S. R. will increase based on the number of units connected in series as well. V_STEP MODE has no current setting so the screen is the same as the single Power Supply as shown in Figure 3-57.

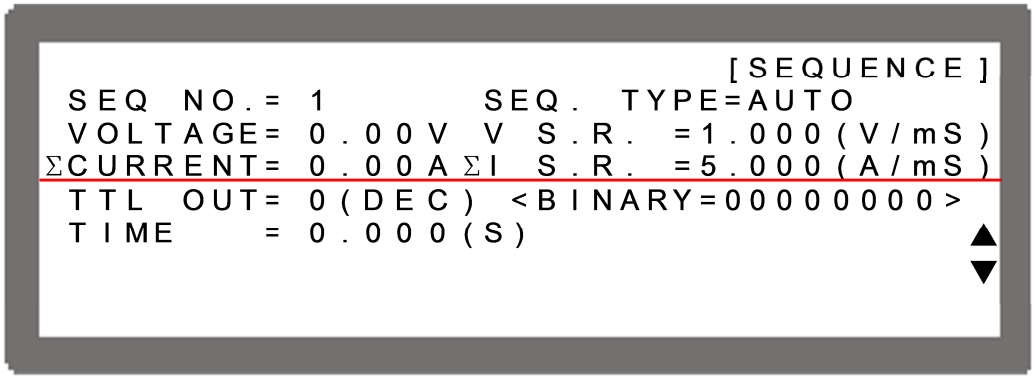


Figure 3-56

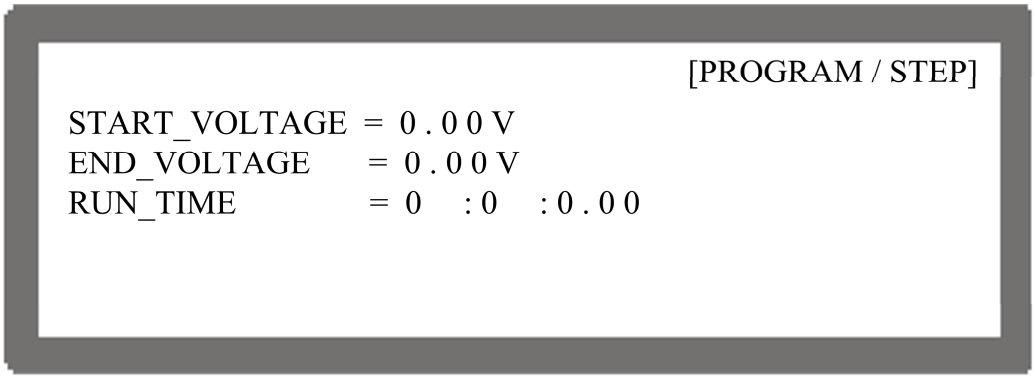


Figure 3-57

3.3.3.6 Setting Procedure for APG in Series or Parallel

Series and parallel operation can also be used with the APG interface. See sections 3.3.1.3 and 3.3.3.1 to 3.3.3.6 for more detailed information.

3.3.3.6.1 Series Setting

To connect 5 62012P-80-60 DC Power Supplies for series operation and set the APG option to APG = V & I and Vref(V) = 5. The MAIN PAGE of the MASTER is shown in Figure 3-58.

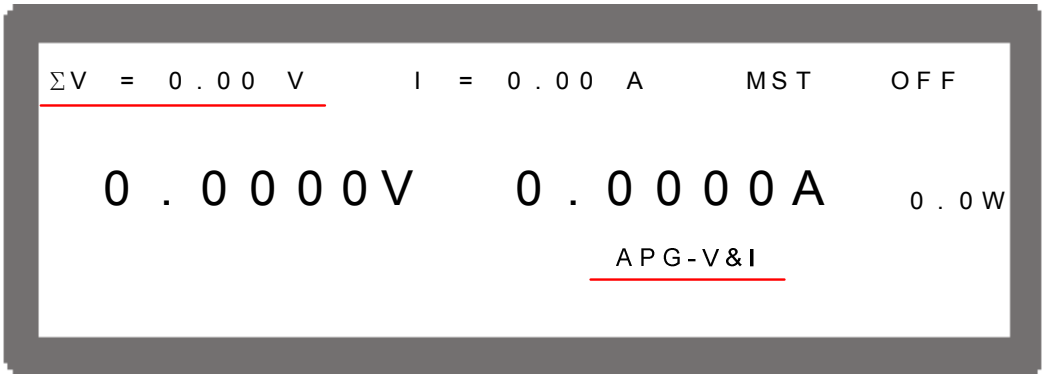


Figure 3-58

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 shown in Figure 3-59(a). Setting 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 shown in Figure 3-59(b). 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.

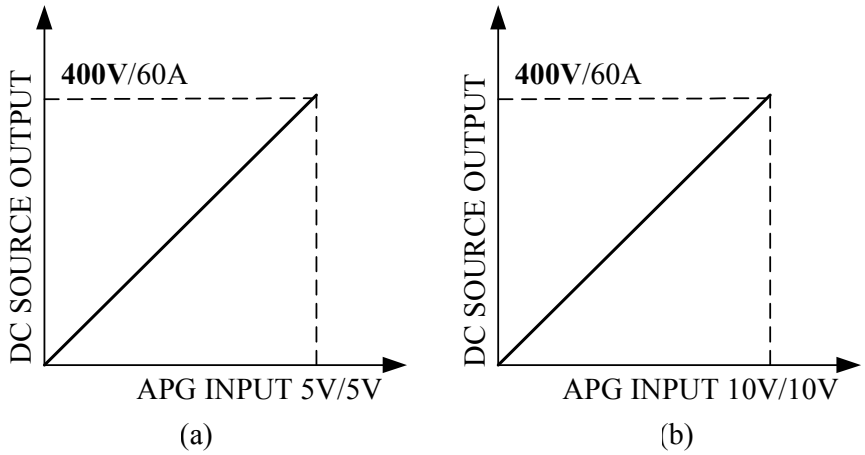


Figure 3-59

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 shown in Figure 3-60(a). Setting 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 shown in Figure 3-60(b).

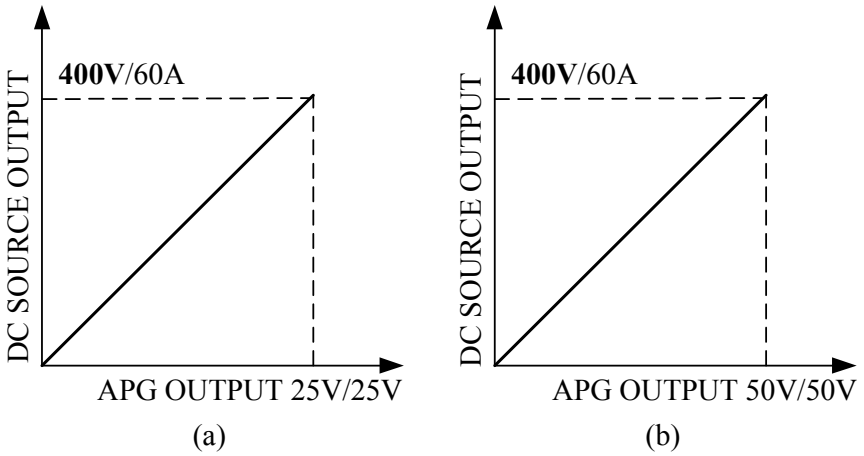


Figure 3-60

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 is shown in Figure 3-61.

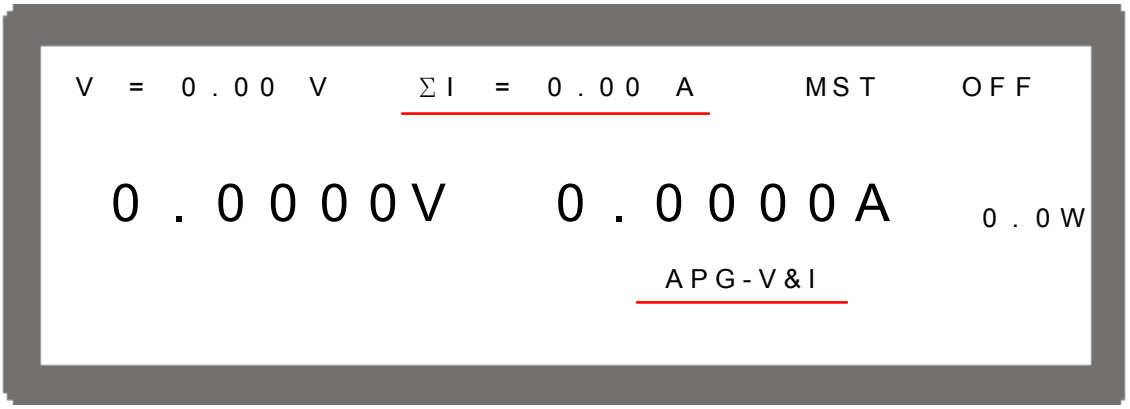


Figure 3-61

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 3-62(a) shows. Setting 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 3-62(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.

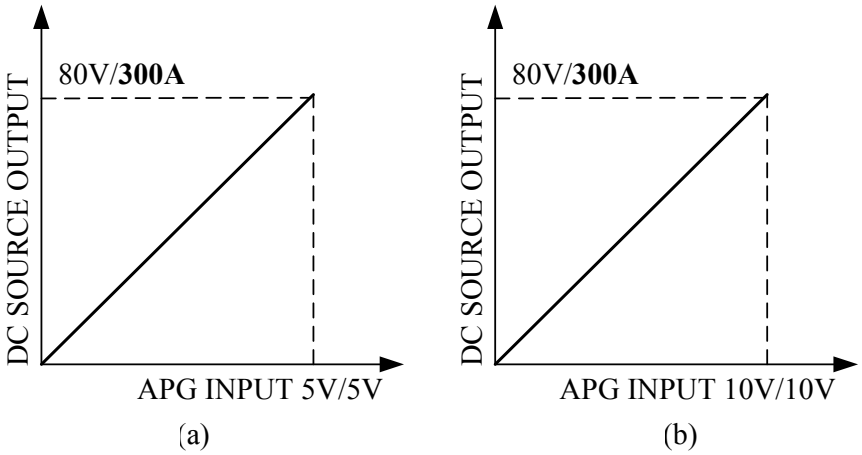


Figure 3-62

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 3-63(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 3-63(b) shows.

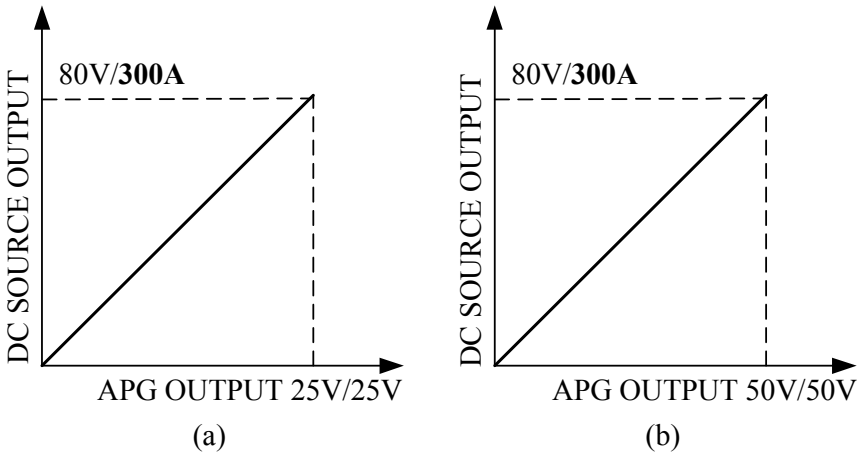


Figure 3-63

Notice

For example, to connect 5 sets of 62012P-80-60 in series or parallel, the fixture circuit in Figure 3-64 can be referenced if expecting the relationship of APG total voltage/current measurements mapping to the actual output voltage/current is as Figure 3-65 shows.

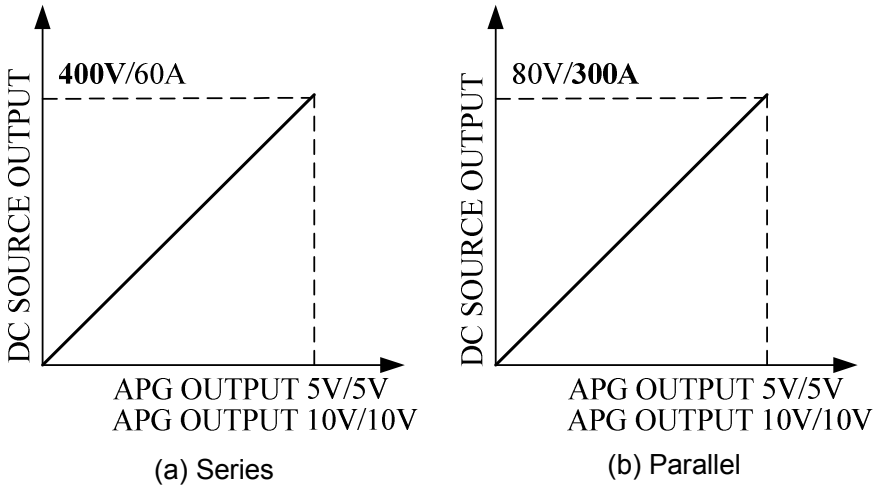


Figure 3-64

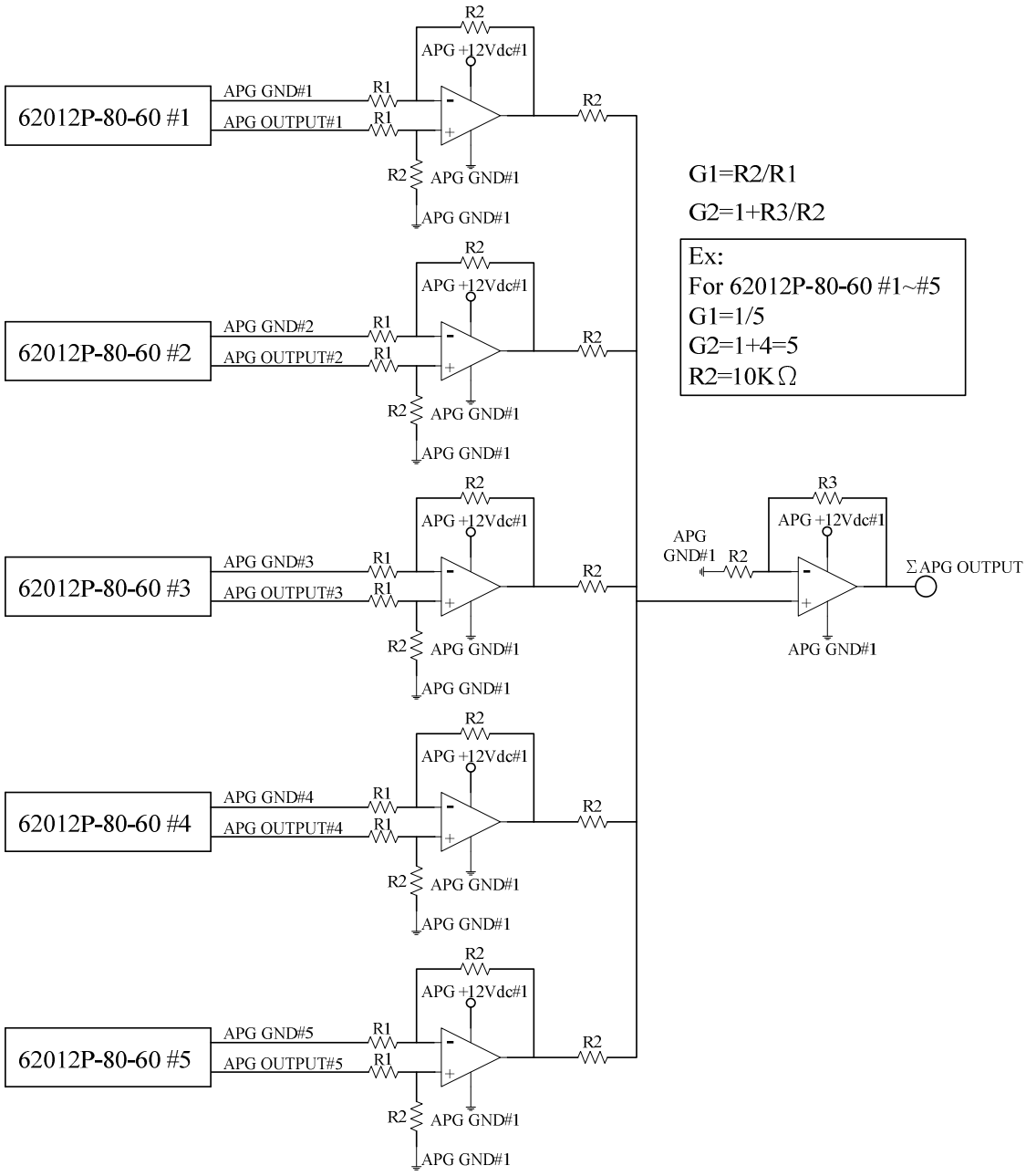


Figure 3-65

3.3.4 DISPLAY

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

3.3.4.1 DISPLAY SELECTION

The DISPLAY setting shows the internal settings on the last line of MAIN PAGE for easy identification without having to enter the setting pages. 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 the Config setting page, press "4" to display the screen.
2. Press "ENTER" to enter into DISPLAY SELECTION as shown in Figure 3-66.
3. Use the numeric (0-9) keys or the "Rotary" ( ) knob to select the desired setting.

3.3.4.1.1 NONE

When DISPLAY SELECTION is set to NONE, the last line of MAIN PAGE will not show any messages.

1. Use the " ", " " keys to move the cursor to the column to be set as shown in Figure 3-66.
2. Press "ENTER" to confirm it.
3. Press "EXIT" to return to MAIN PAGE.

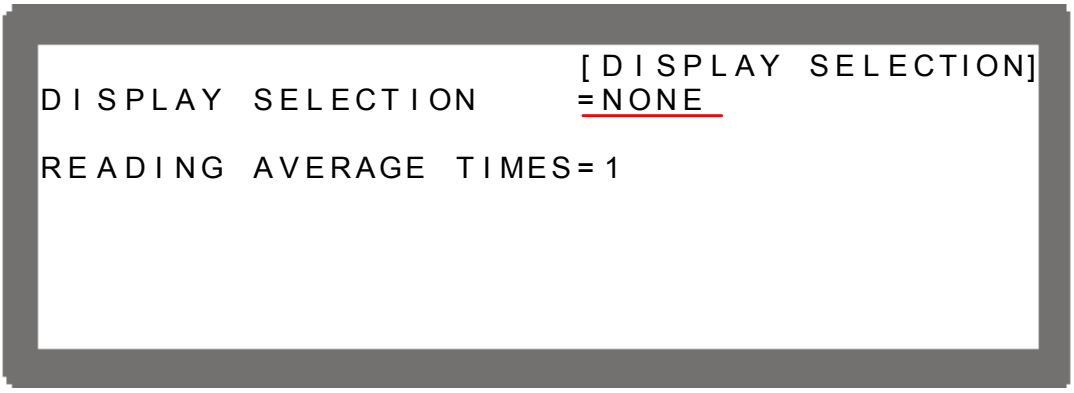


Figure 3-66

3.3.4.1.2 V/I LIMIT

When DISPLAY SELECTION 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 sections 3.3.2.1 and 3.3.2.2 for detailed information. The MAIN PAGE will display the following when the setting is completed.

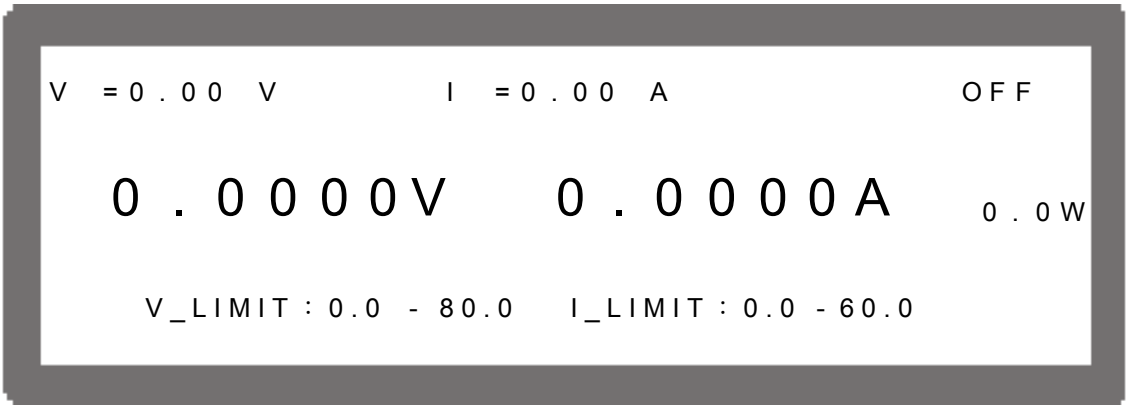


Figure 3-67

3.3.4.1.3 V/I/P PROTECT

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

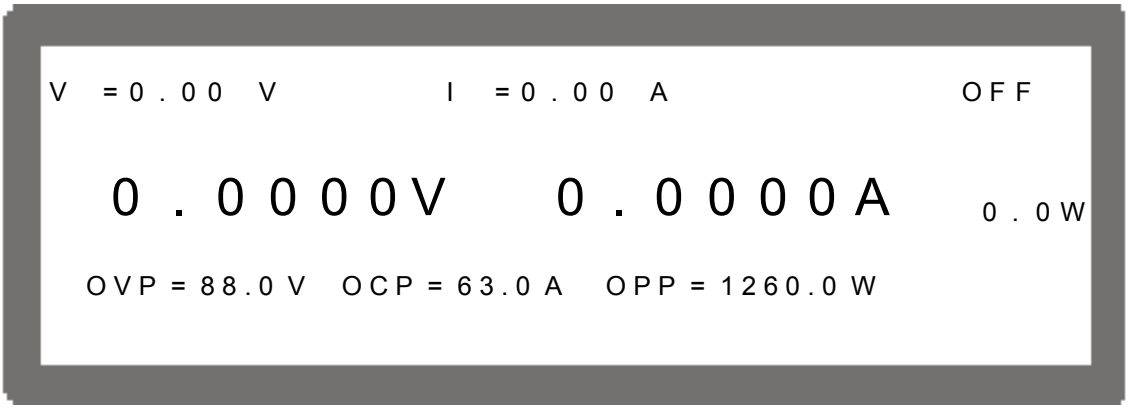


Figure 3-68

3.3.4.1.4 V/I SLEW RATE

When DISPLAY SELECTION 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 sections 3.3.2.3 and 3.3.2.4 for detailed information.

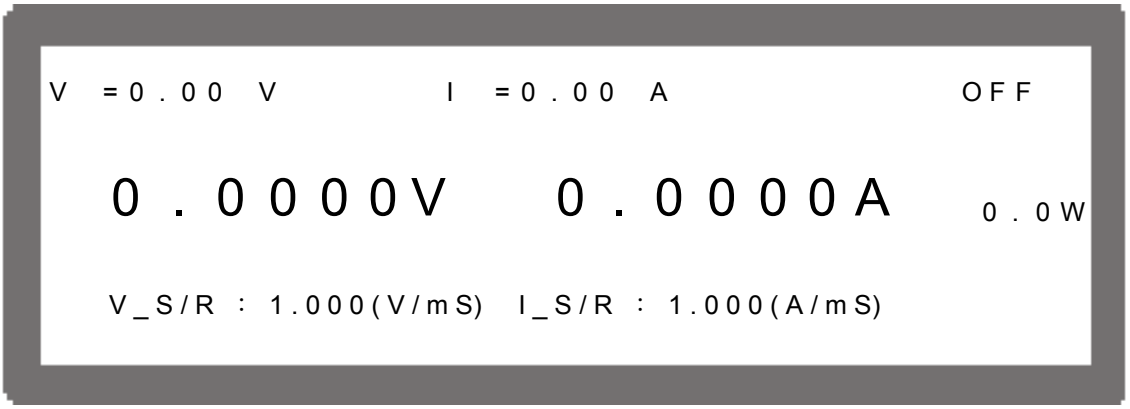


Figure 3-69

3.3.4.1.5 TTL VALUE

When DISPLAY SELECTION 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 detailed information.

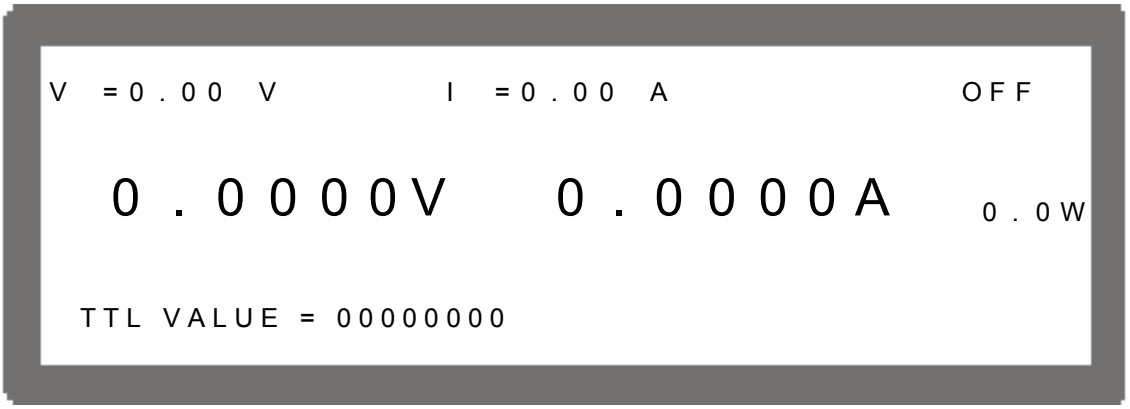


Figure 3-70

3.3.4.2 READING AVERAGE TIME

The voltage and current readings displayed on the MAIN PAGE are five and half digits. The option READING AVERAGE TIME sets the average time for the voltage and current to be updated. The larger the average time number, the slower the voltage and current readings are updated. The default setting is “1”, as shown in Figure 3-71.

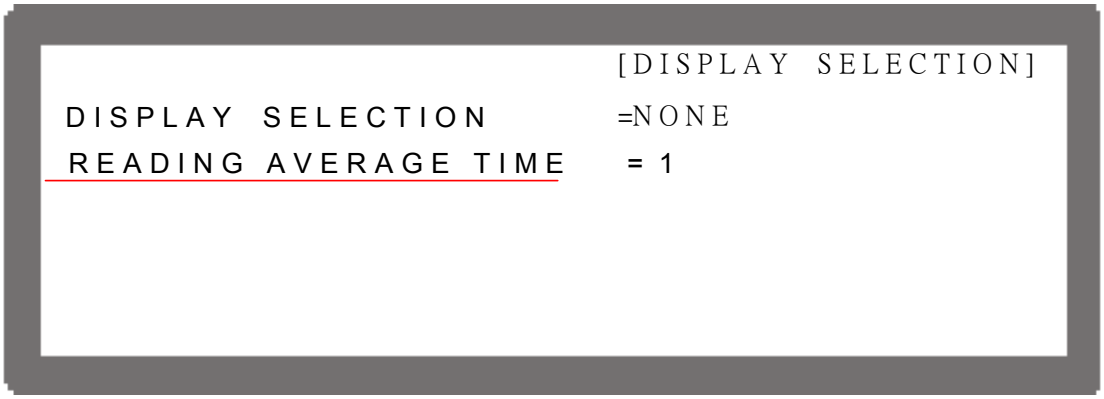


Figure 3-71

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

Notice

1. The reading uses a ROLLING average; therefore, when the actual output changes rapidly and the average time is larger than 1, the displayed reading will gradually rise to the actual output.
2. The panel reading is updated every 200mS.

3.3.5 PROTECTION

Chroma 62000P Series DC Power Supplies have complete protection functions divided into 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 the PROTECTION setup screen:

1. In the Config Setup, press "5" to show Figure 3-72.

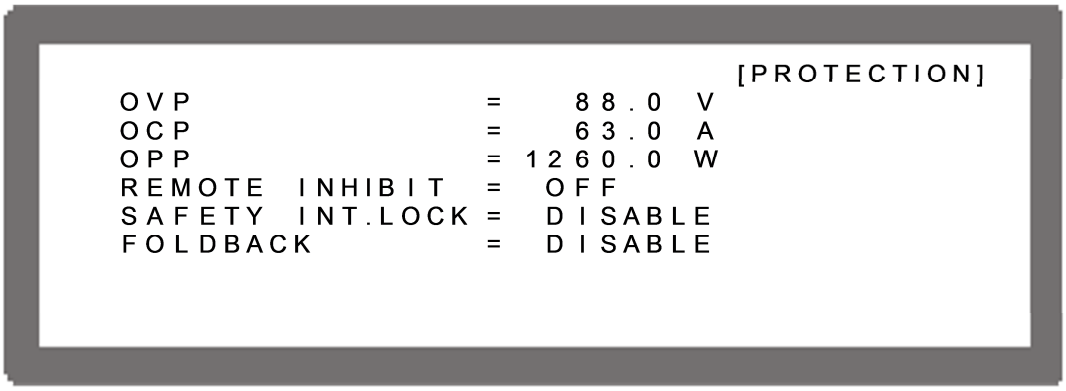


Figure 3-72

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

Notice

1. When in the option page, use the “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set.
2. The values in Figure 3-72 are the 62012P-80-60 defaults.

3.3.5.1 OVP Protection

1. Use the “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as shown in Figure 3-73.

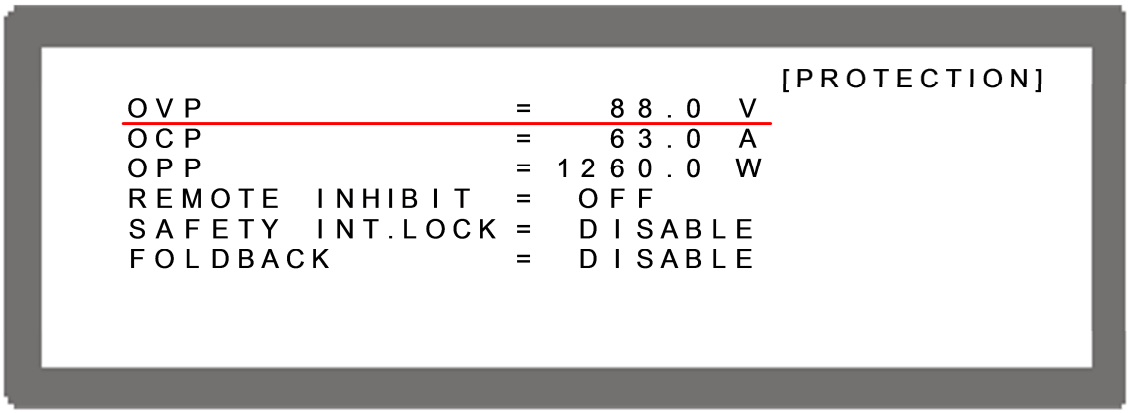


Figure 3-73

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

This function sets the Over Voltage protection point. Once the output voltage exceeds the range, it will turn off the output to protect the unit under test.

Notice

The table below shows the voltage range for OVP.

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

Table 3-4 OVP Range

If an OVP occurs, the main page will display the protection message shown below:

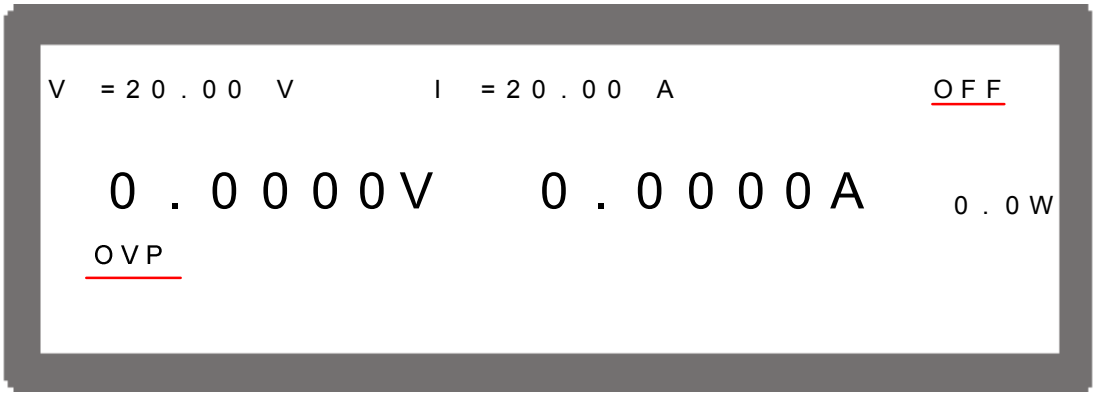


Figure 3-74

3.3.5.2 OCP Protection

1. Use the "◄↑", "►↓" keys to move the cursor to the column to be set as shown in Figure 3-75.

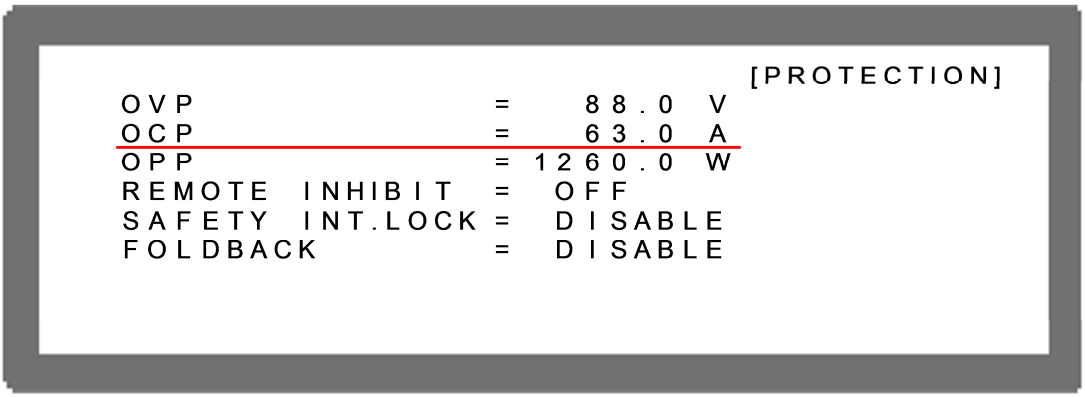


Figure 3-75

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

This function sets the Over Current protection point. Once the output current exceeds the range, it will turn off the output to protect the unit under test.

Notice The table below shows the current range for OCP.

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

Table 3-5 OCP Range

If an OCP occurs, the main page will display the protection message shown below:

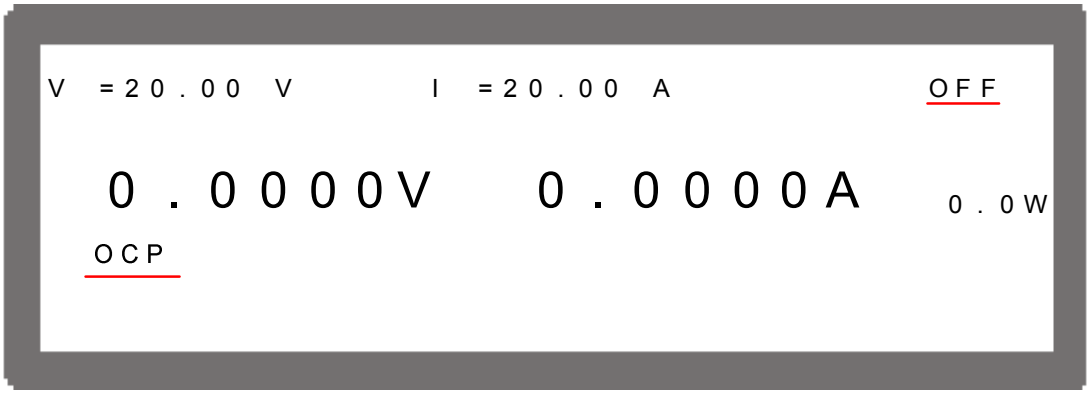


Figure 3-76

3.3.5.3 OPP Protection

1. Use the "[←↑]", "[→↓]" keys to move the cursor to the column to be set as shown in Figure 3-77.

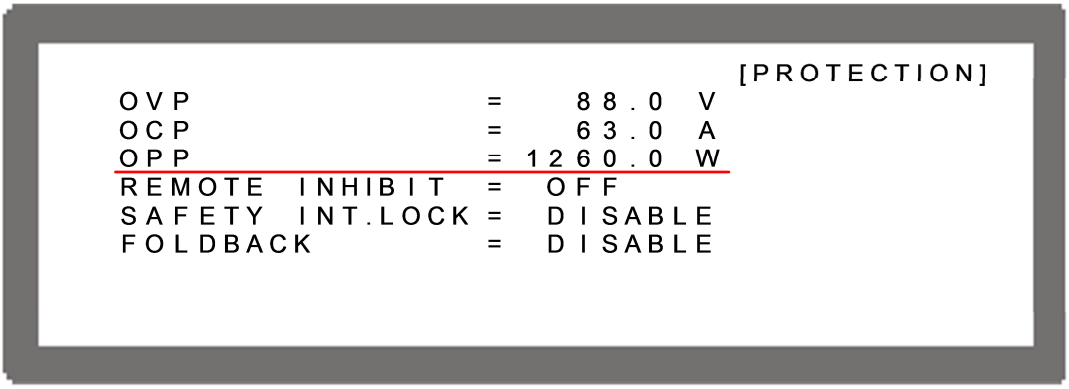


Figure 3-77

2. Use the numeric ([0]-[9]) keys or the "Rotary" ( ) knob to set the value.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to MAIN PAGE.

This function sets the Over Power protection point. Once the output power exceeds the range, it will turn off the output to protect the unit under test.

Notice

1. The table below shows the power range for OPP.

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

Table 3-6 OPP Range

2. The OPP protection point is based on the calculated power of the

output current and the remote sense voltage. If the power measured at the output terminal on the rear panel is larger than the listed maximum output power in Table 3-6, the system will still display OPP and turn off the output.

If an OPP occurs, the main page will display the protection message shown below:

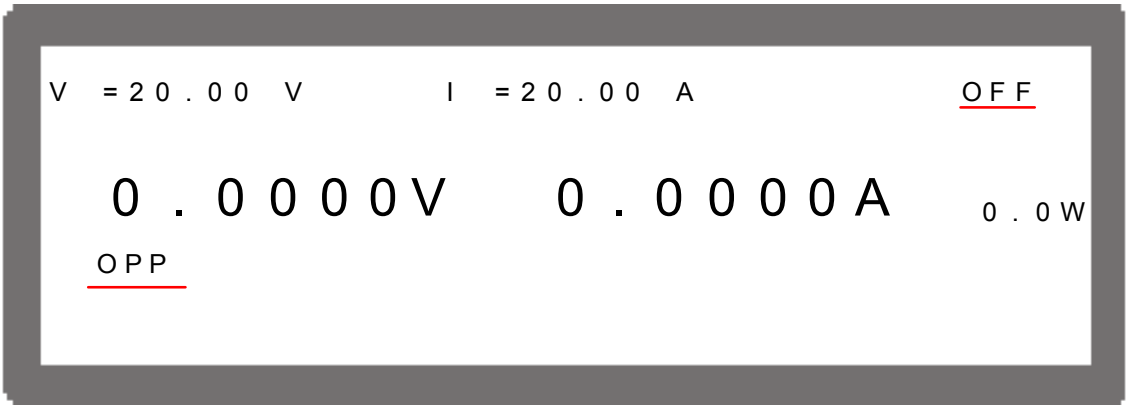


Figure 3-78

3.3.5.4 REMOTE INHIBIT

This function allows remote control of the power supply's ON/OFF directly through the PIN9 _INHIBIT in APG & SYSTEM STATUS.

1. Use the "  " & "  " keys to move the cursor to the column to be set as shown in Figure 3-79.

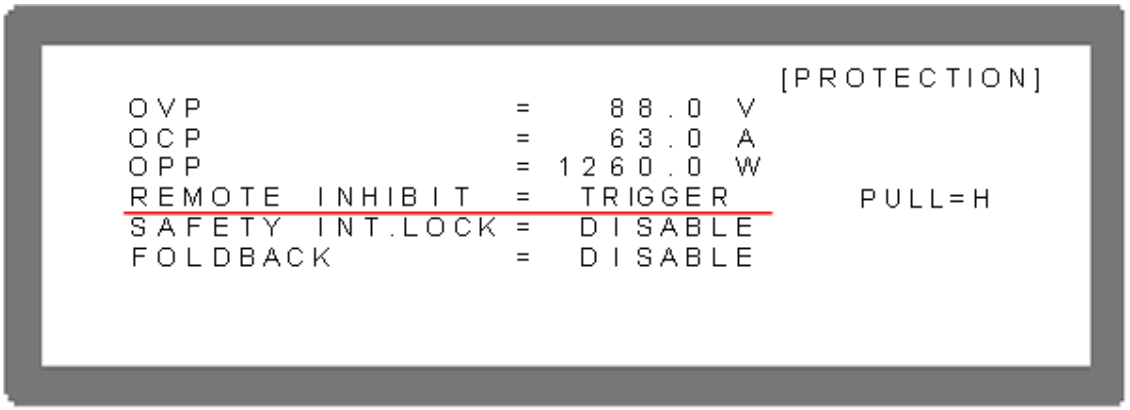


Figure 3-79

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

   (1) Selecting OFF: Disables the function.
   (2) Selecting TRIGGER: Sets the REMOTE INHIBIT to TRIGGER. When a low level triggers the PIN9 _INHIBIT in APG & SYSTEM

STATUS, it is the same as pressing the "OUTPUT" key to set OUTPUT = OFF.

(3) Selecting EXT. ON/OFF: Sets the REMOTE INHIBIT to EXT. ON/OFF and replaces the "OUTPUT" key by disabling it from controlling the output of the power supply. When the voltage level of PIN9 _INHIBIT in APG & SYSTEM STATUS goes LOW, the power supply output is turned OFF. The power supply output goes HIGH when the voltage level of this pin goes HIGH.

(4) Selecting PULL: This is the APG & SYSTEM STATUS PIN9 level defined by the user. There are two options: H (HIGH) or L (LOW). The default for PIN9 is High level.

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

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

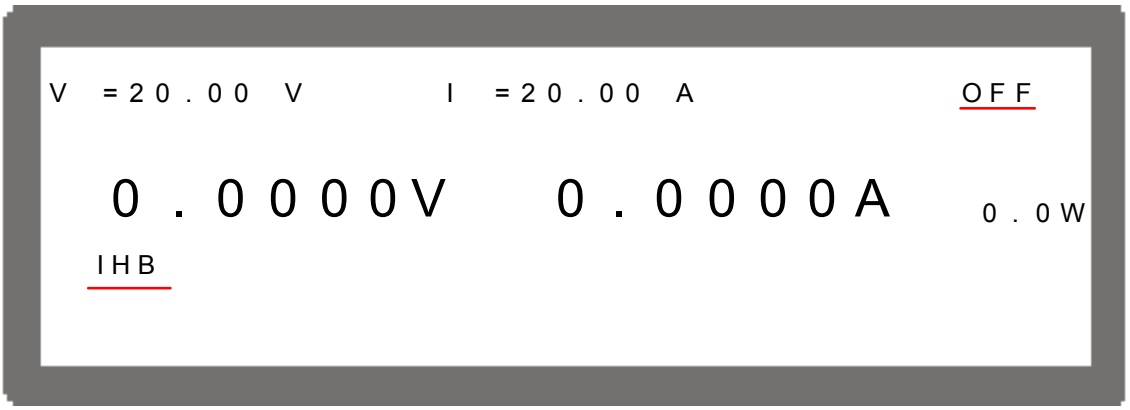


Figure 3-80

3.3.5.5 SAFETY INT.LOCK

This function controls the ON/OFF of the power supply through PIN7 of APG & SYSTEM STATUS.

1. Use the "←↑" & "→↓" keys to move the cursor to the column to be set as shown in Figure 3-81.

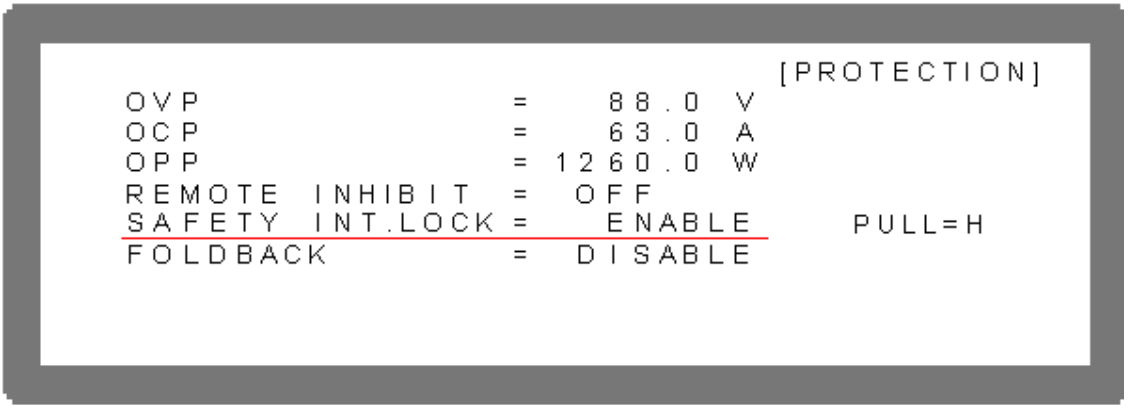


Figure 3-81

2. Use the "Rotary" (◎) knob to set the SAFETY INT.LOCK mode. There are two options: DISABLE and ENABLE.

   (1) Selecting DISABLE: Disables this function.
   (2) Selecting ENABLE: Sets SAFETY INT.LOCK to ENABLE. When PIN7 of APG & SYSTEM STATUS is HIGH, it indicates the power supply is outputting normally and ON/OFF is still controlled by the "OUTPUT" key. When PIN7 of APG & SYSTEM STATUS is LOW, it turns OFF the power supply output and issues a protection signal.
   (3) Selecting PULL: This is the APG & SYSTEM STATUS PIN7 level defined by the user. There are two options: H (HIGH) or L (LOW). The default for PIN7 is High level.

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

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

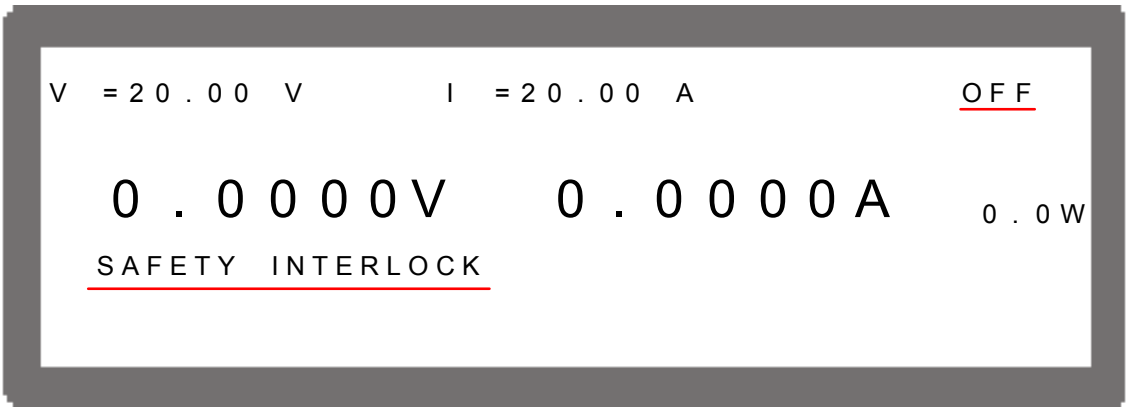


Figure 3-82

3.3.5.6 FOLDBACK

This function turns off the output when changing output mode (CV to CC, or CC to CV) to protect the unit under test.

1. Use the " ← ↑ ", " → ↓ " keys to move the cursor to the column to be set as shown in Figure 3-83.

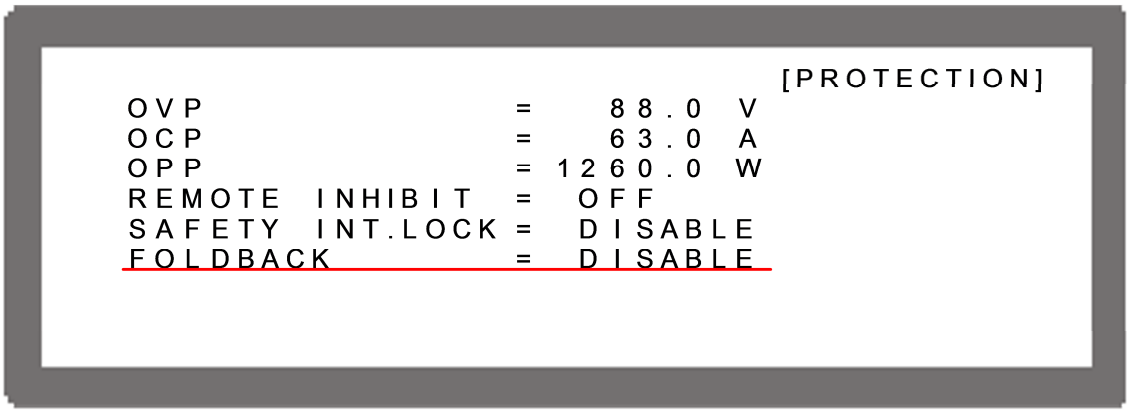


Figure 3-83

2. Use the "Rotary" ( ) knob to set the protection mode.

   There are three options available for selection: DISABLE, CV TO CC and CC TO CV.

   (1) DISABLE: Disables the function.
   (2) CV TO CC: Active in CV MODE only. Once the mode is 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 mode is changed to CV MODE the system will turn off the output to protect the UUT.

   When the FOLDBACK option is set to CV TO CC or CC TO CV, a selection for DELAY TIME will display under the FOLDBACK option to set the time delay before protection after changing the mode as shown in Figure 3-84.

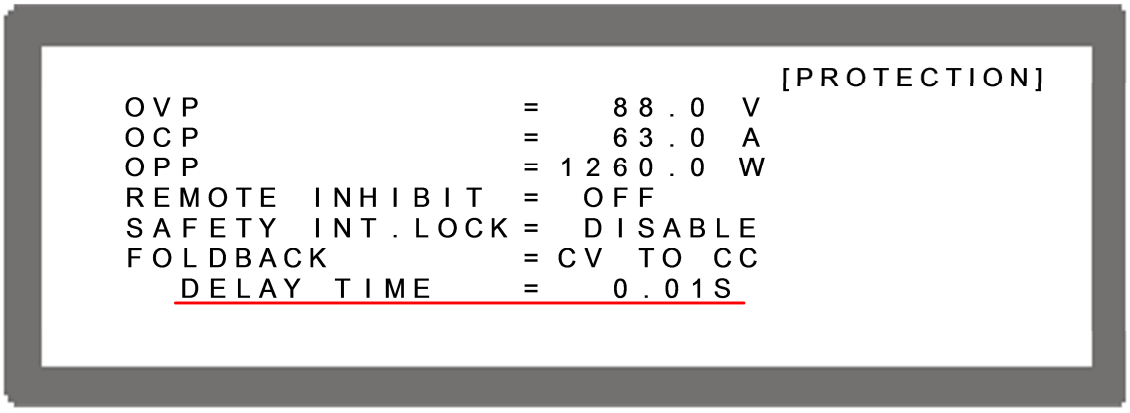


Figure 3-84

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

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

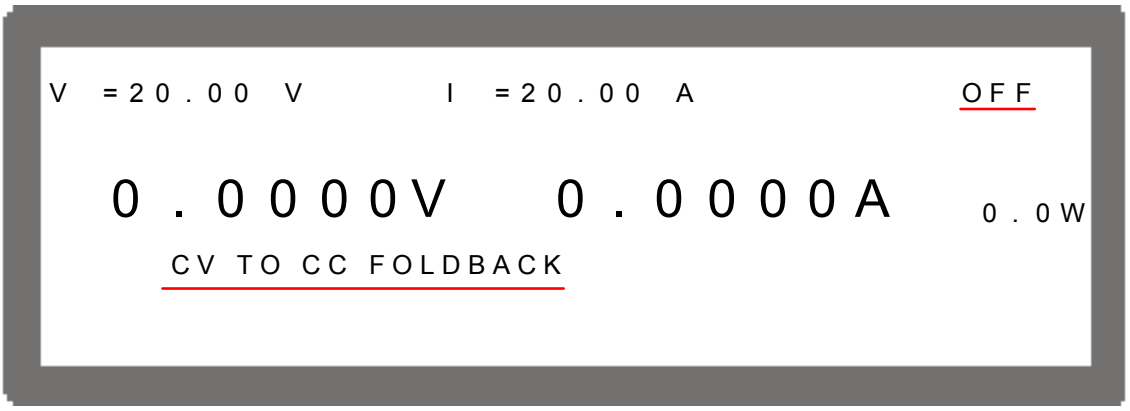


Figure 3-85

If DELAY TIME is set to *t* seconds, the FOLDBACK will not be activated until *t* seconds after a mode change is detected. If the actual mode change time is less than *t* seconds, it will return to its original state and FOLDBACK protection will not occur as shown in Figure 3-86.

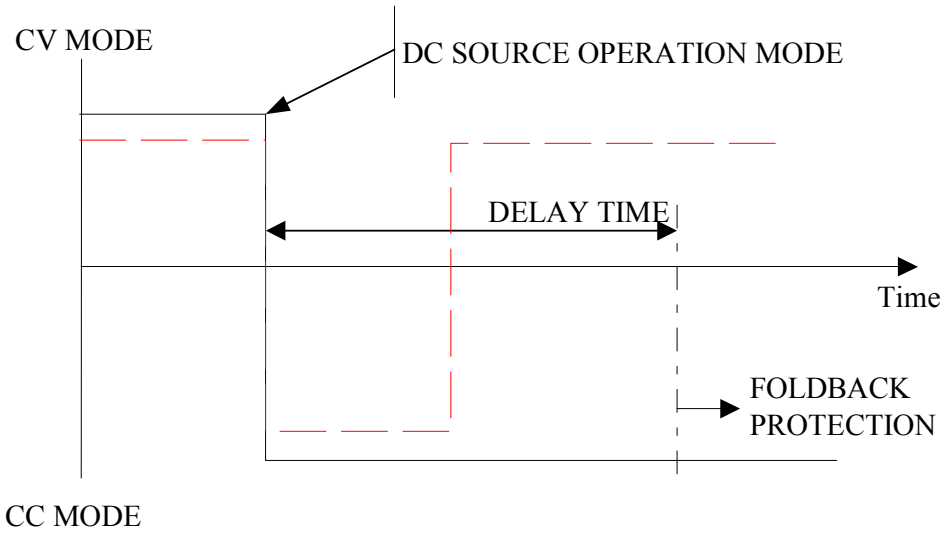


Figure 3-86

Assuming the FOLDBACK is set to CV TO CC, the solid line in Figure 3-86 will create FOLDBACK protection while the dotted line will not. It is the reverse for CC TO CV.

3.3.5.7 OTP

OTP protection will be activated when the internal temperature reaches the high limit and the output will be turned OFF.

When an OTP occurs the main page will display a protection message as shown below:

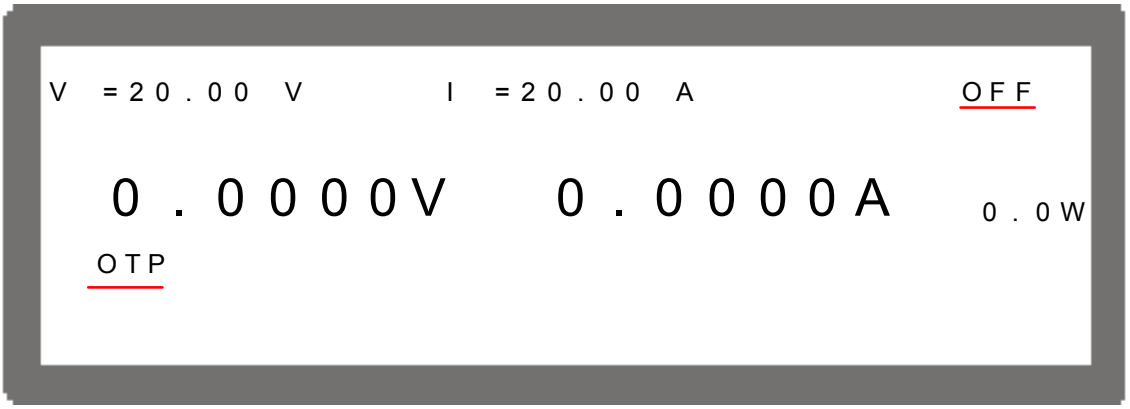


Figure 3-87

Notice

1. The OTP setting cannot be changed by the operator. It is set at the factory.
2. The output will turn OFF when an OTP occurs and it will not turn ON again until the internal temperature drops to the factory set value.

3.3.5.8 AC FAULT

AC FAULT protection will be activated when the internal input voltage is not within the model's range and the output will be turned OFF.

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

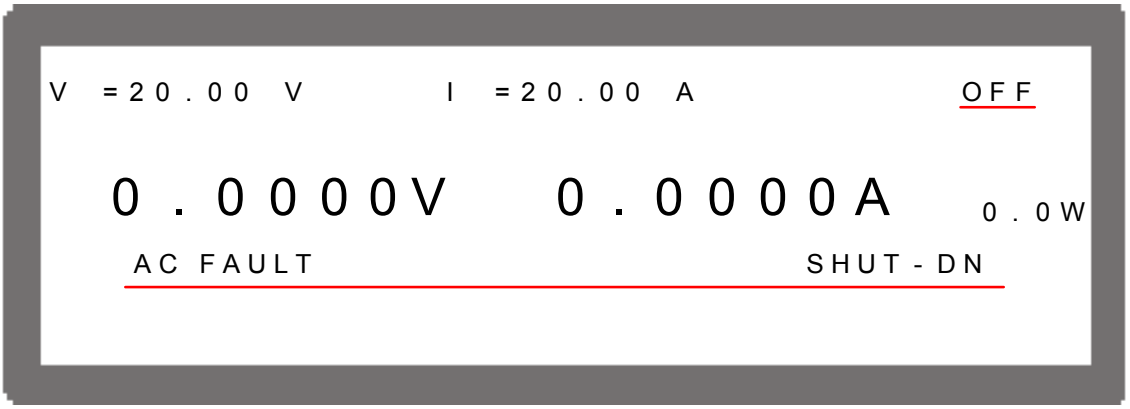


Figure 3-88

Notice

1. The table below lists the typical values for an AC FAULT for the 62000P Series:

Models	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. If an AC FAULT occurs, the output is turned OFF. It cannot be turned ON until the input voltage is within SPEC.
3. The diameter of the input wire must be within specification, or the line loss generated may cause the input voltage to be out of spec. and an AC FAULT may occur. See section 2.3.2 for the wire diameter specifications.

3.3.5.9 SENSE FAULT Protection

The remote sense is located on the rear panel near the output terminal. See section 2.5.1 for the correct connection. When the connection is correct it can adjust the UUT's voltage to be the same as the panel voltage setting without being affected by the voltage drop of the load wire.

An incorrect connection occurs when:

1. The VOLTAGE SENSING polarity is reversed, i.e., the UUT's " - " terminal is connected to the " + " of the output terminal and the UUT's " + " terminal is connected to the " - " of the output terminal.
2. One of the VOLTAGE SENSING wires is connected incorrectly and the other is disconnected.
3. One of the VOLTAGE SENSING wires is connected correctly but the other one is disconnected.

Any of the incorrect connections above may cause a SENSE FAULT protection and the output will be turned OFF. Connect the REMOTE SENSING wires correctly and press "ENTER" to remove the protection. When a SENSE FAULT occurs the main page will display a protection message as shown below:

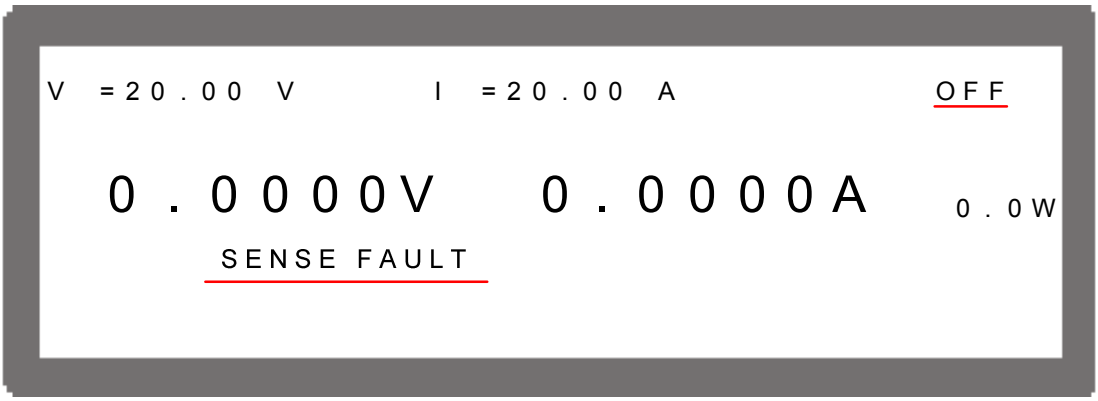


Figure 3-89

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 fails, FANLOCK protection will occur and the output will turn OFF.

When FANLOCK occurs the main page will display a protection message as shown below:

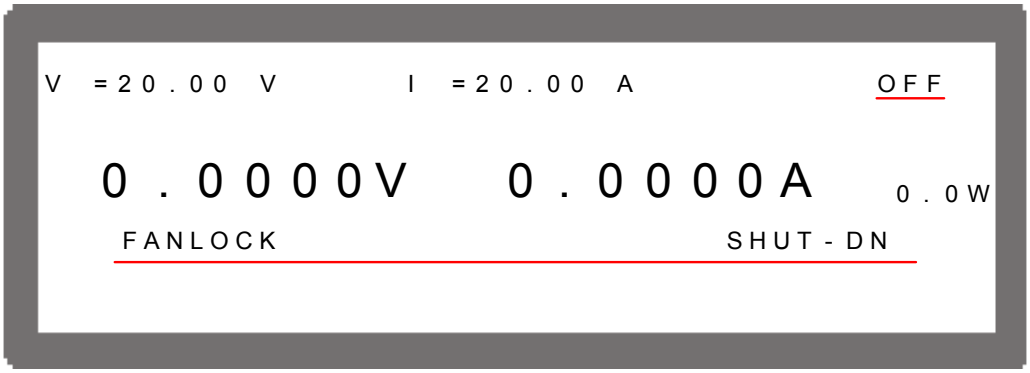


Figure 3-90

Notice

1. Troubleshooting:
   (1) If a FANLOCK protection occurs, contact a sales agent for repair services.
   (2) Keep the two sides and the rear of the DC Power Supply clear when operating to prevent an Over Temperature Protection from occurring.
2. If a FANLOCK protection occurs, power OFF the instrument and then power it ON again to see if it is caused by another error.

3.3.5.11 BUSOVP Protection

The PFC stage of the internal main circuit converts the AC mains voltage to DC voltage for the main circuit DC TO DC stage. If the DC voltage is abnormal, a BUSOVP error will occur and the output will turn OFF.

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

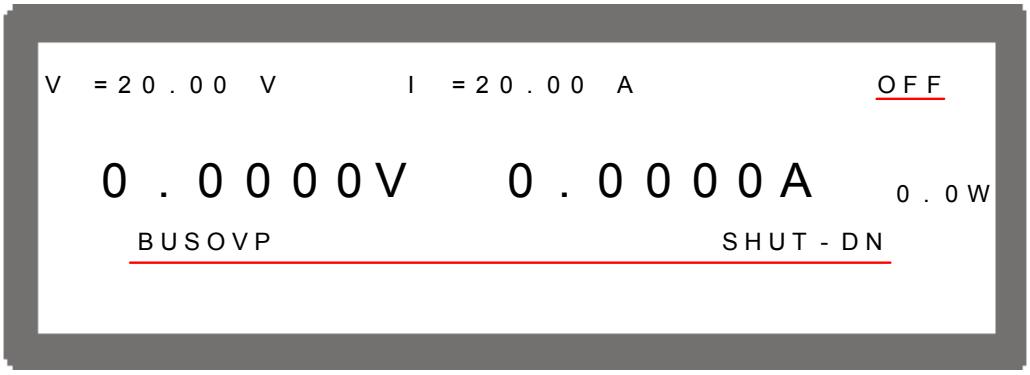


Figure 3-91

Notice

Troubleshooting:
1. If a BUSOVP occurs, power OFF the instrument and then power it ON again to see if it is caused by another error.
2. If a BUSOVP occurs again, contact a sales agent for repair services.

3.3.5.12 SERIES FAULT Protection

Do not connect the CURRENT SHARING cable when operating in series as it may damage the supply. The DC power supply will detect the CURRENT SHARING connection in series mode, resulting in a SERIES FAULT protection. Figure 3-92 shows the error message for the MASTER unit while Figure 3-93 shows the SLAVE unit:

Figure 3-92

Figure 3-93

Notice

Troubleshooting:
1. If a SERIES FAULT protection occurs, power OFF the instrument and remove the CURRENT SHARING connecting cable and then power it ON again.
2. If a SERIES FAULT occurs again, contact a sales agent for repair services.

3.3.5.13 D/D FAULT Protection

If the internal output main circuit (DC TO DC Stage) has an error, a D/D FAULT protection signal will be generated and the output will be turned OFF.

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

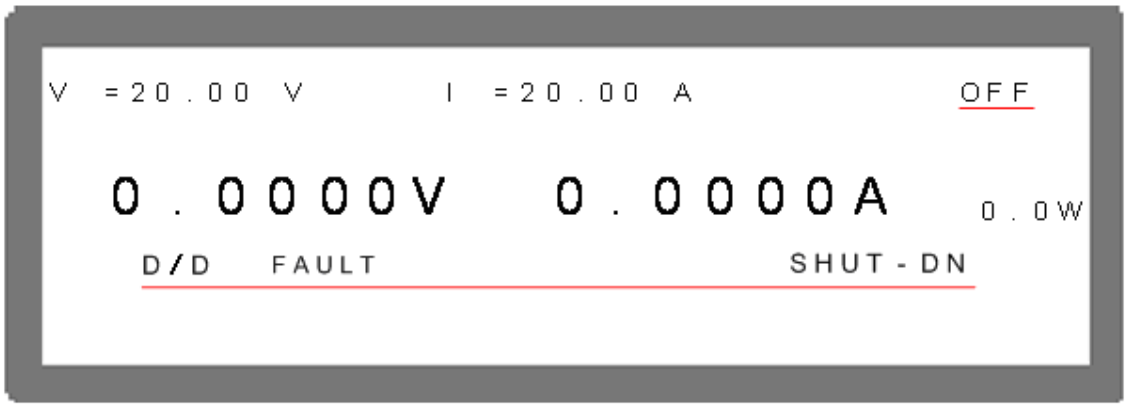


Figure 3-94

Notice

Troubleshooting:
(1) If a D/D FAULT protection occurs, turn OFF the Power Supply, remove the load, and check if the connections are correct and then power it ON again.
(2) If a D/D FAULT protection occurs again, contact a sales agent for repair services.

3.3.6 FACTORY SETTING

This function resets the instrument to its factory default settings.

1. In the Config Setup page, press "6" to go to the FACTORY SETTING screen (see Figure 3-95).
2. Press "ENTER" to enter into the FACTORY SETTING option.

   The 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 the user. If it is set to FACTORY DEFAULT = YES all configuration settings will return to the factory default.

   The screen will display the messages: DEVICE MODEL, SERIAL NO. and FIRMWARE VERSION.

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

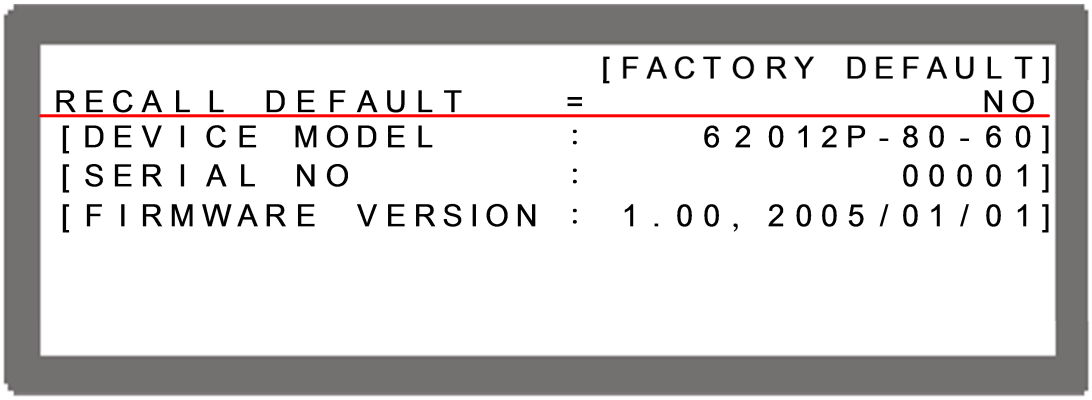


Figure 3-95

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 of current accuracy.
(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 the CONFIG Setup page, press "7".
2. Press "ENTER" to go to the CALIBRATION option as shown in Figure 3-96:

Figure 3-96

3. Enter the password and press "ENTER" to confirm. The screen will display 4 calibration options as shown in Figure 3-97. The calibration steps are described in Sections 3.3.7.1 to 3.3.7.5.

4. To abort CALIBRATION, press "EXIT" to return to MAIN PAGE.

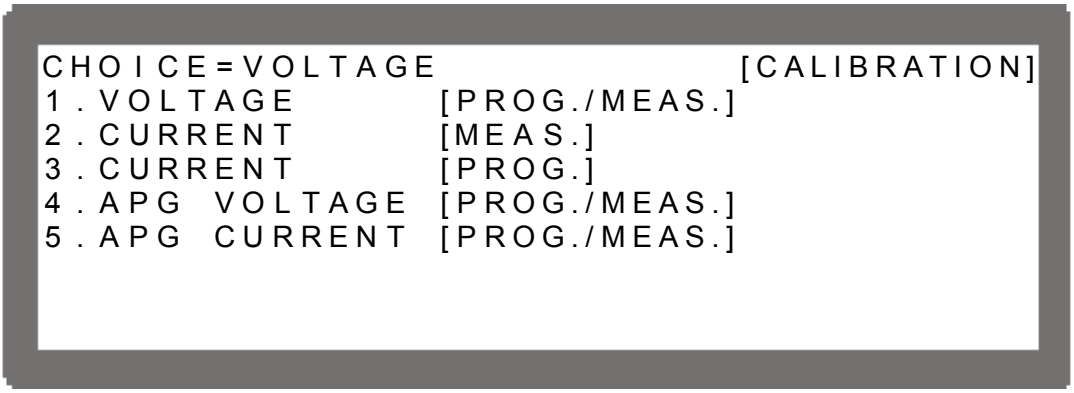


Figure 3-97

Notice The 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

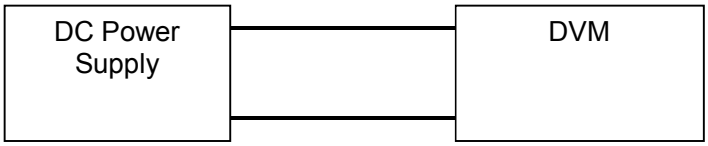


Figure 3-98

Notice The accuracy of the instrument that performs the calibration must be greater than the specification accuracy of the power supply.

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

1. Enter into the main CALIBRATION page (see Figure 3-97).
2. In the CALIBRATION page, press "1" or turn the "Rotary" ( ) knob to set CHOICE=1.
3. Press "ENTER" to confirm entering into the VOLTAGE CALIBRATION options as shown in Figure 3-99.

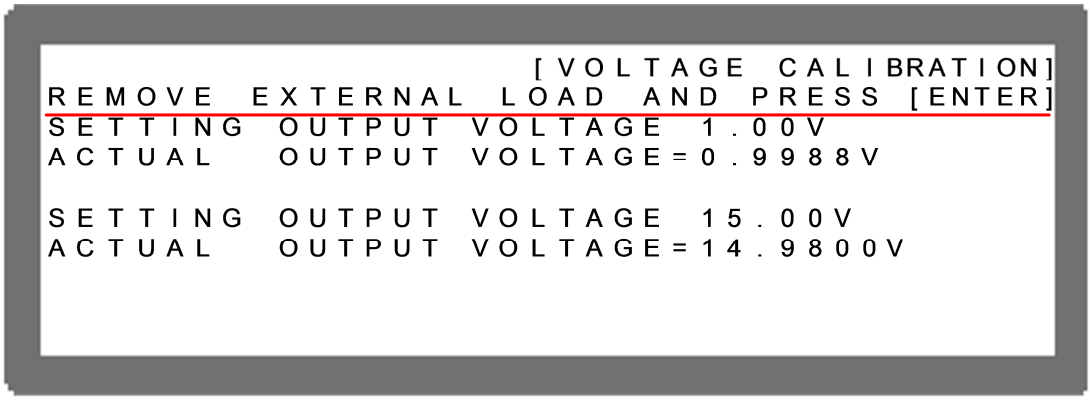


Figure 3-99

4. In the VOLTAGE CALIBRATION page, press "ENTER" to confirm.
5. The first test is the low voltage range calibration (16V). The instrument will set the output voltage to 1.00V and the cursor will stop at position [1] as shown in Figure 3-100. Enter the voltage measured by the DVM (enter 4 digits after the decimal point) and press "ENTER" to confirm.
6. Press "→↓" again to test the second low voltage range calibration point. The instrument will set the output voltage to 15.00V and the cursor stops at position [2] as shown in Figure 3-100. Enter the voltage measured by the DVM (enter 4 digits after the decimal point) and press "ENTER" to confirm.

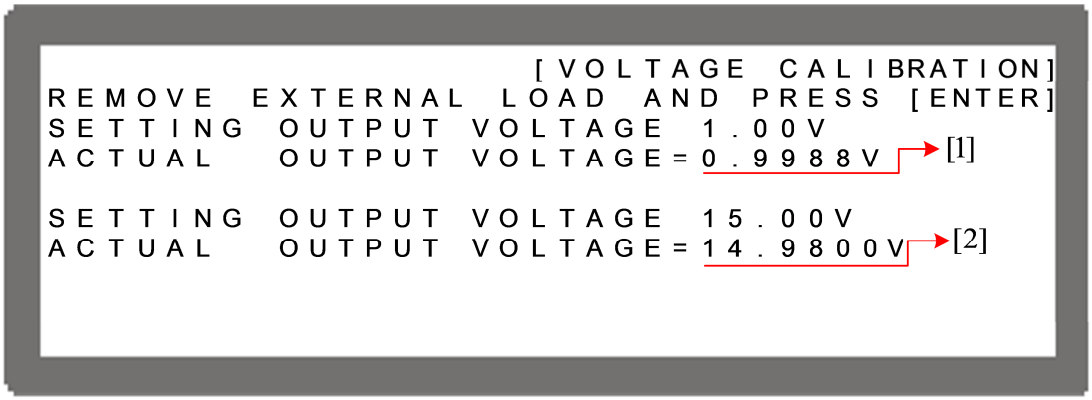


Figure 3-100

7. Press "→↓" to go to the low range of the high voltage range calibration (80V). The instrument will set the output voltage to 20.00V and the cursor will stop at position [3] as shown in Figure 3-101. Enter the voltage measured by the DVM (enter 4 digits after the decimal point) and press "ENTER" to confirm.
8. Press "→↓" again to go to the high range of the high voltage range calibration. The instrument will set the output voltage to 70.00V and the cursor will stop at position [4] as shown in Figure 3-101. Enter the voltage measured by the DVM (enter 4 digits after the decimal point) and press "ENTER" to confirm.

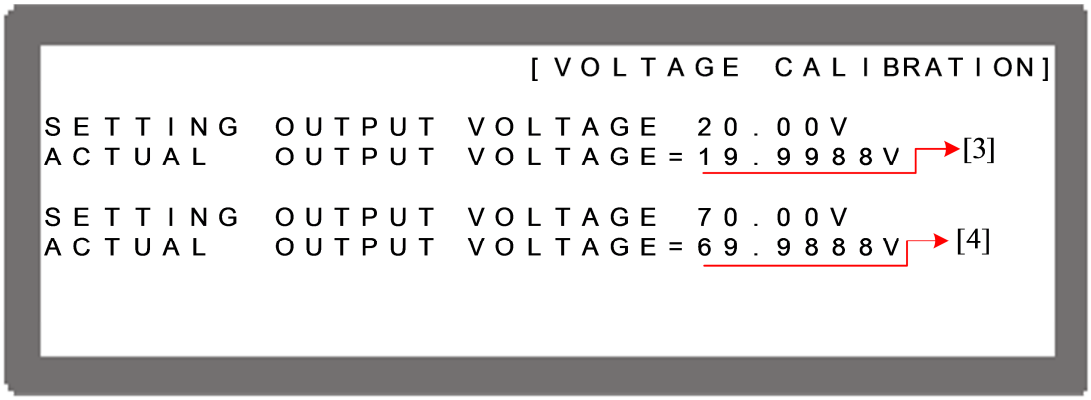


Figure 3-101

9. The voltage calibration is done once the above actions are completed. Remove the load on the Electronic LOAD and press "SAVE" to display the confirmation page as shown in Figure 3-102. Press "ENTER" to save it or press "EXIT" to return to the MAIN PAGE.

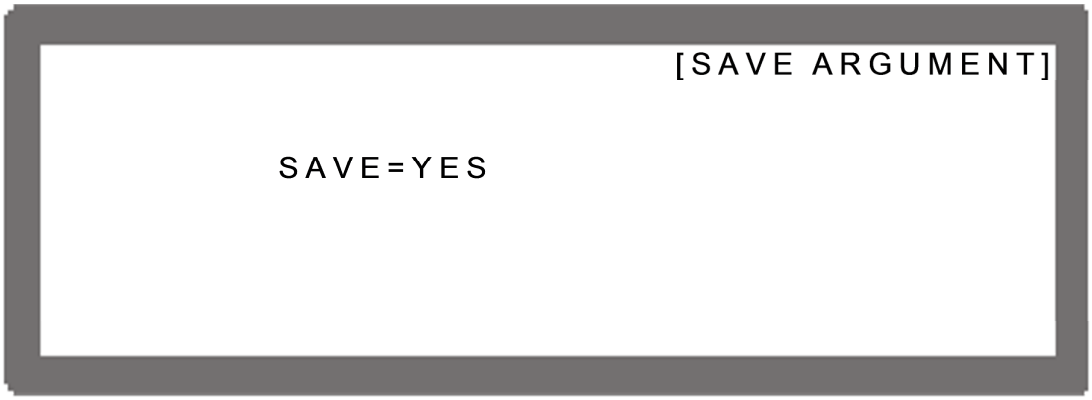


Figure 3-102

Notice

1. The calibration points may be different for other models (non 62012P-80-60). Follow the instructions for those models when calibrating the instrument.
2. Remove the output load before performing the voltage calibration. The LCD panel will display the text shown in Figure 3-100 and once the load is disconnected, 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	Current capability >=100A

Table 3-9

3.3.7.2.2 SETUP

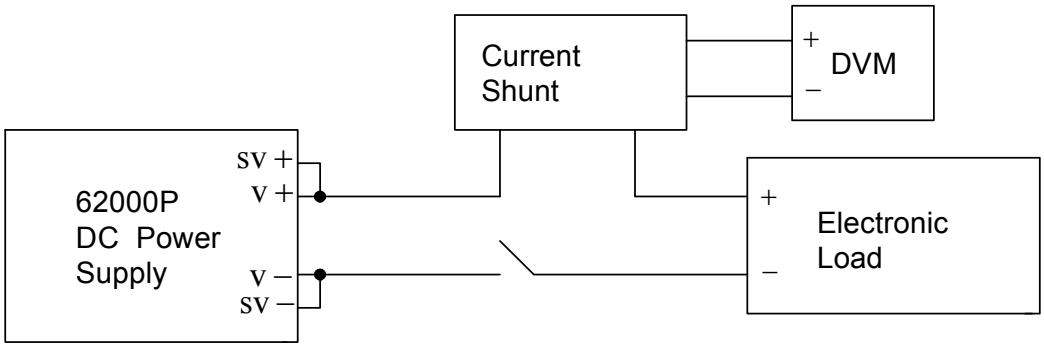


Figure 3-103

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

1. In the CALIBRATION page, press "2" or turn the "Rotary" ( ) knob to set CHOICE=2.
2. Press "ENTER" to confirm and go to the current calibration options as shown in Figure 3-104.

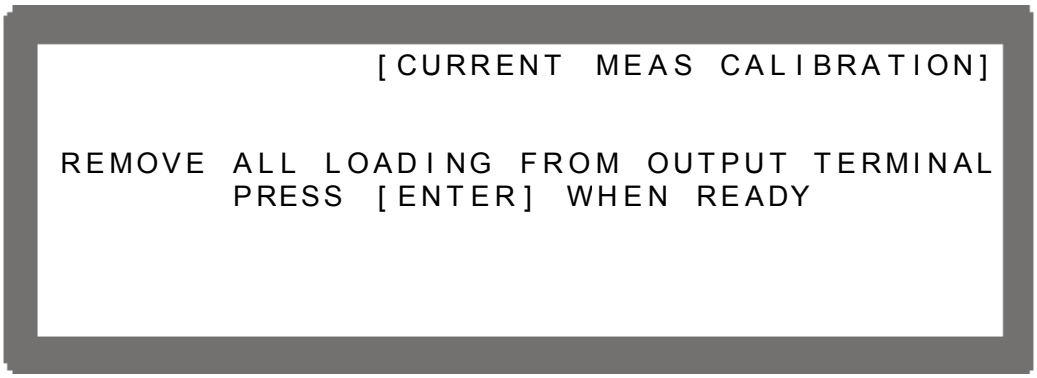


Figure 3-104

3. Open the Breaker to ensure the DC Power Supply has no load and press "ENTER" to confirm.
4. Reconnect the DC Power Supply to a current shunt whose rating is closest to but still covers 2A. For the Prodigit 7530, use the 2A shunt directly.
5. Figure 3-105 will display. Press "ENTER" to confirm the shunt is attached. The low current range will be calibrated first. The system outputs 5V volts and then sets the loading current to 2.00A. The cursor will stop at position [1] as shown in Figure 3-105. Enter the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press "ENTER" to confirm and wait for the test to end.

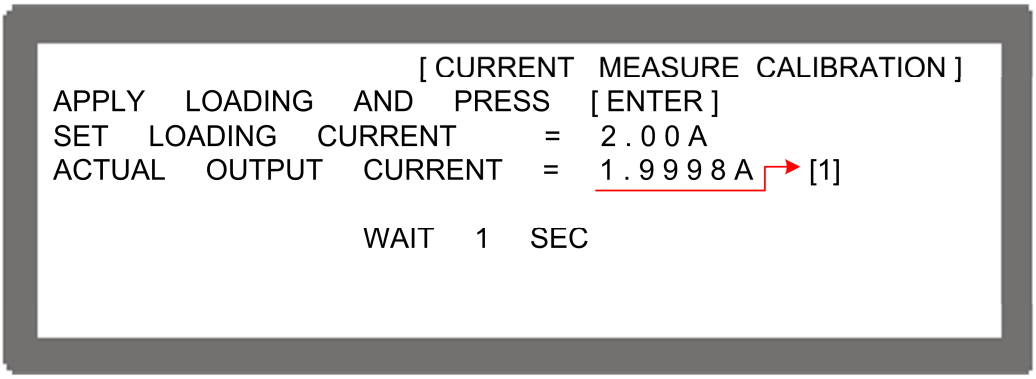


Figure 3-105

6. Once the 2A point is calibrated, turn off the output of the Electronic Load and reconnect the DC Power Supply to a current shunt whose rating is closest to but still covers 10A. For the Prodigit 7530, use the 20A shunt directly.
7. Next, press "→↓" to do the 10A calibration. The cursor will stop at position [2] as shown in Figure 3-106 for setting the loading current of the Electronic LOAD to10.00A. Enter the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press "ENTER" to confirm and wait for the test to end. Using 2A and 10A for calibration, the system will calculate the calibration factor for the low current range.

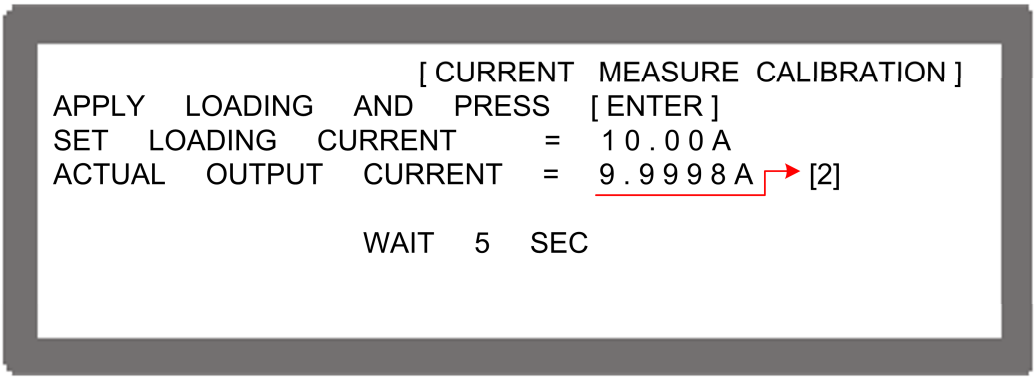


Figure 3-106

8. After the low current range is calibrated, turn off the output of the Electronic Load and reconnect the DC Power Supply to a current shunt whose rating is closest to but still cover 20A. For the Prodigit 7530, use the 20A shunt directly.
9. For the high current range calibration, press "→↓" to perform the 20A calibration. The cursor will stop at position [3] as shown in Figure 3-107 for setting the loading current of the Electronic LOAD to 20.00A. Enter the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press "ENTER" to confirm and wait for the test to end.

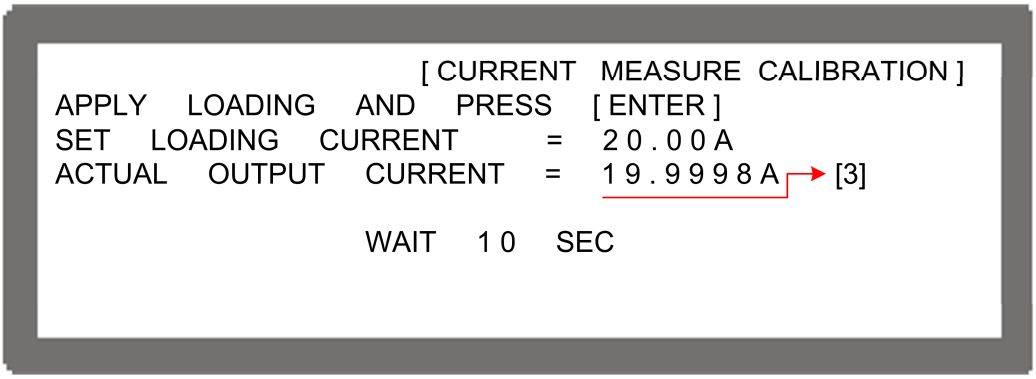


Figure 3-107

10. Once the 20A point is calibrated, turn off the output of the Electronic Load and reconnect the DC Power Supply to a current shunt whose rating is closest to but still cover 50A. For the Prodigit 7530, use the 250A shunt directly.
11. Press " → ↓ " to perform the 50A calibration. The cursor will stop at position [4] as shown in Figure 3-108 for setting the loading current of the Electronic LOAD to 50.00A. Enter the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press "ENTER ↵" to confirm and wait for the test to end. Using 20A and 50A for calibration, the system will calculate the calibration factor for the high current range.

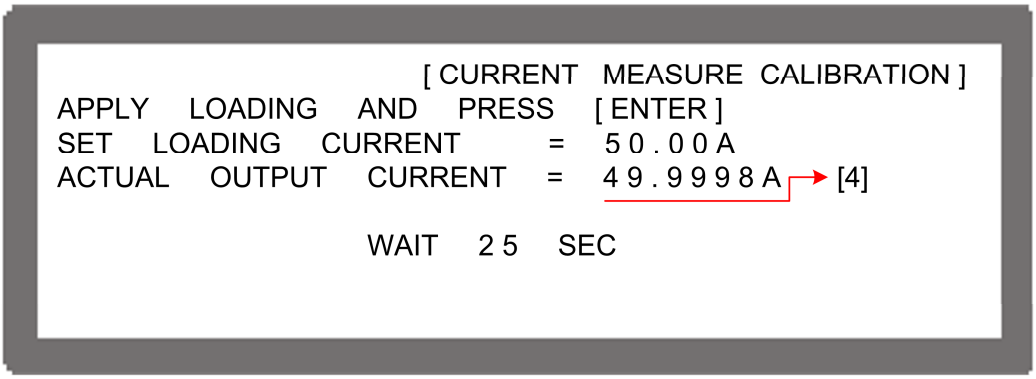


Figure 3-108

12. The current calibration is done once the above actions are completed. Remove the load on the Electronic LOAD and press "SAVE" and "ENTER ↵"to save the calibrated data as shown in Figure 3-109, or press "EXIT" to return to MAIN PAGE.

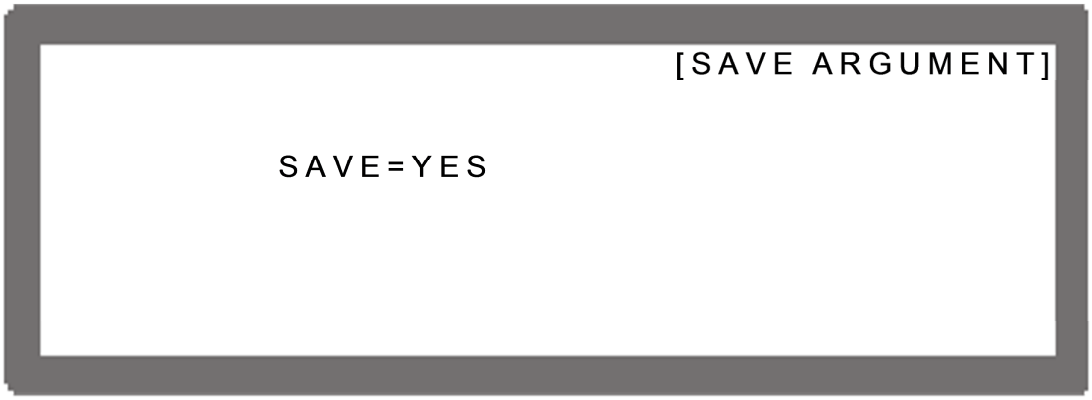


Figure 3-109

CAUTION An improper shunt range selection may cause damage to the current shunt.

Notice The calibration points may be different for other models (non 62012P-80-60). Follow the instructions for those models when calibrating the instrument.

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	Current capability >=100A

Table 3-10

3.3.7.3.2 SETUP

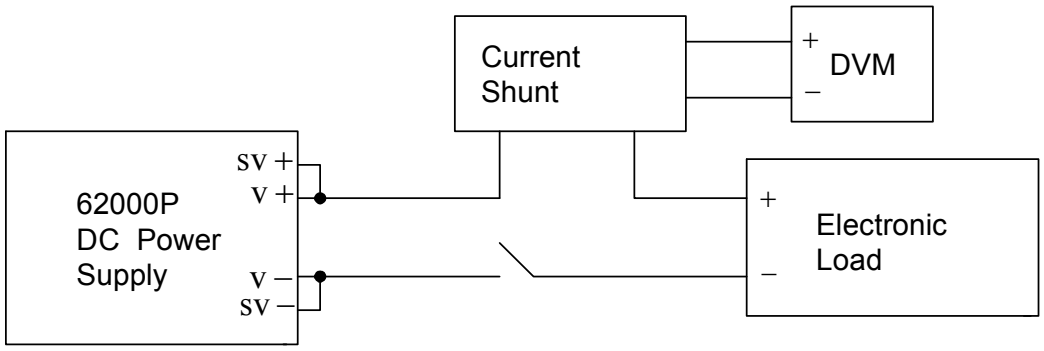


Figure 3-110

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

1. Set the Electronic Load to CV mode 5V. Short the output terminals directly if there is no Electronic Load.
2. In the CALIBRATION page, press "3" or turn the "Rotary" ( ) knob to set CHOICE=3.
3. Press "ENTER" to confirm and go to the current calibration options as shown in Figure 3-111.

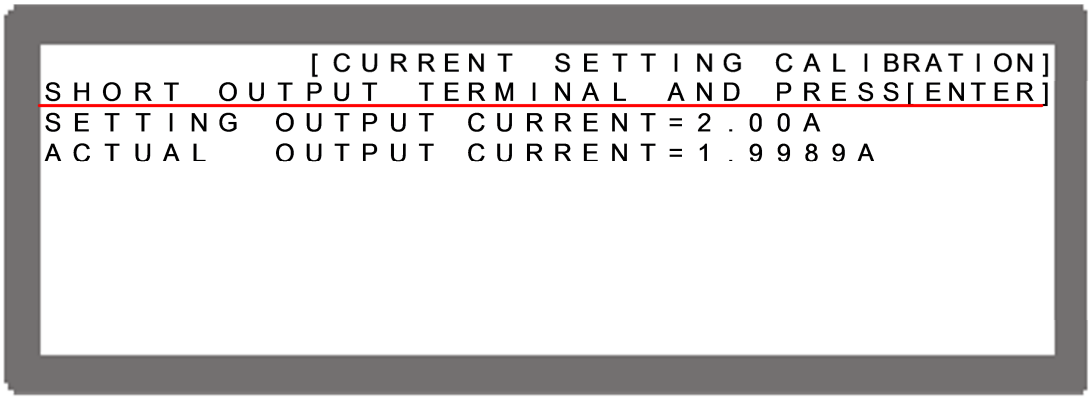


Figure 3-111

4. The output of the DC Power Supply will be off before ENTER is pressed. Once ENTER is pressed, a message will pop up to remind users to connect a current shunt in the correct range. Use a current shunt whose rating is closest to but still covers 2A. For the Prodigit 7530, use the 2A shunt directly.
5. Press ENTER and the system will automatically set the output current to 2.00A. Once the reading is done, the cursor will stop at position [1] as shown in Figure 3-112. Input the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press "ENTER" to confirm.

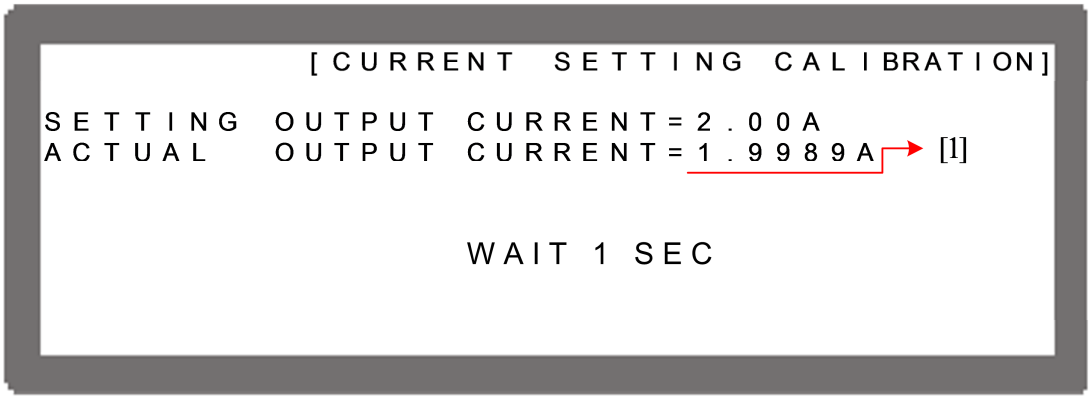


Figure 3-112

6. The DC Power Supply output will be turned off. Press "→↓" to do the 10A calibration. A message will pop up to remind users to connect a current shunt in the correct range. Use a current shunt whose rating is closest to but still covers 10A. For the Prodigit 7530, use

the 20A shunt directly. Press " [→↓] " to perform the 10A calibration. The system will automatically set the output current to 10.00A. Once the reading is done, the cursor will stop at position [2] as shown in Figure 3-113. Input the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press " [ENTER] " to confirm. Using 2A and 10A for calibration, the system will calculate the calibration factor for the low current range.

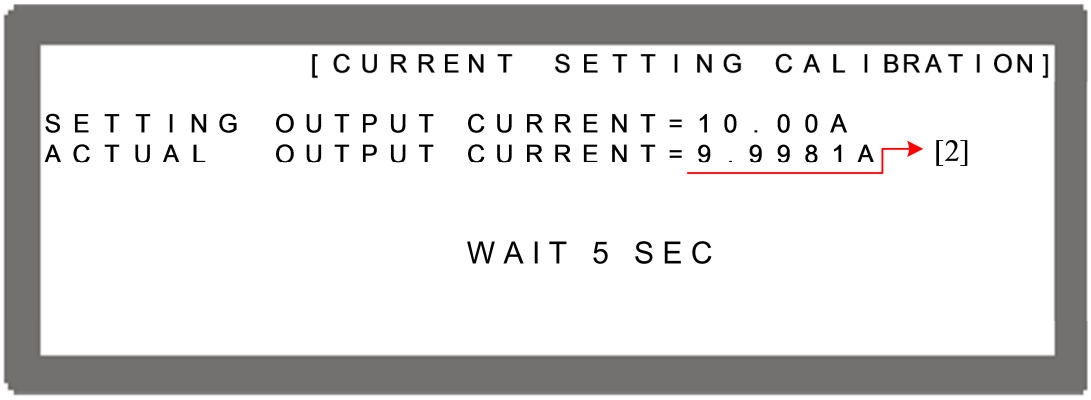


Figure 3-113

7. The DC Power Supply output will be turned off. Press " [→↓] " to do the 20A calibration. A message will pop up to remind users to connect a current shunt in the correct range. Use a current shunt whose rating is closest to but still covers 10A. For the Prodigit 7530, use the 20A shunt directly.
8. Press " [→↓] " to perform the 20A calibration. The system will automatically set the output current to 20.00A. Once the reading is done, the cursor will stop at position [3] as shown in Figure 3-114. Input the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press " [ENTER] " to confirm.

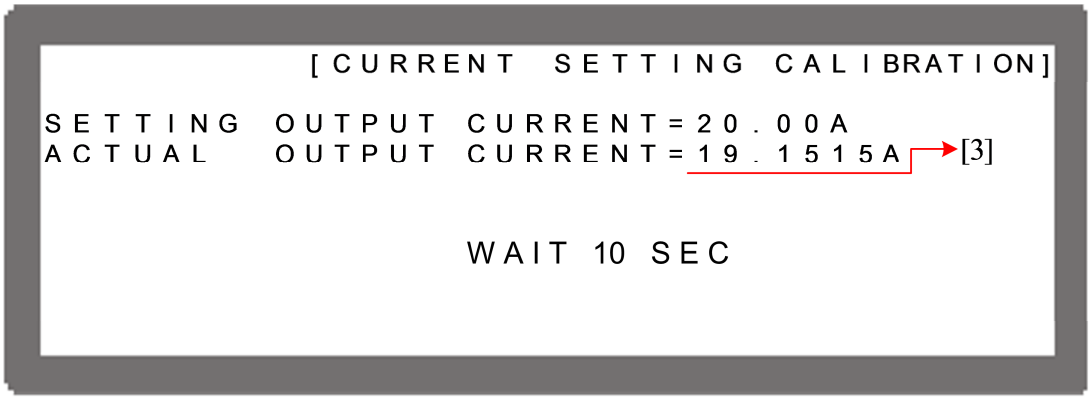


Figure 3-114

9. The DC Power Supply output will be turned off. Press " [→↓] " to do the 50A calibration. A message will pop up to remind users to connect a current shunt in the correct range. Use a current shunt whose rating is closest to but still covers 10A. For the Prodigit 7530, use the 250A shunt directly.

10. Press " → ↓ " to perform the 50A calibration. The system will automatically set the output current to 50.00A. Once the reading is done, the cursor will stop at position [4] as shown in Figure 3-115. Input the current (enter 4 digits after the decimal point) read by the Current Shunt (DVM) and press "ENTER" to confirm.

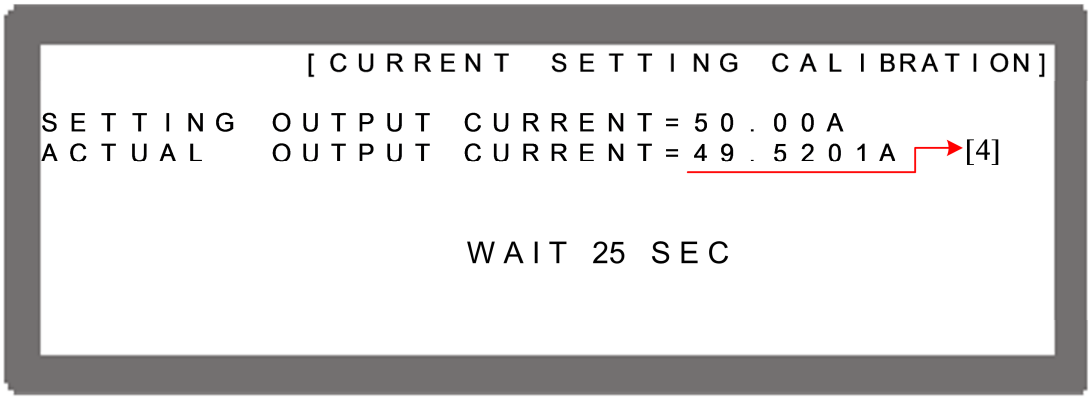


Figure 3-115

11. 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 shown in Figure 3-116, or press "EXIT" to return to MAIN PAGE.

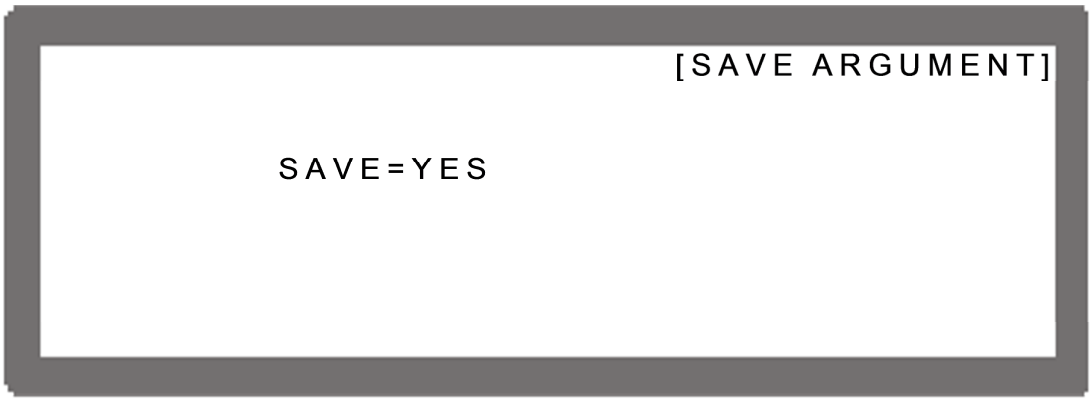


Figure 3-116

CAUTION An improper shunt range selection may cause damage to the current shunt.

Notice The calibration points may be different for other models (non 62012P-80-60). Follow the instructions for those models when calibrating the instrument.

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

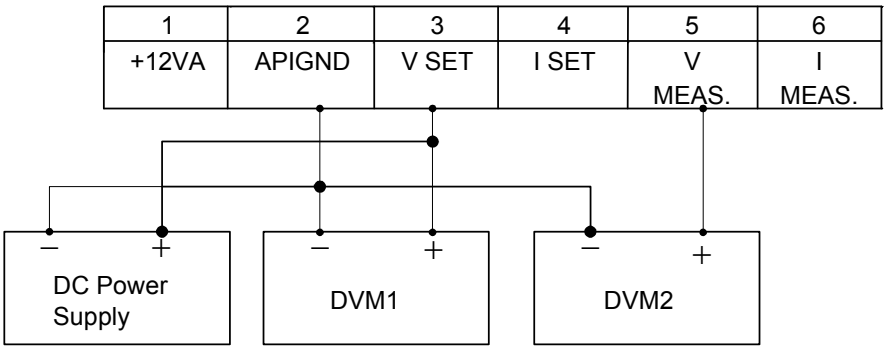


Figure 3-117

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

1. In the CALIBRATION page, press "4" or turn the "Rotary" ( ) knob to set CHOICE = 4.
2. Press "ENTER" to confirm and go to the APG Voltage Calibration options as shown in Figure 3-118.

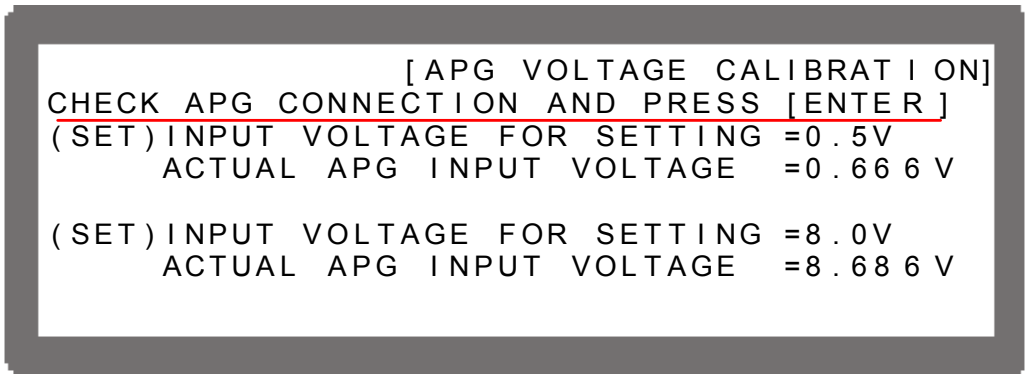


Figure 3-118

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

3. When the APG connection is correct, press "ENTER" to confirm.
4. Input a 0.5V voltage signal on (Pin 3). The cursor stops at position [1] as shown in Figure 3-119. Adjust the Power Supply to 0.5V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage (enter 3 digits after the decimal point) read by DVM 1 to position [1] and press "ENTER" to confirm.

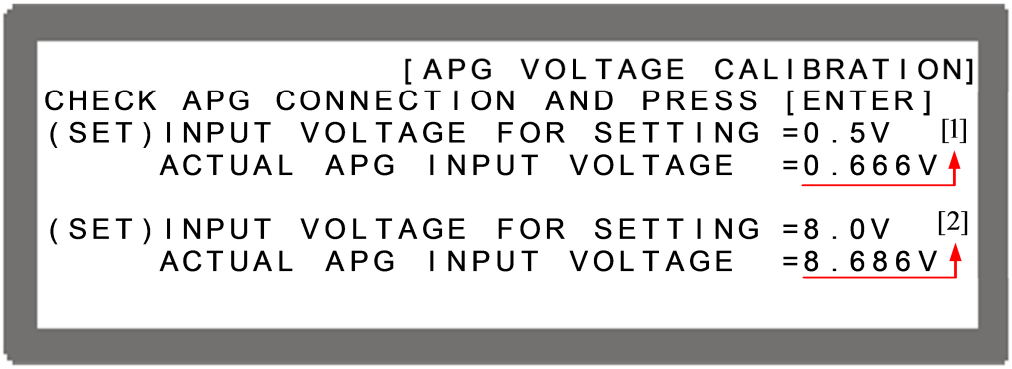


Figure 3-119

5. Press "→↓" and input an 8.0V voltage signal on (Pin 3). The cursor stops at position [2] as shown in Figure 3-119. Adjust the Power Supply to 8V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage (enter 3 digits after the decimal point) read by DVM 1 to position [2] and press "ENTER" to confirm.
6. Press "→↓" and the cursor stops at position [3] as shown in Figure 3-120. Open the device cover and find VR402 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Set the DVM2 reading of Pin5 to be 0.00V±2.5mV by adjusting the resistance of VR402. Once the reading is adjusted, press "ENTER" to confirm it.

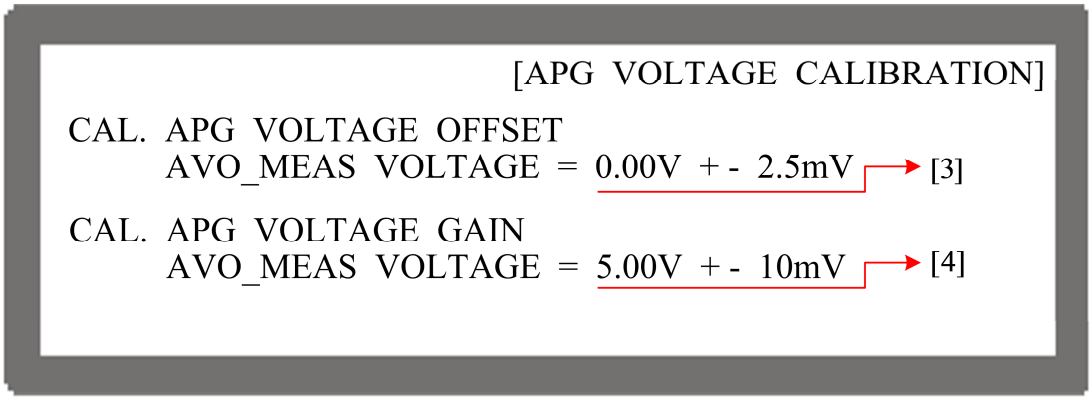


Figure 3-120

7. Press "→↓" and the cursor stops at position [4] as shown in Figure 3-120. Open the device cover and find VR401 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Set the DVM2 reading of Pin5 to be 5.00V±10mV by adjusting the resistance of VR401. Once the reading is adjusted, 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 shown in Figure 3-116, or press "EXIT" to return to MAIN PAGE.

Notice The calibration points may be different for other models (non 62012P-80-60). Follow the instructions for those models when calibrating the instrument.

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	Current capability >=100A

Table 3-12

3.3.7.5.2 SETUP

(1) APG CURRENT PROGRAM

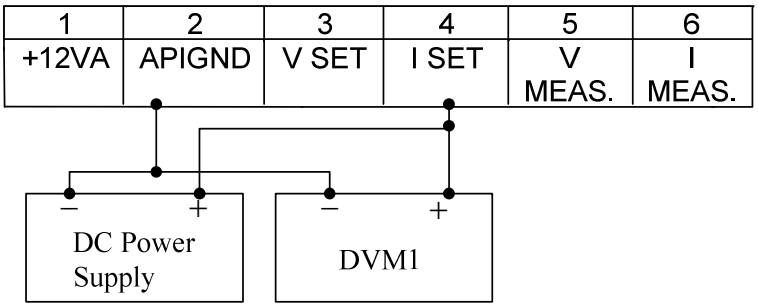


Figure 3-121

(2) APG CURRENT MEASUREMENT

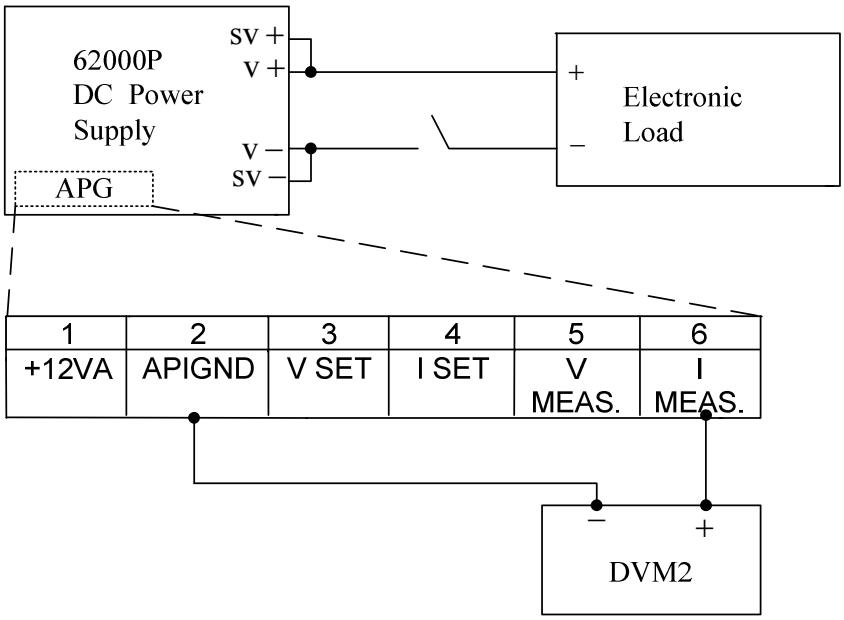


Figure 3-122

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

1. In the CALIBRATION page, press "5" or turn the "Rotary" ( ) knob to set CHOICE = 5.
2. Press "ENTER" to go to the APG Voltage Calibration options as shown in Figure 3-123.

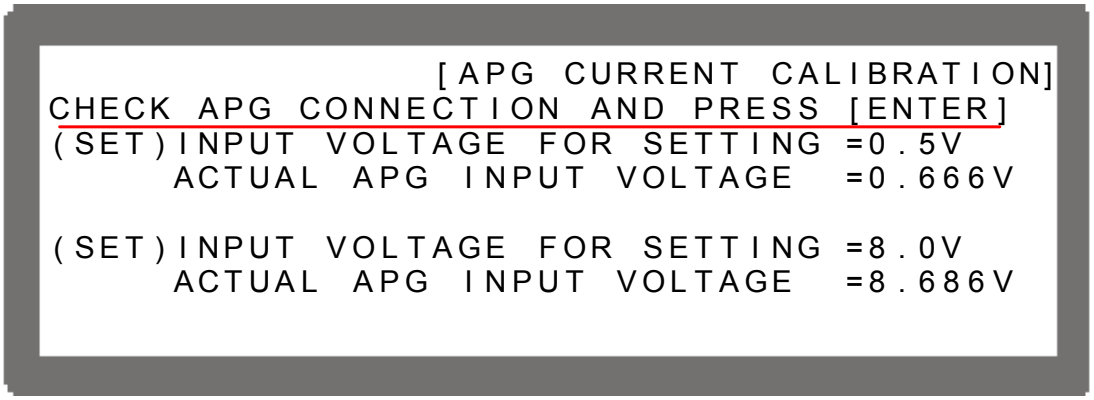


Figure 3-123

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 the APG current calibration, complete the voltage/current output and measurement calibrations.

3. When the APG connection is correct, press "ENTER" to confirm.
4. Input a 0.5V voltage signal on (Pin 4). The cursor stops at position [1] as shown in Figure 3-124. Adjust the Power Supply to 0.5V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage (enter 3 digits after the decimal point) read by DVM 1 to position [1] and press "ENTER" to confirm.

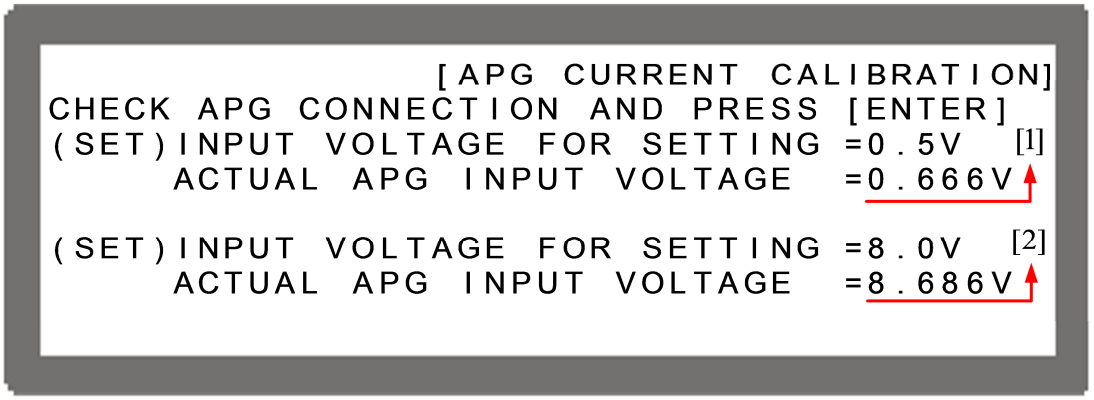


Figure 3-124

5. Press "→↓" and input an 8.0V voltage signal on (Pin 4). The cursor stops at position [2] as shown in Figure 3-124. Adjust the Power Supply to 8V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage (enter 3 digits after the decimal point) read by DVM 1 to position [2] and press "ENTER" to confirm.

6. Press "→↓" and the cursor stops at position [3] as shown in Figure 3-125. Open the device cover and find VR404 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Set the DVM2 reading of Pin6 to be 0.00V±2.5mV by adjusting the resistance of VR404. Once the reading is adjusted, press "ENTER" to confirm it.

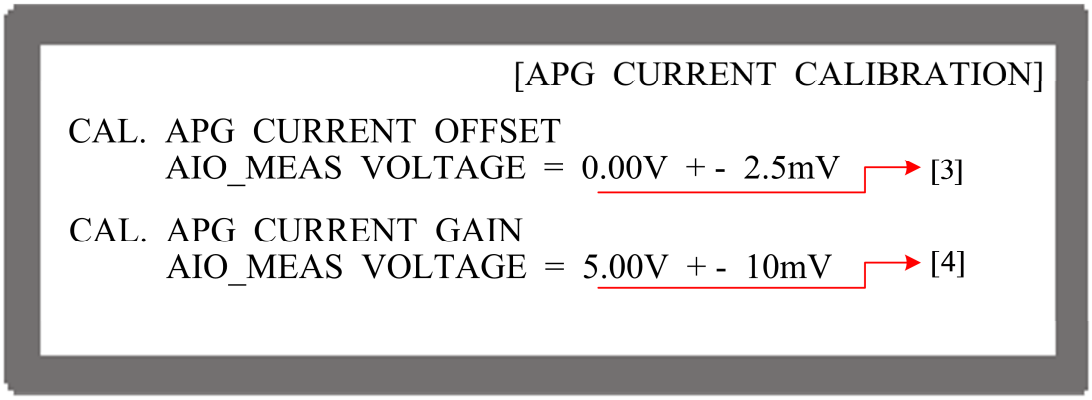


Figure 3-125

7. Press "→↓" and the cursor stops at position [4] as shown in Figure 3-125. Set the Electronic Load to CV mode with 5V loading and then open the device cover and find VR403 (adjustable resistor) on the PCB of 62xxxP-xx-xx C ver.x. Set the DVM2 reading of Pin6 to be 5.00V±10mV by adjusting the resistance of VR403. Once the reading is adjusted, press "ENTER" to confirm it and remove the 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 shown in Figure 3-116, or press "EXIT" to return to MAIN PAGE.

Notice The calibration points may be different for other models (non 62012P-80-60). Follow the instructions for those models when calibrating the instrument.

4. Program Sequence

The 62000P Series provides LIST MODE and V_STEP MODE to program the output sequence and CP_TRACKING MODE to track constant power. LIST MODE has 10 Programs and each Program can add a total of 100 sequences that are available for editing. V_STEP MODE provides a run time voltage program with a maximum of 99 hours 59 minutes and 59.99 seconds.

Each sequence in LIST MODE can be edited for 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. The LCD displays the PROGRAM options as shown in Figure 4-1 .
3. Use the numeric (1 - 3) keys or the "Rotary" ( ) knob to set the desired mode.
4. Press "ENTER" to confirm.
5. To quit the PROGRAM, press "EXIT" to return to MAIN PAGE.

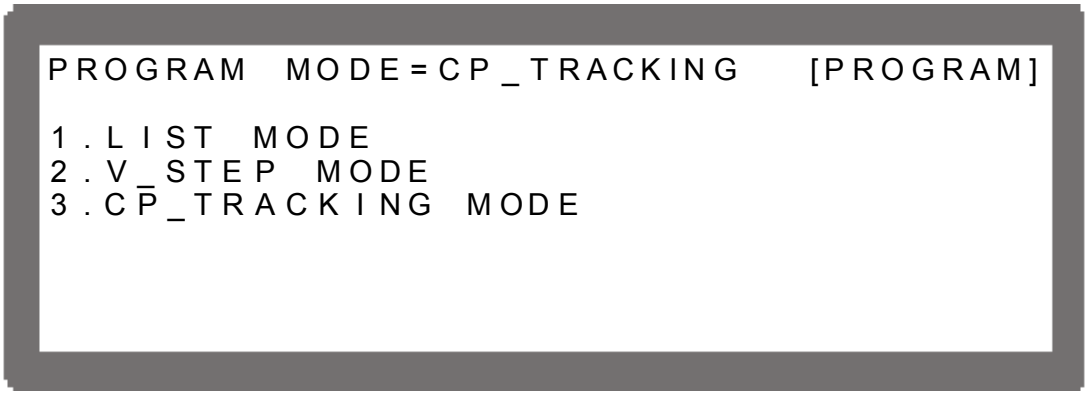


Figure 4-1

4.1 LIST MODE

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

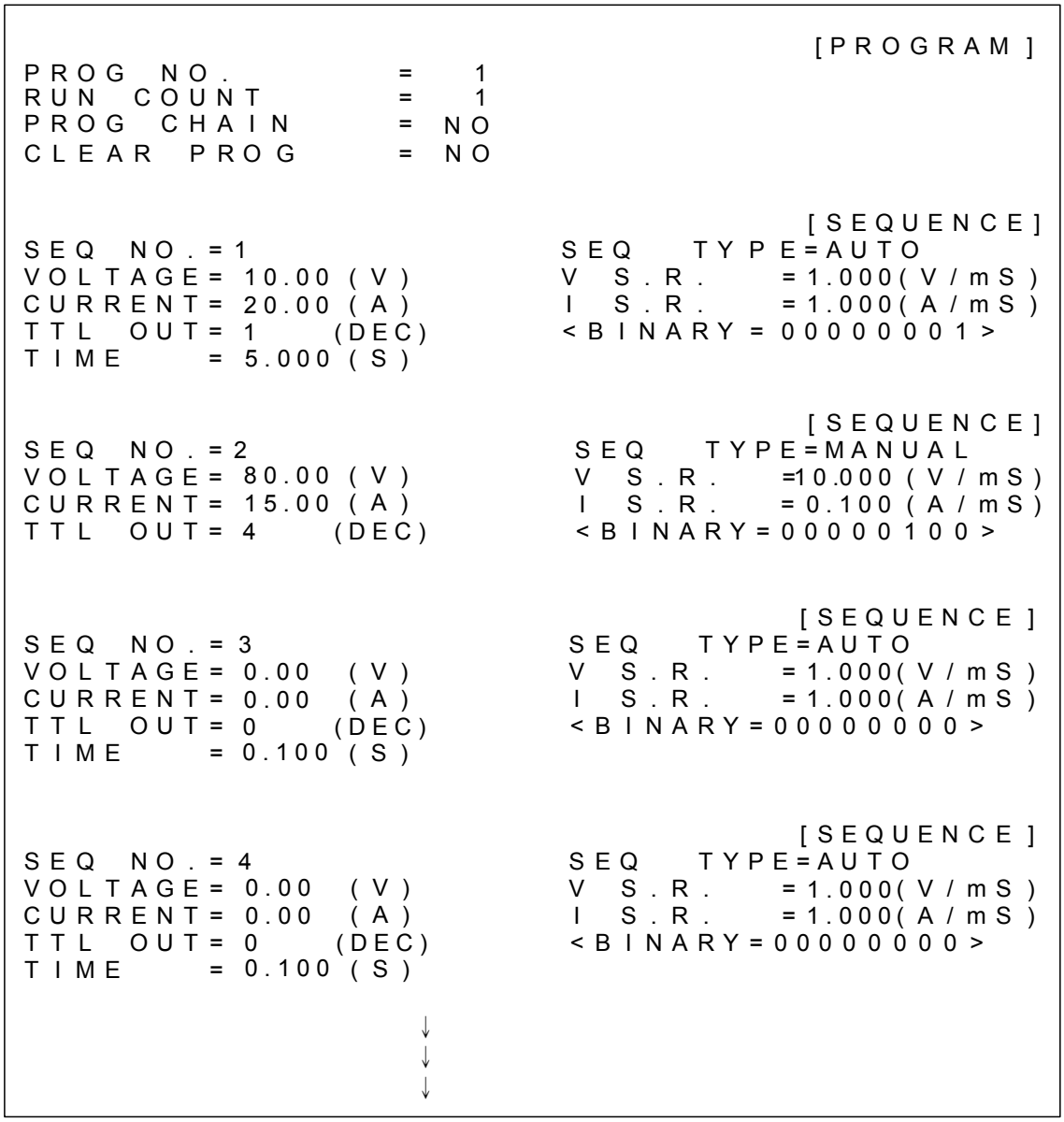


Figure 4-2

4.1.1 Description of PROGRAM Settings

A PROGRAM has 4 settings: (1) PROG NO., (2) RUN COUNT, (3) PROG CHAIN and (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 the “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as shown in Figure 4-3 (1).
3. Use the numeric (0 - 9) keys or the “Rotary” ( ) knob to set the value.
4. Press “ ENTER ↵ ” to confirm.
5. Press “ EXIT ” to return to Figure 4-1.

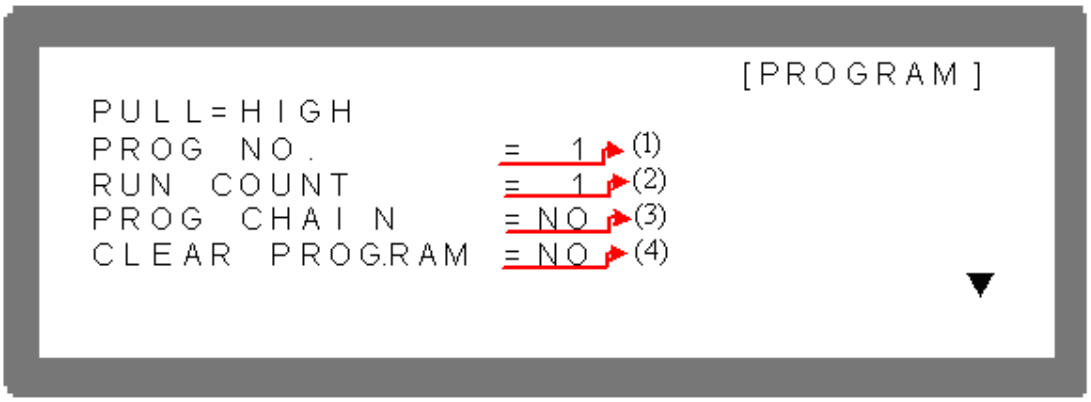


Figure 4-3

There are 10 programs available for programming; the PROG NO. range is 1 - 10.

4.1.1.2 Setting RUN COUNT

1. Use the “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as shown in Figure 4-3 (2).
2. Use the numeric (0 - 9) keys or the “Rotary” ( ) knob to set the value.

Each PROGRAM has a RUN COUNT that sets the number of times it will be executed. The 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 for RUN COUNT is shown in Figure 4-4.

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

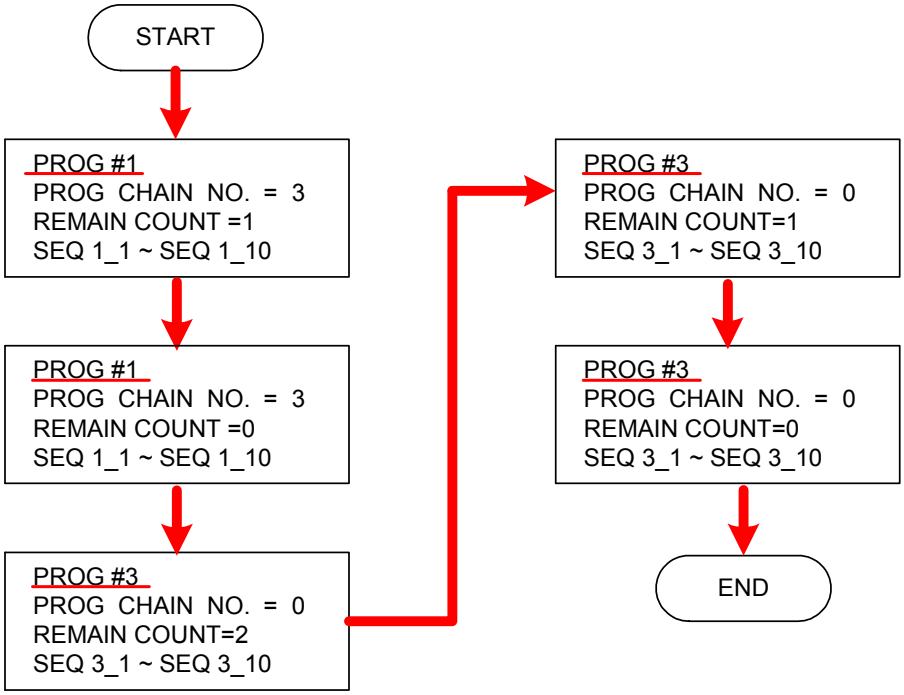


Figure 4-4

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

4.1.1.3 Setting PROG CHAIN

1. Use the " ← ↑ ", " → ↓ " keys to move the cursor to the column to be set as shown in Figure 4-3 (3).
2. Use the numeric (0-9) keys or the "Rotary" ( ) knob to set YES or NO.

The PROGRAM CHAIN indicates the link between 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
Setting NEXT TO PROG NO. to 0 means no program link.
(2) Set NEXT TO PROG NO. to non-0
Setting NEXT TO PROG NO. to non-0 means to link programs as shown 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 shown in Figure 4-5.

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

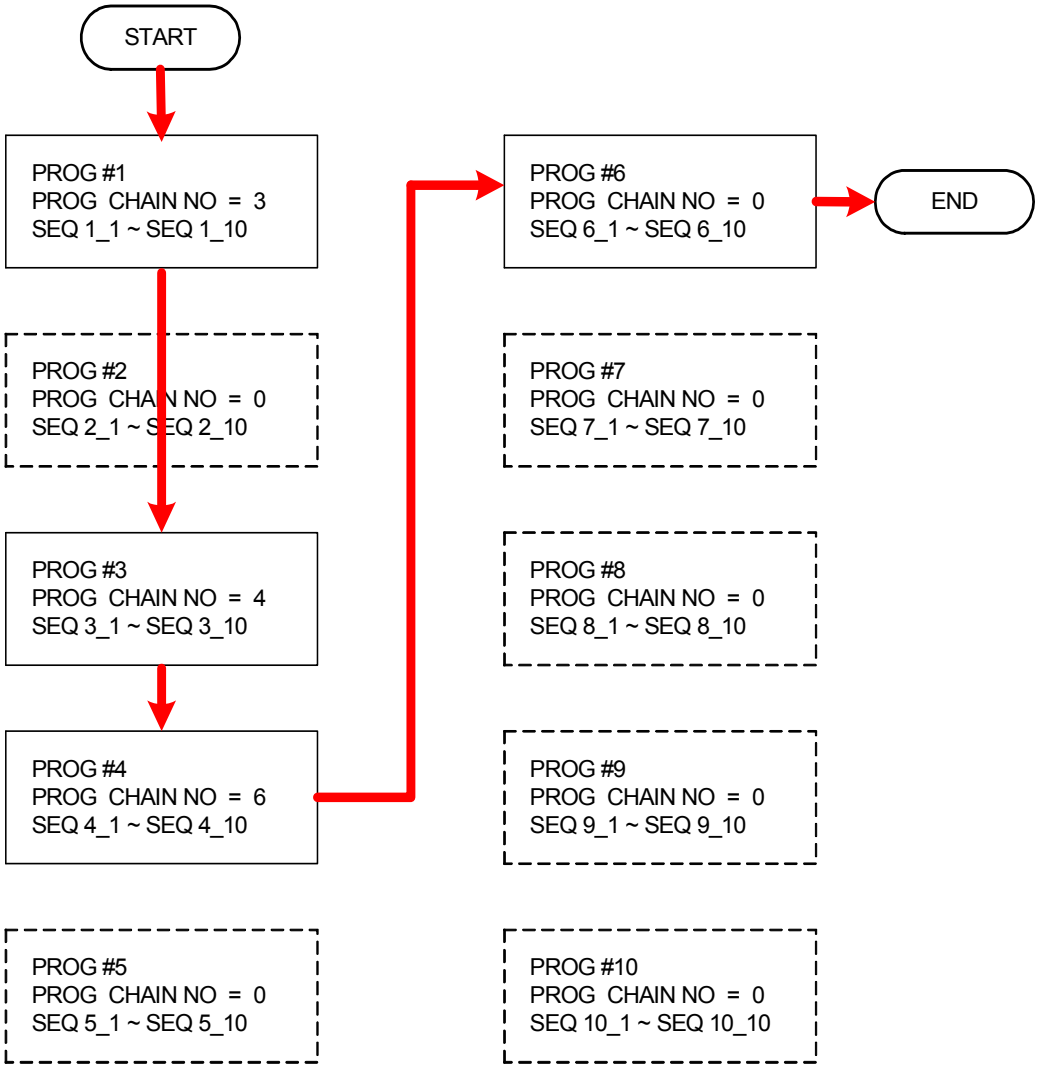


Figure 4-5

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 shown in Figure 4-6.

A3: Execution steps:

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

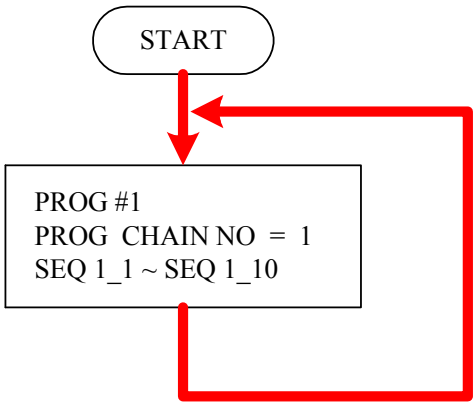


Figure 4-6

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 shown in Figure 4-7.

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.

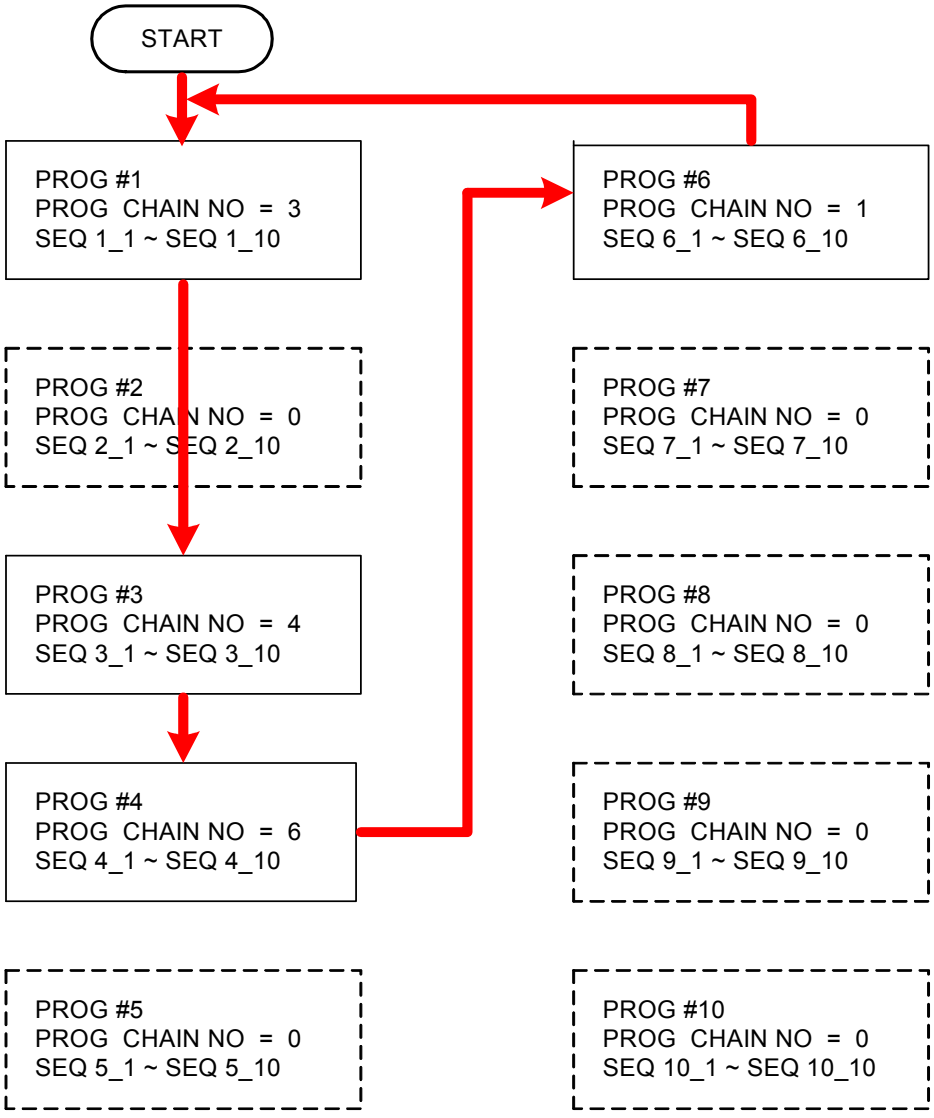


Figure 4-7

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

Notice If the next PROGRAM has no SEQUENCEs, all SEQUENCEs will be set to SKIP (see *4.1.2.2 Setting Sequence Type*) and the PROGRAM will stop execution.

4.1.1.4 Setting CLEAR PROGRAM

1. Use the "←↑", "→↓" keys to move the cursor to the column to be set as shown in Figure 4-3 (4).
2. Use the numeric (0-1) keys or the "Rotary" (◎) knob to set the value.

Clear Program has two options: 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 NO. for all PROGRAMS is 0. A maximum of 100 SEQUENCES can be added to each PROGRAM. The total number of SEQUENCES that can be programmed by the 10 PROGRAMS is 1000.

2. Adding a new SEQUENCE:
   a. In the PROGRAM page (Figure 4-3), if the PROGRAM has no SEQUENCE when the cursor is at (4), press "→↓" to add a new SEQUENCE. The page will skip to Figure 4-8.
   b. When the cursor is at (8) in Figure 4-8, press "→↓" to add a new SEQUENCE NO.

Notice The "→↓" function key is usually used as a cursor movement key; only when in the above situations can it be used for adding a new SEQUENCE.

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

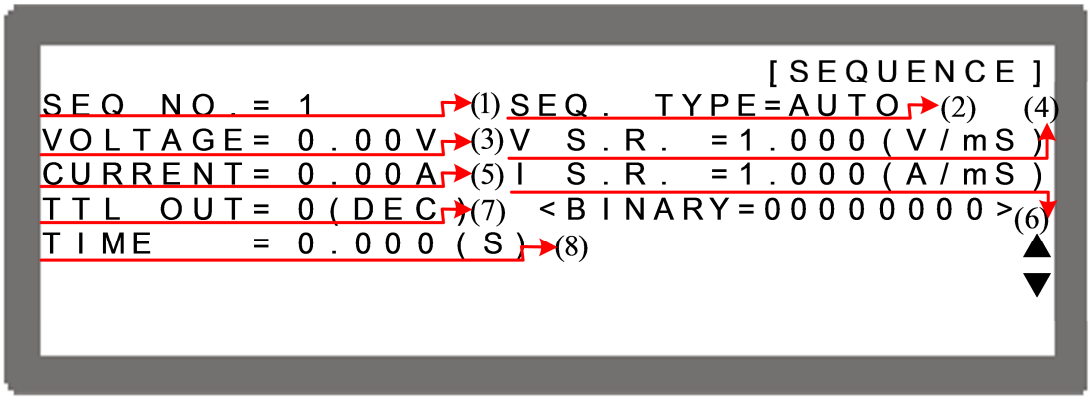


Figure 4-8

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 the Program PAGE (Figure 4-3).

4.1.2.1 Setting Sequence Number

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

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

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

4.1.2.2 Setting Sequence Type

1. Use the “ ←↑ ”, “ →↓ ” keys to move the cursor to the column to be set as shown in Figure 4-8 (2).
2. Use the numeric (0 - 3) keys or the “Rotary” (◎) knob to set the Sequence Type. There are four Sequence Types: (1) AUTO, (2) MANUAL, (3) TRIGGER, (4) SKIP.

   (1) Setting Sequence Type to AUTO
   When SEQ TYPE = AUTO, the sequence will automatically complete the execution and go to the next sequence. TIME= will display in the lower left corner to prompt users to enter the time remaining for this sequence (see Figure 4-94-9).

Notice

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

TIME	Min. (Sec)	Max. (Sec)
	0.001	60000

Table 4-2

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

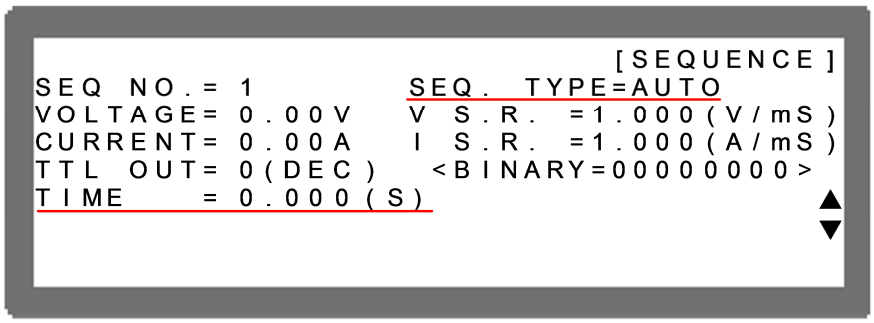


Figure 4-9

Ex. 5: Set Sequence Type to AUTO
If PROGRAM 1 is set as shown in Figure 4-10, 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 the 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 the voltage rise.
3. Once the voltage reaches 10V, the program maintains the 10V for the remainder of the 5 seconds from the beginning of the rise.
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 the SEQ#2 voltage rise, the maximum loading current is 3A and does not exceed the current setting 20A; therefore, SEQ#2 is in CV Mode during the voltage rise.
3. Once the voltage reaches 30V, the program maintains the 30V for the remainder of the 10 seconds from the beginning of the rise.
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 executed and the Program is ended.

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

Figure 4-11 shows the output waveform:

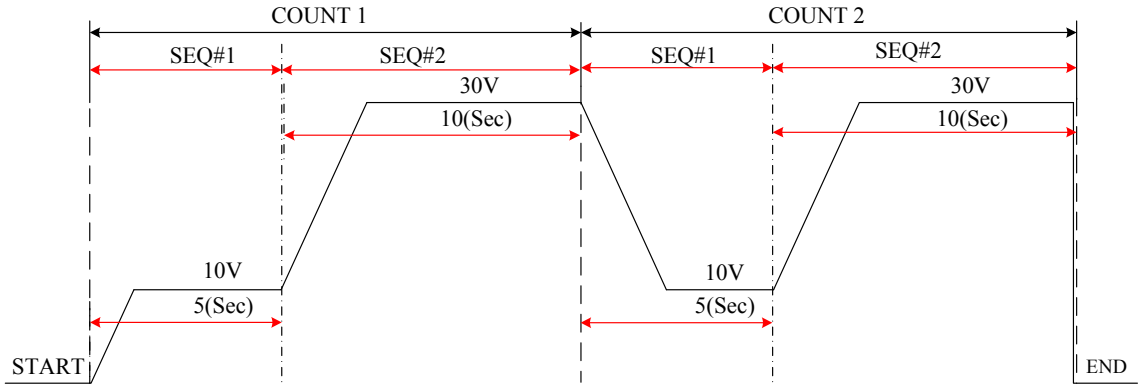


Figure 4-11

(2) Setting Sequence Type to MANUAL
When SEQ TYPE = MANUAL, the sequence will run automatically and stop at the VOLTAGE or CURRENT setting without skipping to the next sequence until any key on the front panel is pressed. It will not prompt users to enter the time for the sequence when set to MANUAL (see Figure 4-12).

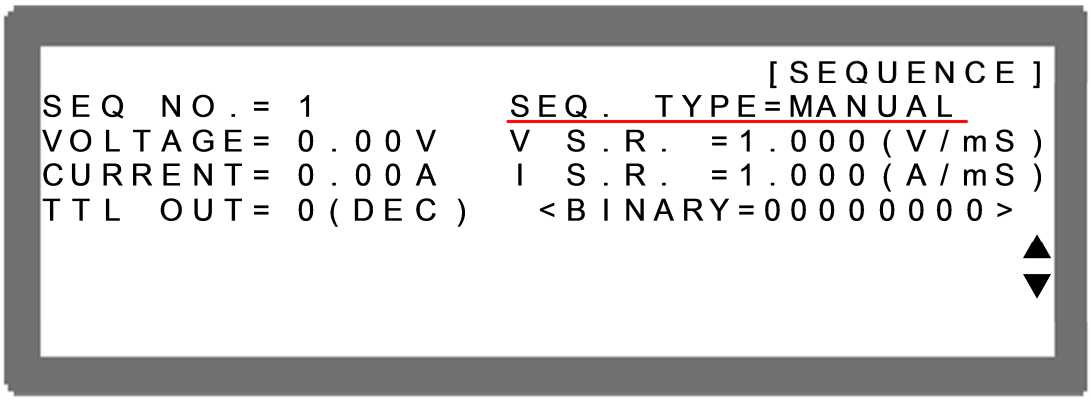


Figure 4-12

(3) Setting Sequence Type to TRIGGER
When SEQ TYPE = TRIGGER, the sequence will run automatically and stop at the VOLTAGE or CURRENT setting without skipping to next sequence until a sine wave (positive edge triggered TTL level) is input on PIN 8 of the Analog Interface on the

rear panel. It will not prompt users to enter the time for the sequence when set to TRIGGER (see Figure 4-13).

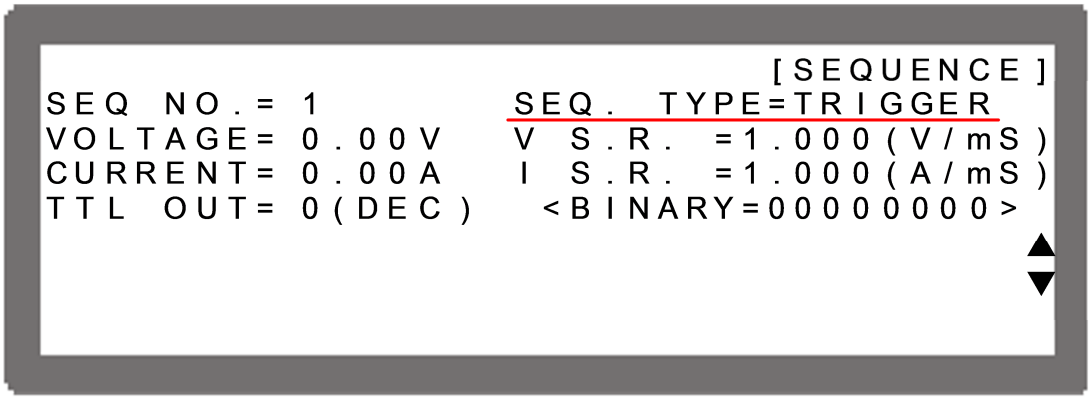


Figure 4-13

(4) Set Sequence Type to SKIP
When SEQ TYPE = SKIP, the sequence will skip automatically and jump to the next SEQUENCE. It will not prompt users to enter the time for this sequence (see Figure 4-14).

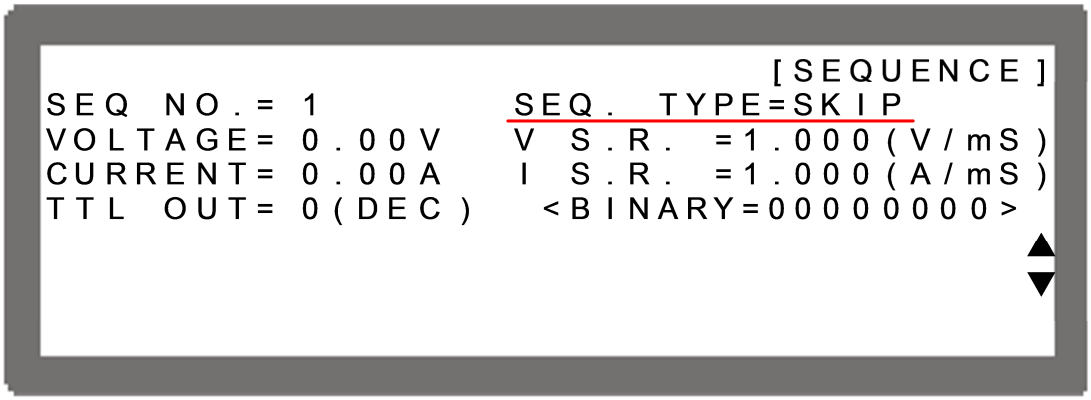


Figure 4-14

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

4.1.2.3 Setting Voltage

1. Use the "←↑", "→↓" keys to move the cursor to the column to be set as shown in Figure 4-8 (3).
2. Use the numeric (0-9) keys or the "Rotary" (◎) knob to set the SEQ output voltage.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the Program PAGE (Figure 4-3).

See section 3.2 for a detailed description of the settings.

4.1.2.4 Setting Current

1. Use the " ← ↑ ", " → ↓ " keys to move the cursor to the column to be set as shown in Figure 4-8 (5).
2. Use the numeric (0 - 9) keys or the "Rotary" (◎) knob to set the SEQ output current limit.
3. Press " ENTER ↵ " to confirm.
4. Press " EXIT " to return to the Program PAGE (Figure 4-3).

See section 3.2 for a detailed description of the settings.

4.1.2.5 Setting Voltage Slew Rate

1. Use the " ← ↑ ", " → ↓ " keys to move the cursor to the column to be set as shown in Figure 4-8 (4).
2. Use the numeric (0 - 9) keys or the "Rotary" (◎) knob to set the SEQ voltage conversion slew rate.
3. Press " ENTER ↵ " to confirm.
4. Press " EXIT " to return to the Program PAGE (Figure 4-3).

See section 3.3.2.3 for a detailed description of the settings.

4.1.2.6 Setting Current Slew Rate

1. Use the " ← ↑ ", " → ↓ " keys to move the cursor to the column to be set as shown in Figure 4-8 (6).
2. Use the numeric (0 - 9) keys or the "Rotary" (◎) knob to set the SEQ current conversion slew rate.
3. Press " ENTER ↵ " to confirm.
4. Press " EXIT " to return to the Program PAGE (Figure 4-3).

See section 3.3.2.4 for a detailed description of the settings.

4.1.2.7 Setting TTL OUT

1. Use the " ← ↑ ", " → ↓ " keys to move the cursor to the column to be set as shown in Figure 4-8 (7).

2. Use the numeric ([0]-[9]) keys or the "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 a detailed description of settings.

4.1.2.8 Setting Time

1. Use the "[←↑]", "[→↓]" keys to move the cursor to the column to be set as shown in Figure 4-8 (8).
2. Use the numeric ([0]-[9]) keys or the "Rotary" ( ) knob to set the value.

   This function sets the time duration of the sequence. The TIME = setting 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

Once the SEQUENCES have been edited, press "[OUTPUT]" to start execution and press "[EXIT]" to stop execution.

4.1.3.1 Running LIST MODE

1. Pressing "[OUTPUT]" will display a confirmation page as shown in Figure 4-15.

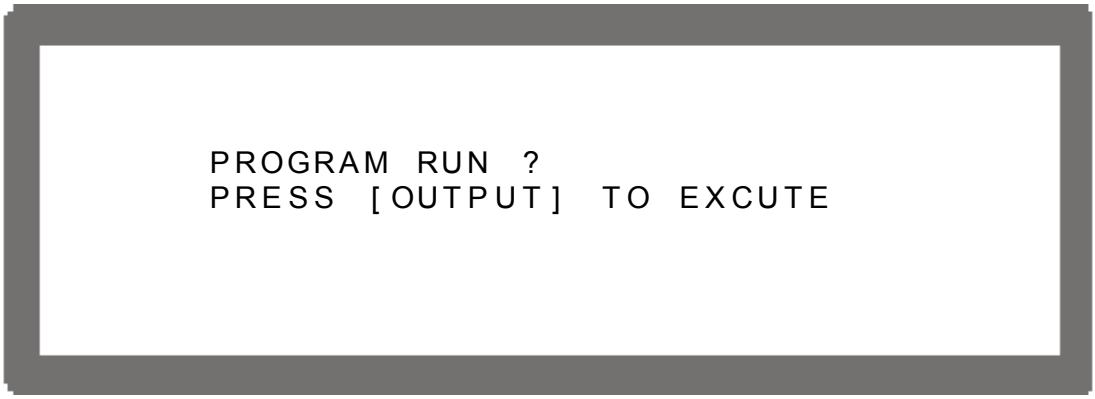


Figure 4-15

2. Press "OUTPUT" again to confirm the execution and go to MAIN PAGE as shown in Figure 4-16. To stop the execution, press "EXIT". The screen will return to the standby MAIN PAGE.

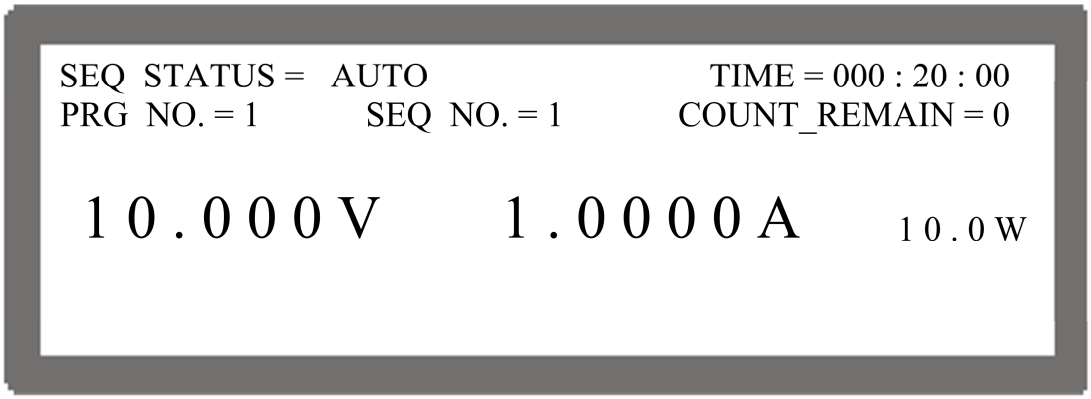


Figure 4-16

Notice

1. Pressing "OUTPUT" in the Program page (Figure 4-3) or Sequence page (Figure 4-8) will display a confirmation page as shown in Figure 4-15.
2. Press "EXIT" to abort the executing program and turn off the Power Supply 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.

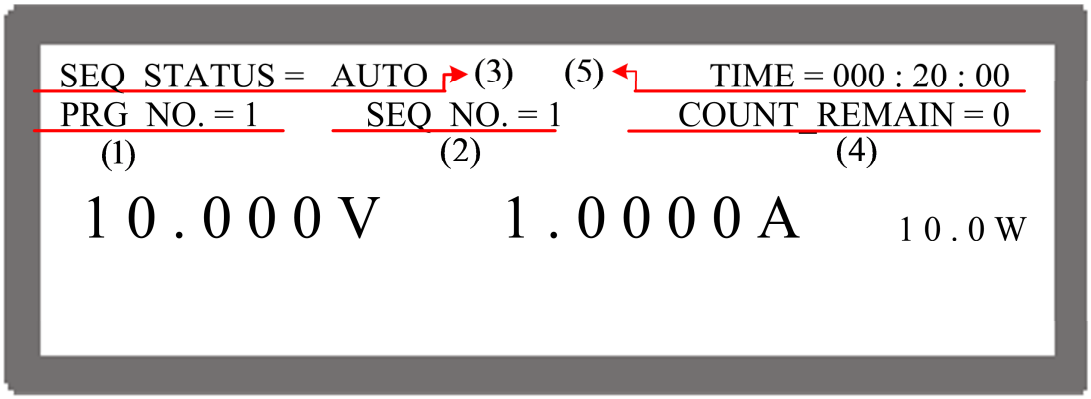


Figure 4-17

(1) Program Number: PRG NO. indicates the Program Number currently being executed.
(2) Sequence Number: SEQ NO. indicates the Sequence Number currently being executed.
(3) Sequence Status: SEQ STATUS indicates the Sequence state currently being executed.
(4) Count_Remain: COUNT_REMAIN indicates the remaining steps to be executed for the current Program.
(5) Running Time: TIME indicates the total time from program execution to the sequence running on Main Page.

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

4.2 V_STEP MODE

Run time programs are defined in V_STEP MODE (see Figure 4-18).

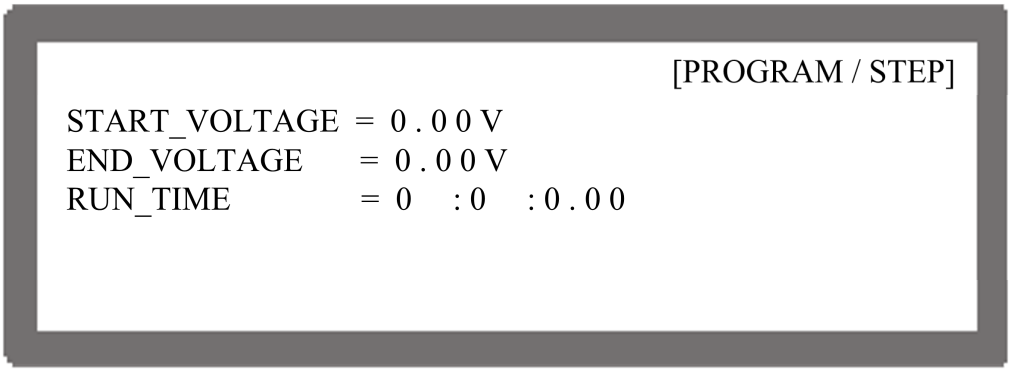


Figure 4-18

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 the "[←↑]", "[→↓]" keys to move the cursor to the column to be set as shown in Figure 4-19 (1). Set the start voltage for STEP MODE.
2. Use the numeric ([0]-[9]) keys or the "Rotary" (◎) knob to set the value.
3. Press "[ENTER ↵]" to confirm.
4. Press "[EXIT]" to return to Figure 4-1.

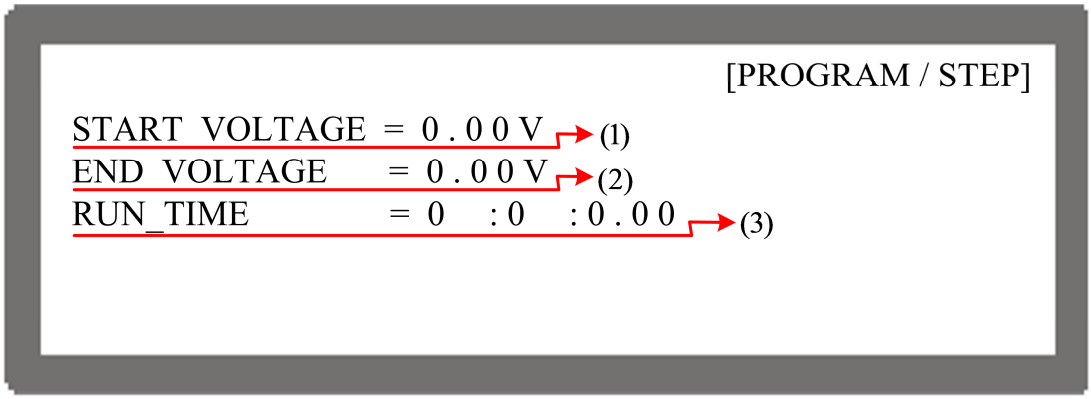


Figure 4-19

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

4.2.1.2 Setting END_VOLTAGE

1. Use the "[←↑]", "[→↓]" keys to move the cursor to the column to be set as shown in Figure 4-19 (2). Set the end voltage for STEP MODE.
2. Use the numeric ([0]-[9]) keys or the "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 the "[←↑]", "[→↓]" keys to move the cursor to the column to be set as shown in Figure 4-19(3). Set the run time for 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 the "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 END_VOLTAGE setting.

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 shown in Figure 4-20.
CASE2: The hardware initial voltage is 10V and the output waveform is shown in Figure 4-21.
CASE3: The hardware initial voltage is 20V and the output waveform is shown in Figure 4-22.

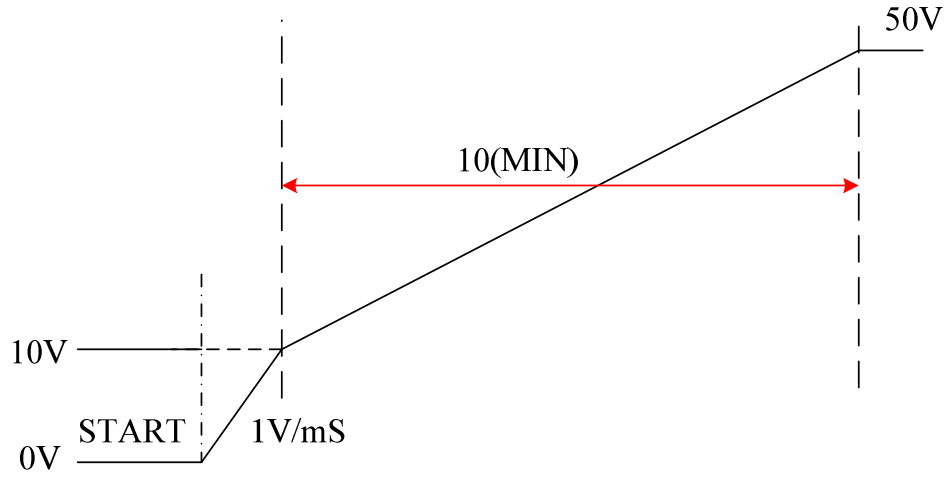


Figure 4-20

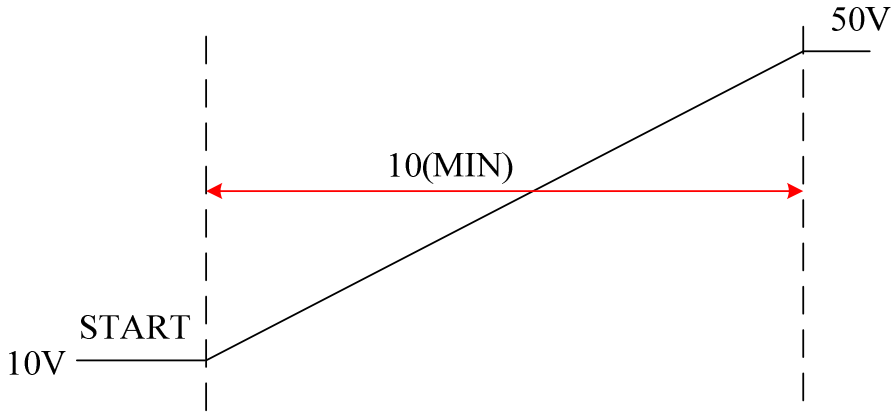


Figure 4-21

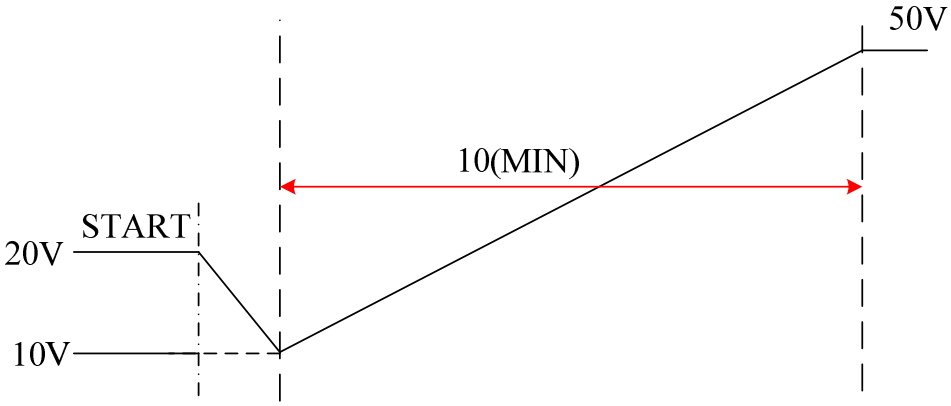


Figure 4-22

4.2.2 Execution of V_STEP MODE

When all the steps have been programmed, press "OUTPUT" to confirm and start the execution. To stop execution, press "EXIT".

4.2.2.1 Running V_STEP MODE

1. Pressing "OUTPUT" will display a confirmation window as shown in Figure 4-15.
2. Press "OUTPUT" again to confirm the execution. The screen will go to MAIN PAGE during execution as shown in Figure 4-23. To stop the execution, press "EXIT" and return to the MAIN PAGE window in standby.

Notice Pressing "EXIT" will forcibly interrupt the Program execution (the Power Supply turns off the output).

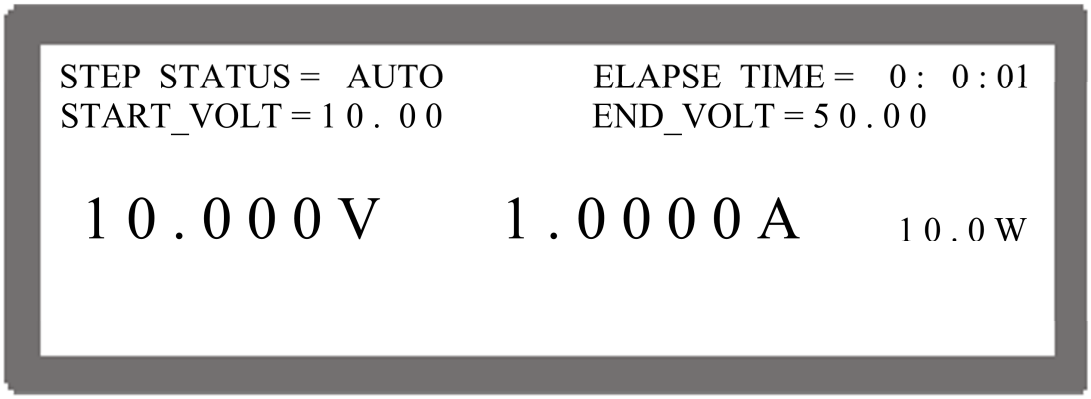


Figure 4-23

4.2.2.2 Description of Program V_Step Mode

Figure 4-24 shows the main screen when executing V_STEP MODE. Items (1)-(4) in Figure 4-24 are explained below.

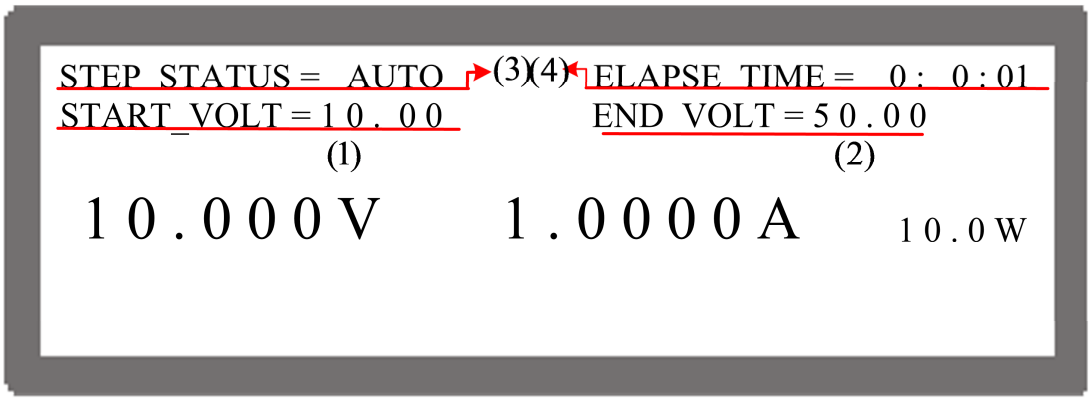


Figure 4-24

(1) START_VOLT: the starting voltage setting of V_STEP MODE.
(2) END_VOLT: the ending voltage setting of V_STEP MODE.
(3) STEP STATUS: the current status of V_STEP MODE.
(4) ELAPSE TIME: the length of time V_STEP MODE has been running. The time format is HOUR:MIN:SEC and the maximum display is 99 hours 59 minutes and 59 seconds.

4.3 CP_TRACKING MODE

The TRACKING speed can be set in CP_TRACKING MODE. Select CP_ TRACKING MODE (see Figure 4-25).

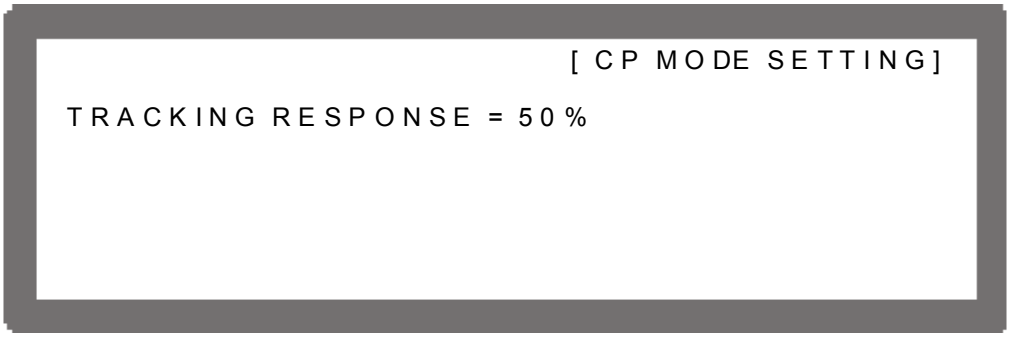


Figure 4-25

4.3.1 Setting CP_TRACKING MODE

1. Use the numeric ([0]-[9]) keys or the "Rotary" ( ) knob to set the value. The input range is 1-100 as shown in Figure 4-25. The smaller the number the slower the response speed but the higher the stability.
2. Press "[OUTPUT]" to confirm and start the execution. To stop it, press "[EXIT]".

4.3.2 Description of CP_TRACKING MODE

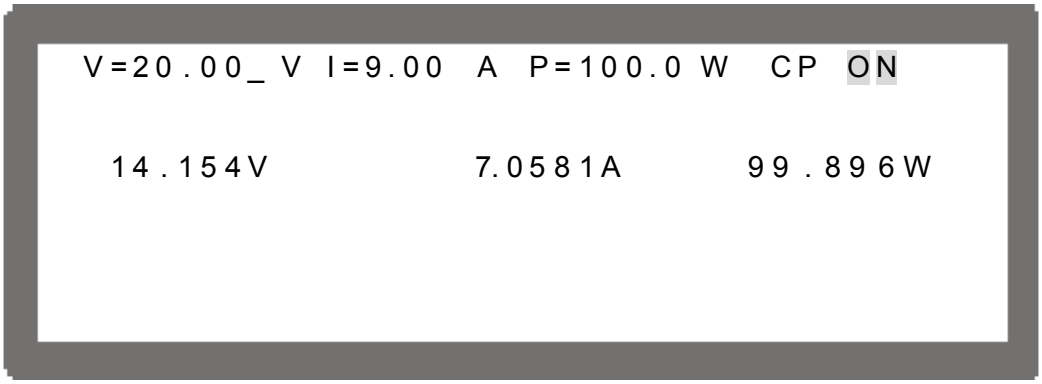


Figure 4-26

1. Press "VOLTAGE" to set the output voltage. The cursor after the V value on the MAIN PAGE will blink as shown in Figure 4-26.
2. Use the numeric (0-9) keys to set the value and press "ENTER" to complete the voltage setting, or turn the "Rotary" ( ) knob to adjust the settings directly.
3. Press "CURRENT" and set the current in the same way as the voltage settings.
4. Use the " " key to move the cursor to the P column and set the power in the same way as the voltage settings.

Notice

1. CP_TRACKING MODE does not support series/parallel operation.
2. This function is limited by the hardware response time. Different loads will have different response speeds.

5. Remote Operation

5.1 Overview

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

The USB interface supports USB 2.0/USB 1.1. The GPIB interface is an 8-bit parallel data bus that synchronizes with the host bus commands. The Ethernet interface is used in a local area network for data transmission. RS-232C is a serial bus with less powerful functions; however, remote control is easily done 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:	The 62000P Series USB Interface supports USBTMC. If the PC OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) there is no need to install other drivers. The OS will automatically search for the standard USBTMC driver installation program.

If the PC OS does not support USBTMC, install the NI-VISA runtime version 3.00 or above. When the installation of NI-VISA runtime is done, the USBTMC driver program is stored in the OS. The PC can communicate with the 62000P Series via NI-VISA after connecting them using a USB cable.

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 sections 3.3.1.1 and 3.3.1.2.

5.1.3 Connecting RS-232C

The default baud rate of the 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 RS-232C connector is a 9-pin D type small female connector. Table 5-1 lists the pins and signals of the 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 connections between a 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	Sets the SRQ line to true if there is an enabled service request condition.
Remote/Local	Powers ON in local mode. The front panel is operational and the commands respond through the GPIB. In remote mode, all front panel keys except LOCAL/REMOTE are invalid. Press "LOCAL/REMOTE" to 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 conventions used in this section.

Angle brackets	< >	Items in angle brackets are parameter abbreviations.
Vertical bar	|	A 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 one or more times.

Table 5-4

5.3.2 Numerical Data Formats

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

Symbol	Description	Example
NR1	A digit without a decimal point. The decimal is assumed to be to the right of the least significant digit.	123, 0123
NR2	A digit with a decimal point.	12.3, .123
NR3	A digit with a decimal point and an exponent.	1.23E+2
NRf	A flexible decimal format including NR1or NR2 or NR3.	123, 12.3, .23E+3
NRf+	An extended decimal format including NRf and MIN, MAX. MIN and MAX are the low and high limits of a 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> only takes the form ON|OFF.

5.3.4 Character Data Format

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

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

5.3.5 Basic Definition

5.3.5.1 Command Tree Structure

The commands of the DC Power Supply are based on a hierarchical structure, also known as a tree system. 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. The 62000P Series only accepts the exact short and long forms. A special notation will be used to differentiate the short form header from the long one of the same header in this subsection. The short form header is shown in upper case characters, whereas the rest of the headers are shown in lower case.

5.3.5.5 Program Header Separator (:)

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

5.3.5.6 Program Message

Program messages consist of a sequence of zero or other elements of program message units that are separated by separator elements of program message units.

5.3.5.7 Program Message Unit

A 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 refer 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 in the order received. Program message units except coupled commands are executed in order of reception. The execution of coupled commands is deferred until the program message terminator is received. A coupled command sets parameters, which are affected by the setting of other commands. Problems may arise, because the prior state of the 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 the DC Power Supply.

5.6.1 Common Command Syntax

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

***CLS** **Clear Status**
Type: Device status
Description: The *CLS command does the following:
It clears any error codes and resets any error messages. If “*CLS” is followed by <nl>, the “output queue” and MAV bit will be cleared 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 enable events of the Standard Event Status Event register are logically ORed to cause the ESB (bit 5) of the Status Byte register to be set.
Syntax: *ESE <NRf>
Parameter: 0 to 255
Example: *ESE 48 This command enables the CME and EXE events of the Standard Event Status Event register.
Query Syntax: *ESE?
Return Parameter: <NR1>
Query Example: *ESE? This query returns the current setting of the 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? Returns the status readings of the 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
12345	Serial No.

Return Example: CHROMA 62012P-80-60, 01.00, 12345

***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 bytes set to “1”.)

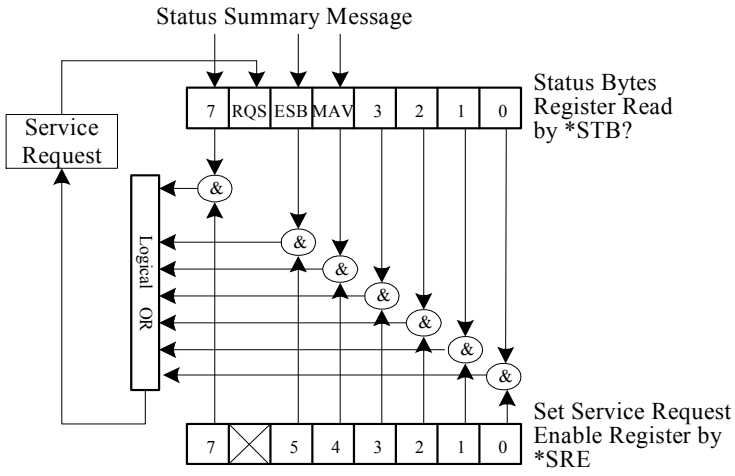


Figure 5-1

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 commonly used commands *ESE and *ESR? can be utilized to program it.

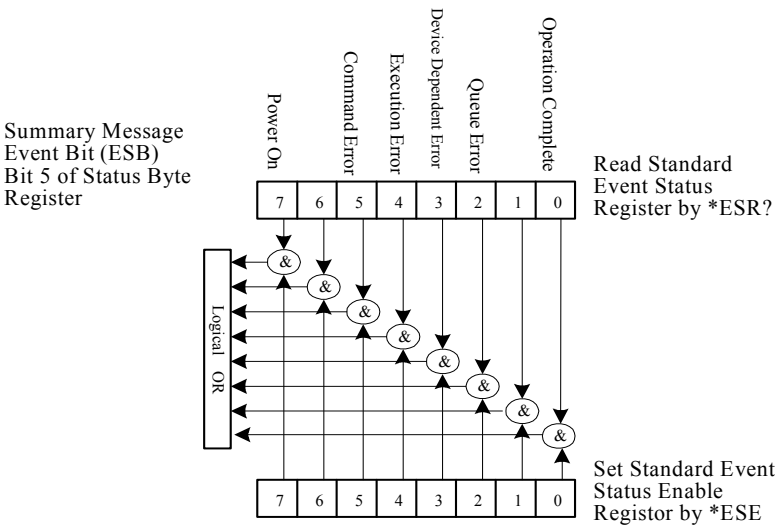


Figure 5-2

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

Table 5-9

5.6.2 Specific Commands for 62000P Series

5.6.2.1 ABORT Subsystem

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

5.6.2.2 CONFIGURE Subsystem

(1) CONFigure: TTLport

Description:	Sets the output value for the 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?	Returns the output value of the TTL Port.
Return Example:	0 or 255	

(2) CONFigure:BEEPer

Description:	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?	Returns the beeper control status.
Return Example:	ON or OFF	

(3) CONFigure:REMote

Description:	Sets the remote control status (valid for RS232C only).	
Syntax:	CONFigure:REMote ON	
	CONFigure:REMote OFF	
Parameter:	ON|OFF	
Example:	CONF:REM OFF	Disables remote control.

(4) CONFigure:OUTPut

Description:	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:	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?	Returns the status setting.

Return Example: DISABLE or CVTOCC or CCTOCV

(6) CONFigure:FOLDT
Description: Sets the delay time of FOLDBACK PROTECT
Syntax: CONFigure:FOLDT < NR2>
Parameter: 0.01-600.00 (Unit:Sec)
Example: CONF:FOLDT 10
Query Syntax: CONF:FOLDT?
Return Parameter: < NR2> or <NR3>
Query Example: CONF:FOLDT?
Return Example: 1.000000e+01

(7) CONFigure:APGmode
Description: Sets the 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? Returns the status setting.
Example: NONE | V | I | VI

(8) CONFigure:APGV
Description: 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? Returns the status setting.
Return Example: 5V or 10V

(9) CONFigure:MEASure:SPeed
Description: Sets the reading speed of the 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: Wets 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: 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: 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? Returns the LCD backlight state.
Return Example: HIGH

(13) CONFigure:MSTSLV:ID
Description: Sets the supply 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: Sets 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:	Sets the number of SLAVEs 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:	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
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:	Wxecutes 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.

(18) CONFigure:INHibit:PULL
Description: Executes Remote Inhibit to Pull Low or Pull High.
Syntax: CONFigure:INHibit:PULL
Parameter: LOW | HIGH
Example: CONFigure:INHibit:PULL LOW
CONFigure:INHibit:PULL HIGH
Query Syntax: CONFigure:INHibit:PULL?
Return Parameter: LOW,HIGH
Query Example: CONF:INH:PULL?
Return Example: LOW

(19) CONFigure:INTERLOCK
Description: Executes Safety Interlock control.
Syntax: CONFigure: INTERLOCK ENABLE
Parameter: ENABLE | DISABLE
Example: CONFigure: INTERLOCK ENABLE
CONFigure: INTERLOCK DISABLE
Query Syntax: CONFigure: INTERLOCK ?
Return Parameter: ENABLE | DISABLE
Query Example: CONF: INTERLOCK?
Return Example: DISABLE

(20) CONFigure: INTERLOCK:PULL
Description: Executes Safety Interlock to Pull Low or Pull High.
Syntax: CONFigure: INTERLOCK:PULL
Parameter: LOW | HIGH
Example: CONFigure INTERLOCK:PULL LOW
CONFigure: INTERLOCK:PULL HIGH
Query Syntax: CONFigure: INTERLOCK:PULL?
Return Parameter: LOW,HIGH
Query Example: CONF: INTERLOCK:PULL?
Return Example: LOW

5.6.2.3 SOURCE Subsystem

(1) SOURce:VOLTage
Description: 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 Sets the output voltage to 0.01 volt.
SOUR:VOLT 80.00 Sets the output voltage to 80.00 volt.
Query Syntax: SOUR:VOLT?
Return Parameter: <NR2> or <NR3> [Unit Volt]
Query Example: SOUR:VOLT? Returns the voltage setting.
Return Example: 8.000000e1

(2) SOURce:VOLTage:LIMit:{HIGH/LOW}

Description:	Sets the output voltage range.	
Syntax:	SOURce:VOLTage:LIMIT:HIGH <NRf+>[suffix]	
	SOURce:VOLTage:LIMIT:LOW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:LIMIT:HIGH 60.0	Sets the output voltage range to 60V maximum.
	SOUR:VOLT:LIMIT:LOW 20.0	Sets the output voltage range to 20V minimum.
Query Syntax:	SOUR:VOLT:LIMIT:HIGH?	
	SOUR:VOLT:LIMIT:LOW?	
Return Parameter:	<NR2> or <NR3> [Unit Volt]	
Query Example:	SOUR:VOLT:LIMIT:HIGH?	Returns the maximum range setting for voltage.
Return Example:	80.0	

(3) SOURce:VOLTage:PROTect:{HIGH}

Description:	Sets the voltage range for over voltage protection.	
Syntax:	SOURce:VOLTage:PROTect:HIGH <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:PROT:HIGH 60.0	Sets the high limit to 60V for voltage output protection.
Query Syntax:	SOUR:VOLT:PROT:HIGH?	
Return Parameter:	<NR2> or <NR3> [Unit Volt]	
Query Example:	SOUR:VOLT:PROT:HIGH?	Returns the high limit for voltage protection.
Return Example:	88.00	

(4) SOURce:VOLTage:SLEW

Description:	Sets the rising or falling slew rate (volt/ms) of the output voltage.	
Syntax:	SOURce:VOLTage:SLEW <NRf+>[suffix]	
	SOURce:VOLTage:SLEW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:SLEW 0.01	Sets the output voltage slew rate to 0.01volt/mS
	SOUR:VOLT:SLEW 10	Sets the output voltage slew rate to 100 volt/mS
Query Syntax:	SOUR:VOLT:SLEW?	
Return Parameter:	<NR2> or <NR3> [Unit Volt/ms]	
Query Example:	SOUR:VOLT:SLEW?	Returns the voltage slew rate.
Return Example:	10	

(5) SOURce: CURRent

Description:	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	Sets the output current to 1 amp.
	SOUR:CURR 60.00	Sets the output current to 60.00 amps.
Query Syntax:	SOUR:CURR?	
Return Parameter:	<NR2> or <NR3> [Unit Amp]	
Query Example:	SOUR:CURR?	Returns the output current setting.
Return Example:	9.000000e1	

(6) SOURce:CURRent:LIMit:{HIGH/LOW}

Description:	Sets the output current range.	
Syntax:	SOURce:CURRent:LIMIT:HIGH <NRf+>[suffix]	
	SOURce:CURRent:LIMIT:LOW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:CURR:LIMIT:HIGH 60.0	Sets the output current range to 60A maximum.
	SOUR:CURR:LIMIT:LOW 20.0	Sets the low limit to 20A for output current protection.
Query Syntax:	SOUR:CURR:LIMIT:HIGH?	
	SOUR:CURR:LIMIT:LOW?	
Return Parameter:	<NR2> or <NR3> [Unit Amp]	
Query Example:	SOUR:CURR:LIMIT:HIGH?	Returns the maximum range setting for current.
Return Example:	60.00	

(7) SOURce:CURRent:PROTect:{HIGH }

Description:	Sets the current range for over current protection.	
Syntax:	SOURce:CURRent:PROTect:HIGH <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:CURR:PROT:HIGH 60.0	Sets the high limit to 60A for output current protection.
Query Syntax:	SOUR:CURR:PROT:HIGH?	
Return Parameter:	<NR2> or <NR3> [Unit Amp]	
Query Example:	SOUR:CURR:PROT:HIGH?	Returns the high limit setting for current protection.
Return Example:	50.00	

(8) SOURce:CURRent:SLEW

Description:	Sets the rising or falling slew rate (amp/ms) of the output current.	
Syntax:	SOURce:CURRent:SLEW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:CURR:SLEW 0.01	Sets the output current slew rate to 0.01 Amp/mS.
	SOUR:CURR:SLEW 1.00	Sets the output current slew rate to 1.00 Amp/mS.
Query Syntax:	SOUR:CURR:SLEW?	
Return Parameter:	<NR2> or <NR3> [Unit Amp/ms]	
Query Example:	SOUR:CURR:SLEW?	Returns the current slew rate setting.
Return Example:	1.00	

(9) SOURce:CURRent:SLEWINF

Description:	Sets the I Slewrate to INF.	
Syntax:	SOURce:CURRent:SLEWINF ENABLE	
	SOURce:CURRent:SLEWINF DISABLE	
Parameter:	ENABLE/DISABLE	
Example:	SOUR:CURR:SLEWINF ENABLE	Sets the I Slewrate to INF.
	SOUR:CURR:SLEWINF DISABLE	Resets the I Slewrate and returns to 1A/ms.
Query Syntax:	SOUR:CURR:SLEW?	
Return Parameter:	INF. or <NR2> or <NR3> [Unit = Ampere]	
Query Example:	SOUR:CURR:SLEW?	Returns the Slewrate setting.
Return Example:	INF.	

(10) SOURce:POWer:PROTect:HIGH

Description:	Sets the over power point (Watts) for output power.	
Syntax:	SOURce:POWer:PROTect:HIGH <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOURce:POWer:PROTect:HIGH 1260	Sets the over power point to 1260.
Query Syntax:	SOURce:POWer:PROTect:HIGH?	
Return Parameter:	<NR2> or <NR3> [Watt]	
Query Example:	SOURce:POWer:PROTect:HIGH?	Returns the over power setting.
Return Example:	1260.00	

(11) SOURce:DCON:{RISE/FALL}

Description:	Sets the DC_ON signal active point.	
Syntax:	SOURce:DCON:RISE <NRf+>[suffix] SOURce:DCON:FALL <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:DCON:RISE 79.5	Sets the DC_ON rise to 79.5V.
	SOUR:DCON:FALL 0.5	Sets the DC_ON fall to 0.5V.
Query Syntax:	SOUR:DCON:RISE? SOUR:DCON:FALL?	
Return Parameter:	<NR2> or <NR3> [Unit = Volt]	
Query Example:	SOUR:DCON:RISE?	Returns the DC_ON setting.
Return Example:	79.5	

Note The output must be OFF before setting.

5.6.2.4 FETCH Subsystem

(1) FETCh:VOLTage?

Description:	Measures the output of the Power Supply and returns the real time voltage.
Query Syntax:	FETCh:VOLTage?
Return Parameter:	<NR2> or <NR3> [Unit Volt]
Query Example:	FETC:VOLT?
Return Example:	8.12

(2) FETCh:CURRent?

Description:	Measures the output of the Power Supply and returns the real time current.
Query Syntax:	FETCh:CURRent?
Return Parameter:	<NR2> or <NR3> [Unit Amp]
Query Example:	FETC:CURR?
Return Example:	3.15

(3) FETCh:POWer?

Description:	Measures the output of the Power Supply and returns the real time power.
Query Syntax:	FETCh:POWer?
Return Parameter:	<NR2> or <NR3> [Unit Watt]
Query Example:	FETC:POW?
Return Example:	1100.00

(4) FETCh:STATus?

Description: Returns the status code of the Power Supply's state.
Query Syntax: FETCh:STATus?
Return Parameter: <Arg1><,><Arg2><,><Arg3>
<Arg1>: returns 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 current output status
<Arg3>: CV or CC current status

5.6.2.5 MEASURE Subsystem

(1) MEASure:VOLTage?

Description: Returns the voltage measured at the output of the Power Supply.
Query Syntax: MEASure:VOLTage?
Return Parameter: <NR2> or <NR3> [Unit Voltage]
Query Example: MEAS:VOLT?
Return Example: 8.12

(2) MEASure:CURRent?

Description: Returns the current measured at the output of the Power Supply.
Query Syntax: MEASure:CURRent?
Return Parameter: <NR2> or <NR3> [Unit Amp]
Query Example: MEAS:CURR?
Return Example: 3.15

(3) MEASure:POWer?

Description: Returns the power measured at the output of Power Supply.
Query Syntax: MEASure:POWer?
Return Parameter: <NR2> or <NR3> [Unit Amp]
Query Example: MEAS:POW?
Return Example: 1000.00

5.6.2.6 PROGRAM Subsystem

(1) PROGram: SELected

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

(2) PROGram:LINK

Description:	Links a program to another when it 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:	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:	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: PULL

Description:	Executes the Program Trigger to Pull Low or Pull High.
Syntax:	PROGram:PULL
Parameter:	LOW | HIGH
Example:	PROGram:PULL LOW PROGram:PULL HIGH
Query Syntax:	PROGram:PULL?
Return Parameter:	LOW,HIGH
Query Example:	PROGram:PULL?
Return Example:	LOW

(6) PROGram:SAVE

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

(7) PROGram:SEQuence:SELected

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

(8) PROGram:SEQuence:TYPE

Description:	Sets the sequence action type.
Syntax:	PROGram:SEQuence:TYPE TRI PROGram:SEQuence:TYPE AUTO PROGram:SEQuence:TYPE MANUAL
Parameter:	SKIP, AUTO, MANUAL
Example:	PROG:SEQ:TYPE TRI PROG:SEQ:TYPE AUTO PROG:SEQ:TYPE MANUAL
Query Syntax:	PROG:SEQ:TYPE?
Return Parameter:	SKIP, AUTO, MANUAL
Query Example:	PROG:SEQ:TYPE?
Return Example:	1

(9) PROGram:SEQuence:VOLTage

Description:	Sets the voltage output sequence.
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

(10) PROGram:SEQuence:VOLTage:SLEW

Description:	Sets the output voltage slew rate sequence.
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

(11) PROGram:SEQuence:CURRent

Description:	Sets the output current sequence.
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

(12) PROGram:SEQuence:CURRent:SLEW
Description: Sets the output voltage slew rate sequence.
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

(13) PROGram:SEQuence:CURRent:SLEWINF
Description: Sets the current output slewrate sequence 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 INF Slewrate and returns to 1A/ms
Query Syntax: PROGram:SEQuence:CURRent:SLEW?
Return Parameter: INF. Or <NRf+>[Unit Amp]
Query Example: PROGram:SEQuence:CURRent:SLEW? Returns the settings.
Return Example: INF.

(14) PROGram:SEQuence:TTLport

Description:	Sets the TTL Port output sequence.
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

(15) PROGram:SEQuence:TIME

Description:	Sets the time duration sequence.
Syntax:	PROGram:SEQuence:TIME <NRf1>
Parameter:	0, 0.005-15000 (0 means Sequence ends.)
Example:	PROG:SEQ:TIME 10
Query Syntax:	PROG:SEQ:TIME?
Return Parameter:	<NR1>
Query Example:	PROG:SEQ:TIME?
Return Example:	6000

(16) PROGram:CLEAR

Description:	Clears the sequence.
Syntax:	PROGram:CLEAR
Example:	PROG:CLEAR

(17) PROGram:ADD

Description:	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 – indicates the remaining no. is 85.

(18) PROGram:MAX?

Description:	Queries the number of sequences in the current program.
Syntax:	PROGram:MAX?
Parameter:	
Example:	PROG:MAX?
Return Example:	2 means there are two sequences in the current program.

(19) PROGram:SEQuence

Description: 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

(20) PROGram:MODE
Description: Sets the Program Mode output.
Syntax: PROGram:Mode LIST
PROGram:Mode STEP
PROGram:Mode CP
Parameter: LIST | STEP|CP
Example: Changes the Program Mode to STEP Mode.
PROGram:Mode STEP
Query Syntax: PROGram:Mode?
Return Parameter: LIST | STEP|CP
Query Example: PROG:MODE?
Return Example: STEP

(21) PROGram:STEP:STARTV
Description: Sets the Step Mode start voltage output.
Syntax: PROGram:STEP:STARTV <NRf+>
Example: 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

(22) PROGram:STEP:ENDV
Description: Sets the Step Mode end voltage output.
Syntax: PROGram:STEP:ENDV <NRf+>
Example: 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

(23) PROGram:STEP:TIME
Description: Sets the Step Mode execution time.
Syntax: PROGram:STEP:TIME <Hour><,><Minute><,><Second>
Parameter: Hour : <NR1> 0 - 99
Minute : <NR1> 0 - 59
Second : <NRf1> 0 - 59.99
Example: 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

(24) PROGram:CP:RESPonse

Description:	Sets the response speed for the CP Tracking Mode.
Syntax:	PROGram:CP:RESPonse <NR1>
Parameter:	1-100
Example:	Sets the response speed for CP Tracking to 50. PROGram:CP:RESP 50
Query Syntax:	PROGram:CP:RESP?
Return Parameter:	1-100
Query Example:	PROGram:CP:RESP ?
Return Example:	50

(25) PROGram:CP:VOLTage

Description:	Sets the output voltage for the CP Tracking Mode.
Syntax:	PROGram:CP:VOLTage <NRf+>
Parameter:	
Example:	Sets the output voltage for CP Tracking to 40V. PROGram:CP:VOLTage 40
Query Syntax:	PROGram:CP:VPLTage?
Return Parameter:	<NRf+>
Query Example:	PROGram:CP:VOLTage ?
Return Example:	40.0

(26) PROGram:CP:CURRent

Description:	Sets the output current limit for the CP Tracking Mode.
Syntax:	PROGram:CP:CURRent <NRf+>
Parameter:	
Example:	Sets the output current limit for CP Tracking to 10A. PROGram:CP:CURRent 40
Query Syntax:	PROGram:CP: CURRent?
Return Parameter:	<NRf+>
Query Example:	PROGram:CP: CURRent?
Return Example:	10.0

(27) PROGram:CP:POWer

Description:	Sets the output power for the CP Tracking Mode.
Syntax:	PROGram:CP: POWer <NRf+>
Parameter:	
Example:	Sets the output power for CP Tracking to 500W. PROGram:CP: POWer 500
Query Syntax:	PROGram:CP: POWer?
Return Parameter:	<NRf+>
Query Example:	PROGram:CP: POWer?
Return Example:	500.0

5.6.2.7 FORM Subsystem

(1) FORM:DATA

Description: Sets the return numeric data format to NR2 or NR3.
Syntax: FORM:DATA <NR2>
FORM:DATA <NR3>
Parameter: <NR2> | <NR3>
Example: FORM:DATA NR2
FORM:DATA NR3
Query Syntax: FORM:DATA?
Return Paramter: <NR2> | <NR3>
Query Example: FORM:DATA?
Return Example: NR2 or NR3

5.6.2.8 SYSTEM Subsystem

(1) SYSTem:ERRor?

Description: Returns the error message and code of the 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 10 circuit boards in it: A, B, C, D, G, I, K, M, N and S.

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

Figure 6-1 shows the system diagram.

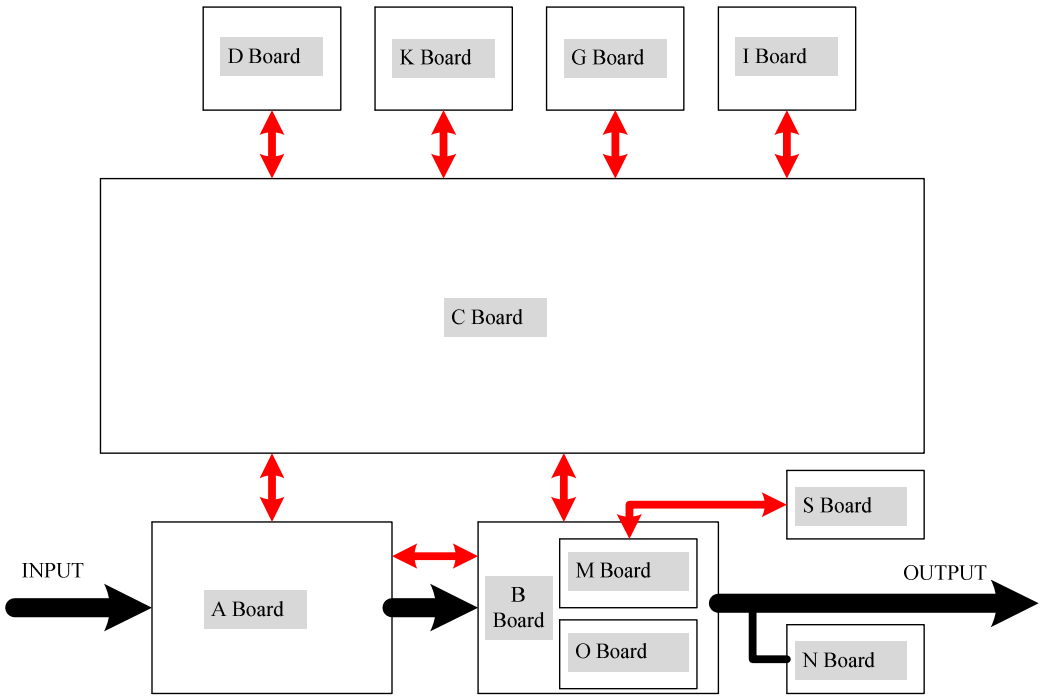


Figure 6-1

Figure 6-2 shows the input stage structure.

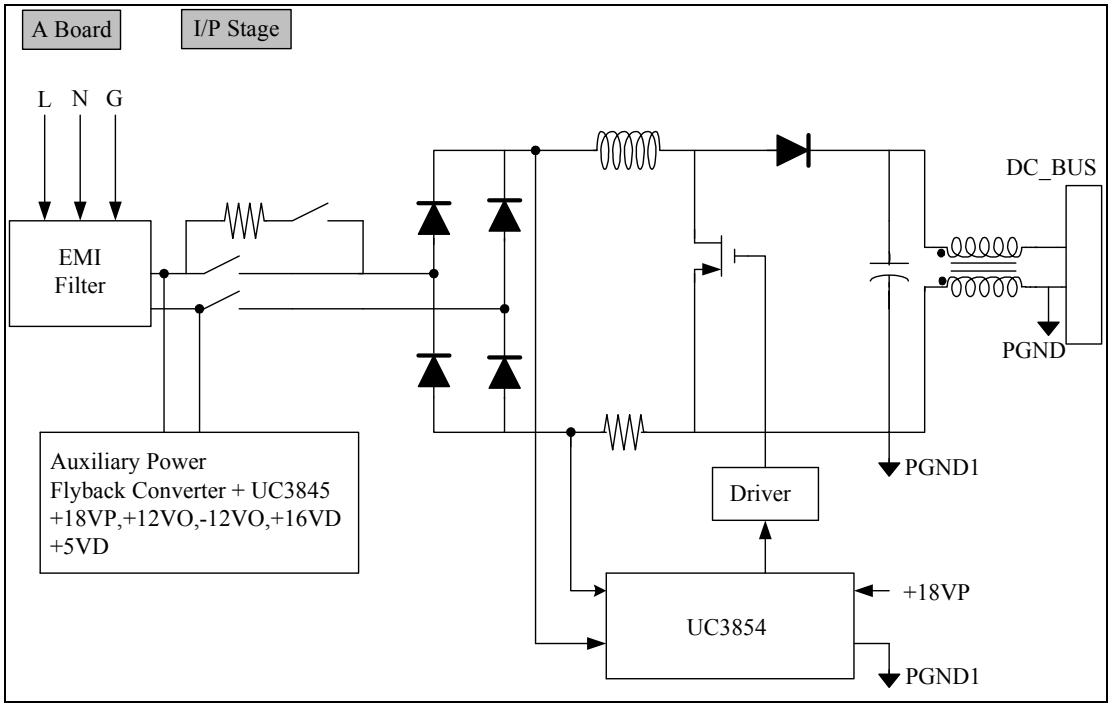


Figure 6-2

Figure 6-3 shows the output stage structure.

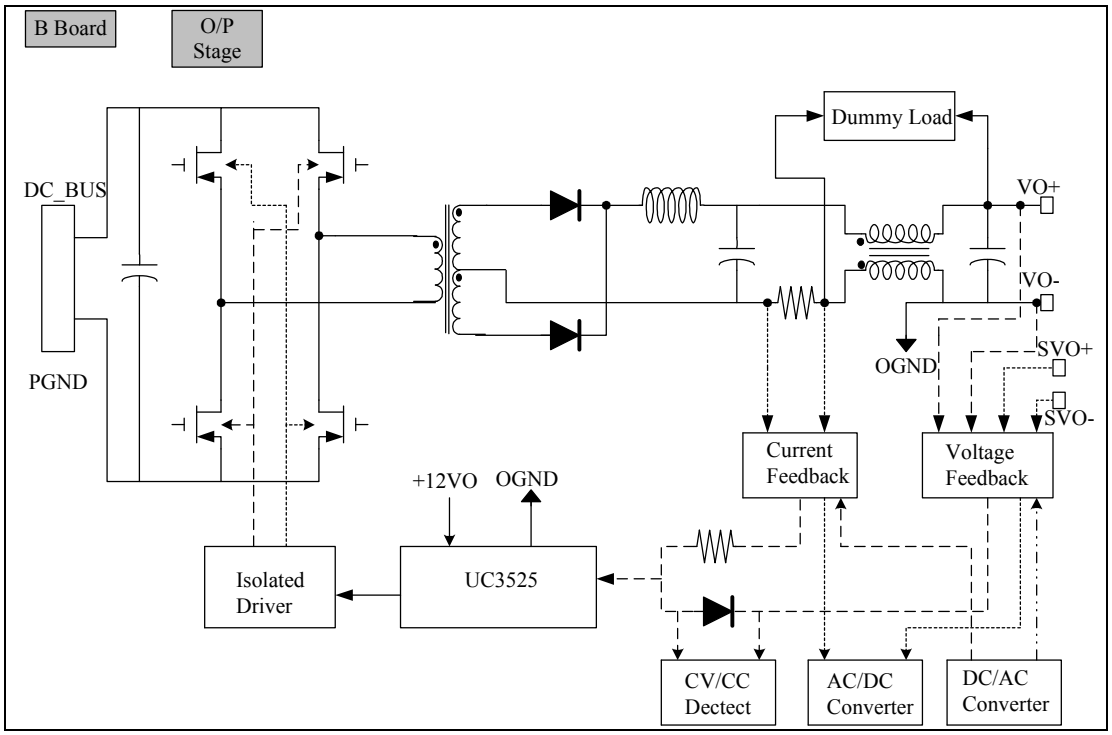


Figure 6-3

Figure 6-4 shows the digital stage structure.

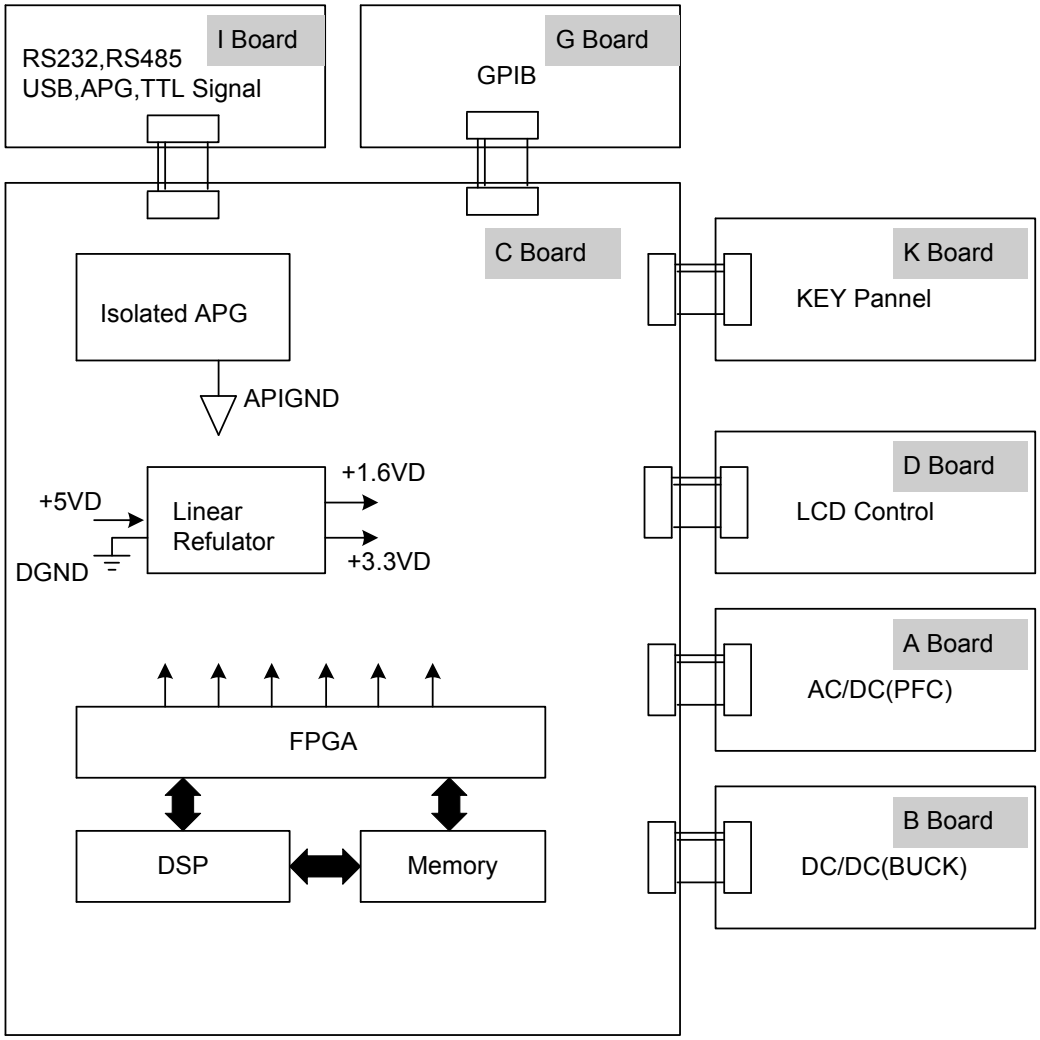


Figure 6-4

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 a Unitrode UCC3854 that is controlled in the average current mode with a 30 KHz switching frequency.
2. The input stage inhibits inrush current by switching the relay to a series of 300-400Ω resistors during power-on to charge the PFC output capacitance. It turns on another relay after a few seconds and bypasses this current limit resistance to enable the UCC3854.
3. The PFC output has over voltage protection. When the output voltage is set to high, it will disable the UCC3854 and send a signal back to the CPU to shut down the system.

6.2.2 Auxiliary Power

1. The input terminal for auxiliary power is the AC source (after the EMI filter but before the PFC relay and fuse) which goes through a bridge rectifier and passes the flyback converter to get the desired output voltage.
2. The auxiliary power output is divided into three types of isolated power: PGND, OGND and DGND, based on their potential. The PGND is input for the PFC and primary side reference potential of the output stage, while OGND is the secondary side reference potential of the output stage and DGND is the reference potential of the digital signal and communication interface.

6.2.3 Output Stage

1. The output stage structure is a full wave bridge that uses a Unitrode UC3525 as the PWM IC and is controlled under voltage mode.
2. There are two output modes -- Constant Voltage (CV Mode) and Constant Current (CC Mode) that switch automatically according to the load state.

   In Constant Voltage mode the following variables control the IC detecting signal:
   (1) Output voltage
   (2) The actual load voltage (through the remote sense) on the output line (the remote sense can be disconnected but the accuracy will decrease).

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

3. The secondary side has two stages of LC filtering to lower ripple voltage and ripple current.
4. The Constant Current Source drives the Dummy load current so the Dummy load current will adjust according to the output voltage. It will act if the programmed voltage is less than the current output voltage. 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

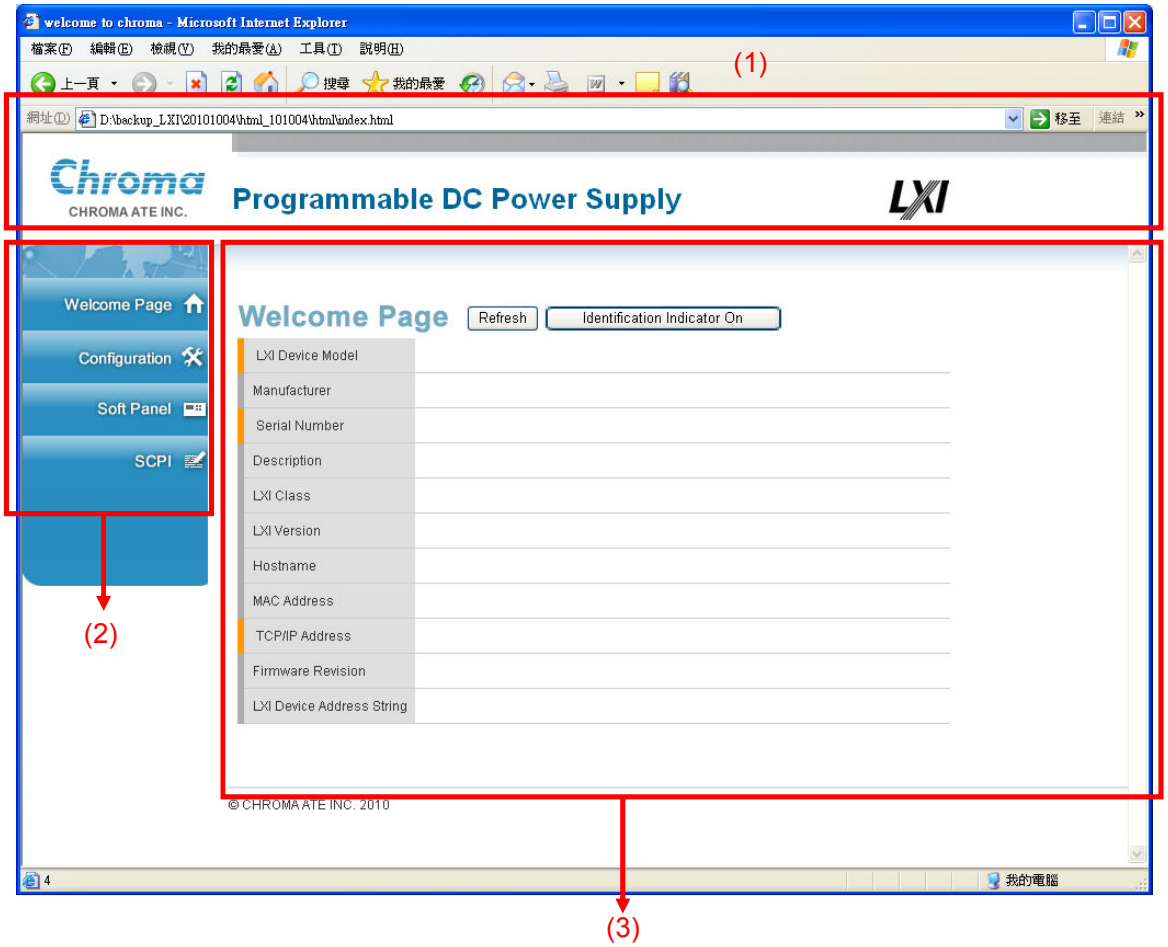
1. The digital circuit control unit is a TI TMS320VC5501PGF300 Fixed-Point Digital Signal Processor with Lattice FPGA (LFXP6C3QN208CES).
2. The power source 3.3V required by the FPGA is derived from +5VD.
3. The DSP source 3.3V and 1.6V power is derived from +5VD.
4. The analog program interface signal and digital circuit are isolated by the +12VD power source by the free-running flyback converter and linear regulator.
5. The TTL output is +5V and the internal digital signal is +3.3V.

7. Introduction to LXI Function

The 62000P complies with the LXI Standard (Rev. 1.3 October 30, 2008 Edition) Class C device but without the additional functions mentioned in section 1.9.1.2.2 of the LXI standard (LXI Trigger Bus, LXI Event Messaging, LXI Clock Synchronization using IEEE 1588, LXI Timestamped Data and LXI Event Logs are not supported.)

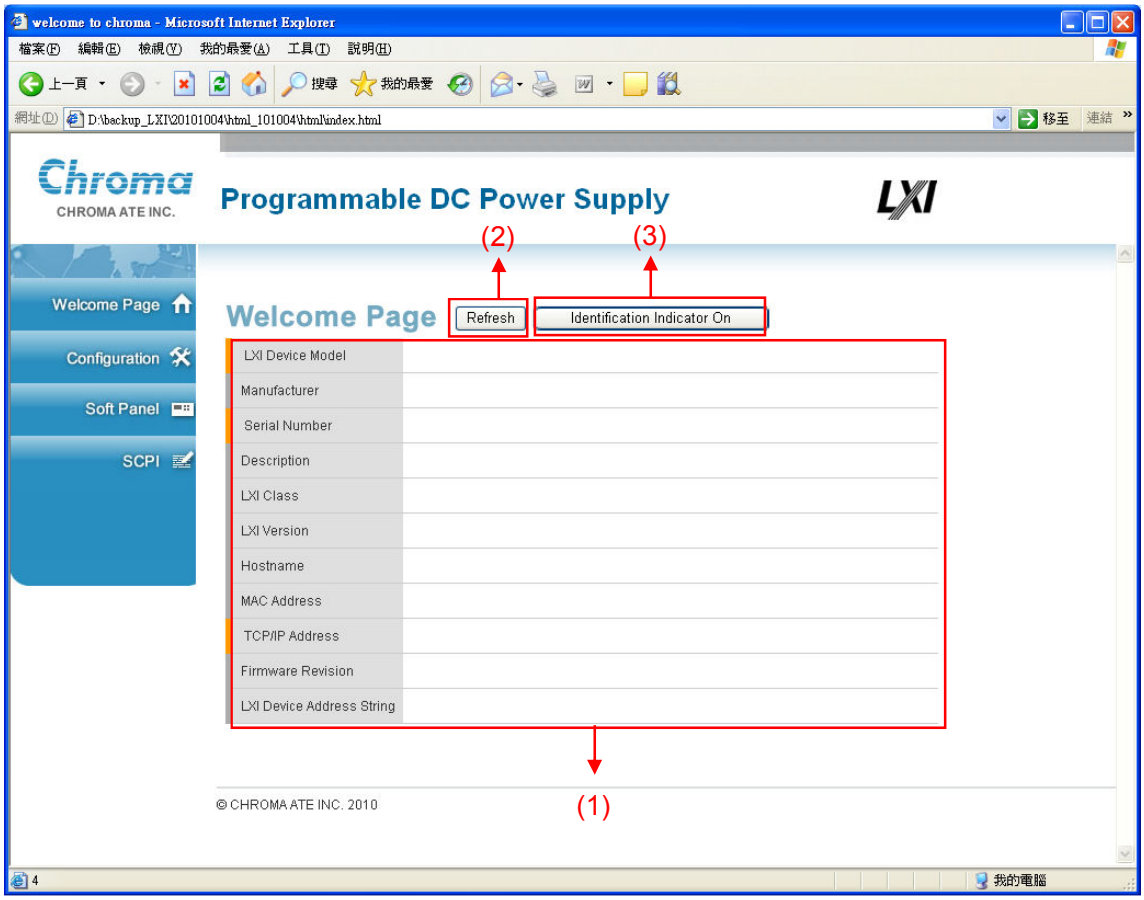
7.1 Using the Web Page

7.1.1 Home Page (index.html)



(1) LOGO display area.
(2) Function page switch area: Allows switching between Welcome, Configuration, Soft Panel and SCPI pages.
(3) Function setting area: Different function buttons and messages are displayed depending on the selected page.

7.1.2 Welcome Page



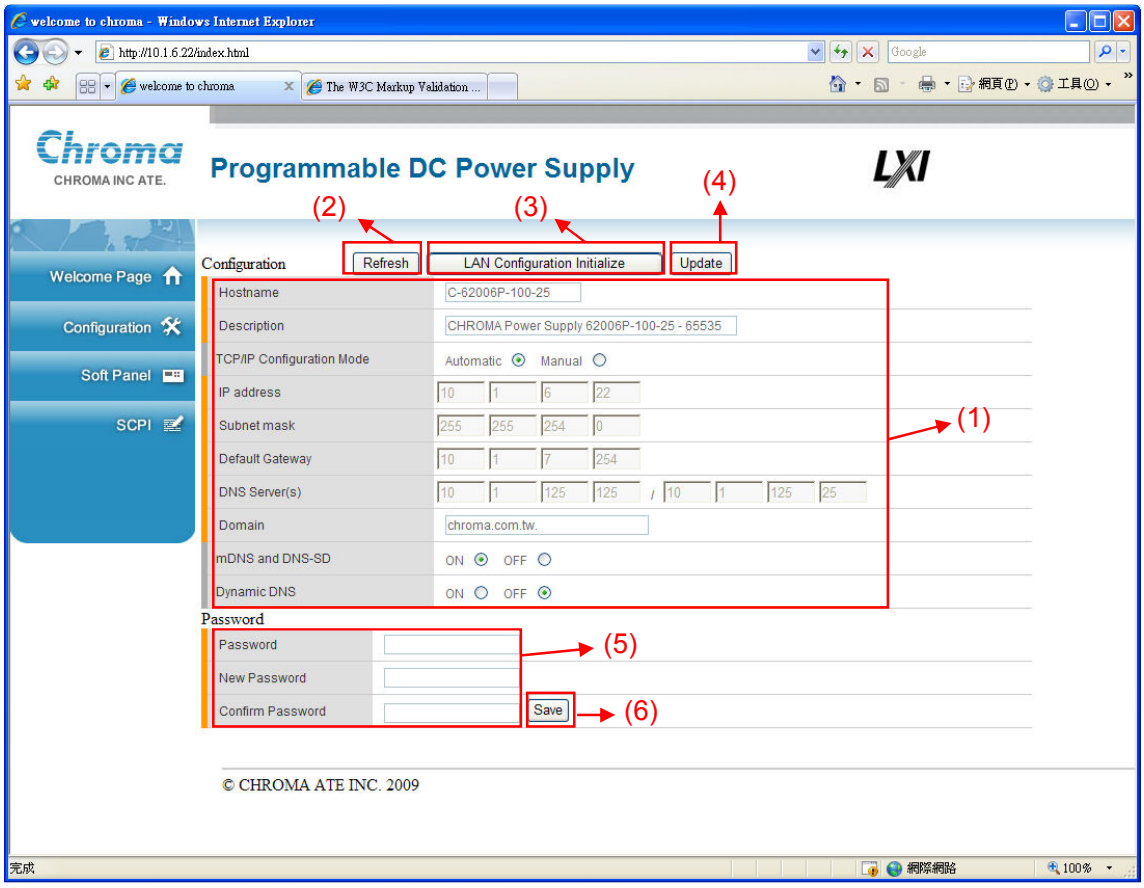
The Welcome Page retrieves the related data and displays them in the message area on the page.

(1) Message area: A read only area to display the message.

(2) Refresh button: Refreshes the page for the related data to display in the message area.

(3) Identification Indicator button: Provides Device Identification. Click **Identification Indicator On** to activate the device identification function (the ETHERNET CONFIG setting page of the Power Supply will show "ID Indicator"). Click **Identification Indicator Off** to disable the device identification function (the "ID Indicator" will disappear in the ETHERNET CONFIG setting page.)

7.1.3 Configuration Page

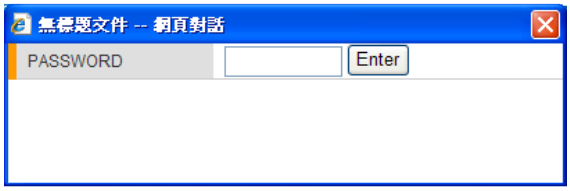


The Configuration page retrieves the current network configuration and displays it in the message area [1].

(1) Message area [1]: Displays the network configuration and provides editing for IP address, Subnet mask, Default Gateway and DNS Server(s) which vary with the TCP/IP Configuration Mode. It is editable when set to Manual and not editable if set to Automatic.

(2) Refresh button: Refreshes the page for the related data to display in the message area [1].

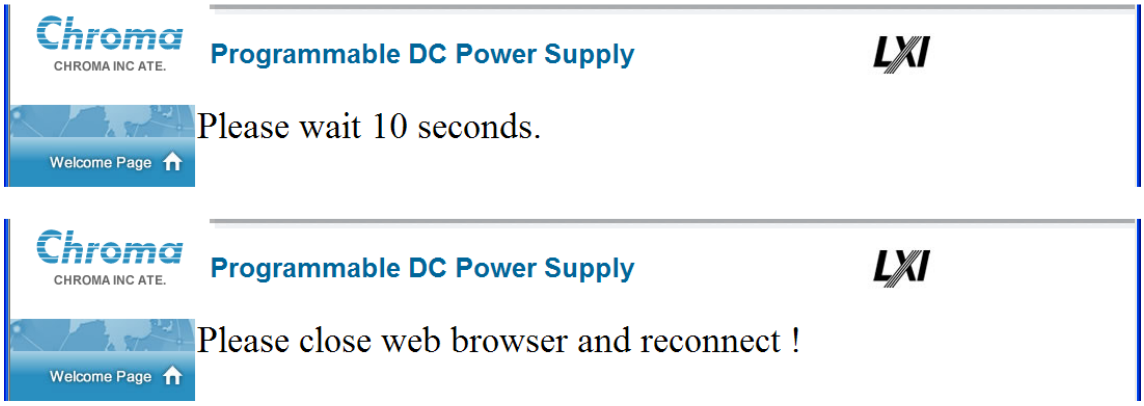
(3) LAN Configuration Initialize button: Initializes the network. The settings will reset to the factory default when doing initialization instead of using the ones set in the message area [1]. A password is required for confirmation before executing this function. (No confirmation is needed if there is no system password.)



A message window will display once the password is entered correctly.

Click **LAN Configuration Initialize** again after the confirmation and then another confirmation window will appear. Click **OK** to start the initialization.

A wait message will appear during initialization. Perform any action messages and wait for 10 seconds to close the web browser and reconnect.



Note When the initialization is done, the system password will be set to blank.

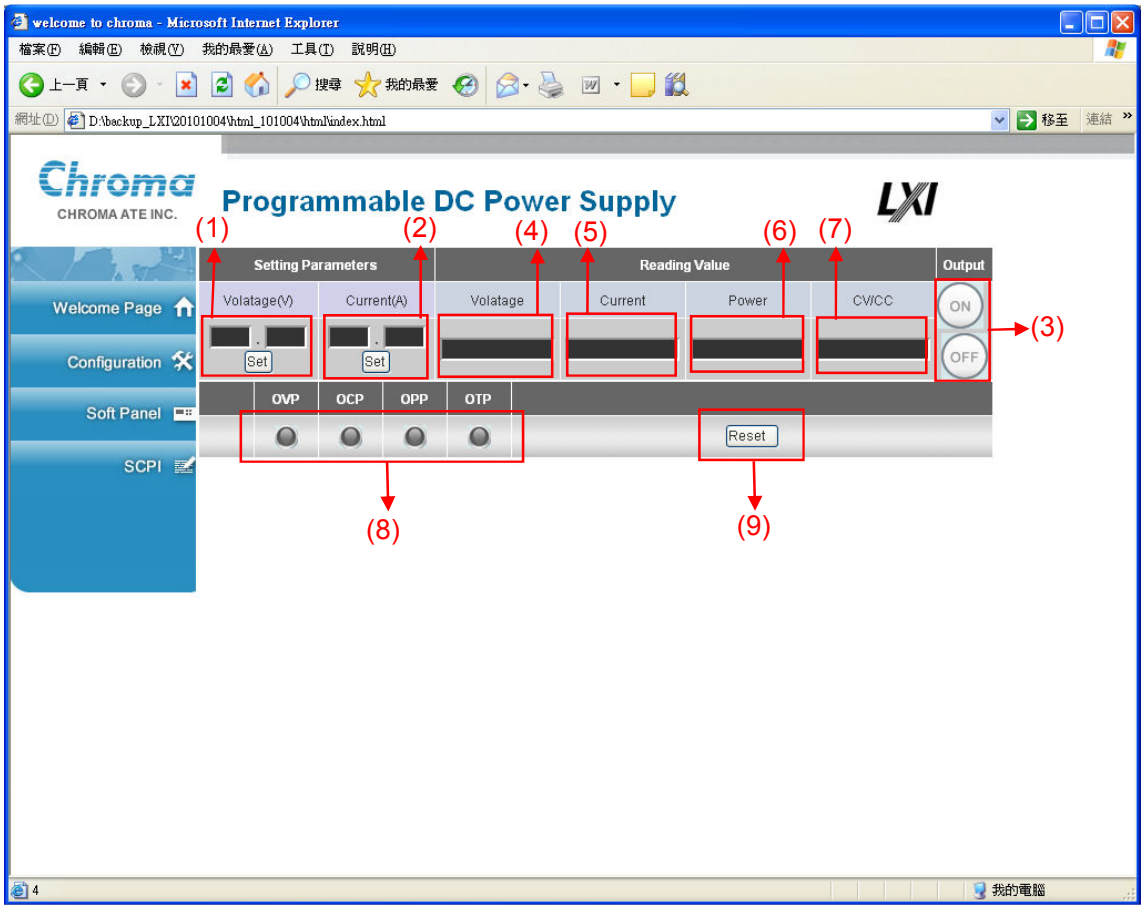
(4) Update button (password required): The execution procedure is similar to the LAN Configuration Initialization, the only difference is that Update uses the contents in the message area [1] to reconfigure the network.

(5) Password change area: Displays the password change related information as listed below:
- ♦ Password
- ♦ New Password
- ♦ Confirm Password

The password contains 0 - 8 characters (blank is also valid) that can be the numeric 0 - 9, English letters A - Z (upper case) or a - z (lower case). The default system password is blank.

(6) Save button: Saves the changed password.

7.1.4 Soft Panel



The Soft Panel simulates the device panel function and provides 7 kinds of command interfaces for executing the device functions. If the system has a password, a window will display requesting it when the execution button is clicked. Once the correct password is entered, click the execution button again to run the function.

Setting Parameters：

(1) Voltage: Sets the voltage.
(2) Current: Sets the current.
(3) Output Mode: Enables or disables the output.

Selections (1) and (2) will automatically read the current settings upon entering the Soft Panel.

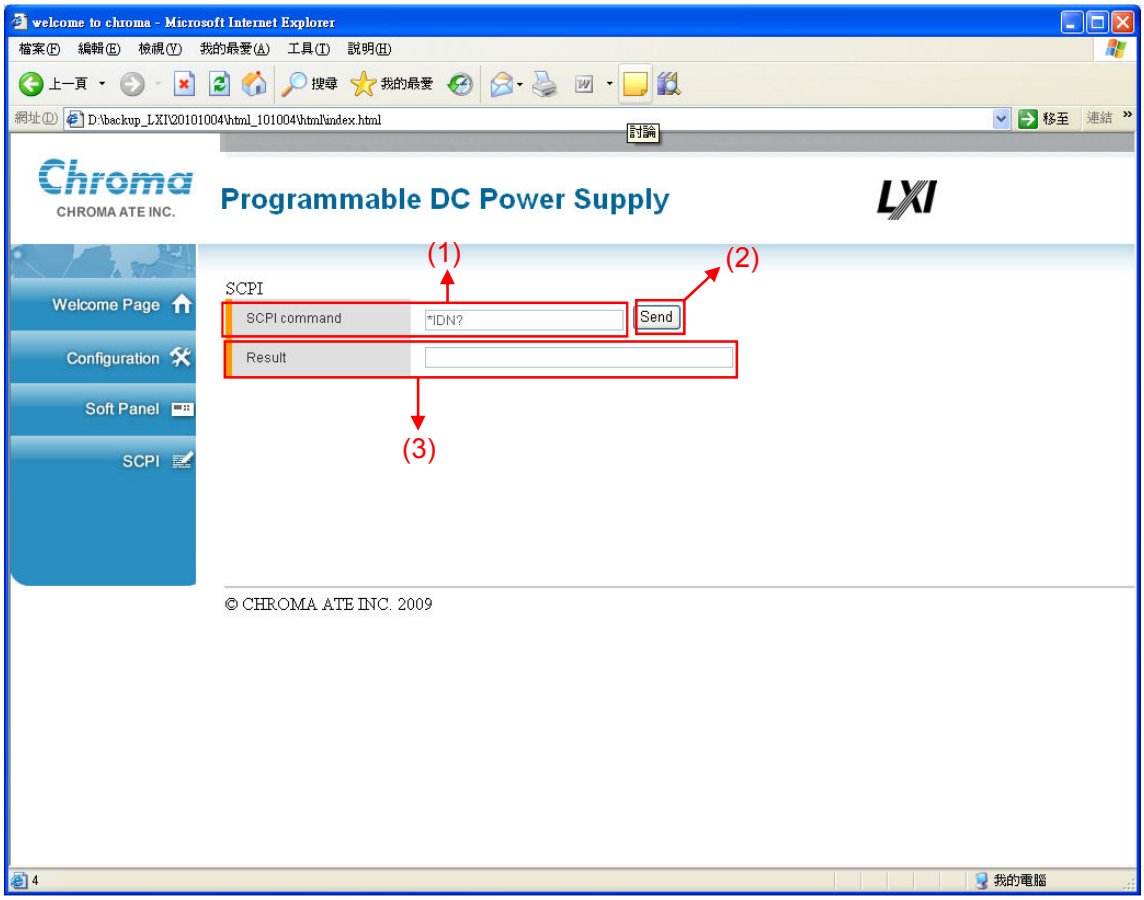
Reading Value：

(4) Voltage: Reads the output voltage of the active device.
(5) Current: Reads the output current of the active device.
(6) Power: Reads the output power of the active device.
(7) CV/CC: Reads the status parameter of the active device.

Selections (4), (5), and (6) will automatically update the output values of the active device every second.

(8) Warning light: The warning light will be ON if an error is encountered.
(9) Reset: Clears the warning light.

7.1.5 SCPI



The SCPI sends the command strings to the device and activates the corresponding function. Refer to the device User's Manual for details of related commands.

(1) SCPI command: The command string input area.

(2) Send (password required): Sends the command strings to the device and activates the corresponding function.

(3) Result: Return message display area. If the command sent to the device has a corresponding return value, it will show in this area.

7.1.6 Notices

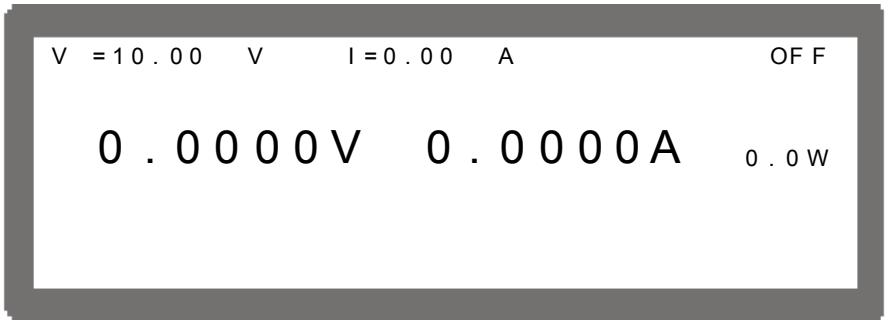
(1) If the system password is blank, there is no need to enter the password.

(2) Once the password is confirmed, functions that are protected by a password no longer require password confirmation until it is reset to a new password or the web page is reloaded.

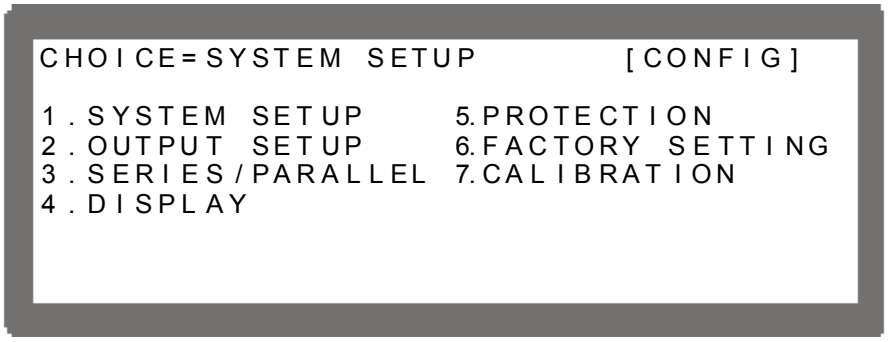
7.2 Quick Operation of LXI on 62000P

7.2.1 ETHERNET SETUP Page

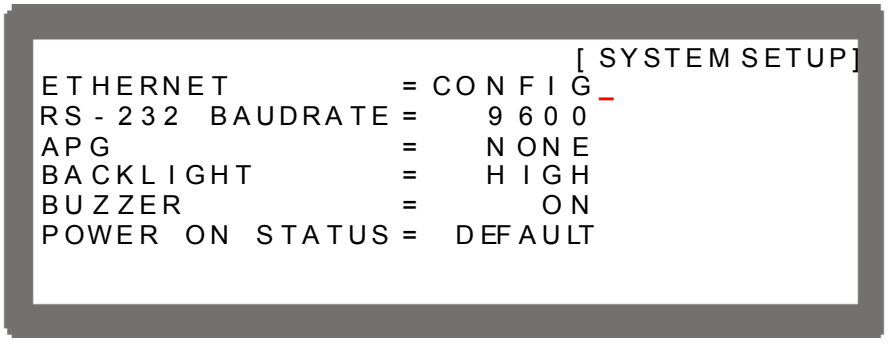
After the 62000P is powered on, wait a few seconds to enter into the main page.



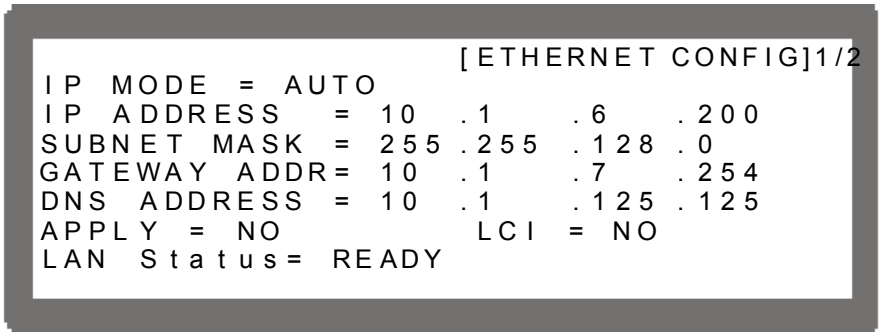
Press **CONFIG** in the main page to go to the CONFIG page.



Select SYSTEM SETUP in CONFIG page and press **ENTER** to go to the SYSTEM SETUP page.



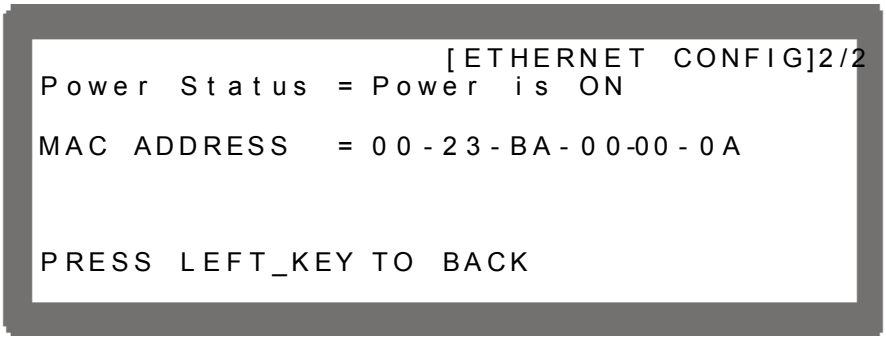
In SYSTEM SETUP page, select ETHERNET = CONFIG and press **ENTER** to go to the ETHERNET CONFIG 1/2 setting page.



Note The ETHERNET configuration, LXI status and network identification features of a single unit are all displayed/operated in this page.

7.2.2 Displaying Power Indicator & MAC Address

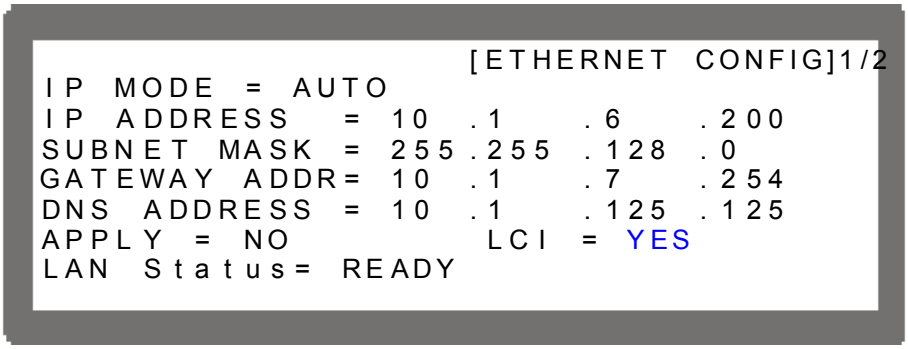
In ETHERNET CONFIG 1/2, continue to press ↓→ to skip each setting to go to ETHERNET CONFIG 2/2 page that displays the Power Status and MAC address.



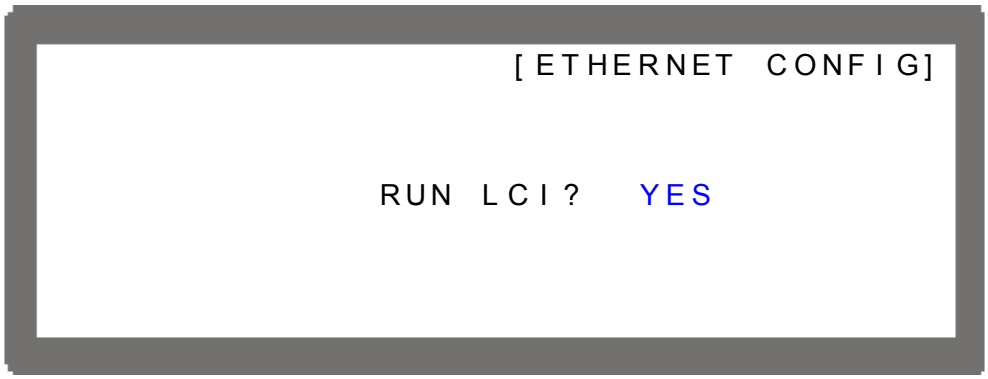
Press ←↑ to return to ETHERNET CONFIG 1/2 page.

7.3 Initializing LAN Configuration (LCI)

In ETHERNET CONFIG 1/2, continue to press ↓→ to LCI and turn the rotary knob to YES, and then press **ENTER**. The screen RUN LCI? will appear again for confirmation.

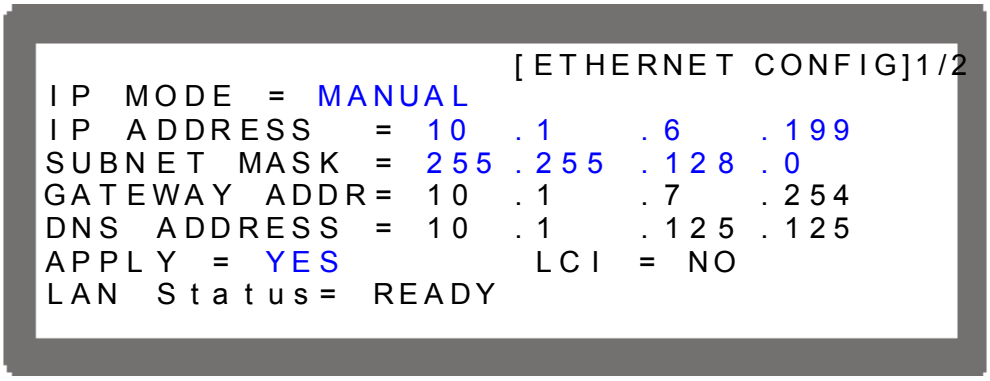


Turn the rotary knob to YES and press **ENTER** to execute the LCI function.



The initialization of the network configuration shows LAN Status = SETTING. Once the initialization is done, it will return to LAN Status = READY.

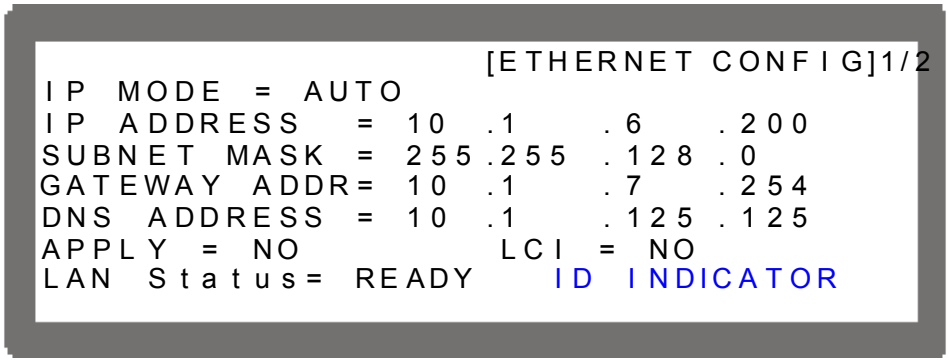
7.3.1 Setting IP



Change the IP settings in ETHERNET CONFIG 1/2. Use the rotary knob to change the value of each item and the ←↑ ↓→ keys to switch the item for modification. (The rest of the network settings will be applied when MANUAL is selected for IP MODE. If IP MODE is set to AUTO, the rest of the network settings are ignored.) Once the modifications are done, go to APPLY and turn the rotary knob to YES, and then press **ENTER** to update the new network configuration. It shows LAN Status = SETTING during the update and returns to LAN Status = READY when the setting is done.

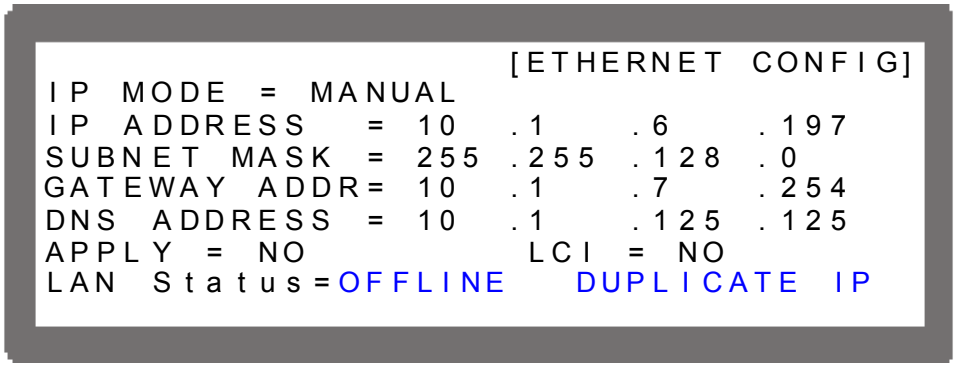
7.3.2 Device Identification Function

If the device identification function on the web page is activated, the lower right corner of the display will show an “ID INDICATOR” message.

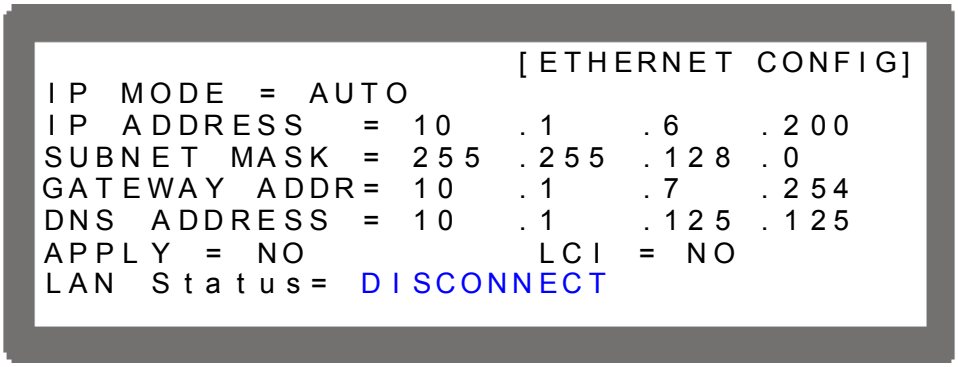


7.3.3 Status Indicator

If a DHCP Lease Renewal error occurs, the lower right corner will show "RENEWAL FAIL."
If a Duplicate IP Address Detected error occurs, the lower right corner will show "DUPLICATE IP."



If an Ethernet Cable Unplugged error occurs, the lower left corner will show "DISCONNECT."
When No Fault (Normal Operation) occurs, the lower left corner will show "READY."



8. Self-Test & Troubleshooting

8.1 Overview

Follow the actions described in this chapter to inspect the instrument and troubleshoot the problem if the 62000P Series DC Power Supply does not operate normally. Consult the sales agent or distributor if the information provided in this manual does not resolve the problem.

8.2 Troubleshooting

Operation problems and suggestions for resolution:

Problem	Cause	Resolution
Bad measurement for V, I	Output swings due to aged components.	Do periodic calibration. See section 3.3.7 Calibration.
Output is not within Accuracy SPEC.	Output swings due to aged components.	Do periodic calibration. 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 a temperature range of 0 - 40°C. 2. Clear the vent.
Over Power Protection (OPP)	The output power exceeds the spec.	Remove the over load or increase the OPP settings.
Over Current Protection (OCP)	The output current exceeds the spec. or OCP settings.	Remove the over load or inicrease 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 unable to reset the protection state.
Input Error Protection 1 AC OFF	The voltage of the AC input line is either too low or too high.	Adjust the voltage if it exceeds the spec. when measuring the input voltage.
Input Error Protection 1 BUS_OVP	1. The DC_BUS feedback is abnormal. 2. The control IC (UC3854) is damaged. 3. The AD power stage is damaged.	Consult local sales agent if 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 unable to reset the protection state.
Over Voltage Protection (OVP)	The output voltage exceeds the spec. or OVP settings.	Check the OVP settings. Consult local sales agent if 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	1. The address of DC Power	1. Update the address.

Problem	Cause	Resolution
Supply via GPIB	Supply is incorrect. 2. The GPIB cable is loose and fallen at rear.	2. Check the cable connection and secure it with screws.

Appendix A APG & System Status Pin Assignment

The 20-pin horizontal socket connector (green) is located on the rear panel.

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 for Program mode; see section 4.1.2.2.
(9) PIN 9: When the voltage level on this pin goes LOW, it inhibits the output of the DC Power Supply. When REMOTE INHIBIT is set to OFF, the pin is invalid. When REMOTE INHIBIT is set to TRIGGER, once a low level triggers it, it equals pressing the "OUTPUT" key to set OUTPUT = OFF. When REMOTE INHIBIT is set to EXT. ON/OFF, once the voltage level goes LOW, it equals pressing the "OUTPUT" key to set OUTPUT = OFF. When the voltage level of this pin goes HIGH the power supply returns to normal output. Figure A-1 shows the actions in detail.
(10) PIN 10: When the DC power supply output is ON and the voltage is over VDC_R, pin10 (DC_ON) will go HIGH. When the DC power supply output voltage is lower than the VDC_F setting, pin10 (DC_ON) will go LOW.
(11) PIN 11: When protection occurs as described in section 3.3.5, this will go LOW.
(12) PIN 12: Bit 0 of TTL signal output; see section 3.3.2.5 for setting.
(13) PIN 13: Bit 1 of TTL signal output; see section 3.3.2.5 for setting.
(14) PIN 14: Bit 2 of TTL signal output; see section 3.3.2.5 for setting.
(15) PIN 15: Bit 3 of TTL signal output; see section 3.3.2.5 for setting.
(16) PIN 16: Bit 4 of TTL signal output; see section 3.3.2.5 for setting.
(17) PIN 17: Bit 5 of TTL signal output; see section 3.3.2.5 for setting.
(18) PIN 18: Bit 6 of TTL signal output; see section 3.3.2.5 for setting.
(19) PIN 19: Bit 7 of TTL signal output; see section 3.3.2.5 for setting.
(20) PIN 20: Ground of TTL (digital) signal.

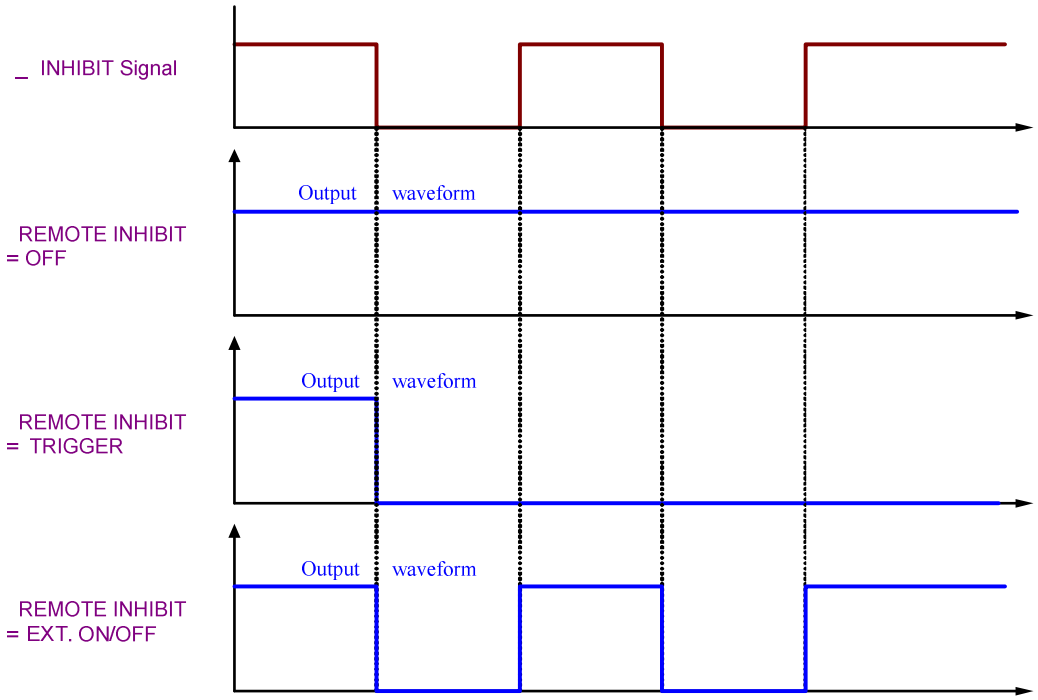
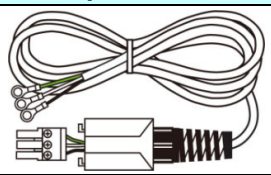
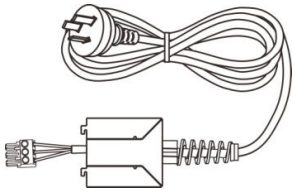
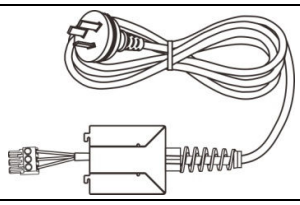
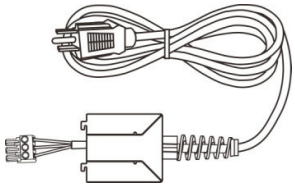
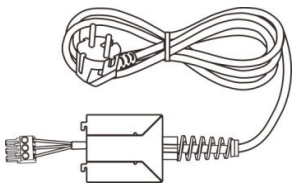
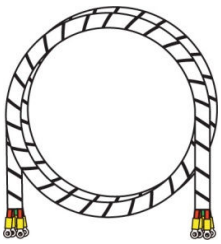


Figure A-1 Detailed Actions of PIN9

Appendix B List of Protections

Protection	Message on Panel	Protection	Message on Panel
Over voltage	OVP	Abnormal input voltage	AC FAULT
Over current	OCP	Input stage over voltage	BUS_OVP
Over power	OPP	Remote sense reversed	SENSE FAULT
Over temperature	OTP	CV TO CC mode change	CV TO CC FOLDBACK
Fan fail	FANLOCK	CC TO CV mode change	CC TO CV FOLDBACK
Series Fault	SERIES FAULT		

Appendix C Input Cable Selection Table

Item	Input Cable	Type &Spec.	Applicable Models	Applicable Area
1		Terminal type 20A	62006P-XX-XX, 62012P-XX-XX, 62024P-XX-XX	All
2		SL-16 250Vac/10A	62006P-XX-XX, 62012P-XX-XX	China
3		WS-015D 250Vac/16A	62024P-XX-XX	China
4		AL-201 125Vac/15A	62006P-XX-XX, 62012P-XX-XX	Taiwan, Japan, USA
5		AL-301 250Vac/16A	62006P-XX-XX, 62012P-XX-XX, 62024P-XX-XX	Netherlands, Germany, France
6		Terminal type 20A	62050P-100-100	All

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