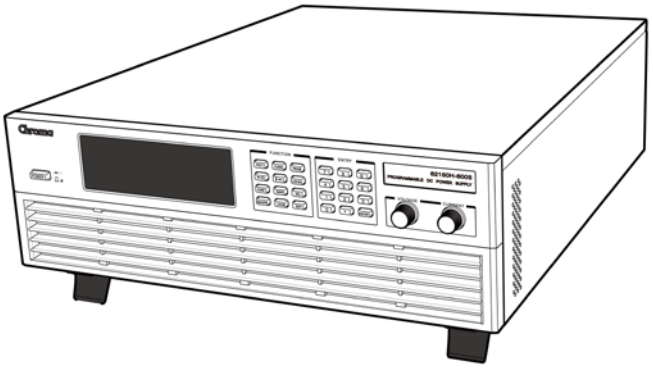
Chroma

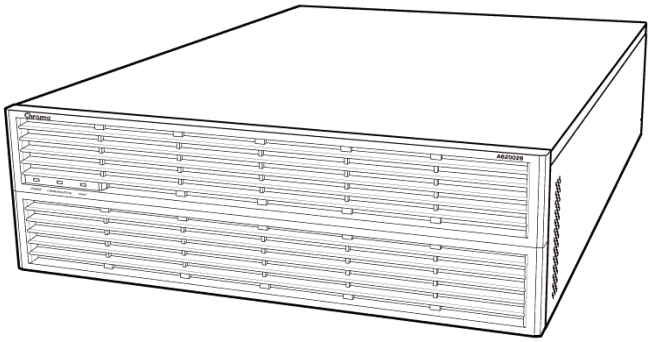
Programmable DC Power Supply (with Solar Array Simulation)

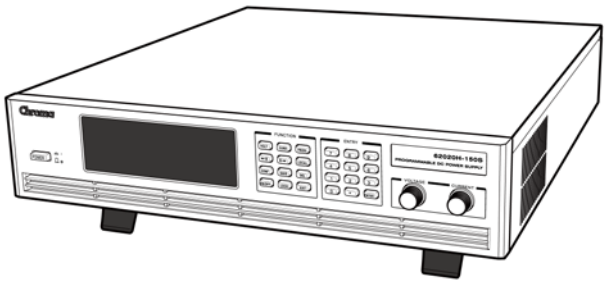
62000H Series

Operating & Programming Manual

Programmable DC Power Supply (with Solar Array Simulation) 62000H Series Operating & Programming Manual







Version 1.9
August 2017

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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Material Contents Declaration

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

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

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

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

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

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

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

Disposal

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

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Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62150H-600S, 62100H-600S, 62050H-600S, 62150H-600, 62100H-600, 62050H-600, A620027 (for 200-220V input)

(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 61326-1:2013(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

EN 61010-1:2010

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	**2016.05.17**	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)

62150H-600S, 62100H-600S, 62050H-600S, A620027 (for 380-400V input)

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

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T&M BU Vice President

(Position/Title)

Taiwan	**2016.05.17**	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)

62150H-600S, 62100H-600S, 62050H-600S, 62150H-600, 62100H-600, 62050H-600, A620027 (for 440-480V input)

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

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IEC 61326-1:2012 and EN 61326-1:2013

EN 55011:2009+A1:2010 Group 1 Class A, IEC 61000-3-12:2011, IEC 61000-3-11:2000, 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

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(Place)	(Date)	(Legal Signature)

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Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62150H-1000S, 62150H-1000, 62100H-1000, A620028 (for 200-220V input)

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

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EN 61326-1:2013 Class A

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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Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62150H-1000S, 62150H-1000, 62100H-1000, A620028 (for 380-400V input)

(Model Designation)

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EN 61326-1:2013 Class A, EN 61326-2-1:2013

EN 55011:2009+A1:2010 Group 1 Class A

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 61000-4-6:2009, EN 61000-4-8:2010, EN 61000-4-11:2004

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Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62150H-1000S, 62150H-1000, 62100H-1000, A620028 (for 440-480V input)

(Model Designation)

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EN 61326-1:2013, EN 61326-2-2:2013

CISPR 11:2009+A1:2010, Group 1,Class A, EN 61000-3-12:2011, EN 61000-3-11:2000,

IEC 61000-4-2:2008 ED 2.0, IEC 61000-4-3:2010 ED 3.2, IEC 61000-4-4:2012 ED 3.0,

IEC 61000-4-5:2005 ED 2.0, IEC 61000-4-6:2013 ED 4.0, IEC 61000-4-8:2009 ED 2.0,

IEC 61000-4-11:2004 ED 2.0

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Declaration of Conformity

For the following equipment :

Programmable DC Power Supply

(Product Name/ Trade Name)

62020H-150S

(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

EN 55011:2009+A1:2010 Class A, EN 61000-3-2:2006/A1:2009 and /A2:2009,

EN 61000-3-3:2008, IEC 61000-4-2:2008, IEC 61000-4-3:2006/A1:2007/A2:2010,

IEC 61000-4-4:2004/A1:2010, IEC 61000-4-5:2005, IEC 61000-4-6:2008,

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(Name, Surname)

T&M BU Vice President

(Position/Title)

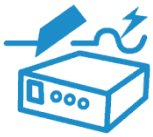
Taiwan	**2016.05.17**	Vincent Wu.
(Place)	(Date)	(Legal Signature)

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

Safety Symbols

	**DANGER –** High voltage.
	**Explanation:** To avoid injury, death of personnel, or damage to the instrument, 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:** Identifies 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:** Identifies 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
May 2010	1.0	Complete this manual.
Aug. 2010	1.1	Modify the following sections to add new model 62150H-1000S and I-V Curve Programming function: – "*Specifications*" and "*Other Specifications*" as well as Notes in the chapter of "*Overview*" – "*Specification of Parallel Capacitance* " in the chapter of "*Installation*" – "*Setting Configuration* " and "*SERIES/PARALLEL* " in the chapter of "*Manual Operation*" Add the following: – Suggested O type terminal specification in the section of "*Input Connection*" under "*Installation*" – "*SAS Subsystem*" in the chapter of "*Remote Operation*" Update the following: – "*TABLE MODE*" and "*SAS MODE*" section in the chapter of "*Manual Operation*" – "*IV Subsystem*" in the chapter of "*Remote Operation*"
Apr. 2011	1.2	Add the following in the chapter of "*Overview*" & "*Remote Operation*": – Specification of model 62050H-600S – Two reference figures in the "*CAUTION*" under Specification – TRIG command to "*SAS Subsystem*" Update the following in the chapter of "*Overview*": – Specification of 62150H-1000S – The figure of front panel of 62000H with Solar Array Simulation and main power switch
Nov. 2011	1.3	Add A620028 and A620027 SLAVE models in the manual.
Aug. 2012	1.4	Update the following: – Description in "*Specification*" section – Value of minimum output voltage in "*Other Specifications*" section – Notice in "*Checking the Package*" section – Notice in "*SERIES/PARALLEL*" section – Notice in "*Assembling Series/Parallel Communication Interface*" section Add "*D/D FAULT Protection*" section in the chapter of "*Manual Operation*"
Oct. 2013	1.5	Add the following functions (only applicable when the firmware is upgraded to 2.00): – "*CURR. SHARING ERR Protection*", "*FPGA UPDATE! Protection*", "*C/S CABLE ERR. Protection*", "*MATCH Warning*", "*RS485 PARSER*", "*EN50530 MODE*" and "*SANDIA_ MODE"* sections in the chapter of "*Manual Operation*" – "*EN50530 MODE*" and "*SANDIA_ MODE*" description in the section of "*SAS Subsystem*"
Jul. 2014	1.6	Add Model 62020H-150S along with its specifications and usage descriptions in the manual.
Mar. 2015	1.7	Update the following: – The figure of rear panel. – The output connecting cables diagram for Model 62020H-150S.

Oct. 2016	1.8	Update CE “*Declaration of Conformity*”.
Aug. 2017	1.9	Revised text throughout the manual.

Table of Contents

1. Overview

1.1 Introduction

Chroma 62000H Series Programmable DC Power Supplies with Solar Array Simulation are high power density power supplies that provide stable DC output and accurate measurement of voltage and current.

62000H Series DC Power Supplies with Solar Array Simulation have the following features:

(1) The output can simulate the I-V curve of a solar panel module in the Programming Mode.
(2) Voltage mode with two control loops to provide a stable, quick response output.
(3) The ability to set the slew rates of the output voltage and current.
(4) High power density output; the maximum output power can be as high as 15kW in a unit under 3U in height.
(5) 16-bit ADC/16-bit DAC to provide excellent resolution.
(6) Lower transient spike and transient response time to insure the unit under test receives a stable output and protection under load variations.
(7) Editing mode (Programming Mode) for output waveforms to provide multiple output voltage and current combinations in real time for extended time period tests.
(8) Rotary knob and keyboard controls on the front panel to set the output voltage and current.
(9) VFD panel: a high brightness, wide viewing angle interface for monitoring and setting functions.
(10) Remote control via GPIB/Ethernet (option), USB, RS-232/RS-485, or Analog Programmable (APG) interface.

1.2 System Functions

1.2.1 Operating Modes

(1) Local operation using the keyboard and rotary knob on the front panel.
(2) Remote operation using a GPIB/Ethernet (option), USB or RS-232/RS-485 interface.
(3) Through the APG input to control the output using analog signals.
(4) The setting and editing of I-V curves is provided by the Solar Array Simulation Soft Panel.

1.2.2 Protection

(1) Protection is provided for voltage phase loss, input over-voltage or under-voltage, output over-voltage, over-current, over-power, over-temperature, fan fail, CV/CC foldback, etc.
(2) Fan speed is controlled by the internal temperature of the power supply.

1.2.3 Output/Indication

(1) Auxiliary power output (12Vdc/10mA).
(2) 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.
(3) Output indicator (DC ON) signal.
(4) Protection state indication (OVP/OCP/OPP /FAN LOCK/AC FAULT, etc.).
(5) Over temperature (OTP) protection signal.
(6) CV/CC status indicators.
(7) Output status indicators.

1.2.4 Input Control Signals

(1) Remote sense input for voltage drop compensation.
(2) Analog reference voltage (APG) input allowing voltage and current to be set by a voltage source, current source, or resistance that adjusts for the panel setting.
(3) Remote inhibit control signal (TTL)

1.2.5 Measuring & Editing

(1) Measurements for voltage, current and power.
(2) 10 programs and 100 sequences to define voltage/current output waveforms.
(3) One run time voltage program that can be set for up to 99 hours.
(4) 10 programs and 100 sequences to define I-V curve output waveforms.

1.3 Specifications

Chroma 62000H Series High Power Density DC Power Supplies with Solar Array Simulation offer 2KW (62020H), 5KW (62050H), 10KW (62100H) and 15KW (62150H) models based on the output power and the power supply of each model. Table 1-1 lists the output specifications of the 62000H Series 2KW, 5KW, 10KW and 15KW DC Power Supplies with Solar Array Simulation. Warm up the instrument for at least 10 minutes before performing any test items. The maximum DC Power Supply output voltage must be 5% less than full-scale. All specifications are tested using Chroma's standard test procedures at 25 ± 5°C, on a remote sense connection with a resistive load, unless specified otherwise.

Table 1-1 62000H Series with Solar Array Simulation Operating Specifications

Model	62020H-150S	62050H-600S	62100H-600S	62150H-600S
Output Ratings				
Output Voltage[1]	**0-150V**	**0-600V**	**0-600V**	**0-600V**
Output Current[2]	**0-40A**	**0-8.5A**	**0-17A**	**0-25A**
Output Power	**2000W**	**5000W**	**10000W**	**15000W**
Voltage Measurement				
Range[3]	**60V / 150V**	**120V / 600V**	**120V / 600V**	**120V / 600V**
Accuracy	**0.05% + 0.05%F.S**	**0.05% + 0.05%F.S.**	**0.05% + 0.05%F.S.**	**0.05% + 0.05%F.S.**
Current Measurement				
Range[3]	**16A / 40A**	**3.4A / 8.5A**	**6.8A / 17A**	**10A / 25A**
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.**
Output Noise & Ripple				
Voltage Noise(P-P)[4]	**450 mV**	**1500 mV**	**1500 mV**	**1500 mV**
Voltage Ripple(rms)	**65 mV**	**650 mV**	**650 mV**	**650 mV**
Current Ripple(rms)[5]	**80 mA**	**150 mA**	**300 mA**	**450 mA**
Programming Response Time				
Rise Time: 50%F.S. CC Load	**10ms (6.66A loading)**	**30 ms**	**30 ms**	**30 ms**
Rise Time: No Load	**10ms**	**30 ms**	**30 ms**	**30 ms**
Fall Time: 50%F.S. CC Load	**10ms (6.66A loading)**	**30 ms**	**30 ms**	**30 ms**
Fall Time: 10%F.S. CC Load	**83ms (1.33A loading)**	**100 ms**	**100 ms**	**100 ms**
Fall Time:No Load	**300ms**	**1.2 s**	**1.2 s**	**1.2 s**
Slew Rate Control				
Voltage slew rate range[6]	**0.001V/ms - 15V/ms**	**0.001V/ms – 20V/ms**	**0.001V/ms – 20V/ms**	**0.001V/ms – 20V/ms**
Current slew rate range[7]	**0.001A/ms - 1A/ms, or INF**	**0.001A– 0.1A/ms or INF**	**0.001A– 0.1A/ms or INF**	**0.001A– 0.1A/ms or INF**
Minimum transition time	**0.5ms**	**0.5 ms**	**0.5 ms**	**0.5 ms**

Model	62150H-1000S	A620027 Slave Unit (15kW)	A620028 Slave Unit (15kW)
Output Ratings			
Output Voltage[1]	0-1000V	0-600V	0-1000V
Output Current [2]	0-15A	0-25A	0-15A
Output Power	15000W	15000W	15000W
Voltage Measurement			
Range[3]	200V / 1000V	120V / 600V	200V / 1000V
Accuracy	0.05% + 0.05%F.S.	0.05% + 0.05%F.S.	0.05% + 0.05%F.S.
Current Measurement			
Range[3]	6A / 15A	10A / 25A	6A / 15A
Accuracy	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.	0.1% + 0.1%F.S.
Output Noise & Ripple			
Voltage Noise(P-P)[4]	2550 mV	1500 mV	2550 mV
Voltage Ripple(rms)	1950 mV	650 mV	1950 mV
Current Ripple(rms)[5]	270mA	450mA	270mA
Programming Response Time			
Rise Time: 50%F.S. CC Load	25 ms	30ms	25ms
Rise Time: No Load	25 ms	30ms	25ms
Fall Time: 50%F.S. CC Load	25 ms	30ms	25ms
Fall Time: 10%F.S. CC Load	80 ms	100ms	80ms
Fall Time: No Load	3 s	1.2s	3s
Slew Rate Control			
Voltage slew rate range[6]	0.001V/ms – 40V/ms	0.001V/ms - 20V/ms	0.001V/ms - 40V/ms
Current slew rate range[7]	0.001A – 0.1A/ms or INF	0.001A/ms - 0.1A/ms, or INF	0.001A/ms - 0.1A/ms, or INF
Minimum transition time	0.5 ms	0.5ms	0.5ms

1.3.1 Other Specifications

Table 1-2 lists the other specifications of the 62000H. Table 1-3 lists the other specifications of the A620027 & A620028 models.

Table 1-2 62000H with Solar Array Simulation Other Specifications (without the A620027 & A620028 models)

Model	**62000H Series with Solar Array Simulation**	
Line Regulation[8]		
Voltage	+/- 0.01% F.S.	
Current	+/- 0.05% F.S.	
Load Regulation[9]		
Voltage	+/- 0.05% F.S.	
Current	+/- 0.1% F.S.	
OVP Adjustment Range		
Range	0-110% programmable from front panel, remote digital inputs.	
Accuracy	+/- 1% of full-scale output	
Efficiency [10]	0.87(Typical) / 0.77(Typical) for 62020H-150S	
Drift (30 minutes) [11]		
Voltage	0.04% of Vmax	
Current	0.06% of Imax	
Drift (8 hours) [12]		
Voltage	0.02% of Vmax	
Current	0.04% of Imax	
Temperature Coefficient[13]		
Voltage	0.04% of Vmax/^{0}C	
Current	0.06% of Imax/^{0}C	
Transient Response Time[14]	Recovers within 1ms to +/- 0.75% of steady-state output for a 50% to 100% or 100% to 50% load change(1A/us)	
Programming & Measurement Resolution	62000H-600S / 62020H-150S	62000H-1000S
Voltage (Front Panel)	10 mV	100mV
Current (Front Panel)	1 mA	1mA
Voltage (Digital Interface)	0.002% of Vmax	
Current (Digital Interface)	0.002% of Imax	
Voltage (Analog Interface)	0.04% of Vmax	
Current (Analog Interface)	0.04% of Imax	
Remote Interface		
Analog programming	Standard with Isolated	
USB	Standard	
RS232	Standard	
RS485	Standard	
GPIB[15]	Optional	
Ethernet[15]	Optional	
System bus(CAN)	Standard for master/slave control	
Programming Accuracy		
Voltage (Front Panel and Digital Interface)	0.1% of Vmax (Voltage scale: 150V) 0.1%+25mV (Voltage scale: 60V) for 62020H-150S	
Current (Front Panel and Digital Interface)	0.3% of Imax (Current scale : 16A / 40A) for 62020H-150S	
Voltage (Analog Interface)	0.2% of Vmax	
Current (Analog Interface)	0.3% of Imax	
GPIB Command Response Time		
Vout setting	GPIB send command to DC source receiver <20ms	

?Volt, ? Current	Under GPIB command using Measure <25ms
Analog Interface (I/O)	
Voltage and Current Programming inputs (I/P)	0-10Vdc / 0-5Vdc / 0-5k ohm / 4-20 mA of F.S.
Voltage and Current monitor output (O/P)	0-10Vdc / 0-5Vdc / 4-20mA of F.S.
External ON/OFF (I/P)	TTL: Active Low or High (Selective)
DC_ON Signal (O/P)	Level by user define (Time delay= 1ms at voltage slew rate of 10V/ms.)
CV or CC mode Indicator (O/P)	TTL Level High=CV mode; TTL Level Low=CC mode
OTP Indicator (O/P)	TTL: Active Low
System Fault indicator (O/P)	TTL: Active Low
Auxiliary power supply (O/P)	Nominal supply voltage : 12Vdc / Maximum current sink capability: 10mA
Safety interlock (I/P)	Time accuracy: <100ms
Remote inhibit (I/P)	TTL: Active Low
Analog Interface Accuracy	
Measurement	
Voltage	0.5% of F.S.
Current	0.75% of F.S.
Series & Parallel Operation[16]	Master / Slave control via CAN for 10 units up to 150KW. (Series: two units / Parallel: ten units)
	Master / Slave control via CAN for 10 units up to 20KW. (Series: two units / Parallel: ten units) for 62020H-150S
Auto Sequencing (List mode)	
Number of program	10
Number of sequence	100
Dwell time Range	5ms – 15,000s
Trig. Source	Manual / Auto / External
Auto Sequencing (Step mode)	
Start voltage	0 to Full scale
End voltage	0 to Full scale
Run time	hh : mm : ss.ss (00 : 00 : 00.01 to 99 : 59 : 59.99)
Trig. Source	Auto
Auto Sequencing (I-V program)	
Number of program	10
Number of sequence	100
Dwell time Range	1s – 15,000s
Trig. Source	Manual / Auto
Input Specification	
AC input voltage 3phase , 3 wire + ground[17]	200/220 Vac (operating range 180 -242 Vac) 380/400 Vac (operating range 342 - 440 Vac) 440/480 Vac (operating range 396 - 528 Vac)
AC input voltage Single Phase	200/240VAC +/- 10% for 62020H-150S

AC frequency range	47-63 Hz	
Power factor	62020H: 0.95	(200/240Vac)
	62050H: 0.5	(200/220Vac)
		(380/400Vac)
		(440/480Vac)
	62100H: 0.55	(200/220Vac)
		(380/400Vac)
		(440/480Vac)
	62150H : 0.6	(200/220Vac)
		(380/400Vac)
		(440/480Vac)
General Specification		
Maximum Remote Sense Line Drop Compensation	2% of full scale voltage per line (4% total)	
Weight	62020H : Approx. 17 kg / 37.44 lbs 62050H : Approx. 23 kg / 50.70 lbs 62100H : Approx. 29 kg / 63.88 lbs 62150H : Approx. 35 kg / 77.09 lbs	
Dimensions (HxWxD) mm[18]	132.8 x 428 x 610 mm / 5.23 x 16.85 x 24.02 inch	
	89 mm x 428 mm x 465 mm / 3.5 x 16.85 x 16.73 inch for 62020H-150S	
Operating Temperature Range	0°C - 40°C	
Storage Temperature Rage	-40°C to +85°C	
Approval	CE	

Table 1-3 A620027/A620028 Slave Other Specifications

Model	**A620027/A620028 Slave Unit (15kW)**
Line Regulation[8]	
Voltage	+/- 0.01% F.S.
Current	+/- 0.05% F.S.
Load Regulation[9]	
Voltage	+/- 0.05% F.S.
Current	+/- 0.1% F.S.
OVP Adjustment Range	
Range	0-110% programmable from front panel, remote digital inputs
Accuracy	+/- 1% of full-scale output
Efficiency [10]	0.87(Typical)
Drift (30 minutes) [11]	
Voltage	0.04% of Vmax
Current	0.06% of Imax
Drift (8 hours) [12]	
Voltage	0.02% of Vmax
Current	0.04% of Imax
Temperature Coefficient[13]	
Voltage	0.04% of Vmax/^{0}C
Current	0.06% of Imax/^{0}C
Transient Response Time[14]	Recovers within 1ms to +/- 0.75% of steady-state output for a 50% to 100% or 100% to 50% load change(1A/us)
Remote Interface	

System bus (CAN)	Standard
Input Specification	
AC input voltage 3phase , 3 wire + ground[17]	200/220 Vac (operating range 180 -242 Vac) 380/400 Vac (operating range 342 - 440 Vac) 440/480 Vac (operating range 396 - 528 Vac) * *Call for Availability
AC frequency range	47-63 Hz
Power factor	0.6 (200/220Vac) 0.6 (380/400Vac) 0.6 (440/480Vac)
General Specification	
Maximum Remote Sense Line Drop Compensation	2% of full scale voltage per line (4% total)
Weight	< 35 kg / 77.16 lbs.
Dimensions (HxWxD) mm[18]	132.8 x 428 x 610 mm / 5.23 x 16.85 x 24.02 inch
Operating Temperature Rage	0°C - 40°C
Storage Temperature Rage	-40°C to +85°C
Approval	CE

All specifications are subject to change without prior notice.

Note

1. Minimum output voltage <0.5% of rated voltage. The 62020H-150S minimum output rated voltage is 1.5V.
2. Minimum output current <0.2% of rated current.
3. The applicable Range for change is only valid in CV/CC MODE and the Range of TABLE MODE and SAS MODE is Full Scale.
4. The measurement frequency range is 20k Hz - 20M Hz.
5. The output voltage range is from 10% to 100% and the output current is measured under full load.
6. This setting is only valid when there is output and the voltage as well as the current setting is larger than the one specified in **Note 1** and the load current is 40% over Imax. When the output is connected to a capacitor, the voltage slew rate will decrease as the capacitance is increased.
7. This setting is valid only when the load voltage is larger than the one specified in **Note 1**. The factory default is INF. Adjust the slew rate settings as required.
8. ±10% variation under rated voltage.
9. For 0-100% load step with nominal line voltage.
10. Under the maximum output power condition of rated voltage.
11. The maximum drift of output power during the 30 minutes test period when the input, loading and ambient temperature are fixed.
12. The maximum drift of output power after warming up for 30 minutes and 8 hours test period when the input, loading and ambient temperature are fixed.
13. The change caused by the ambient temperature per centigrade when the input and loading are fixed.
14. Over 50% of maximum output voltage and the loading slew rate is 1A/us for rise and fall.
15. Either Ethernet or GPIB can be selected when shipping.
16. Consult with the manufacturer when there are 5 DC Power Supplies connected in parallel. There is a parallel mode for DC Power Supply when the I-V Curve function is enabled.
17. Varies by local voltage regulation. The 5KW, 10kW & 15kW models in the 62000H Series with Solar Array Simulation have 200/220 Vac, 380/400 Vac and 440/480 Vac types of input voltage for selection. There is also a single

phase 200/240 Vac 2KW model power supply available for selection. Follow the local voltage regulation to select a proper voltage spec. The Power Supply is set to the required input voltage when shipped. If the input voltage is not within the range, an AC_fault protection error will occur and shut down the output.

18. Chassis size without any accessories.

CAUTION

1. If the power supply is connected to a battery or inductance load such as a motor, connect a diode in series with the output port to prevent the load current from reversing and damaging the supply (see Figure 1-1).
2. For switchable power load applications, if the output load cable is longer than 20cm, strand the load cable and parallel the capacitance at the load input to prevent any unexpected oscillation from occurring (see Figure 1-2).
3. For parallel load applications, connect a capacitor of more than 100uF to the load input to avoid any unexpected oscillation from occurring.
4. Do not wrap the external input, output, and communication cables together to avoid interference that may cause a device error.

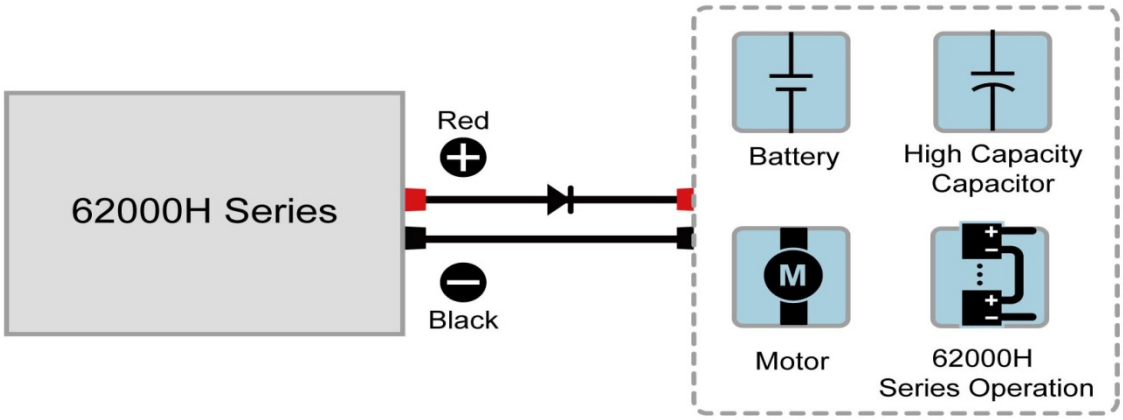


Figure 1-1

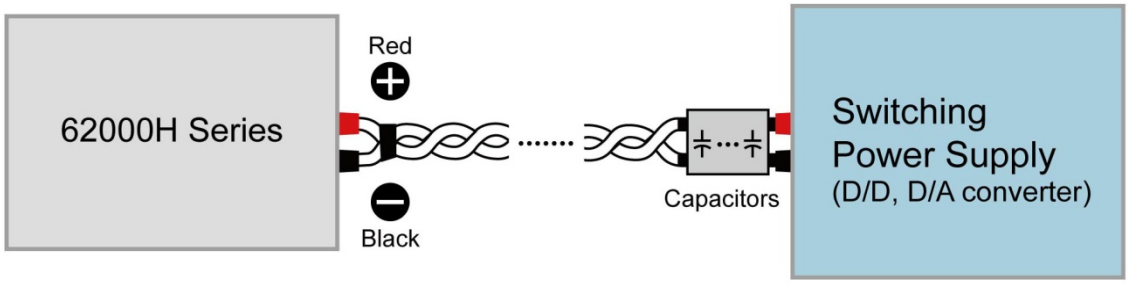


Figure 1-2

CAUTION

Voltage from the two output terminals to earth varies with the 62000H Series Models with Solar Array Simulation as shown in Table 1-4 below:

Table 1-4

Model	Max. Voltage (Vdc) Difference between Output Terminal and Earth
62020H-150S	±250

62050H-600S	±1200
62100H-600S	±1200
62150H-600S	±1200
62150H-1000S	±1200
A620028	±1200
A620027	±1200

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

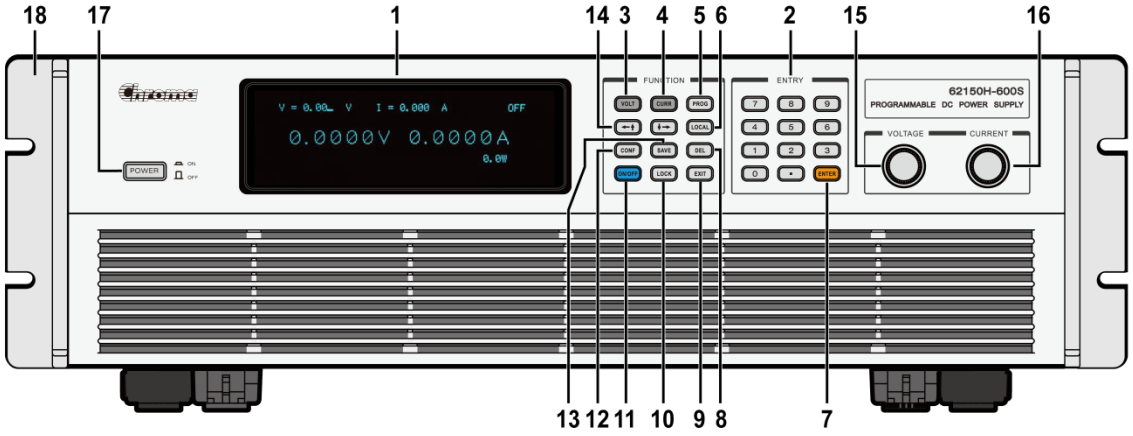


Figure 1-3 Front Panel of 62000H with Solar Array Simulation

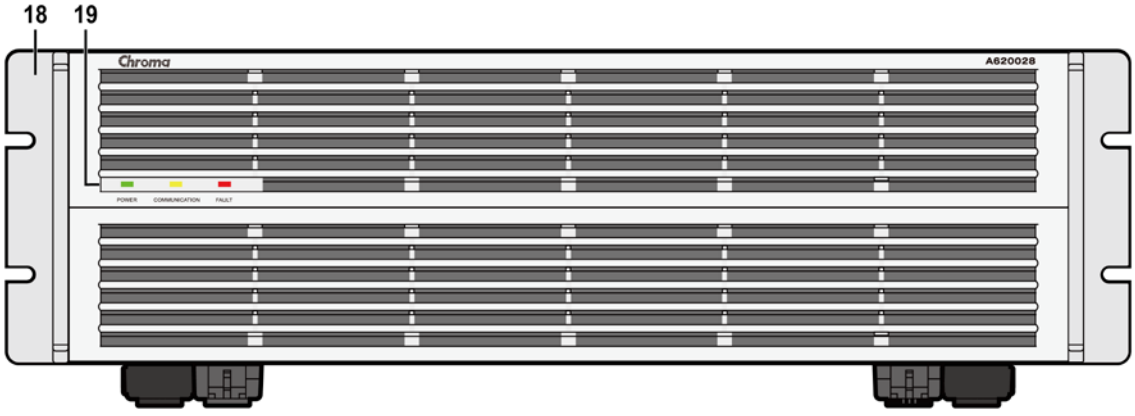


Figure 1-4 Front Panel of Slave Model A620027/A620028

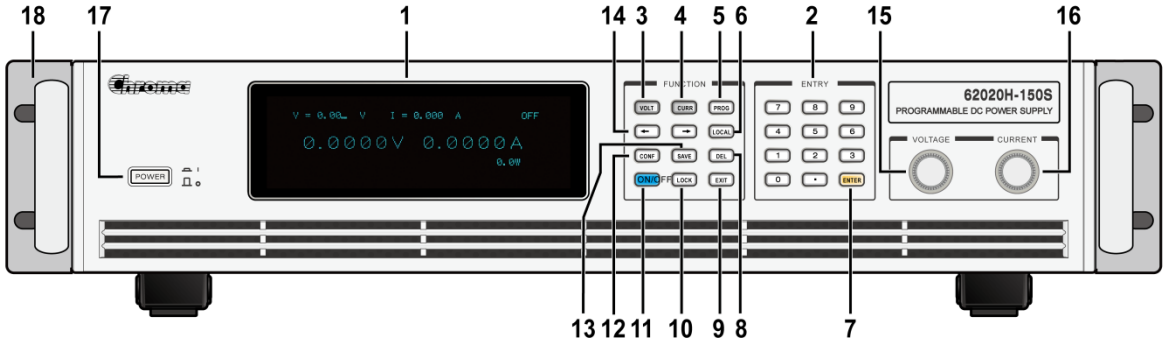
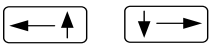
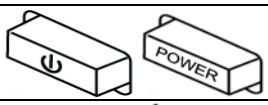


Figure 1-5 Front Panel of 62020H-150S with Solar Array Simulation

Table 1-5 Description of Front Panel

Item	Symbol	Description
1		***Display:*** VFD Display: displays the output settings and measurement results.
2	0 to 9 and ●	***Numeric and Decimal Point Keys:*** Numeric keys and the decimal point key to enter digital data.
3	VOLT	***Voltage Setting Key:*** Enters voltage setting mode. Use numeric keys or voltage rotary knob (◎) to input voltage values.
4	CURR	***Current Setting Key:*** Enters current limit setting mode. Use numeric keys or current rotary knob (◎) to input current limit values.
5	PROG	***PROGRAM Key:*** Press this key to skip to the “Program Function Page” for entering waveform editing mode.
6	LOCAL	***LOCAL Key:*** Press this key to switch the control mode from remote control back to the manual operating mode.
7	ENTER	***ENTER Key:*** Press this key to confirm the parameter settings.
8	DEL	***Delete Key:*** Press this key to delete the input value.
9	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.
10	LOCK	***LOCK Key:*** Press this key to lock all keys and rotary knob. To unlock, press “LOCK” for 3 seconds.
11	ON/OFF	***ON/OFF Key:*** Press this key to switch the output “ON” or “OFF”.
12	CONF	***CONFIG Key:*** Press this key to skip to the “Config Choose Page” for setting various functions.
13	SAVE	***SAVE Key:*** Press this key to save the settings in the “Program and Config Function Page”.

Item	Symbol	Description
14		***Cursor Movement Keys:*** Use the “ ” and “ ” keys to move the cursor to the parameter to be modified.
15		***Voltage Rotary Knob:*** Turn the knob “ ” to input data or select an item.
16		***Current Rotary Knob:*** Turn the knob “ ” to input data or select an item.
17		***Main Power Switch:*** Switches the power “ON” or “OFF”.
18		***Rack Bracket:***(Option) Use the left (right) bracket to attach the Power Supply to the Rack.
19		***LED on Slave Model:*** When the slave model is “ON”, the LEDs show its status. The green light indicates POWER ON, the yellow light indicates the data is transmitting or communication is normal, the red light indicates a fault occurred during operation.

1.4.2 Rear Panel

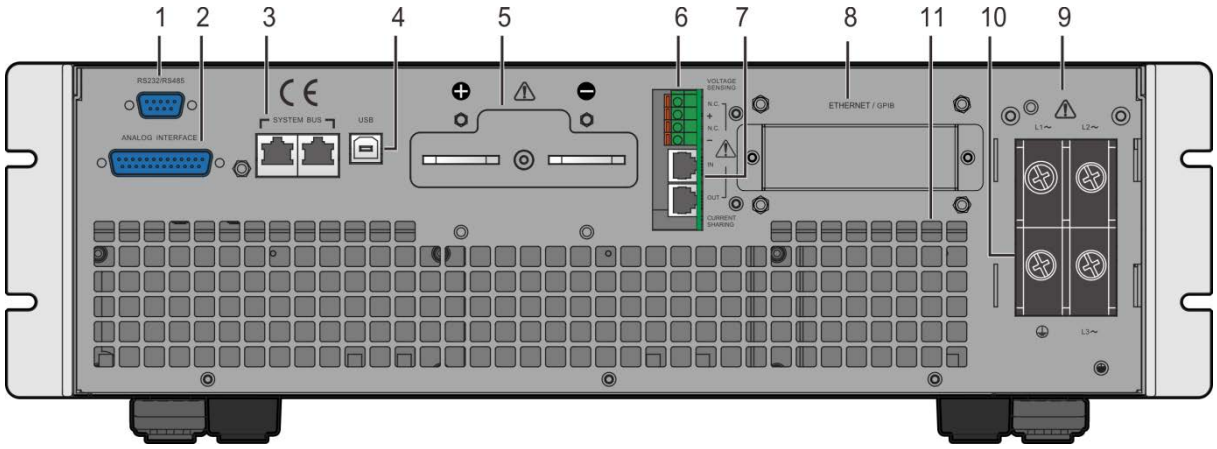


Figure 1-6 Rear Panel of 62000H with Solar Array Simulation

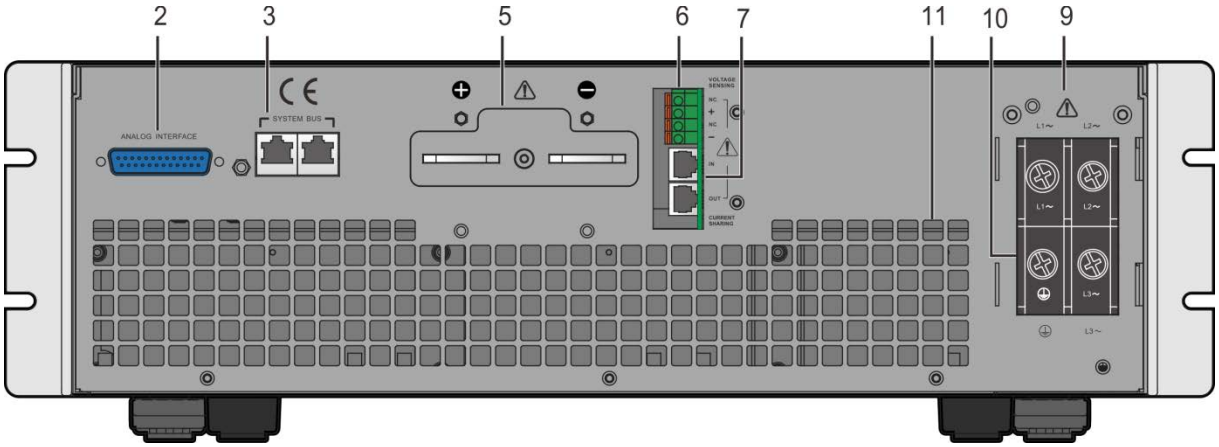


Figure 1-7 Rear Panel of Slave Model A620027/A620028

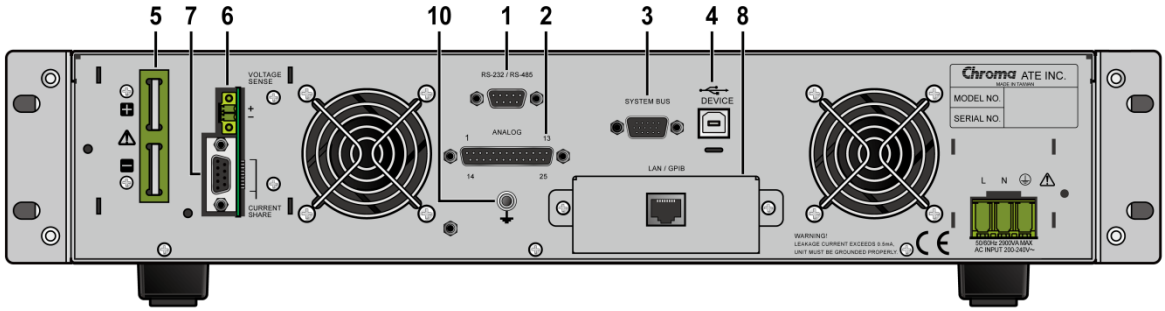


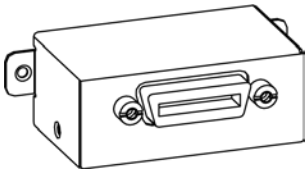
Figure 1-8 Rear Panel of 62020H-150S with Solar Array Simulation

Table 1-6 Description of Rear Panel

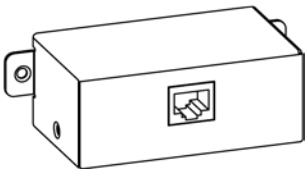
Item	Name	Description
1	RS-232C /RS-485	9-pin D type male connector. The control commands are transmitted between power supply and PC for remote control.
2	ANALOG INTERFACE Signal Connecting Terminal	25 pin signals that include APG input/output terminals and system status signal terminals. See *Appendix A* for detailed pin assignments.
3	System Bus	Bus for serial/parallel data transmission.
4	USB	The USB bus is connected to the PC via this connector for remote control.
5	Output terminal	Output terminals of the DC Power Supply.
6	Remote Sense Connector	Connect this connector to the load to compensate for the voltage drop generated due to cable resistance. Connect the remote sense connector "+" to the positive output terminal and the "–" connector to the negative output terminal. Do NOT reverse the remote sense connectors to the "+", "–" output terminals.
7	Current Sharing Connector	When used in parallel mode, this cable must be connected to share the output current. The cable must be removed when used in series mode or standalone mode to prevent damage to the unit.
8	GPIB/ETHERNET Connector (Option)	The GPIB/ETHERNET bus is connected to the PC via this connector for remote control.
9	AC Power Connector	Inputs AC power from the power line and connects to the input stage through this connector.
10	Functional Ground	Earth Ground connection point.
11	Fan Mask	Protects the fan. Do not block the fan mask to avoid accumulating heat inside the machine.

Notice The callout 8 in Figure 1-6 is the cover plate for the standard

configuration. When the GPIB/ETHERNET interface is selected as the shipping default, it will be installed before shipment as shown in Figure 1-9 (a) & (b).



(a) GPIB Interface



(b) ETHERNET Interface

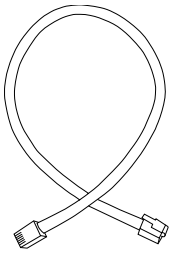
Figure 1-9

2. Installation

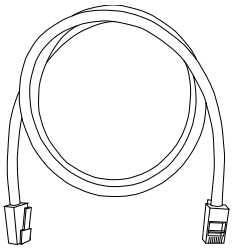
2.1 Checking the Package

(1) After unpacking, check if there is any damage or any missing accessories.
(2) If any damage is found, contact “Chroma RMA” immediately to request a return shipment.

Figure 2-1 (a), (b), (c), (d), (e), (f), (g) and (h) are the accessories.

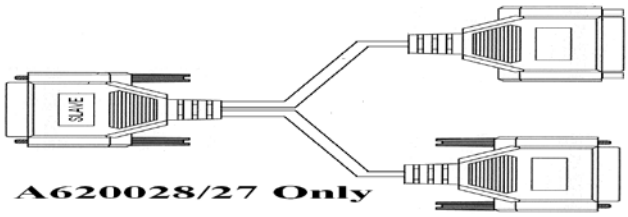


(except 62020H-150S)
(a) cable for current sharing

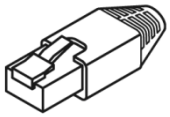


(except 62020H-150S)
(b) cable for system bus

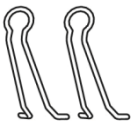
(c) cable for A/B type USB



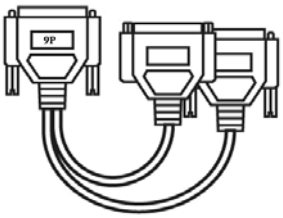
(d) cable for analog



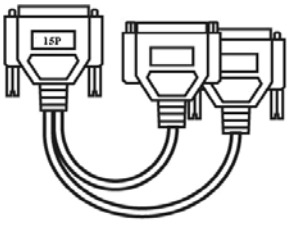
A620028/27 Only
(e) terminator for system bus



A620028/27 Only
(f) hoop



62020H-150S Only
(g) cable for current sharing



62020H-150S Only
(h) cable for system bus

Figure 2-1

Notice

1. Keep all of the packing materials in case the device needs to be returned for repair.
2. Do not return the instrument to the factory without obtaining prior RMA approval from Chroma.
3. Verify all the accessories listed in the packing list were received.

WARNING The power supply is too heavy for one person to safely lift and mount. To avoid injury, ask a co-worker for assistance.

2.1.1 Maintenance & Cleaning

Remove all connected wires and cables on the instrument before cleaning. Use a brush to remove any dust on 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) Remove the iron holder on the front panel as shown in Figure 2-2 and keep it in case the Power Supply needs to be returned for service.
(2) Be sure the Power Supply is connected to an AC line input that meets the specifications.
(3) The instrument must be installed in an area with good air circulation to avoid the internal temperature getting too high.
(4) The ambient temperature should not exceed 40°C.

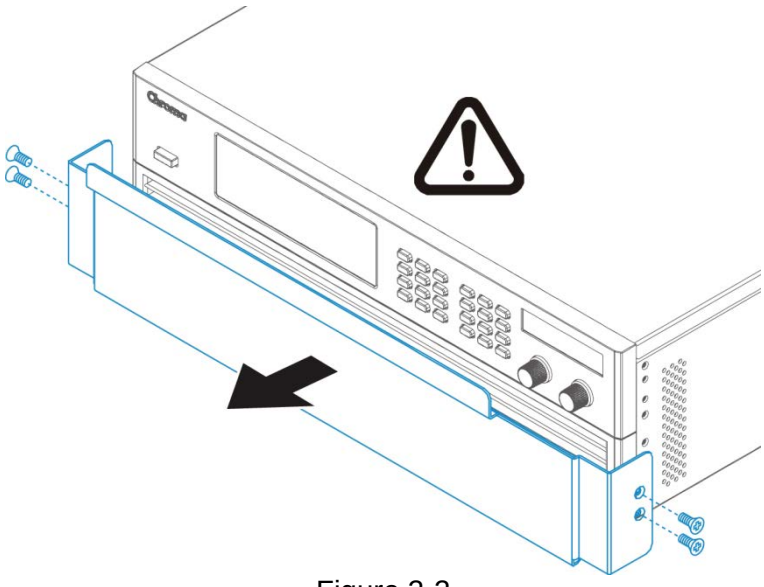


Figure 2-2

CAUTION

1. If the iron holder on the front panel is not removed, it may cause an OTP error or damage to the hardware due to poor ventilation.
2. The 62020H-150S model does not have the holder.

2.2.1 Normal Environment Conditions

(1) Indoor use.
(2) Altitude up to 2000 meters.
(3) Temperature 0°C to 40°C.
(4) Maximum relative humidity is 65% at 25°C, increasing linearly to 90% relative humidity for temperatures up to 40°C.
(5) Input AC power voltage fluctuations can be up to ±10% of the rated voltage.
(6) Transient over voltage meets impulse withstand CAT II.
(7) Pollution degree II.

2.3 Input Power Requirements

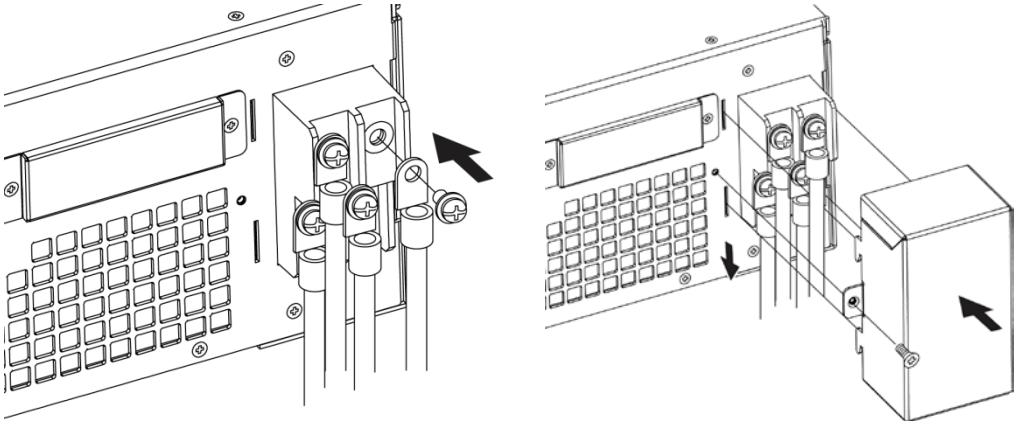
2.3.1 Ratings

(1) Model 62050H-xxxxS
Maximum input power: 12 kVA
(2) Model 62100H-xxxxS
Maximum input power: 21 kVA
(3) Model 62150H-xxxxS/A620027/A620028
Maximum input power: 29 kVA
(4) Model 62020H-150S:
Maximum input power: 2.9 kVA

Model / Vin	62050H-xxxxS	62100H-xxxxS	62150H-xxxxS A620027 A620028	62020H-150S	
200/220	39A	69 A	93 A		Current of each phase
380/400	22A	37 A	50 A		
440/480	19A	32 A	44 A		
200/240				15.2 A	

2.3.2 Input Connections

(1) The 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 must be within 6AWG-8AWG. (Note: 10AWG-12AWG is required for the 62020H-150S Model.)
(4) See Figure 2-3 (a), (b) to connect the cables to the 62000H. See Figure 2-5 to connect the cables to the 62020H-150S. Then perform the following steps:
   a. Remove the input terminal safety cover from the rear panel of the DC Power Supply.
   b. Scrape off any coating on the power cable tip (the bare portion is about 1cm) and use an O type terminal to crimp it. (For the 62020H-150S, the bare portion needs to be tinned.)
   c. Secure the power cable to the input terminal with a Phillips screwdriver with a lock torque in the 30-40 (kg-cm) range. (For the 62020H-150S, insert the power terminal and use a Phillips screwdriver to secure it.)
   d. Lock the safety cover to avoid electric shock.
   e. Secure the safety cover latch and safety cover to prevent the cable from falling or the electric terminal from being exposing.



(a) (b)

Figure 2-3

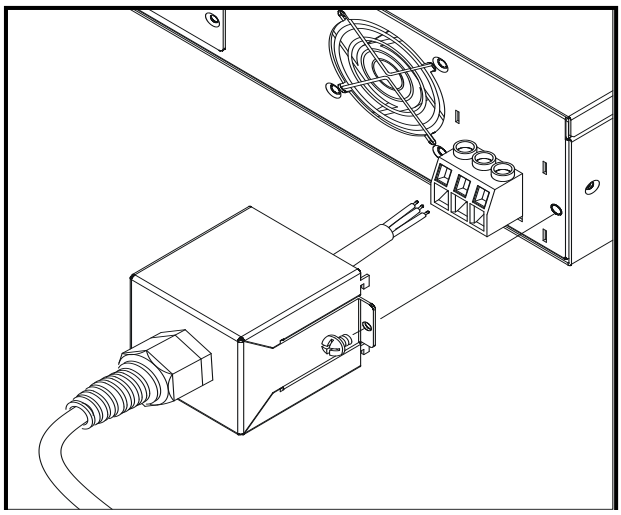


Figure 2-4

Notice

1. Connect the green or green/yellow metal wire to the ⏚ terminal.
2. Connect the black or brown metal wire to the “L1, L2, L3” terminals.
3. Figure 2-5 shows the suggested specification of an O type terminal.

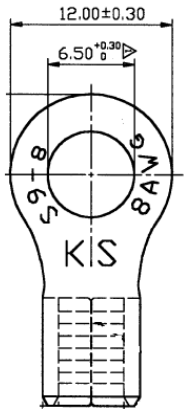


Figure 2-5

4. Connect the white or blue metal wire of the 62020H-150S to the “N” terminal.

5. Connect the black or brown metal wire of the 62020H-150S to the “L” terminal.

⚠WARNING

1. To protect the operator, the wire connected to the GND terminal (⏚) must be connected to the earth. This DC Power Supply must be operated with an adequate ground connection.
2. Installation of the power cord must be done by a professional and compliant with local electrical codes.

⚡CAUTION

1. Be sure to select an appropriate withstand voltage cable based on the desired input voltage.
2. To ensure operational safety, select a proper current rated BREAKER for the input power source that switches each phase and connect it to the input terminal.

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

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

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

2.4 Remote Sensing

2.4.1 Correct Connection

1. Connect the remote sensing wire to ensure the output voltage equals the set voltage. The DC Power Supply is able to compensate up to a 4% F.S. line voltage drop.
2. Figure 2-6 shows the correct connection. Use two wires to connect the positive and negative connectors of the load to the remote sensing connector on the rear panel. The

connecting wire diameter must be larger than 30AWG and it's withstand voltage should be within the specification.

3. Although remote sensing is able to compensate for a voltage drop, if the line loss is too large (see specification) it will cause a protection error as shown in Figure 2-8 indicating it is unable to compensate for the voltage drop.
4. Connect the remote sensing wire of the 62020H-150S as shown in Figure 2-7.
5. The remote sensing wire needs to be connected to the DC Power Supply local output or the remote input of the UUT.

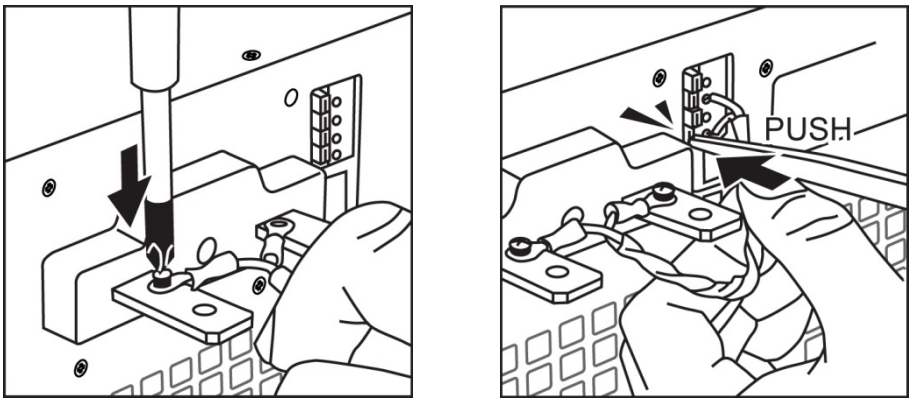


Figure 2-6

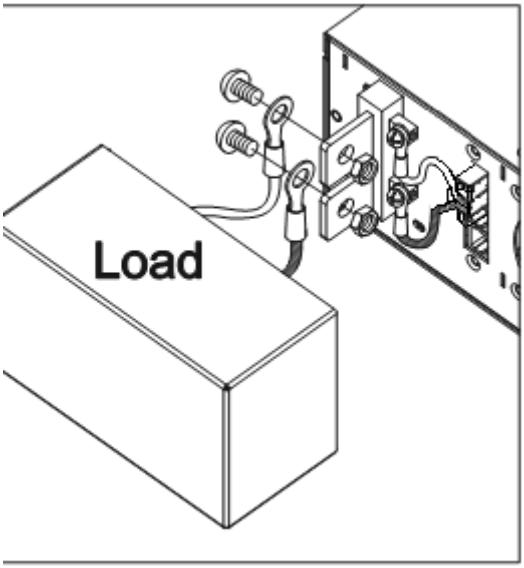


Figure 2-7

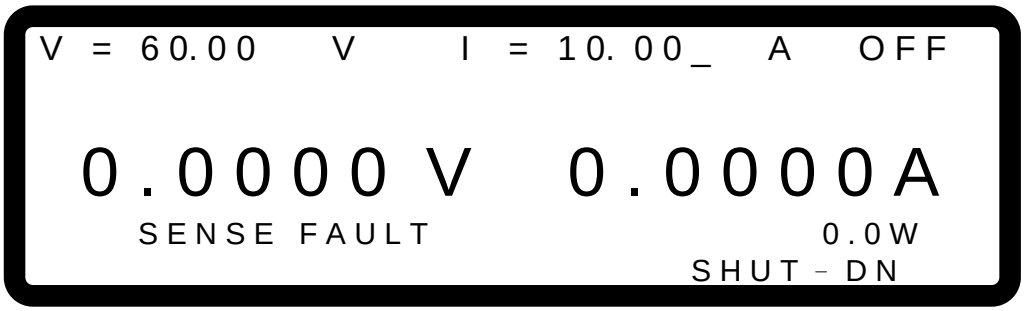


Figure 2-8

2.4.2 Reverse Connection of Remote Sensing Wire Polarity

The remote sensing wire polarity must be correct, with the "+" terminal connected to the "+"output terminal and the "–" terminal connected to the "–"output terminal. If the polarity is reversed, the output will drop to 0V and the error message "SENSE FAULT" will display as shown in Figure 2-8.

Notice

If the power supply remote sense error appears, do the following to reset it:

1. Power off the equipment.
2. Connect the remote sensing wire properly.
3. Restart the Power Supply.

CAUTION

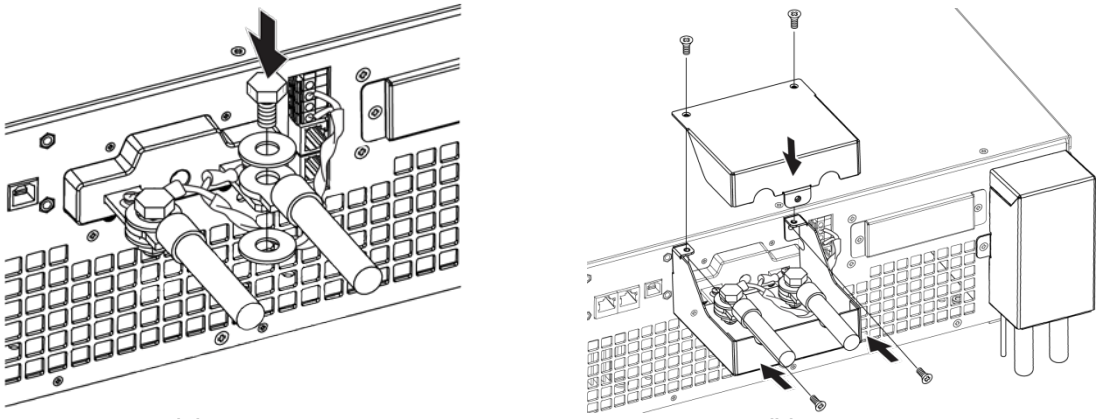
1. If there is voltage on the Power Supply output, do not reverse the Remote sense connection on the supply or the UUT to avoid damaging the Power Supply.
2. The Remote Sense and local output voltage needs to be less than 10% V_MAX to avoid damaging the Power Supply.
3. The output voltage may overshoot if the Remote sense wire is disconnected during operation. Be sure to connect the Remote sense wire to the DC Power Supply local output or the Load UUT before operating the power supply.

2.5 Output Connection

The output connector of the 62000H Series DC Power Supply with Solar Array Simulation is located in the upper middle area on the rear panel and for the 62020H-150S it is on the left side of the rear panel. The load is connected to the "+" and "–" output terminals.

2.5.1 Rear Panel Output

(1) The output terminal is located in the upper middle area on the rear panel. (For the 62020H-150S, the output terminal is located on the left side of the rear panel.)
(2) The output cable must be rated for 85°C or higher.
(3) To connect the output cables, see Figure 2-9 (a) & (b) for the 62000H and Figure 2-11 (c), (d), (e), (f) and (g) for the 62020H-150S. Perform the steps below:
   a. Scrape off any coating on the power cable tip (the bare portion is about 1cm) and use an O type terminal to crimp it.
   b. Secure the power cable and input terminal with a Phillips screwdriver.
   c. Secure the safety cover latch and safety cover to prevent the cable from falling or the electric terminal from being exposed.
(4) A standard hoop is attached when purchasing the A620028 or A620027 SLAVE model to hold the current sharing cables as shown in Figure 2-10. Mount it first and then continue the installation as shown in Figure 2-9.



(a) (b)

Figure 2-9

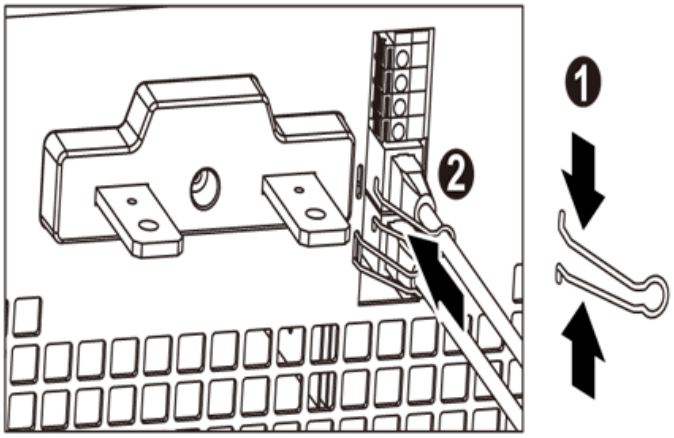
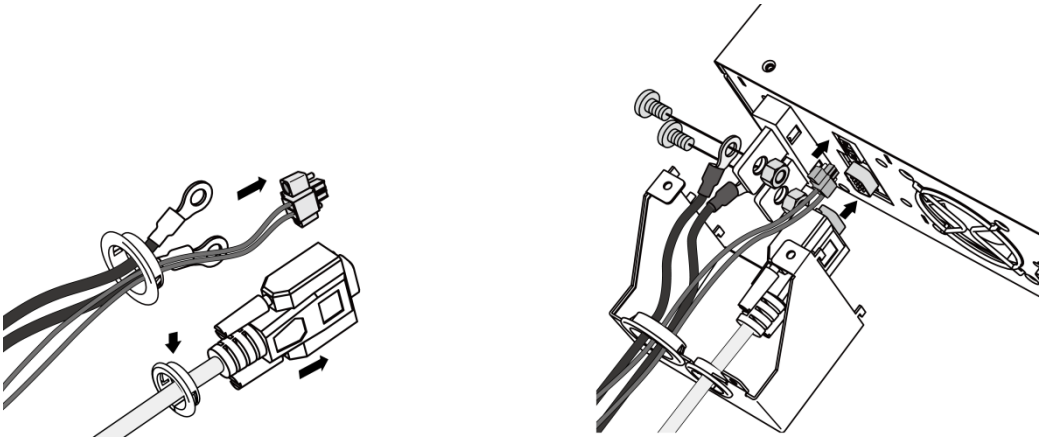
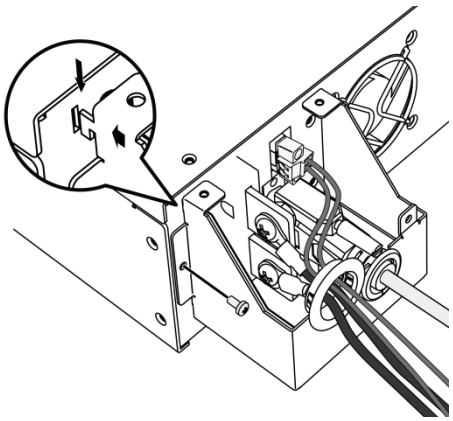


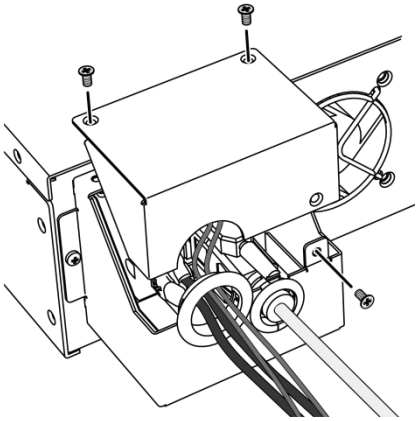
Figure 2-10



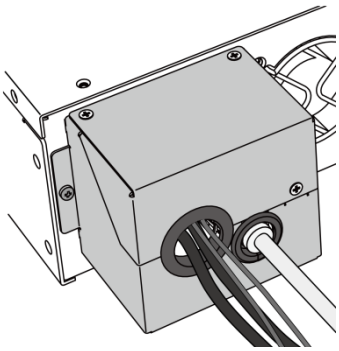
(c) (d)



(e)



(f)



(g)

Figure 2-11

CAUTION

1. The safety cover must be tightly secured to meet the safety requirements.
2. Make sure the wire connected to the load is able to carry the maximum applied current.
3. There is no need to use the 62020H-150S 9PIN current sharing cable when using the device in standalone mode.

CAUTION

Do not exceed the rated output current (different for each model in the 62000H Series).

2.5.2 Connecting Wire Specifications

The maximum inductance of the wire connected to the source should be less than 2μH (the total inductance of two wires after twisting or otherwise bundled, including self-inductance and mutual inductance).

CAUTION

1. To ensure the system's stability, the cable inductance should not exceed 2μH. If the UUT input capacitance is too small (less than 100uF), the inductance of the UUT input should be added to the cable inductance when calculating the total cable inductance. The maximum inductance of some models, such as the 62150H-1000S (380/400Vac, 440/480Vac) and the A620028 (380/400Vac, 440/480Vac), can be up to 2mH. The maximum inductance can be identified by the sticker labeled 2mH on top of the output cover as

shown in Figure 2-12. For other models, contact your Chroma agent.
2. Be sure to use the proper diameter wire to avoid overheating.

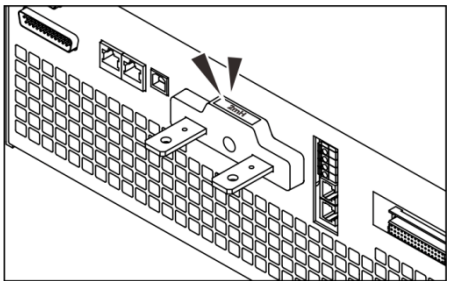


Figure 2-12

2.5.3 Parallel Capacitance Specifications

The maximum parallel output capacitance varies according to the 62000H Series Models as shown in Table 2-2.

Table 2-2

Model	Max. Parallel Capacitance for Output (uF)
62050H-600S	1350
62100H-600S	2700
62150H-600S	4050
62150H-1000S	1350
A620028	1350
A620027	4050
62020H-150S	10000

CAUTION

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

2.5.4 Installing the Handle (62150H for example)

Use M4x12 flat head screws to secure the handle to the rack mounting kit as shown in Figure 2-13.

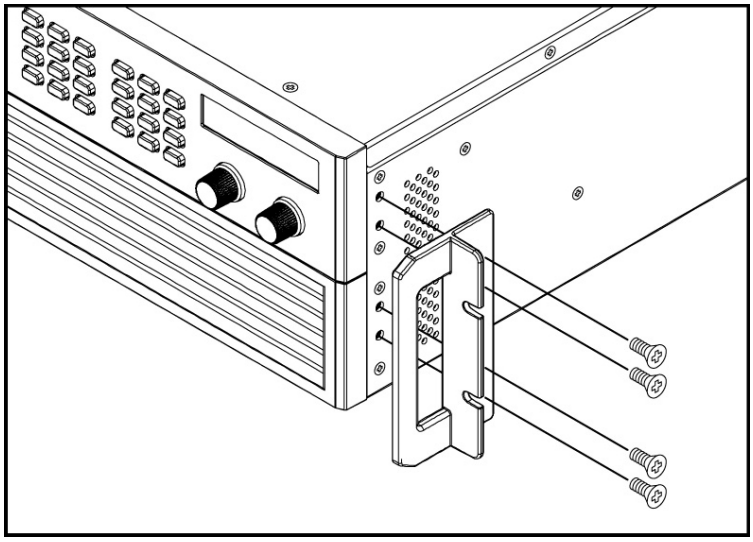


Figure 2-13 Installing the Handle

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 VFD on the front panel will light up and display the following:

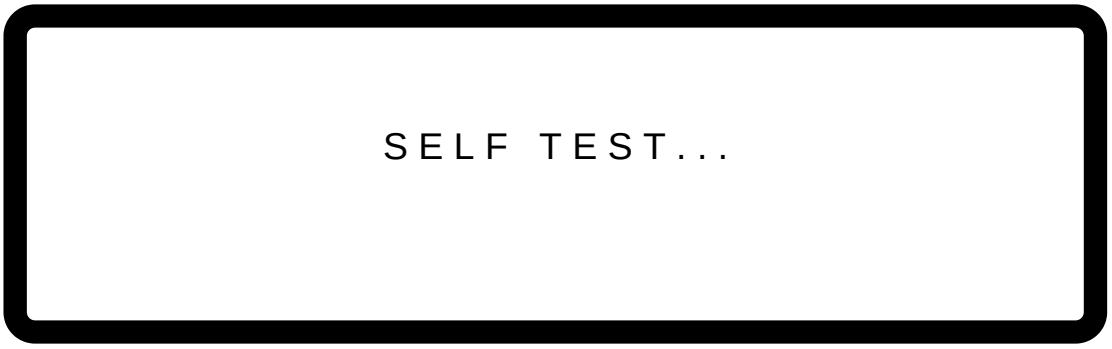


Figure 2-14

The DC Power Supply will run self-tests for memory, data, and communication. Once the self-tests are completed, the Model No., Serial No., and an "*OK*" prompt will display on the screen if all tests completed successfully. When the self-test is done the display shows:

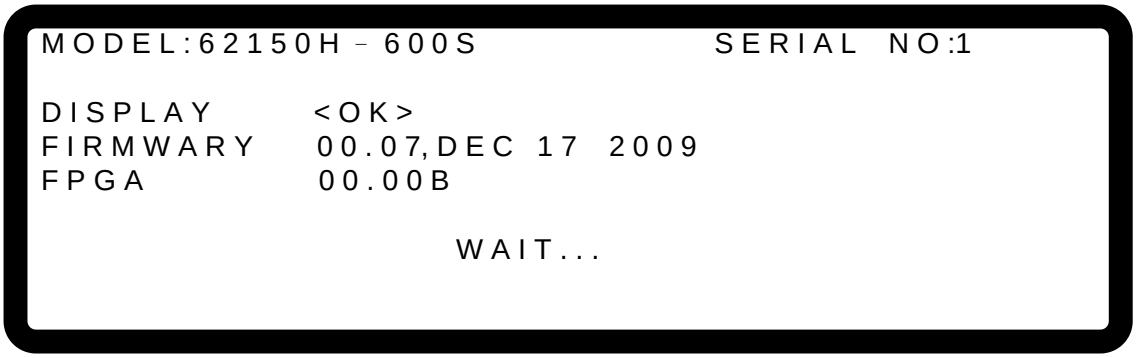


Figure 2-15

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

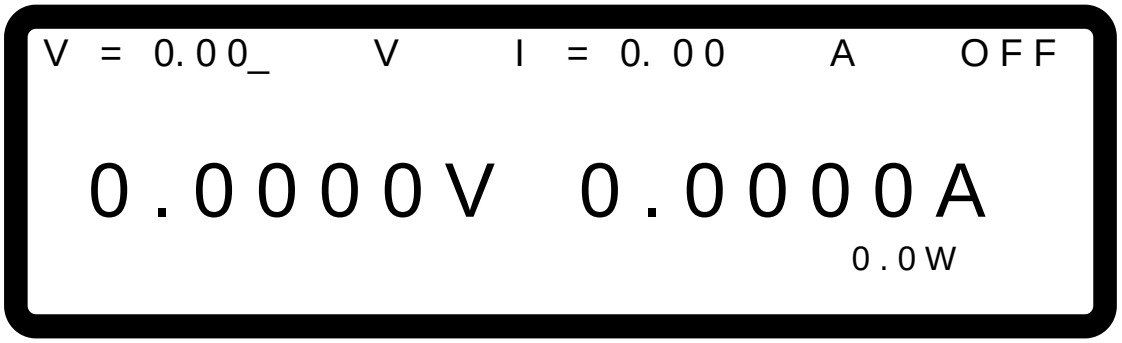


Figure 2-16

⚠WARNING The DC Power Supply internal circuits may not be able to reset if it is powered off and on quickly. Wait at least 3 seconds after powering OFF before powering 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 exist with any incomplete grounding, resulting in injury to personnel.

3. Manual Operation

3.1 Introduction

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

Notice If the operation mode is not saved before the instrument is powered off, the operation mode is 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 "VOLT", the cursor for V on MAIN PAGE blinks.
2. Use the numeric keys (1 - 9) to set the value and press "ENTER" to complete the voltage setting or turn the "Rotary" ( ) knob to adjust the set value.
3. Press "ON/OFF" to output the set voltage. (To keep the output in CV mode the current setting must be larger than the load current; otherwise, the output voltage will not be equal to the set voltage.)

Method 2:

1. Press "VOLT", the cursor for V on MAIN PAGE blinks.
2. When using the Rotary knob ( ) for setting, the " ", " " keys can be used to move the cursor to each individual digit, then turning the rotary knob to increase or decrease the value.
3. Press "ON/OFF" to output the set voltage. (To keep the output in CV mode the current setting must be larger than the load current; otherwise, the output voltage will not be equal to the set voltage.)

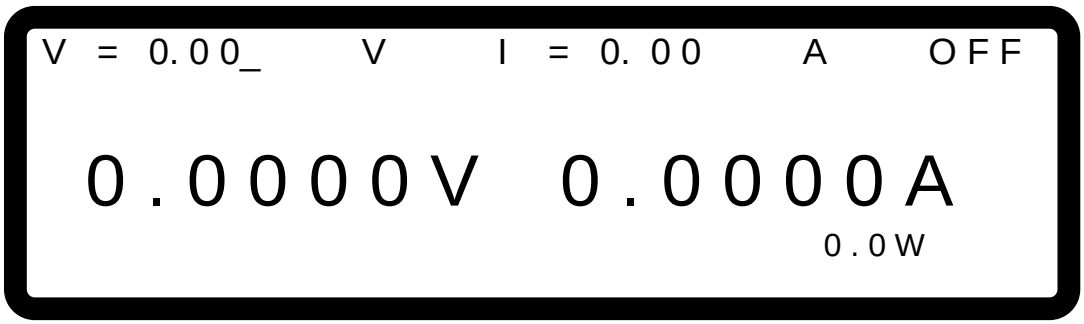


Figure 3-1

To set the current (CC MODE):

Press "CURR". The remaining steps are the same as the voltage settings, as shown in Figure 3-2. (To keep the output in CC mode the voltage setting must be larger than the load voltage; otherwise, the output current will not be equal to the set current.)

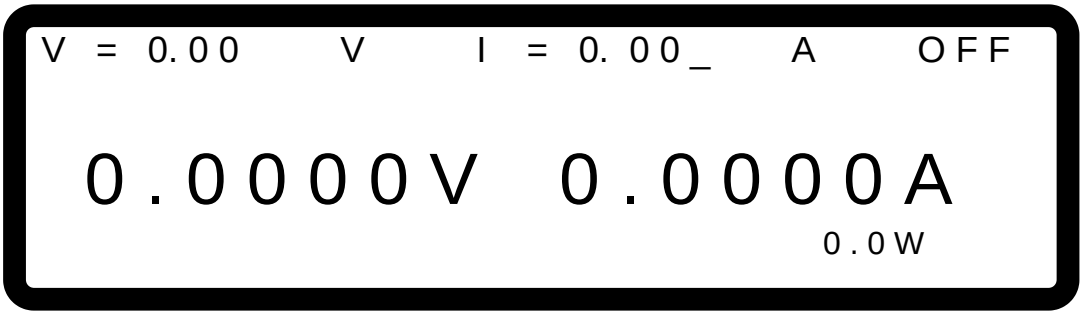


Figure 3-2

3.3 Setting Configuration

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

1. System Setup : Sets various system parameters including GPIB address.
2. Output Setup : Sets various output parameters including voltage/current slew rate etc.
3. Series/Parallel : Sets the parameters for series or parallel mode.
4. Display : Sets the parameter arrangement on panel.
5. Protection : Sets the parameters for each protection function.
6. Factory Setting : Sets the production information and settings.
7. Calibration : Calibrates the DC Power Supply.
8. Remote Setting : Sets the system parameters for GPIB address etc.
9. Output Mode : Selects CV/CC mode or the output mode with IV function.

To set the configuration:

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

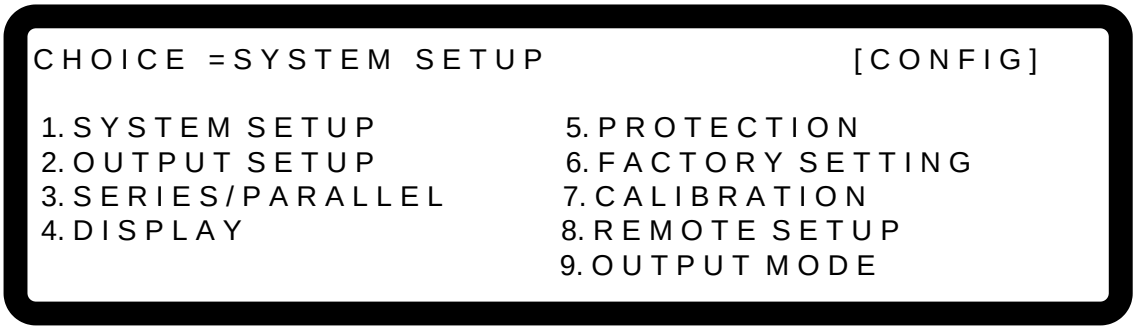


Figure 3-3

1. Use the numeric keys (1 - 9) or the “Rotary” ( ) knob to select the item to be set.
2. Press “ ENTER ” to confirm.
3. Press “ EXIT ” to return to the MAIN PAGE.

Notice

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

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

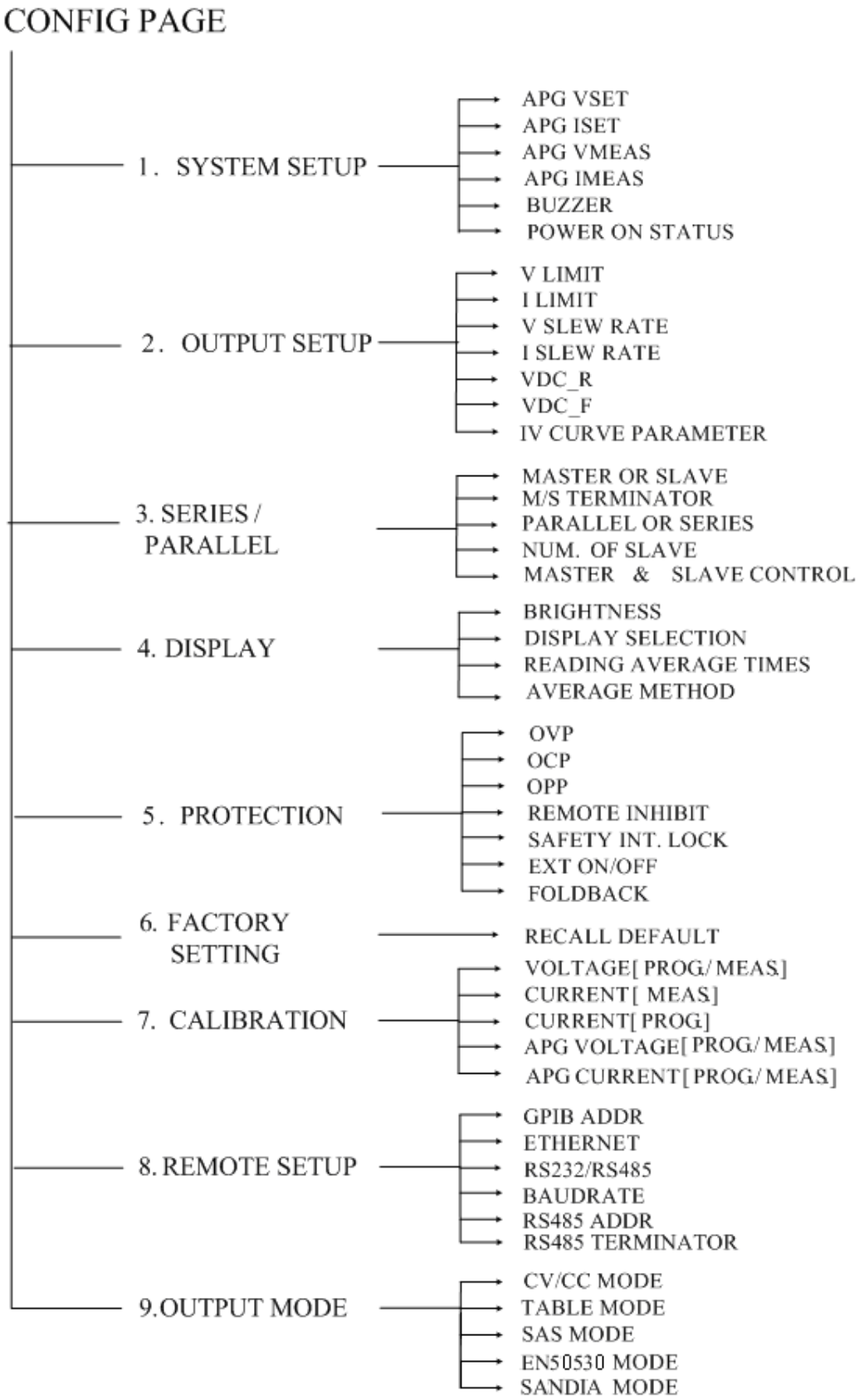

CONFIG PAGE
1. SYSTEM SETUP
APG VSET
APG ISET
APG VMEAS
APG IMEAS
BUZZER
POWER ON STATUS
2. OUTPUT SETUP
V LIMIT
I LIMIT
V SLEW RATE
I SLEW RATE
VDC_R
VDC_F
IV CURVE PARAMETER
3. SERIES / PARALLEL
MASTER OR SLAVE
M/S TERMINATOR
PARALLEL OR SERIES
NUM. OF SLAVE
MASTER & SLAVE CONTROL
4. DISPLAY
BRIGHTNESS
DISPLAY SELECTION
READING AVERAGE TIMES
AVERAGE METHOD
5. PROTECTION
OVP
OCP
OPP
REMOTE INHIBIT
SAFETY INT. LOCK
EXT ON/OFF
FOLDBACK
6. FACTORY SETTING
RECALL DEFAULT
7. CALIBRATION
VOLTAGE[PROG./ MEAS.]
CURRENT[MEAS.]
CURRENT[PROG.]
APG VOLTAGE[PROG./ MEAS.]
APG CURRENT[PROG./ MEAS.]
8. REMOTE SETUP
GPIB ADDR
ETHERNET
RS232/RS485
BAUDRATE
RS485 ADDR
RS485 TERMINATOR
9.OUTPUT MODE
CV/CC MODE
TABLE MODE
SAS MODE
EN50530 MODE
SANDIA MODE

Figure 3-4

3.3.1 SYSTEM SETUP

1. In the Config setup page, press "1" then "ENTER" to display the screen shown in Figure 3-5. Use the " ◄—▲ ", " ▼—► " keys to move the cursor to the desired selection.

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

Figure 3-5

3.3.1.1 APG

The Analog Programming interface (APG) performs the following two functions: 1. uses the analog signal control panel to set the value and 2. uses the analog signal to indicate the panel measurement. The values for set and measure can be set separately as described below.

1. Use the " ◄—▲ ", " ▼—► " keys to move the cursor to the column to be set as shown in Figure 3-6.

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

Figure 3-6

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

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

3. Press "ENTER" to confirm.

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

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

5. Press "[ENTER]" to confirm.

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

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

7. Press "[ENTER]" to confirm.

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

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

9. Press "[ENTER]" to confirm.

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

Notice

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

600V/0A ~ 25A will map to 4-20mA as shown in Figure 3-7 (c).

d. Selecting Vref=5KOhm means the DC Power Supply's output 0V - 600V/0A ~ 25A will map to 0-5KOhm as shown in Figure 3-7 (d).

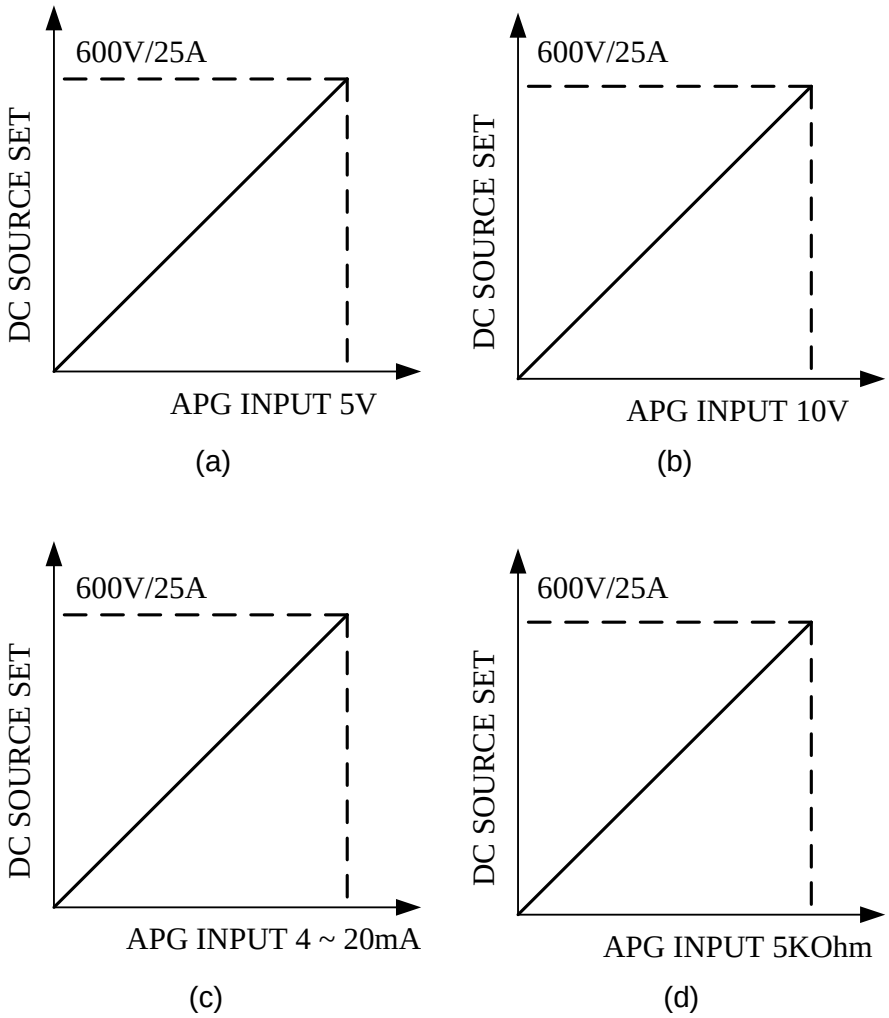


Figure 3-7

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

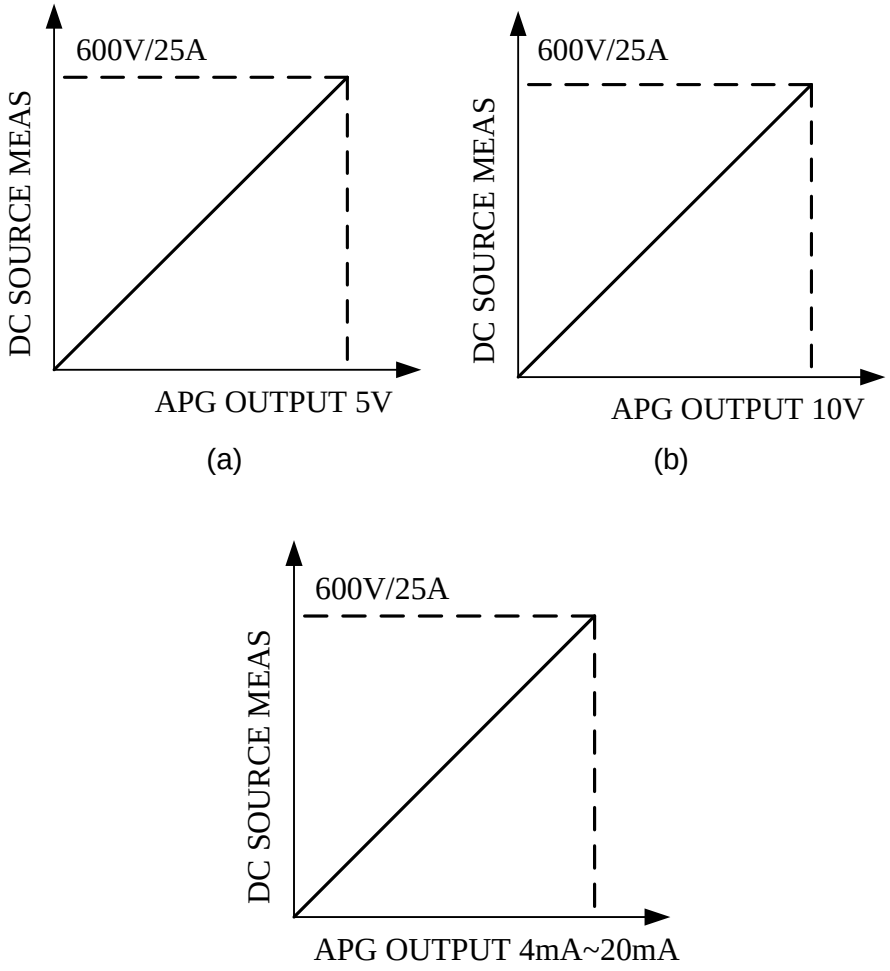


Figure 3-8

3. Calibrate the APG settings and measurements before using APG control.
4. When setting the APG VMEAS/APG IMEAS to Iref(4-20mA) mode, ensure the series resistance does not exceed 500Ω so the DC Power Supply outputs the correct values. Ensure the resistor wattage is sufficient to avoid damaging the resistor.

3.3.1.1.1 Pin Assignment of the APG Control Interface

The APG interface is a bi-directional interface utilizing analog signals. The connector is located on the rear panel and its pin assignments are shown in Figure 3-9, Figure 3-10, and Appendix A.

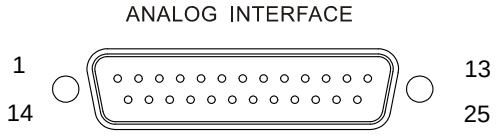


Figure 3-9

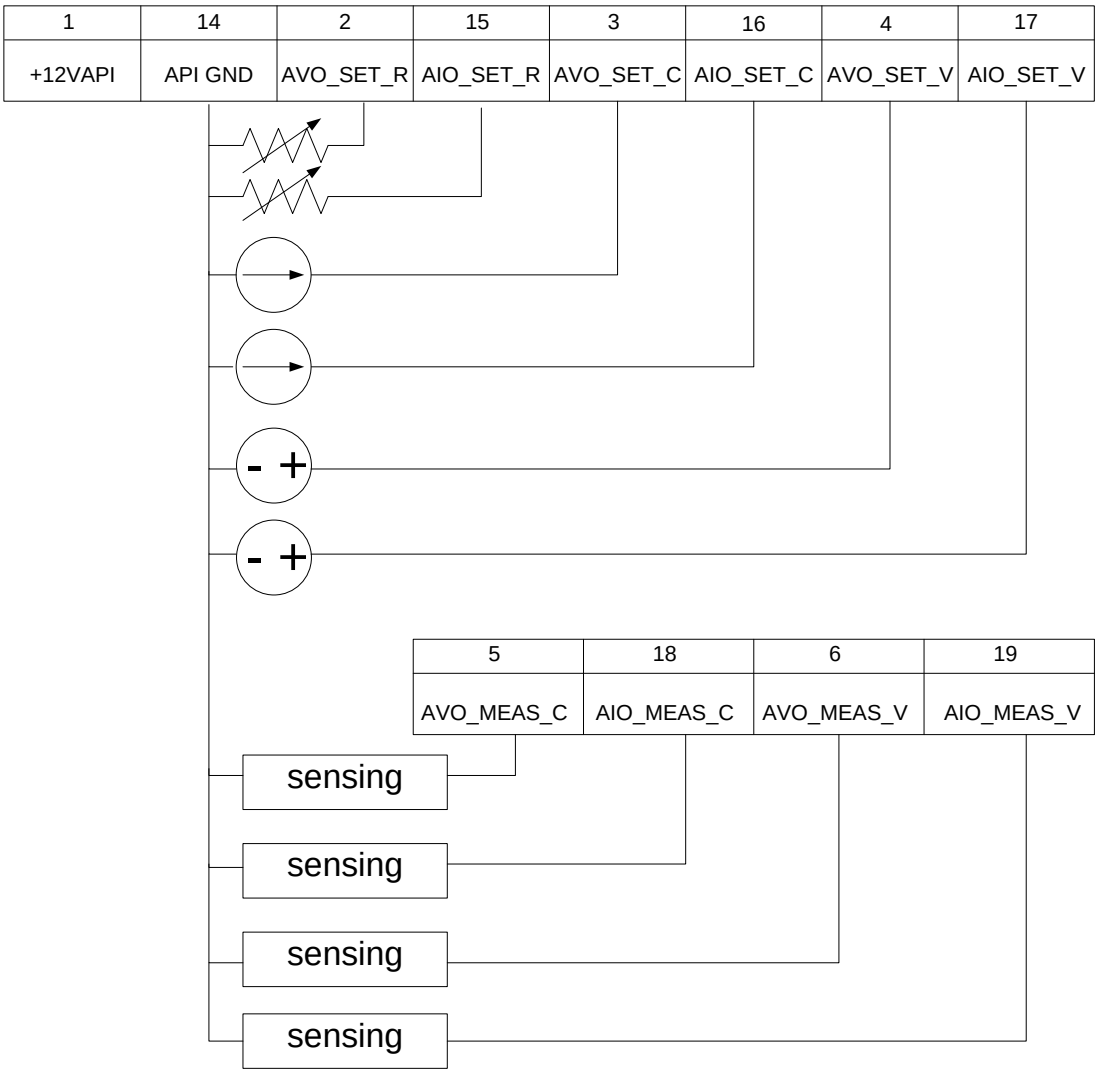


Figure 3-10

APG Interface pin definitions:

1. Auxiliary power Vcc: outputs +12Vdc with a maximum output current of 10mA (output port).
2. Voltage programming: inputs the resistance (0-5K Ohm) between this pin and APIGND to linearly control the output voltage (CV mode).
3. Voltage programming: inputs the analog current (4-20mA) between this pin and APIGND to linearly control the output voltage (CV mode).
4. Voltage programming: inputs the analog voltage (0-5Vdc or 0-10Vdc) between this pin and APIGND to linearly control the output voltage (CV mode).
5. Voltage measurement: outputs the analog current (4mA-20mA) for monitoring.
6. Voltage measurement: outputs the analog voltage (0-5V or 0-10V) for monitoring.

14. APIGND: This contact is the reference potential of the APG interface. The potential is isolated between the APG and chassis with a maximum voltage differential of 70Vdc.
15. Current programming: inputs the resistance (0-5K Ohm) between this pin and APIGND to linearly control the output current (CC mode).
16. Current programming: inputs the analog current (4-20mA) between this pin and APIGND to linearly control the output current (CC mode).

17. Current programming: inputs the analog voltage (0-10Vdc or 0-5Vdc) between this pin and APIGND to linearly control the output current (CC mode).
18. Current measurement: outputs the analog current (4mA-20mA) for monitoring.
19. Current measurement: outputs the analog voltage (0-5V or 0-10V) for monitoring.

3.3.1.2 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 an audio response is not necessary. (The default is ON.)

1. Use the " ◄—↑ ", " ↓—► " keys to move the cursor to the column to be set as shown in Figure 3-11.

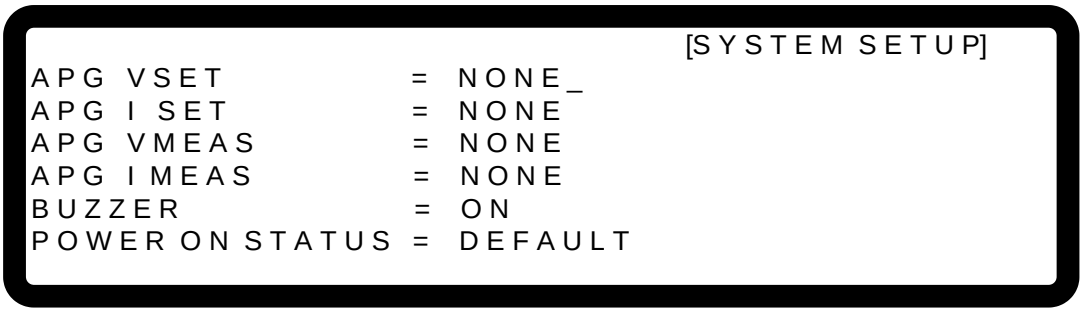


Figure 3-11

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

Notice

1. The BUZZER has two options: ON / OFF. (Default is ON).
2. When the BUZZER is set to ON, pressing any key or turning the rotary knob will sound the buzzer.
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.

3.3.1.3 POWER ON STATUS

Automatically loads the default output status when the unit is powered ON.

1. Use the " ◄—↑ ", " ↓—► " keys to move the cursor to the column to be set as shown in Figure 3-12.

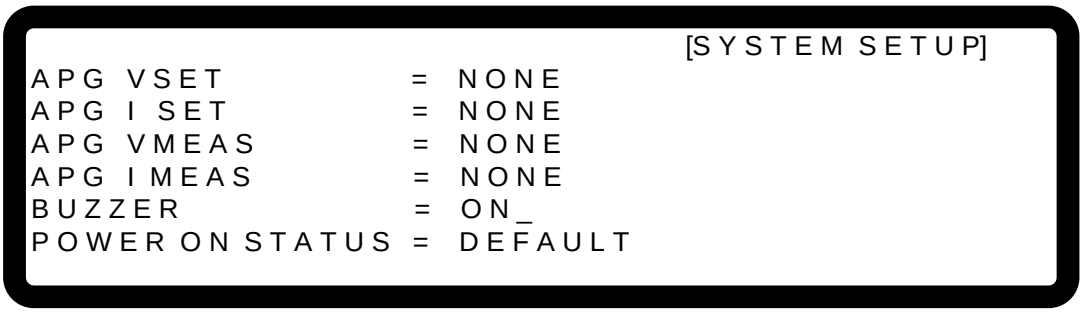


Figure 3-12

2. Press "**0**" or "**2**" or use the ""Rotary" (◎) knob to set the value.

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

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

   When set to LAST TURN OFF STATUS, the instrument will store the last voltage, current and output state settings before powering off and they will be restored on power ON.

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

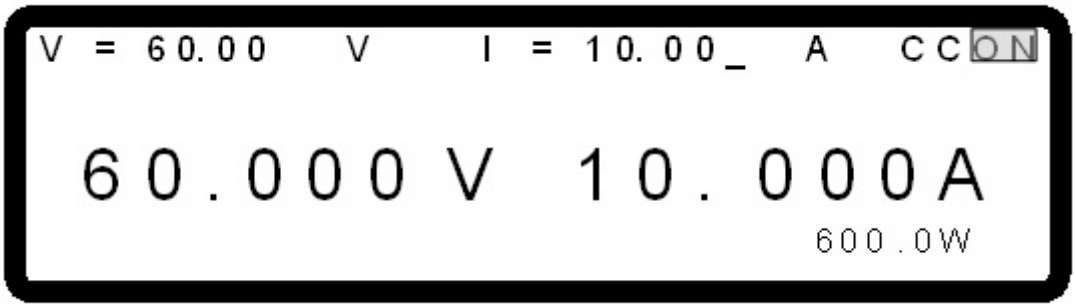


Figure 3-13

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

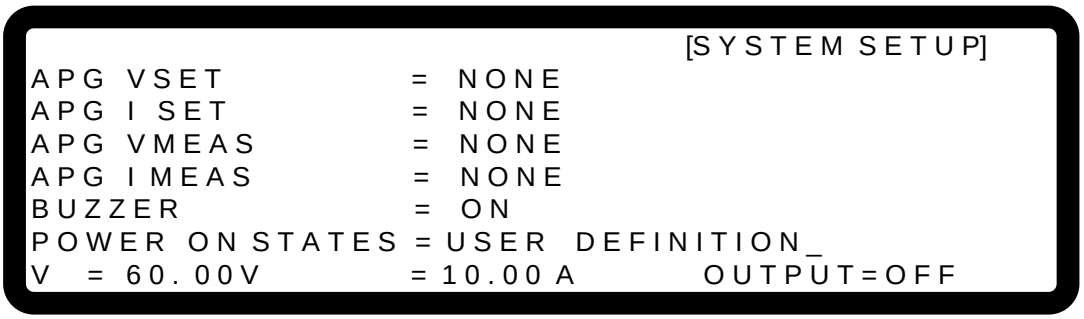


Figure 3-14

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

3.3.2 OUTPUT SETUP

1. In the Config Setup page, press "2" then "ENTER" to enter into the Output Setup screen as shown in Figure 3-15.
2. Press the " ◄— ▲ ", " ▼ —► " keys to move the cursor to the column to be set.
3. Press "EXIT" to return to the MAIN PAGE.

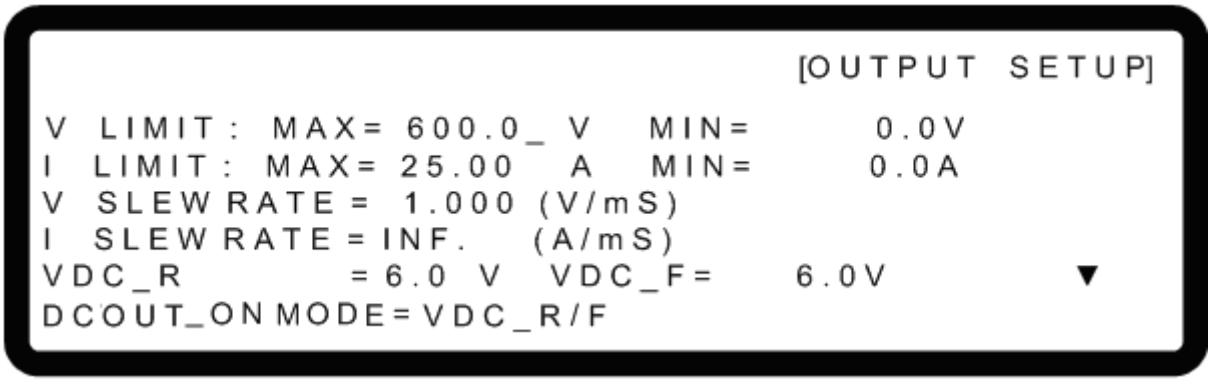


Figure 3-15

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

3.3.2.1 VOLTAGE LIMIT SETTING

1. Use the “ ”, “ ” keys to move the cursor to the column to be set as shown in Figure 3-16.

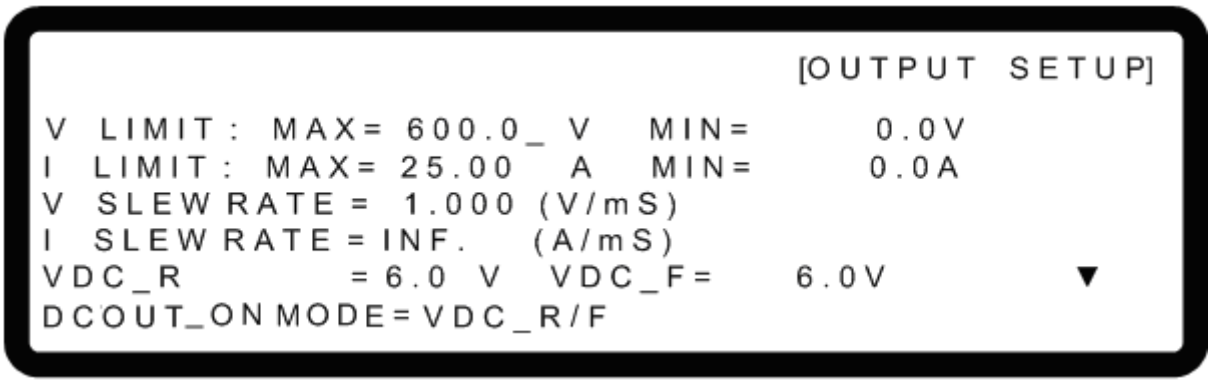


Figure 3-16

2. Use the numeric keys (0 - 9) or the “Rotary” ( ) knob to set the value. Use this option to narrow down the range by setting the MIN and MAX values. When “ VOLT ” 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]. For example, if the V LIMIT is set to MAX=100V, MIN=20V and the setting exceeds the output voltage set by the user (e.g. 110V), the BUZZER will beep one time (if the BUZZER is set to ON) and the main screen will automatically prompt a warning message as shown in Figure 3-17 below.

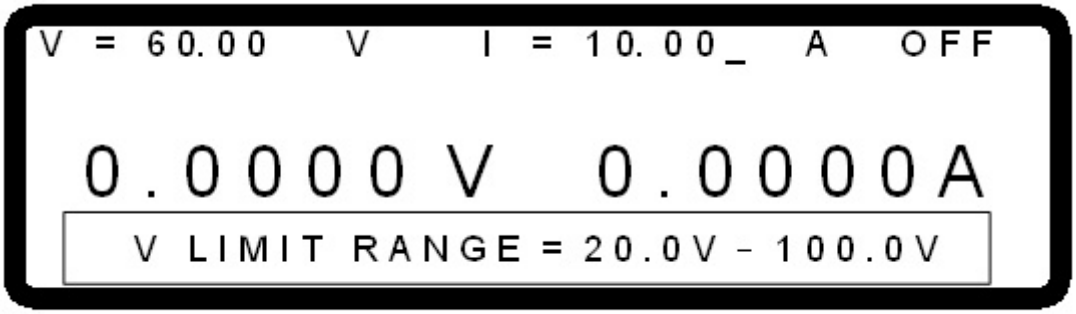


Figure 3-17

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

3.3.2.2 CURRENT LIMIT SETTING

1. Use the " ", " " keys to move the cursor to the column to be set as shown in Figure 3-18.

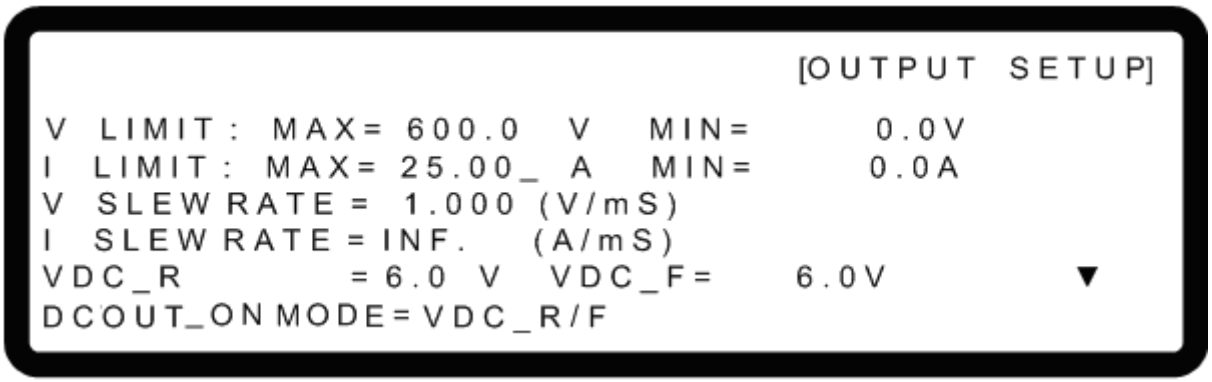


Figure 3-18

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

   Use this option to narrow down the range by setting the MIN and MAX values. When " CURR " is pressed to set the output current, the DC Power Supply sets the current within the range of [MIN value ≤ user-defined value ≤ MAX value]. For example, if the I LIMIT is set to MAX=20A, MIN=2A and the setting exceeds the output current set by the user (e.g., 21A), the BUZZER will beep one time (if BUZZER is set to ON) and the main screen will automatically prompt a warning message as shown in Figure 3-19 below.

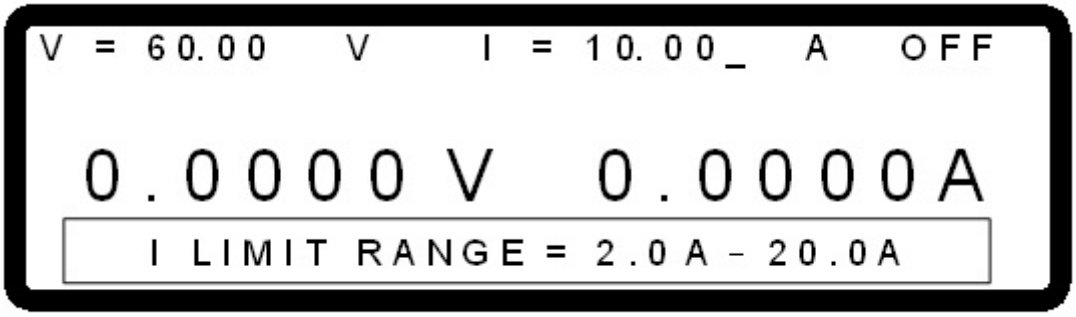


Figure 3-19

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

3.3.2.3 VOLTAGE SLEW RATE

1. Use the “ ”, “ ” keys to move the cursor to the column to be set as shown in Figure 3-20.

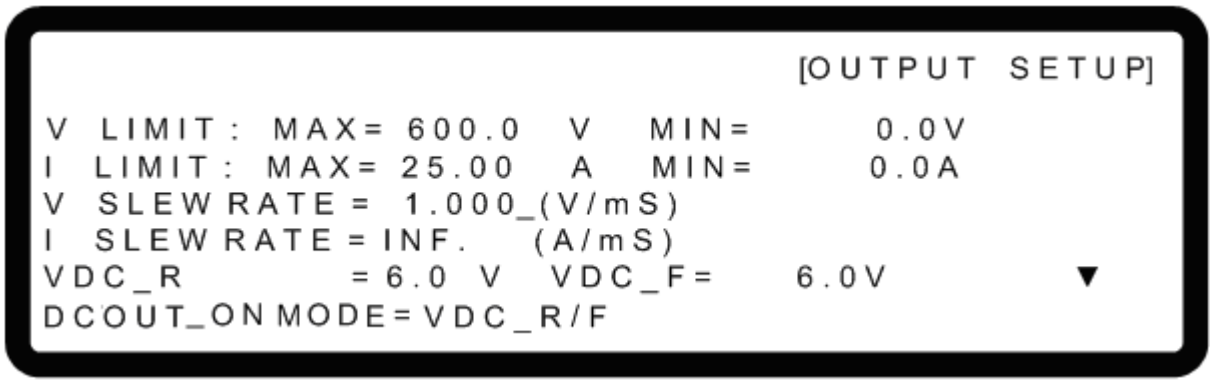


Figure 3-20

2. Use the numeric keys (0 - 9) or the “Rotary” ( ) knob to set the value. The output voltage slew rate of the DC Power Supply is set as shown in Figure 3-21. The maximum input Slew Rate is 20V/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.

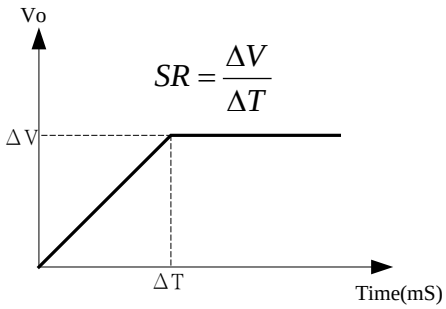


Figure 3-21

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

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

3.3.2.4 CURRENT SLEW RATE SETTING

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

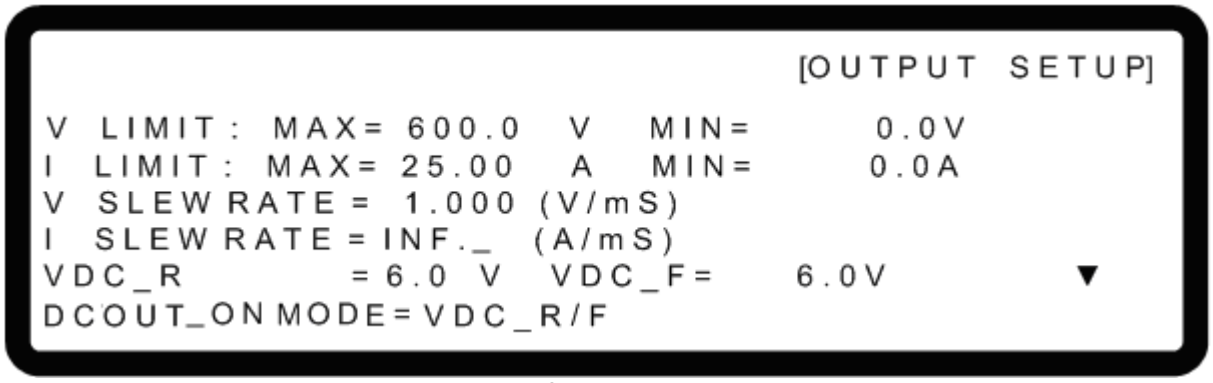


Figure 3-22

2. Use the numeric keys (0 - 9) or the “Rotary” ( ) knob to set the value. The output current slew rate of the DC Power Supply is set as shown in Figure 3-23. The maximum input Slew Rate is 0.1A/mS and the minimum is 0.003A/mS. If the input is larger than 0.3A/mS, the current Slew Rate will be set to INF. and will change with the maximum slew rate (near infinite). The output of the DC Power Supply will follow the rising slew rate to the set output current.

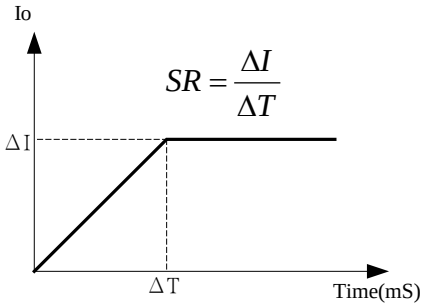


Figure 3-23

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

3.3.2.5 Setting DC_ON

The DCOUT_ON signal on the ANALOG INTERFACE can be set to follow the rising and falling edges of the voltage waveform or the position of the OUTPUT button on the front panel. If the DCOUT_ON signal is set to VDC_R/F and the voltage is over VDC_R, pin10 DCOUT_ON on the ANALOG INTERFACE will go HIGH. If the voltage is lower than VDC_F, pin10 DCOUT_ON on the ANALOG INTERFACE will go LOW. If the DCOUT_ON signal is set to VDC_ON/OFF, the signal will follow the position of the OUTPUT button on the front panel, as shown in Figure 3-24:

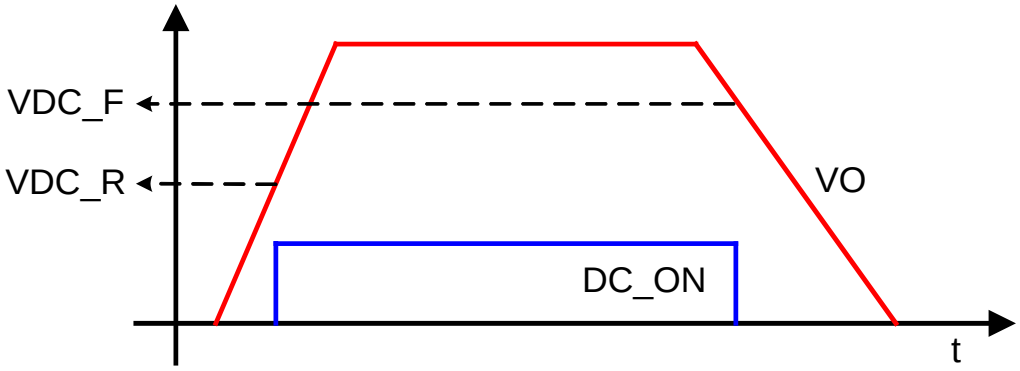


Figure 3-24

Set DC_ON as described below:

1. Method 1: Use the “ ”, “ ” keys to move the cursor to the column to be set as shown in Figure 3-25.

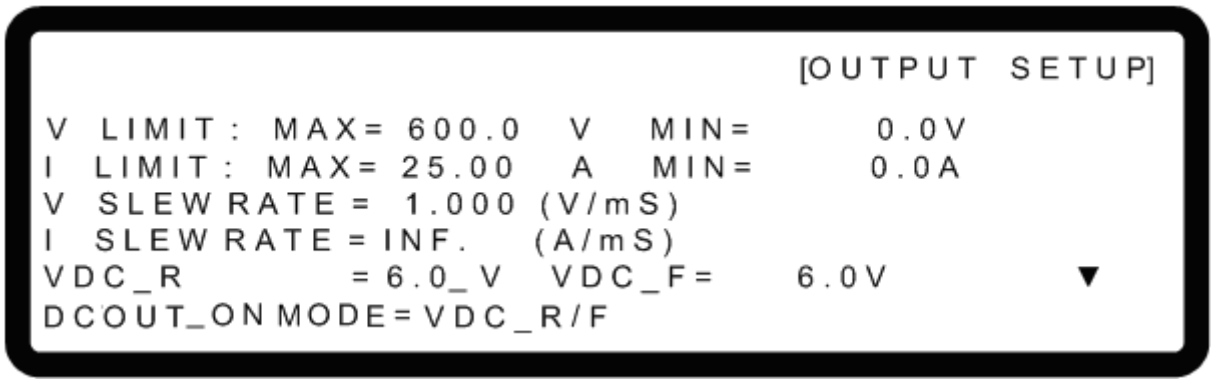


Figure 3-25

2. Use the numeric keys (0 - 9) or the “Rotary” ( ) knob to set the values. The lower limit is 1%Vmax and the upper limit is 99%Vmax, e.g., the lower limit of DC_ON is 6V and the upper limit is 594V for the 62150H-600S.

3. Method 2: Use the “ ”, “ ” keys to move the cursor to the column to be set as shown in Figure 3-26.

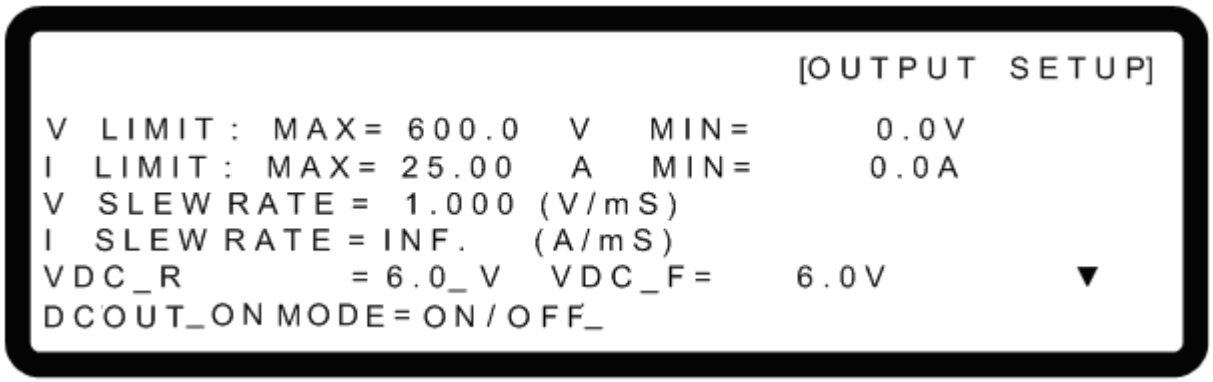


Figure 3-26

4. Use the numeric keys (0 - 1) or the "Rotary" ( ) knob to set DCOUT_ON MODE to ON/OFF, which causes pin10 on the ANALOG INTERFACE to follow the OUTPUT button on the front panel.

3.3.2.6 Setting IV CURVE Parameters

IV Curve related parameters such as CONTROL MODE, INPUT FILTER, OUTPUT SPEED and SETTING MARGIN can be modified in the IV CURVE PARAMETER as shown in Figure 3-27. The IV CURVE PARAMETER settings adjust the IV Curve algorithm in Table mode, SAS mode, and IV Program.

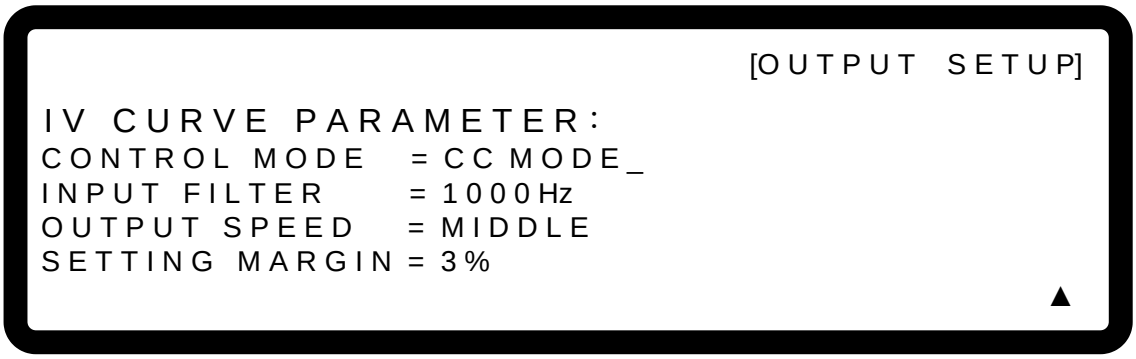
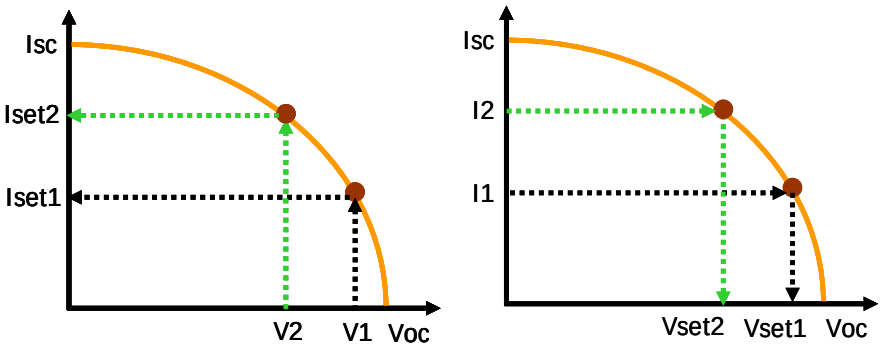


Figure 3-27

3.3.2.6.1 Setting CONTROL MODE

When the DC Power Supply is operating in IV mode, the CONTROL MODE will affect the IV Curve settings and the measured object. When set to CC mode, the DC Power Supply will measure the output voltage and use the IV Curve mapped current as the control current to draw the IV Curve shown in Figure 3-28(a). If the CONTROL MODE is set to CV mode, the DC Power Supply will measure the output current and use the IV Curve mapped voltage as the control voltage to draw the IV Curve shown in Figure 3-28(b).



(a) CC Mode (b) CV Mode

Figure 3-28

Set the CONTROL MODE as described below:

1. Use the " ", " " keys to move the cursor to the column to be set as shown in Figure 3-27.
2. Use the numeric keys (0 - 1) or the "Rotary" ( ) knob to select either CC MODE or CV MODE. The default setting is CC MODE.
3. Press " ENTER " to confirm.
4. Press " EXIT " to return to the MAIN PAGE.

3.3.2.6.2 Setting INPUT FILTER

INPUT FILTER filters the measured signals for the IV Curve calculation used in IV mode. For example, if the measured voltage waveform has 20 kHz ripple then setting the INPUT FILTER to 1kHz can eliminate the 20 kHz ripple component.

1. Use the " ", " " keys to move the cursor to the column to be set as shown in Figure 3-29.

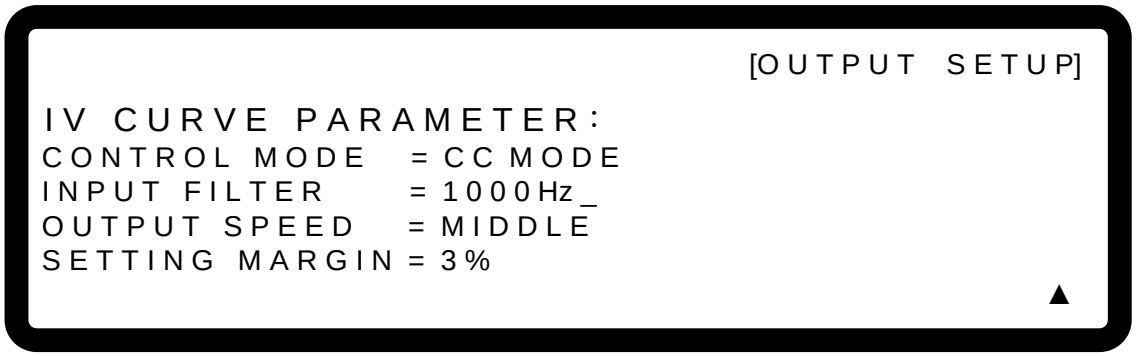


Figure 3-29

2. Use the numeric keys (0 - 9) or the "Rotary" ( ) knob to set the INPUT FILTER frequency. The setting range is 1-3125Hz and the default is 1000Hz.
3. Press " ENTER " to confirm.
4. Press " EXIT " to return to the MAIN PAGE.

3.3.2.6.3 Setting OUTPUT SPEED

OUTPUT SPEED sets the output response speed of the IV Curve to FAST, MIDDLE or SLOW. The sequence for the output response speed setting is FAST > MIDDLE > SLOW.

1. Use the " ◄─▲ ", " ▼─► " keys to move the cursor to the column to be set as shown in Figure 3-30.

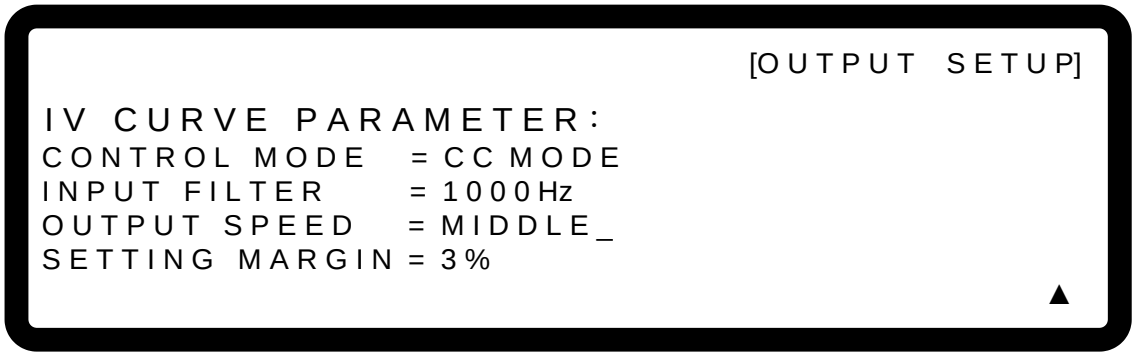


Figure 3-30

2. Use the numeric keys (0 - 2) or the "Rotary" ( ) knob to set the OUTPUT SPEED. The default is MIDDLE.
3. Press " ENTER " to confirm.
4. Press " EXIT " to return to the MAIN PAGE.

3.3.2.6.4 Setting MARGIN

SETTING MARGIN sets the margin for non-control settings in the IV Curve. For example, when set to CC mode, the non-control item is the voltage setting and when set to CV mode it is the current setting. To ensure the control mode remains in a fixed mode, the setting must be larger than 3%. As shown in Figure 3-28(a), the voltage measurement is V1 so the control item is the current setting, Iset1, instead of Vset1. When SETTING MARGIN is set to 3%, the Vset1=1.03*V1.

1. Use the " ◄─▲ ", " ▼─► " keys to move the cursor to the column to be set as shown in Figure 3-31.

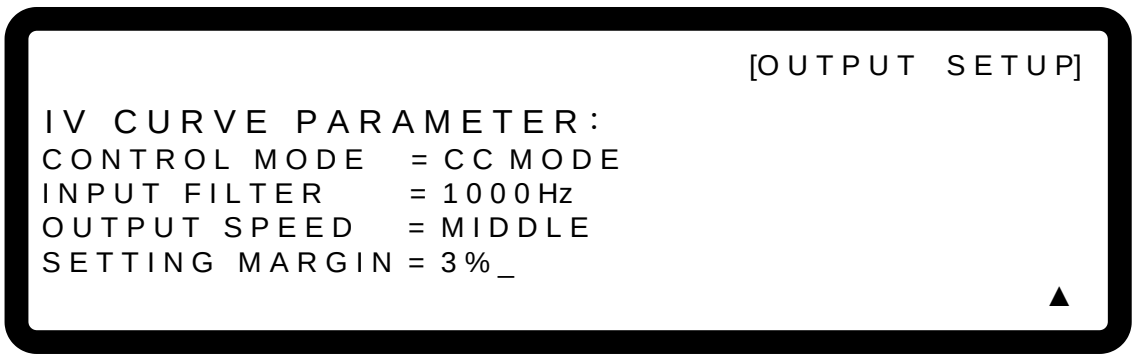


Figure 3-31

2. Use the numeric keys (0 - 9) or the “Rotary” ( ) knob to set the range of SETTING MARGIN. The default is 3%.
3. Press “ ENTER ” to confirm.
4. Press “ EXIT ” to return to the MAIN PAGE.

3.3.3 SERIES/PARALLEL

62000H Series DC Power Supplies with Solar Array Simulation may be connected in series or parallel when in the CV/CC MODE. The maximum voltage is 1200V if connected in series and the maximum current is 250A if connected in parallel. When the IV curve function is enabled in the TABLE Mode, SAS Mode or IV PROGRAM Mode, only parallel connections are supported (no series connections).

Notice

1. Series/Parallel cannot be used at the same time. A620028 and A620027 models only support parallel connections.
2. The maximum output voltage or current is 1200V or 250A when operating the 62000H Series with Solar Array Simulation in series or parallel. Table 3-1 shows the values for the 62xxxH-xxxS models.

Table 3-1

62000H Series Model with Solar Array Simulation	Serial		Parallel	
	Max. Devices	Max. Output Voltage (V)	Max. Devices	Max. Output Current (A)
62150H-600S	2	1200	10	250
62150H-1000S	2	1200	10	150
62020H-150S	2	250	10	400

3. Model types cannot be mixed when operating in Series/Parallel.
4. Insure the breaker capacity is sufficient and the earth grounding wire is grounded to earth ground when connecting in series/parallel.
5. When more than 5 devices are to be paralleled, contact the Service Center or CHROMA agent for connection instructions.
6. Stack the DC Power Supplies vertically for parallel connection. The standard CURRENT SHARING cable cannot be used if the devices are placed horizontally in the parallel configuration; an optional CURRENT SHARING (100CM) cable is required. Contact the CHROMA Service Center or local agent for further information. No more than 2 units may be paralleled when placed horizontally. .
7. Firmware versions 2.00 and above are not backward compatible. Be sure to upgrade the firmware version from 1.XX to 2.00 when connecting to a device with firmware version 2.00 for series use. Contact Chroma’s service unit for a firmware upgrade.

3.3.3.1 Connecting Series/Parallel Output Cables

Figure 3-32 and Figure 3-33 show how to connect the serial and parallel output cables.

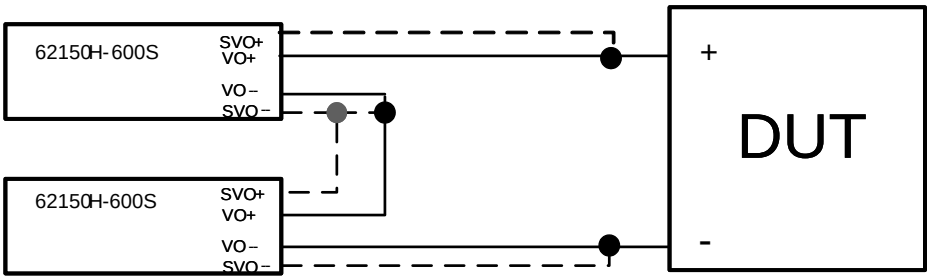


Figure 3-32

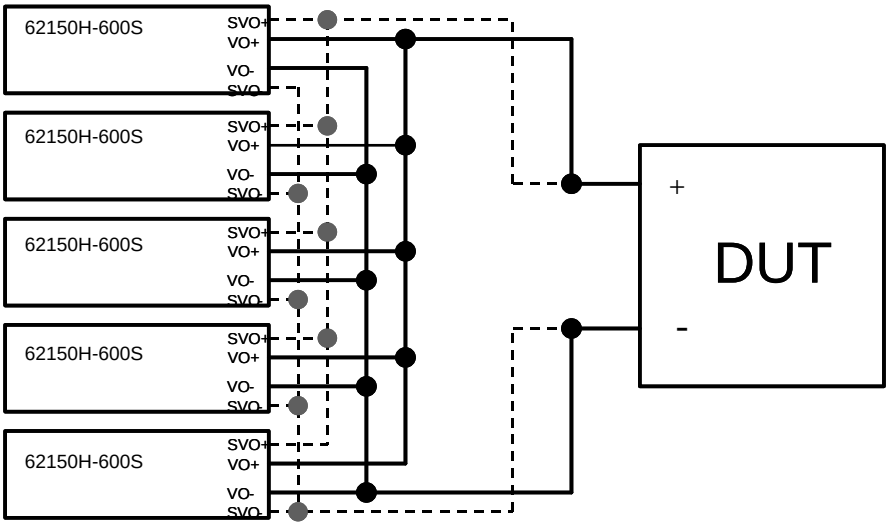
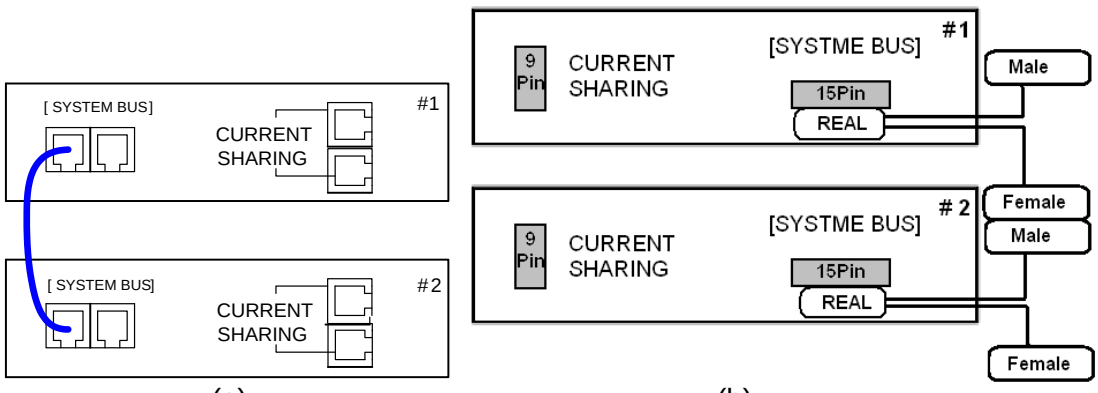


Figure 3-33

3.3.3.2 Assembling Series/Parallel Communication Interface

1. When the DC Power Supplies are connected in series, the SYSTEM BUS connectors on the rear panel must be connected as shown in Figure 3-34(a.). For the 62020H-150S, connect the cables as shown in Figure 3-34(b).



(a) (b)

Figure 3-34

2. When the DC Power Supplies are connected in parallel, both the SYSTEM BUS and CURRENT SHARING connectors must be connected as shown in Figure 3-35 (a) [and Figure 3-35 (b) for the 62020H-150S]. For the A620028 and A620027 the MASTER unit and ANALOG must be connected as shown in Figure 3-36.

Notice

1. The A620028 and A620027 SLAVE models only work when the MASTER firmware version is 1.30 or above. If a firmware upgrade is required, contact Chroma.
2. The A620028 and A620027 SLAVE models have a 1 to 2 ANALOG communication cable labeled “SLAVE”. This standard accessory is for A620028 and A620027 use only. The other 1 to 2 ANALOG cable labeled “MASTER” connects the MASTER side with the A620028 and A620027 as shown in Figure 3-36 (this cable is optional).
3. Plug in the 62020H-150S SYSTME BUS CABLE connector labeled “REAL” to the device rear panel. See Figure 3-35(b) for connecting other devices for communication.

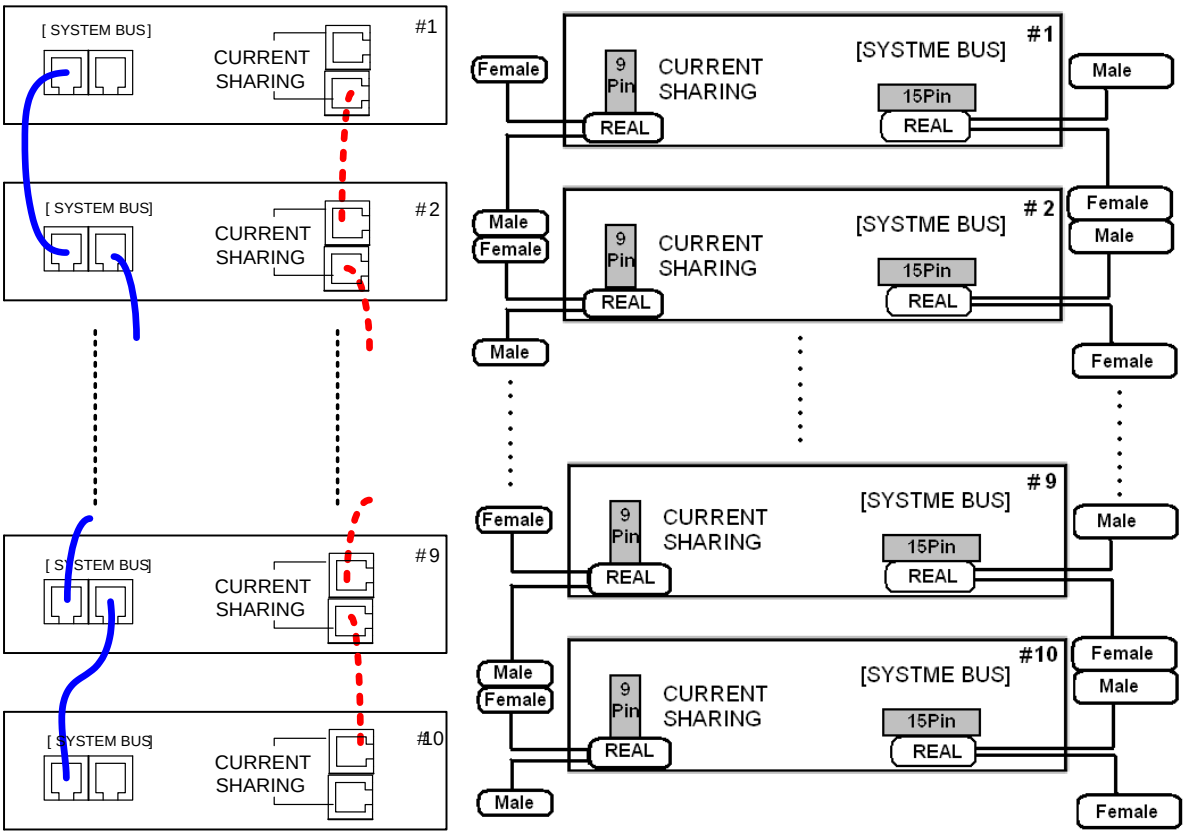


Figure 3-35

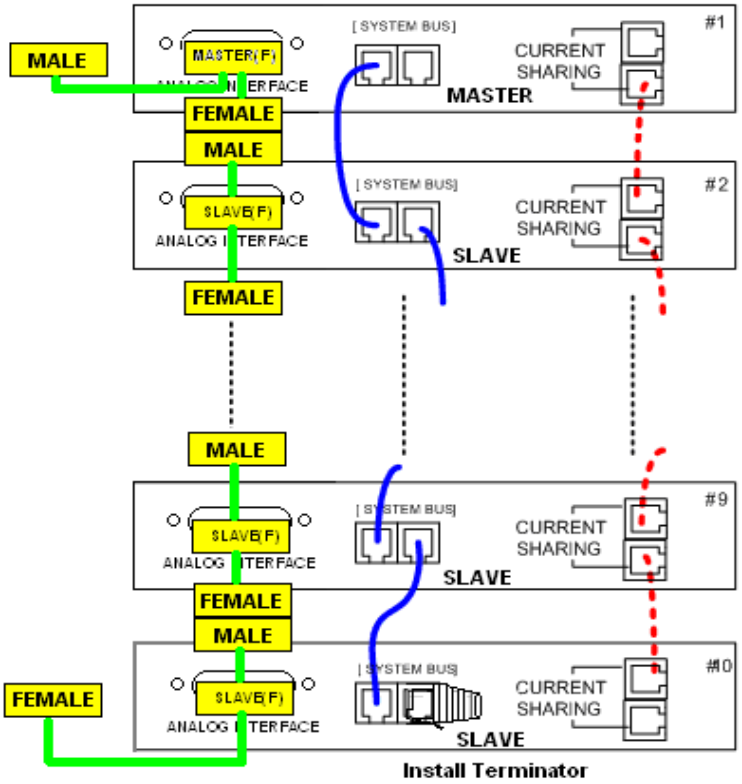


Figure 3-36

Notice

1. Each DC Power Supply has two RS485 female interface connectors. They must be connected for 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 3-34 or Figure 3-35. For the 62020H-150S, connect the 15P 1 to 2 cable labeled “REAL” to the rear panel; also connect the two cables as shown in Figure 3-34 or Figure 3-35. The maximum length for the communication cable is 7.2 meters. Exceeding the length limit may result in unstable operation.
2. Each DC Power Supply has two CURRENT SHARING connecting terminals. Connect the output terminal of the first Power Supply to the input terminal of the second Power Supply and so forth as shown by the dotted lines in Figure 3-35. For the 62020H-150S, connect the 9P 1 to 2 cable labeled “REAL” to the rear panel; also connect the two cables as shown in Figure 3-35. Be sure to use the CURRENT SHARING communication cable provided by CHROMA. The maximum length for the CURRENT SHARING cable is 3.4 meters. Exceeding the length limit may result in unstable operation.
3. The CURRENT SHARING communication cable must be securely connected during parallel operation or it may result in unstable operation.
4. When the A620028 and A620027 are connected to the MASTER unit, install a Terminator on the last SYSTEM BUS of the parallel path as shown in Figure 3-36.

CAUTION

1. The DC Power Supply could malfunction or be damaged if the CURRENT SHARING cable is connected incorrectly when in parallel mode.

2. Do not connect the CURRENT SHARING cable when in series operation as it could cause a malfunction or damage the unit.
3. Do not connect the CURRENT SHARING cable when operated standalone as it could cause a malfunction or damage the unit.
4. Remove the SYSTEM BUS and CURRENT SHARING signal cables when returning to standalone operation as it could cause a malfunction or damage the unit if they remain connected.

3.3.3.3 Setting Series/Parallel Operation Mode

3.3.3.3.1 Setting SLAVE

CAUTION Set the SLAVE first and then the MASTER when operating the DC Power Supplies with Solar Array Simulation in series or parallel mode, otherwise they may not be able to operate due to communication errors.

When MASTER OR SLAVE is set to SLAVE, set the SLAVE to SLAVE1 - SLAVE9 and the M/S TERMINATOR selection. Set the SLAVE sequence starting from SLAVE1.

1. In the Config Setup page, press "3" then "ENTER" to select PARALLEL /SERIES as shown in Figure 3-37.
2. Use the " ", " " keys to move the cursor to the PARALLEL OR SERIES selection column.

```
                                [SERIES/PARALLEL]
MASTER OR SLAVE                   =   MASTER_
   M/S TERMINATOR                 =   DISABLE
   PARALLEL OR SERIES             = PARALLEL
   NUM. OF SLAVE                  =          1
   MASTER & SLAVE CONTROL=                 NO
```

Figure 3-37

3. Use the numeric keys (1 - 9) or the "Rotary" ( ) knob to set SLAVE1-SLAVE9 as shown in Figure 3-38.

```
                                [SERIES/PARALLEL]
MASTER OR SLAVE                   =   SLAVE 1_
   M/S TERMINATOR                 =   DISABLE
```

Figure 3-38

4. Use the “ ”, “ ” keys to move the cursor to the M/S TERMINATOR selection item.
5. Use the numeric keys (1 - 0) or the “Rotary” ( ) knob to ENABLE or DISABLE the TERMINATOR as shown in Figure 3-38.
6. Press “ENTER” to confirm.
7. Press “EXIT” to return to the MAIN PAGE.

3.3.3.3.2 Setting MASTER

If MASTER OR SLAVE is set to MASTER, M/S TERMINATOR, PARALLEL OR SERIES and NUM. OF SLAVE selections also need to be set. See the description of PARALLEL OR SERIES in section 3.3.3.3.3 and NUM. OF SLAVE in section 3.3.3.3.4.

MASTER has two main functions:
(1) It issues commands to all SLAVE units, such as voltage setting, current setting, and protection setting, etc., which means all settings in SLAVE units are set from the MASTER. The original settings in the SLAVE units are temporary ignored.
(2) It accepts all measurement values and protection signals from the SLAVE units. The MASTER calculates all measurement values and displays them in the MAIN PAGE. When a protection error occurs in one SLAVE unit, the MASTER will notify the other SLAVE units to turn ON protection and display the error on 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.

Configure a unit as MASTER as described below:

1. In the Config Setup page, press “3” then ENTER to select PARALLEL/SERIES.
2. Use the numeric key (0) or the “Rotary” ( ) knob to set MASTER as shown in Figure 3-39.

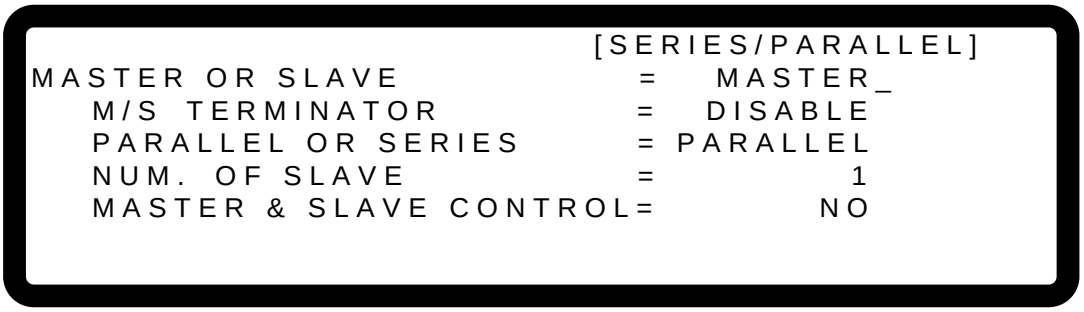


Figure 3-39

3. Use the “ ”, “ ” keys to move the cursor to the M/S TERMINATOR selection item.

4. Use the numeric keys (1 - 0) or the “Rotary” ( ) knob to ENABLE or DISABLE the TERMINATOR as shown in Figure 3-39.
5. Press “ ENTER ” to confirm.

Notice

Description of M/S TERMINATOR

When the 62000H Series Models with Solar Array Simulation are operating in MASTER OR SLAVE mode, be aware of the M/S TERMINATOR setting. Assuming the connection is as shown in Figure 3-40, the M/S TERMINATOR of the first and last devices must be ENABLED with a 120Ω internal resistance. When using A620028 and A620027 SLAVE models, the TERMINATOR is installed externally as shown in Figure 3-36.

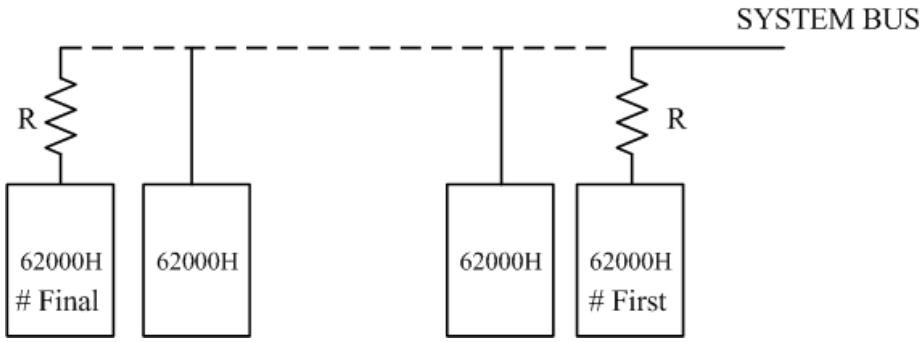


Figure 3-40

3.3.3.3.3 Setting PARALLEL or SERIES

Set the Power Supply to Series or Parallel mode as shown in Figure 3-41. There are two selections: PARALLEL and SERIES.

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

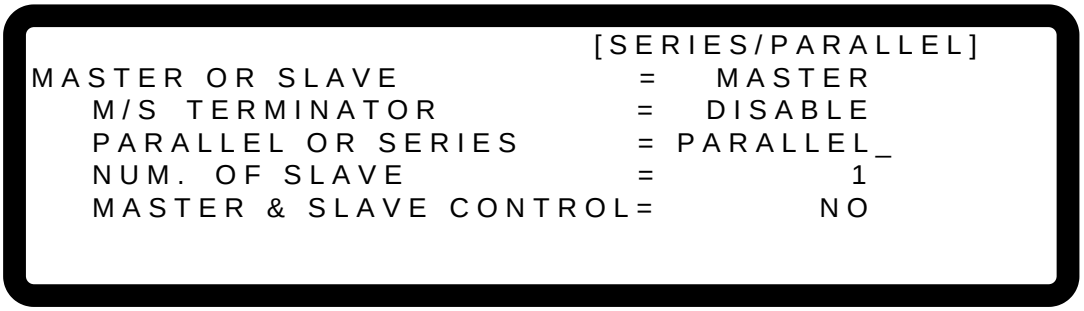


Figure 3-41

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

Connect the cables on the rear panel as shown in Figure 3-34 when set to SERIES and as shown in Figure 3-35 when set to PARALLEL.

Selecting SERIES will display the window shown in Figure 3-42 to remind the user to disconnect the CURRENT SHARING cable on the rear panel.

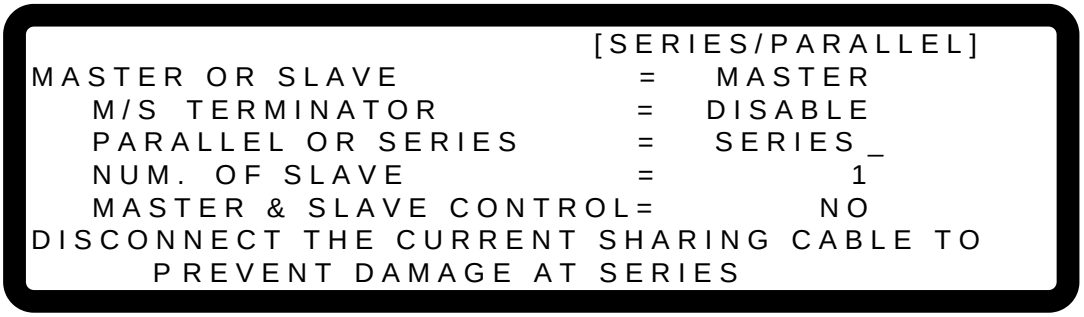


Figure 3-42

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

3.3.3.3.4 Setting NUM. OF SLAVE

When a DC Power Supply is set to MASTER, the number of SLAVEs must be set as well. If there are 4 SLAVEs, set NUM. OF SLAVE = 4 as shown below in Figure 3-43.

1. Use the " ", " " keys to move the cursor to the column to be set.
2. Use the numeric keys (0 - 9) or the "Rotary" ( ) knob to set the number of SLAVEs.

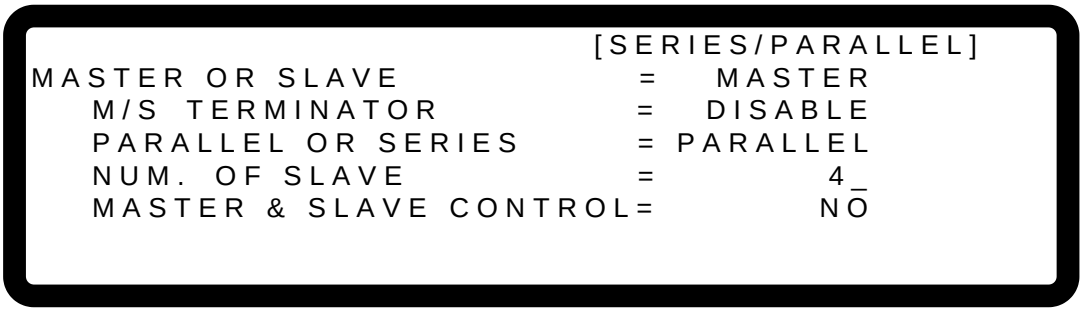


Figure 3-43

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

Notice

Using the 62150H-600S as an example:

1. If there are 5 sets connected in parallel for 600V/100A, each unit should be set for 600V/20A and the total output will be 600V/100A.
2. If there are 2 sets connected in series for 1200V/25A, each unit should be set for 600V/25A and the total output will be 1200V/25A.
3. A maximum of 2 units may be connected in series; therefore, the maximum number of NUM. OF SLAVE is 1.
4. A maximum of 10 units may be connected in parallel; therefore, the maximum number of NUM. OF SLAVE is 9.

3.3.3.3.5 Activating MASTER & SLAVE CONTROL

When connecting units in PARALLEL OR SERIES, set NUM. OF SLAVE in the MASTER unit as described below:

1. Use the “ ”, “ ” keys to move the cursor to the column to be set as shown in Figure 3-44.
2. Use the numeric key (1) or the “Rotary” ( ) knob to set YES.

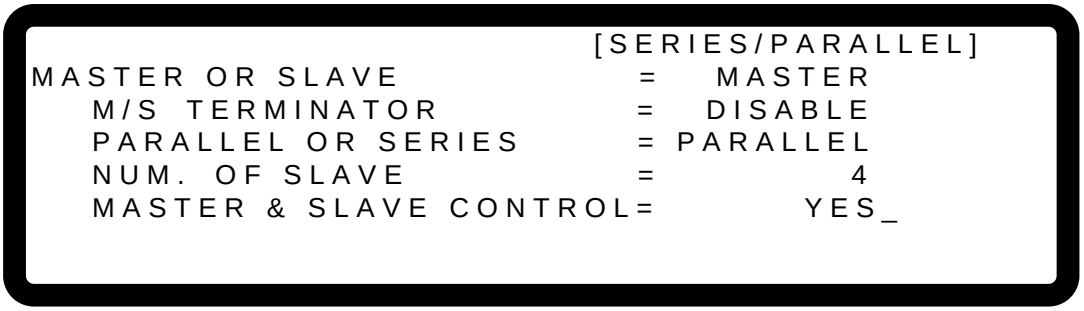


Figure 3-44

3. Press “ENTER” to confirm and the menu will automatically switch to the series/parallel MASTER page as shown in Figure 3-45.

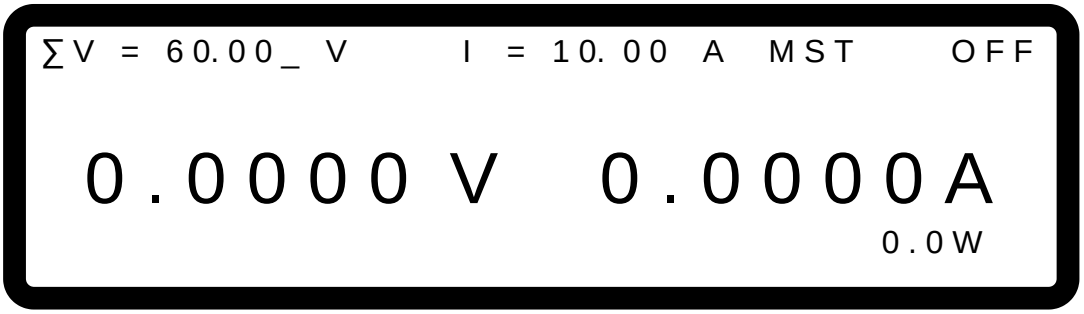


Figure 3-45

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

Figure 3-46

5. The units are now ready to be used in the series/parallel mode.

CAUTION

1. Communication errors will occur if the SLAVE settings are the same (such as SLAVE 1 & SLAVE 1). The MAIN PAGE of the MASTER unit will show the following message if this type of error occurs. First exit the series/parallel operation and then change the SLAVE setting to resume operation.

Figure 3-47

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

3.3.3.4 Setting Series Parameters

The following parameter setting screens display once the software communication and hardware settings for series operation are completed - (1) MAIN PAGE, (2) SYSTEM SETUP, (3) OUTPUT SETUP and (4) PROTECTION.

3.3.3.4.1 Setting MAIN PAGE

MAIN PAGE is used to set voltage (V) and current (I). The difference between single unit and series operation is that the voltage setting will increase according to the number of units connected in series. The voltage setting is indicated by ΣV for easy identification. When set to MASTER, MST will appear in the window's upper right corner as shown in Figure 3-48 below.

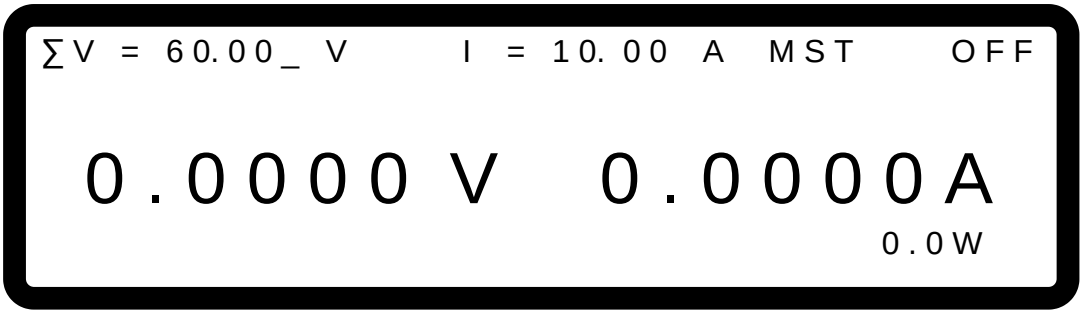


Figure 3-48

3.3.3.4.2 Setting SYSTEM SETUP for Series

The operation of POWER ON STATUS in [SYSTEM SETUP] during series operation is the same as for a single unit except the output voltage will increase based on the number of units connected in series. For example, if there are 2 sets of 62150H-600S in series, the maximum output voltage that can be set is 1200V, and the maximum output current is 25A, as shown in Figure 3-49 below:

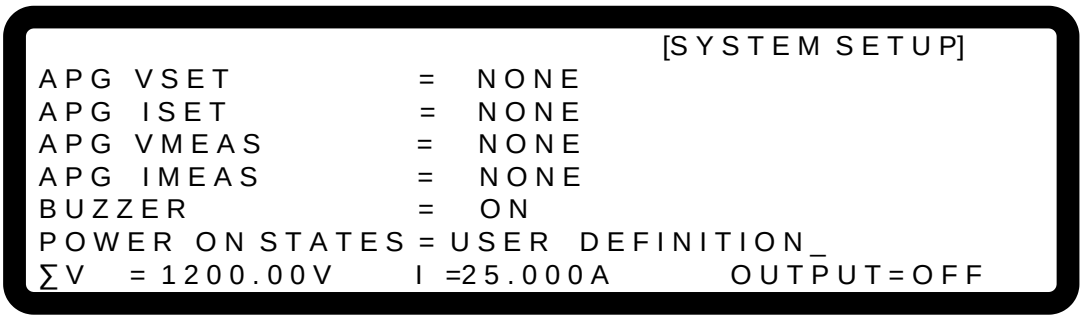


Figure 3-49

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

3.3.3.4.3 Setting OUTPUT SETUP for Series

The V LIMIT MAX in [OUTPUT SETUP] in the MASTER unit in a series connection will increase based on the number of units connected in series. The set voltage is indicated by ΣV LIMIT: MAX for easy identification as shown in Figure 3-50 below. The setting range of ΣV SLEW RATE will also increase based on the number of units connected in series.

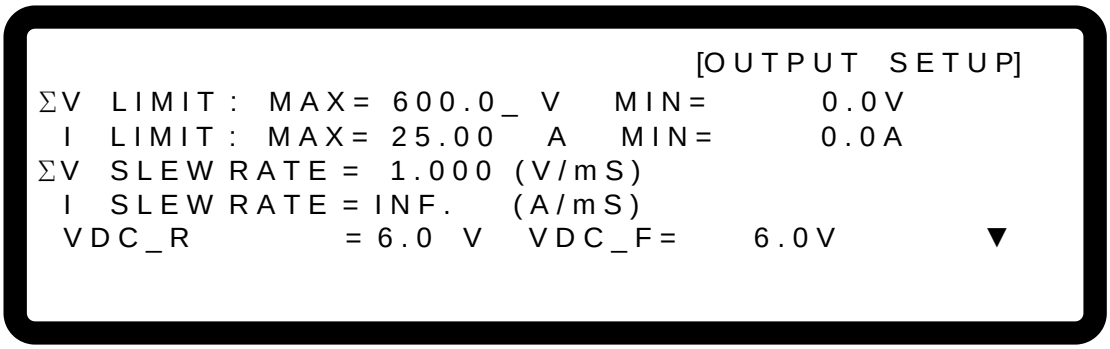


Figure 3-50

3.3.3.4.4 Setting PROTECTION for Series

The OVP and OPP [PROTECTION] settings in the MASTER unit in a series connection will increase based on the number of units connected in series. They are indicated by ΣOVP and ΣOPP for easy identification as shown in Figure 3-51 below.

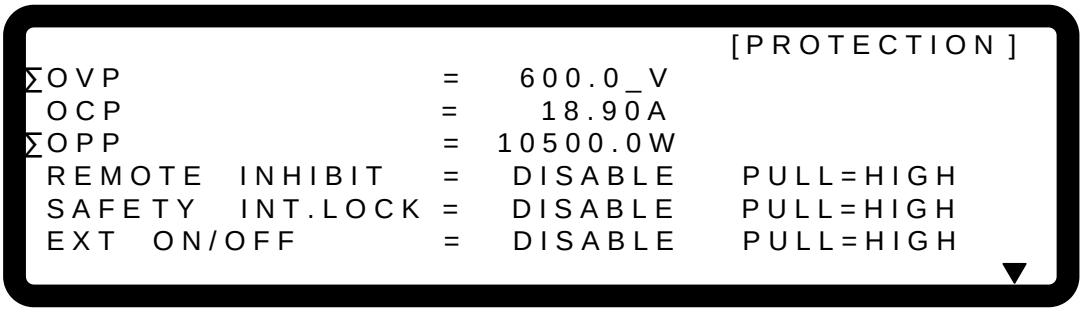


Figure 3-51

3.3.3.5 Setting Parallel Parameters

The following parameter setting screens display once the software communication and hardware settings for parallel operation are completed - (1) MAIN PAGE, (2) SYSTEM SETUP, (3) OUTPUT SETUP and (4) PROTECTION.

3.3.3.5.1 Setting MAIN PAGE

MAIN PAGE is used to set voltage (V) and current (I). The difference between single unit and parallel operation is that the current setting will increase according to the number of units connected in parallel. The current setting is indicated by ΣI for easy identification. When set to MASTER, MST will appear in the window's upper right corner as shown in Figure 3-52 below.

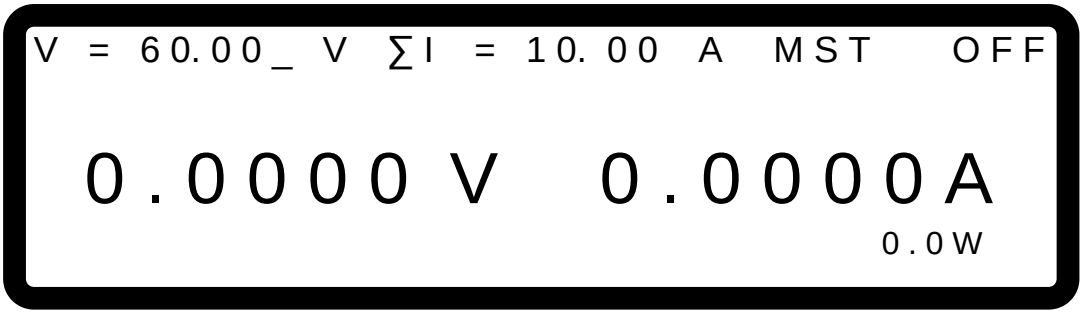


Figure 3-52

3.3.3.5.2 Setting SYSTEM SETUP for Parallel

The operation of POWER ON STATUS in [SYSTEM SETUP] for parallel operation is the same as for a single unit except the output current will increase based on the number of units connected in parallel. For example, if there are 5 sets of 62150H-600S in parallel, the maximum output voltage that can be set is 600V, and the maximum output current is 125A, as shown in Figure 3-53 below:

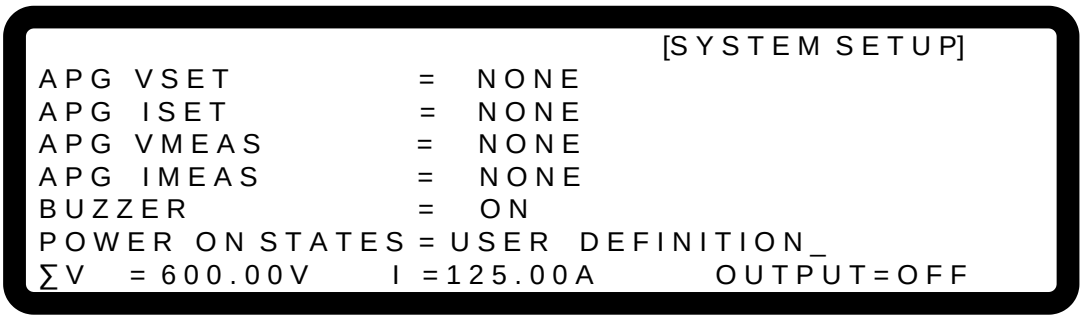


Figure 3-53

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

3.3.3.5.3 Setting OUTPUT SETUP for Parallel

The I LIMIT MAX in [OUTPUT SETUP] in the MASTER unit in a parallel connection will increase based on the number of units connected in parallel. The current setting is indicated by ΣV LIMIT: MAX for easy identification as shown in Figure 3-54 below. The setting range of ΣV SLEW RATE will also increase based on the number of units connected in parallel.

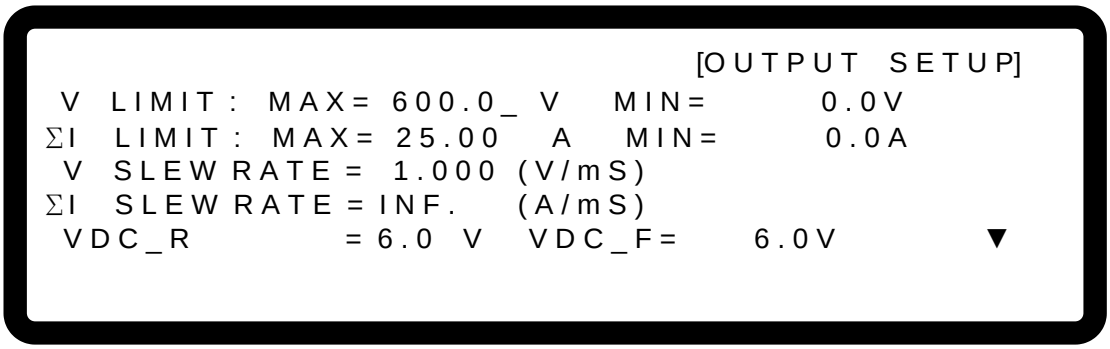


Figure 3-54

3.3.3.5.4 Setting PROTECTION for Parallel

The OCP and OPP [PROTECTION] settings in the MASTER unit in a parallel connection will increase based on the number of units connected in parallel. They are indicated by ΣOCP and ΣOPP for easy identification, as shown in Figure 3-55 below.

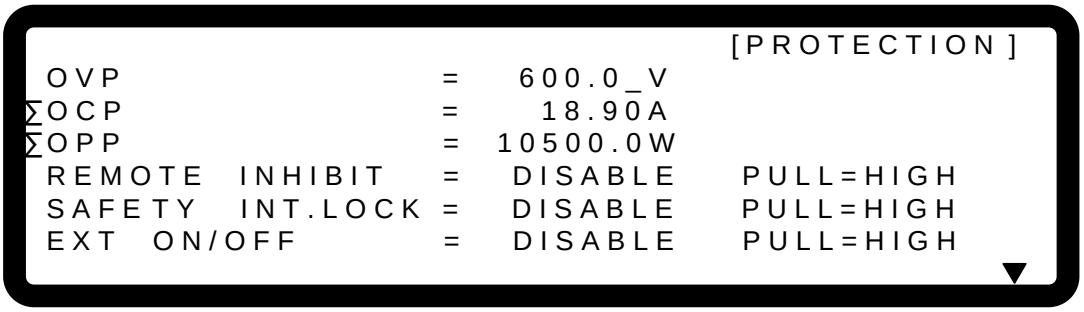


Figure 3-55

3.3.3.6 Setting Procedure for APG in Series or Parallel

3.3.3.6.1 Series Setting

The MAIN PAGE menu of the MASTER unit will display the following screen when connecting two 62150H-600S DC Power Supplies for series operation and setting the APG option to APG VSET/APG ISET = Vref(0-5V):

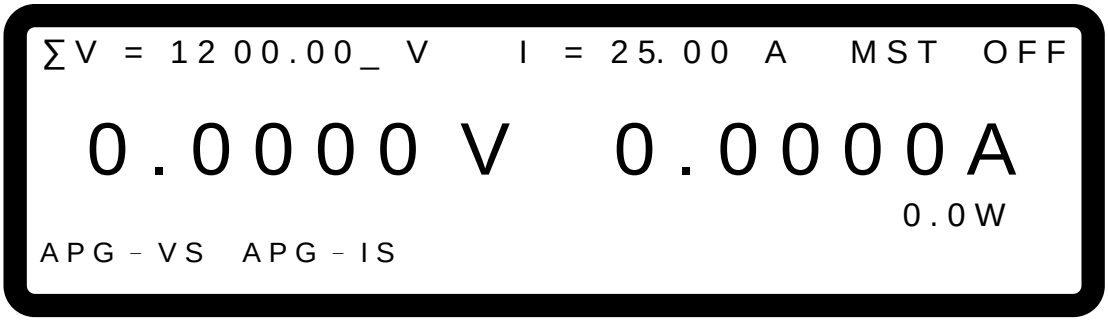
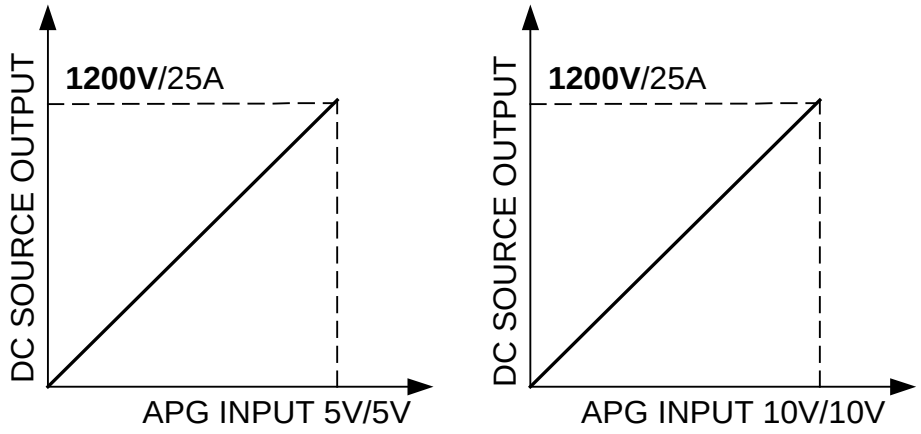


Figure 3-56

The external analog voltage 0-5V maps to the actual output voltage (0-1200V) and the actual output current (0-25A) as shown in Figure 3-57(a). When the APG option is set to APG VSET/APG ISET = Vref(0-10V) the external analog voltage 0-10V maps to the actual output voltage (0-1200V) and the actual output current (0-25A) as shown in Figure 3-57(b). The analog voltage signal wire needs to be routed through the APG interface connectors in series in APG mode.



(a) (b)

Figure 3-57

3.3.3.6.2 Parallel Setting

The MAIN PAGE menu of the MASTER unit will display the following screen when connecting five 62150H-600S DC Power Supplies for parallel operation and setting the APG option to APG VSET/APG ISET = Vref(0-5V):

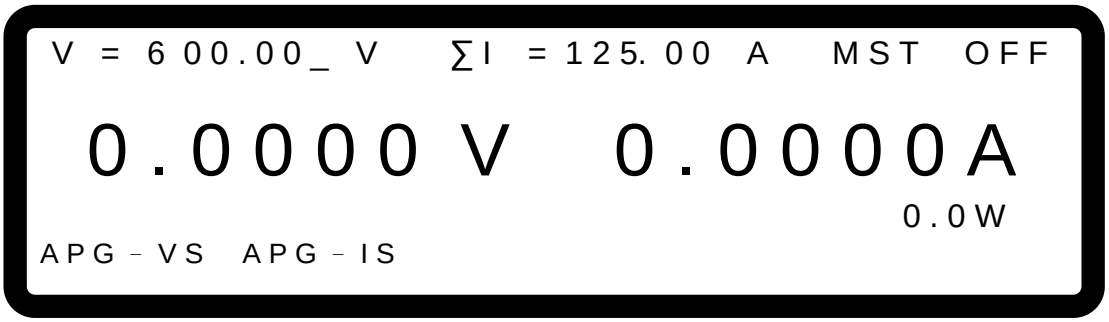
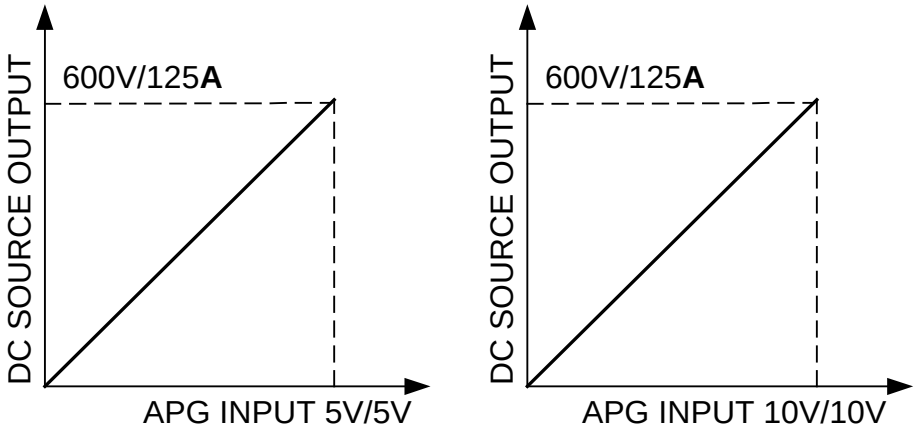


Figure 3-58

The external analog voltage 0-5V maps to the actual output voltage (0-600V) and the actual output current (0-125A) as shown in Figure 3-59(a). When the APG option is set to APG VSET/APG ISET = Vref(0-10V) the external analog voltage 0-10V maps to the actual output voltage (0-600V) and the actual output current (0-125A) as shown in Figure 3-59(b). The analog voltage signal wire needs to be routed through the APG interface connectors in series in APG mode.



(a) (b)

Figure 3-59

3.3.4 DISPLAY

The DISPLAY setting has 4 options: (1) BRIGHTNESS (2) DISPLAY SELECTION (3) READING AVERAGE TIMES (4) AVERAGE METHOD.

3.3.4.1 BRIGHTNESS

This option sets the backlight panel brightness of the VFD on the front panel. There are 4 backlight brightness settings to select from (including turn off the backlight) for use in various situations.

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

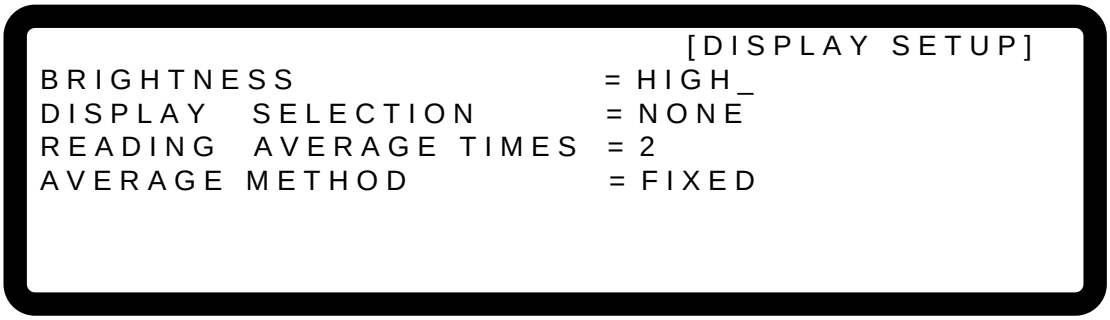


Figure 3-60

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

Notice

1. There are 3 selections for BRIGHTNESS: **HIGH /NORMAL/ DIMMED**. The default is **HIGH**.

2. Settings and brightness descriptions:
   a. Press "0", BRIGHTNESS = HIGH.
   b. Press "1", BRIGHTNESS = NORMAL.
   c. Press "2", BRIGHTNESS = DIMMED.
3. The lower the backlight brightness, the longer the display panel life. Set the backlight brightness to DIMMED when the device is doing burn-in to prolong the product life of the VFD display.

3.3.4.2 DISPLAY SELECTION

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

1. In the Config setting page, press "4" to display the screen then "ENTER" to enter into DISPLAY SELECTION as shown in Figure 3-61.

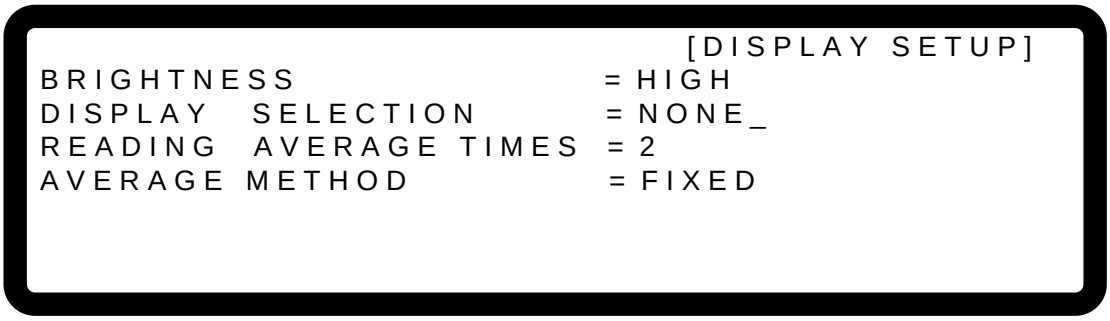


Figure 3-61

2. Use the "◄—▲", "▼—►" keys to move the cursor to the column to be set as shown in Figure 3-61.
3. Use the numeric keys (0 - 3) or the "Rotary" (◎) knob to select the desired setting. There are 4 selections on the MAIN PAGE: (1)NONE, (2)V/I LIMIT, (3)V/I/P PROTECT and (4)V/I SLEWRATE. The system default is NONE.

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

   When the selection is set to V/I LIMIT, the last line on MAIN PAGE will show the range set by V LIMIT and I LIMIT in the OUTPUT SETUP as shown in Figure 3-62. See sections 3.3.2.1 and 3.3.2.2 for a detailed description.

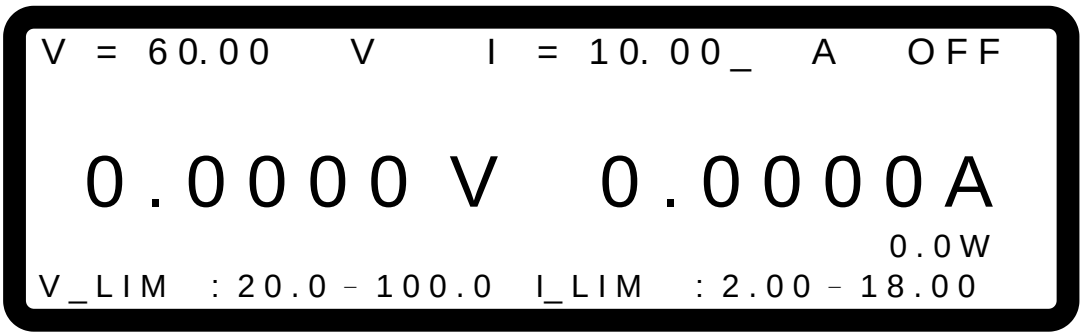


Figure 3-62

When the selection is set to V/I /P PROTECT, the last line of the MAIN PAGE will show the OVP, OCP and OPP settings in the PROTECTION as shown in Figure 3-63. See sections 3.3.5.1 - 3.3.5.3 for a detailed description.

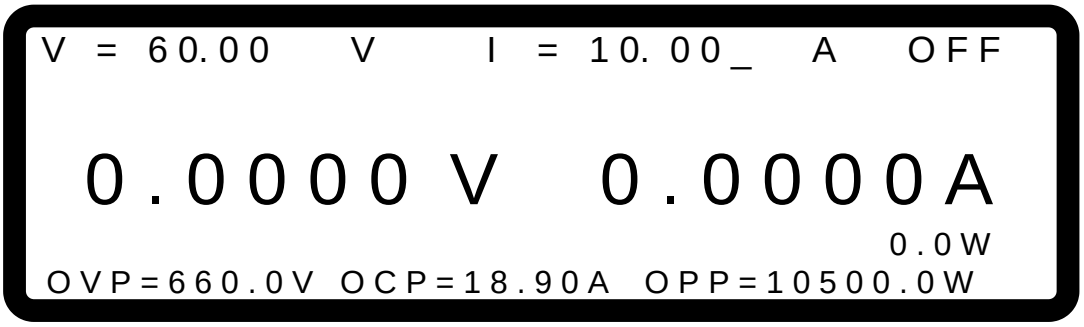


Figure 3-63

When the selection is set to V/I SLEW, the last line on the MAIN PAGE will show the settings of V SLEWRATE and I SLEWRATE in the OUTPUT SETUP as shown in Figure 3-64. See sections 3.3.2.3 and 3.3.2.4 for a detailed description

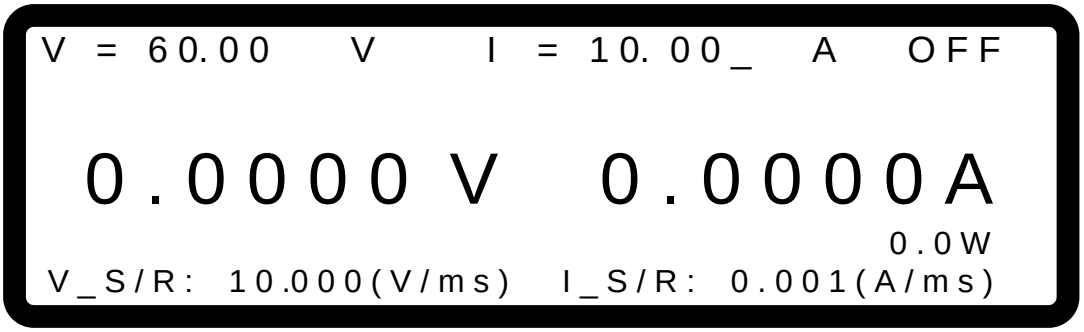


Figure 3-64

3.3.4.3 READING AVERAGE TIMES

The READING AVERAGE TIMES sets the number of samples to be averaged and displayed on the MAIN PAGE screen. The default is 2. When changing the READING AVERAGE TIMES default, the average method can also be changed.

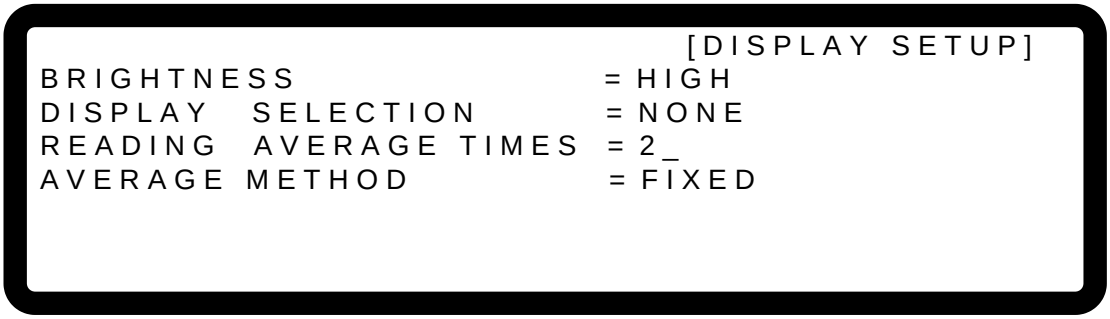


Figure 3-65

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

1. Use the numeric keys “ ◄—▲ ”, “ ▼—► ” to move the cursor to the column to be set.
2. Use the numeric keys 0 - 3 or the “Rotary” (◎) knob to select the number of samples to be averaged. READING AVERAGE TIME can be set to 1, 2, 4 and 8.
3. Move the cursor to AVERAGE METHOD and use the numeric keys (0 - 1) or the “Rotary” (◎) knob to select the desired average method. AVERAGE METHOD has two options: FIXED and MOVING.

Notice

1. As an example, setting the READING AVERAGE TIME = 8 and AVERAGE METHOD = FIXED, the next sampling clears all of the old samples (A1 - A8) in the buffer and saves the new samples (B1 - B8), then averages them as shown in Figure 3-66.

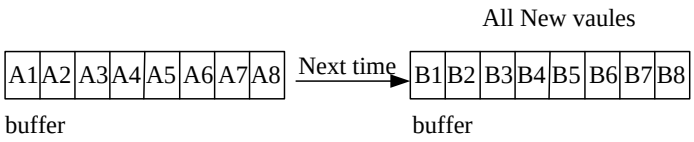


Figure 3-66

2. Setting the READING AVERAGE TIME = 8 and AVERAGE METHOD:MOVING, the next sampling removes the oldest sample in the buffer and saves the new sample, then averages them as shown in Figure 3-67.

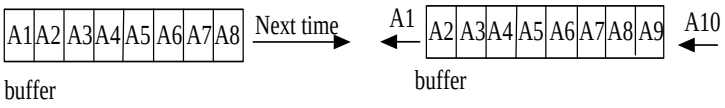


Figure 3-67

3. The panel reading is refreshed every 200mS.

3.3.5 PROTECTION

Chroma 62000H Series DC Power Supplies with Solar Array Simulation have protection functions divided into two classes. The first protection class includes over voltage, over current, over power and FOLDBACK; the second protection class includes over temperature, fan failure and over/under input voltage. The first class of protection trigger points is set by the user as described below, while the second protection class is auto detected by the system hardware protection circuits.

To enter into the Protection mode:

1. Press " CONF " to go to the Config Setup page.
2. Press "5" then "ENTER" to enter into the PROTECTION selection page as shown in Figure 3-68.

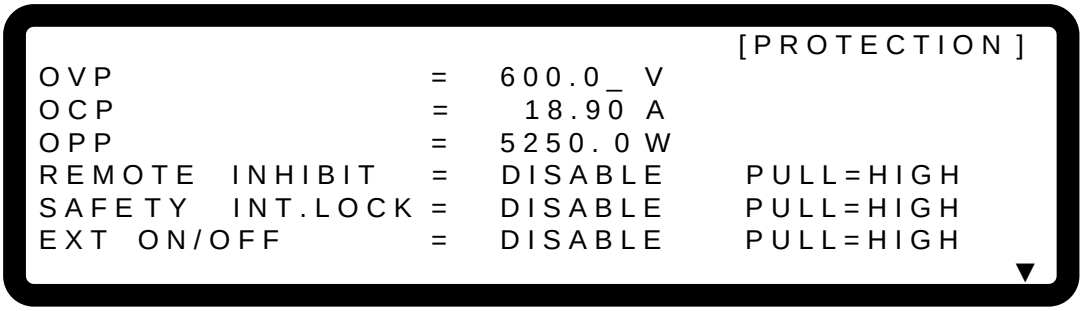


Figure 3-68

Notice When in the selection page, use the " ◄— ↑ ", " ↓ —► " keys to move the cursor to the column to be set.

3.3.5.1 OVP Protection

1. Use the " ◄— ↑ ", " ↓ —► " keys to move the cursor to the column to be set as shown in Figure 3-69.

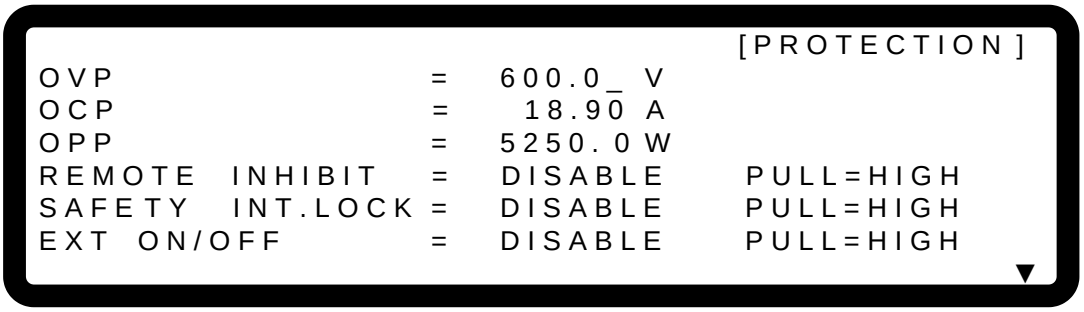


Figure 3-69

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

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

Notice

Table 3-2 shows the voltage range of OVP.

Table 3-2 OVP Range

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

If an OVP occurs the MAIN PAGE will display a protection message as shown in Figure 3-70.

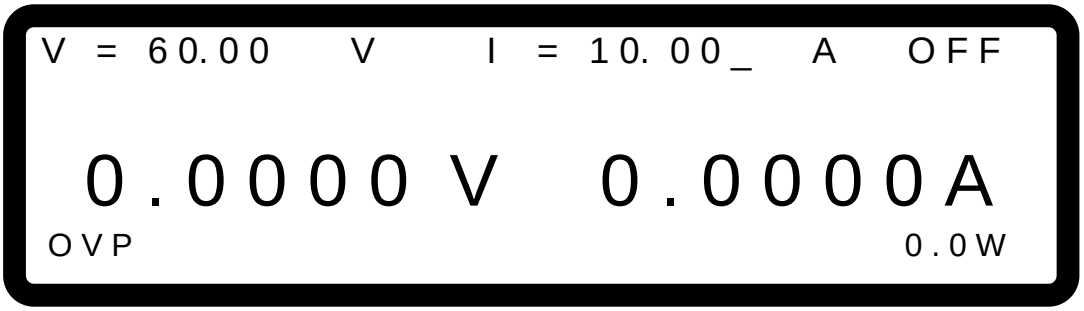


Figure 3-70

3.3.5.2 OCP Protection

1. Use the “ ”, “ ” keys to move the cursor to the column to be set as shown in Figure 3-71.

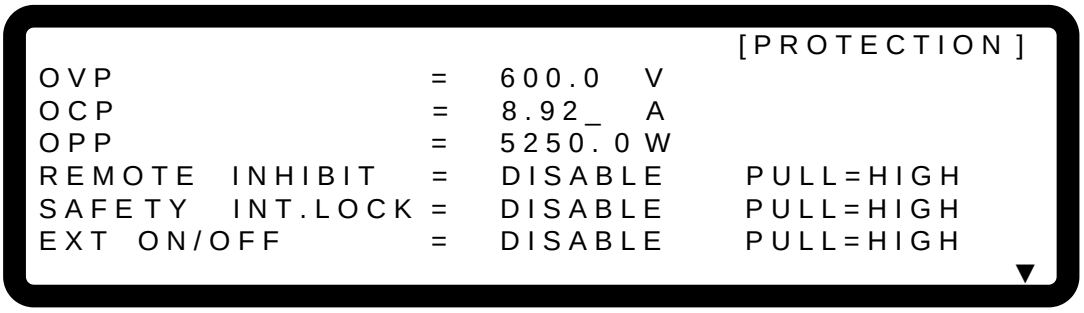


Figure 3-71

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

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

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

Table 3-3

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

If an OCP occurs the MAIN PAGE will display a protection message as shown in Figure 3-72.

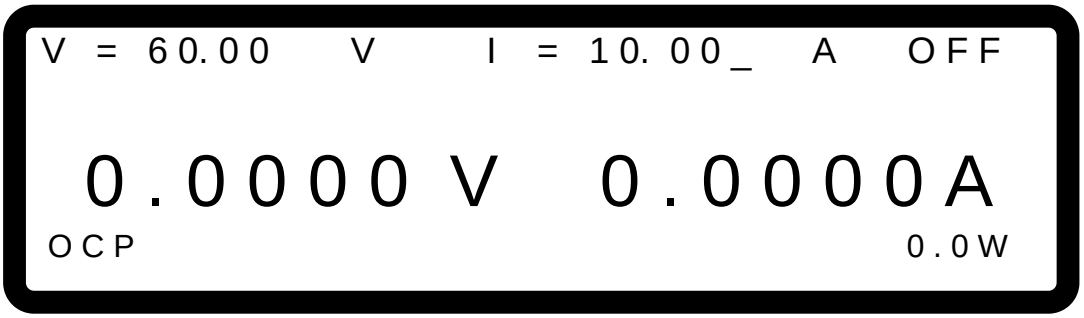


Figure 3-72

3.3.5.3 OPP Protection

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

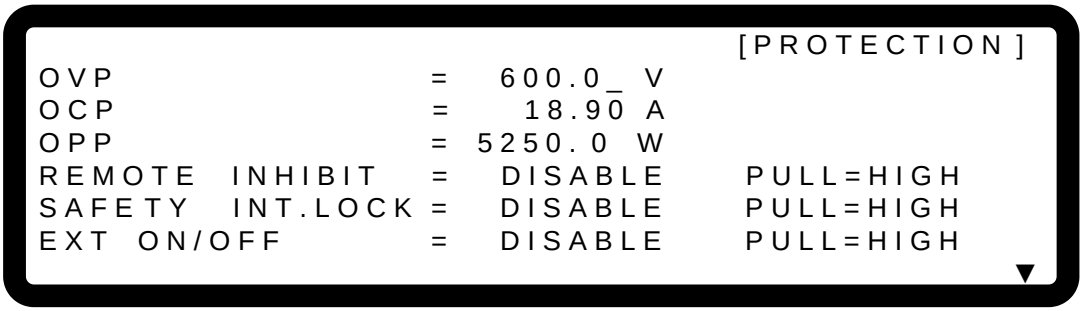


Figure 3-73

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

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

Notice

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

Table 3-4

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

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

If an OPP occurs the MAIN PAGE will displaty a protection message as shown in Figure 3-74.

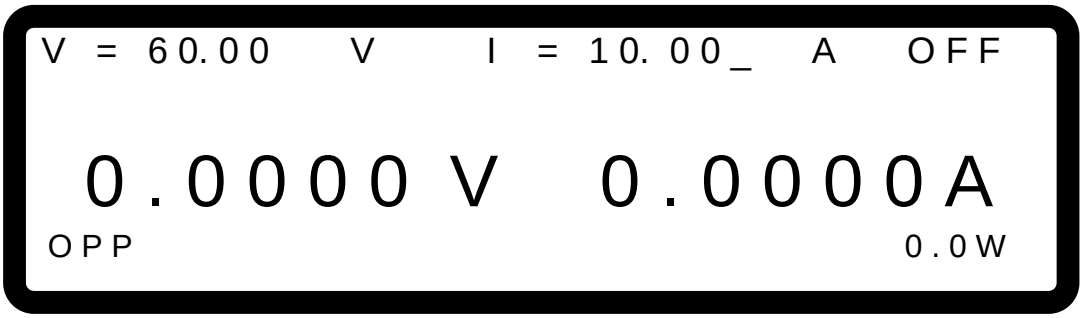


Figure 3-74

3.3.5.4 REMOTE INHIBIT

This function controls the power supply's ON/OFF function directly through PIN 9 (_INHIBIT) of the ANALOG INTERFACE in the APG & SYSTEM STATUS menus.

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

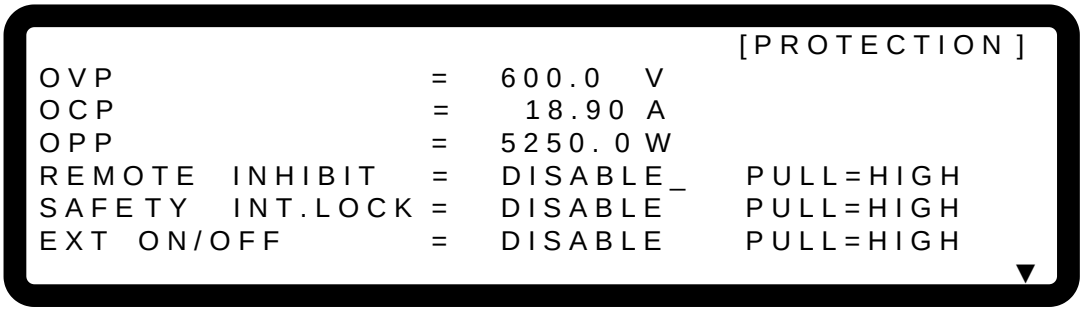


Figure 3-75

2. Use the numeric keys [0] - [1] or the "Rotary" (◎) knob to set the REMOTE INHIBIT mode. There are two options: DISABLE and ENABLE.

   1. Selecting DISABLE: Disables the remote function.

2. Selecting ENABLE: Sets the REMOTE INHIBIT to ENABLE. The DC Power Supply's ON/OFF is still controlled by the "ON/OFF" key. When Pin 9 (_INHIBIT) of the ANALOG INTERFACE is triggered by a Low Level (same as pressing the "ON/OFF" key on the front panel) it sets OUTPUT = OFF. The DC Power Supply will shut down and send out a protection signal (in this case the "ON/OFF" will be OFF.) Pin 9 (_INHIBIT) of the ANALOG INTERFACE cannot be used to release the protection.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

3. When protection occurs due to a REMOTE INHIBIT signal the MAIN PAGE will display the protection message as shown in Figure 3-76.

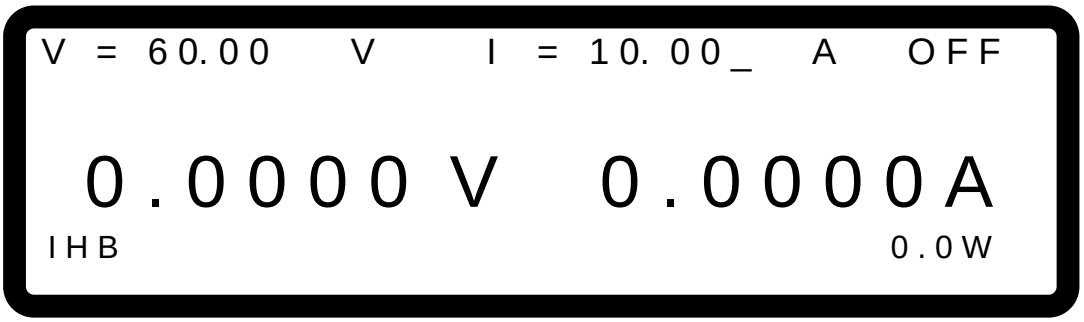


Figure 3-76

4. Pin 9 is a TTL Level input pin. The initial state can be set to PULL=HIGH or PULL=LOW.

5. When the DC Power Supply is set to OUTPUT = ON, the REMOTE INHIBIT signal will control the output as shown in Figure 3-77.

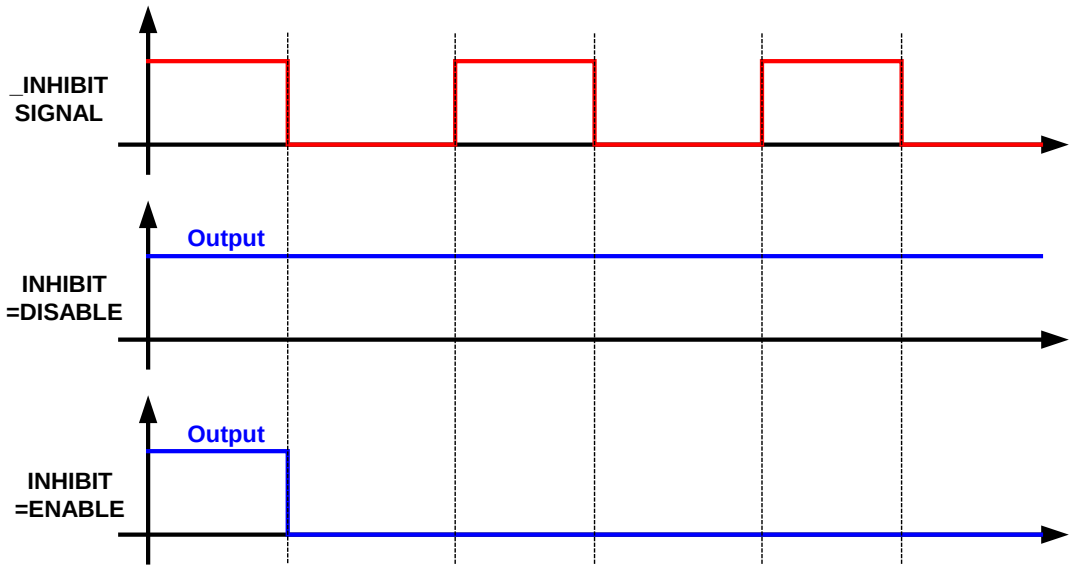


Figure 3-77

3.3.5.5 SAFETY INT.LOCK

This function controls the power supply's ON/OFF function directly through Pin 21 (INTERLOCK) of the ANALOG INTERFACE.

1. Use the " ◄─▲ ", " ▼─► " keys to move the cursor to the column to be set as shown in Figure 3-78.

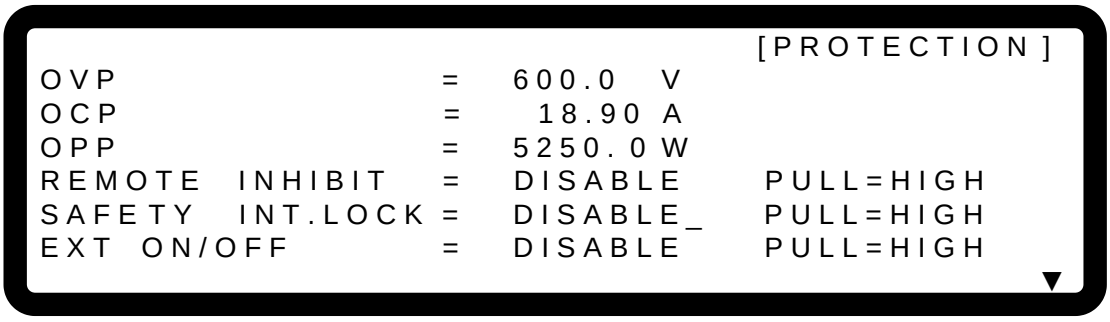


Figure 3-78

2. Use the numeric keys [0] - [1] or 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. The DC Power Supply's ON/OFF is still controlled by "[OUTPUT]". When PIN 21 of the ANALOG INTERFACE is at a low level, it indicates the power supply is outputting normally and when it is at a high level, it stops the power supply output temporary (the "[ON/OFF]" is still on) and issues a protection signal. Once Pin

21 of the ANALOG INTERFACE is returned to a low level, the DC Power Supply will continue to output normally.

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

3. If a protection occurs due to a SAFETY INT.LOCK signal the MAIN PAGE will display the protection message as shown in Figure 3-79.

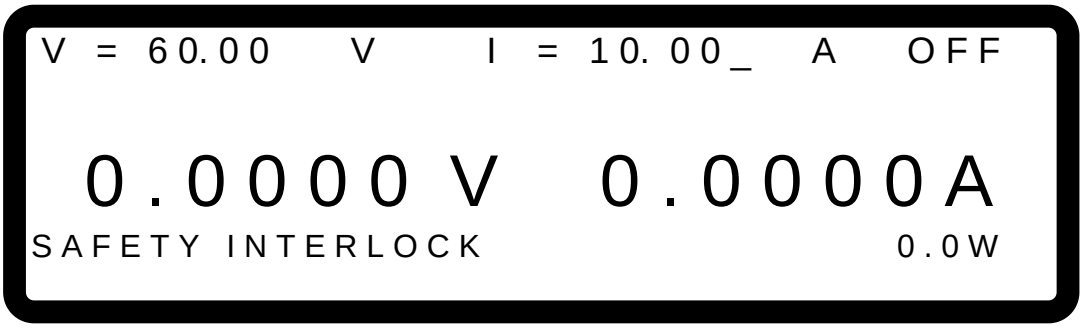


Figure 3-79

4. Pin 21 is a TTL Level input pin. The initial state can be set to PULL=HIGH or PULL=LOW.

5. When the DC Power Supply is set to OUTPUT = ON, the SAFETY INT.LOCK signal will control the output as shown in Figure 3-84.

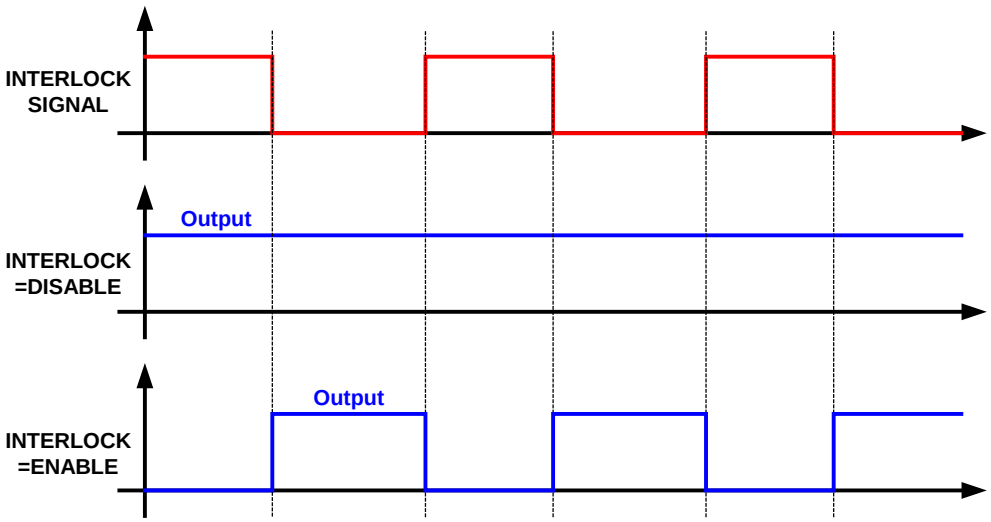


Figure 3-80

3.3.5.6 EXTERNAL ON/OFF

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

1. Use the " ", " " keys to move the cursor to the column to be set as shown in Figure 3-81.

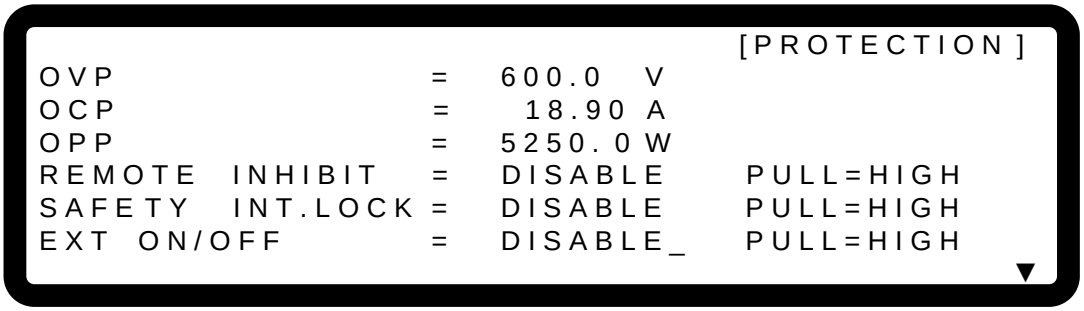


Figure 3-81

2. Use the numeric keys (0 - 9) or the "Rotary" ( ) knob to set the EXTERNAL ON/OFF mode. This function has two options: DISABLE and ENABLE.

   1. Selecting DISABLE: Disables this function.
   2. Selecting ENABLE: Sets EXTERNAL ON/OFF to ENABLE and disables the "ON/OFF" key. Pin 22 (_EXT_ON) replaces the "ON/OFF" key to control the Power Supply's ON/OFF function. When the Pin 22 (_EXT_ON) voltage level on the ANALOG INTERFACE goes HIGH, the Power Supply output is turned OFF. When the Pin 22 (_EXT_ON) voltage level goes LOW, the DC Power Supply is turned ON.
   3. Press "ENTER" to confirm.
   4. Press "EXIT" to return to the MAIN PAGE.

3. When EXT. ON/OFF is enabled, the MAIN PAGE will display the EXT message as shown in Figure 3-82.

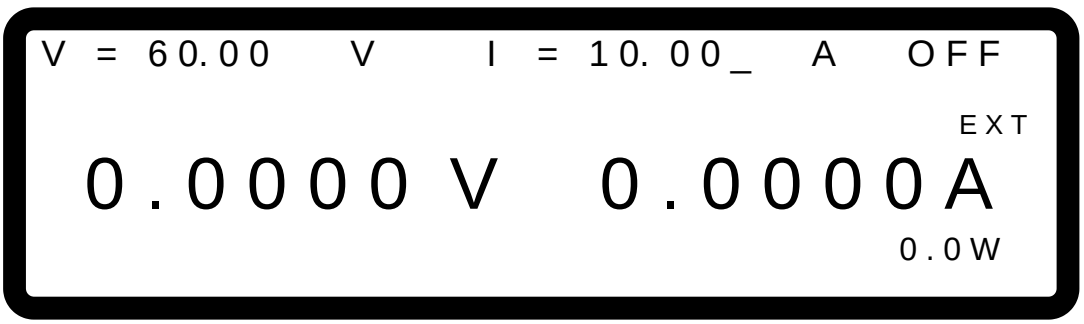


Figure 3-82

4. Pin 22 is a TTL Level input pin. The initial state can be set to PULL=HIGH or PULL=LOW.

5. When the DC Power Supply is set to OUTPUT = ON, the EXTERNAL ON/OFF signal will control the output as shown in Figure 3-83.

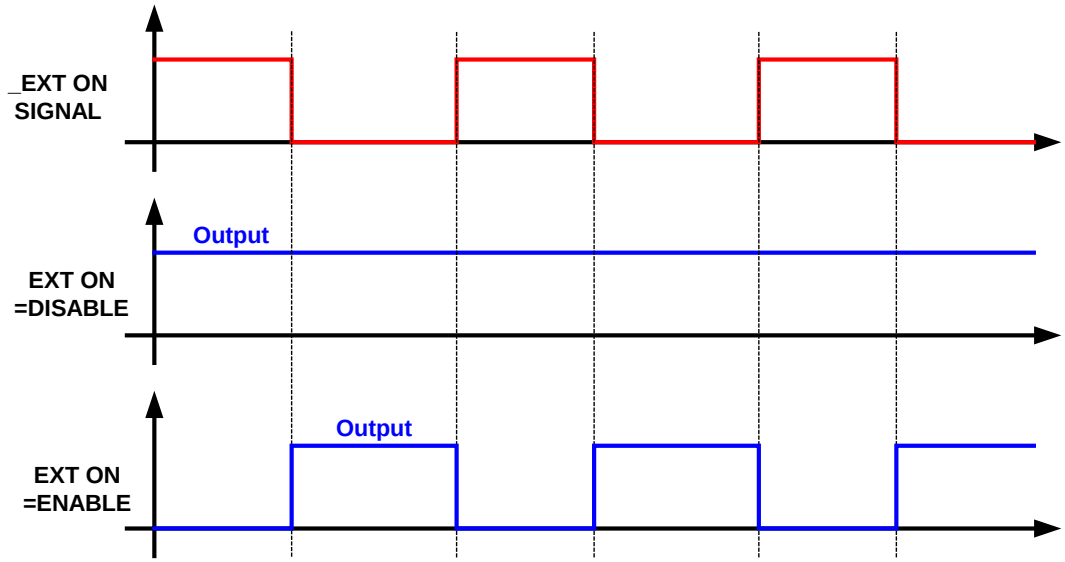


Figure 3-83

3.3.5.7 FOLDBACK

This function turns off the output when the output mode is changed (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 3-84.

Figure 3-84

2. Use the numeric keys (0 - 1) or the "Rotary" ( ) knob to set the FOLDBACK mode. There are three options available for selection: DISABLE, CV TO CC and CC TO CV.

1. DISABLE: Ignore the output off function.
2. CV TO CC: Active in CV MODE only. When 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. When 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 to set the time delay for protection to occur after a mode change, as shown in Figure 3-85.

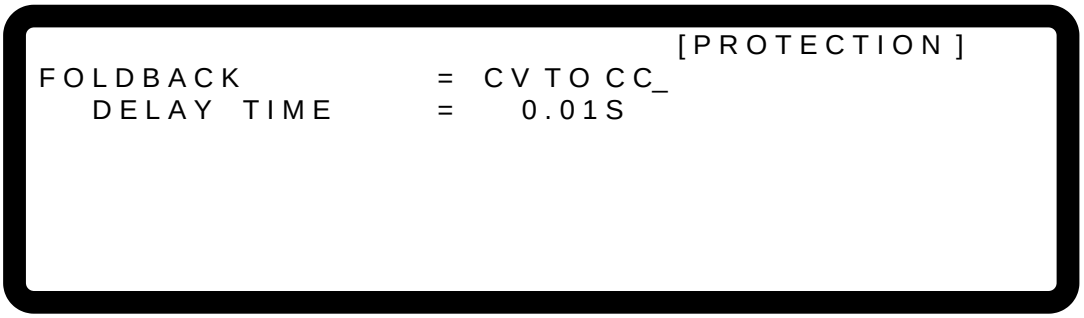


Figure 3-85

If FOLDBACK protection occurs the MAIN PAGE will display a protection message as shown in Figure 3-86.

Figure 3-86

If DELAY TIME is set to *t* seconds, FOLDBACK will not be activated until *t* seconds after a mode change is detected. If the mode change switches back in less than *t* seconds the DC source operation mode will return to its original state and FOLDBACK protection will not , as shown in Figure 3-87.

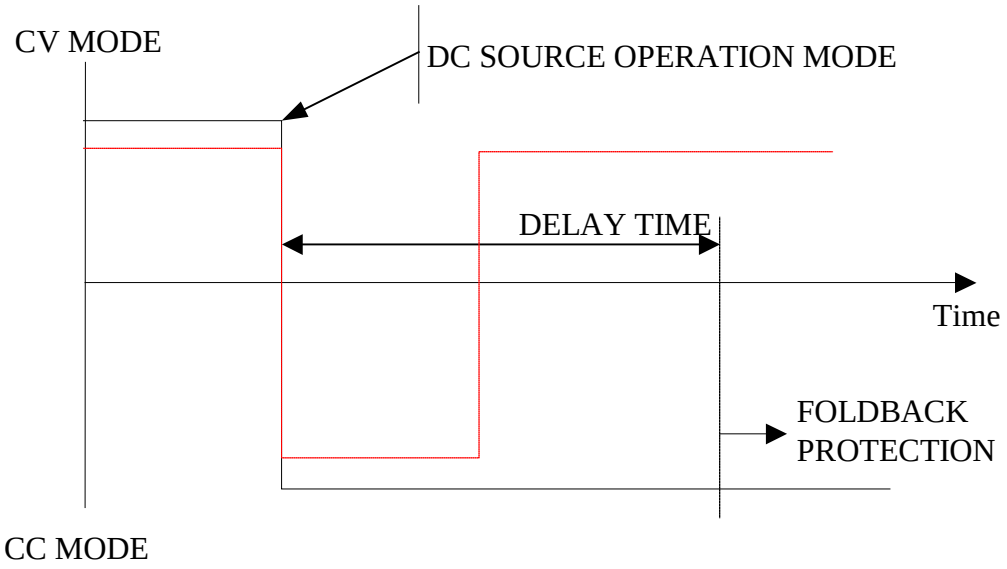


Figure 3-87

Assuming the FOLDBACK is set to CV TO CC, the solid line in Figure 3-87 indicates when Foldback protection occurs while the dotted line indicates when it will not occur.

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

3.3.5.8 OTP

The OTP protection will activate when the internal temperature reaches the high limit. The output will be turned off.

If an OTP occurs the MAIN PAGE menu will display a protection message as shown in Figure 3-88.

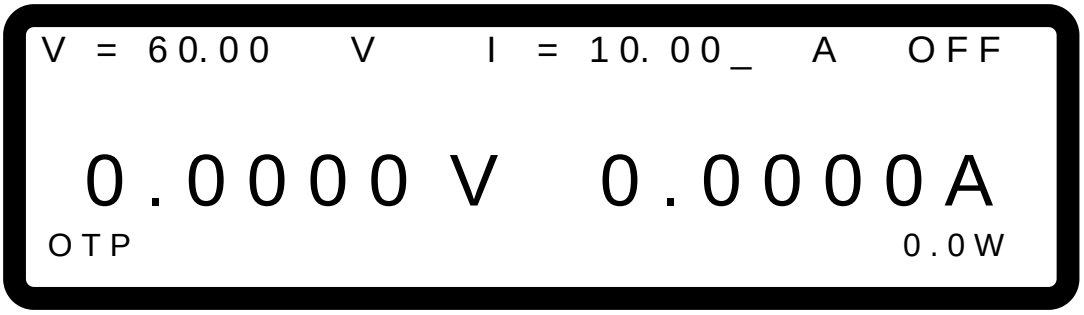


Figure 3-88

Notice

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

3.3.5.9 AC FAULT

The AC FAULT protection will activate when the internal input voltage is not within the model's range, or when the input voltage is too low. The output will turn OFF.

If an AC FAULT occurs, the MAIN PAGE will display a protection message as shown in Figure 3-89.

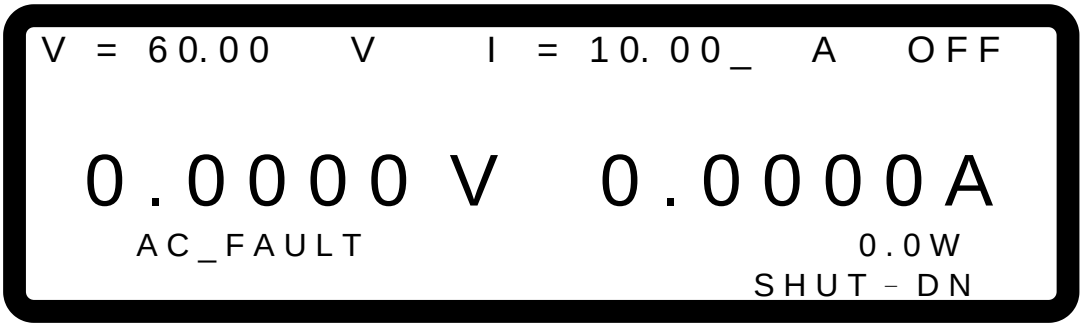


Figure 3-89

Notice

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

Table 3-5 AC FAULT Range

Line to Line Rated Voltage	Lower than (Vac)	Higher than (Vac)
200/220Vac	180	242
380/400Vac	342	440
440/480Vac	396	528
200/240Vac	180	264

2. Once the AC FAULT is activated, the output is turned OFF. Power OFF the device and then power it ON again after the correct input voltage and connection are confirmed. If the input voltage or connection is incorrect, AC FAULT protection will occur continuously.
3. The diameter of the input wire must be large enough 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 spec.

3.3.5.10 SENSE FAULT Protection

The remote sense input is located on the rear panel near the output terminal (see section 2.4.1 for the correct connection). It adjusts the power supply's output so the UUT's voltage is consistent with the voltage set on the front panel so the UUT is not affected by the voltage drop across the load wires.

(1) If the connection is wrong, for instance the VOLTAGE SENSING polarity is reversed (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), or

(2) The voltage drop across the load wire exceeds the full scale output voltage by 4%, protection will occur when the load wire voltage drop > 600 x 0.04=24V (using the 62150H-600S as an example).

SENSE FAULT protection will turn OFF the output if either of these two situations occurs. Connect the REMOTE SENSING wires correctly or increase the load wire size and reboot to remove the fault.

If a SENSE FAULT occurs, the MAIN PAGE menu will display a protection message as shown in Figure 3-90 shows.

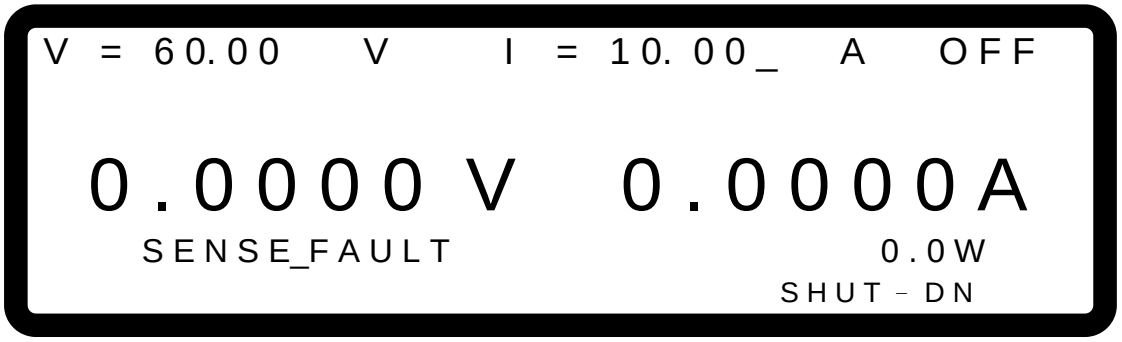


Figure 3-90

3.3.5.11 FANLOCK Protection

Fans are installed 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.

If a FANLOCK occurs the MAIN PAGE menu will display a protection message as shown in Figure 3-91.

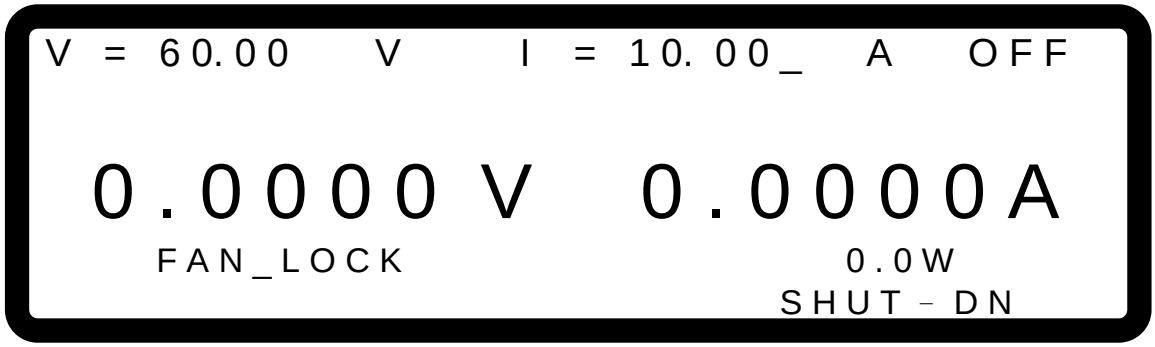


Figure 3-91

CAUTION

1. Troubleshooting:
   (1) If a FANLOCK protection occurs, power OFF the instrument and then power it ON again to see if it is a false error.
   (2) If the FANLOCK protection occurs again, 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 fault from occurring.

3.3.5.12 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 to protect the DC Power Supply.

If a D/D FAULT protection occurs, the MAIN PAGE menu will display a protection message as shown below.

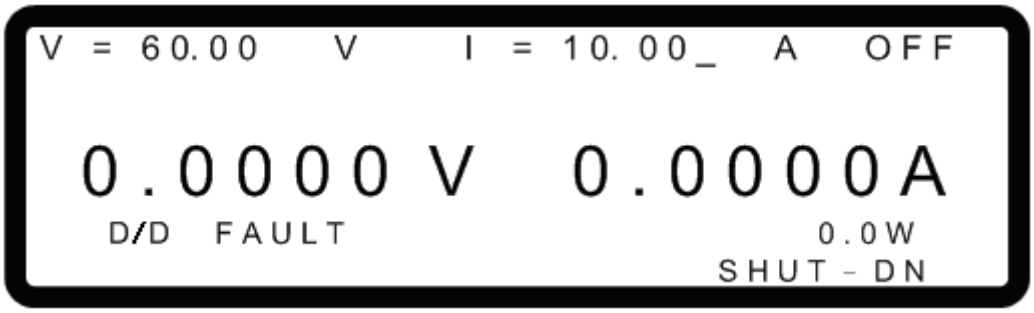


Figure 3-92

Notice

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

3.3.5.13 CURR. SHARING ERR Protection

This protection occurs when the power supply detects uneven current sharing in parallel mode. When the CURR. SHARING ERR signal occurs the output will be turned OFF to protect the DC power supply.

The message “CURR. SHARING ERR” will display on the main screen as shown in Figure 3-93.

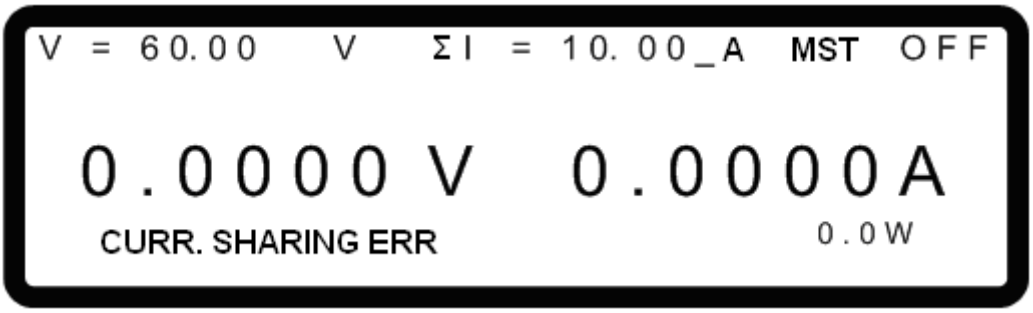


Figure 3-93

Notice

Troubleshooting:
(1) If a CURR. SHARING ERR occurs, turn the power supply OFF and remove the load. Check if the connections are correct and turn the power supply ON again.
(2) If the CURR. SHARING ERR occurs again, contact a sales agent for repair services.

CAUTION

1. The DC Power Supply could malfunction or be damaged if the CURRENT SHARING cable is connected incorrectly when in parallel mode.
2. DO NOT connect the CURRENT SHARING cable during series operation. Connecting the cable may cause damage to the supply.
3. DO NOT connect the CURRENT SHARING cable during standalone operation. Connecting the cable may cause damage to the supply.
4. Remove the SYSTEM BUS and CURRENT SHARING signal cables when returning to standalone operation. Leaving the cables connected may cause damage to the supply.

3.3.5.14 FPGA UPDATE! Protection

This protection occurs when the device firmware has been upgraded to 2.00 but the FPGA is not upgraded to version 1.11 or above. When FPGA UPDATE! occurs, the main screen will display the message as shown in Figure 3-94.

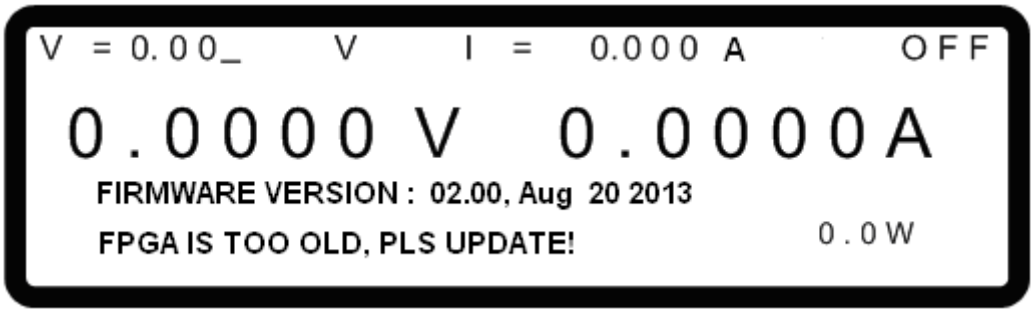


Figure 3-94

Notice

Troubleshooting: Contact a local Chroma agent if an FPGA UPDATE! occurs.

3.3.5.15 C/S CABLE ERR. Protection

This protection occurs under the following three conditions: 1.The current sharing cable is connected on the rear panel when the power supply is being used in standalone mode as shown in Figure 3-95. 2. The current sharing cable is connected when the power supply is being used in series mode as shown in Figure 3-96 and Figure 3-97. 3. The current sharing cable is not connected when the power supply is being used in parallel mode as shown in Figure 3-96 and Figure 3-97.

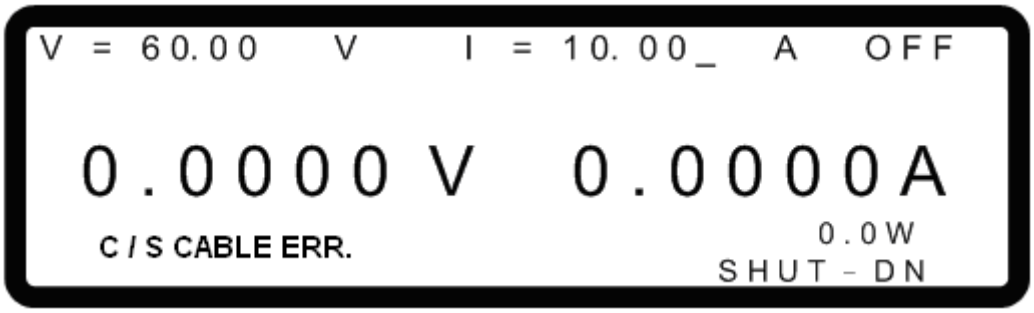


Figure 3-95

Figure 3-96

Figure 3-97

Notice

Troubleshooting:

(1) If a C/S CABLE ERR. occurs, turn the power supply OFF and remove the load. Check if the cable connections are correct and turn the power supply ON again.

(2) This protection supports firmware version 2.00 or above and FPGA version 1.11 or above. The hardware must be upgraded as well. To validate the hardware is an upgraded version, check if there is a HOOP hole on the rear panel as shown in Figure 2-10 (the SLAVE models A620028 and A620027 are not included)

(3) Contact a local Chroma agent for the hardware upgrade.

CAUTION

1. The DC Power Supply could malfunction or be damaged if the CURRENT SHARING cable is connected incorrectly when in parallel mode.
2. Do not connect the CURRENT SHARING cable during series operation. Connecting the cable may cause damage to the supply.
3. Do not connect the CURRENT SHARING cable during standalone operation. Connecting the cable may cause damage to the supply.
4. Remove the SYSTEM BUS and CURRENT SHARING signal cables when returning to standalone operation. Leaving the cables connected may cause damage to the supply.

3.3.5.16 MATCH Warning

This message occurs if different models of power supplies are connected in series or parallel mode. If a MATCH warning occurs, the main screen will display a warning message as shown in Figure 3-98.

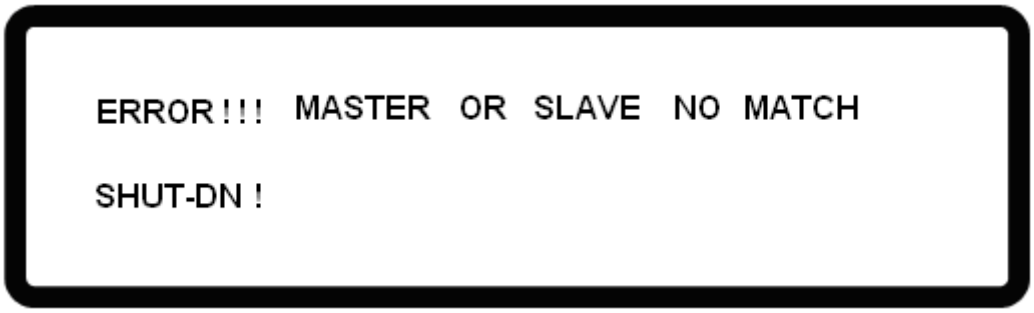


Figure 3-98

Notice

Troubleshooting:
(1) Make sure the same model power supplies are connected in series or parallel. For instance, the 62050H-600S model can only be connected to a power supply of the same model for series or parallel operation.
(2) There are two exceptions: the 62150H-1000S can connect with the A620028 and the 62150H-600S can connect with the A620027 for parallel/series connection.

Notice

Do NOT connect power supplies with different input voltages for series or parallel use. The output specification cannot be guaranteed if the power supplies are not connected properly.

3.3.6 FACTORY SETTING

This function resets the instrument to its factory default settings.

In the Config Setup page, press "6" then ENTER to enter the FACTORY SETTING option as shown in Figure 3-99.

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 5 messages: DEVICE MODEL, SERIAL NO., FIRMWARE VERSION, FPGA VERSION and MODULE VERSION.

DEVICE MODEL	:	Display the model no. **62150H-600S**
SERIAL NO.	:	Display the serial no. **22**
FIRMWARE VERSION	:	Display firmware version **01.11** and the released date Feb 1, 2010
FPGA VERSION	:	Display the FPGA version no. **01.00,01.00**
MODULE VERSION	:	Display the module version no. **01.00,01.00,01.00**

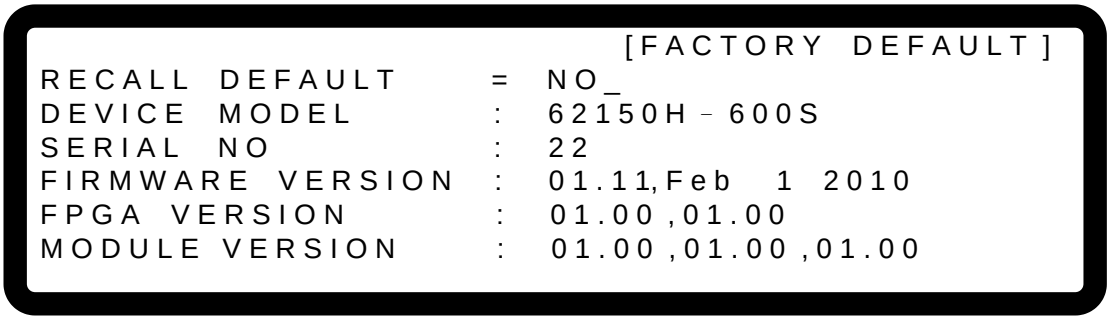


Figure 3-99

3.3.7 CALIBRATION

Chroma 62000H Series DC Power Supplies with Solar Array Simulation provide calibration functions (1) - (5), the A620028 and A620027 provide calibration functions (1)(2)(3) and the 62020H-150S model provides calibration functions (1) - (7):

(1) VOLTAGE: the actual output voltage (CV mode) and the measurement accuracy.
(2) CURRENT: the measurement accuracy of the current.
(3) CURRENT: the actual output current (CC mode).
(4) APG VOLTAGE: the actual output voltage and the accuracy of the analog V Monitor under analog voltage control mode.
(5) APG CURRENT: the actual output current and the accuracy of the analog I Monitor under analog current control mode.
(6) IV VOLTAGE: the actual voltage setting (CV mode) and the measurement accuracy in SAS mode.
(7) IV CURRENT: the current measurement accuracy in SAS mode.

Follow the procedure below to enter into calibration mode:

1. In the CONFIG Setup page, press "7" then ENTER to enter into the CALIBRATION option as shown in Figure 3-100.

Figure 3-100

2. Enter the password and press "ENTER" to confirm. The screen will display 4 calibration options as shown in Figure 3-101. The calibration steps are described in sections 3.3.7.1 to 3.3.7.5.
3. To abort the CALIBRATION, press "EXIT" to return to the MAIN PAGE.

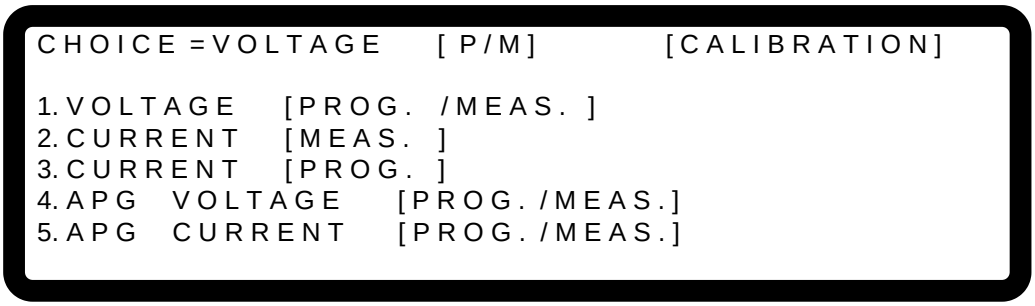


Figure 3-101

The slave models (A620028/A620027) of the Chroma 62000H Series DC Power Supplies with Solar Array Simulation have 3 CALIBRATION functions:

(1) VOLTAGE: the actual output voltage (CV mode) and the measurement accuracy.
(2) CURRENT: the measurement accuracy of the current.
(3) CURRENT: the actual output current (CC mode).

1. The A620028/A620027 SLAVE models must be calibrated through the MASTER unit. First execute the steps described in sections 3.3.3.3.2 to 3.3.3.3.5 and return to the main screen when the parallel setting is done. Press Config, "3" then "ENTER" to enter into the SERIES/PARALLEL selection. Use the " ", " " keys to move the cursor to PAGE2 and select IDN using the "Rotary Knob" ( ) as shown in Figure 3-102. Confirm the ID address of the SLAVE to be calibrated. The yellow light on the panel of the selected SLAVE will blink.

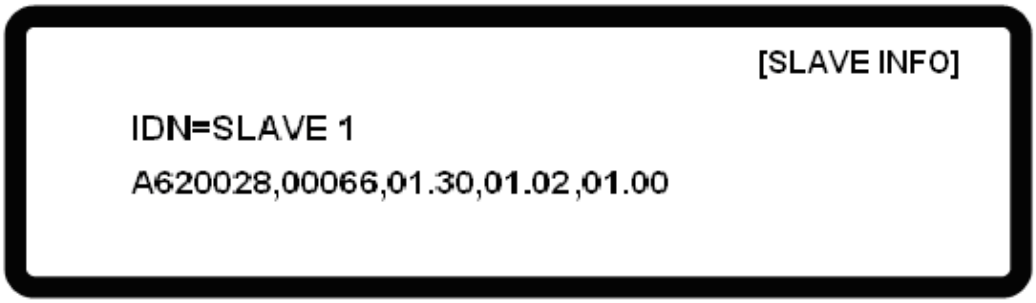


Figure 3-102

2. When the address of the SLAVE to be calibrated is confirmed, stay in parallel mode and go to the CONFIG setting page, press "7" then "ENTER" to enter into CALIBRATION for password input as shown in Figure 3-100.

3. Select MASTER OR SLAVE via the "Rotary Knob" ( ) and select the SLAVE to be calibrated as shown in Figure 3-103. Press "ENTER" to enter into the calibration screen as shown in Figure 3-104. For the calibration procedure for each item, see the descriptions in sections 3.3.7.1 to 3.3.7.3.

Figure 3-103

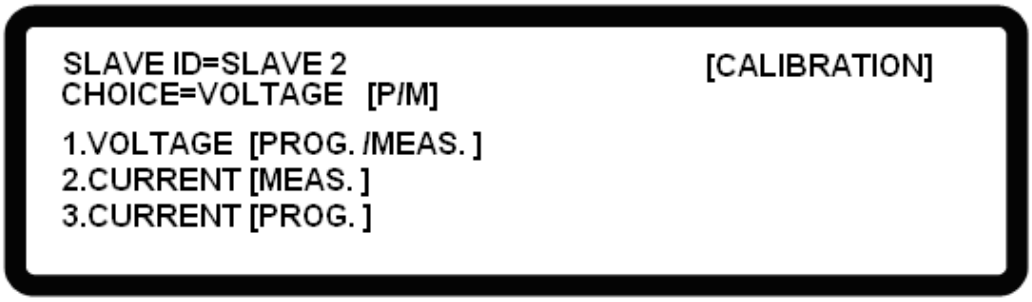


Figure 3-104

Notice

1. A password is required for CALIBRATION. The password is "3636".
2. A SLAVE model can only be calibrated via the MASTER. First remove the output cable and then disconnect the current sharing cable. Leave the ANALOG and SYSTEM BUS cables on the device.
3. The MASTER provides the panel output for the SLAVE. The load and measurement cables for the actual calibration need to be installed on the SLAVE.
4. The DC Power Supply should be calibrated every year. Contact Chroma for further information.

3.3.7.1 Voltage Output & Measurement Calibration

3.3.7.1.1 Hardware Requirement

The hardware requirement is shown in Table 3-6.

Table 3-6

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

3.3.7.1.2 SETUP

The setup is shown in Figure 3-105.

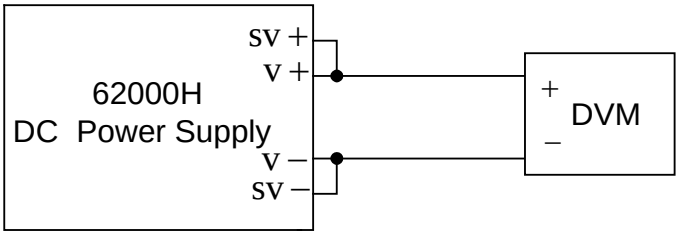


Figure 3-105

Notice

1. The accuracy of the instrument that performs the calibration must be greater than the accuracy of the power supply specification.
2. Set the Resolution parameter of the HP34401 to SLOW 6 digit.
3. Key in at least 5 digits for each calibration point to ensure the Power Supply accuracy after calibration.

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

1. In the CONFIG Setup page, press "7" then press ENTER to enter the CALIBRATION option (see section 3.3.7 above).
2. In the CALIBRATION page, press "1" or turn the "Rotary" (🔘) knob to set CHOICE=1.
3. Press "ENTER" to display the voltage calibration options as shown in Figure 3-106.

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

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

Figure 3-106

4. In the Voltage calibration page, press "ENTER" to confirm.
5. The low voltage range calibration is done first. The instrument will set the output voltage to 8.00V and the cursor stops at position [1] as shown in Figure 3-107. Enter the voltage measured by the DVM and press "ENTER" to confirm.
6. Press "↓→" again to do the low voltage range calibration for the second point. The instrument will set the output voltage to 115.00V and the cursor stops at position [2] as shown in Figure 3-107. Enter the voltage measured by the DVM and press "ENTER" to confirm.

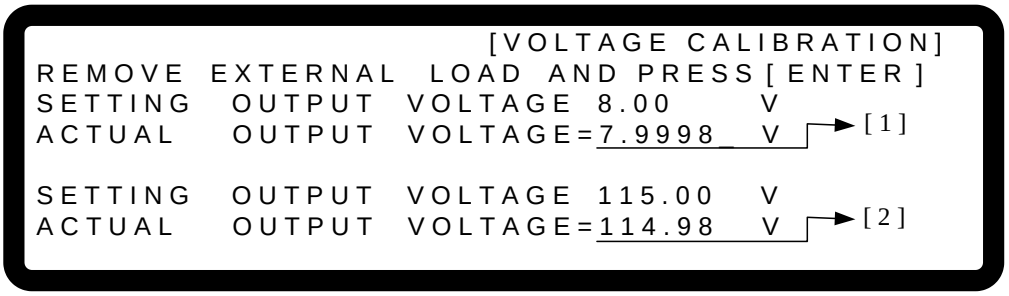


Figure 3-107

7. Press "↓→" to do the high voltage range calibration. The instrument will set the output voltage to 150.00V and the cursor stops at position [3] as shown in Figure 3-108. Enter the voltage measured by the DVM and press "ENTER" to confirm.
8. Press "↓→" again to do the high voltage range calibration for the second point. The instrument will set the output voltage to 525.00V and the cursor stops at position [4] as shown in Figure 3-108. Enter the voltage measured by the DVM and press "ENTER" to confirm.

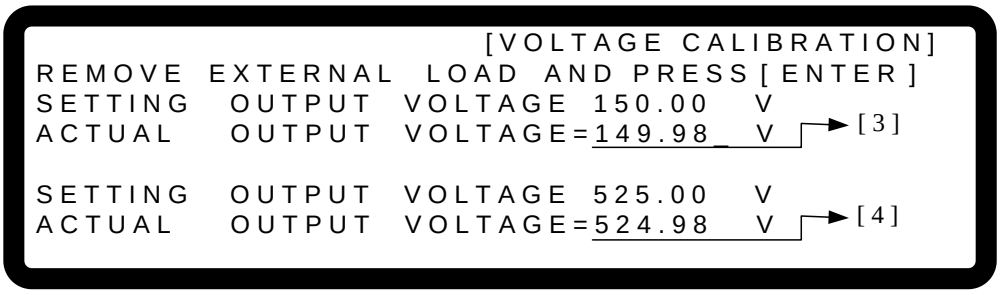


Figure 3-108

9. The voltage calibration is now done. To save the calibration data, press "SAVE" to display the confirmation page as shown in Figure 3-109. Press "1" or turn the "Rotary" (◎) to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

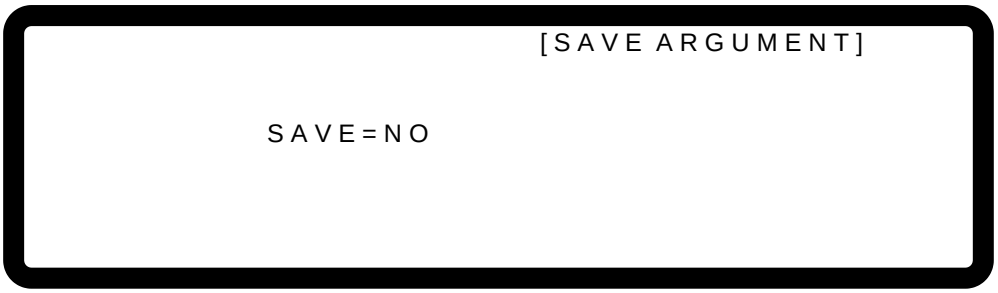


Figure 3-109

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

Notice

1. The calibration points may be different for other models (non 62150H-600S); perform the calibration following the instructions displayed.
2. Remove the output load when performing the voltage calibration. The LCD panel will display the text as shown in Figure 3-107 and once no load is confirmed on the output, press "ENTER" to start the calibration.

3.3.7.2 Current Measurement Calibration

3.3.7.2.1 Hardware Requirements

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

Table 3-7

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

CAUTION

1. The table above lists the BREAKER capacity for the 62150H-600S only. For the applicable BREAKER capacity for other models, see the specifications for OUTPUT CURRENT in Table 1-1.
2. Use the ULTRASTAB SATURN to do the calibration for the 62020H-150S model.

3.3.7.2.2 SETUP

Figure 3-110 is the diagram for connecting current calibration devices.

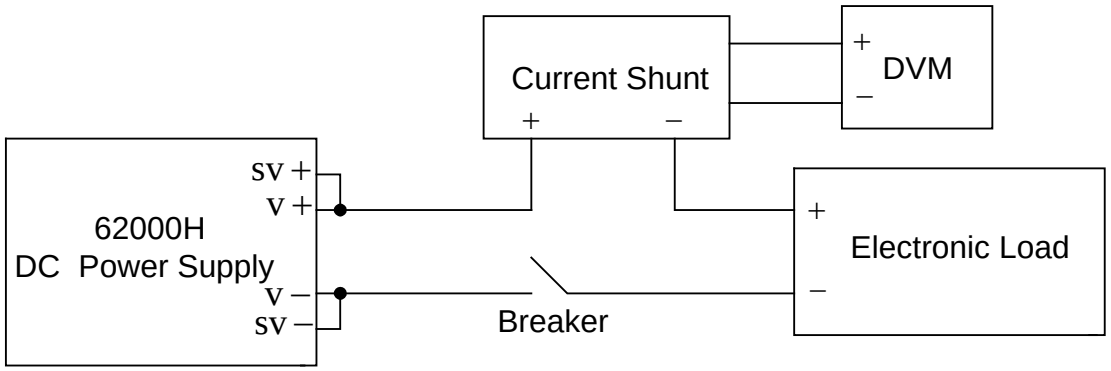


Figure 3-110

Notice

1. Calibrate the offset voltage of the ULTRASTAB SATURN before using it for the current calibration. Press "Null" and the DVM panel digits will reset and show "Math" for the current calibration.
2. Key in at least 5 digits for each calibration point to ensure the Power Supply accuracy after calibration.

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

1. In the CONFIG Setup page, press "7" then press ENTER to enter the CALIBRATION option (see section 3.3.7 above).
2. In the CALIBRATION page, press "2" or turn the "Rotary" (◎) knob to set CHOICE=2.
3. Press "ENTER" to display the current calibration options shown in Figure 3-111.

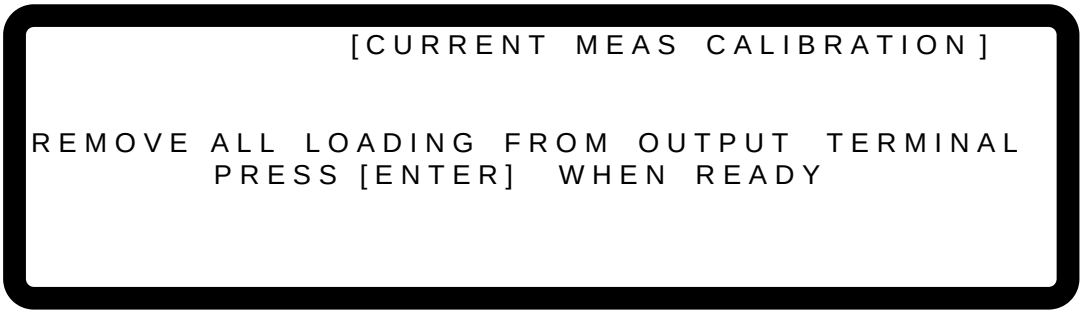


Figure 3-111

4. Open the Breaker to ensure the DC Power Supply has no load and press "ENTER" to confirm.
5. **It is important** to reconnect the DC Power Supply to a current shunt whose rating is closest to but still covers 2A. For the Prodigit 7550, use the 2A shunt directly.
6. The calibration option will display as shown in Figure 3-112. Press "ENTER". The low current range will be calibrated first. The system outputs a fixed voltage and then sets the loading current of the Electronic LOAD to 1.5A. The cursor stops at position [1] as shown in Figure 3-112. Enter the current read by the Current Shunt (DVM) and press "ENTER" to confirm and wait for it to end.

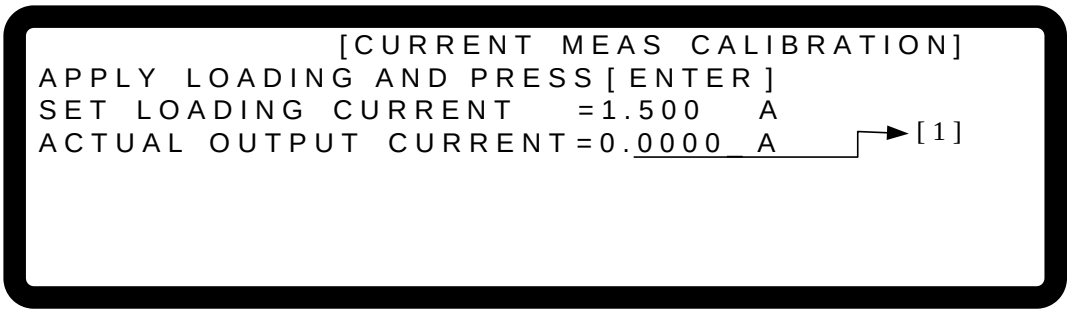


Figure 3-112

7. Once the 1.5A point is calibrated, **it is important** to turn the loading from the Electronic Load off and reconnect the DC Power Supply to a current shunt whose rating is closest to but still covers 2A. For the Prodigit 7550, use the 2A shunt directly.

8. Next, press "↓→" to do the 4.5A calibration. The cursor will stop at position [2] as shown in Figure 3-113 for setting the loading current of the Electronic LOAD to 4.500A. Enter the current read by the Current Shunt (DVM) and press "ENTER" to confirm and wait for it to end. Use 1.5A and 4.5A for calibration; the system will calculate the calibration factor for the low current range.

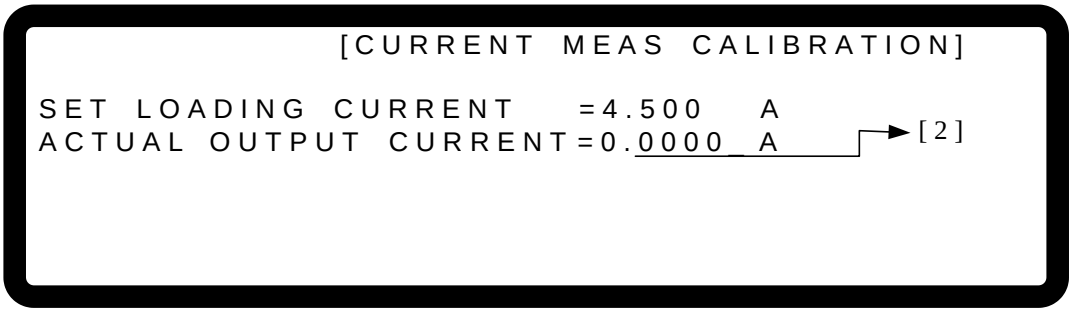


Figure 3-113

9. After the low current range is calibrated, **it is important** to turn the loading from the Electronic Load off and reconnect the DC Power Supply to a current shunt whose rating is closest to but still covers 20A. For the Prodigit 7550, use the 20A shunt directly.

10. For the high current range calibration, press "↓→" to perform the 7.5A calibration. The cursor will stop at position [3] as shown in Figure 3-114 for setting the loading current of the Electronic LOAD to 7.500A. Enter the current read by the Current Shunt (DVM) and press "ENTER" to confirm and wait for it to end.

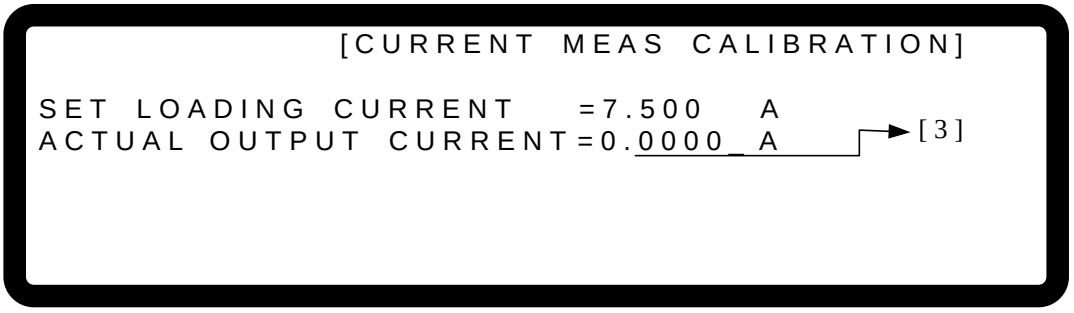


Figure 3-114

11. Once the 7.5A point is calibrated, **it is important** to turn the loading of the Electronic Load off and reconnect the DC Power Supply to a current shunt whose rating is closest to but still covers 20A. For the Prodigit 7550, use 20A shunt directly.
12. Press "[↓→]" to perform the 19.5A calibration. The cursor will stop at position [4] as shown in Figure 3-115 for setting the loading current of the Electronic LOAD to 19.500A. Enter the current read by the Current Shunt (DVM) and press "[ENTER]" to confirm and wait for it to end. Use 7.5A and 19.5A for calibration; the system will calculate the calibration factor for the high current range.

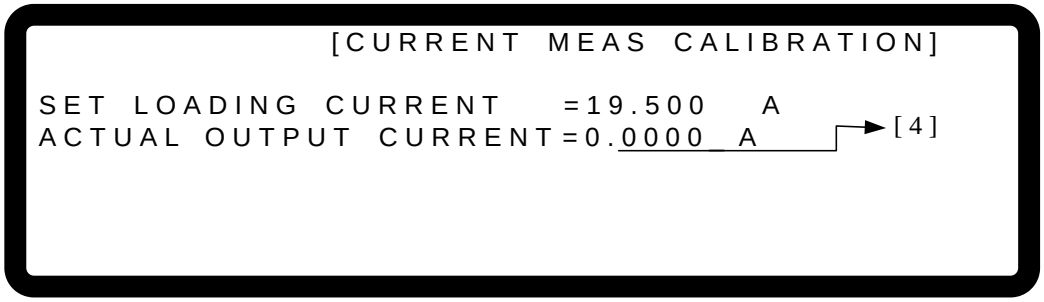


Figure 3-115

13. The current calibration is done once the above actions are completed. To save the calibration data, press "[SAVE]" to display the confirmation page as shown in Figure 3-116. Press "[1]" or turn the "Rotary" ( ) to set SAVE=YES and press "[ENTER]" to save it. If there is no need to save it, press "[EXIT]" to return to the Calibration screen.

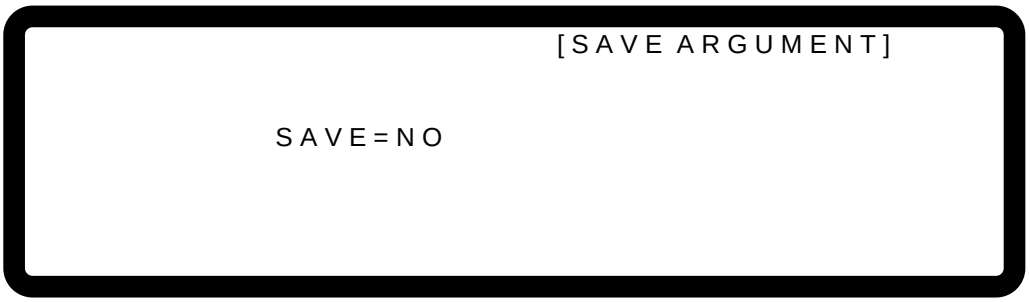


Figure 3-116

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

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

Notice The calibration points may be different for other models (non 62150H-600S); perform the calibration following the instructions displayed.

3.3.7.3 Current Output (PROG.) Calibration

3.3.7.3.1 Hardware Requirements

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

Table 3-8

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

CAUTION

1. The table above lists the BREAKER capacity for the 62150H-600S only. For the applicable BREAKER capacity for other models, see the specifications for OUTPUT CURRENT in Table 1-1.
2. Use the ULTRASTAB SATURN to do the calibration for the 62020H-150S model.

3.3.7.3.2 SETUP

Figure 3-117 shows the wiring connections.

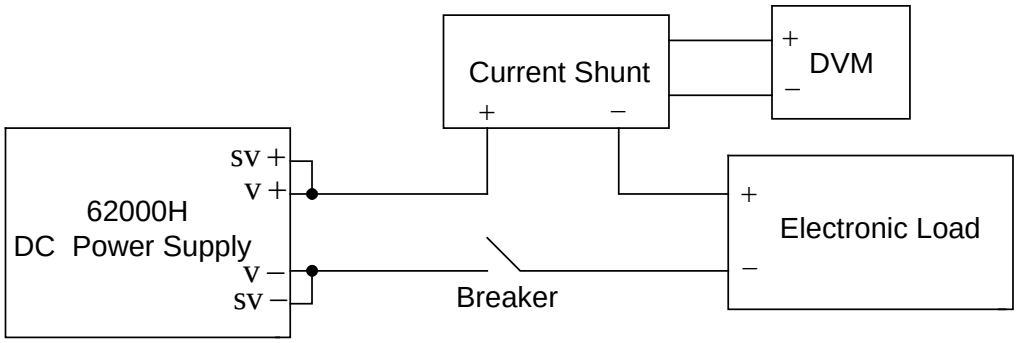


Figure 3-117

Notice

1. Calibrate the offset voltage of the ULTRASTAB SATURN before using it for the current calibration. Press "Null" and the DVM panel digits will reset and show "Math" for the current calibration.
2. Key in at least 5 digits for each calibration point to ensure the Power Supply accuracy after calibration.

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

1. Set the Electronic Load to CV mode 48V.
2. In the CALIBRATION page, press "3" or turn the "Rotary" ( ) knob to set CHOICE=3.
3. Press "ENTER" to display the current calibration options as shown in Figure 3-118.

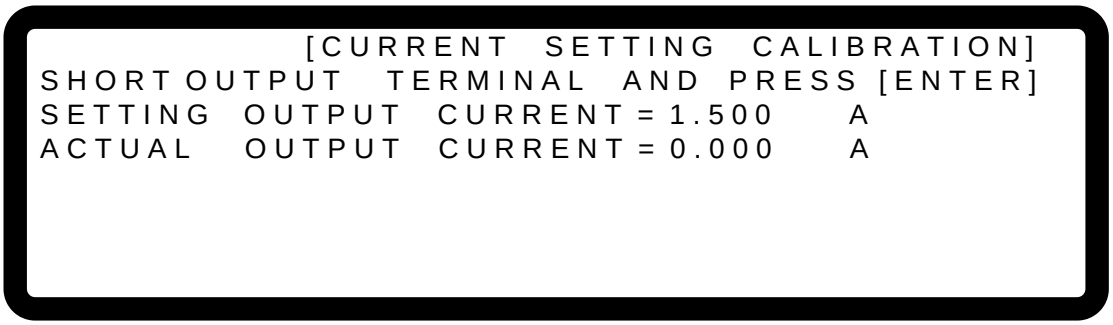


Figure 3-118

4. Turn OFF the output of the DC Power Supply before pressing ENTER. Set the Electronic Load to CV mode 48V. Select a current shunt whose rating is closest to but still covers 2A. For the Prodigit 7550, use the 2A shunt directly.

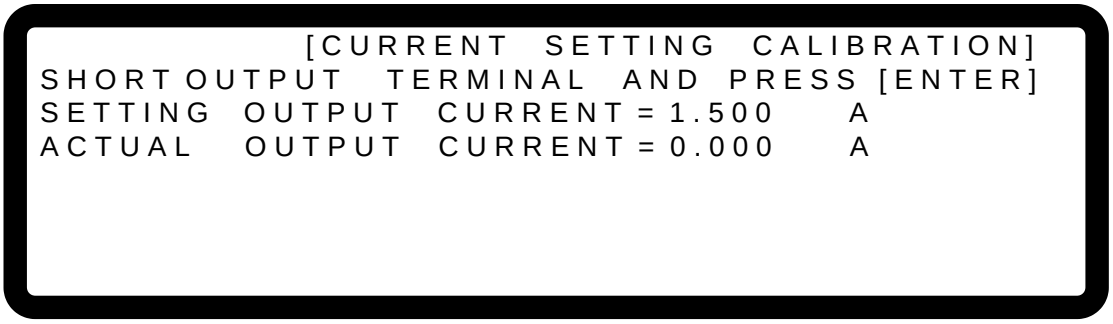


Figure 3-119

5. Press ENTER and the system will set the output current to 1.500A automatically and the cursor will stop at position [1] as shown in Figure 3-120. Input the current read by the Current Shunt (DVM) and press "ENTER" to confirm.

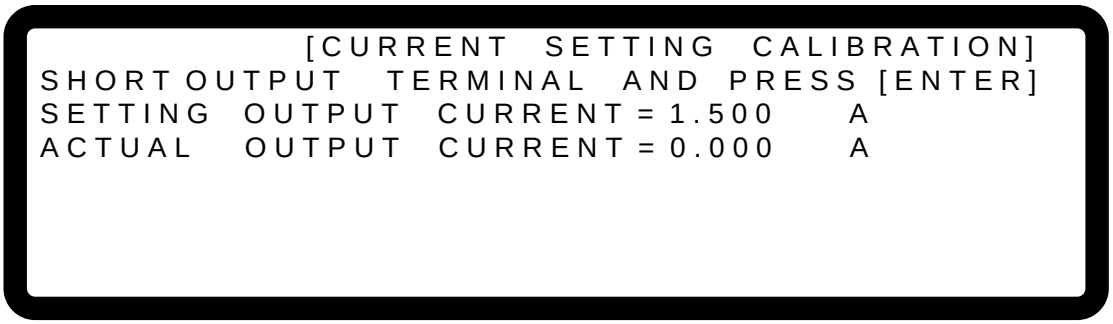


Figure 3-120

6. Turn OFF the output of the DC Power Supply. A message will display to remind the user to reconnect a current shunt. Select a current shunt whose rating is closest to but still covers 20A. For the Prodigit 7550, use the 20A shunt directly.

7. Press "↓→" to do the 4.5A calibration. The system will set the output current to 4.500A automatically and the cursor will stop at position [2] as shown in Figure 3-121. Input the current read by the Current Shunt (DVM) and press "ENTER" to confirm. Using 1.5A and 4.5A for calibration, the system will calculate the calibration factor for the low current range.

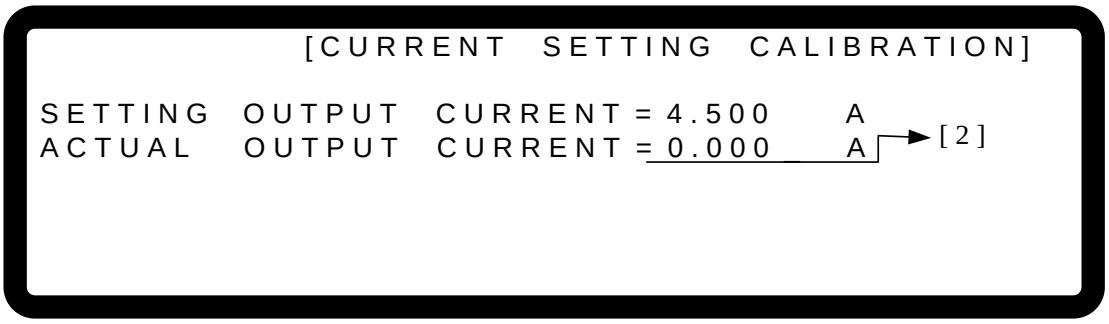


Figure 3-121

8. Now start the high current range calibration. Select a current shunt whose rating is closest to but still covers 20A. For the Prodigit 7550, use the 20A shunt directly.
9. Press "↓→" to do the 7.5A calibration. The system will set the output current to 7.500A automatically and the cursor will stop at position [3] as shown in Figure 3-122. Input the current read by the Current Shunt (DVM) and press "ENTER" to confirm.

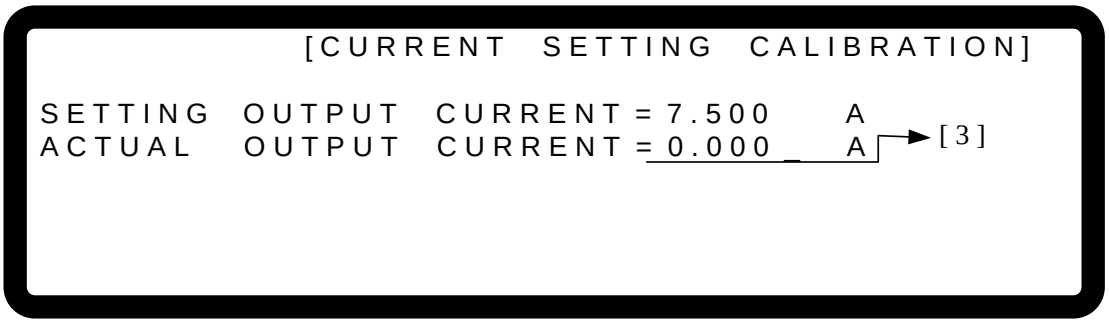


Figure 3-122

10. Turn OFF the output of the DC Power Supply. Select a current shunt whose rating is closest to but still covers 20A. For the Prodigit 7550, use the 20A shunt directly.
11. Press "↓→" to do the 19.5A calibration. The system will set the output current to 19.500A automatically and the cursor will stop at position [4] as shown in Figure 3-123. Input the current read by the Current Shunt (DVM) and press "ENTER" to confirm.

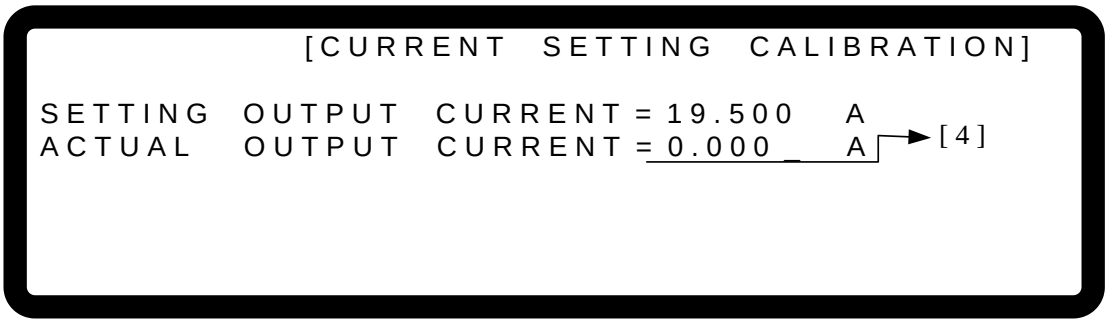


Figure 3-123

12. The current calibration is done once the above actions are completed and the DC Power Supply output is turned OFF. To save the calibration data, pressing "SAVE" will display a confirmation page as shown in Figure 3-124. Press "1" or turn the "Rotary" (◎) to

set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

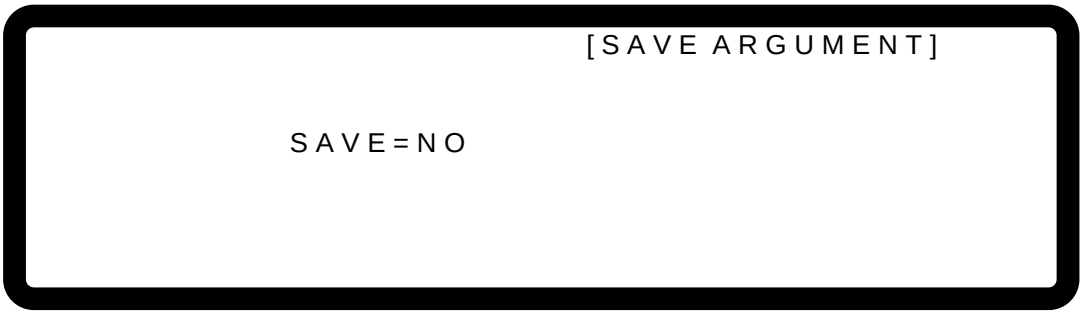


Figure 3-124

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

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

Notice The calibration points may be different for other models (non 62150H-600S); perform the calibration following the instructions displayed.

3.3.7.4 APG Voltage Calibration

3.3.7.4.1 Hardware Requirements

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

Table 3-9

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

3.3.7.4.2 SETUP

Figure 3-125 shows the wiring connections for APG voltage calibration.

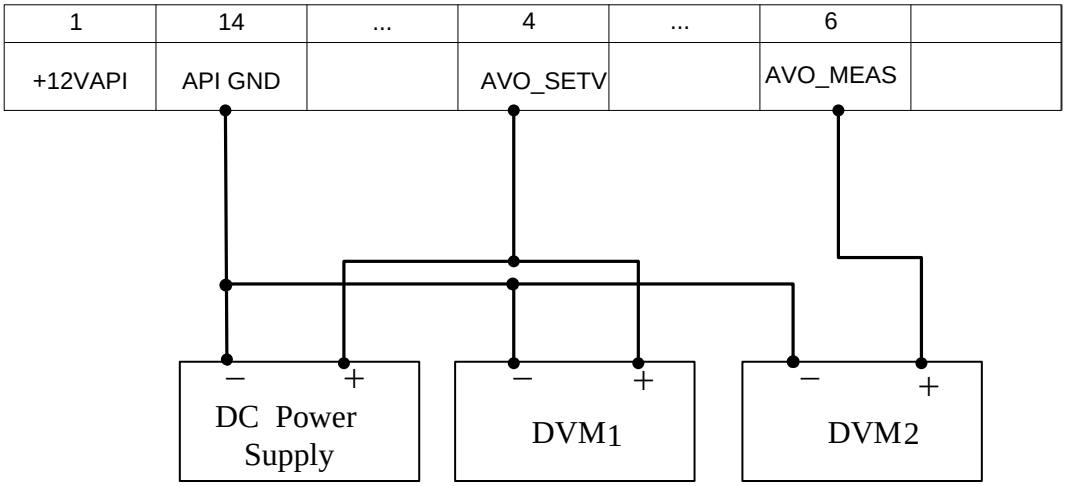


Figure 3-125

Notice Key in at least 5 digits for each calibration point to ensure the Power Supply accuracy after calibration.

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

1. In the CALIBRATION page, press "4" or turn the "Rotary" ( ) knob to set CHOICE = 4.
2. Press "ENTER" to display the current calibration options as shown in Figure 3-126.

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

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

Figure 3-126

Notice

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

3. Insure the interface connection on the rear panel is correct and then press "ENTER" to confirm.

4. Input a 0.5V voltage signal on Pin 4. The cursor stops at position [1] as shown in Figure 3-127. Adjust the Power Supply to 0.5V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage read by DVM1 and press "ENTER" to confirm.

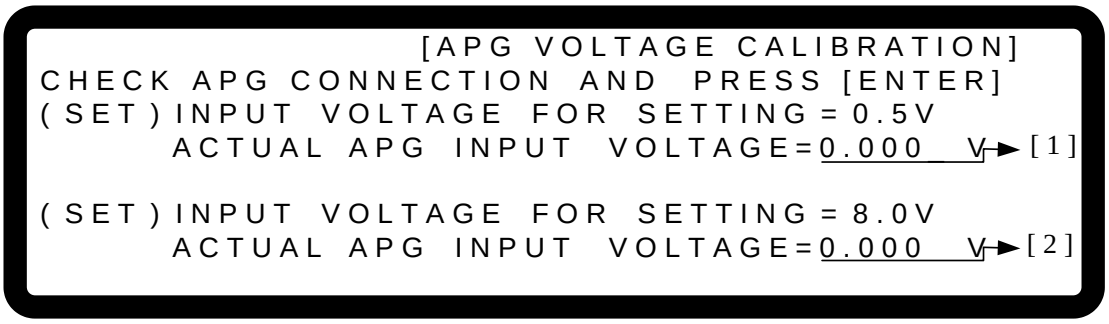


Figure 3-127

5. Press "↓→" and input an 8.0V voltage signal on Pin 4. The cursor stops at position [2] as shown in Figure 3-127. Adjust the Power Supply to 8V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage read by DVM1 and press "ENTER" to confirm.

6. Press "↓→" again and the system will set the output voltage of Pin 6 on the rear panel to 0.5V and the cursor will stop at position [3] as shown in Figure 3-128. Input the voltage read by DVM2 and press "ENTER" to confirm.

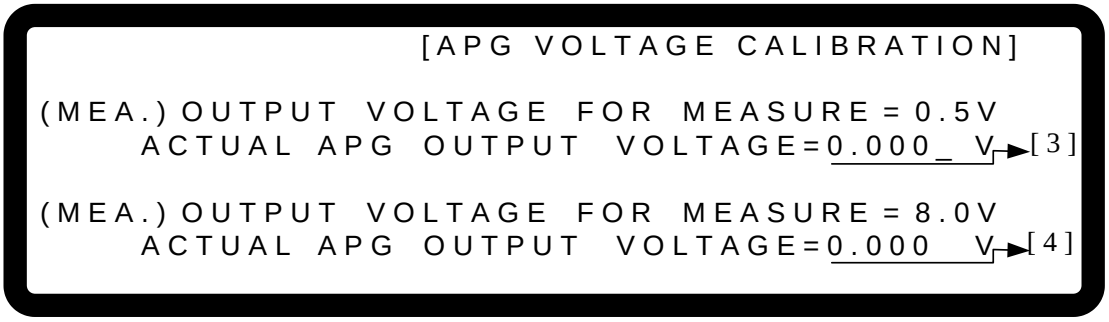


Figure 3-128

7. Press "↓→" again and the system will set the output voltage of Pin 6 on the rear panel to 8.0V and the cursor stops at position [4] as shown in Figure 3-128. Input the voltage read by DVM2 and press "ENTER" to confirm.

8. The APG Voltage calibration is done once the above actions are completed. To save the calibration data, pressing "SAVE" will display a confirmation page as shown in Figure 3-129. Press "1" or turn the "Rotary" (◎) to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

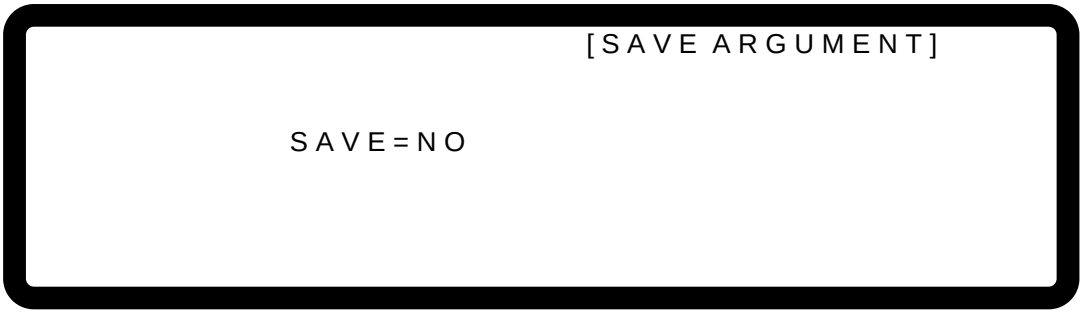


Figure 3-129

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

Notice The calibration points may be different for other models (non 62150H-600S); perform the calibration following the instructions displayed.

3.3.7.5 APG Current Calibration

3.3.7.5.1 Hardware Requirements

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

Table 3-10

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

3.3.7.5.2 SETUP

Figure 3-130 shows the wiring connections for APG current calibration.

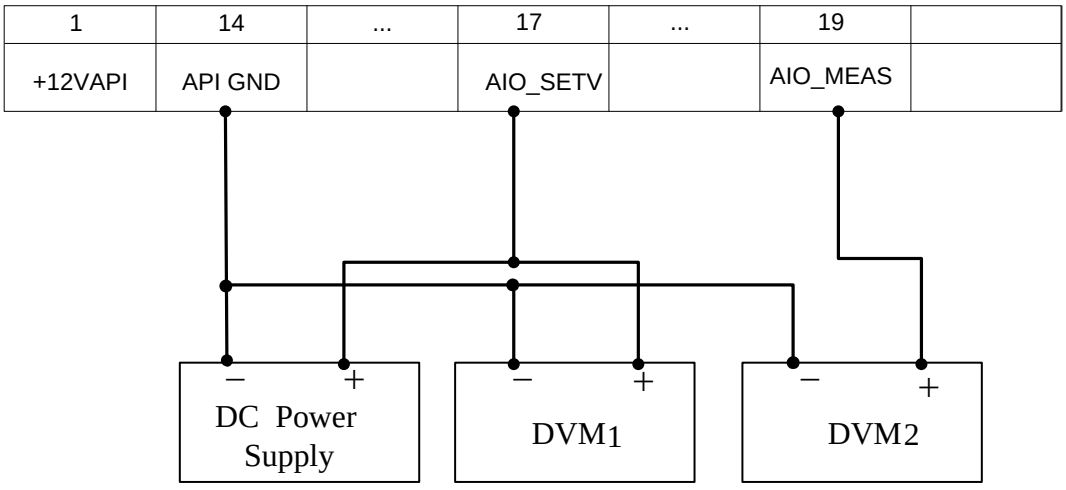


Figure 3-130

Notice Key in at least 5 digits for each calibration point to ensure the Power Supply accuracy after calibration.

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

1. In the CALIBRATION page, press "5" or turn the "Rotary" ( ) knob to set CHOICE = 5.
2. Press "ENTER" to display the current calibration options as shown in Figure 3-131.

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

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

Figure 3-131

3. Insure the interface connection on the rear panel is correct and then press "ENTER" to confirm.

4. Input a 0.5V voltage signal on Pin 17. The cursor stops at position [1] as shown in Figure 3-132. Adjust the Power Supply to 0.5V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage read by DVM 1 and press "ENTER" to confirm.

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

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

Figure 3-132

5. Press "↓→" again and input an 8.0V voltage signal on Pin 17. The cursor stops at position [2] as shown in Figure 3-132. Adjust the Power Supply to 8V±0.2V and use DVM1 to measure the reading of the Power Supply. Input the voltage read by DVM1 to position [2] and press "ENTER" to confirm.
6. Press "↓→" again and the system will set the output voltage of Pin 19 on the rear panel to 0.5V and the cursor stops at position [3] as shown in Figure 3-133. Input the voltage read by DVM2 to position [3] and press "ENTER" to confirm.

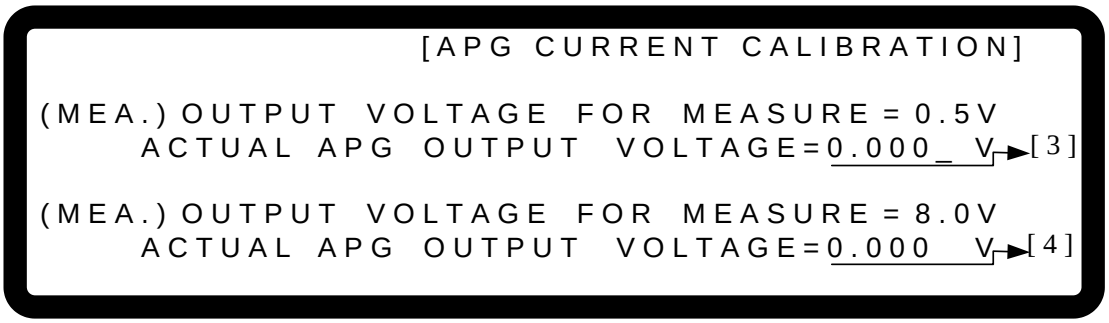


Figure 3-133

7. Press "[↓→]" again and the system will set the output voltage of Pin 19 on the rear panel to 8.0V and the cursor stops at position [4] as shown in Figure 3-133. Input the voltage read by DVM2 to position [4] and press "ENTER" to confirm.

8. The APG current calibration is done once the above actions are completed. To save the calibration data, pressing "SAVE" will display a confirmation page as shown in Figure 3-134. Press "1" or turn the "Rotary" (🔘) knob to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

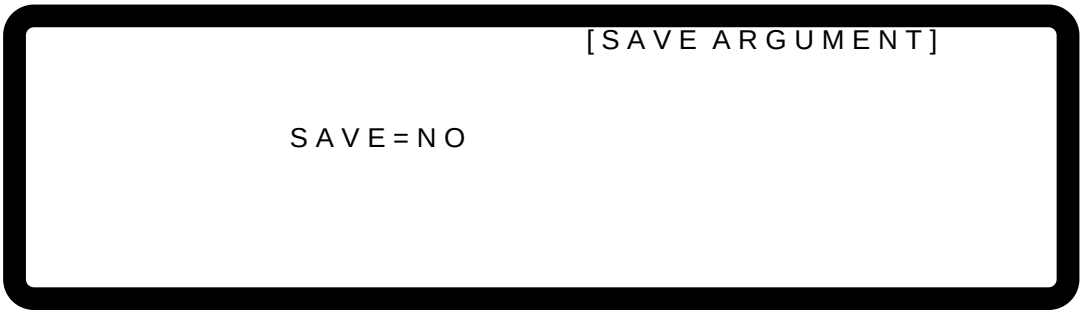


Figure 3-134

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

Notice The calibration points may be different for other models (non 62150H-600S); perform the calibration following the instructions displayed.

3.3.7.6 IV Voltage Output & Measurement Calibration (62020H-150S Only)

3.3.7.6.1 Hardware Requirements

The hardware required for calibration is shown in Table 3-11.

Table 3-11

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

3.3.7.6.2 Setup

The wiring diagram is shown in Figure 3-135.

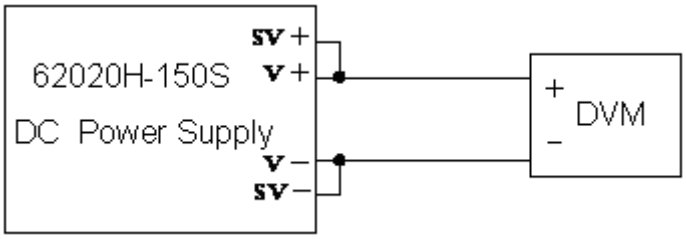


Figure 3-135

Notice

1. Before perfoming a calibration, ensure the resolution of the test equipment exceeds the 62020H-150S specifications.
2. Set the Resolution of the HP34401 to SLOW 6 digit.
3. Key in at least 5 digits for each calibration point to ensure the Power Supply accuracy after calibration.
4. This calibration function is only valid for the 62020H-150S.

3.3.7.6.3 Calibration Procedure

1. Go to the CALIBRATION the screen as shown in Figure 3-136.

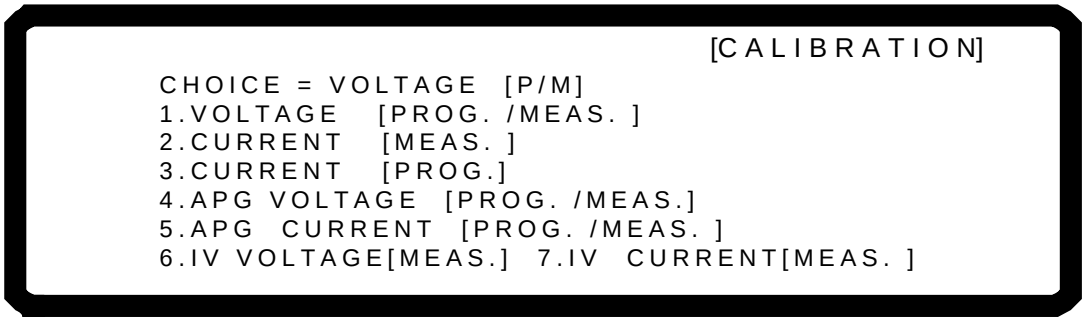


Figure 3-136

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

3. Press "ENTER" to display the current calibration options as shown in Figure 3-137.

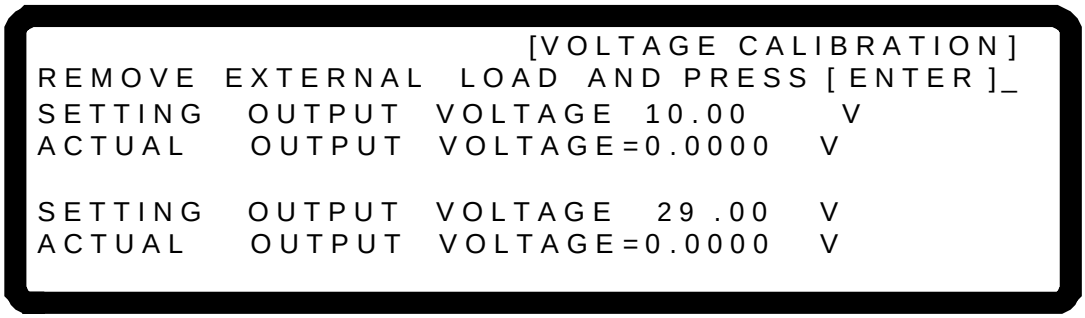


Figure 3-137

4. Verify the external load has been removed and press "ENTER" to confirm.
5. The device will output 10.00V and the cursor will stop at position [1] as shown in Figure 3-138. Enter the voltage read by the DVM and press "ENTER" to confirm it.
6. Press "↓→" to do the second low voltage range point calibration. The device will output 29.00V and the cursor will stop at position [2] as shown in Figure 3-138. Enter the voltage read by the DVM and press "ENTER" to confirm it.

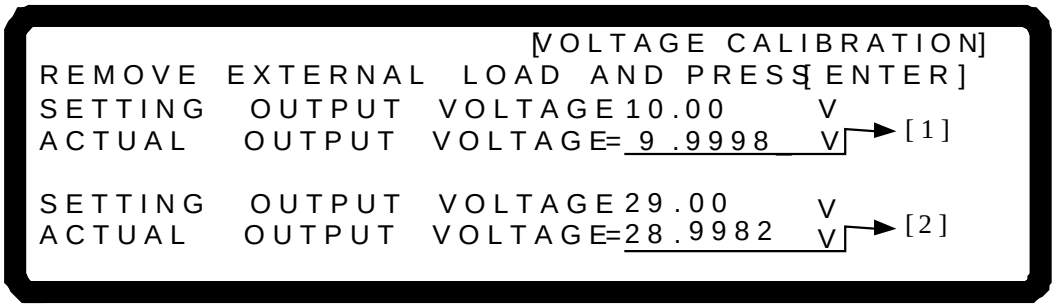


Figure 3-138

7. Press "↓→" to do the high voltage range calibration. The device will output 38.00V and the cursor will stop at position [3] as shown in Figure 3-139. Enter the voltage read by the DVM and press "ENTER" to confirm it.
8. Press "↓→" to do the second high voltage range point calibration. The device will output 132.00V and the cursor will stop at position [4] as shown in Figure 3-139. Enter the voltage read by the DVM and press "ENTER" to confirm it.

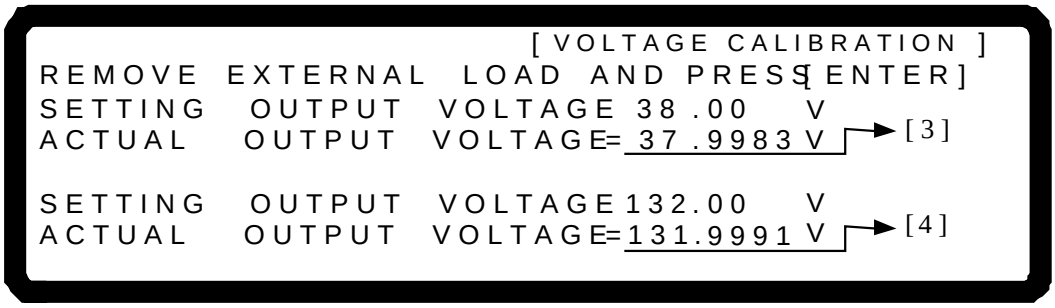


Figure 3-139

9. The voltage calibration is done when the above actions are completed. To save the calibrated values, press "SAVE" and a confirmation screen will appear as shown in Figure 3-140. Press "1" or turn the "Rotary" (◎) knob to set SAVE=YES and press "ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

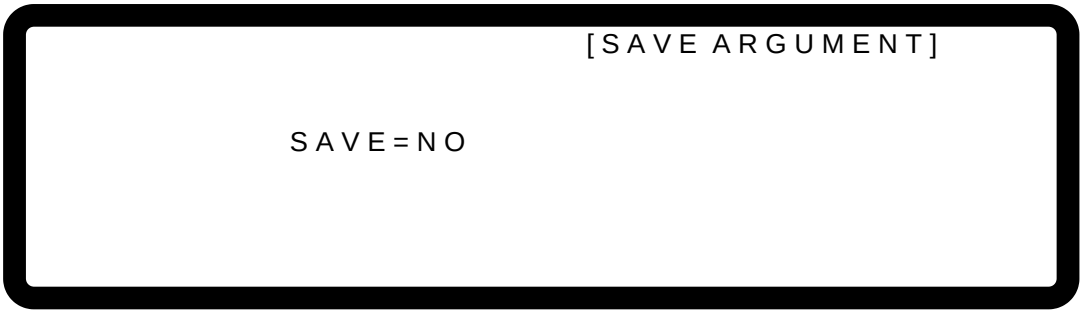


Figure 3-140

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

3.3.7.7 IV Current Calibration (62020H-150S Only)

3.3.7.7.1 Hardware Requirements

The hardware required for current calibration is shown in Table 3-12.

Table 3-12

Device		Suggest Model or Capacity
DVM		HP 34401A or equivalent DVM
DCCT		ULTRASTAB SATURN
LOAD	ELECTRICAL LOAD	CHROMA 63204 or equivalent
	BREAKER	Current >=100A

CAUTION The BREAKER capacity listed in the table above is only for the 62150H-600S. For other models, see the OUTPUT CURRENT spec in Table 1-1 to select the appropriate BREAKER rating.

3.3.7.7.2 SETUP

The wiring diagram for current calibration is shown in Figure 3-141.

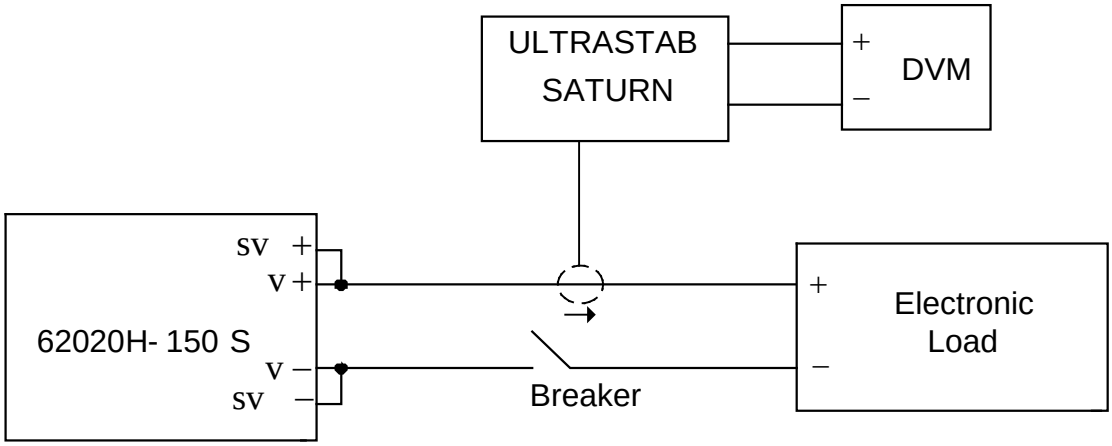


Figure 3-141

Notice

1. Calibrate the offset voltage of the ULTRASTAB SATURN before using it for the current calibration. Press "Null" and the DVM panel

digits will reset and show “Math” for the current calibration.

2. Key in at least 5 digits for each calibration point to ensure the Power Supply accuracy after calibration.

3.3.7.7.3 Calibration Procedure

1. Go to the CALIBRATION page as shown in Figure 3-136.
2. In the CALIBRATION page, press “2” or turn the “Rotary” ( ) knob to set CHOICE=2.
3. Press “ENTER” to display the current calibration options as shown in Figure 3-142.

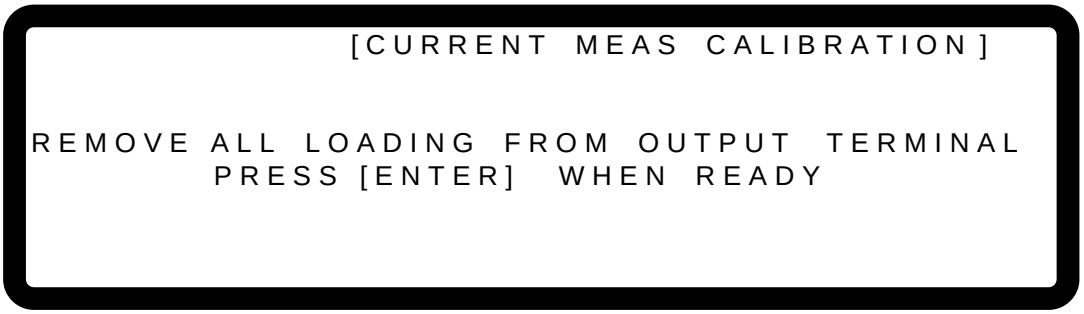


Figure 3-142

4. Verify all loads have been removed from the output terminal and press “ENTER” to confirm.
5. Press “ENTER” to do the first low current range point calibration. The system will output a fixed voltage and then set the Electronic Load to draw 1.0A current. The cursor will stop at position [1] as shown in Figure 3-143. Enter the current read by the ULTRASTAB SATURN (DVM) to position [1] and press “ENTER” to confirm it.

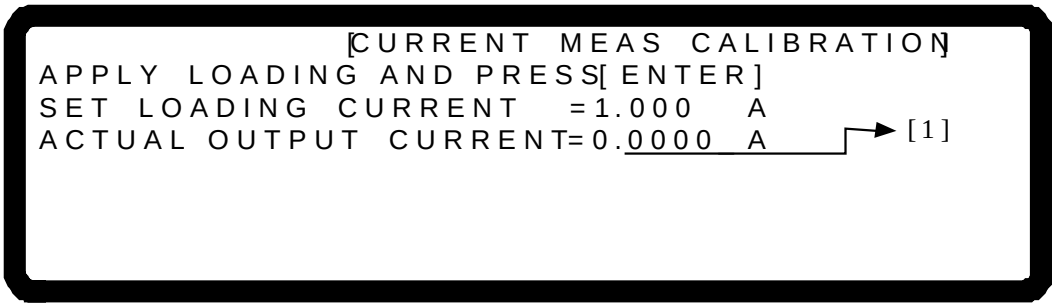


Figure 3-143

6. Turn off the Electronic Load and reconnect the DC Power Supply to a current shunt whose rating is closest to but still covers 20A. For the Prodigit 7550, use the 20A shunt directly.
7. Press “ ” to perform the 6.7A calibration. The cursor will stop at position [2] as shown in Figure 3-144. Set the Electronic Load to draw 6.700A current. Enter the current read by the ULTRASTAB SATURN (DVM) and press “ENTER” to confirm. Using the calibration values obtained, the system will calculate the calibration factor for the low current range.

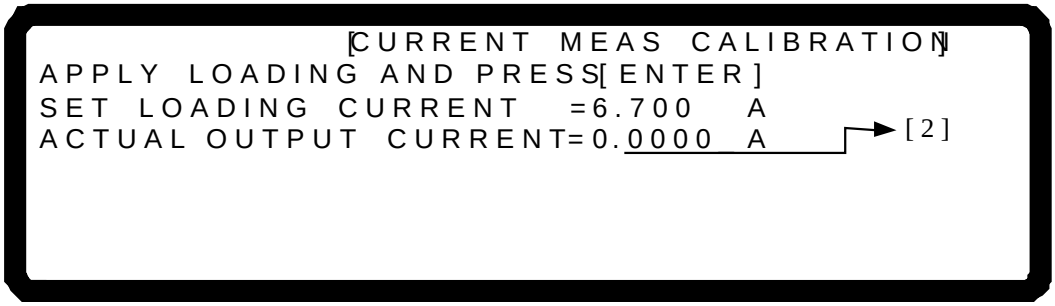


Figure 3-144

8. Press "↓→" to perform the 12A calibration. When the cursor stops at position [3] as shown in Figure 3-145, set the Electronic Load to draw 12.00A current. Enter the current read by the ULTRASTAB SATURN (DVM) and press "ENTER" to confirm it.

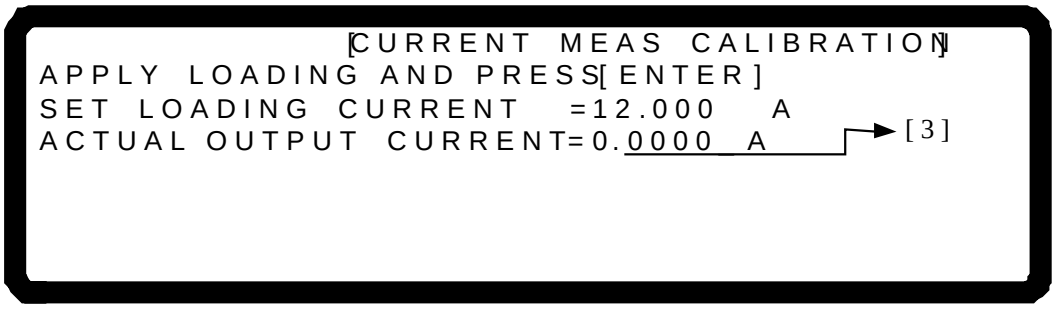


Figure 3-145

9. Press "↓→" to do the 36.00A calibration. When the cursor stops at position [4] as shown in Figure 3-146, set the Electronic Load to draw 36.00A current. Enter the current read by the ULTRASTAB SATURN (DVM) and press "ENTER" to confirm it. Using the calibration values obtained, the system will calculate the calibration factor for the high current range.

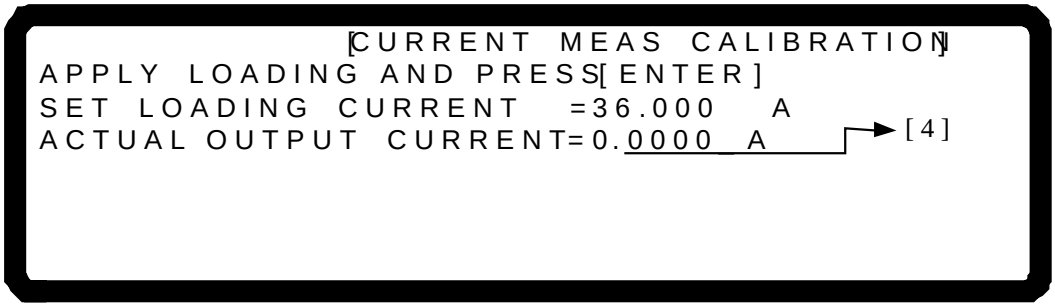


Figure 3-146

10. The current calibration is done when the above actions are completed. To save the calibrated values, press "SAVE" and a confirmation screen will appear as shown in Figure 3-147. Press "1" or turn the "Rotary" (◎) knob to set SAVE=YES and press

"ENTER" to save it. If there is no need to save it, press "EXIT" to return to the Calibration screen.

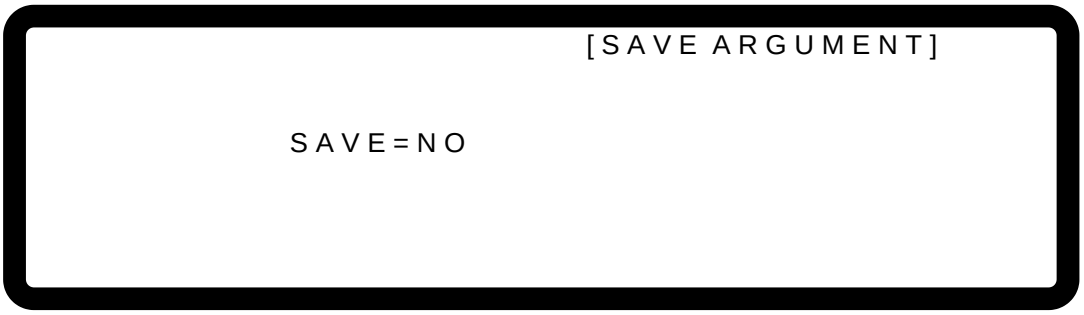


Figure 3-147

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

3.3.8 REMOTE SETUP

3.3.8.1 GPIB ADDRESS

The DC Power Supply supports remote operation through the GPIB interface. The GPIB address must be set prior to remote operation.

1. Use the " ◄▲ ", " ▼► " keys to move the cursor to the GPIB ADDR column as shown in Figure 3-148.

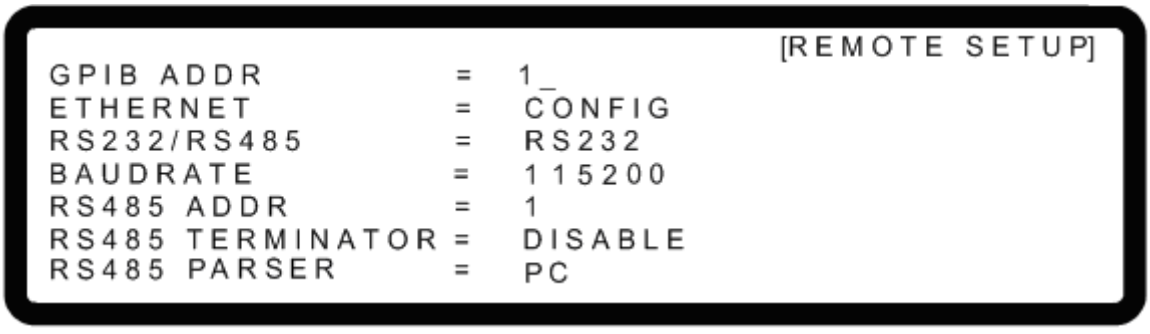


Figure 3-148

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

Notice The valid address range is 1-30.

3.3.8.2 ETHERNET

The DC Power Supply supports remote operation through the ETHERNET interface. The ETHERNET IP address must be set prior to remote operation.

Notice

1. Connect the network cable to the DC Power Supply for auto detection.
2. If the network cable is not connected properly, it may cause the DC Power Supply screen to display incorrectly. Turn OFF the DC Power Supply, resolve the network cable problem, and reboot it to clear the abnormal screen.

1. Use the “ ”, “ ” keys to move the cursor to the ETHERNET column as shown in Figure 3-149.
2. Press “ENTER” to go to the ETHERNET IP address setting screen as shown in Figure 3-150.

Auto detection:

The DHCP default is “ON” and the DC Power Supply will automatically detect the external network IP address as shown in Figure 3-150,

Manual detection:

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

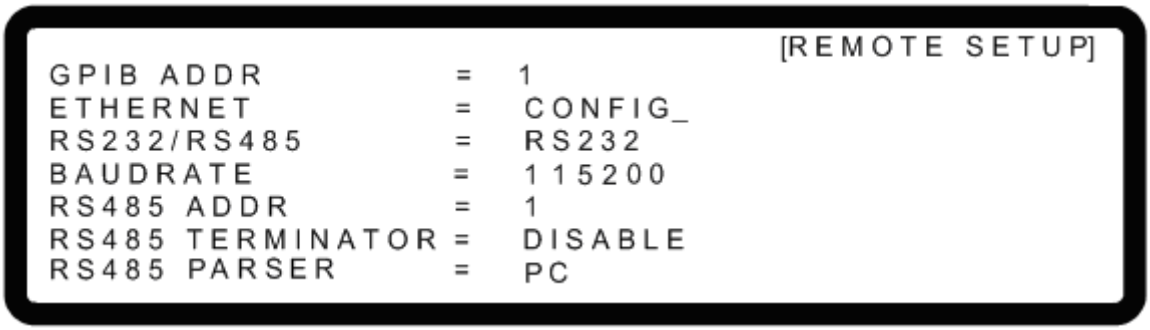


Figure 3-149

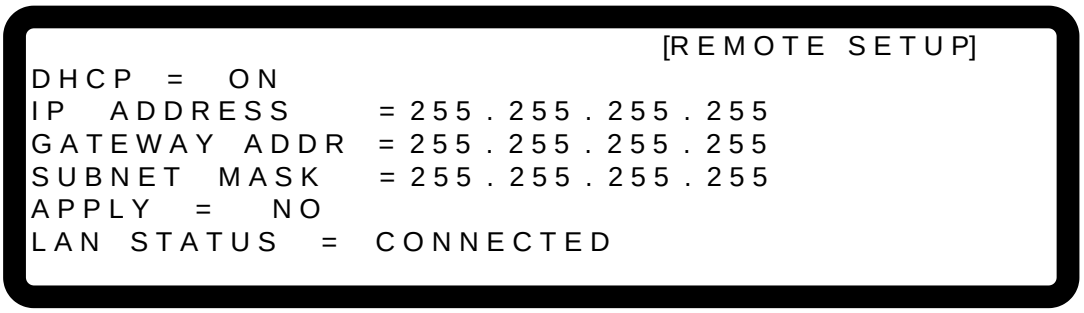


Figure 3-150

Notice

1. The LAN STATUS displays the following 5 actions:
   CONNECTED: the network is connected.
   CONNECTING. . . .: the network is connecting.
   NONE CONNECT: the network is not connected.
   SETTING. . . .: the network is being set up.
   ETHERNET MODULE FAIL: the network module has failed.
2. The ETHERNET IP address range is 0-255. DHCP=ON sets the address automatically and DHCP=OFF requires the address be set manually. Once the IP address is set, set APPLY=YES and press "ENTER" for the address to take effect.

3.3.8.3 RS232/RS485

1. Use the " ◄—▲ ", " ▼—► " keys to move the cursor to the RS232/RS485 column as shown in Figure 3-151.

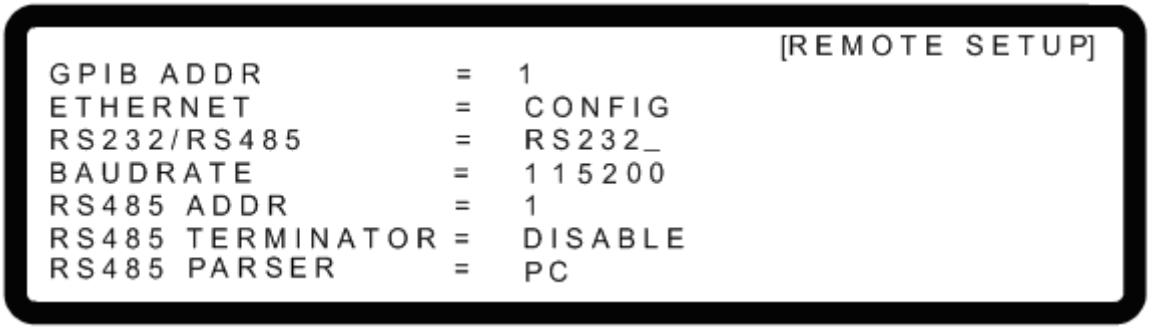


Figure 3-151

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

3.3.8.4 BAUDRATE

The DC Power Supply supports remote operation through the RS232 interface. The RS232 baudrate must be set prior to remote operation.

1. Use the “ ◄—▲ ”, “ ▼—► ” keys to move the cursor to the BAUDRATE column as shown in Figure 3-152.

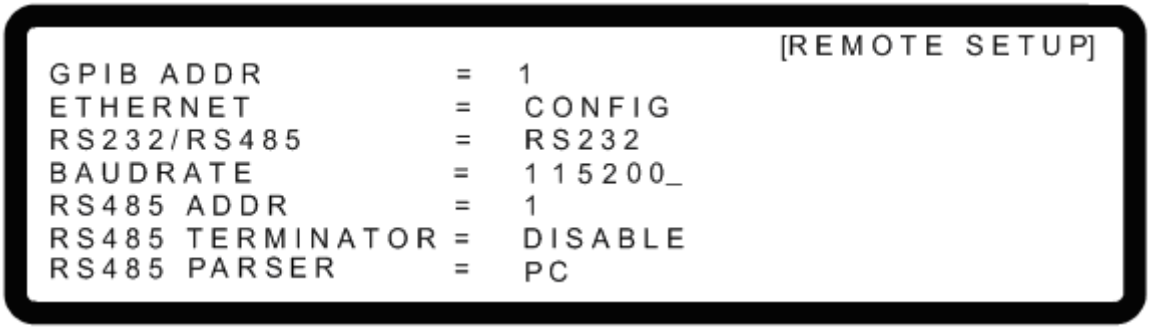


Figure 3-152

2. Use the numeric keys [0] - [4] or the “Rotary” (◎) knob to select BAUDRATE.
3. Press “[ENTER]” to confirm.
4. Press “[EXIT]” to return to the MAIN PAGE.

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

3.3.8.5 RS485 ADDR

The DC Power Supply supports remote operation through the RS485 interface. The RS485 address must be set prior to remote operation.

1. Use the “ ◄—▲ ”, “ ▼—► ” keys to move the cursor to the RS485 ADDR column as shown in Figure 3-153.

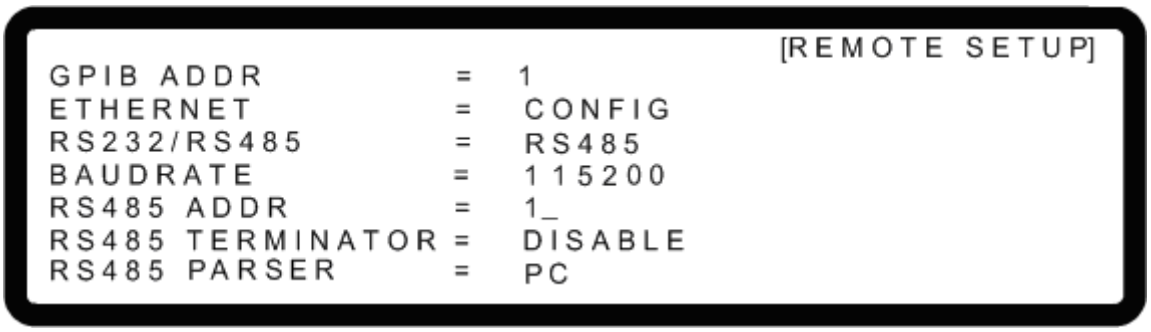


Figure 3-153

2. Use the numeric keys [0] - [9] or the “Rotary” (◎) knob to set the address.

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

Notice The valid address range is 1-30.

3.3.8.6 RS485 TERMINATOR

The terminator status needs to be set when using the RS485 remote operation function.

1. Use the " ◄▲ ", " ▼► " keys to move the cursor to the RS485 TERMINATOR column as shown in Figure 3-154.

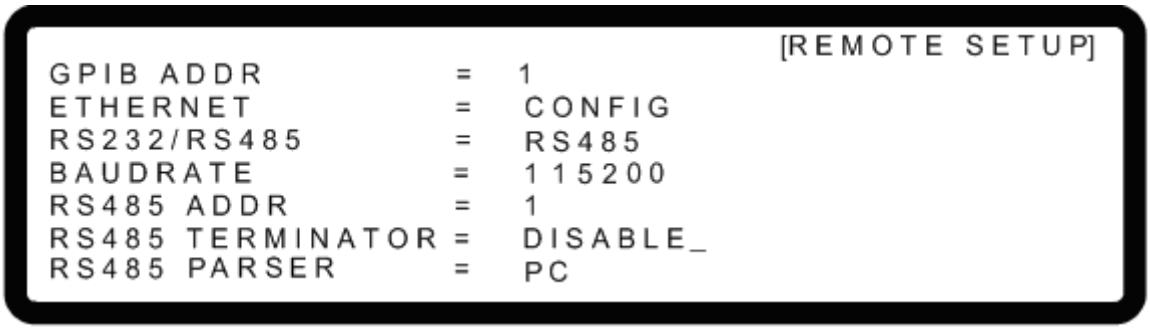


Figure 3-154

2. Use the numeric keys 0 - 1 or the "Rotary" (◎) knob to enable or disable the RS485 TERMINATOR.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the MAIN PAGE.

Notice The RS485 TERMINATOR internal resistance is 120Ω.

3.3.8.7 RS485 PARSER

The RS485 interface can be used in standalone mode or with the A620029 (option) for online use.

1. Use the " ◄▲ ", " ▼► " keys to move the cursor to the RS485 PARSER column as shown in Figure 3-155.

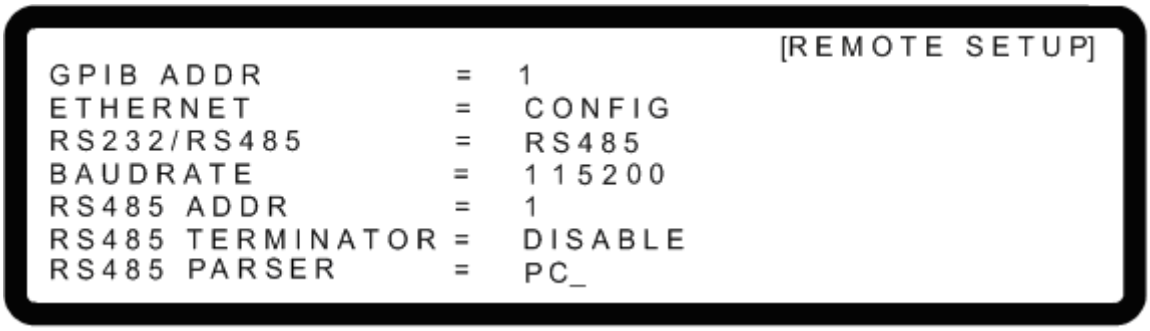


Figure 3-155

2. Use the numeric keys [0] - [1] or the "Rotary" (◯) knob to set the RS485 PARSER status.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to MAIN PAG.

Notice

1. The default setting for RS485 PARSER is "PC". "CSU" is used for paralleling multiple units and connecting with the A620029 (option). See the A620029 User's Manual for setup instructions.
2. The DC power supply firmware must be version 2.00 or above when used with the A620029. Version 2.00 firmware is not backward compatible. Contact Chroma if a firmware upgrade is required.

3.3.9 OUTPUT MODE

62000H Series DC Power Supplies with Solar Array Simulation have 5 operating modes:

(1) CV/CC MODE: the common CV MODE and CC MODE of a DC Power Supply.
(2) TABLE MODE: imports the voltage/current settings from an Excel spreadsheet using the Solar Array Simulation Soft Panel to implement the IV Curve function of a Solar Array.
(3) SAS MODE: utilizes the built-in Solar Array IV Curve formula to run the Solar Array Simulation function.
(4) EN50530 MODE: utilizes the built-in EN50530 formula to generate the Solar Array IV curve.
(5) SANDIA_ MODE: utilizes the built-in SANDIA formula to generate the Solar Array IV curve.

1. In the CONFIG page, press "[9]" then "[ENTER]" to go to the OUTPUT MODE as shown in Figure 3-156.

Figure 3-156

2. Use the numeric keys [0] - [2] or the "Rotary" (◎) knob to select the OUTPUT MODE. The default is CV/CC MODE.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to the MAIN PAGE.

3.3.9.1 CV/CC MODE

The Chroma 62000H Series DC Power Supply with Solar Array Simulation can also be used as a general purpose DC Power Supply. The supply provides CV and CC modes as shown in Figure 3-157. See section 3.2 for detailed operating procedures.

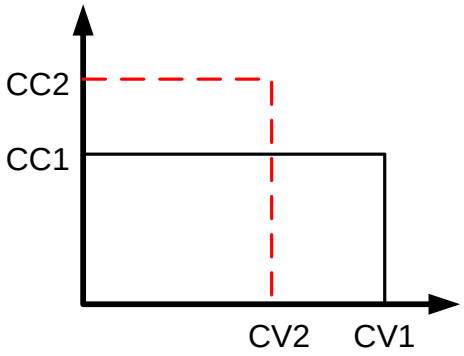
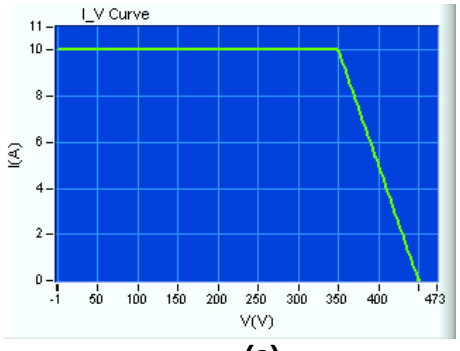


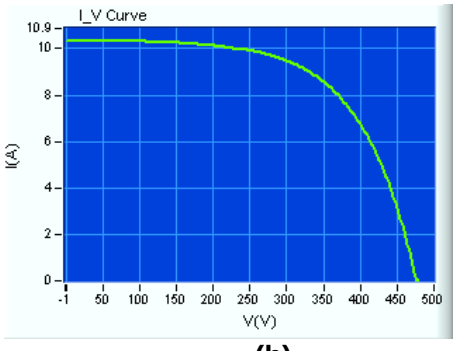
Figure 3-157

3.3.9.2 TABLE MODE

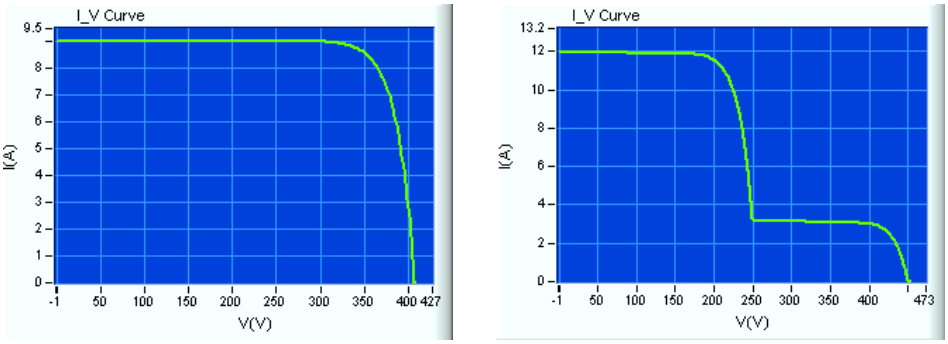
IV Curve data in an Excel spreadsheet can be imported using the Solar Array Simulation Soft Panel. This mode allows the creation of various IV Curves, as shown in Figure 3-158, to generate Solar Cell IV Curves for different types of cells or IV Curves for different operating environments such as irradiation change, temperature change, cloud shadows, etc. The curve can be changed in real time to simulate various conditions.



(a)



(b)



(c) **(d)**

Figure 3-158

Figure 3-159 shows the screen display when using the Solar Array Simulation Soft Panel. The settings cannot be changed from the front panel.

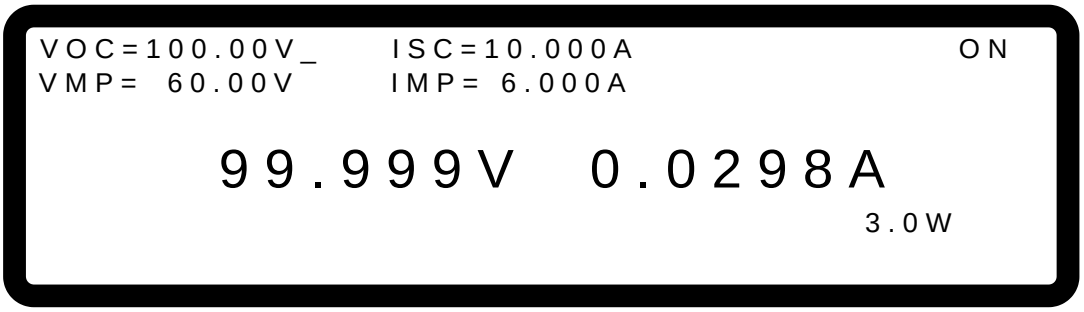


Figure 3-159

Notice

To create an IV Curve in Excel, perform the following steps:

1. Open a blank worksheet.
2. The first column in the worksheet is voltage and the second column is current.
3. The first row in the worksheet is the first dot of the IV Curve. A maximum of 128 dots (rows) can be plotted per curve. The curve can be less than 128 dots but must be greater than 3 dots with duplicates.
4. The voltage and current of an IV Curve must be in reverse order, i.e., when the voltage is increasing the current must be decreasing and vice versa.
5. The first voltage dot must be zero or the maximum value and the current must be the opposite. If the voltage is zero, the current must be the maximum current. The maximum voltage is the open voltage (Voc) of the Solar Cell and the maximum current is the short circuit current (Isc) of the cell.
6. Figure 3-160 shows 10 dots of data to create an IV curve. Column A is voltage and column B is current, while rows 1-10 are the data points.

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

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

Figure 3-160

3.3.9.3 SAS MODE

The Chroma 62000H Series DC Power Supply with Solar Array Simulation is not only able to simulate the Solar Cell curve using the Solar Array Simulation Soft Panel but it also has a built-in model to provide a solar cell curve simulation function called SAS Mode. See Britton, Lunscher, and Tanju, "A 9 KW High-Performance Solar Array Simulator", Proceedings of the European Space Power Conference, August 1993 (ESA WPP-054, August 1993) for the built-in model. The model formula discussed in the thesis is described below.

$$V = \frac{\dfrac{V_{oc}\ln\left(2-\left(\dfrac{I}{I_{sc}}\right)^{N}\right)}{\ln(2)} - R_s\left(I - I_{sc}\right)}{1+\dfrac{R_s I_{sc}}{V_{oc}}}$$

where

$$R_s = \frac{V_{oc}-V_{mp}}{I_{mp}} \quad , \quad N = \frac{\ln\left(2-2^{a}\right)}{\ln\left(\dfrac{I_{mp}}{I_{sc}}\right)} \quad , \quad a = \frac{V_{mp}\left(1+\dfrac{R_s I_{sc}}{V_{oc}}\right)+R_s\left(I_{mp}-I_{sc}\right)}{V_{oc}}$$

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

Procedure for selecting the SAS MODE:

1. Use the numeric keys [0] - [2] or the "Rotary" (◎) knob to select SAS_MODE as shown in Figure 3-161.
2. Press "[ENTER]" to confirm.
3. Press "[EXIT]" to return to the MAIN PAGE.

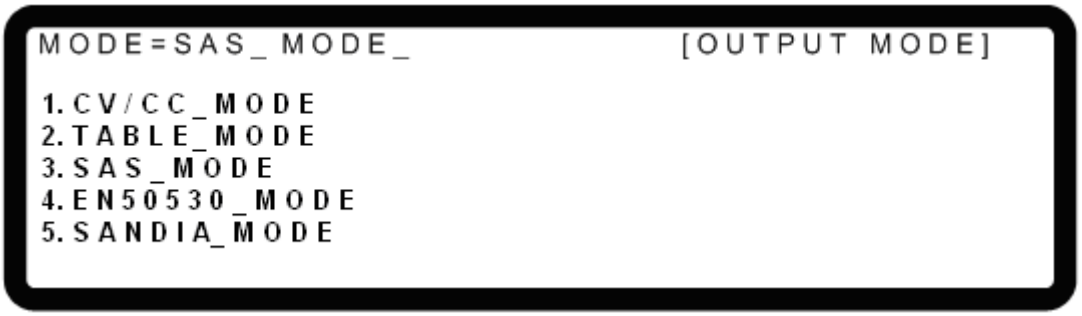


Figure 3-161

Figure 3-162 shows the screen in the SAS MODE.

Figure 3-162

Procedure for setting the SAS MODE parameters:

1. Move the cursor to VOC and use the numeric keys [0] - [9] to set the open voltage.
2. Move the cursor to ISC and use the numeric keys [0] - [9] to set the short circuit current.
3. Move the cursor to VMP and use the numeric keys [0] - [9] to set the maximum power voltage.
4. Move the cursor to IMP and use the numeric keys [0] - [9] to set the maximum power current.
5. Press "[ON/OFF]" to display the confirmation screen shown in Figure 3-163.

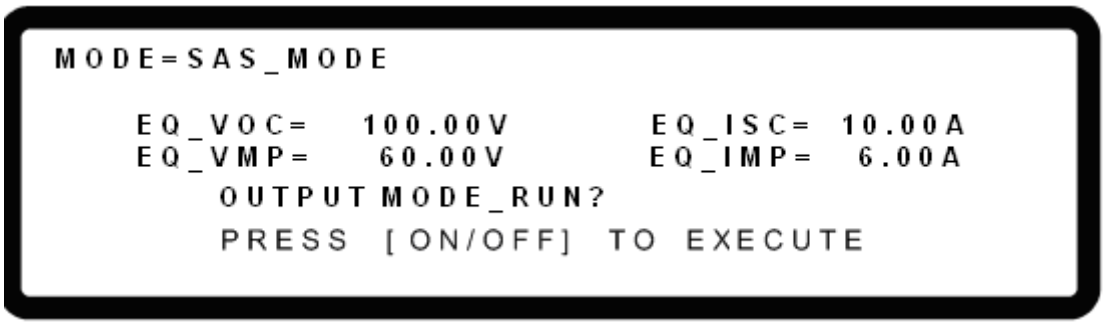


Figure 3-163

6. Press "ON/OFF" again to start program execution. The SAS MODE main screen will display as shown in Figure 3-164. To quit, press "EXIT" to return to the MAIN PAGE.

Figure 3-164

Figure 3-164 shows the screen during SAS MODE output. The EQ_PMP, EQ_VMP and EQ_IMP are the actual operating points that are calculated from the user settings for VMP and IMP using the built-in formula. Since the model formula will use the entered Vmp and Imp to get the maximum power point, the calculated Vmp and Imp may be different.

The VOC, ISC, VMP and IMP parameters can be changed using the "◄▲", "▼►" function keys. When any of the parameters are modified, use the "▼►" keys to move the cursor to TRIG and press "ENTER" to confirm. The IV curve and EQ_PMP, EQ_VMP and EQ_IMP parameters will be immediately updated.

Notice

1. Fill Factor (FF): $\mathrm{FF} = \dfrac{V_{mp} I_{mp}}{V_{oc} I_{sc}}$

2. Voc, Vmp, Isc and Imp parameter limits:

   a. $V_{oc} > V_{mp} > 0$

   b. $I_{sc} > I_{mp} > 0$

   c. $V_{mp} > V_{oc}\left(1 - \dfrac{I_{mp}}{I_{sc}}\right)$

3.

I-V Curve Programming Response Time (Typical)	
62050H-600S	Delta V= 600 to 0V (1s @ No Load) (40ms @ 500W) (8ms @ 2500W) Delta V=350 to 250V (160ms @ No Load) (6.6ms @ 500W) (1.4ms @ 2500W)
62100H-600S	Delta V= 600 to 0V (1s @ No Load) (40ms @ 1000W) (8ms @ 5000W) Delta V=350 to 250V (160ms @ No Load) (6.6ms @ 1000W) (1.4ms @ 5000W)
62150H-600S	Delta V= 600 to 0V (1s @ No Load) (40ms @ 1500W) (8ms @ 7500W) Delta V=350 to 250V (160ms @ No Load) (6.6ms @ 1500W) (1.4ms @ 7500W)
62150H-1000S	Delta V= 1000 to 0V (1.5s @ No Load) (40ms @ 1500W) (8ms @ 7500W) Delta V=580 to 420V (240ms @ No Load) (6.4ms @ 1500W) (1.3ms @ 7500W)
A620028	Delta V= 1000 to 0V (1.5s @ No Load) (40ms @ 1500W) (8ms @ 7500W) Delta V=580 to 420V (240ms @ No Load) (6.4ms @ 1500W) (1.3ms @ 7500W)
A620027	Delta V= 600 to 0V (1s @ No Load) (40ms @ 1500W) (8ms @ 7500W) Delta V=350 to 250V (160ms @ No Load) (6.6ms @ 1500W) (1.4ms @ 7500W)
62020H-150S	Delta V= 150 to 0V (120ms @ No Load) (16ms @ 200W)

	(3.2ms @ 1000W) Delta V=50 to 20V (25ms @ No Load) (1.5ms @ 200W) (0.3ms @ 1000W)

3.3.9.4 EN50530 MODE

The Chroma 62000H Series Programmable DC Power Supply with Solar Array Simulation has EN50530 built-in to provide a solar cell curve simulation function.

1. Use the numeric keys [0] - [4] or the rotary knob ( ) to select EN50530_MODE as shown in Figure 3-165.
2. Press "[ENTER]" to confirm.
3. Press "[EXIT]" to return to the MAIN PAGE.

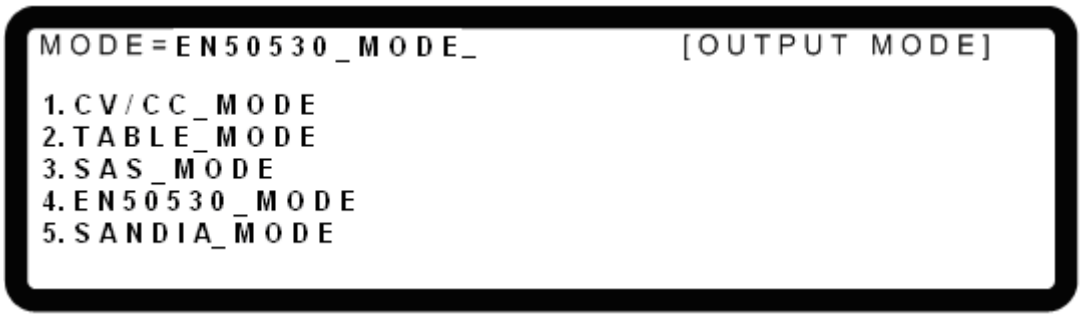


Figure 3-165

In EN50530 _MODE the display shows:

Figure 3-166

Procedure for setting the EN50530 MODE parameters:

1. Move the cursor to VMP and use the numeric keys ([0] - [9]) to set the maximum power voltage.
2. Move the cursor to PMP and use the numeric keys ([0] - [9]) to set the maximum power.
3. Move the cursor to FF and use the numeric keys ([0] - [9]) to set the PV Fill Factor.
4. Move the cursor to IRR and use the numeric keys ([0] - [9]) to set the irradiation.

5. Press "ON/OFF" to display the confirmation window as shown in Figure 3-167.

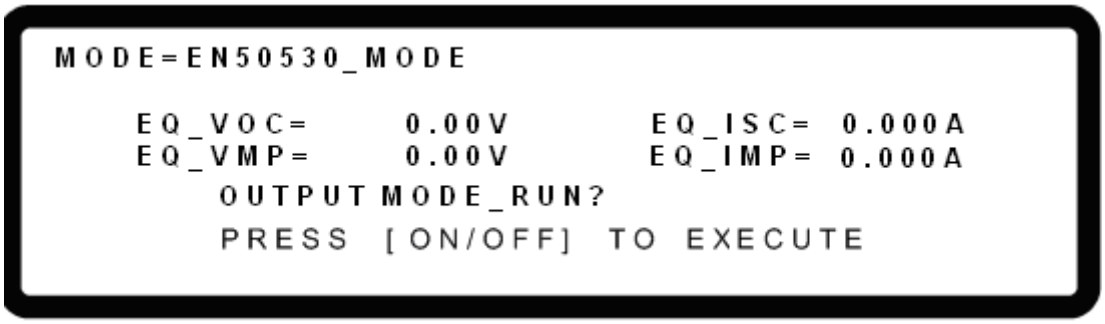


Figure 3-167

6. Press "ON/OFF" again to start program execution. The EN50530 MODE main screen will display as shown in Figure 3-168. To quit, press "EXIT" to return to the MAIN PAGE.

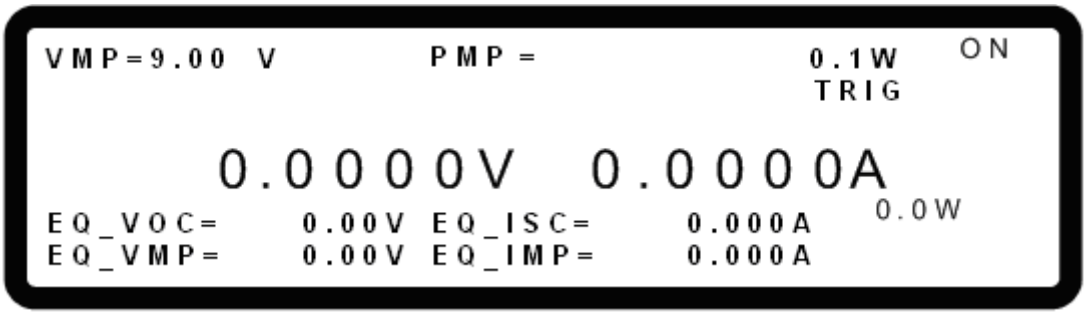


Figure 3-168

Figure 3-168 shows the screen during EN50530_MODE output. The EQ_VOC, EQ_VMP, EQ_ISC and EQ_IMP are the actual operating points that are calculated based on the settings of VMP and PMP using the built-in formula.

Use the " ◄—▲ " and " ▼—► " keys to change the VMP and PMP parameters. When the VMP or PMP parameters are changed, use " ▼—► " to move the cursor to TRIG and press "ENTER" to confirm the change. The IV curve and EQ_VOC, EQ_VMP, EQ_ISC and EQ_IMP parameters will be immediately updated.

3.3.9.5 SANDIA MODE

The Chroma 62000H Series Programmable DC Power Supply with Solar Array Simulation has SANDIA_MODE built-in to provide a solar cell curve simulation function.

1. Use the numeric keys 0 - 4 or the rotary knob ( ) to select SANDIA_MODE as shown in Figure 3-169.

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

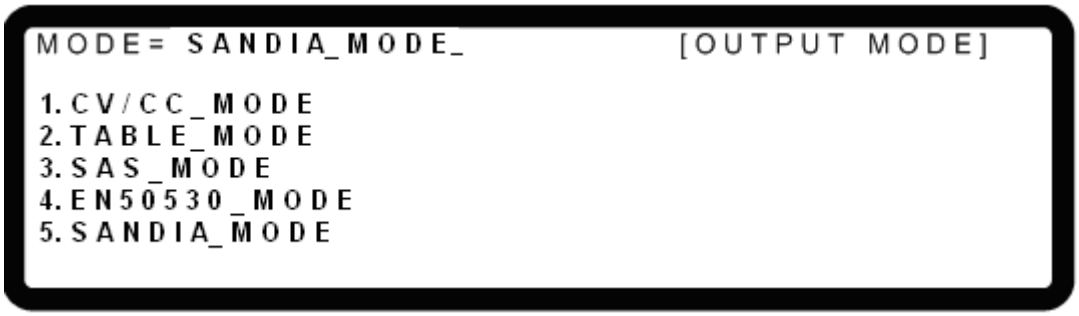


Figure 3-169

In SANDIA _MODE the display shows:

Figure 3-170

Procedure for setting the SANDIA_MODE parameters:

1. Move the cursor to VMP and use the numeric keys (0 - 9) to set the maximum power voltage.
2. Move the cursor to PMP and use the numeric keys (0 - 9) to set the maximum power.
3. Move the cursor to FF and use the numeric keys (0 - 9) to set the fill factor.
4. Move the cursor to BETA and use the numeric keys (0 - 9) to set the voltage temperature coefficient.
5. Move the cursor to IRR and use the numeric keys (0 - 9) to set the irradiation.
6. Move the cursor to IRR REF and use the numeric keys (0 - 9) to set the irradiation reference.
7. Move the cursor to TMP and use the numeric keys (0 - 9) to set the temperature.
8. Move the cursor to TMP_REF and use the numeric keys (0 - 9) to set the temperature reference.
9. Press “ ON/OFF ” to display the confirmation window as shown in Figure 3-171.

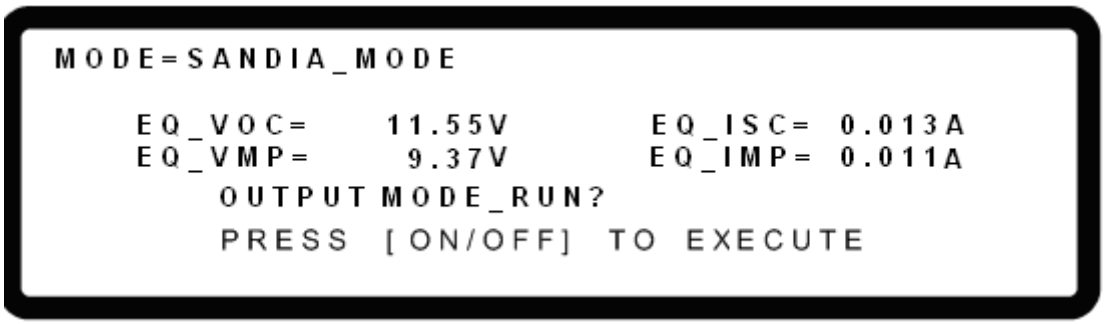


Figure 3-171

10. Press "ON/OFF" again to start program execution. The SANDIA_MODE main screen will display as shown in Figure 3-172. To quit, press "EXIT" to return to the MAIN PAGE.

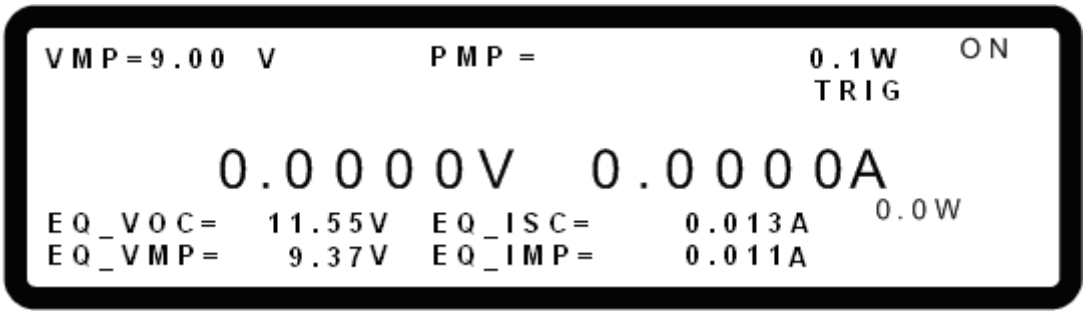


Figure 3-172

Figure 3-172 shows the screen during SANDIA_MODE output. The EQ_VOC, EQ_VMP, EQ_ISC and EQ_IMP are the actual operating points that are calculated based on the settings of VMP and PMP using the built-in formula.

Use the " ", " " keys to change the VMP and PMP parameters. When the VMP or PMP parameters are changed, use " " to move the cursor to TRIG and press "ENTER" to confirm the change. The IV curve and EQ_VOC, EQ_VMP, EQ_ISC and EQ_IMP parameters will be immediately updated.

3.3.9.6 Error Message

If invalid parameters are entered in SAS_MODE, the screen will display an error message. Press "EXIT" to return to OUTPUT_MODE and re-enter the correct parameters.

Figure 3-173

If invalid parameters are entered in EN50530 or SANDIA_MODE or a parameter returns a negative value after the calculation has been completed, the screen will display an error message. Press "EXIT" to return to OUTPUT_MODE and re-enter the correct parameters.

Figure 3-174

4. Program Sequence

62000H Series DC Power Supplies with Solar Array Simulation allow users to program the output sequence in LIST MODE, V_STEP MODE and IV PROGRAM. LIST MODE and IV PROGRAM both have 10 Programs and each Program can add a total of 100 sequences that are available for editing. IV PROGRAM is used to edit the IV Curve waveform. V_STEP MODE provides a run time voltage program with a maximum of 99 hours 59 minutes and 59 seconds.

Each sequence in LIST MODE can be edited for voltage settings, voltage slew rates, current settings, current slew rates, run times and trigger types that can apply to almost any situation.

1. Press "PROG" on the front panel.
2. The PROGRAM options are displayed as shown in Figure 4-1.
3. Use the numeric keys 1 - 3 or the "Rotary" (◎) knob to set the desired mode.
4. Press "ENTER" to confirm.
5. To quit the PROGRAM mode, press "EXIT" to return to the MAIN PAGE.

Figure 4-1

4.1 LIST MODE

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

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

                              ↓
                              ↓
                              ↓
```

Figure 4-2

4.1.1 Description of PROGRAM Settings

A PROGGRAM has 5 settings: (1) EXT._TRIG PULL, (2) PROG NO., (3) RUN COUNT, (4) PROG CHAIN and (5) CLEAR PROG.

4.1.1.1 Setting EXT._TRIG PULL

1. Use the “ ”, “ ” keys to move the cursor to the column to be set as shown in Figure 4-3 (1).
2. Use the numeric keys 0 - 1 or the “Rotary” ( ) knob to set HIGH or LOW.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Figure 4-1.

Notice

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

4.1.1.2 Setting PROG NO.

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 keys (0 - 9) or the “Rotary” ( ) knob to set the value.
3. Press “ENTER” to confirm.
4. Press “EXIT” to return to Figure 4-1.

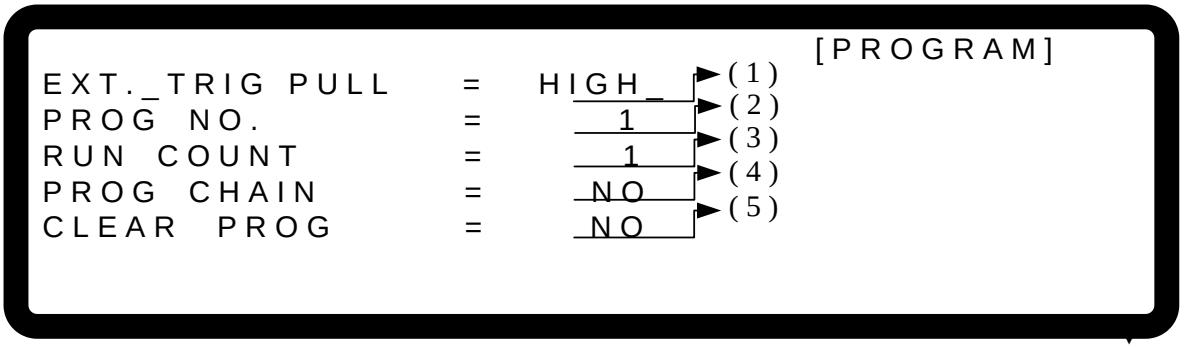


Figure 4-3

The valid range for PROG NO. is 1 - 10.

4.1.1.3 Setting RUN COUNT

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

Each PROGRAM has a RUN COUNT that sets the number of times the program is executed. The following table shows the RUN COUNT range:

Table 4-1

RUN COUNT	MIN	MAX
TIMES	1	15000

Ex.1: Set RUN COUNT for a PROGRAM
Set PROG #1 to NEXT TO PROG NO =3, RUN COUNT=2.
PROG #3 to NEXT TO PROG NO =0, RUN COUNT=3.
The program execution flow of RUN COUNT is 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

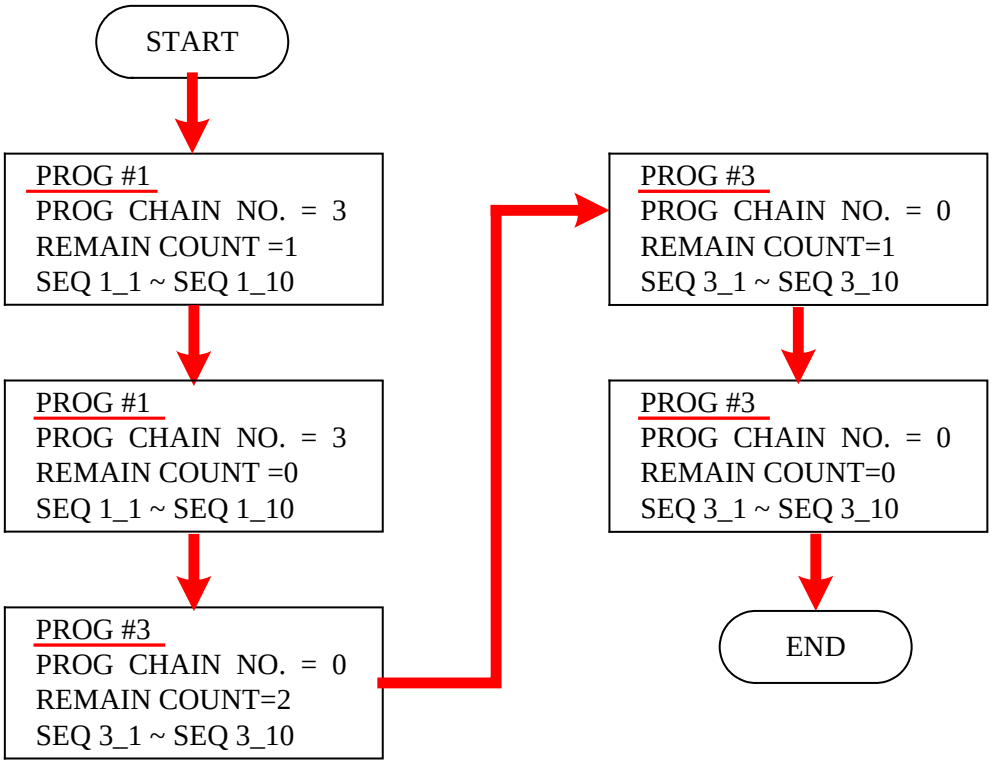


Figure 4-4

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

4.1.1.4 Setting PROG CHAIN

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 keys 0 - 1 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 disables program linking.
(2) Set NEXT TO PROG NO. to non 0
Setting NEXT TO PROG NO. to non-0 enables program linking, as shown below.

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

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

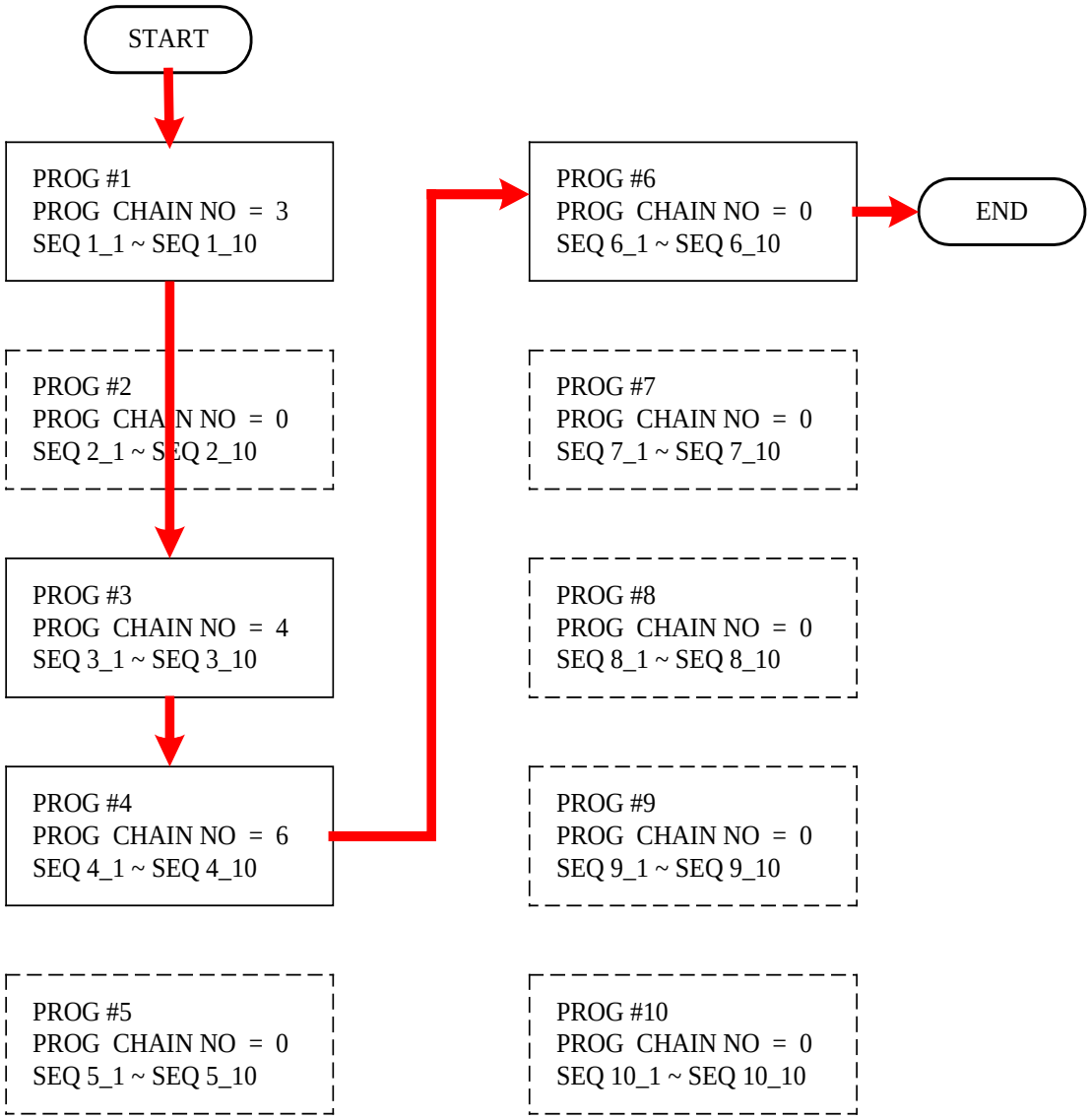


Figure 4-5

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

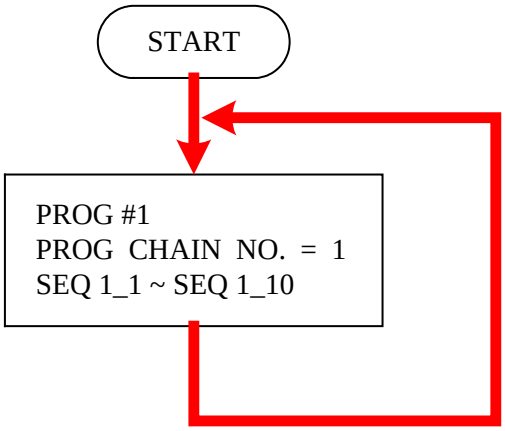


Figure 4-6

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.

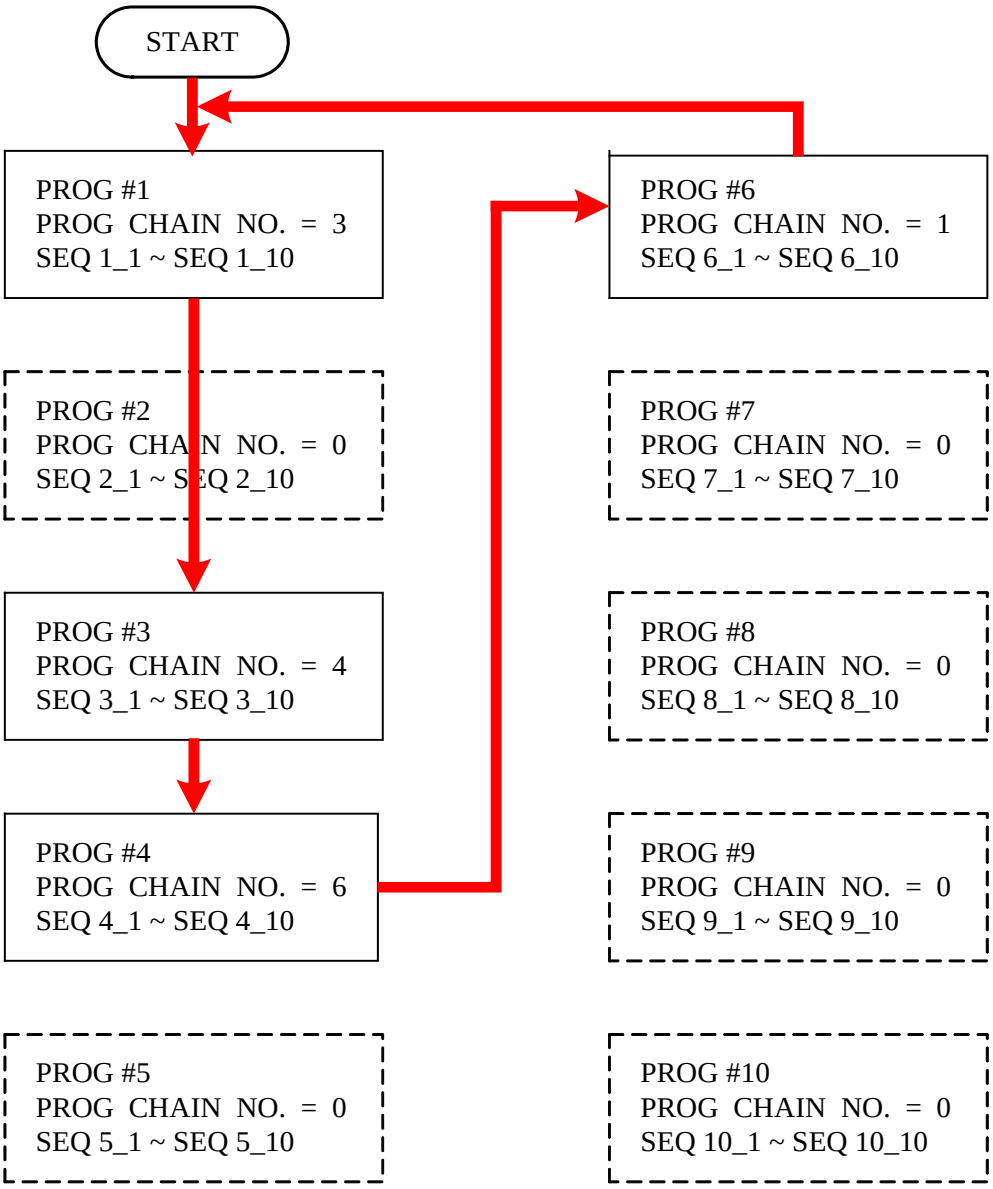


Figure 4-7

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

Notice If the next PROGRAM has no SEQUENCE, all SEQUENCES will be set to SKIP (see 4.1.2.2 SEQUENCE TYPE) and the PROGRAM will stop execution.

4.1.1.5 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 keys 0 - 1 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 number of SEQUENCEs for each PROGRAM is 0. A maximum of 100 SEQUENCES can be added to a PROGRAM. The total number of SEQUENCES that can be set 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 (5), pressing "↓→" will add a new SEQUENCE. The page will skip to Figure 4-8.
   b. When the cursor is at (7) in Figure 4-8, press "↓→" to add a new SEQUENCE.

Notice

The "↓→" function key is usually used as a cursor movement key; in the above situations it is used for adding new SEQUENCEs.

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

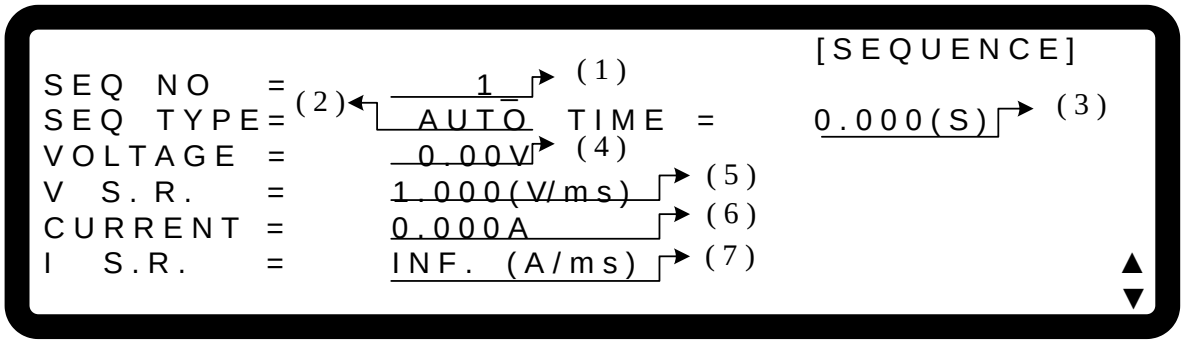


Figure 4-8

Each sequence has seven options: (1) SEQ NO., (2) SEQ. TYPE, (3) TIME, (4) VOLTAGE, (5) V S.R., (6) CURRENT and (7) I S.R. which are described 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 at Figure 4-8 (7), press " ↓─► " to add a new SEQUENCE. The numeric keys 0 - 9 or the "Rotary" (◎) knob can also be used 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 keys 0 - 3 or the "Rotary" (◎) knob to set the Sequence Type.

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

   a. Setting Sequence Type to AUTO

   When SEQ TYPE = AUTO is set, the page shown in Figure 4-9 indicates the sequence will complete the execution automatically and skip to the next sequence. TIME= will display in the lower left corner for entering the time duration of this sequence.

Notice

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

Table 4-2

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

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

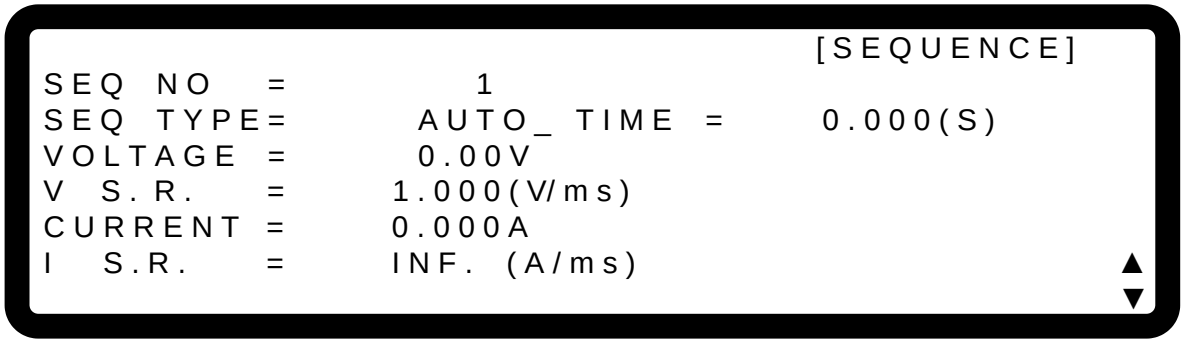


Figure 4-9

Ex. 5: Set Sequence Type to AUTO

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

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

                                  ↓
                                  ↓
                                  ↓

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

Figure 4-10

A5: Execution step:

(1) SEQ#1:

A. Since SEQ TYPE = AUTO is set for SEQ#1, it begins to execute the settings in SEQ#1.

B. During the SEQ#1 voltage rise, the maximum loading current is 1A and does not exceed the current setting of 20A; therefore SEQ#1 is in CV Mode during the voltage rise.

C. Once the voltage reachs 10V, the program maintains the 10V for the remainder of the time duration setting.

D. Skip to SEQ#2.

(2) SEQ#2:

A. Since SEQ TYPE = AUTO is set for SEQ#2, it begins to execute the settings in SEQ#2.

B. During the SEQ#2 voltage rise, the maximum loading current is 3A and does not exceed the current setting of 20A; therefore, SEQ#2 is in CV Mode during the voltage rise.

C. Once the voltage reaches 30V, the program maintains the 30V for the remainder of the time duration setting.

D. Skip to SEQ#3.

(3) SEQ#3:

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

(5) End.

Figure 4-11 shows the output waveform:

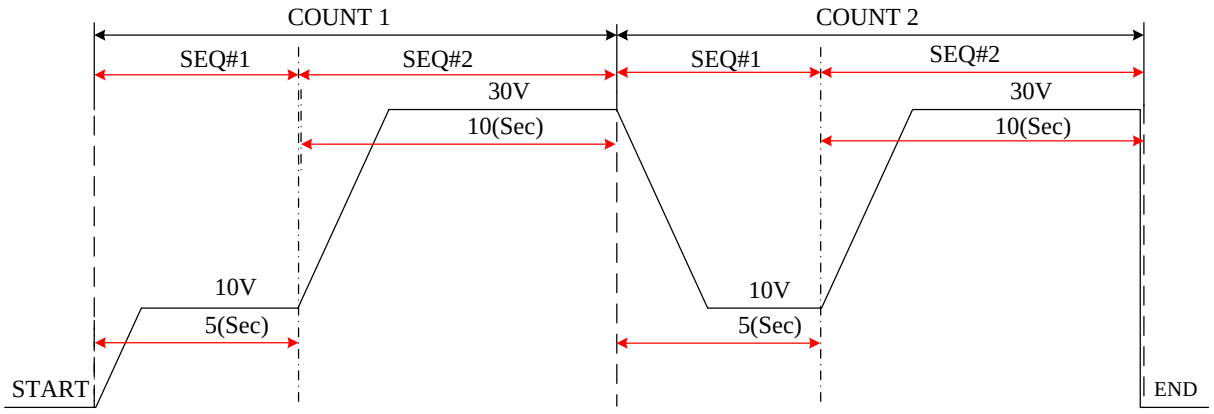


Figure 4-11

b. Setting Sequence Type to MANUAL

When SEQ TYPE = MANUAL is set, the Sequence page shown in Figure 4-12 indicates 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. The (TIME =) setting does not display when the Sequence Type is set to MANUAL.

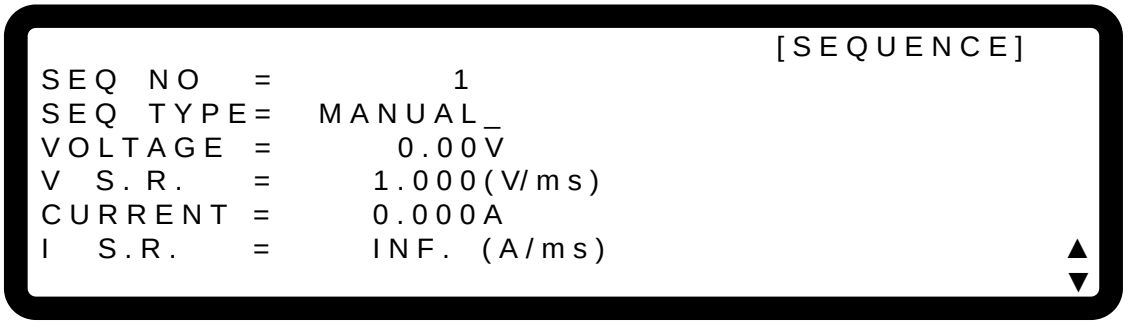


Figure 4-12

c. Setting Sequence Type to TRIGGER

When SEQ TYPE = TRIGGER is set, the Sequence page shown in Figure 4-13 indicates the sequence will run automatically and stop at the VOLTAGE or CURRENT setting without skipping to the next sequence until a signal is input from PIN 8 of the Analog Interface on the rear panel (see section **Error! Reference source not found.** for the input signal definition of Analog Interface PIN 8). The (TIME =) setting does not display when the Sequence Type is set to TRIGGER.

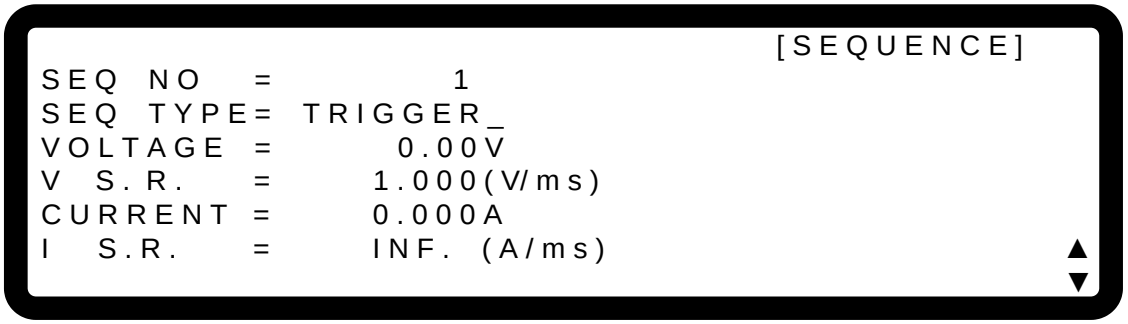


Figure 4-13

d. Set Sequence Type to SKIP

When SEQ TYPE = SKIP is set, the Sequence page shown in Figure 4-14 indicates the Sequence will skip automatically and jump to the next SEQUENCE. The (TIME =) setting does not display when the Sequence Type is set to SKIP.

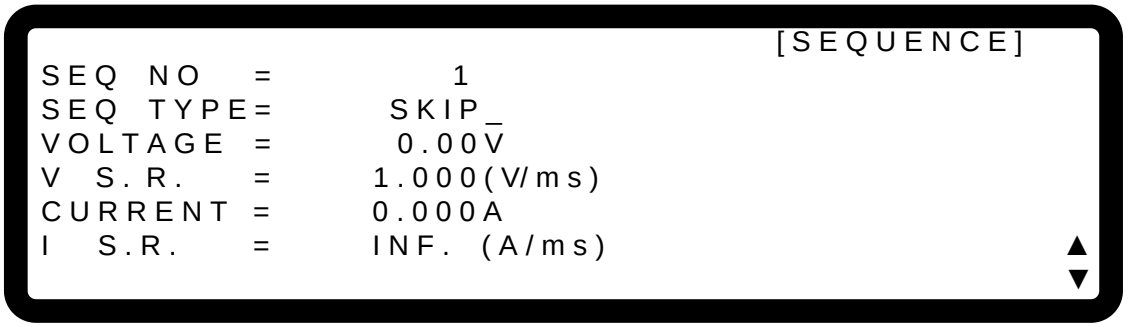


Figure 4-14

4.1.2.3 Setting Time

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 keys [0] - [9] or the "Rotary" (◎) knob to set the value.
3. This function sets the time duration of a sequence. The TIME = setting only appears when SEQ. TYPE = AUTO.
4. Press "[ENTER]" to confirm.
5. Press "[EXIT]" to return to the Program PAGE (Figure 4-3).

4.1.2.4 Setting Voltage

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 keys [0] - [9] 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.

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 (5).
2. Use the numeric keys [0] - [9] or the "Rotary" (◎) knob to set the SEQ voltage conversion slew rate.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to Program PAGE (Figure 4-3).

See section 3.3.2.3 for a detailed description.

4.1.2.6 Setting Current

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 keys [0] - [9] or the "Rotary" (◎) knob to set the SEQ output current limit.
3. Press "[ENTER]" to confirm.
4. Press "[EXIT]" to return to Program PAGE (Figure 4-3).

See section 3.2 for a detailed description.

4.1.2.7 Setting Current Slew Rate

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 keys [0] - [9] 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.

4.1.3 Execution in LIST MODE

Once all the sequences have been programmed, press “[ON/OFF]” to start execution and press “[EXIT]” to abort.

4.1.3.1 Running LIST MODE

1. Pressing “[ON/OFF]” will display a confirmation page as shown in Figure 4-15.

Figure 4-15

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

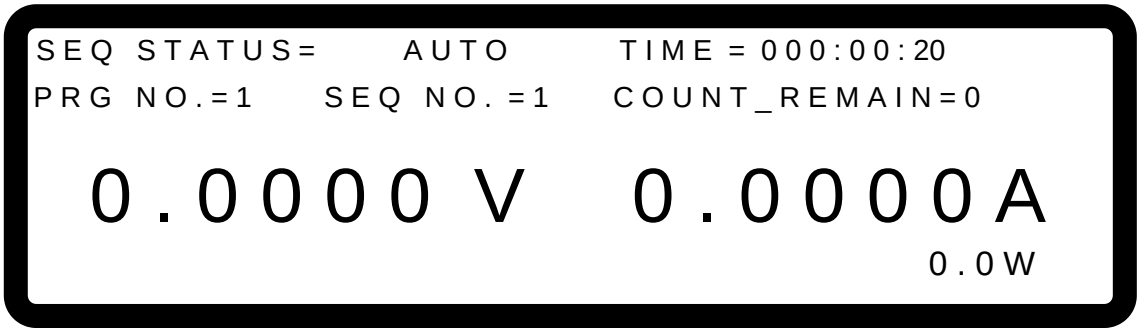


Figure 4-16

Notice

1. Pressing "ON/OFF" 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. Pressing "EXIT" will abort the executing program and shut 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.

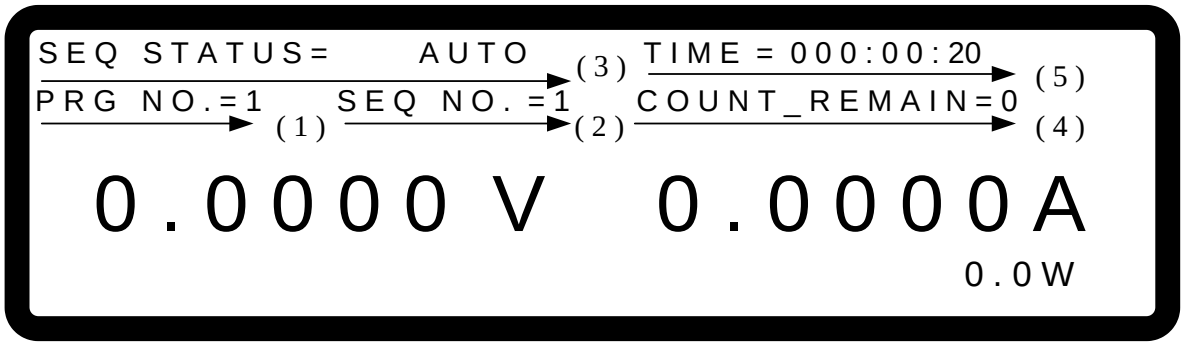


Figure 4-17

(1) Program Number: PRG NO. indicates the current Program Number being executed.
(2) Sequence Number: SEQ NO. indicates the current Sequence Number being executed.
(3) Sequence Status: SEQ STATUS indicates the current Sequence state being executed.
(4) Count_Remain: COUNT_REMAIN indicates the remaining number of sequences to be executed for the current Program.
(5) Running Time: TIME indicates the total time for program execution.

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

4.2 V_STEP MODE

A run time program can be set in V_STEP MODE. Figure 4-18 shows the screen when V_STEP MODE is selected.

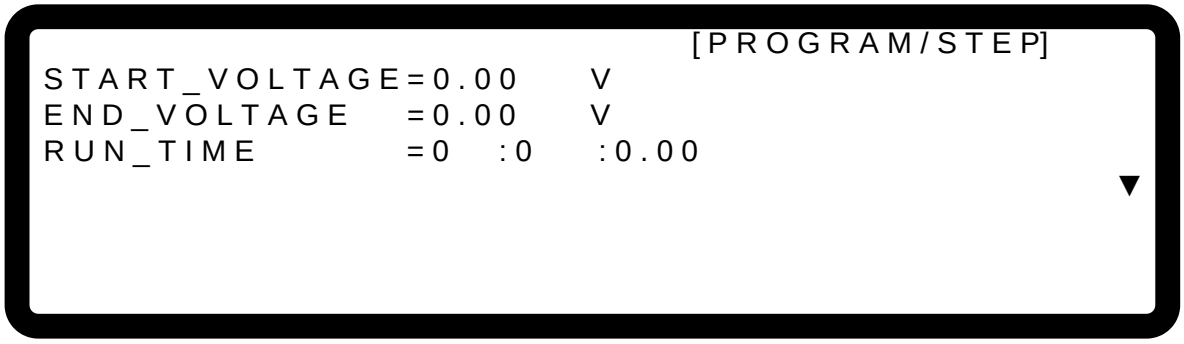


Figure 4-18

4.2.1 Setting V_STEP MODE

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

4.2.1.1 Setting START_VOLTAGE

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

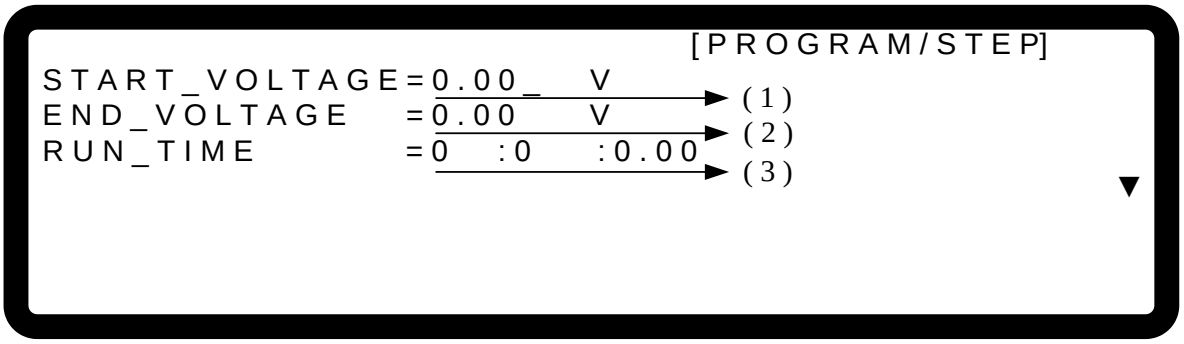


Figure 4-19

⚡ CAUTION The initial voltage of the hardware may not be equal to 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 using 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 of STEP MODE.
2. Use the numeric keys 0 - 9 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 of STEP MODE. The time format is HOUR:MIN:SEC and the maximum setting is 99 hours 59 minutes and 59.99 seconds.
2. Use the numeric keys 0 - 9 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.

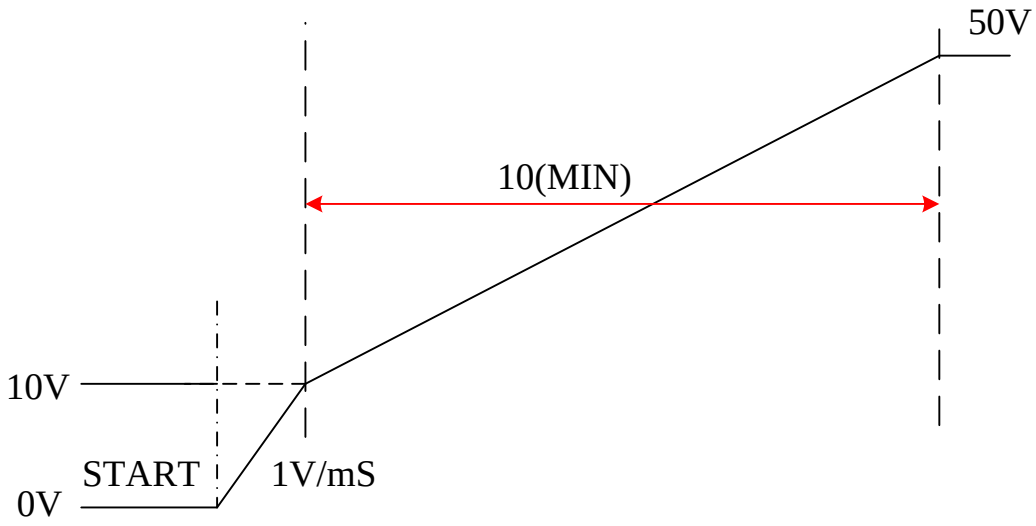


Figure 4-20

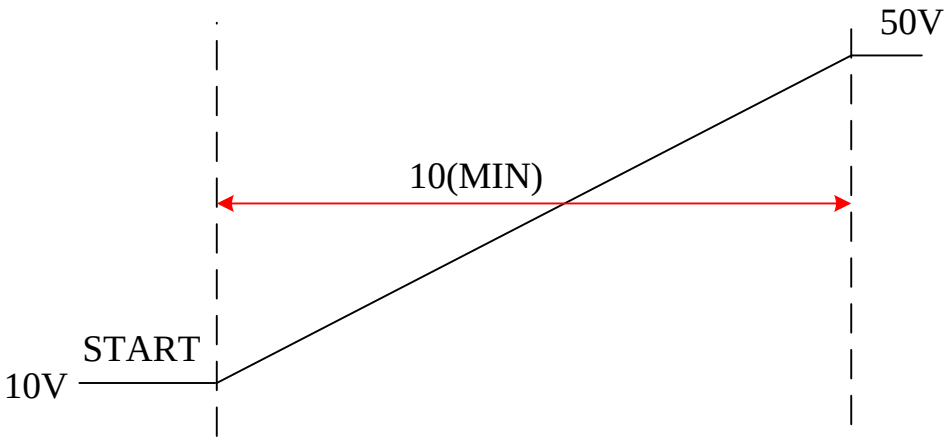


Figure 4-21

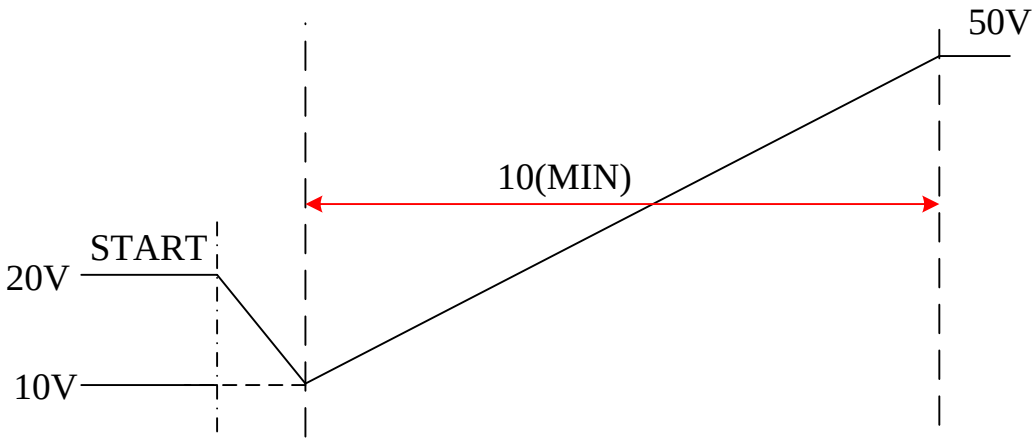


Figure 4-22

4.2.2 Execution of V_STEP MODE

Once all the sequences have been programmed, press "ON/OFF" to start execution. Press "EXIT" to stop execution.

4.2.2.1 Running V_STEP MODE

1. Pressing "ON/OFF" will display a confirmation window as shown in Figure 4-15.
2. Press "ON/OFF" one more time to confirm the execution. The display will go to the MAIN PAGE during execution as shown in Figure 4-23. To stop the execution, press "EXIT" to return to the MAIN PAGE screen.

Notice Pressing "EXIT" will abort the executing program and shut off the Power Supply output.

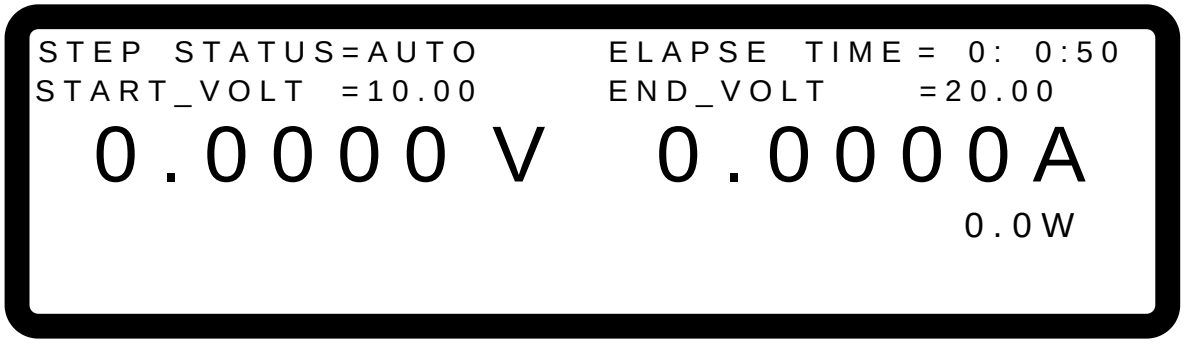


Figure 4-23

4.2.2.2 Description of Program V_Step Mode

Figure 4-24 shows the main execution page of V_STEP MODE. Items (1) - (4) in the figure are explained below.

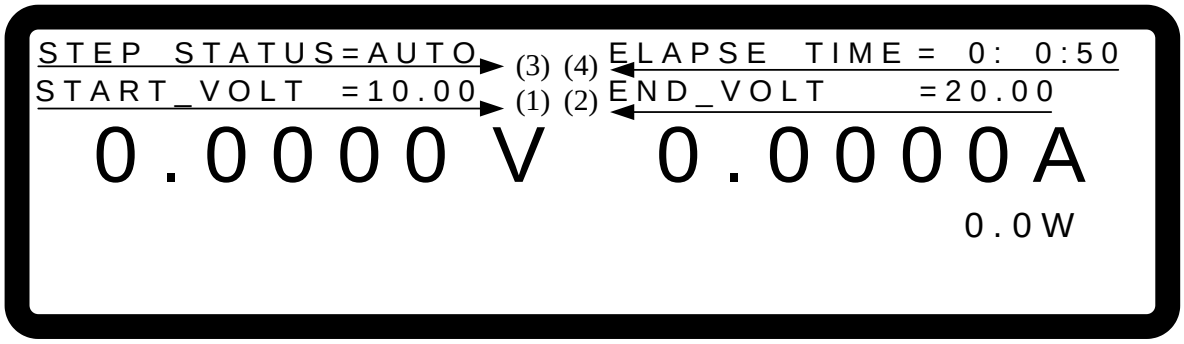


Figure 4-24

(1) START_VOLT: the start voltage setting of V_STEP MODE.
(2) END_VOLT: the end voltage setting of V_STEP MODE.
(3) STEP STATUS: the executing status of V_STEP MODE.
(4) ELAPSE TIME: the elapsed time of V_STEP MODE. The time format is HOUR:MIN:SEC (the maximum display is 99 hours 59 minutes and 59 seconds).

4.3 IV PROGRAM

The IV Curve can be edited in IV PROGRAM. An IV-Program can add a maximum of 100 IV curves to the IV-Sequence. Setting the IV-Sequence is described in 4.3.2. Figure 4-25 shows the complete IV-Program structure.

```
                                                    [ IV-PROGRAM ]
PROG  NO.          =  1
RUN   COUNT        =  1
PROG  CHAIN        =  NO
CLEAR PROG         =  NO
                                                    [ IV-SEQUENCE ]
SEQ   NO.          =  1
IV-FILE NO.        =  0
SEQ   TYPE         =  AUTO
TIME               =   0 (S)
                                                    [ IV-SEQUENCE ]
SEQ   NO.          =  2
IV-FILE NO.        =  0
SEQ   TYPE         =  AUTO
TIME               =   0 (S)
                                                    [ IV-SEQUENCE ]
SEQ   NO.          =  3
IV-FILE NO.        =  0
SEQ   TYPE         =  AUTO
TIME               =   0 (S)
```

↓
↓
↓

Figure 4-25

4.3.1 Setting IV-PROGRAM

There are 4 options in the IV-PROGRAM menu: (1) PROG NO., (2) RUN COUNT, (3) PROG CHAIN and (4) CLEAR PROG. See sections 4.1.1.2 through 4.1.1.5 for setting these 4 parameters.

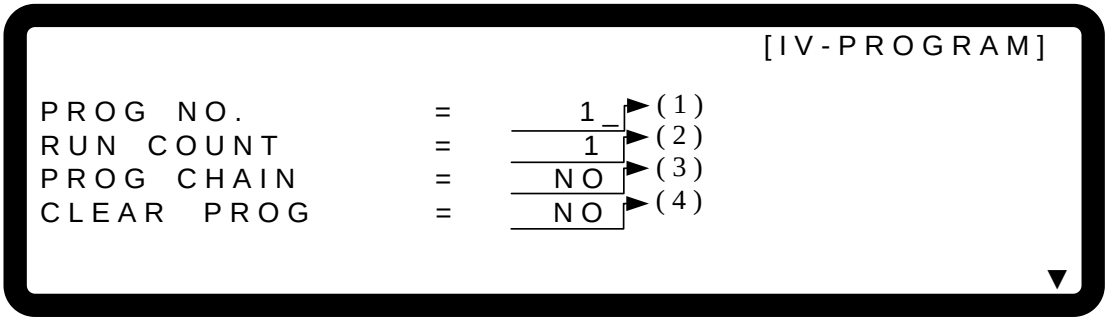


Figure 4-26

4.3.2 Setting IV-Sequence

1. The default number of IV-SEQUENCE(s) in an IV-PROGRAM is 0. Each IV-PROGRAM can add up to 100 sequences. The maximum number of IV-SEQUENCE(s) set in the 10 IV-PROGRAMS is 1000.

2. To add a new IV-SEQUENCE:

   a. In the IV-PROGRAM page (Figure 4-26), when the cursor is at (4), press "[→]" to add the first IV-SEQUENCE if there is no IV-SEQUENCE in the IV-PROGRAM. The screen will appear as shown in Figure 4-27.
   b. In the IV-SEQUENCE page (Figure 4-27) under an IV-PROGRAM, when the cursor is at (4), press "[→]" to add another new IV-SEQUENCE.

Notice The "[→]" key is normally used as the direction key and is only used to add new IV-SEQUENCE(s) in the above two conditions.

3. Use the "[↑←]", "[→]" keys to move the cursor to the column to be set as shown in Figure 4-27.

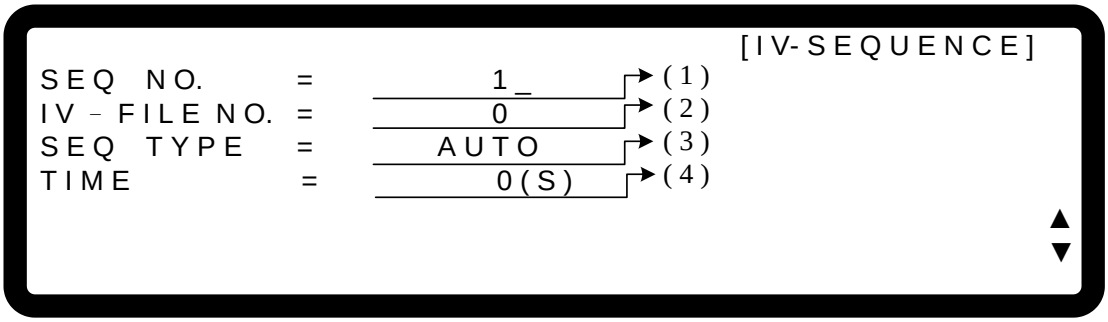


Figure 4-27

4. Use the numeric keys [0] - [9] or the "Rotary" (◎) knob to set the value. Each IV-Sequence can set the following 4 items: (1) SEQ NO., (2) IV-FILE NO., (3) SEQ. TYPE and (4) TIME.
5. Press "[ENTER]" to confirm.
6. Press "[EXIT]" to return to IV-Program Page (Figure 4-26).

4.3.2.1 Setting Sequence Number

1. Use the "[↑←]", "[→]" keys to move the cursor to the column to be set as shown in Figure 4-27 (1).

2. When the cursor is at Figure 4-27 (4), press "[→]" to add a new IV-SEQUENCE. The numeric keys [0] - [9] or the "Rotary" (◎) knob can also be used to enter a

number and return to a previously set Sequence Number. An IV-Program is able to add a maximum of 100 IV-Sequences, so the SEQ NO. range is 1-100.

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the IV-Program Page (Figure 4-26).

4.3.2.2 Setting IV-FILE Number

1. IV-FILE NO. selects the IV Curve number to be executed for the IV-Sequence Number. The IV Curve number is edited in the Solar Array Simulation Soft Panel.
2. Use the " ", " " keys to move the cursor to the column to be set as shown in Figure 4-27 (2).
3. Use the numeric keys 0 - 9 or the "Rotary" ( ) knob to set the IV-FILE Number. The range is 0-99.
4. Press "ENTER" to confirm.
5. Press "EXIT" to return to the IV-Program Page (Figure 4-26).

4.3.2.3 Setting Sequence Type

1. Use the " ", " " keys to move the cursor to the column to be set as shown in Figure 4-27 (3).
2. Use the numeric keys 0 - 1 or the "Rotary" ( ) knob to set the Sequence Type. There are two Sequence Types: (1) AUTO and (2) MANUAL.

   a. Set the Sequence Type to AUTO
   When setting SEQ TYPE = AUTO, the IV-Sequence page appears as shown in Figure 4-28. The IV-Sequence will run automatically and go to the next sequence when done. In the meantime the IV-Sequence page will display TIME= to prompt the user to input the time duration for this IV-Sequence.

Notice

1. The table below shows the TIME = setting range.

TIME	Min. (Sec)	Max. (Sec)
	1	15000

2. When SEQ. TYPE = AUTO and TIME = 0, the IV-Program ends at the last IV-Sequence before TIME = 0.

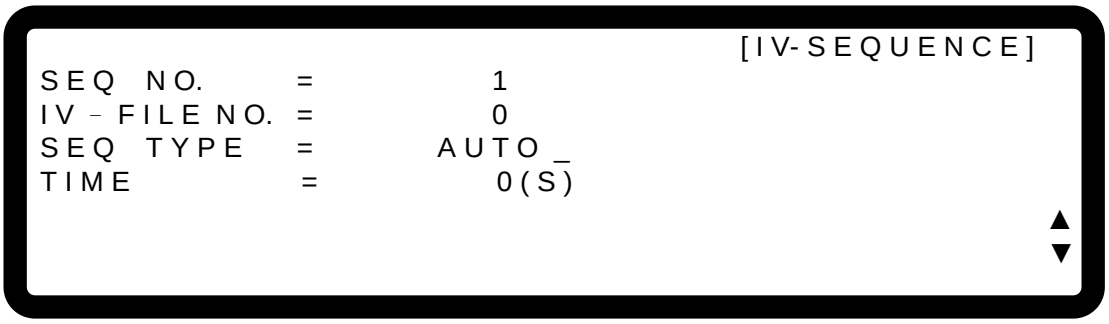


Figure 4-28

b. Set the Sequence Type to MANUAL
When setting SEQ TYPE = MANUAL, the IV-Sequence page appears as shown in Figure 4-29. The IV-Sequence will run automatically and stops at the IV-FILE Number set in the IV-Sequence. It will not go to the next IV-Sequence until the "ENTER" key on the front panel is pressed. The IV-Sequence page will not ask the user to enter the time duration when SEQ TYPE =MANUAL.

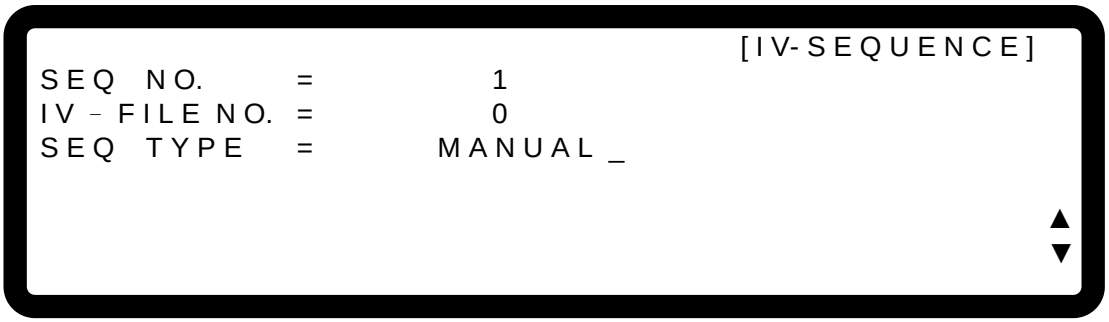


Figure 4-29

3. Press "ENTER" to confirm.
4. Press "EXIT" to return to IV-Program Page (Figure 4-26)。

4.3.2.4 Setting Time

1. Use the " ◄—▲", "▼—►" keys to move the cursor to the column to be set as shown in Figure 4-27 (4).
2. Use the numeric keys 0 - 9 or the "Rotary" (◎) knob to set the value. This function sets the time duration for the IV-Sequence. TIME = only appears when SEQ. TYPE = AUTO.
3. Press "ENTER" to confirm.
4. Press "EXIT" to return to the IV-Program Page (Figure 4-26).

4.3.3 Execution of IV PROGRAM

When the IV PROGRAM has been completed, press "ON/OFF" to confirm it and press "EXIT" to abort the execution.

4.3.3.1 Running IV PROGRAM

1. Pressing "ON/OFF" will display the confirmation screen as shown in Figure 4-30.

Figure 4-30

2. Press "ON/OFF" again to start the program. The screen will go to the IV-MAIN PAGE as shown in Figure 4-31. To abort the execution, press "EXIT" to return to the MAIN PAGE menu.

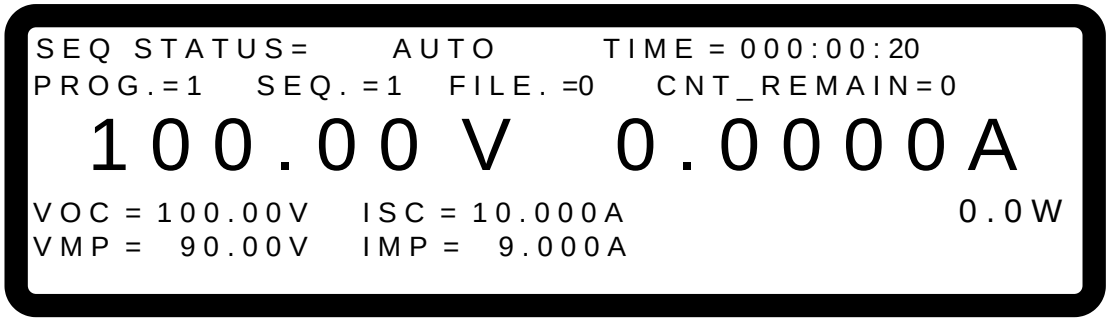


Figure 4-31

Notice

1. Pressing "ON/OFF" in the IV-Program page (Figure 4-26) or the IV-Sequence page (Figure 4-27) will display the confirmation screen as shown in Figure 4-30.
2. Pressing "EXIT" will forcibly abort the IV-Program under execution.

4.3.3.2 IV Program Main Screen

When the IV PROGRAM is running, the main screen will display the following information. Items (1) - (10) in Figure 4-32 are described below.

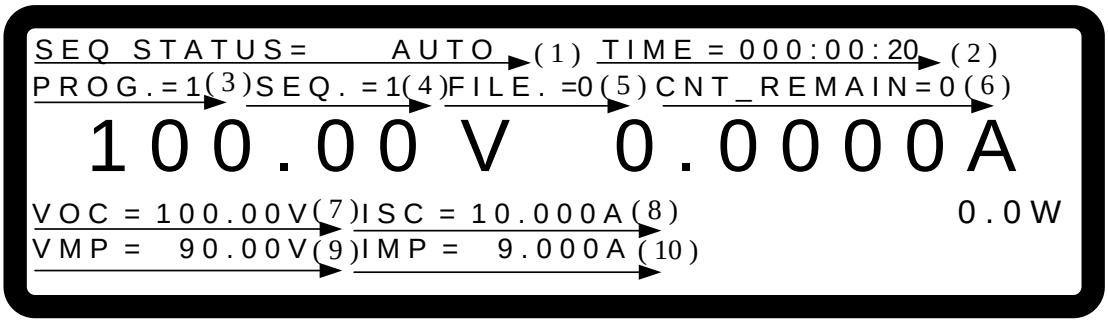


Figure 4-32

(1) IV-Sequence status: SEQ STATUS shows the IV-Sequence status currently running.
(2) Total Time accumulated: TIME shows the total time accumulated from the execution of the IV-PROGRAM to the IV-Sequence on the IV-Main Page. The time format is HOUR:MIN:SEC. The maximum time displayed is 99 hours 59 minutes and 59 seconds. If the accumulated time exceeds the maximum time display, it will reset to zero and re-accumulate.
(3) IV-Program Number: PROG. shows the IV-Program Number being executed.
(4) IV-Sequence Number: SEQ. shows the IV-Sequence Number being executed.
(5) IV-FILE Number: FILE. shows the IV-FILE Number being executed.
(6) Count_Remain : CNT_REMAIN shows the number of IV-Programs to be executed.
(7) Open Circuit Voltage: VOC shows the open circuit voltage of the IV-FILE Number being executed.
(8) Short Circuit Current: ISC shows the short circuit current of the IV-FILE Number being executed.
(9) Max. Power Voltage: VMP shows the maximum power voltage of the IV-FILE Number being executed.
(10) Max. Power Current: IMP shows the maximum power current of the IV-FILE Number being executed.

5. Remote Operation

5.1 Overview

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

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 easy 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/Windows 7/Windows 8
(4)	Installing Driver:	The 62000H Series USB Interface supports USBTMC, so if the PC OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) there is no need to install other drivers. The OS will search for the standard USBTMC driver installation program automatically.

If the PC OS does not support USBTMC, install the NI-VISA runtime version 3.00 or above first. When the installation of NI-VISA runtime is done, the USBTMC driver program is stored in the OS. The PC can communicate with the 62000H Series via NI-VISA after connecting the 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, RS-232C & RS-485 Parameters

See section 3.3.8.

5.1.3 Connecting RS-232C

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

Table 5-1

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

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

Table 5-2

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

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

5.1.4 Connecting RS-485

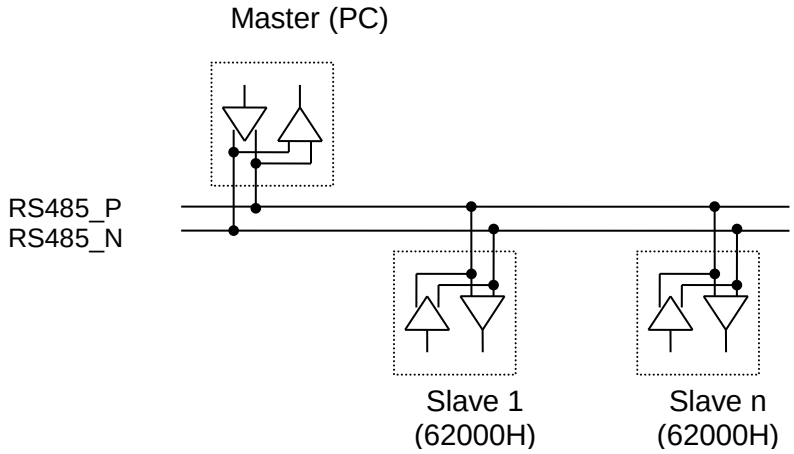
The default baudrate of the 62000H Series DC Power Supply is set to 115200 and the parity check is set to None. The RS-485 interface is a half-duplex two-wire differential signaling transmission system and only RS485_P and RS485_N signals are required for data transmission. The connector is the same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

Table 5-3

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

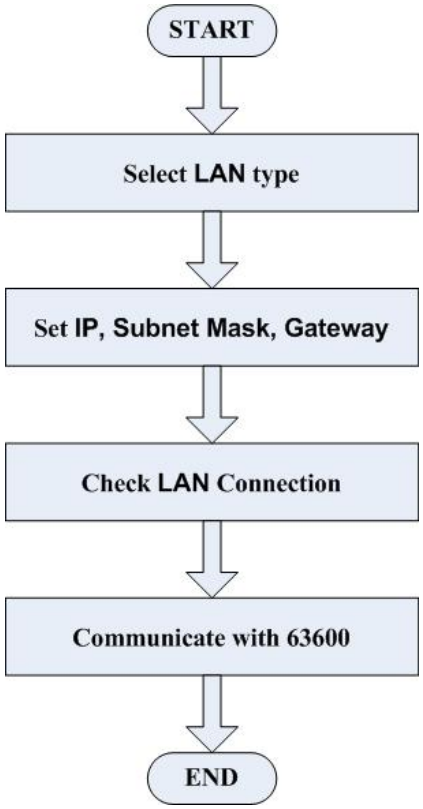
8	---
9	RS485_N

The pin connections are shown below:



5.1.5 Ethernet Remote Control

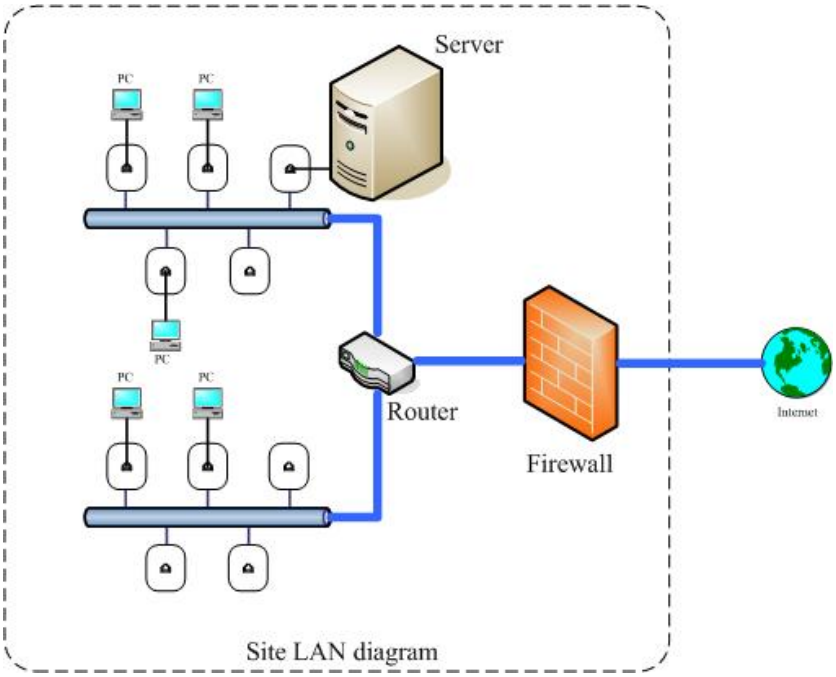
To remotely program the DC Power Supply via a PC using the Ethernet interface, the IP address, Gateway address and Subnet mask need to be set in advance. To ensure reliable data transmission, TCP is used for data transmission and the communication port is 2101. There are 4 procedures for setting up the interface as shown below.



5.1.5.1 Selecting the LAN to be Connected

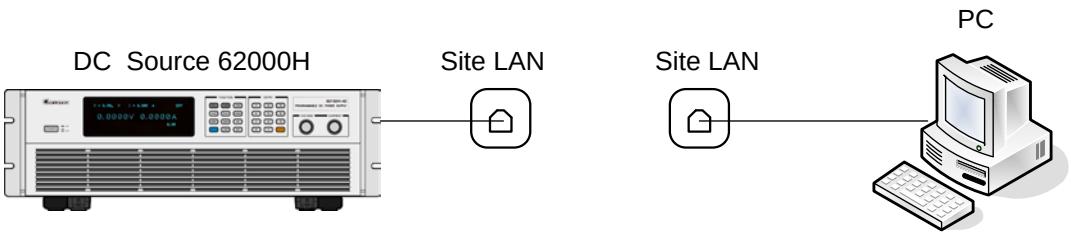
The LAN is divided into two types: Site LAN and Private LAN.

The Site LAN is a larger local area network such as an Intranet that contains the network server (DHCP, WINS, DNS, etc.), Terminator, Router, Firewall and Internet connection as shown below.

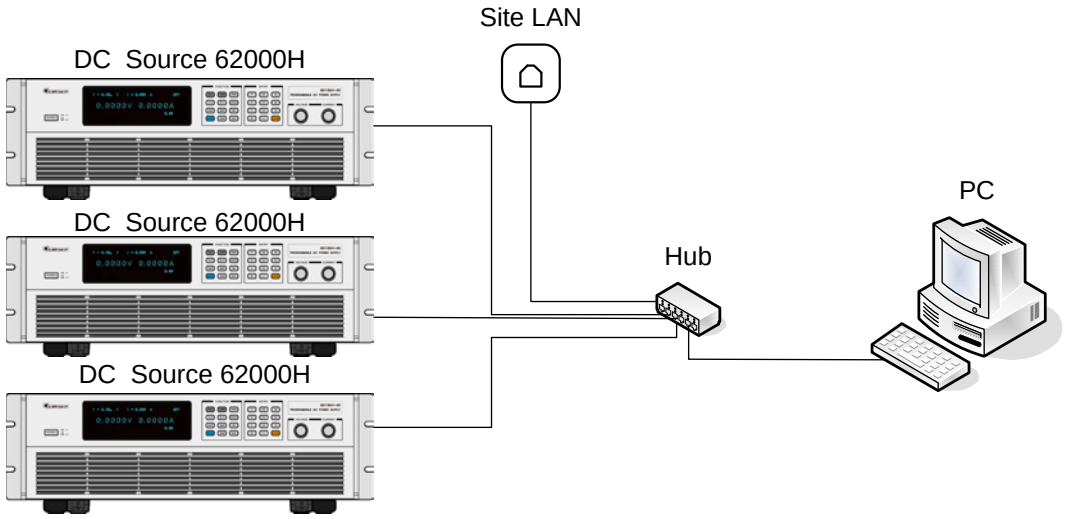


There are two ways to connect the PC if the Site LAN mode is selected:

(1)



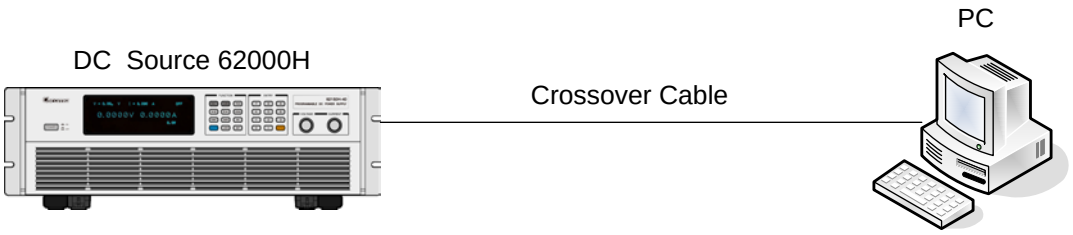
(2)

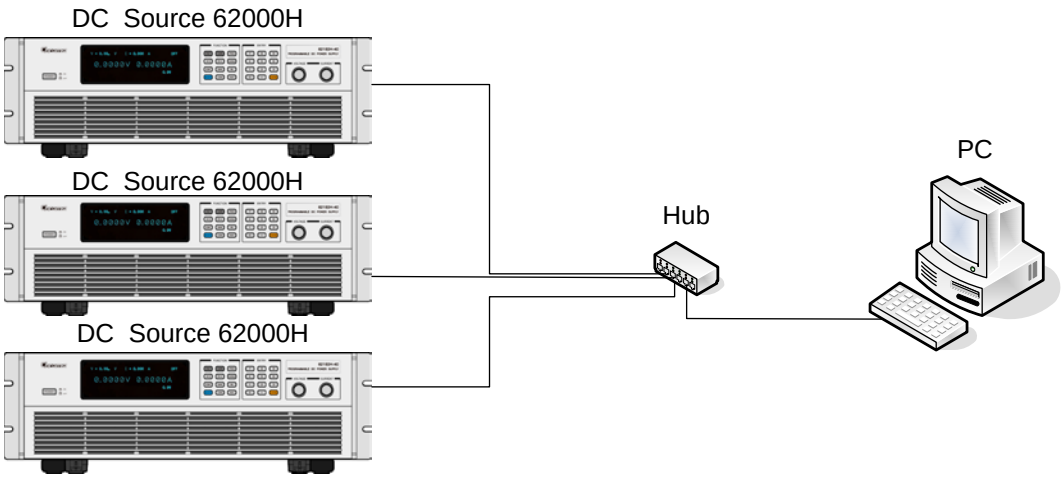


The Private LAN is a smaller local area network that is composed of two or more terminators and a Hub or two terminators linked through a Crossover Cable. For the 62020H-150S Model, both a Crossover Cable and a Non-Crossover Cable can be used.

There are two ways to connect the PC if the Private LAN mode is selected:

(1)





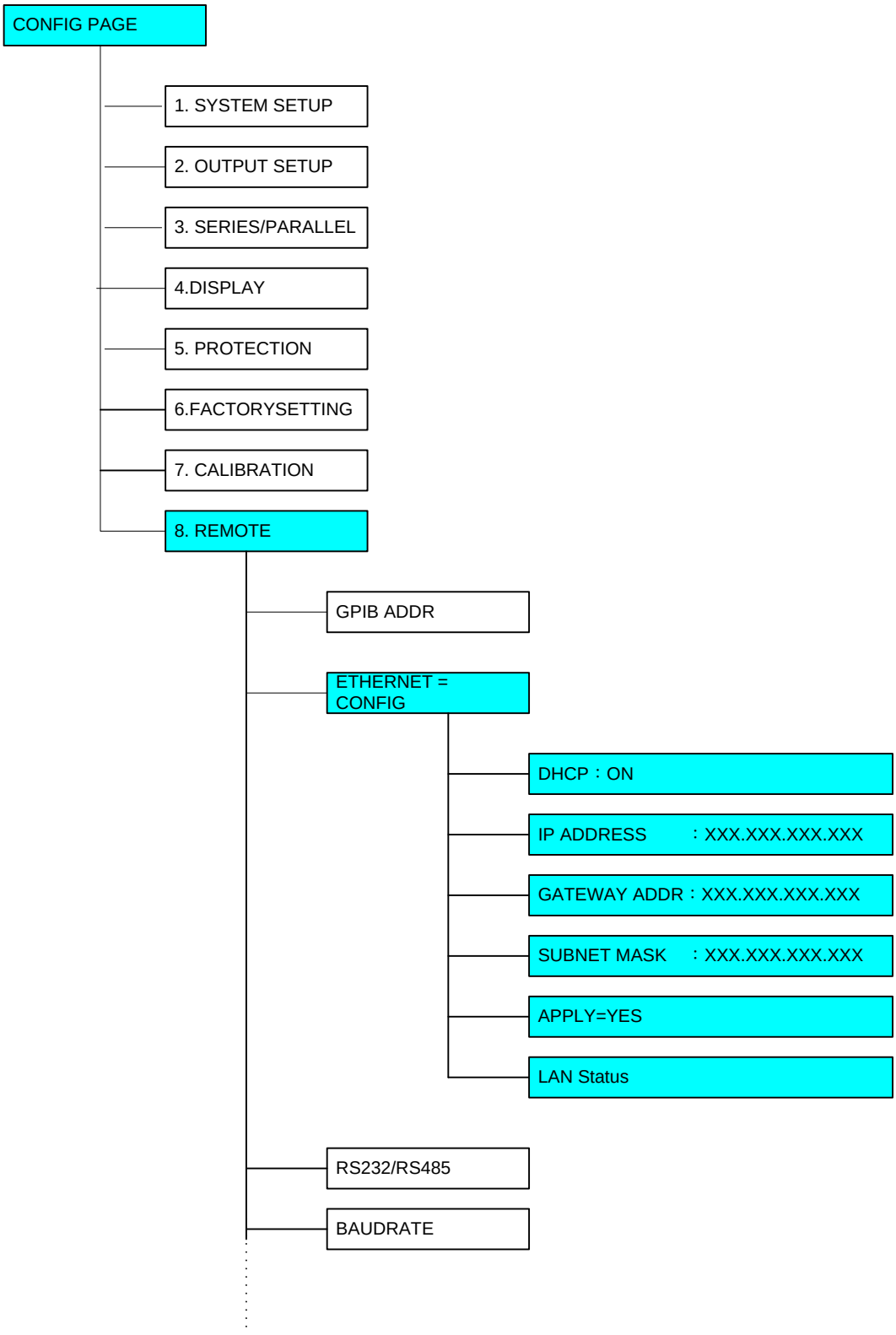
5.1.5.2 Setting IP, Subnet Mask & Gateway

1. In Site LAN

Only the 62000H needs to be set up on the network. DHCP can be set to ON (the server sets the IP automatically) or OFF (set the IP manually.) For the 62020H-150S Model, refer to 7.2.1 for the network parameter settings.

Procedure for setting DHCP = ON on Chroma DC Source

STEP 1:
Click "CONFIG" to enter into the CONFIG selections. Find the DHCP location in the tree diagram listed below and set the DHCP to ON.



STEP 2:

Press  to go to APPLY and set to YES to confirm sending out the settings.

STEP 3:

The screen will display the network setting status with one of the messages listed below:

a. SETTING : The network card is being set.
b. CONNECTING : The network card is connecting.
c. NONE_CONNECT : The network is not connected.
d. CONNECTED : The network is connected.
e. MODULE_ERR : The network card setting is wrong.

Once the setup is complete, the panel will update and show the network settings and clear the status message.

STEP 4:
Save the settings and return to the panel main screen.

Procedure for setting DHCP = OFF on Chroma DC Source 62000H

STEP 1:
Set the IP, GATEWAY and SUBNET MASK parameters manually when DHCP=OFF.

If the Site LAN parameters are not known, contact the network administrator and request the settings for the network parameters.

Notice

The SUBNET MASK and GATEWAY can be input directly into the 62000H. The IP Address can be set with one on the same domain but different from the PC. For instance, if the PC's settings are: IP: 10.1.7.100, Mask: 255.255.254.0, and Gateway: 10.1.7.254, set IP: 10.1.7.101, Mask: 255.255.254.0 and Gateway: 10.1.7.254 for the 62000H.

STEP 2:
Press  to go to APPLY and set to YES to confirm sending out the settings.

STEP 3:
The screen will display the network setting status with one of the messages listed below:

a. SETTING : The network card is being set.
b. CONNECTING : The network card is connecting.
c. NONE_CONNECT : The network is not connected.
d. CONNECTED : The network is connected.
e. MODULE_ERR : The network card setting is wrong.

Once the setup is complete, the panel will update and show the network settings and clear the status message.

STEP 4:
Save the settings and return to the panel main screen.

2. In Private LAN

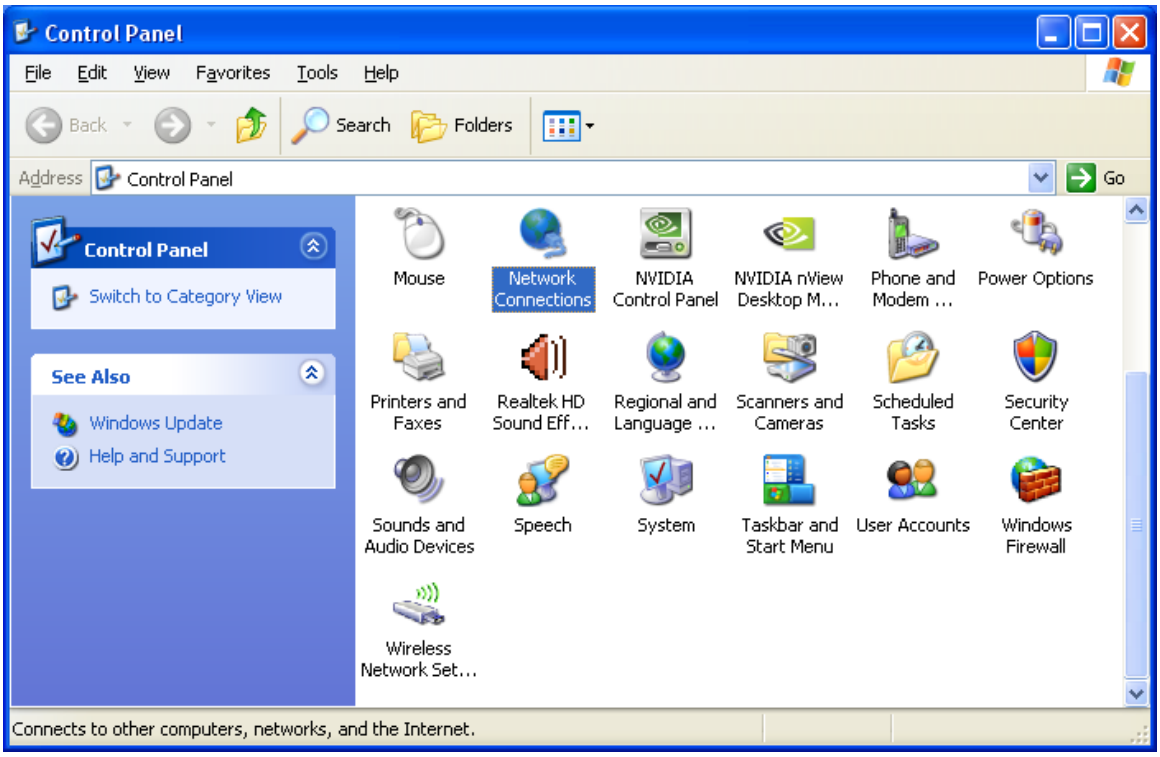
In most situations the PC will not have a DHCP Server. In a Private LAN, the IP addresses of all connected network devices need to be set manually. For the 62020H-150S Model, refer to section 7.2.1 for the network parameter settings.

Procedure for setting DHCP = OFF on PC

Ensure DHCP=OFF. If it is YES, change it to OFF and complete the following steps.

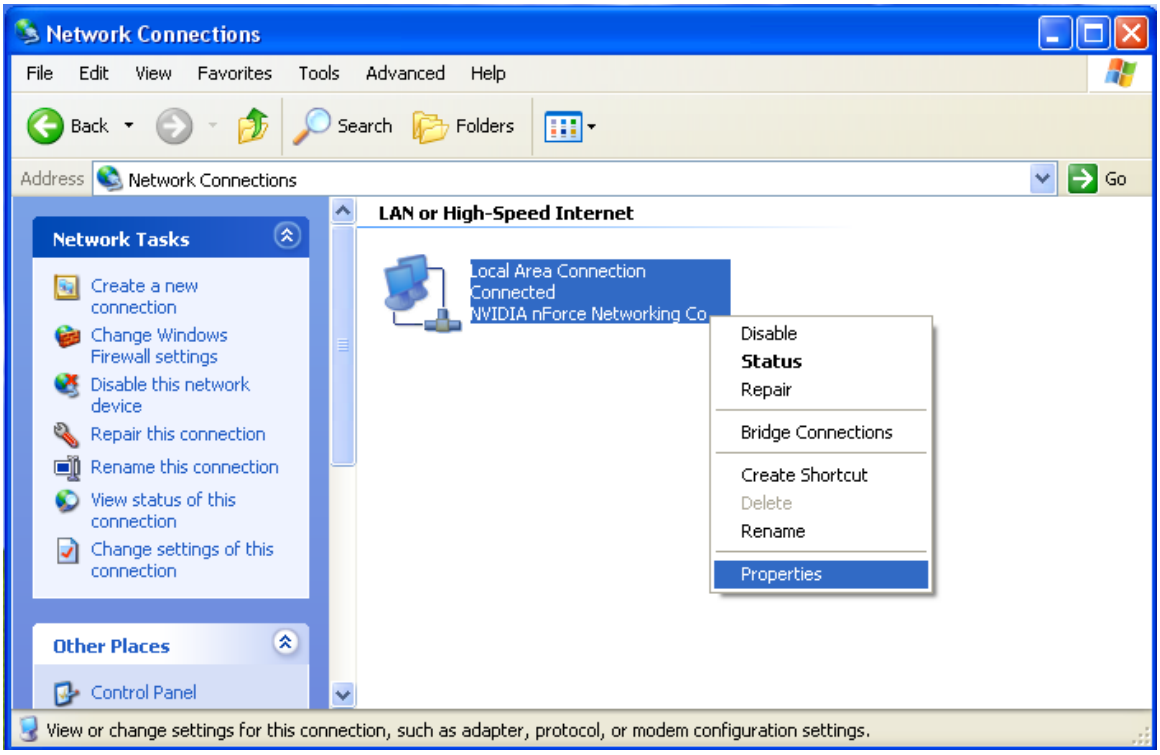
STEP 1:

Click **[Control Panel]** on the PC and click **"Network Connections"**.



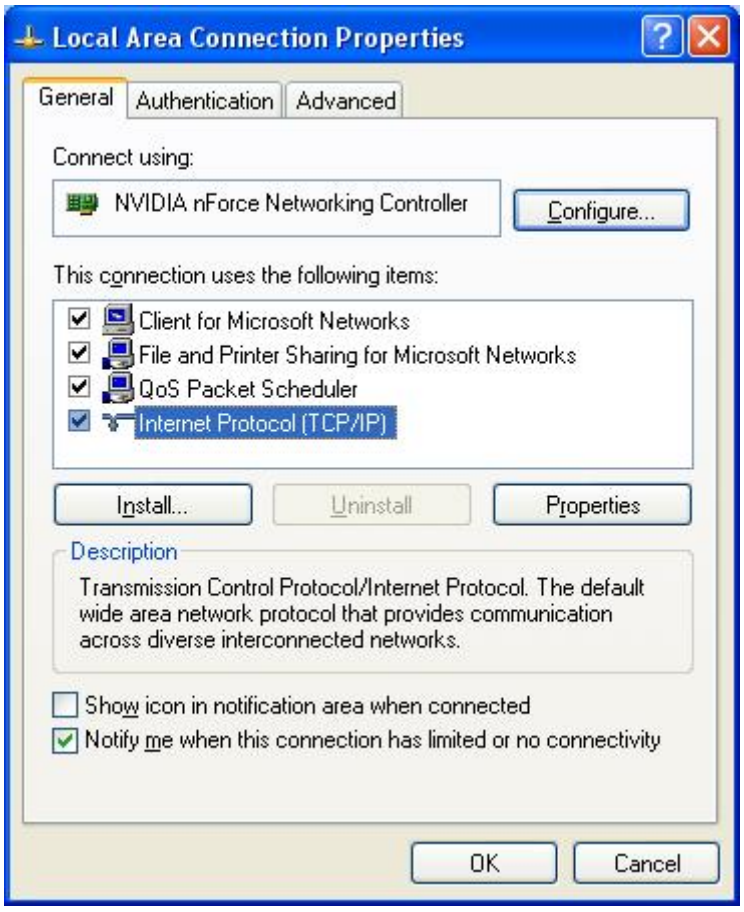
STEP 2:

Select **"Local Area Connection"** and right-click it to select the **[Properties]**.

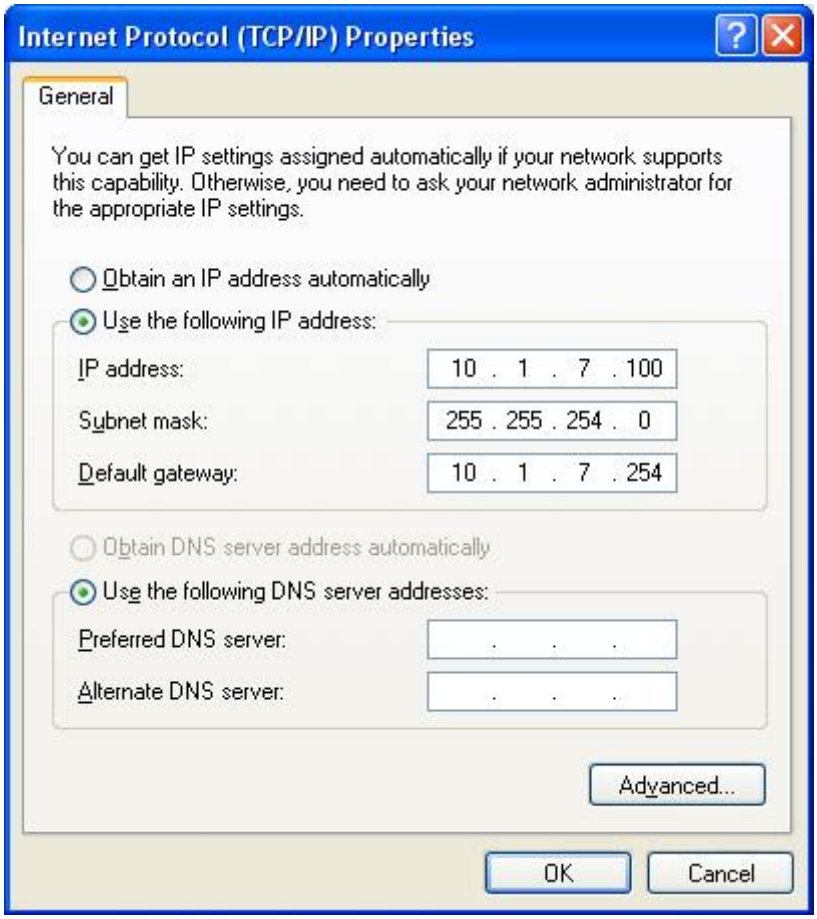


STEP 3:

Double-click **"Internet Protocol (TCP/IP)"** to enter the configuration screen.



STEP 4:
Select **"Use the following IP address"** to manually set the IP address. Enter the desired IP address.



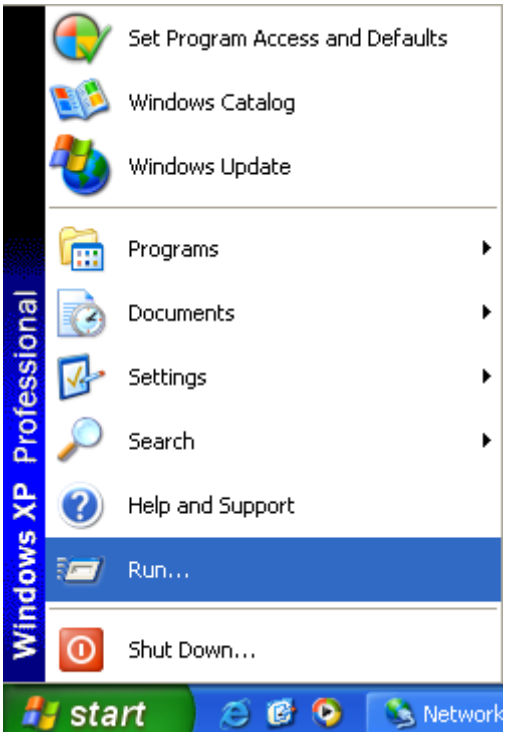
STEP 5:
When the IP address has been set, click **OK** to return to the previous level and click **OK** again to complete the setting procedure.

5.1.5.3 Confirming Network Connected Successfully

When all of the steps above have been completed, the local area network of the Chroma DC Source 62000H should be ready to use. Follow the steps below to confirm the local area network setup is correct.

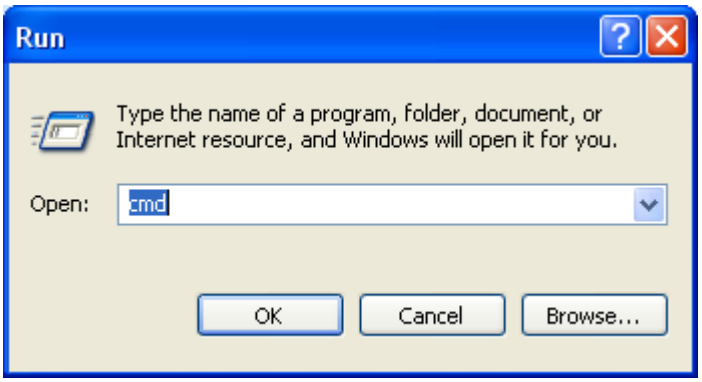
STEP 1:

Click **[Start]** on the Windows desktop and select **[Run]**.



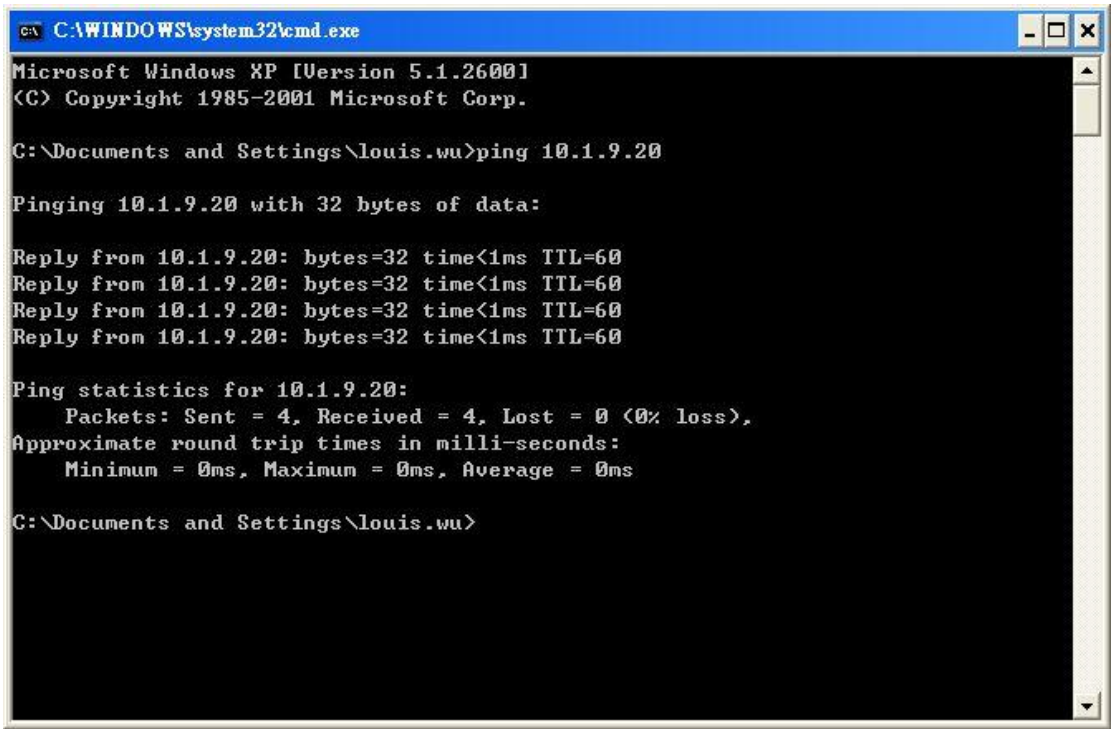
STEP 2 :

Input **"cmd"** and click **OK** to run the cmd program.



STEP 3:

When the MS-DOS environment is entered in STEP 2, test the IP address by pinging it directly by entering *ping IP address*, i.e., "ping 10.1.9.20". If there is a response, it means the local area network setup has been successfully completed.



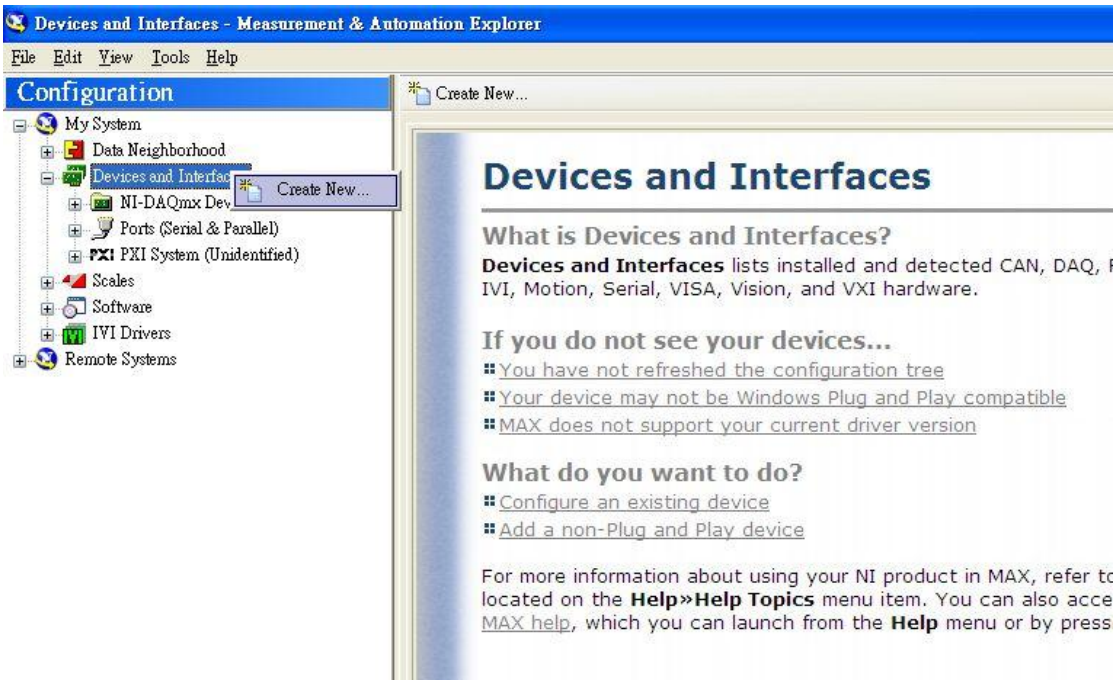
5.1.5.4 Communicating with the Instrument

Use the NI-MAX (Measurement & Automation Explorer) application software from National Instruments or a customized program to communicate with the instrument. When using NI VISA, open the VISA Session Resource Name in the format of TCPIP0::<IP address>::2101::SOCKET, i.e., : TCPIP0::10.1.7.100:: 2101::SOCKET.
If a customized program is used, specify the TCP/IP SOCKET PORT to 2101.

Follow the example below to use the NI-MAX (Measurement & Automation Explorer):

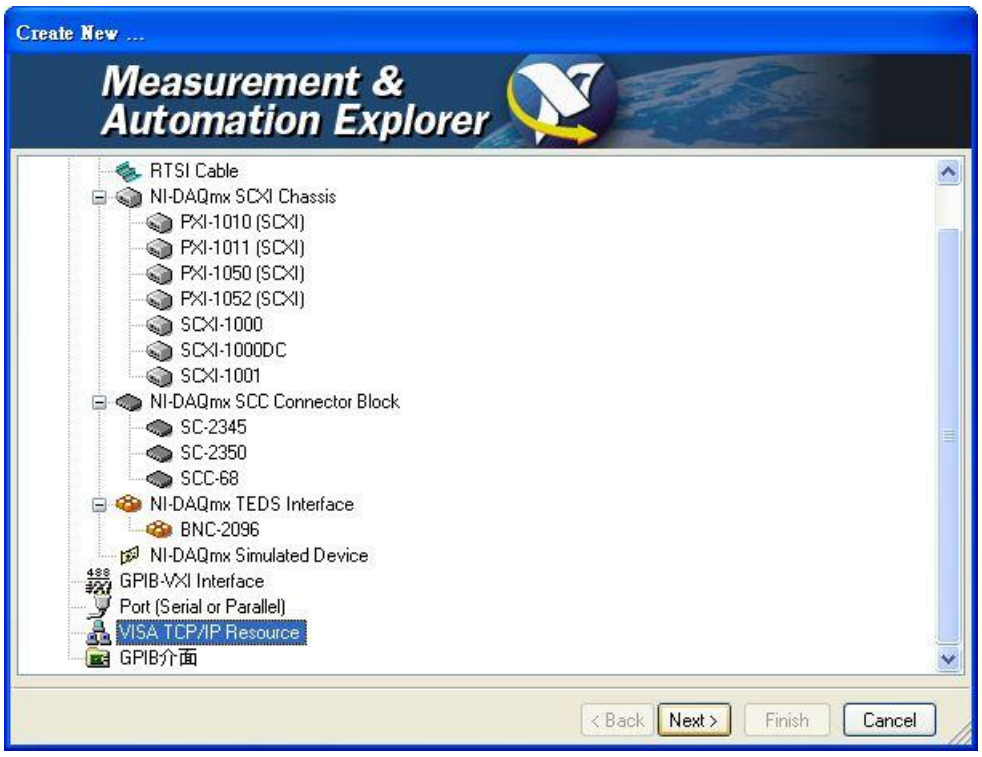
STEP 1:

Open NI-MAX (Ver. 4.3.0F0), right-click the **[Devices and Interface]** and click **[Create New. . .]**.



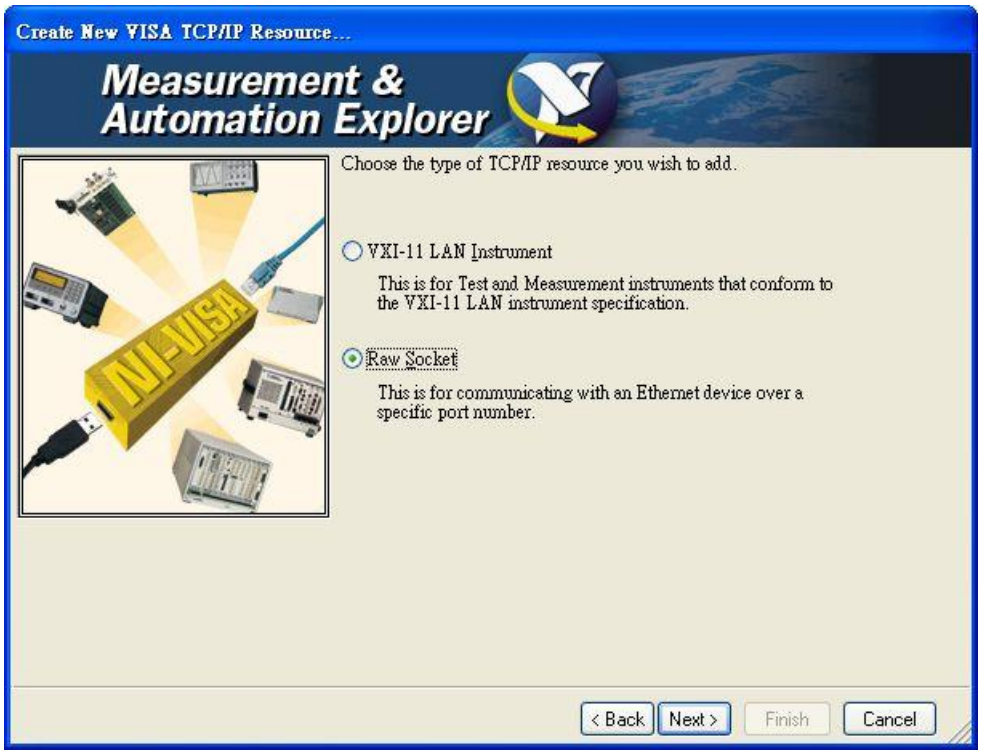
STEP 2:

Select **"VISA TCP/IP Resource"** and click **Next**.



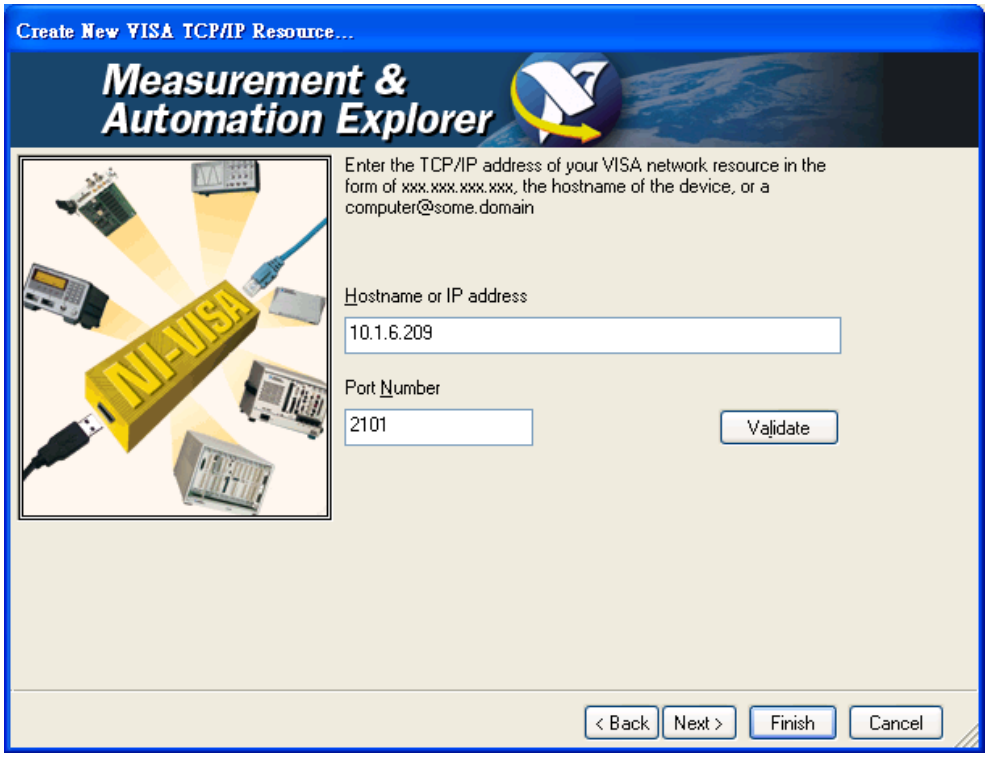
STEP 3:

Select Raw Socket and click **Next**.



STEP 4:

Input the IP Address and Port Number (the TCP/IP Port used by the 62000H is 2101) and click Validate.

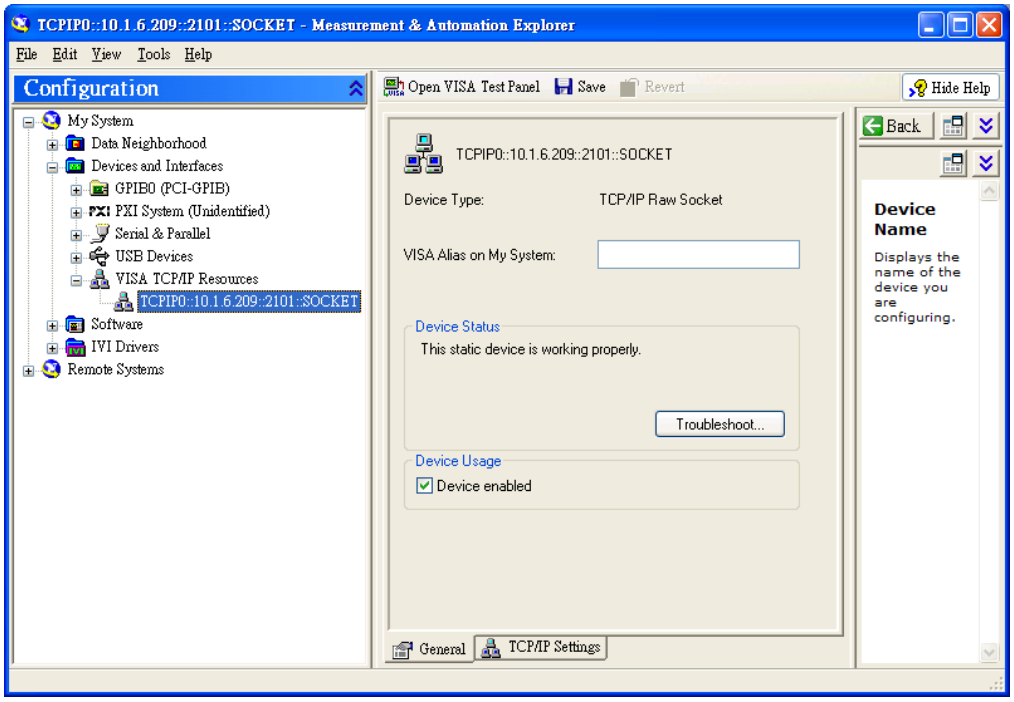

Create New VISA TCP/IP Resource...
Measurement & Automation Explorer
NI-VISA
Enter the TCP/IP address of your VISA network resource in the form of xxx.xxx.xxx.xxx, the hostname of the device, or a computer@some.domain
Hostname or IP address
10.1.6.209
Port Number
2101
Validate
< Back
Next >
Finish
Cancel

STEP 5:

The following screen will appear if the connection is successful. Close this message and then click **Finish**.

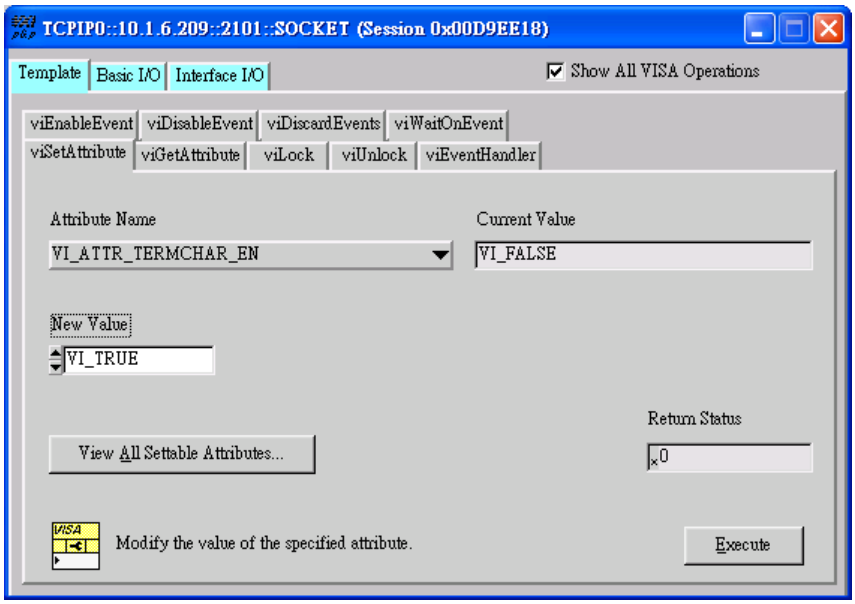
STEP 6:

A VISA TCP/IP Resource will be added to the Configuration list under Devices and Interfaces. Click it to open the VISA Session (NI VISA Ver. 3.0).



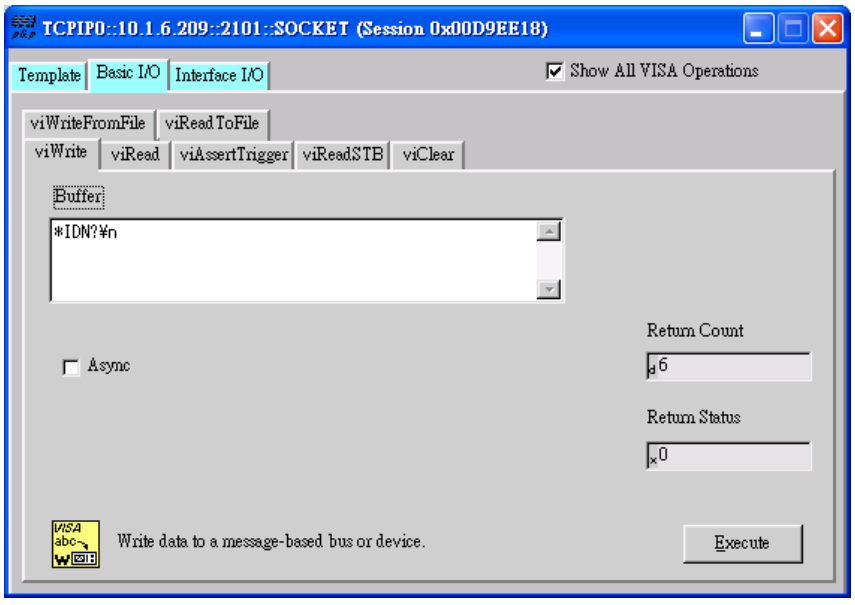
STEP 7:

Select 'Termination Char Enable' for the Attribute Name in Property Node (Write) under the **"Template"** tab. If the Current Value is set to VI_FALSE, change the New Value to VI_TRUE and click **Execute**.



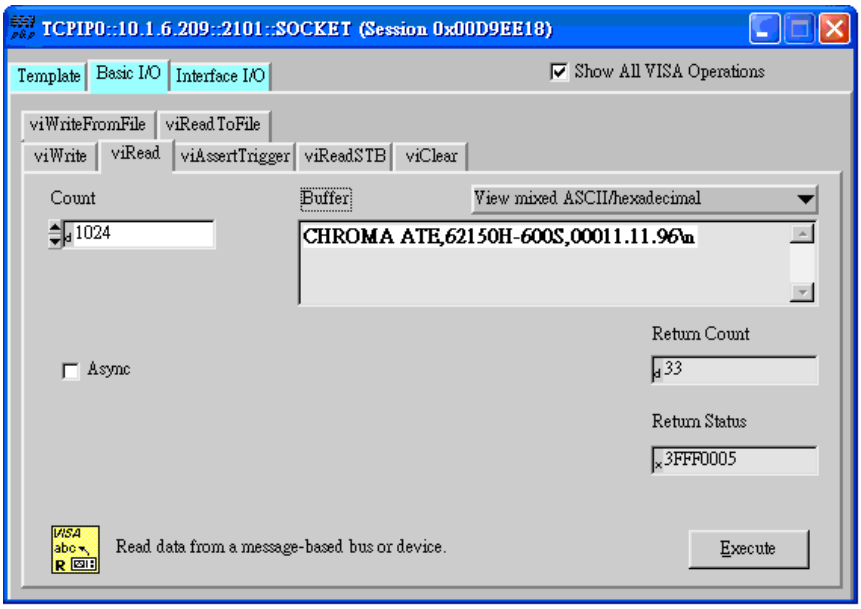
STEP 8:

Click the **"Basic I/O"** tab and select the 'Write' tab to write in the command to the 62000H (using *IDN? as the example) and click **Execute**.



STEP 9:

Select the **"Basic I/O"** tab and select the 'Read' tab to read back the 62000H status and click **Execute**.



5.2 GPIB Function of 62000H Series

Table 5-4

GPIB Function	Description
Talker/Listener	Commands and response messages can be sent and received over the GPIB bus. Status information can be read using a series poll.
Service Request	Sets the SRQ line to true if there is an enabled service request condition.
Remote/Local	When powered-on in local mode, the front panel is operational and the commands are sent through the GPIB interface. When in remote mode, all front panel keys are invalid except LOCAL. Pressing LOCAL will return the supply to local mode operation.

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 causing a query interrupt error.

5.3.1 Conventions

The table below lists the conventions used in this section.

Table 5-5

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.

5.3.2 Numerical Data Formats

The numerical data formats of the 62000H DC Power Supply are listed in Table 5-6.

Table 5-6 Format of Numerical Data

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	Flexible decimal format including NR1or NR2 or NR3.	123, 12.3, .23E+3
NRf+	Extended decimal format including NRf and MIN, MAX. MIN and MAX are the low and high limits of a parameter.	123, 12.3,1.23E+3, MIN, MAX

5.3.3 Boolean Data Format

The Boolean parameter <Boolean> only uses 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 create 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 a 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.

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 62000H 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, separate them with a colon (FETC:CURR FUNC:SHAP). Data must be separated from the program header by at least one space (SOUR:CURR 5).

5.3.5.6 Program Message

A program message consists of a sequence of one or more program message units that are separated by separator elements.

5.3.5.7 Program Message Unit

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

Example: VOLT?, OUTPut ON.

5.3.5.8 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>

5.3.5.9 Program Message Terminator (<PMT>)

A program message terminator represents the end of a program message. The three terminators are:

(1) <END> : end or identify (EOI)
(2) <NL> : new line which is a single ASCII-encoded byte 0A (10 decimal).
(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 the root level.

Example:

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

5.5 Execution Order

The 62000H DC Power Supply executes program messages in the order received.

5.6 DC Power Supply Commands

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

5.6.1 Common Command Syntax

'Common' and 'Query' commands are defined by the IEEE488.2 standard. Common commands begin with an "*" and consist of three letters and/or one "?" (query). Common commands and queries are listed alphabetically below.

***CLS** **Clear Status**
Type: Device status
Description: The *CLS command does the following:
1. Clears Error Codes
2. Resets Error Messages.
3. 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 the enabled 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 settings of the Standard Event Status Enable register.

***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? This query returns the current settings of the Standard Event Status register.
Return Example: 48

***IDN?** **Identification Query**
Type: System interface
Description: This query requests the 62000H to identify itself.
Query Syntax: *IDN?
Query Example: *IDN?

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

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

***OPC** **Operation Complete Command**
Type: Device status
Description: This command causes the interface to set the OPC bit (bit 0) of the Standard Event Status register when the DC Power Supply has completed all pending operations.
Syntax: *OPC
Parameter: None

***OPC?** **Operation Complete Query**
Type: Device status
Description: This query returns an ASCII “1” when all pending operations are completed.
Query Syntax: *OPC?
Return Parameter: <NR1>
Query Example: 1

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

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

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

***SRE** **Service Request Enable Command/Query**
Type: Device status

Description:	This command sets the condition of the Service Request Enable register, which determines which events of the Status Byte register (see *STB) are allowed to set the MSS (Master Status Summary) bit. A "1" in the bit position enable bits are logically ORed to cause Bit 6 (the Master Summary Status Bit) of the Status Byte register to be set. See the Status Byte register for a detailed description.	
Syntax:	*SRE <NRf>	
Parameter:	0 to 255	
Example:	*SRE 20	Enables the CSUM and MAV bits of the Service Request Enable register.
Query Syntax:	*SRE?	
Return Parameter:	<NR1>	
Query Example:	*SRE?	Returns the current settings of the Service Request Enable register.

***STB?** **Read Status Byte Query**

Type:	Device status	
Description:	This query reads the Status Byte register. Note that the MSS (Master Summary Status) bit instead of the RQS bit is returned in Bit 6. This bit indicates if the High Slew Rate Load has at least one reason for requesting service. *STB? does not clear the Status Byte register, which is cleared only when subsequent action has cleared all its set bits.	
Query Syntax:	*STB?	
Return Parameter:	<NR1>	
Query Example:	*STB?	Returns the contents of the Status Byte.
Return Example:	20	

Notice

1. Status Byte Register:
   The Status Byte Register is composed of eight bits that summarize an overlaying status data structure. The Status Byte Register can be read using *STB? to return a decimal expression of the register contents (which means the total byte weight of all the bytes set to “1”.)

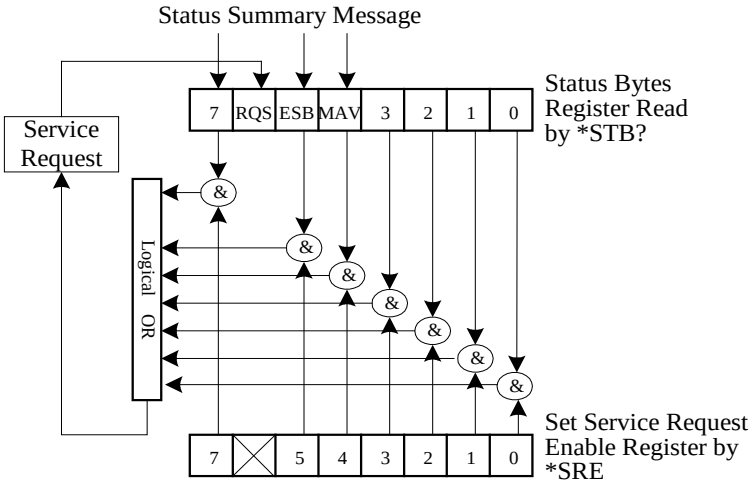


Figure 5-1

Table 5-7

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

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

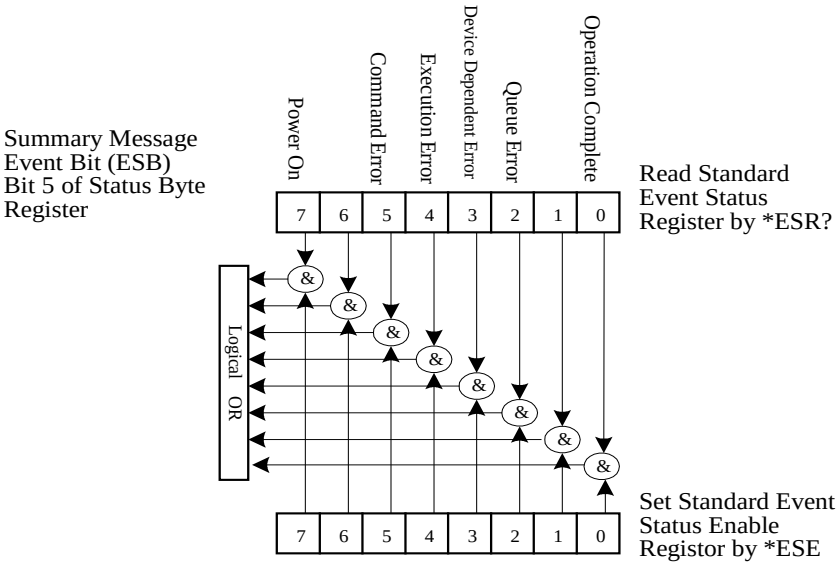


Figure 5-2

Table 5-8

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	

5.6.2 Specific Commands for 62000H 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: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

2. 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.

3. CONFigure:OUTPut

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

4. CONFigure:FOLDback

Description:	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 FOLDBACK status.
Return Example:	DISABLE or CVTOCC or CCTOCV	

5. CONFigure:FOLDT

Description:	Sets the delay time for FOLDBACK PROTECT
Syntax:	CONFigure:FOLDT <NRf1>
Parameter:	0.01-600.00 (Unit : Sec)
Example:	CONF:FOLDT 10
Query Syntax:	CONF:FOLDT?
Return Parameter:	<NRf1>
Query Example:	CONF:FOLDT?
Return Example:	1.000000e+01

6. CONFigure:APGVSet

Description:	Sets the APG VSET mode.
Syntax:	CONFigure:APGVSet NONE
	CONFigure:APGVSet VREF5
	CONFigure:APGVSet RREF
Parameter:	NONE | VREF5 | VREF10 | IREF | RREF
Example:	CONFigure:APGVSet VREF10
Query Syntax:	CONFigure:APGVSet?
Query Example:	CONFigure:APGVSet?
Return Example:	VREF10

7. CONFigure:APGVMeas

Description:	Sets the APG VMEAS mode.
Syntax:	CONFigure:APGVMeas NONE
	CONFigure: APGVMeas VREF5
	CONFigure: APGVMeas IREF
Parameter:	NONE | VREF5 | VREF10 | IREF
Example:	CONFigure:APGVMeas VREF10
Query Syntax:	CONFigure: APGVMeas?
Query Example:	CONFigure: APGVMeas?
Return Example:	VREF10

8. CONFigure:APGISet

Description:	Sets the APG ISET mode.
Syntax:	CONFigure:APGISet NONE CONFigure:APGISet VREF5 CONFigure:APGISet RREF
Parameter:	NONE | VREF5 | VREF10 | IREF | RREF
Example:	CONFigure:APGISet VREF10
Query Syntax:	CONFigure:APGISet?
Query Example:	CONFigure:APGISet?
Return Example:	VREF10

9. CONFigure:APGIMeas

Description:	Sets the APG IMEAS mode.
Syntax:	CONFigure:APGIMeas NONE CONFigure: APGIMeas VREF5 CONFigure: APGIMeas IREF
Parameter:	NONE | VREF5 | VREF10 | IREF
Example:	CONFigure:APGIMeas VREF10
Query Syntax:	CONFigure:APGIMeas?
Query Example:	CONFigure:APGIMeas?
Return Example:	VREF10

10. CONFigure:AVG:TIMES

Description:	Sets the AVG averaging time for the 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 AVG averaging method for the input voltage/current.
Syntax:	CONFigure:AVG:METHOD <NR1>
Parameter:	FIX/MOV
Example:	CONFigure:AVG:METHOD FIX CONFigure:AVG:METHOD MOV
Query Syntax:	CONFigure:AVG:METHOD?
Return Parameter:	FIX | MOV
Query Example:	CONFigure:AVG:METHOD?
Return Example:	FIX

12. CONFigure:BRIGhtness

Description:	Sets the panel display brightness.
Description:	CONFigure:BRIGhtness CONFigure: BRIGhtness DIM
Parameter:	HIGH | NOR | DIM

Example:	CONFigure: BRIGhtness HIGH CONFigure: BRIGhtness NOR CONFigure: BRIGhtness DIM	
Query Syntax: :	CONFigure: BRIGhtness?	
Return Parameter:	HIGH | NOR | DIM	
Query Example:	CONFigure: BRIGhtness ?	Returns the brightness control status of the panel.
Return Example:	HIGH	

13. CONFigure:MSTSLV:ID

Description:	Sets the power supply to Master or Slave.
Syntax:	CONFigure:MSTSLV:ID MASTER CONFigure:MSTSLV:ID SLAVE1
Parameter:	MASTER,SLAVE1,SLAVE2,SLAVE3…….SLAVE9.
Example:	CONFigure:MSTSLV:ID MASTER CONFigure:MSTSLV:ID SLAVE2
Query Syntax:	CONFigure:MSTSLV:ID?
Return Parameter:	MASTER | SLAVE1 | SLAVE2 | …… | SLAVE9
Query Example:	CONF:MSTSLV:ID?
Return Example:	MASTER or SLAVE1~SLAVE9

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

14. CONFigure:MSTSLV:PARSER

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

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

15. CONFigure:MSTSLV:NUMSLV

Description:	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

1. CONFigure:MSTSLV? must be OFF when setting it. (Not in series/parallel mode.)
2. Only 1 slave can be set when in series mode and a maximum of 9 slaves can be set when in 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 commands before using this function:
   - CONFigure:MSTSLV:ID
   - ONFigure:MSTSLV:PARSER
   - CONFigure:MSTSLV:NUMSLV
2. Series/parallel control is not available when Program RUN is active. To set the series/parallel control, first exit the Program Mode.

17. CONFigure:INHibit

Description:	Enables or Disables the Remote Inhibit control.
Syntax:	CONFigure:INHibit <ARG>
Parameter:	DISABLE| ENABLE
Example:	CONFigure:INHibit DISABLE CONFigure:INHibit ENABLE
Query Syntax:	CONFigure:INHibit?
Return Parameter:	DISABLE | ENABLE
Query Example:	CONF:INH?
Return Example:	DISABLE

18. CONFigure:INHibit:PULL

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

19. CONFigure:INTERLOCK

Description:	Enables or Disables the Safety Interlock control.
Syntax:	CONFigure:INTERLOCK <ARG>
Parameter:	DISABLE| ENABLE
Example:	CONFigure:INTERLOCK DISABLE CONFigure:INTERLOCK ENABLE
Query Syntax:	CONFigure:INTERLOCK?
Return Parameter:	DISABLE | ENABLE
Query Example:	CONF:INTERLOCK?
Return Example:	DISABLE

20. CONFigure:INTERLOCK:PULL

Description:	Controls the internal resistance status of the Safety Interlock input signal.
Syntax:	CONFigure:INTERLOCK:PULL <ARG>
Parameter:	LOW|HIGH
Example:	CONFigure:INTERLOCK:PULL LOW CONFigure:INTERLOCK:PULL HIGH
Query Syntax:	CONFigure:INTERLOCK:PULL?
Return Parameter:	LOW | HIGH
Query Example:	CONF:INTERLOCK:PULL?
Return Example:	LOW

21. CONFigure:EXTON

Description:	Enables or Disables the External ON/OFF control.
Syntax:	CONFigure: EXTON <ARG>
Parameter:	DISABLE| ENABLE
Example:	CONFigure: EXTON DISABLE CONFigure: EXTON ENABLE
Query Syntax:	CONFigure: EXTON?
Return Parameter:	DISABLE | ENABLE
Query Example:	CONF: EXTON?
Return Example:	DISABLE

22. CONFigure: EXTON:PULL

Description:	Controls the internal resistance status of the External ON/OFF input signal.
Syntax:	CONFigure: EXTON:PULL <ARG>
Parameter:	LOW|HIGH
Example:	CONFigure: EXTON:PULL LOW CONFigure: EXTON:PULL HIGH
Query Syntax:	CONFigure: EXTON:PULL?
Return Parameter:	LOW | HIGH
Query Example:	CONF: EXTON:PULL?
Return Example:	LOW

5.6.2.3 SOURCE Subsystem

1. SOURce:VOLTage

Description:	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:	<NRf+> [Unit Volt]	
Query Example:	SOUR:VOLT?	Returns the output voltage setting value.
Return Example:	8.000000e+01	

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

Description:	Sets the output voltage range.	
Syntax:	SOURce:VOLTage:LIMIT:HIGH <NRf+>[suffix]	
	SOURce:VOLTage:LIMIT:LOW <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:LIMIT:HIGH 60.0	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:	<NRf+> [Unit Volt]	
Query Example:	SOUR:VOLT:LIMIT:HIGH?	Returns the maximum range setting for voltage.
Return Example:	8.000000e+01	

3. SOURce:VOLTage:PROTect:{HIGH}

Description:	Sets the voltage range for over voltage protection.	
Syntax:	SOURce:VOLTage:PROTect:HIGH <NRf+>[suffix]	
Parameter:	Refer to individual spec for valid numeric range.	
Example:	SOUR:VOLT:PROT:HIGH 60.0	Sets the high limit to 60V for voltage output protection.
Query Syntax:	SOUR:VOLT:PROT:HIGH?	
Return Parameter:	<NRf+> [Unit Volt]	
Query Example:	SOUR:VOLT:PROT:HIGH?	Returns the high limit setting for voltage protection.
Return Example:	8.800000e+01	

4. SOURce:VOLTage:SLEW

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

Query Example: SOUR:VOLT:SLEW? Returns the output voltage slew rate setting.
Return Example: 1.000000e+01

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: <NRf+> [Unit Amp]
Query Example: SOUR:CURR? Returns the output current setting.
Return Example: 1.000000e+00

6. SOURce:CURRent:LIMit:{HIGH/LOW}
Description: Sets the output current range.
Syntax: SOURce:CURRent:LIMIT:HIGH <NRf+>[suffix]
SOURce:CURRent:LIMIT:LOW <NRf+>[suffix]
Parameter: Refer to individual spec for valid numeric range.
Example: SOUR:CURR:LIMIT:HIGH 60.0 Sets the output current range to 60A maximum.
SOUR:CURR:LIMIT:LOW 20.0 Sets the low limit to 20A for current output protection.
Query Syntax: SOUR:CURR:LIMIT:HIGH?
SOUR:CURR:LIMIT:LOW?
Return Parameter: <NRf+> [Unit Amp]
Query Example: SOUR:CURR:LIMIT:HIGH? Returns the maximum range set for current.
Return Example: 6.000000e+01

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 current output protection.
Query Syntax: SOUR:CURR:PROT:HIGH?
Return Parameter: <NRf+> [Unit Amp]
Query Example: SOUR:CURR:PROT:HIGH? Returns the high limit setting for current protection.
Return Example: 6.000000e+01

8. SOURce:CURRent:SLEW
Description: Sets the rising or falling slew rate (amp/ms) of output current.
Syntax: SOURce:CURRent:SLEW <NR1>[suffix]
SOURce:CURRent:SLEW <NR1>[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: <NR1> [Unit Amp/ms]
Query Example: SOUR:CURR:SLEW? Returns the current slew rate setting.
Return Example: 1.000000e+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 It resets the I Slewrate and returns to 1A/ms.
Query Syntax: SOUR:CURR:SLEW?
Return Parameter: INF. Or <NRf+>[Unit = Ampere]
Query Example: SOUR:CURR:SLEW? Returns the Slewrate setting.
Return Example: INF.

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

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: <NRf+> [Unit = Volt]
Query Example: SOUR:DCON:RISE? Returns the DC_ON setting.
Return Example: 7.950000e+01

Note The output must be OFF for 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: <NRf+> [Unit Volt]
   Query Example: FETC:VOLT?
   Return Example: 9.983100e+00

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

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

4. FETCh:STATus?
   Description: Returns the status code of the Power Supply's state.
   Query Syntax: FETCh:STATus?
   Return Parameter: <Arg1><,><Arg2><,><Arg3>
   <Arg1>: return warning message 0~65535, 0: no warning, use binary for the rest and identify the cause of the error.
   BIT 0: OVP
   BIT 1: OCP
   BIT 2: OPP
   BIT 3: Remote Inhibit
   BIT 4: OTP
   BIT 5: FAN_LOCK
   BIT 6: SENSE FAULT
   BIT 7: SERIES FAULT
   BIT 8: Reserved
   BIT 9: AC FAULT
   BIT 10: FOLD Back CV to CC
   BIT 11: FOLD Back CC to CV
   BIT 12: Reserved
   BIT 13: Reserved
   BIT 14: Reserved
   BIT 15: Reserved
   <Arg2>: ON|OFF output status at present
   <Arg3>: CV or CC status at present

5.6.2.5 MEASURE Subsystem

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

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

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

5.6.2.6 PROGRAM Subsystem

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

2. PROGram:LINK
   Description: Links a program to another program 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 or stops the program.
Syntax:	PROGram:RUN ON PROGram:RUN OFF
Parameter:	ON/1, OFF/0
Example:	PROG:RUN ON
Query Syntax:	PROGram:RUN?
Return Parameter:	<NR1>
Query Example:	PROGram:RUN?
Return Example:	1

5. PROGram:SAVE

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

6. PROGram:PULL

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

7. PROGram:SEQuence:SELected

Description:	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 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: 4.050000e+01

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: 1.000000e+01

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: 4.500000e+01

12. PROGram:SEQuence:CURRent:SLEW
    Description: Sets the output current 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: 1.000000e+00

13. PROGram:SEQuence:CURRent:SLEWINF
    Description: Sets the output current 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 setting to default.
    Return Example: INF.

14. PROGram:SEQuence:TIME
    Description: Sets the time duration of a sequence.

Syntax: PROGram:SEQuence:TIME <NRf1>
Parameter: 0.005-15000 , 0 (0 means end)
Example: PROG:SEQ:TIME 10
Query Syntax: PROG:SEQ:TIME?
Return Parameter: <NR1>
Query Example: PROG:SEQ:TIME?
Return Example: 1.000000e+01

15. PROGram:CLEAR
Description: Clears a sequence.
Syntax: PROGram:CLEAR
Example: PROG:CLEAR

16. 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.

17. 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.

18. PROGram:SEQuence
Description: Sets the parameters for a single sequence.
Syntax: PROGram:SEQuence
<arg1><,><arg2><,><arg3><,><arg4><,><arg5><,><arg6><,><arg7>
Parameter:
Arg1: Sequence TYPE (NR1 0:Auto, 1:Manual, 2:EXT.Trig, 3:Skip)
Arg2: Sequence Voltage (NRf+ unit: voltage)
Arg3: Sequence Voltage Slewrate (NRf+ unit: voltage)
Arg4: Sequence Current (NRf+ unit: current)
Arg5: Sequence Current Slewrate (NRf+ unit: current) / INF –I Slewrate sets to INF
Arg6: Reserved (always 0)
Arg7: Sequence TIME (NRf+ unit: SEC, only valid when Sequence Type is AUTO)
Example: Set the Sequence
PROGram:SEQuence 0,80,10,15,1,0,10
Query Syntax: PROG:SEQ?
Return Parameter: 0,8.000000e+01,1.000000e+01,1.500000e+01,
1.000000e+00,0,1.000000e+01
Query Example: PROG:SEQ?
Return Example: 0,8.000000e+01,1.000000e+01,1.500000e+01,1.000000e+00,0,
1.000000e+010,80,10,15,1,0,1

19. PROGram:MODE

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

20. PROGram:STEP:STARTV

Description:	Sets the Step Mode start voltage for 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:	2.000000e+01

21. PROGram:STEP:ENDV

Description:	Sets the Step Mode output end voltage.
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:	5.000000e+01

22. 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:	1,30,5.000000e+00

5.6.2.7 IV Subsystem

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

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

3. IVCurve:VMPp?
   Description: Queries the VMPp in IV Curve Mode.
   Query Syntax: IVCurve:VMPp?
   Return Parameter: <NRf+>
   Query Example: IVCurve:VMPp?
   Return Example: 5.000000e+02

4. IVCurve:IMPp?
   Description: Queries the IMPp in IV Curve Mode.
   Query Syntax: IVCurve:IMPp?
   Return Parameter: <NRf+>
   Query Example: IVCurve:IMPp?
   Return Example: 5.000000e+00

5. IVCurve:PMPp?
   Description: Queries the PMPp in IV Curve Mode.
   Query Syntax: IVCurve:PMPp?
   Return Parameter: <NRf+>
   Query Example: IVCurve:PMPp?
   Return Example: 5.000000e+01

6. IVCurve:VT
   Description: Creates the 128 dot voltage data table in IV Curve Mode.
   Syntax: IVCurve:VT <NRf+>...< NRf+>
   Example: Creates the voltage table of IV Curve data.
   IVCurve:VT <V1>,<V2,...<V128>
   Query Syntax: IVCurve:VT?
   Return Parameter: <NRf+>,...,<NRf+>
   Query Example: IVCurve:VT?
   Return Example: <V1>,<V2>,...<V128>

Note The execution time of this command is longer in Master/Slave mode. To ensure normal operation, use the *OPC command. It will run the next command after the *OPC command responds.
Ex.: IVC:VT xxx,xxx,xxx,...
*OPC?

7. IVCurve:IT

Description:	Creates the 128 dot current data table in IV Curve Mode.
Syntax:	IVCurve:IT <NRf+>...< NRf+>
Example:	Creates the current table of IV Curve data. IVCurve:IT <I1>,<I2>,...<I128>
Query Syntax:	IVCurve:IT?
Return Parameter:	<NRf+>,...,<NRf+>
Query Example:	IVCurve:IT?
Return Example:	<I1>,<I1>,...<I128>

Note The execution time of this command is longer in Master/Slave mode. To ensure normal operation, use the *OPC command. It will run the next command after the *OPC command responds.
Ex.: IVC:VT xxx,xxx,xxx,...
*OPC?

8. IVCurve:EDIT <NR1>

Description:	Selects the stored table to be edited in IV Curve Mode. There are 100 stored tables (1-100). The default is 1.
Syntax:	IVCurve:EDIT <NR1>
Example:	Selects the IV Curve stored in table 1 for editing. IVCurve:EDIT 1
Query Syntax:	IVCurve:EDIT?
Return Parameter:	<NR1>
Query Example:	IVCurve:EDIT?
Return Example:	1

9. IVCurve:SELect <NR1>

Description:	Selects the stored table to be run in IV Curve Mode. There are 100 stored tables (1-100). The default is 1.
Syntax:	IVCurve:SELect <NR1>
Example:	Selects the IV Curve stored in table 1 for execution. IVCurve:SELect 1
Query Syntax:	IVCurve:SELect?
Return Parameter:	<NR1>
Query Example:	IVCurve:SELect?
Return Example:	1

10. IVCurve:SEQuence:SELected

Description:	Selects the sequence of the programs for the IV_PROGRAM.
Syntax:	IVCurve:SEQuence:SELected <NR1>
Parameter:	1 to 100
Example:	IVC:SEQ:SEL 3
Query Syntax:	IVC:SEQuence:SELected?
Return Parameter:	<NR1>
Query Example:	IVC:SEQ:SEL?
Return Example:	3

Note Ensure the IV-Program has the desired sequence before selecting it. If not, use the PROG:ADD command to add a new Sequence.

11. IVCurve:SEQuence

Description:	Sets all the parameters for a Sequence in the IV-Program.
Syntax:	IVCurve:SEQuence <arg1><,><arg2><,><arg3><,><arg4>
Parameter:	Arg1: Sequence Number (NR1: 1-100) Arg2: Sequence TYPE (NR1 0:Auto , 1:Manual) Arg3: Sequence FILE (NR1: 1 - 100) Arg4: Sequence TIME (NR1 Unit: SEC, only valid when Sequence Type is set to AUTO.)
Example:	Sets Sequence 5 to TYPE=AUTO,FILE NO=99, TIME=10 Sec IVCurve:SEQuence 5,0,99,10
Query Syntax:	IVCurve:SEQ?
Return Parameter:	SEQ NO,TYPE,FILE NO,TIME
Query Example:	IVC:SEQ?
Return Example:	5,0,99,10

Note Ensure the IV-Program has the desired sequence before selecting it. If not, use PROG:ADD command to add a new Sequence.

12. IVCurve:SEQuence:RUN?

Description:	Queries the running status of the IV-Program.
Query Syntax:	IVCurve:SEQuence:RUN?
Return Parameter:	<ARG1>,<ARG2>,... ,<ARG7>
	<ARG1> Current running status. 0: STOP 1:RUNNING
	<ARG2> Program No. currently running.
	<ARG3> Remaining count of the Program currently running.
	<ARG4> Sequence No. currenly running.
	<ARG5> Sequence Type (0: AUTO, 1: MANUAL).
	<ARG6> File No. currently running.
	<ARG7> Current running time in second(s).
Query Example:	IVC:SEQ:RUN?
Return Example:	1,2,3,0,5,1,123 (Return the status: RUNNING, Program No=2, Cnt_Remain=1, Sequence No=3, Sequence Type=AUTO, File No=5, Time=123 sec.)

13. IVCurve:CONFigure:CONTrol

Description:	Sets the IV Curve output control mode.
Query Syntax:	IVCurve:CONFigure:CONTrol?
Parameter:	CC | CV
Example:	VC:CONF:CONT CC IVC:CONF:CONT CV
Query Example:	IVC:CONF:CONT?
Return Example:	CC or CV

14. IVCurve:CONFigure:FILTer

Description:	Sets the IV-Curve measurement signal cutoff frequency of the input filter in Hz.
Syntax:	IVCurve:CONFigure: FILTer <NR1>
Query Syntax:	IVCurve:CONFigure: FILTer?
Return Parameter:	<NR1>
Example:	IVC:CONF:FILT 1000 (Sets the input filter cutoff frequency to1000Hz.)
Query Example:	IVC:CONF:FILT?
Return Example:	NR1

15. IVCurve:CONFigure:SPEed

Description:	Sets the IV-Curve output response speed.
Syntax:	IVCurve:CONFigure:SPEed
Parameter:	SLOW | MIDDLE | FAST
Query Syntax:	IVCurve:CONFigure:SPEed?
Return Parameter:	SLOW | MIDDLE | FAST
Example:	IVC:CONF:SPE FAST (Sets the IV-Curve output response speed to FAST.)
Query Example:	IVC:CONF:SPE FAST?
Return Example:	SLOW | MIDDLE | FAST

16. IVCurve:CONFigure:MARGIN

Description:	Sets the IV-Curve margin in %.
Syntax:	IVCurve:CONFigure:MARGIN <NR1>
Query Syntax:	IVCurve:CONFigure:MARGIN?
Return Parameter:	<NR1>
Example:	IVC:CONF:MARGIN 100 (Sets the IV-Curve margin to 100%.)
Query Example:	IVC:CONF:MARGIN?
Return Example:	<NR1>

5.6.2.8 SAS Subsystem

1. SAS:VOC
   Description: Sets the VOC in SAS Mode.
   Syntax: SAS:VOC <NRf+>
   Example: Change the VOC to 600.0 V.
   SAS:VOC 600
   Query Syntax: SAS:VOC ?
   Return Parameter: <NRf+>
   Query Example: SAS:VOC ?
   Return Example: 6.000000e+02

2. SAS:ISC
   Description: Sets the ISC in SAS Mode.
   Syntax: SAS:ISC <NRf+>
   Example: Change the ISC to 8.0 A.
   SAS:ISC 8
   Query Syntax: SAS:ISC ?
   Return Parameter: <NRf+>
   Query Example: SAS:ISC ?
   Return Example: 8.000000e+00

3. SAS:VMPp
   Description: Sets the VMPp in SAS Mode.
   Syntax: SAS:VMPp <NRf+>
   Example: Change the VMPp to 500.0 V.
   SAS:VMPp 500
   Query Syntax: SAS:VMPp ?
   Return Parameter: <NRf+>
   Query Example: SAS:VMPp ?
   Return Example: 5.000000e+02

4. SAS:IMPp
   Description: Sets the IMPp in SAS Mode.
   Syntax: SAS:IMPp <NRf+>
   Example: Change the IMPp to 5.0 A.
   SAS:IMPp 5
   Query Syntax: SAS:IMPp ?
   Return Parameter: <NRf+>
   Query Example: SAS:IMPp ?
   Return Example: 5.000000e+00

Note Due to a formula limitation, the following conditions must be followed when running in SAS mode:

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

$$VMP < VOC\ ,IMP < ISC$$

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

5. TRIG
   Description: Updates the output waveform when SAS Mode is running.
   Syntax: TRIG

Example: SAS:VOC 600
SAS:ISC 8
SAS:IMPp 5
SAS:VMPp 400
TRIG

6. SAS:PMPp
   Description: Sets the PMPp in EN50530 Mode.
   Syntax: SAS:VMPp <NRf+>
   Example: Changes the PMPp to 1500.0 W.
   SAS:PMPp 1500
   Query Syntax: SAS:PMPp ?
   Return Parameter:<NRf+>
   Query Example: SAS:PMPp ?
   Return Example: 1.500000e+03

7. SAS:VMPp
   Description: Sets the VMPp in EN50530 Mode.
   Syntax: SAS:VMPp <NRf+>
   Example: Changes the VMPp to 500.0 V.
   SAS:VMPp 500
   Query Syntax: SAS:VMPp ?
   Return Parameter:<NRf+>
   Query Example: SAS:VMPp ?
   Return Example: 5.000000e+02

8. SAS:TECH
   Description: Sets the TECH in EN50530 Mode.
   Syntax: SAS:TECH <NR1>
   Parameter: CSI/TF
   Example: SAS:TECH CSI
   SAS:TECH TF
   Query Syntax: SAS:TECH?
   Return Parameter:CSI | TF
   Query Example: SAS:TECH?
   Return Example: CSI

9. SAS:IRR
   Description: Sets the irradiation in EN50530 Mode.
   Syntax: SAS:IRR <NR1>
   Parameter: <NR1>
   Example: SAS:IRR 1000
   SAS:IRR 3000
   Query Syntax: SAS:IRR?
   Return Parameter:<NR1>
   Query Example: SAS:IRR?
   Return Example: 1000

10. SAS:SANDIA:IRRREF
    Description: Sets the irradiation reference in SANDIA Mode.
    Syntax: SAS:SANDIA:IRRREF <NR1>
    Parameter: <NR1>
    Example: SAS:SANDIA:IRRREF 1000
    SAS:SANDIA:IRRREF 3000

Query Syntax: SAS:SANDIA:IRRREF?
Return Parameter:<NR1>
Query Example: SAS:SANDIA:IRRREF
Return Example: 1000

11. SAS:SANDIA:TMPREF
Description: Sets the temperature reference in SANDIA Mode.
Syntax: SAS:SANDIA:TMPREF <NRf+>
Parameter: <NRf+>
Example: SAS:SANDIA:TMPREF 100
SAS:SANDIA:TMPREF -100
Query Syntax: SAS:SANDIA:TMPREF?
Return Parameter:<NRf+>
Query Example: SAS:SANDIA:TMPREF?
Return Example: -1.000000e+02

12. SAS:SANDIA:BETA
Description: Sets the BETA parameter in SANDIA Mode.
Syntax: SAS:SANDIA:BETA <NRf+>
Parameter: <NRf+>
Example: SAS:SANDIA:BETA 0
SAS:SANDIA:BETA -2
Query Syntax: SAS:SANDIA:BETA?
Return Parameter:<NRf+>
Query Example: SAS:SANDIA:BETA?
Return Example: -2.000000e+00

13. SAS:SANDIA:FF
Description: Sets the fill factor in SANDIA Mode.
Syntax: SAS:SANDIA:FF <NRf+>
Parameter: <NRf+>
Example: SAS:SANDIA:FF 0.4
SAS:SANDIA:FF 0.95
Query Syntax: SAS:SANDIA:FF?
Return Parameter:<NRf+>
Query Example: SAS:SANDIA:FF?
Return Example: -2.000000e+00

14. SAS:SANDIA:IRR
Description: Sets the irradiation in SANDIA Mode.
Syntax: SAS:SANDIA:IRR <NR1>
Parameter: <NR1>
Example: SAS:SANDIA:IRR 1000
SAS:SANDIA:IRR 3000
Query Syntax: SAS:SANDIA:IRR?
Return Parameter:<NR1>
Query Example: SAS:SANDIA:IRR
Return Example: 1000

15. SAS:SANDIA:TMP
Description: Sets the temperature in SANDIA Mode.
Syntax: SAS:SANDIA:TMP <NRf+>
Parameter: <NRf+>
Example: SAS:SANDIA:TMP 100

SAS:SANDIA:TMP -100
Query Syntax: SAS:SANDIA:TMP?
Return Parameter:<NRf+>
Query Example: SAS:SANDIA:TMP?
Return Example: -1.000000e+02

16. SAS:SANDIA:PMPp
Description: Sets the PMPp in SANDIA Mode.
Syntax: SAS:SANDIA:VMPp <NRf+>
Example: Changes the PMPp to 1500.0 W.
SAS:SANDIA:PMPp 1500
Query Syntax: SAS:SANDIA:PMPp?
Return Parameter:<NRf+>
Query Example: SAS:SANDIA:PMPp?
Return Example: 1.500000e+03

17. SAS:SANDIA:VMPp
Description: Sets the VMPp in SANDIA Mode.
Syntax: SAS:SANDIA:VMPp <NRf+>
Example: Changes the VMPp to 500.0 V.
SAS:SANDIA:VMPp 500
Query Syntax: SAS:SANDIA:VMPp?
Return Parameter:<NRf+>
Query Example: SAS:SANDIA:VMPp?
Return Example: 5.000000e+02

5.6.2.9 OUTPUT Subsystem

1. OUTPut [: STATus]
Description: Enables or disables the DC Power Supply output. To stop the output, set the output voltage to 0 volts.
Query Syntax: OUTPut [: STATus]?
Parameter: OFF | ON
Return Parameter: OFF | ON

2. OUTPut : MODE
Description: Sets the output mode. The default operating mode is “CVCC”.
Query Syntax: OUTPut : MODE?
Parameter: CVCC | TABLE |SAS
Example: OUTPut:MODE CVCC
OUTPut:MODE TABLE
OUTPut:MODE SAS
Query Syntax: OUTPut:MODE?
Query Example: OUTPut: MODE?
Return Example: CVCC or TABLE or SAS

TABLE Mode Return Example:

OUTPut:MODE TABLE
IVCurve:EDIT <NR1>
IVCurve:VT {...}
IVCurve:IT {...}
IVCurve:SELect <NR1>
OUTPut ON

5.6.2.10 SYSTEM Subsystem

1. SYSTem:ERRor?
   Description: Returns the Power Supply code and error message.
   Query Syntax: SYSTem:ERRor?
   Query Example: SYST:ERR?
   Return Example: -203, “Data out of range”

Table 5-9

Code	Error Message	Code	Error Message
0	"No error"	-101	"Invalid character"
-102	"Syntax error"	-103	"Invalid separator"
-104	"Data type error"	-105	"GET not allowed"
-106	"Illegal parameter value"	-108	"Parameter not allowed"
-109	"Missing parameter"	-112	"Program mnemonic too long"
-113	"Undefined header"	-121	"Invalid character in number"
-123	"Numeric overflow"	-124	"Too many digits"
-131	"Invalid suffix"	-141	"Invalid character data"
-148	"Character data not allowed"	-151	"Invalid string data"
-158	"String data not allowed"	-202	"Setting conflict"
-203	"Data out of range"	-204	"Too much data"
-211	"Data stale"	-224	"Self-test failed"
-225	"Too many errors"	-226	"INTERRUPTED"
-227	"UNTERMINATED"	-228	"DEADLOCKED"
-229	"MEASURE ERROR"	-230	"Sequence overflow"
-231	"Sequence selected error"		

6. Theory of Operation

6.1 Overview

The 62000H Series DC Power Supply with Solar Array Simulation has a total of 18 circuit boards in it: A, C, D, E, F, G, H, I, K, L, NO, R, S, U, Y, YE, YG, and Z.

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

Figure 6-1 shows the system diagram.

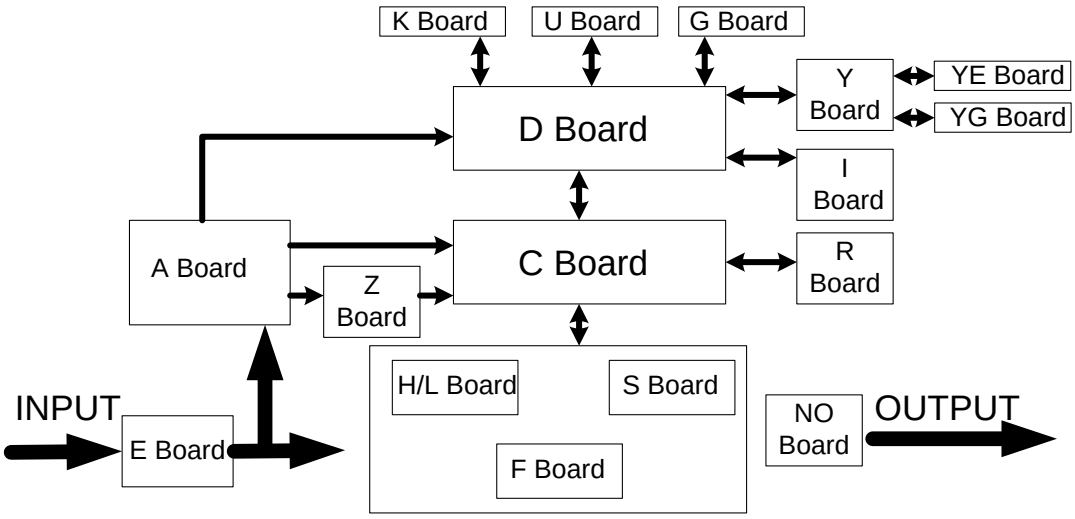


Figure 6-1

Figure 6-2 shows the input stage structure.

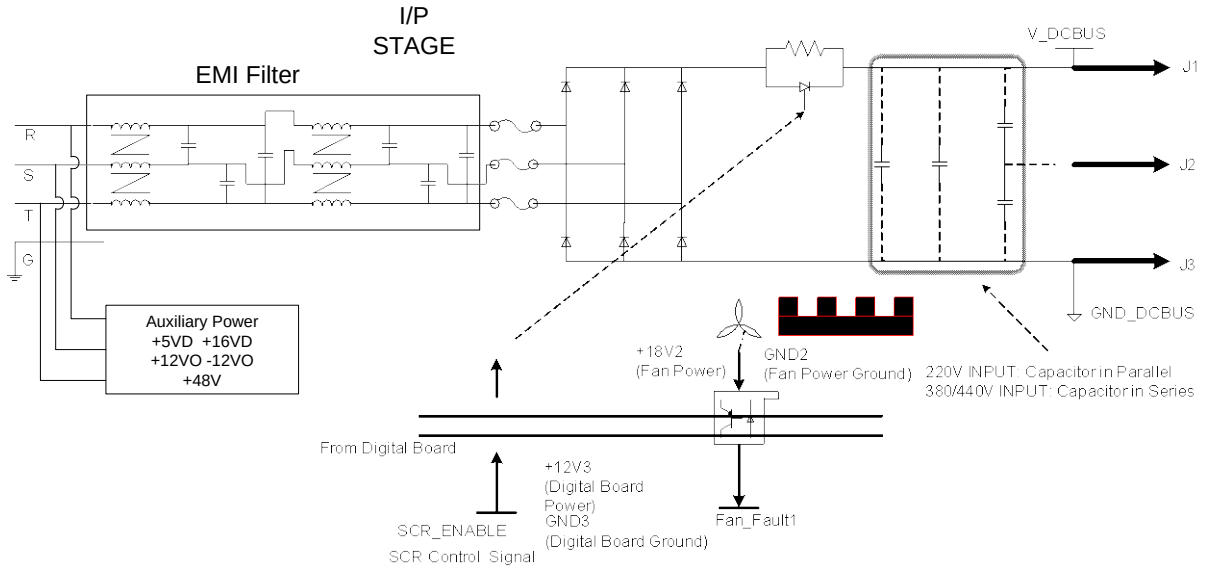


Figure 6-2

Figure 6-3 shows the output stage structure.

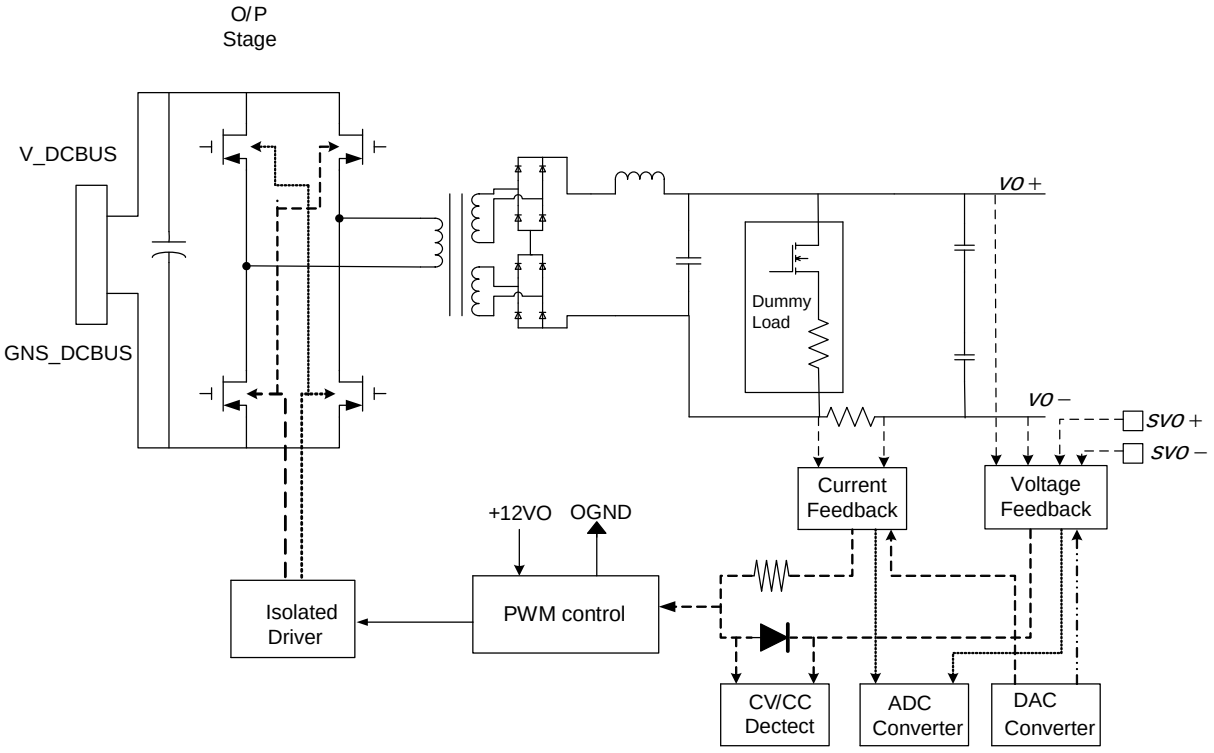


Figure 6-3

Figure 6-4 shows the digital stage structure.

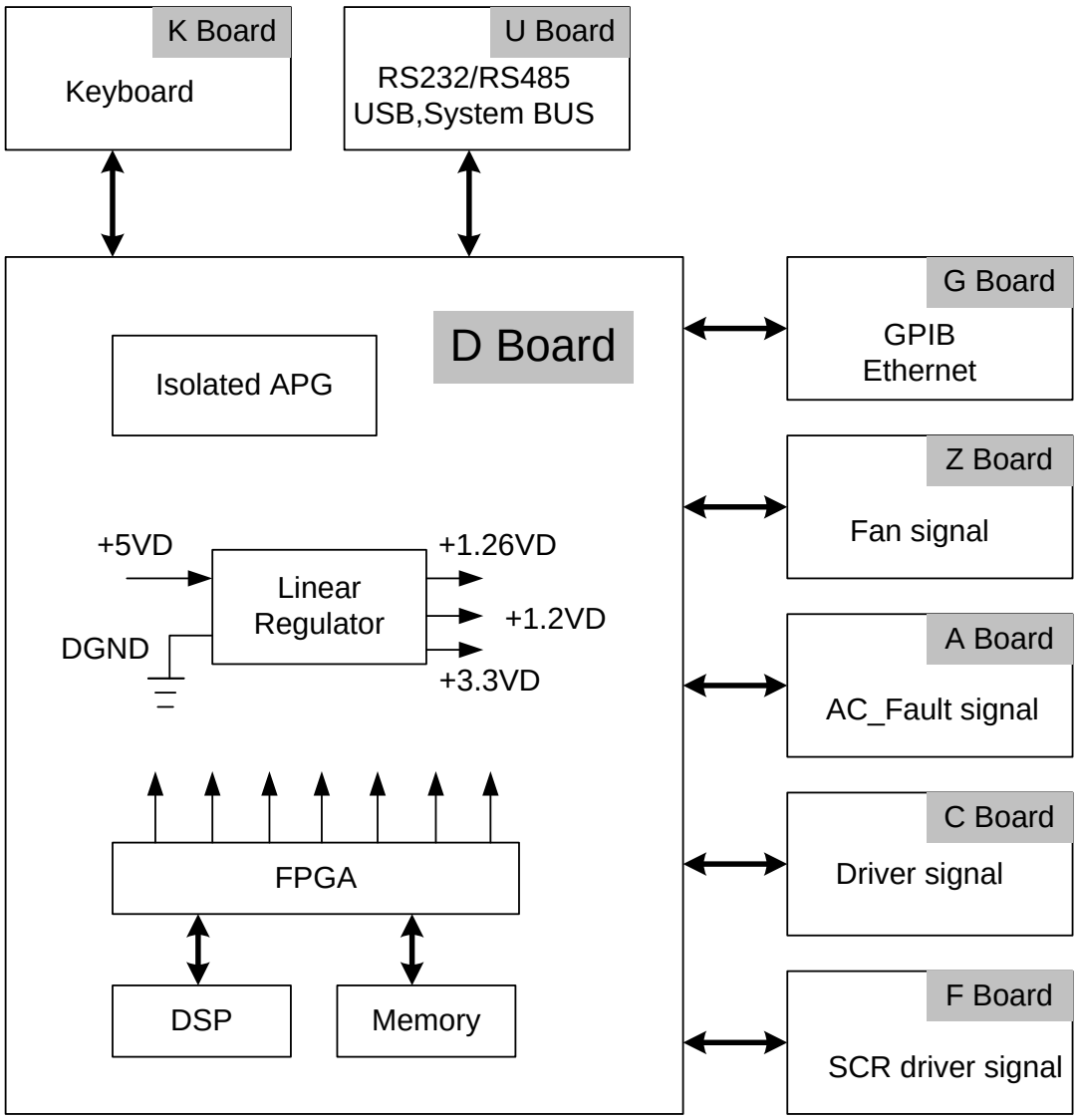


Figure 6-4

6.2 Function Description

6.2.1 I/P (PFC) Stage

1. The input stage is a bridge rectifier that rectifies the 3-phase AC power source to DC.
2. The input stage inhibits inrush current by connecting the input circuit through a 40Ω resistor in series during power-on to charge the input capacitor. It then turns on an SCR after a few seconds and bypasses this current limit resistor.

6.2.2 Auxiliary Power

1. The auxiliary power voltages are generated by sending the AC source input through a bridge rectifier and a flyback converter to get the desired output voltages.
2. The auxiliary power output provides four voltages: +5V, +16V, ±12V, and +48V.

6.2.3 Output Stage

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

   In Constant Voltage mode, the IC detecting signal is the Output voltage and the actual load voltage (remote sense) from the output remote sense line.

   In Constant Current mode, the IC detecting signal is the Output current.

3. The secondary side is a one stage LC filter that reduces the ripple voltage and ripple current.
4. The Dummy load acts as a Constant Current Source. The Dummy load current will be adjusted based on the output voltage. It will respond if the programmed voltage is less than the current output. The output has OVP; when it exceeds the OVP voltage (16 bit DAC) set by the front panel, the output will be disabled.

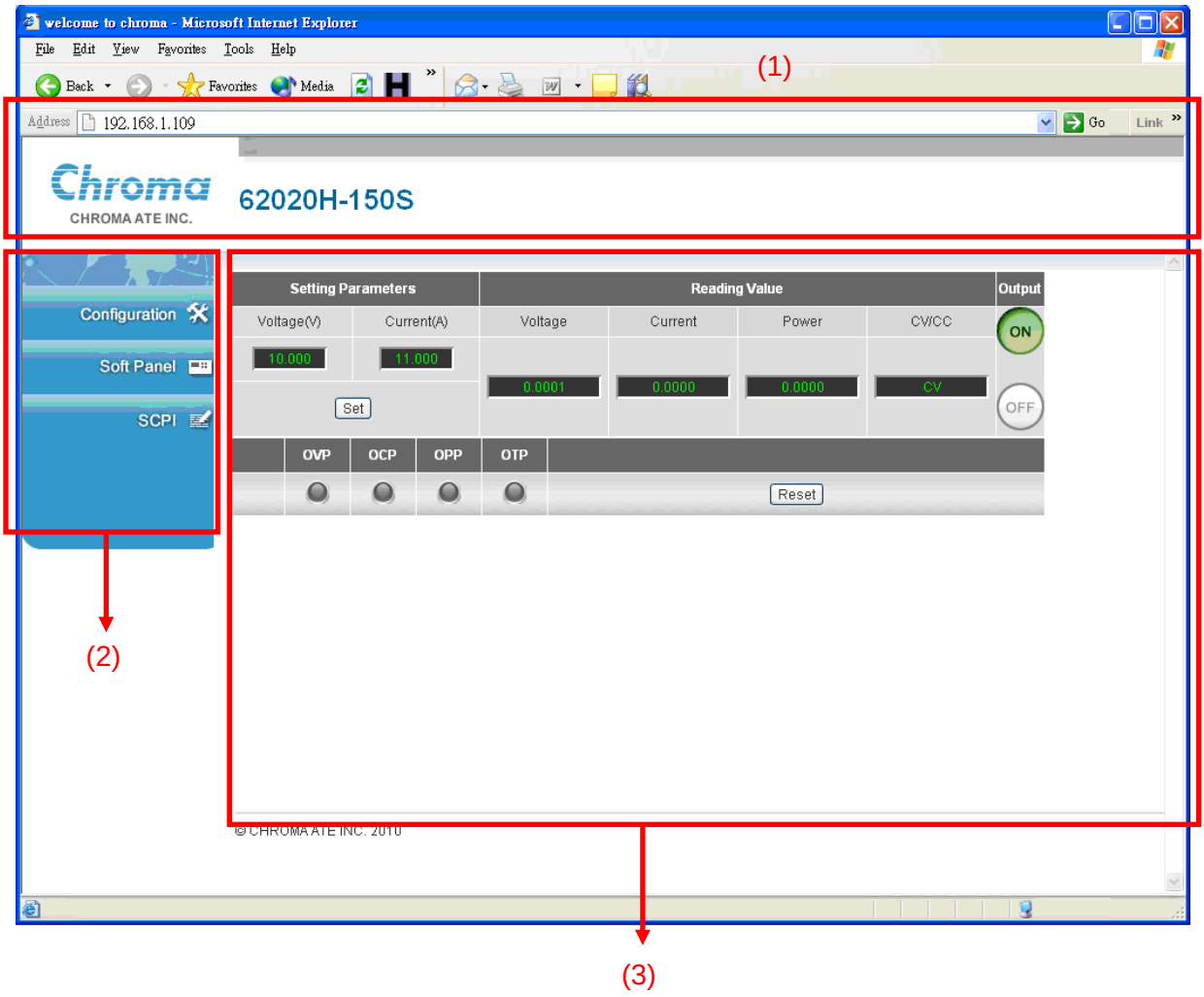
6.2.4 Digital Circuit

1. The digital circuit control unit is composed of TI's IC with the Lattice FPGA.
2. The 3.3V power source required by the FPGA is derived from +5VD.
3. The 3.3V and 1.26V power sources required by the DSP are derived from +5VD.
4. The analog program interface and digital circuit signals are isolated by the +16VD power source with a free-running flyback converter and linear regulator.
5. The TTL output is a +5V level and the internal digital signal is a +3.3V level.

7. ETHERNET Functions (62020H-150S Only)

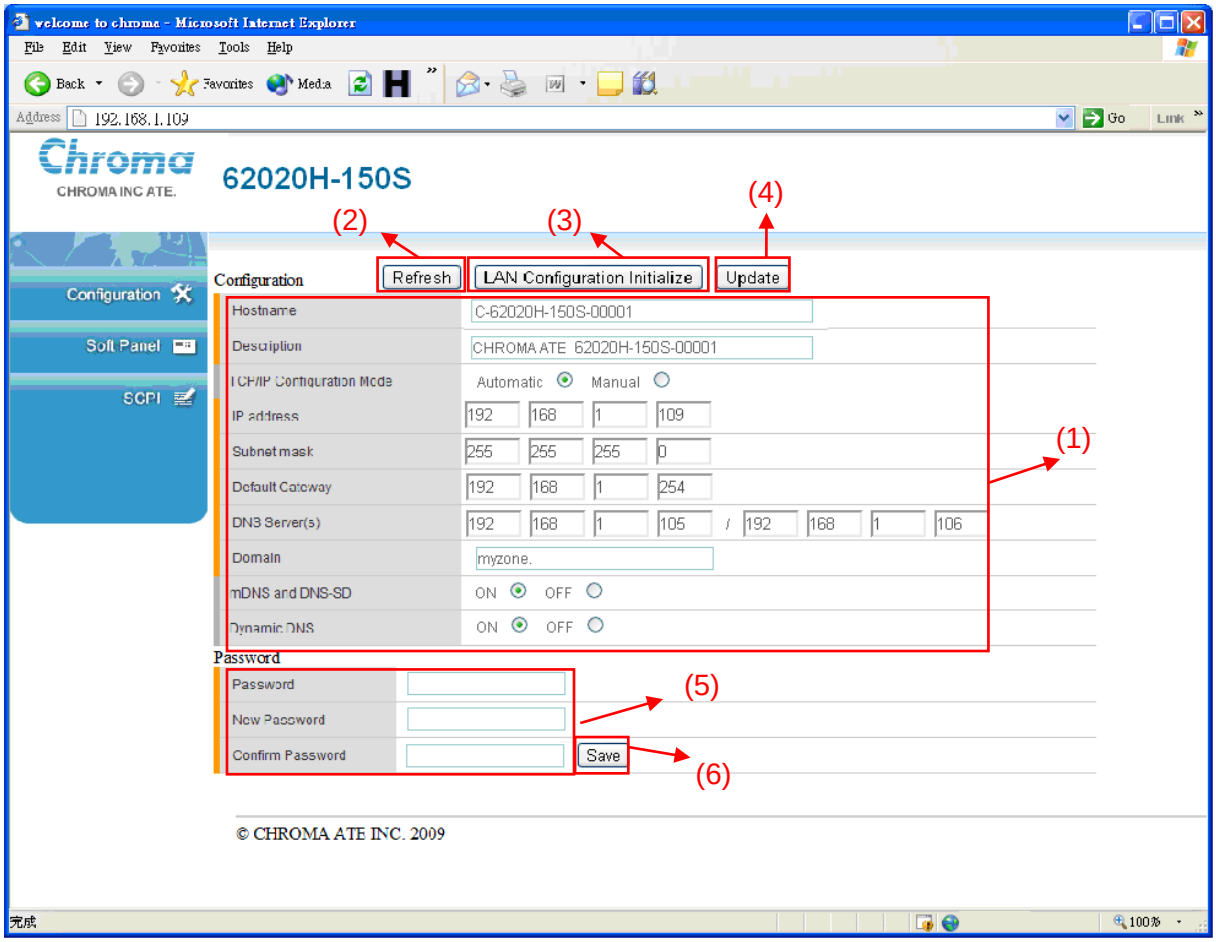
7.1 Usage of Web Page

7.1.1 Home Page (index.html)



(1) LOGO display area.
(2) Menu for selecting the Configuration, Soft Panel or SCPI functions.
(3) Configuration screen where the parameters for the selected fuction can be set.

7.1.2 Configuration Page



The active network configuration will be retrieved and displayed in the message block [1] upon entering the Configuration page.

(1) Message block [1]: displays the active network configuration. The IP address, Subnet mask, Default Gateway and DNS Server(s) are defined by TCP/IP Configuration Mode. The settings can be edited if DHCP is set to OFF (manual setting mode) but they cannot be edited when DHCP is set to ON (automatic setting mode).

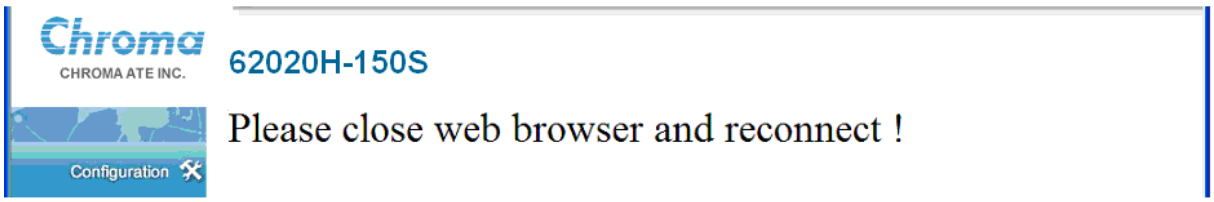
(2) Refresh button: this function refreshes the configuration page by reading the associated information again and displaying it on the message block [1].

(3) LAN Configuration Initialize button: returns the network settings to their factory defaults (it ignores any changes made in the message block [1]). A password confirmation will appear before executing this function. (No confirmation is required if the system password is blank.)

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

Click **OK** and the LAN Configuration Initialize button again. A confirmation window will appear as shown below. Click **OK** to start the initialization.

A "*Please wait 10 seconds.*" message will appear during initialization. After waiting for 10 seconds, close the web browser and restart it.



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

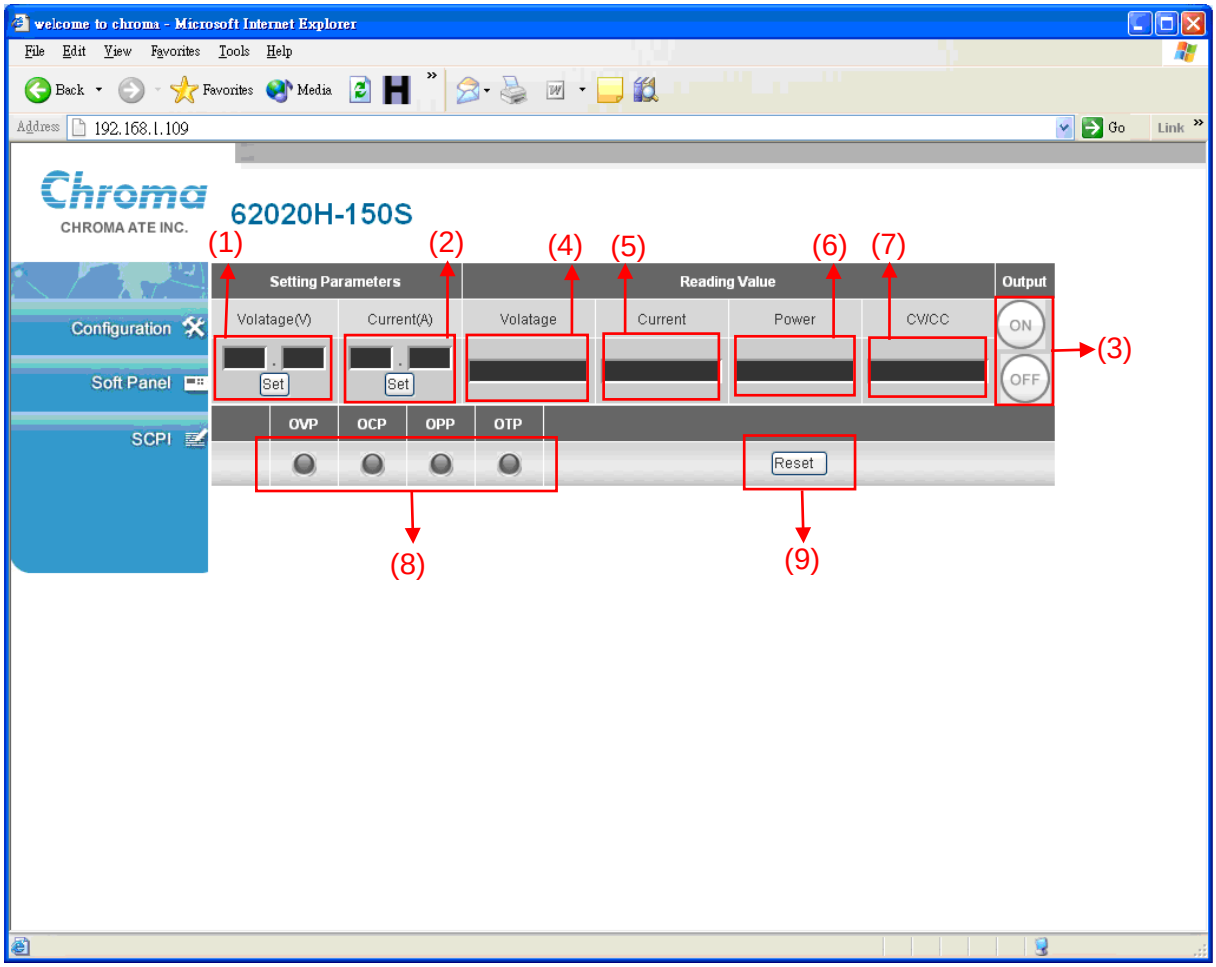
(4) Update function (password required): The execution process of this function is similar to LAN Configuration Initialize. The difference is that the Update will use the Message block [1] settings to reset the network configuration.

(5) Password change block: It is used to change the password by entering the following:
- Password
- New Password
- Confirm Password

The password can be blank or 0 - 8 characters of the numerals 0 - 9, English uppercase letters A to Z or lowercase letters a - z. The default system password is blank.

(6) Save button: saves the changed password.

7.1.3 Soft Panel



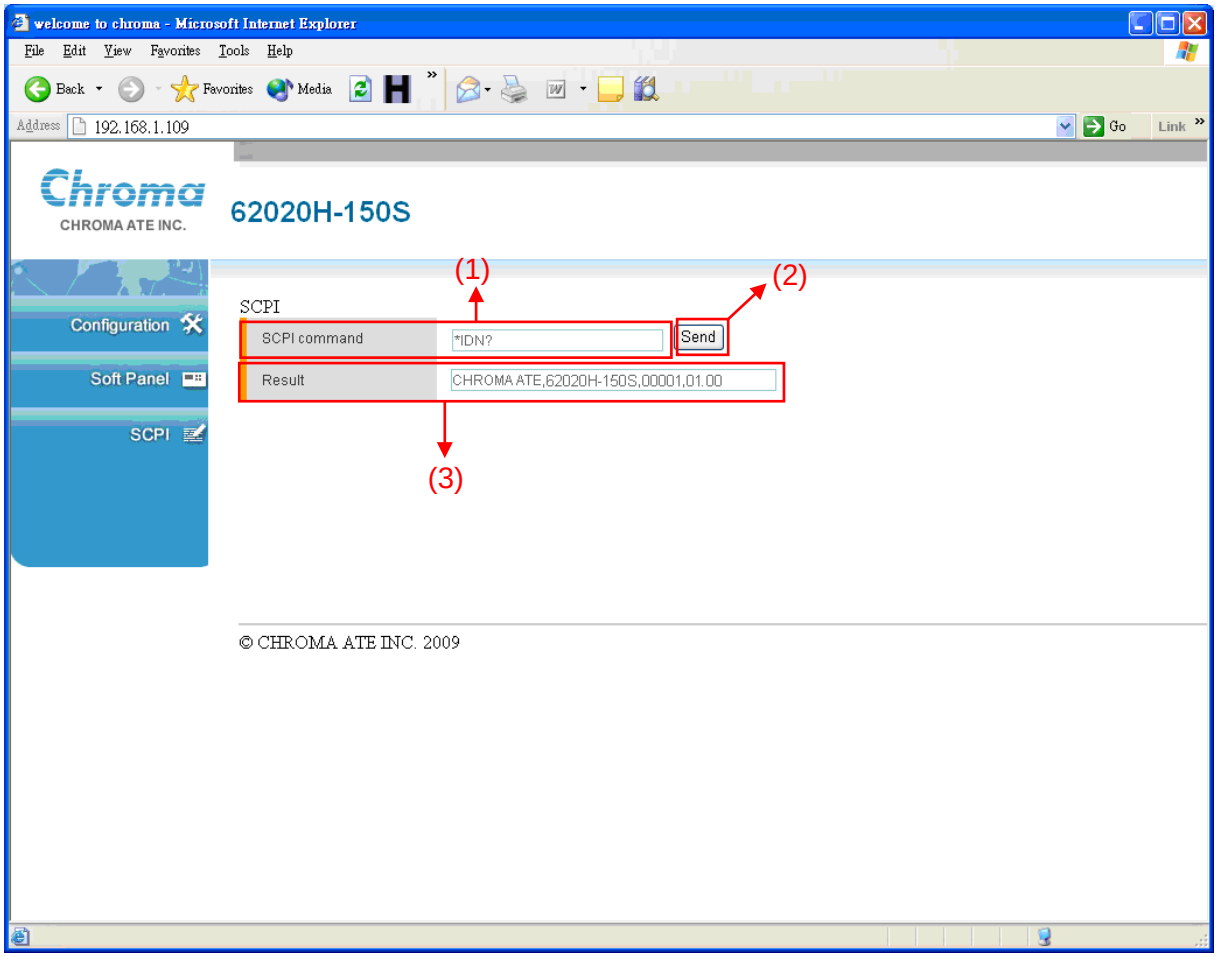
The Soft Panel simulates the actual device panel functions. 7 options may be set. If there is a system password, a window will display requesting the password be entered. Input the password and click **Enter**. If the password is correct, click **OK** to start executing the command.

Setting Parameters:
(1) Voltage: sets the device voltage.
(2) Current: sets the device current.
(3) Output Mode: enables or disables the device output.
Each time the Soft Panel page is entered, items (1) & (2) will automatically read the active device settings.

Reading Value :
(4) Voltage: reads the device output voltage.
(5) Current: reads the device output current.
(6) Power: reads the device output power.
(7) CV/CC: reads the device status.
Items (4), (5) & (6) will automatically update the device output every second.

(8) Warning light: When an error occurs, the associated warning light will turn on.
(9) Reset: clears the warning light.

7.1.4 SCPI



The SCPI sends the command strings to the device to activate the function. See the device user's manual for the associated commands.

(1) SCPI command: The command input area.
(2) Send (password required): sends the command strings to the device to activate the function.
(3) Result: The return message display area. If the command sent to the device has a return value, it will display here.

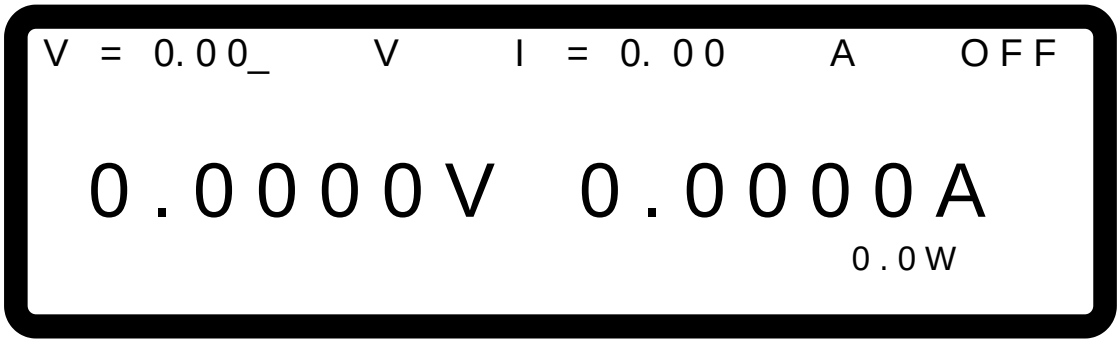
7.1.5 Remarks

(1) If the system password is blank, there is no need to enter the password.
(2) Once the entered password is confirmed, the rest of the functions that are protected by the password will not ask for password confirmation again unless the password is reset or the web page is logged into again.

7.2 62020H-150S ETHERNET Simple Operation

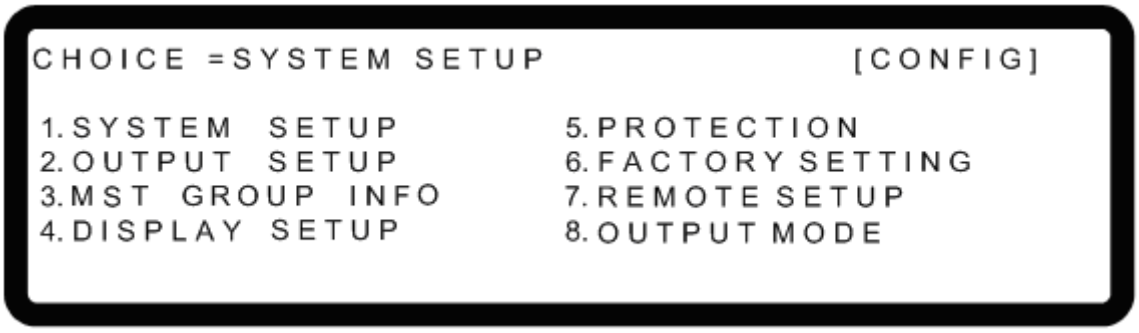
7.2.1 ETHERNET SETUP Page

Turn ON the DC Power Supply and wait for a few seconds before entering the MAIN PAGE.

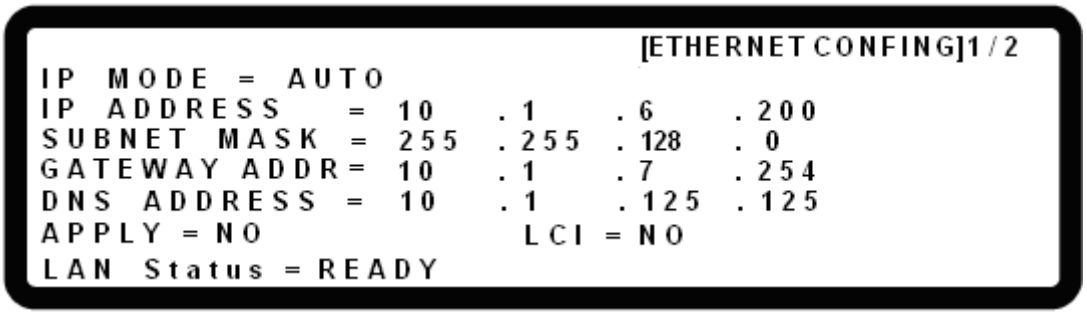


In the MAIN PAGE, press **CONFIG** to go to the CONFIG page.

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



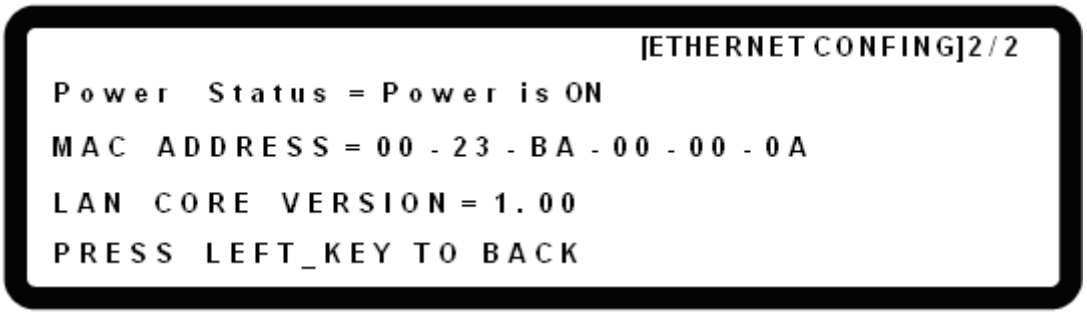
In the SYSTEM SETUP page, select ETHERNET = CONFIG and press **ENTER** to go to the [ETHERNET CONFIG] 1/2 page.



Note The ETHERNET configuration and network identification functions are set and displayed in this page.

7.2.2 Power Indicator & MAC Address Display

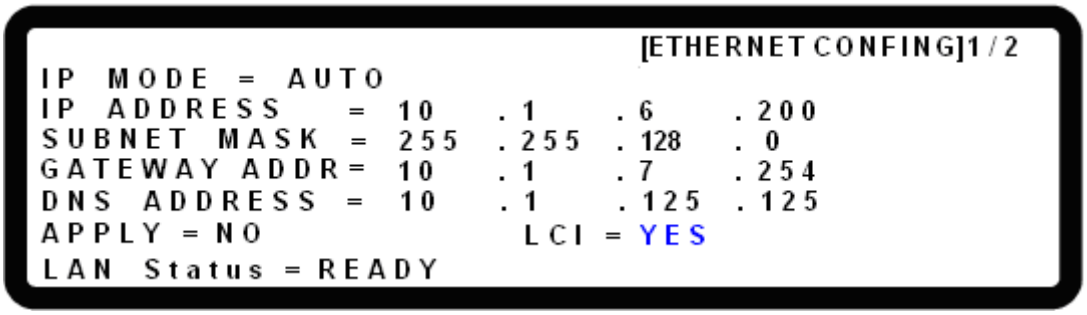
Continue to press [↓→] in the [ETHERNET CONFIG] 1/2 page to go to the [ETHERNET CONFIG] 2/2 page. This page shows the Power Status and MAC address.



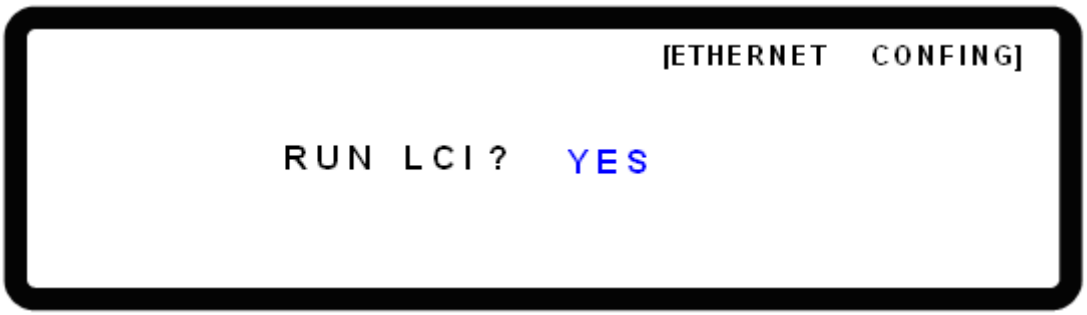
Press [←↑] to return to the [ETHERNET CONFIG] 1/2 page.

7.3 LAN Configuration Initialize (LCI) Function

Continue to press [↓→] in the [ETHERNET CONFIG] 1/2 page until it reaches LCI, turn the rotary knob to YES and press **ENTER**. The RUN LCI? page will appear.

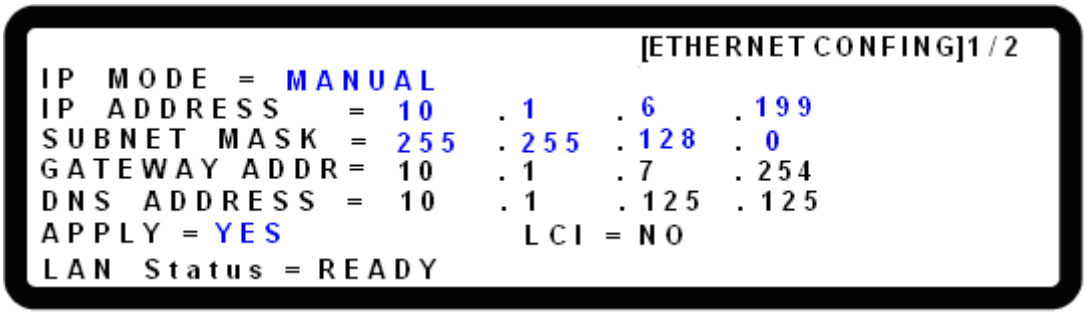


Turn the rotary knob to YES and press **ENTER** to execute the LCI function.



While the network is initializing the display will show LAN Status = SETTING. Once the settings are completed, the display will return to LAN Status = READY.

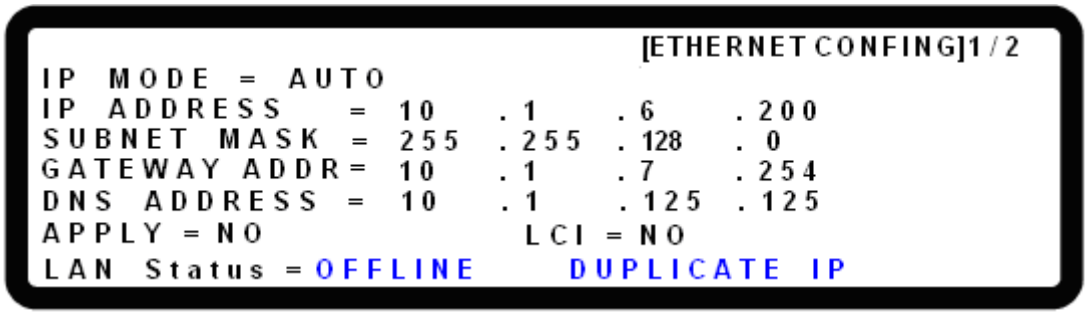
7.3.1 IP Settings



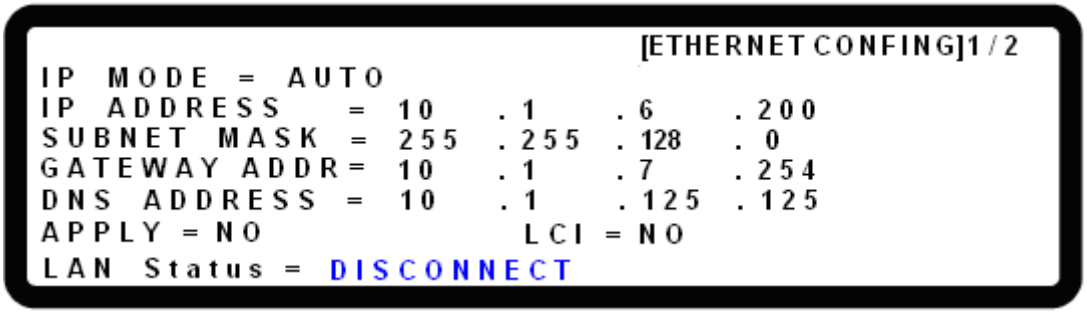
The IP settings can be changed in the [ETHERNET CONFIG] 1/2 page. The settings for each item can be adjusted by the rotary knob, and the ←↑ ↓→ keys can be used to select the item to be modified. (The network settings will be applied if the IP MODE is set to MANUAL. If the IP MODE is set to AUTO, the network settings will be ignored.) When the modifications are done, go to APPLY and turn the rotary knob to YES and press **ENTER** to update the network configuration. During update the display will show LAN Status = SETTING and then return to LAN Status = READY when the update is done.

7.3.2 Status Indicator

"RENEWAL FAIL" will display in the lower right corner when DHCP Lease Renewal fails.
"DUPLICATE IP" will display in the lower right corner when a Duplicate IP Address is detected.



"DISCONNECT" will display in the lower left corner when the Ethernet cable is unplugged.
"READY" will display in the lower left corner when there is No Fault (Normal Operation.)



8. Self Test & Troubleshooting

8.1 Overview

Follow the steps described in this chapter to inspect the instrument and troubleshoot a problem if the 62000H Series DC Power Supply with Solar Array Simulation is not operating normally. Consult the sales agent or distributor if the information provided in this manual does not resolve the problem.

8.2 Troubleshooting

Operational problems and suggestions for resolution:

Problem	Cause	Resolution
Incorrect measurement for V, I	Invalid readings due to aged components.	Supply requires calibration. See section 3.3.7 Calibration.
Output is not within SPEC accuracy.	Invalid readings due to aged components.	Supply requires 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. or OPP settings.	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 increase the OCP settings.
Fan Fail Protection (FAN LOCK)	1. The fan is out of order. 2. The feedback circuit is abnormal.	Contact your local sales agent if the protection state cannot be reset.
Input Error Protection 1 AC FAULT	The voltage of the AC input line is either too low or too high.	Adjust the voltage if it exceeds the spec. when measuring the input voltage.
No output voltage	1. The output voltage feedback is abnormal. 2. The D/D power stage is damaged.	Contact your local sales agent if the protection state cannot be reset.
Over Voltage Protection (OVP)	The output voltage exceeds the spec. or OVP settings.	Check the OVP settings. Contact your local sales agent if the protection state cannot be reset.
Unable to control DC Power Supply via GPIB	1. The address of DC Power Supply is incorrect. 2. The GPIB cable is loose or disconnected	1. Update the address. 2. Check the cable connection and secure it with screws.
Current sharing cable connection error (C/S CABLE ERR.)	1. The current sharing cable is connected when used in series mode.	1. Check if the cables are connected correctly. 2. Contact your local sales

Problem	Cause	Resolution
	2. The current sharing cable is not connected when used in parallel mode. 3. The current sharing cable is connected when used in standalone mode.	agent for further assistance.
Current sharing error protection (CURR. SHARING ERR.)	1. The current sharing cable is not connected when used in parallel mode. 2. Calibration error. 3. The D/D power stage is damaged.	1. Check if the cables are connected correctly. 2. See section 3.3.7.3 Calibration. 3. Contact your local sales agent for further assistance.
D/D power stage error protection (D/D FAULT)	1. The transient current is too large. 2. The D/D power stage is damaged.	1. If a D/D FAULT protection occurs, first turn off the power supply and remove the load. Make sure the cables are connected correctly and then power it on again. 2. Contact your local sales agent for further assistance.
MATCH warning that the models are incompatible when connected in series or parallel (ERROR!!! MASTER OR SLAVE NO MATCH)	The model numbers do not match.	1. Different model power supplies cannot be connected in series or parallel mode. 2. Contact your local sales agent for further assistance.
FPGA UPDATE! - version incompatible protection (FPGA IS TOO OLD,PLS UPDATE!)	The power supply's FPGA does not match with the F/W.	Contact your local sales agent for further assistance.

Appendix A APG & System Status Pin Assignment

The 25-pin connector is located on the rear panel. The pin definitions are shown in Figure A-1:

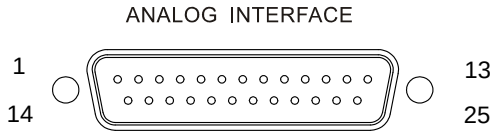


Figure A-1

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

(1) PIN 1: +12V API auxiliary power for APG only (maximum output current: 10mA); see section 3.3.1.1 for a detailed description.
(2) PIN 2: AVO_SET_R, voltage programming for APG only that allows users to set the “resistance form”; see section 3.3.1.1 for a detailed description.
(3) PIN 3: AVO_SET_C, voltage programming for APG only that allows users to set the “current form”; see section 3.3.1.1 for a detailed description.
(4) PIN 4: AVO_SET_V, voltage programming for APG only that allows users to set the “voltage form”; see section 3.3.1.1 for a detailed description.
(5) PIN 5: AVO_MEAS_C, voltage programming for APG only that allows users to set the “current form”; see section 3.3.1.1 for a detailed description.
(6) PIN 6: AVO_MEAS_V, voltage programming for APG only that allows users to set the “voltage form”; see 3.3.1.1 for a detailed description.
(7) PIN 7: N.C.
(8) PIN 8: PROG_TRIG, the external trigger signal (positive edge trigger) in program editing mode; see section 4.1.2.2 for a detailed description.
(9) PIN 9: _INHIBIT, this function uses Pin 9 of the ANALOG INTERFACE to turn off the Power Supply when outputting; see section 3.3.5.4 for a detailed description
(10) PIN 10: DCOUT_ON, when the DC Power Supply output is ON and the voltage exceeds VDC_R, Pin10 (DCOUT_ON) of SYSTEM STATUS on the rear panel will go HIGH. When the DC Power Supply output voltage is lower than the VDC_F setting, Pin10 (DCOUT_ON) of SYSTEM STATUS on the rear panel will go LOW; see 3.3.2.5 for a detailed description.
(11) PIN 11: CV_CC, this pin is HIGH when in CV mode and is LOW when in CC mode.

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

Appendix B List of Protection Messages

Protection	Message on Panel	Protection	Message on Panel
Over voltage	OVP	Abnormal input voltage	AC FAULT
Over current	OCP	Abnormal remote sense	SENSE FAULT
Over power	OPP	CV TO CC mode change	CV TO CC FOLDBACK
Over temperature	OTP	CC TO CV mode change	CC TO CV FOLDBACK
Fan fail	FANLOCK	Current sharing error	CURR. SHARING ERR.
Current sharing cable connecting error	C/S CABLE ERR.	D/D power stage error	D/D FAULT
FPGA UPDATE! version incompatible	FPGA IS TOO OLD, PLS UPDATE!	MATCH warning - the models are incompatible when connected in series or parallel	ERROR!!! MASTER OR SLAVE NO MATCH
REMOTE INHIBIT transition	IHB	SAFETY INT.LOCK transition	SAFETY INT.LOCK
EXTERNAL ON/OFF transition	EXT		

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