AMETEK®
PROGRAMMABLE POWER

Sorensen

SGX Series DC Power Supplies

Operation Manual

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Date and Revision

June 2018, A

Part Number

M551600-01

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Product Family: **M551600-01**

Warranty Period: **Five Years**

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- is used in combination with items, articles or materials not authorized by AMETEK.

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Product Return Procedure

1. Request a Return Material Authorization (RMA) number from the repair facility (**must be done in the country in which it was purchased**):
   - **In the USA**, contact the AMETEK Repair Department prior to the return of the product to AMETEK for repair:
   - Telephone: 800-733-5427, ext. 2295 or ext. 2463 (toll free North America)
     858-450-0085, ext. 2295 or ext. 2463 (direct)
   - **Outside the USA**, contact the nearest Authorized Service Center (ASC). A full listing can be found either through your local distributor or our website, www.programmablepower.com, by clicking Support and going to the Service Centers tab.
2. When requesting an RMA, have the following information ready:
   - Model number
   - Serial number
   - Description of the problem

Note: Unauthorized returns will not be accepted and will be returned at the shipper’s expense.

Note: A returned product found upon inspection by AMETEK, to be in specification is subject to an evaluation fee and applicable freight charges.

IMPORTANT SAFETY INSTRUCTIONS

Before applying power to the system, verify that your product is configured properly for your particular application.

WARNING!

Hazardous voltages might be present when covers are removed. Qualified personnel must use extreme caution when servicing this equipment. Circuitry, test points, and output voltages might be floating with respect to chassis ground. Do not touch electrical circuits, and use appropriately rated test equipment. A safety ground wire must be connected from the chassis to the AC mains input when servicing this equipment.

WARNING!

This equipment contains ESD sensitive input/output connection ports. When installing equipment, follow ESD safety procedures. Electrostatic discharges might cause damage to the equipment.

Only *qualified personnel,* who understand and deal with attendant hazards in power supplies, can perform installation and servicing.

Ensure that the AC mains input ground is connected properly to the chassis safety ground connection. Similarly, other power ground lines, including those to application and maintenance equipment, *must* be grounded properly for both personnel and equipment safety. Always ensure that facility AC mains input is de-energized prior to connecting or disconnecting any cable.

In normal operation from the front panel, the operator does not have access to hazardous voltages within the chassis. However, depending on the application configuration, **HIGH VOLTAGES HAZARDOUS TO HUMAN SAFETY** might be normally generated on the output terminals. The user must ensure that the output power lines are labeled properly as to the safety hazards and that any possibility for inadvertent contact with hazardous voltages is eliminated.

Guard against risks of electrical shock during open cover checks by not touching any portion of the electrical circuits. Even when power is off, capacitors may retain an electrical charge. Use safety glasses during open cover checks to avoid personal injury by any sudden component failure.

Neither AMETEK Programmable Power Inc., San Diego, California, USA, or any of the subsidiary sales organizations, can accept any responsibility for personnel, material or inconsequential injury, loss or damage that results from improper use of the equipment and accessories.

SAFETY SYMBOLS

WARNING: Electrical Shock Hazard

HAZARD: Strong oxidizer

GENERAL WARNING/CAUTION: Read the accompanying message for specific information.

BURN HAZARD: Hot Surface Warning. Allow to cool before servicing.

DO NOT TOUCH: Touching some parts of the instrument without protection or proper tools could result in damage to the part(s) and/or the instrument.

TECHNICIAN SYMBOL: All operations marked with this symbol are to be performed by qualified maintenance personnel only.

ELECTRICAL GROUND: This symbol inside the instrument marks the central safety grounding point for the instrument.

FCC NOTICE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ABOUT THIS MANUAL AND REGULATORY COMPLIANCE

This manual has been written for the Sorensen SGX Series of power supplies, which have been designed and certified to meet the Low Voltage and Electromagnetic Compatibility Directive Requirements of the European Community.

These models have been designed and tested to meet the Electromagnetic Compatibility directive (European Council directive 2014/30/EU; generally referred to as the EMC directive) and to the requirements of the Low Voltage directive (European Council directive 2014/35/EU, 93/68/EEC, dated 22 July 1993). In addition, these models have been found compliant with FCC 47 CFR Part 15, Subpart B107(e) Class A, 109(g) Class A.

Since the Low Voltage Directive is to ensure the safety of the equipment operator, universal graphic symbols have been used both on the unit itself and in this manual to warn the operator of potentially hazardous situations (see Safety Instruction page).

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1 OVERVIEW

1.1 General Description

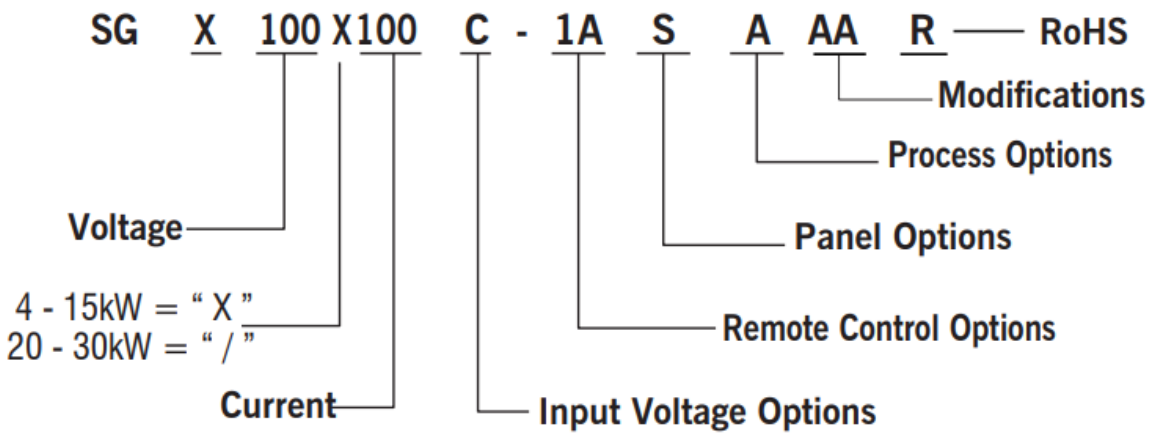
The Sorensen SGX Series represents the next generation of high power programmable DC power supplies. The SGX Series is designed for exceptional load transient response, low noise and the highest power density in the industry. With a full 15 kW available down to 20 V output in a 3U package the SGX leads the industry in power density. The power density is enhanced by a stylish front air intake allowing supplies to be stacked without any required clearance between units. At the heart of the SGX series is a 5 kW power module. Depending on the output voltage, one to six modules can be configured in a single chassis to deliver 5 kW to 30 kW of power. Combinations of these chassis can then be easily paralleled to achieve power levels up to 150 kW. Paralleled units operate like one single supply providing total system current.

The SGX combines onboard intelligent controls with the outstanding power electronics common to all SG family supplies. These controls enable sophisticated sequencing, constant power mode and save/recall of instrument settings. Looping of sequences makes the SGX ideal for repetitive testing.

The SGX Series is operated from the intuitive, easy-to-use front panel touch screen display. Quickly access output programming parameters, measurements, sequencing, configuration and system settings from the touch screen interface. Functions and parameters can be directly selected from the touch screen or by using the encoder selector button. The control resolution is adjusted by a dynamic rate change algorithm that combines the benefits of precise control over small parameter changes with quick sweeps through the entire range.

Additionally, the instrument can be controlled via LXI Ethernet and RS232 standard control interfaces, as well as through the optional GPIB control interface.

Refer to Figure 1-1 for decoding of the SGX Series model number.



For units up to 999 V/999 A, voltage and current are represented in numeric format, e.g., "100" represents 100 V. For units at 1000 V/1000 A and above, the voltage and current are represented by the format "xKx", e.g., "1K0" represents 1000 V.

Option	Description
Input Options	C: Input Voltage 208/230 VAC, 3-Phase D: Input Voltage 380/400 VAC, 3-Phase E: Input Voltage 440/480 VAC, 3-Phase
Remote Control Options	0A: No Option 1A: IEEE-488.2 1D: Isolated Analog Control 2A: Combined Options 1A+1D **Note:** SGX comes default with RS-232C and Ethernet.
Process Options	A: No option B: Certificate of Calibration (includes test data)
Modifications	CV: 400Hz AC input at 208 VAC for 6U units only; does not carry CE, CSA or UL certification; (standard in 3U models)

Figure 1-1. Model Number Decoding

1.2 Specifications

The following subsections provide environmental, electrical, and physical characteristics for the SGX Series power supplies.

Note: Specifications are subject to change without notice.

Note: The SGX Series power supplies are intended for indoor use only. Refer to Section 2.3 for use/location requirements.

1.2.1 Environmental Characteristics

Parameter	Specification
Ambient Temperature	
Operating	0 to 50°C
Storage	-25° to 65°C
Cooling	Forced convection with internal, linearly-variable-speed fans; vents on front, sides and rear; units may be stacked without clearance above or below.
Humidity	95% maximum, non-condensing, 0 to 50°C; 45°C maximum wet-bulb temperature.
Altitude	5,000 ft (1,524 m) operating at full rated output power, derate 10% of full power for every 1,000 ft (3,048 m) higher; non-operating to 40,000 ft (12,192m)

1.2.2 Regulatory Agency Compliance:

EMC	CE marked for EMC Directive 89/336/EEC per EN61326-1:2013, Class-A for emissions and immunity as required for the EU CE Mark.
Safety	CSA NRTL certified for US and Canada to CAN/CSA-C22.2 No. 61010-1-12, UL 61010-1 Third Edition. CE marked for LVD compliance 2006/95/EC to EN 61010-1 Third Edition as required for the EU CE mark.
CE Mark LVD Categories	Installation Overvoltage Category: II; Pollution Degree: 2; Class II equipment; indoor use only.
RoHS	CE marked for compliance with EU Directive 2011/65/EU for Restriction of Hazardous Substances in Electrical and Electronic Equipment.

1.2.3 Electrical Characteristics

Note: Specifications values are valid from 5% of the full-scale value unless otherwise specified.

Note: Output voltage accuracy, regulation and stability specifications are valid at the point where the remote sense leads are connected.

Parameter	Specification
Input Power	
Voltage	208/230 VAC ±10%, allowed range 187-253 VAC; 380/400 VAC ±10%, allowed range 342-440 VAC; 440/480 VAC ±10%, allowed range 396-528 VAC
Frequency	47 Hz to 63 Hz; 400 Hz at 208 VAC for 3U models; 400 Hz at 208 VAC for 6U models is an optional modification (“CV” in model number) and does not carry CE, UL or CSA markings
Configuration	3–phase, 3–wire plus ground; not phase rotation sensitive; neutral not used.

Parameter	Specification
Power Factor (at full rated load; 50/60Hz)	0.90, typical, for all AC input ratings. Power factor is not solely determined by power supply input characteristics, but is dependent on the level of DC output power and interaction with the source impedance of AC mains.
Efficiency	87%, typical, at full load, nominal AC line
Hold-Up Time	1/2 cycle, typical, for loss of all three phases (6.4 ms, typical for 800V/1000V models); 3 cycle, typical, for loss of one phase; sustained missing phase will result in shutdown of the output.
Rated Output Power	4-12 kW for 3U chassis for 10V and 15V models; 5-15 kW for 3U chassis for 20V - 1000V models; 16-24 kW for 6U chassis for 10V and 15V models; 20-30 kW for 6U chassis for 20V - 1000V models; maximum output power is the product of the rated output voltage and current; for specific values refer to Section 1.2.4.
Load Regulation (specified for ±100% rated load change, at nominal AC input voltage)	
Voltage	±0.05%, maximum, of rated output voltage for 10V- 30V models; ±0.02%, maximum, of rated output voltage for 40V-1000V models
Current	±0.1%, maximum, of rated output current
Line Regulation (specified for ±10% change of nominal AC line voltage, at constant load)	
Voltage	±0.05%, maximum, of rated output voltage for 10V-30V models; ±0.01%, maximum, of rated output voltage for 40V-1000V models
Current	±0.05%, maximum, of rated output current
Temperature Coefficient	
Voltage	±0.02%/°C, typical, of rated output voltage
Current	±0.03%/°C, typical, of rated output current
Stability	±0.05%, typical, of rated output voltage or current, over 8 hrs at fixed line, load, and temperature, after 30 min warm-up
Output Voltage Ripple/Noise	Refer to Ripple/Noise specifications in tables of Section 1.2.4.
Load Transient Response	1 ms, typical, to recover within 0.75% of rated output voltage for load step change of 50% of rated output current
Output Voltage Rise Time (with rated load, resistive; current rise time same)	10 ms, maximum, from 10-90% of programming change from zero to rated output voltage for 10V-30V models; 100 ms, maximum, from 5-95% of programming change from zero to rated output voltage for 40V-1000V models; contact factory for values of specific models
Output Voltage Fall Time (with rated load, resistive; current fall time same)	10 ms, maximum, from 90-10% of programming change from rated output voltage to zero for 10V-30V models; contact factory for values of specific models
Output Voltage Fall Time (with no load)	50 ms, maximum, from 90-10% of programming change from rated output voltage to zero for 10V-30V models; 1.5 s, typical, from 100% to 10% of programming change from rated output voltage to zero for 40V-1000V models;

Parameter	Specification
	contact factory for values of specific models
Front Panel Display	
Display	TFT color graphics display with backlight and pressure-actuated touch-screen having menu-driven settings and functions.
Voltage Accuracy (to actual output)	±(0.15% of rated output voltage + 0.1% of actual output + 1 digit) for 10V-30V models; ±(0.1%, maximum, of rated output voltage + 1 digit) for 40V-1000V models
Current Accuracy (to actual output)	±(0.4%, maximum, of rated output voltage + 1 digit)
Front Panel Programming	
Voltage	±(0.1% of rated output voltage + 0.1% of actual output voltage) for 10V-30V models; ±0.1%, maximum, of rated output voltage for 40V-1000V models
Current	±(0.4% of rated output current + 0.1% of actual output current) for 10V-30V models; ±0.4%, maximum, of rated output current for 40V-1000V models
Overvoltage Protection (OVP)	±1%, maximum, of rated output voltage
Remote Sensing	
Connection	Voltage accuracy/regulation specifications apply at the point where the remote sense leads are connected.
Line Drop	1 V, maximum per line for 10V-20V models; 1.5 V, maximum per line for 30V model; 5%, maximum of rated output voltage per line for models, 40V to less than 160V; 2%, maximum of rated output voltage per line for models greater than or equal to 160V; greater level of line drop is allowed, but output voltage regulation specifications no longer apply.
Line Drop Effect on Output Voltage	Rated output voltage applies at the rear panel output terminals, and line drop voltage subtracts from the voltage available at the load terminals
Remote Analog Interface	
Programming Accuracy	
Voltage	±0.25%, maximum, of rated output voltage for 0-5 VDC range, and ±0.5%, maximum, for 0-10 VDC range
Current	±1.0%, maximum, of rated output current for 0-5 VDC range, and ±1.2%, maximum, for 0-10 VDC range for 10V-30V models; ±0.8%, maximum, of rated output current for 0-5 VDC range, and ±1.0%, maximum, for 0-10 VDC range for 40V-1000V models
Overvoltage Protection (OVP)	±1%, maximum, of rated output voltage

Parameter	Specification
Readback Monitor Accuracy	
Voltage (of actual output value)	±0.5%, maximum, of rated output voltage
Current (of actual output value)	±1%, maximum, of rated output current
Resistive-Control Programming	
Voltage	0–5 kΩ for 0-100% of rated output voltage
Current	0–5 kΩ for 0-100% of rated output current
Voltage-Control Programming	
Voltage	0–5 VDC or 0–10 VDC for 0-100% of rated output voltage
Current	0–5 VDC or 0–10 VDC for 0-100% of rated output current
Overvoltage Protection (OVP)	0.25–5.5 VDC for 5-110% or rated output voltage
Remote Control/Monitor Interface	On/Off control via contact closure, 6-120 VDC or 12-240 VAC, and TTL or CMOS gate; output voltage and current monitors; output voltage, current, and OVP programming; summary fault status
Output Isolation	
Output Float Voltage	
Negative Output Terminal	±300 V(PK), maximum, with respect to chassis ground; exceeding the limit will be detected as a fault by a protective supervisory monitor and shutdown of the output will be executed; this condition will be latched, requiring reset to resume normal operation.
Isolation of optional Isolated Analog Interface (J1) to output negative terminal	1000 V(PK), maximum; Isolated Analog Interface (J1 signals) are galvanically isolated from negative output terminal; operation of Isolated Analog Interface signals should be at SELV safety voltage conditions to chassis ground.
Reference of standard Non-Isolated Analog Interface (J1) to output negative terminal	The standard Non-Isolated Analog Interface (J1 signals) is connected to the negative output terminal and, therefore, is not isolated from the output.
Parallel Operation	
Parallel Group	Up to 5 units, of the same voltage rating, may be connected in parallel for additional output current; specifications apply as for single unit, with the exception that each additional paralleled unit will add 0.3% to the output current accuracy. Contact factory for applications requiring paralleling more than five units.
Series Operation	
Series Group	Up to 2 units, of the same current rating, may be connected in series for additional output voltage; see restrictions in Output Isolation section.

1.2.4 SGX Series Voltage and Current Specifications

The following tables present the specifications for rated voltage and current, and ripple/noise for the 10V-1000V models.

Rated Voltage, VDC	Rated Current, ADC						Ripple/ Noise** RMS, mV	Ripple/ Noise* PK–PK, mV
	4 kW	5 kW	8 kW	10 kW	12 kW	15 kW		
0-10††	0-400	N/A	0-800	N/A	0-1200	N/A	20	50
0-15††	0-267	N/A	0-534	N/A	0-801	N/A	20	50
0-20††	N/A	0-250	N/A	0-500	N/A	0-750	20	60
0-30††	N/A	0-167	N/A	0-334	N/A	0-501	20	60

Rated Voltage, VDC	Rated Current, ADC						Ripple/ Noise** RMS, mV	Ripple/ Noise* PK–PK, mV
	5 kW	10 kW	15 kW	20 kW	25 kW	30 kW		
0-40	0-125	0-250	0-375	0-500†	0-625†	0-750†	20	75
0-50	0-100	0-200	0-300	0-400†	0-500†	0-600†	20	75
0-60	0-83	0-167	0-250	0-333	0-417	0-500	20	75
0-80	0-63	0-125	0-188	0-250	0-313	0-375	20	100
0-100	0-50	0-100	0-150	0-200	0-250	0-300	20	100
0-160	0-31	0-63	0-94	0-125	0-156	0-188	25	150
0-200	0-25	0-50	0-75	0-100	0-125	0-150	25	175
0-250	0-20	0-40	0-60	0-80	0-100	0-120	30	200
0-300	0-17	0-33	0-50	0-67	0-83	0-100	30	200
0-330	0-15	0-30	0-45	0-61	0-76	0-91	30	200
0-400	0-12	0-25	0-38	0-50	0-63A	0-75	30	300
0-500	0-10	0-20	0-30	0-40	0-50	0-60	50	350
0-600	0-8	0-17	0-25	0-33	0-42	0-50	60	350
0-800	0-6.2	0-12.5	0-18.7	0-25†	0-31.2†	0-37.5†	80	500
0-1000	0-5	0-10	0-15	0-20†	0-25†	0-30†	100	650

* PK-PK ripple/noise, over 20 Hz to 20 MHz bandwidth, is measured across a 1 µF capacitor at the end of a 6' load cable with the supply operating at full load and nominal AC line voltage.

** RMS ripple/noise, over 20 Hz to 300 kHz bandwidth, is measured directly across the output terminals with the supply operating at full load and nominal AC input line voltage.

† Power level not available in 6U models, but could be produced with paralleled 3U units; up to 75 kW could be produced by paralleling up to five units. Paralleling will increase ripple/noise.

†† Models from 10V-30V are not available in 6U chassis.

1.2.5 Physical Characteristics

Dimensions	3U Models, 10V-30V	3U Models, 40V-1000V	6U Models, 60V-600V
Width	19.00 in (48.26 cm)	19.00 in (48.26 cm)	19.00 in (48.26 cm)
Depth	From inner surface of front panel to maximum protrusion of protective covers at rear panel; refer to installation drawings for chassis dimensions.		
	28.09 in (71.35 cm)	25.46 in (64.67 cm)	27.18 in (69.04 cm)
Height	5.25 in (13.34 cm)	5.25 in (13.34 cm)	10.5 in (26.67 cm)
Weight (nominal)	≤ 65 lb (29 kg), (4 kW, 10V, 15V) ≤ 65 lb (29 kg), (5 kW, 20V, 30V) ≤ 85 lb (39 kg), (8 kW, 10V, 15V) ≤ 85 lb (39 kg), (10 kW, 20V, 30V) ≤ 110 lb (50 kg), (12 kW, 10V, 15V) ≤ 110 lb (50 kg), (15 kW, 20V, 30V)	≤ 60 lb (27 kg), (5 kW) ≤ 75 lb (34 kg), (10 kW) ≤ 90 lb (41 kg), (15 kW)	≤ 140 lb (63 kg), (20 KW) ≤ 155 lb (70 kg), (25 kW) ≤ 170 lb (77 kg), (30 kW)
Shipping Weight	Contact factory for weights of specific models		

2 INSTALLATION

2.1 Inspection

Inspect the shipping carton for possible damage before unpacking the unit. Carefully unpack the equipment. Save all packing materials until inspection is complete. Verify that all items listed on the packing slips have been received. Visually inspect all exterior surfaces for broken knobs, connectors, or display. Inspect for dented or damaged exterior surfaces. External damage may be an indication of internal damage. If any damage is evident, immediately contact the carrier that delivered the unit and submit a damage report. Failure to do so could invalidate future claims. Direct repair issues to Customer Service at 858-458-0223 (local) or 1-800-733-5427 (toll free in North America).

2.2 Contents of Shipment

Depending on the model, configuration, and options available for your SGX Series power supply, the ship kit may include additional parts and accessories.

Minimum items included in the ship kit:

- AMETEK manuals CD-ROM (P/N M550008-01) containing the SGX Series DC Power Supplies Operation Manual (this manual, P/N M551600-01), and the SG manual for the digital interface options, IEEE 488.2/RS232 and Ethernet Programming Manual (P/N M551601-01).

1. Sense mating connector:
   10V-800V models, (Molex P/N 39-01-4031) with loose contacts (Molex P/N 39-00-0182)
   1000V model, (Molex P/N 39-01-4041) with loose contacts (Molex P/N 39-01-0182)

2. J1 mating connector (Cinch P/N DB25P or equivalent) normally shipped attached to rear panel J1

3. Backshell for J1 (DB25) mating connector (Cinch P/N DCH-B-001 or equivalent)

4. Hardware for input/output terminal power connections:
   3U, 4-15 kW, 10V-30V models: 1/2-13UNC-2B x 1.25" long, 4 ea, with nut, washer, and lockwasher;
   3U, 5-15 kW, 40V-600V models: 3/8-16UNC-2B x 1.0”, 2 ea, with nut, washer, and lockwasher;

3U, 5-15 kW, 800V and 1000V models have studs, 1/4-20UNC-2B, 2 ea, with nut, washer, and lockwasher installed on rear panel;

6U, 20-30 kW: 3/8-16UNC-2B x 0.875", 2 ea, with nut and lockwasher, for DC output; 1/4-20UNC-2B, 4 ea, with Keps nut for AC input.

5. Front panel rack fastener, black screw:
   3U, 10V -1000V models: 10-32UNC-2B x 0.5”, 4 ea;
   6U, 20-30 kW: 10-32UNC-2B x 0.5”, 8 ea.

Note: If any of these parts are missing, contact Customer Service at 858458-0223 (local) or 1-800-733-5427 (toll free).

Optional accessories:

890-453-03: Paralleling Cable (for up to 5 units, requires one cable per unit placed in parallel)

K550212-01R: 3U Rack Slides (for 4 kW to 15 kW models)

K550213-01R: 6U Rack Slides (for 20 kW to 30 kW models)

5551082-01R: Optional AC input cover kit - 3U models only

2.3 Location and Mounting

Refer to Sections 2.7 for dimensional and installation drawings.

	WARNING! This unit is intended for installation in a protected environment. Exposure to conductive contaminants or corrosive compounds/gases that could be ingested into the chassis could result in internal damage. To reduce the risk of fire or electrical shock, install the SGX Series unit in a temperature and humidity controlled indoor area.
	CAUTION! The unit should be provided with proper ventilation. The rear and both sides of the unit should be free of obstructions. To ensure proper airflow, a minimum 4" clearance from the rear air outlet is required. The unit should not be installed in an ambient temperature greater than 50°C.
	CAUTION! No user serviceable parts inside; service to be performed by qualified personnel only.

2.3.1 Rack Mounting

The SGX Series models are designed for mounting in a standard 19-inch equipment rack compliant to EIA-310. If additional instrumentation is mounted in the rack, no additional clearance is required above or below the SGX Series units.

Support the SGX Series unit using appropriate L-brackets or rack mount slides; suggested slides kits are listed as follows:

Rack Mount Slide Kit (Option):

3U models, 4–15 kW: AMETEK part number K550212-01R
6U models, 20–30 kW: AMETEK part number K550213-01R

2.3.2 K550212-01R ASSEMBLY STEPS (OPTION KIT)

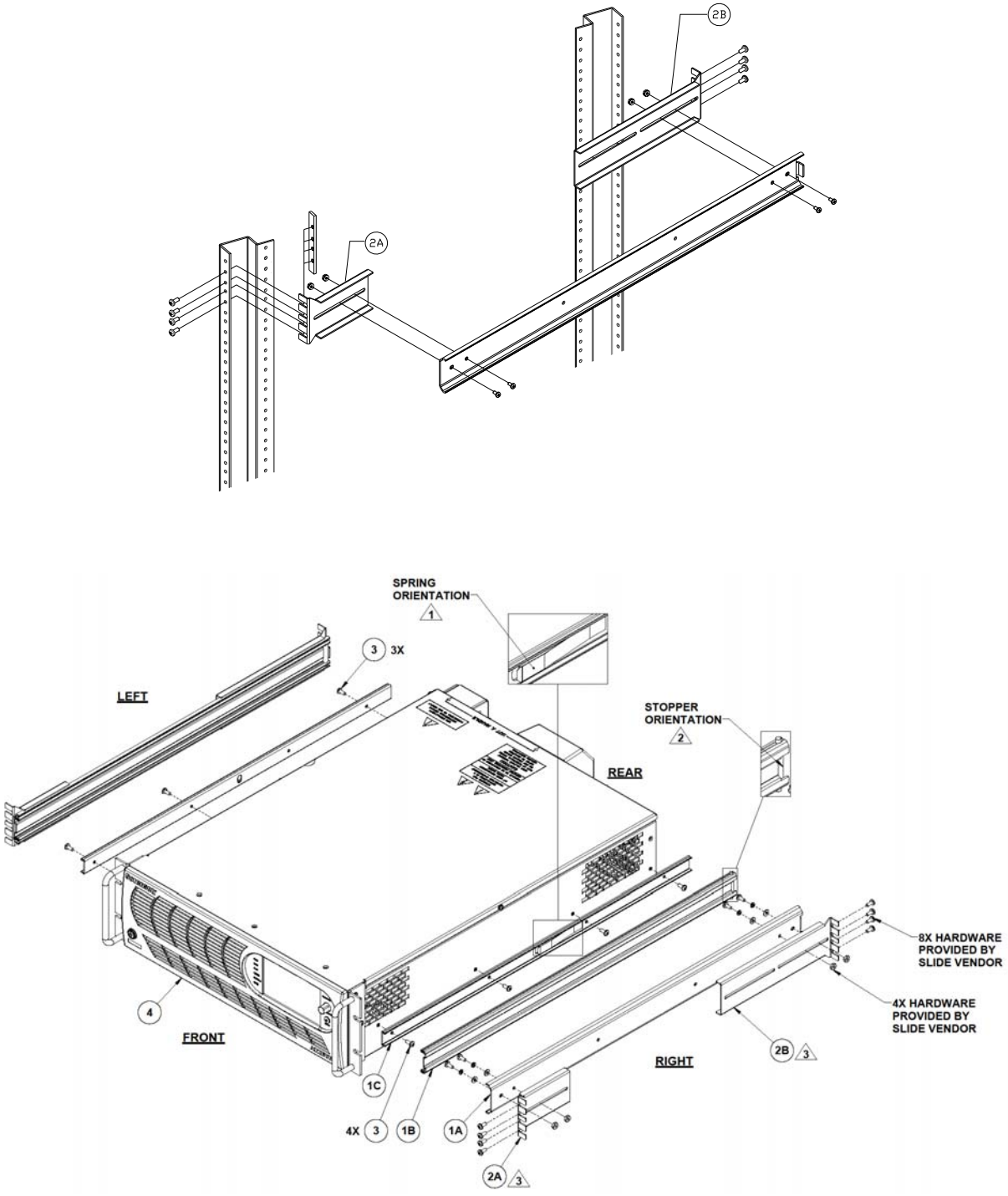


Figure 2-1. Rack Mount Assembly for 3U Models

WARNING!
A minimum two-person lift is required for the 3U SGX Series power supply, which weighs up to 110 lb (50 kg) depending on the model.

Refer to Figure 2-1 for 3U rack mount assembly drawing for the following instructions:

1. Install the slide sections, (1C), on both sides of the power supply chassis with screws (three on left side and four on right side). Ensure that the latch spring orientation is as shown in Note 1.
2. Install the brackets, (2A) and (2B), to the stationary slide sections, (1A), with the hardware provided by the slide supplier as shown in Note 3.
3. Ensure that stopper orientation of slide sections, (1B), is as shown in Note 2. Adjust the location of the mounting brackets as required for the particular type of cabinet vertical rails utilized.
4. Mount the stationary slide sections, (1A), (with brackets already installed) into the cabinet using appropriate hardware (e.g. bar nuts, cage nuts, clip nuts), while ensuring that they are level front to back and left to right of the cabinet rails.
5. Insert power supply chassis with slide sections, (1C), into slide sections, (1B)
6. Secure the front panel of the power supply chassis to the cabinet rack rails using the screws provided in the ship kit.

2.3.3 Chassis Removal from Rack

WARNING!
A minimum two-person lift is required for the 3U SGX Series power supply, which weighs up to 110 lb (50 kg) depending on the model.
A minimum three-person lift is required for the 6U SGX Series unit, which weighs up to 170 lb (77 kg) depending on the model.

The slides have a front disconnect feature and lock at full extension. To disconnect and remove the chassis from the rack, depress the flat steel spring (located on the slides) inward, and pull the chassis forward. To return the chassis back into the rack from full extension, depress the flat steel spring (located on the slides) inward, and push the chassis back.

When the chassis is at full extension, the flat springs are located behind the front rack rails. Retract the springs with a flat blade screwdriver or similar device to release from lock-out or to remove the chassis from the rack.

2.4 Input/Output Connections

Refer to Table 2–1 for AC input current requirements and Section 1.2.4 for output current specifications. Table 2–2 provides information on the external input and output connections for the SGX Series models. Table 2–3 provides input connections descriptions and Table 2–4 provides output connection descriptions. Refer to Table 2–5 for input/output lug recommendations. The recommended tools for crimping and extraction of the sense connector pins are listed below in Table 2–6.

	WARNING! High voltage present at rear panel! Risk of electrical shock. Do not remove protective covers on AC input or DC output. Refer to qualified service personnel.
	WARNING! The input and output voltages at the rear panel of the unit might be HAZARDOUS LIVE. When rack-mounting or panel-mounting the unit, suitable safeguards must be taken by the installer to ensure that HAZARDOUS LIVE voltages are not OPERATOR accessible. OPERATOR access should only be to the front panel of the unit.
	WARNING! A safety disconnect device for the AC mains input must be installed so that it is readily accessible to the user
	WARNING! A properly sized input overcurrent protection device must be installed at the AC mains input, either a circuit breaker or fuse having a rating of 25% over the maximum AC input line currents listed in Table 2–1.
	WARNING! To prevent an electrical shock hazard, a safety ground wire must be connected from the safety ground stud on the rear panel to the AC mains ground.
	CAUTION! Under no condition should the negative output terminal exceed 300V to earth ground. Floating the negative output terminal subjects the internal control circuitry of the power supply to the same potential as present at the negative output terminal. In a unit with the standard Non-Isolated Analog Interface, the signals of control connector, J1, would float at the same potential as the negative output terminal. Damage might occur if the signals of the Non-Isolated Analog control connector are connected to an external ground referenced device, due to unintentional ground loop currents that this connection could generate. To correct ground loop problems, it is advised to use the optional Isolated Analog Interface in order to isolate the external signals from the internal control circuitry of the supply. Refer to section 1.2.3 for additional information.

Model Ratings			Input Line Current, A (RMS)*					
Voltage Model	**AC Input Option Code**	**Input Voltage, VAC**	**5 kW**	**10 kW**	**15 kW**	**20 kW**	**25 kW**	**30 kW**
40V-1000V	C	208/230	20	39	59	79	98	118
	D	380/400	11	22	32	43	54	65
	E	440/480	9	19	28	37	47	56
			4 kW	**8 kW**	**12 kW**	**5 kW**	**10 kW**	**15 kW**
10V-15V	C	208/230	16	32	47	N/A	N/A	N/A
	D	380/400	9	17	26	N/A	N/A	N/A
	E	440/480	7	15	22	N/A	N/A	N/A
20V-30V	C	208/230	N/A	N/A	N/A	20	39	59
	D	380/400	N/A	N/A	N/A	11	22	32
	E	440/480	N/A	N/A	N/A	9	19	28
* AC input current could vary as a result of actual power factor; refer to specifications section for power factor dependency								

Table 2–1. Maximum AC Current Ratings

Connector	Function	Connection
L1 – AC, L2 – AC, L3 – AC, Chassis - GND	AC input power; see Table 2–3	AC mains 3-phase input
Pos. Bus Bar, Neg. Bus Bar	DC output power; see Table 2–4	User load
Analog Interface Connector (J1)	Control interface; see Table 3–4	User controller
Remote Sense Connector	Remote voltage sensing; see Section 3.10	Output load
Parallel In/Out	Parallel operation; see Section 3.12	Master/Slave units
External User Control Signal Connector	External relay interface, Trigger IN, Trigger OUT, Foldback status and shutdown input. Refer to Table 3–5	External digital interface

Table 2–2. Input/Output Connectors

Power Supply Type	Connections	Connection Description
4 kW to 15 kW, 3U	AC Input	Feed-Through terminal block with compression terminals
20 kW to 30 kW, 6U	AC Input	Bus Bar with holes for 1/4"–20 bolts
All 3U and 6U	Chassis Safety Ground	1/4-20 stud

Table 2–3. Input Terminal Connections

CAUTION!
To prevent damage to the AC input connector of the 3U units, follow torque specifications, and, if a wire ferrule is used, ensure that it is properly sized and that it has been crimped with the appropriate ferrule crimping tool.

AC Input Connector for 3U Models

- Recommended torque for the AC input connector screws: 17.7 in-lb to 20.4 in-lb (2 Nm to 2.3 Nm).
- Wire ferrules are recommended, properly sized to match the wire gauge; use appropriate crimp tool for the ferrule size.
- Wire insulation should be stripped to 5/8", maximum.
- For more information on the AC input connector, refer to the manufacturer (Phoenix Contact) part number HDFKV 16 at their website, www.phoenixcontact.com.

Power Supply Type	Connection Description
4 kW to 15 kW, 10V-30V models	Bus bars with two holes for 1/2" bolts on each terminal (POS. and NEG.)
5 kW to 15 kW, 40V-1000V models	40V-600V models: bus bars with single holes for 3/8" bolts on each terminal (POS. and NEG.) 800V and 1000V models: 1/4-20 studs for each terminal (POS. and NEG.)
20 kW to 30 kW	Bus bars with single holes for 3/8" bolts for each terminal (POS. and NEG.)

Table 2–4. Output Terminal Connections

Manufacturer	Low Current	High Current
Panduit	P, PV, or PN series, or equivalent	Standard stranded wire: LCA Series, or equivalent Flexible stranded wire: LCAX Series, or equivalent
Note: Contact lug manufacturer for recommended crimping tool.		

Table 2–5. Recommended Lugs

Tool	Manufacturer	Manufacturer P/N
Crimping	Molex	11-01-0197
Extracting	Molex	11-03-0044

Table* 2–6*. Recommended Sense Connector Tools

2.5 Wire Selection

Care must be taken to properly size all conductors for the input and output of the power supply. This section provides guidance in the selection of wire size.

CAUTION!
Cables with Class B or C stranding should be used. Fine-stranded (flexible) cables should not be used unless crimp-on lugs or ferrules are used that are approved for fine-stranded cables.

2.5.1 Wire Size

The tables below will assist in determining the appropriate wire size for both the input and output connections. Table 2–7 gives *minimum* recommended wire size; these recommendations are for copper wire only. This table is derived from the National Electrical Code, and is for reference only. Local laws and conditions may have different requirements. For higher ratings, wires can be paralleled; refer to the National Electrical Code for guidelines.

Size	**Temperature Rating of Copper Conductor**			
AWG	**60°C**	**75°C**	**85°C**	**90°C**
	Types: RUW, T, TW, UF	Types: FEPW, RHW, RH, RUH, THW, THWN, XHHW, USE, ZW	Types: V, MI	Types: TA, TBS, SA, AVB, SIS, FEP, FEPB, RHH, THHN, XHHW
	Current Rating, A(RMS)			
14	20	20	25	25
12	25	25	30	30
10	30	35	40	40
8	40	50	55	55
6	55	65	70	75
4	70	85	95	95
3	85	100	110	110
2	95	115	125	130
1	110	130	145	150
0	125	150	165	170
00	145	175	190	195
000	165	200	215	225
0000	195	230	250	260

Table 2–7. Minimum Wire Size

When determining the optimum cable specification for your power applications, the same engineering rules apply whether at the input or output of an electrical device. Thus, this guide applies equally to the AC input cable and DC output cable for this power supply and application loads.

Power cables must be able to safely carry maximum load current without overheating or causing insulation degradation. It is important to power supply performance to minimize IR (voltage drop) loss within the cable. These losses have a direct effect on the quality of power delivered to and from instruments and corresponding loads.

When specifying wire gauge, consider derating due to operating temperature at the wire location. Wire gauge current capability and insulation performance drops with the increased temperature developed within a cable bundle and with increased environmental temperature. Thus, short cables with generously derated gauge and insulation properties are recommended for power source applications.

Be careful when using published commercial utility wiring codes. These codes are designed for the internal wiring of homes and buildings and accommodate the safety factors of wiring loss, heat, breakdown insulation, aging, etc. However, these codes consider that up to 5% voltage drop is acceptable. Such a loss directly detracts from the quality performance specifications of this SGX power supply. Also, consider how the wiring codes apply to bundles of wire within a cable arrangement.

In high performance applications requiring high inrush/ transient currents, additional consideration is required. The cable wire gauge must accommodate peak currents developed at peak voltages, which might be up to ten times the average current values. An underrated wire gauge adds losses, which alter the inrush characteristics of the application and thus the expected performance.

Table 2–8 presents wire resistance and resulting cable voltage drop at maximum rated current, with the wire at 20°C. Copper wire has a temperature coefficient of α = 0.00393Ω/°C at t1 = 20°C, so that at an elevated temperature, t2, the resistance would be $R2 = R1 (1 + \alpha (t2 - t1))$.

Column 1	Column 2	Column 3	Column 4
Size, AWG	**A(RMS)**	**Ohms/100 Ft (One Way)**	**Voltage Drop/100 Ft (Column 2 x Column 3)**
14	20	0.253	5.06
12	25	0.156	3.90
10	30	0.999	3.00
8	40	0.063	2.52
6	55	0.040	2.20
4	70	0.025	1.75
3	85	0.020	1.70
2	95	0.016	1.52
1	110	0.012	1.32
0	125	0.010	1.25
00	145	0.008	1.16
000	165	0.006	0.99
0000	195	0.005	0.98

Table 2–8. Wire Resistance and Voltage Drop, 20°C

2.6 Load Considerations

This section provides guidelines for incorporating protective diode networks at the output of the power supply to prevent damage while driving inductive loads or loads having stored energy that could be circulated back to the power supply.

2.6.1 Inductive and Stored-Energy Loads

To prevent damage to the power supply from inductive voltage kickback, connect an anti-parallel diode (rated at greater than the supply's output voltage and current) across the output: Connect the cathode to the positive output and the anode to return.

Where positive load transients, such as back EMF from a motor might occur, or stored energy is present such as a battery, a second blocking diode in series with the output is recommended to protect the power supply.

2.6.1.1 BLOCKING AND ANTI-PARALLEL DIODES

Ensure that the chosen components are suitably rated for the particular inductance and energy to be dissipated. The Peak Reverse Voltage ratings should be a minimum of 2 times the Power Supply maximum output voltage. The Continuous Forward Current ratings should be a minimum of 1.5 times the power supply maximum output current. A heatsink may be required to dissipate the power caused by flow of current.

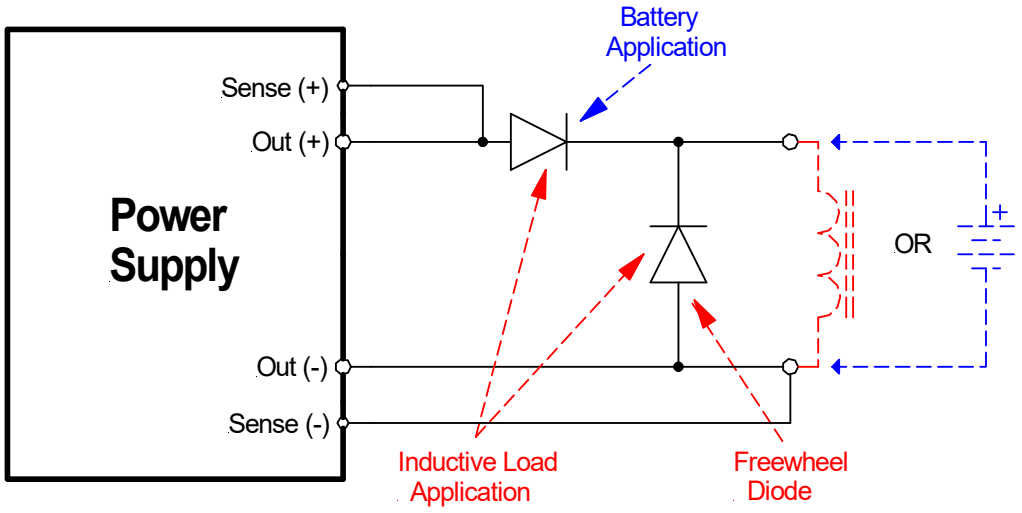


Figure 2-2. Diode Connection

2.7 Outline Drawings

Figure 2-3 through Figure 2-5 show the outlines and overall dimensions for installation of the 3U and 6U models of the SGX Series power supplies. Figure 2-6 through Figure 2-11 show locations of rear panel connectors. Figure 2-12 shows protective covers for the AC input and DC output of the 3U 10V-30V models.

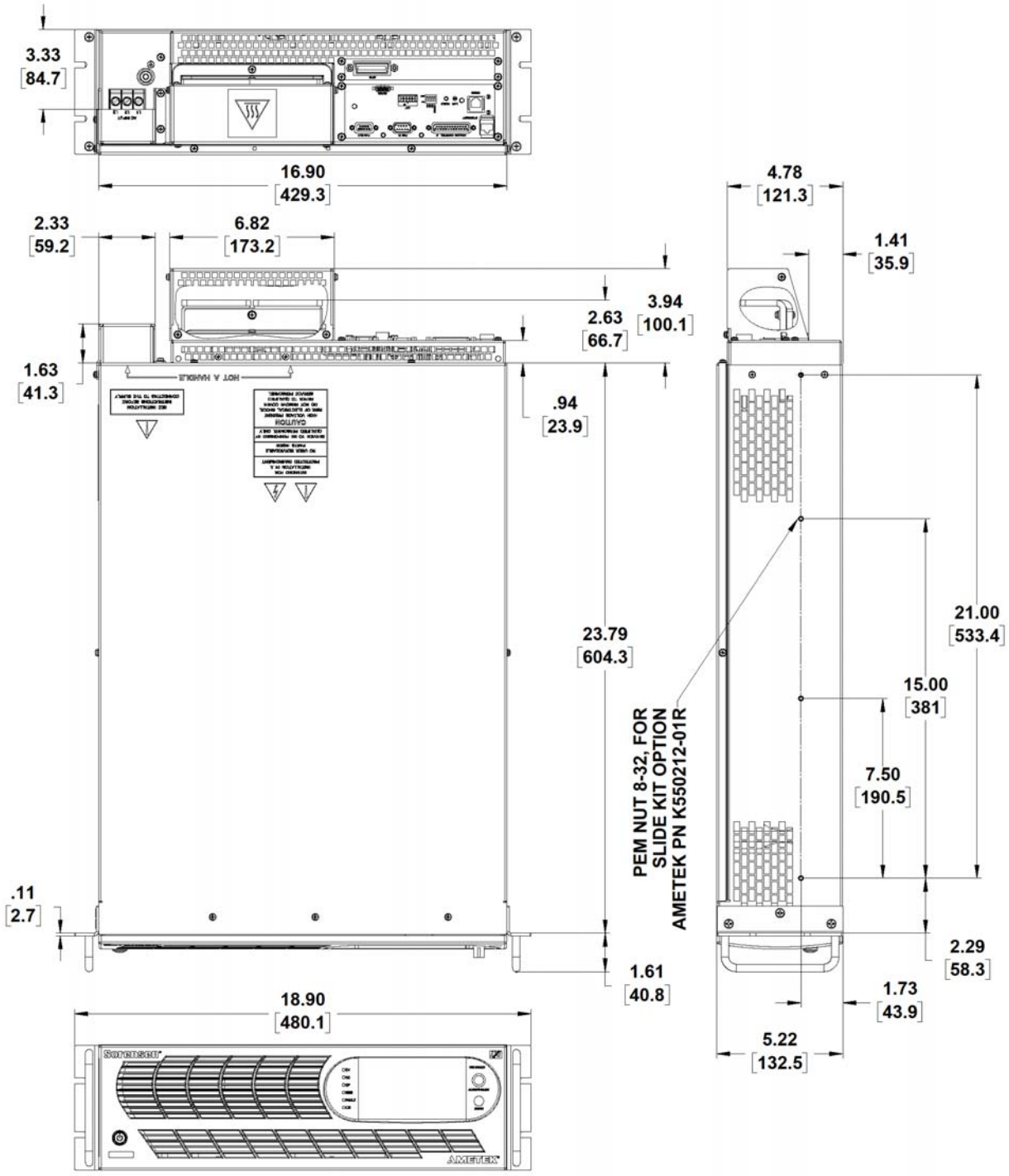


Figure 2-3. Installation Drawing, 3U Models 10V-30V

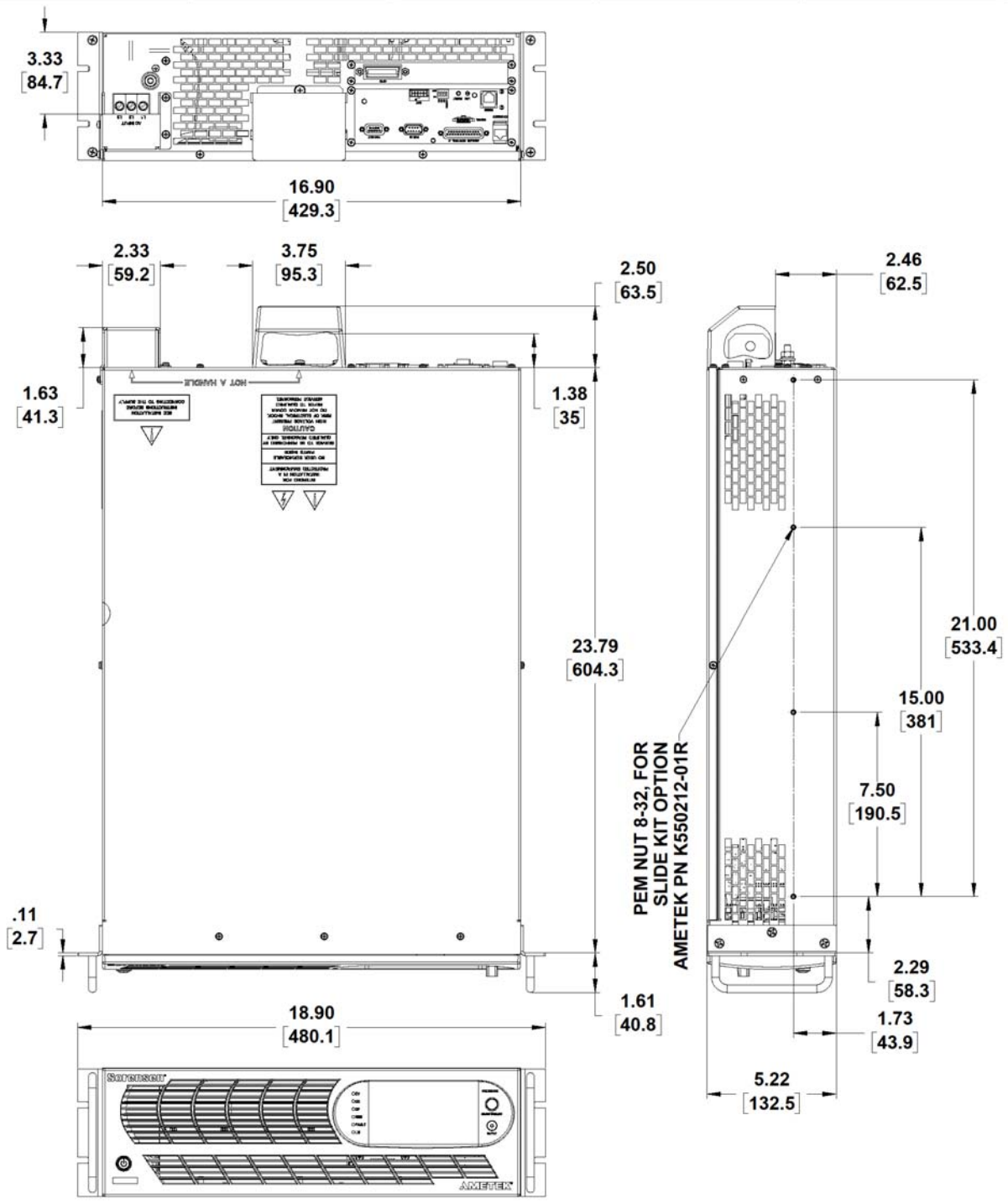


Figure 2-4. Installation Drawing, 3U Models 40V-600V

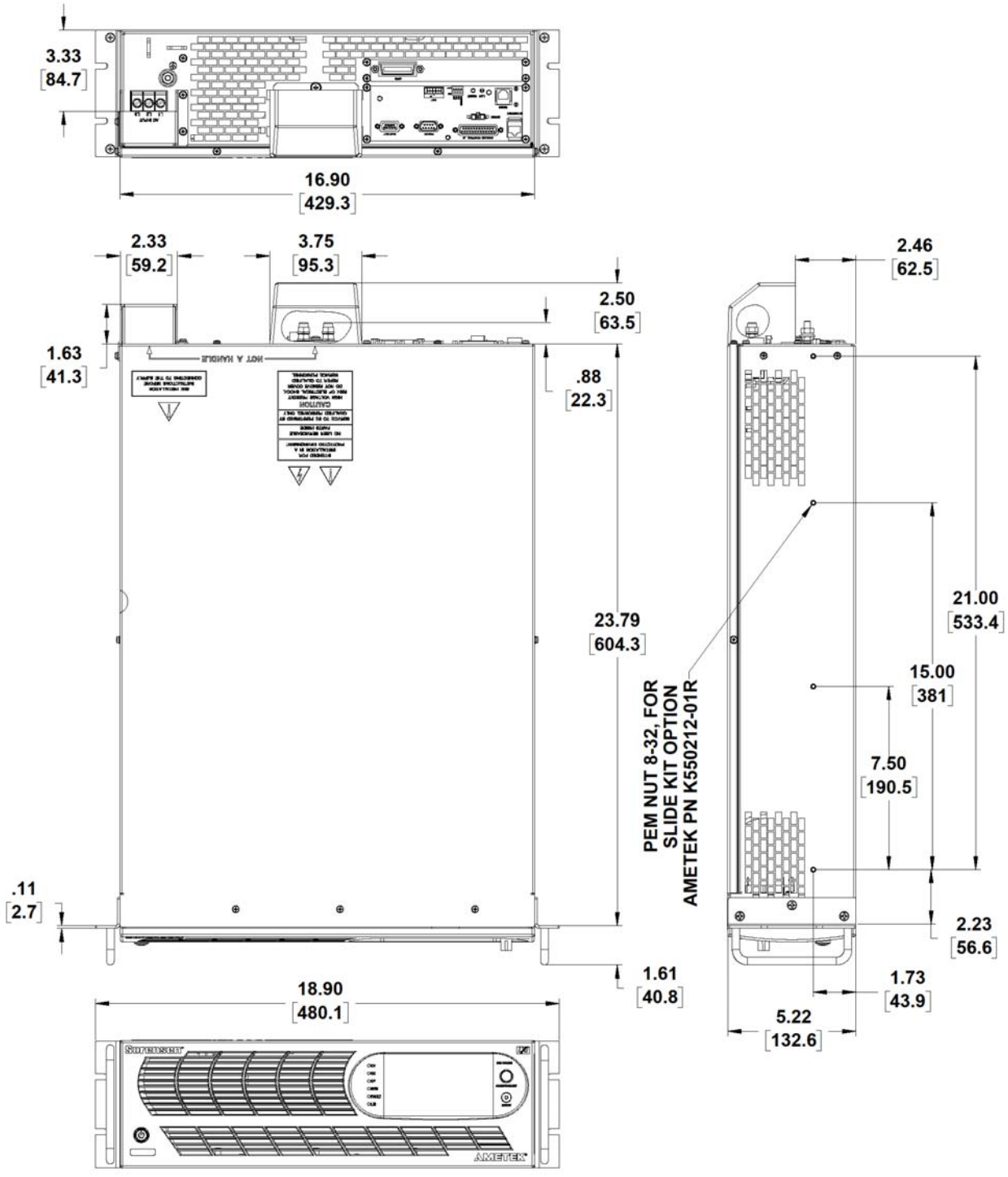


Figure 2-5. Installation Drawing, 3U Models 800V and 1000V

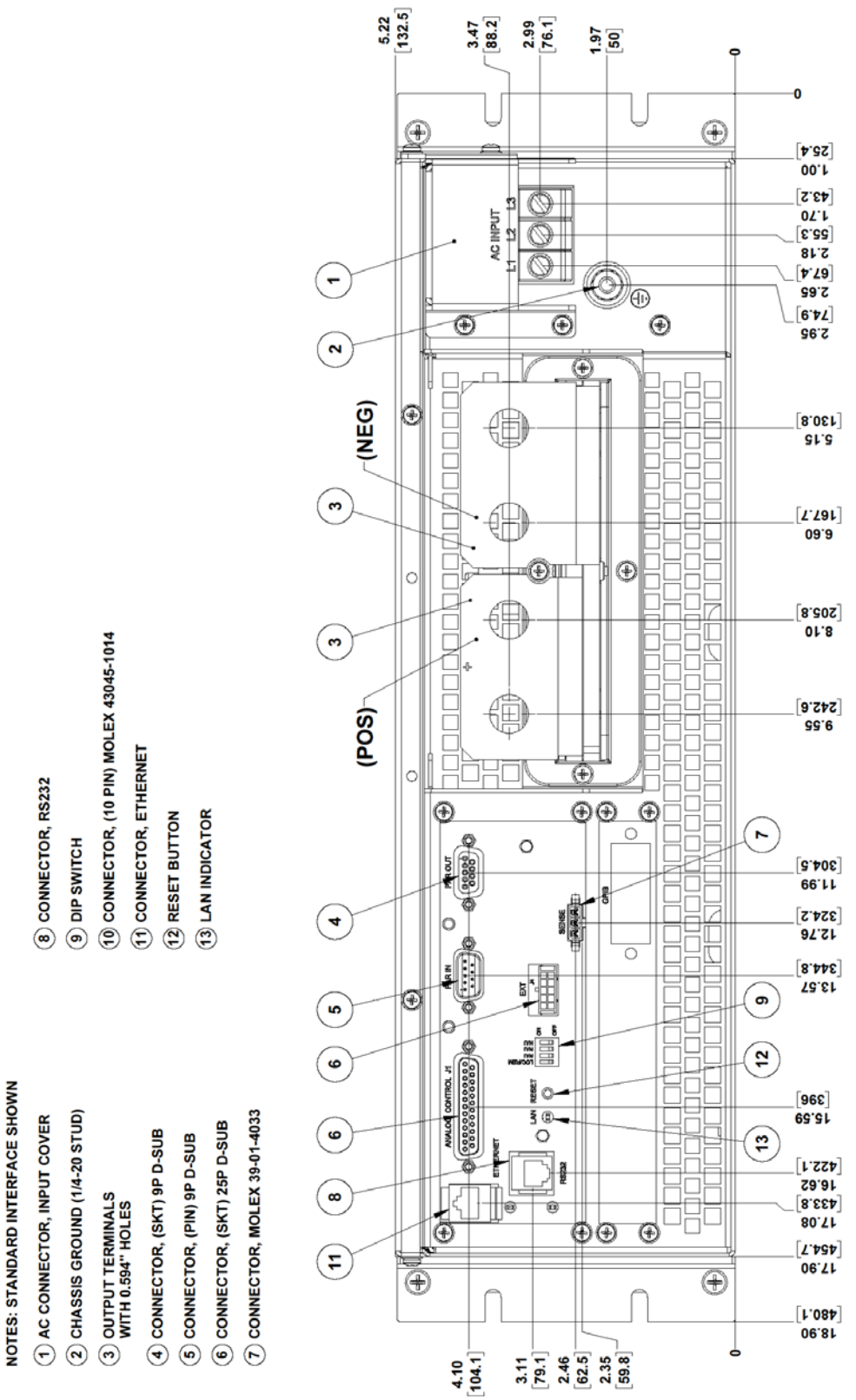


Figure 2-6. Rear Panel, Standard, 3U Models 10V-30V

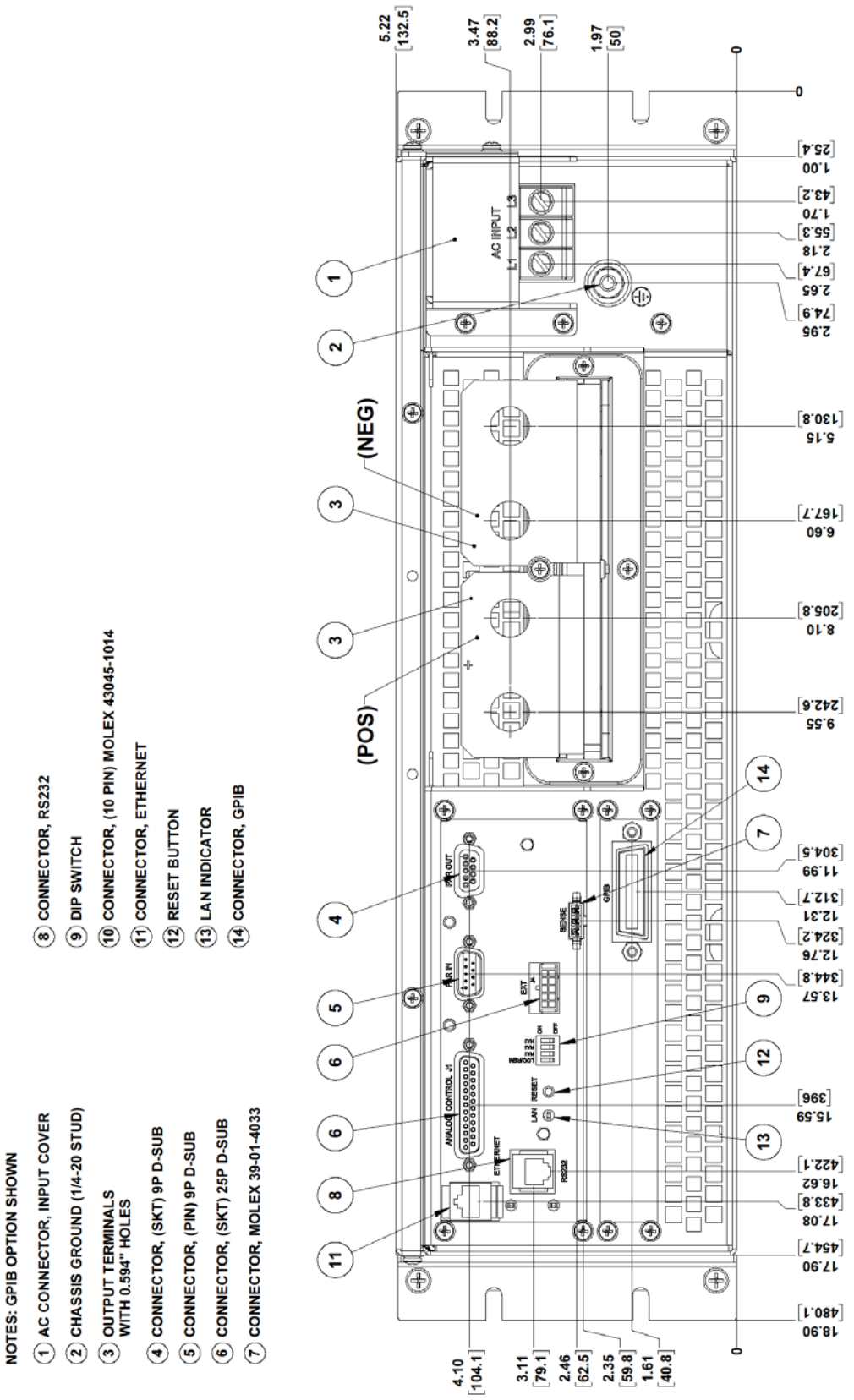


Figure 2-7. Rear Panel, GPIB Option, 3U Models 10V-30V

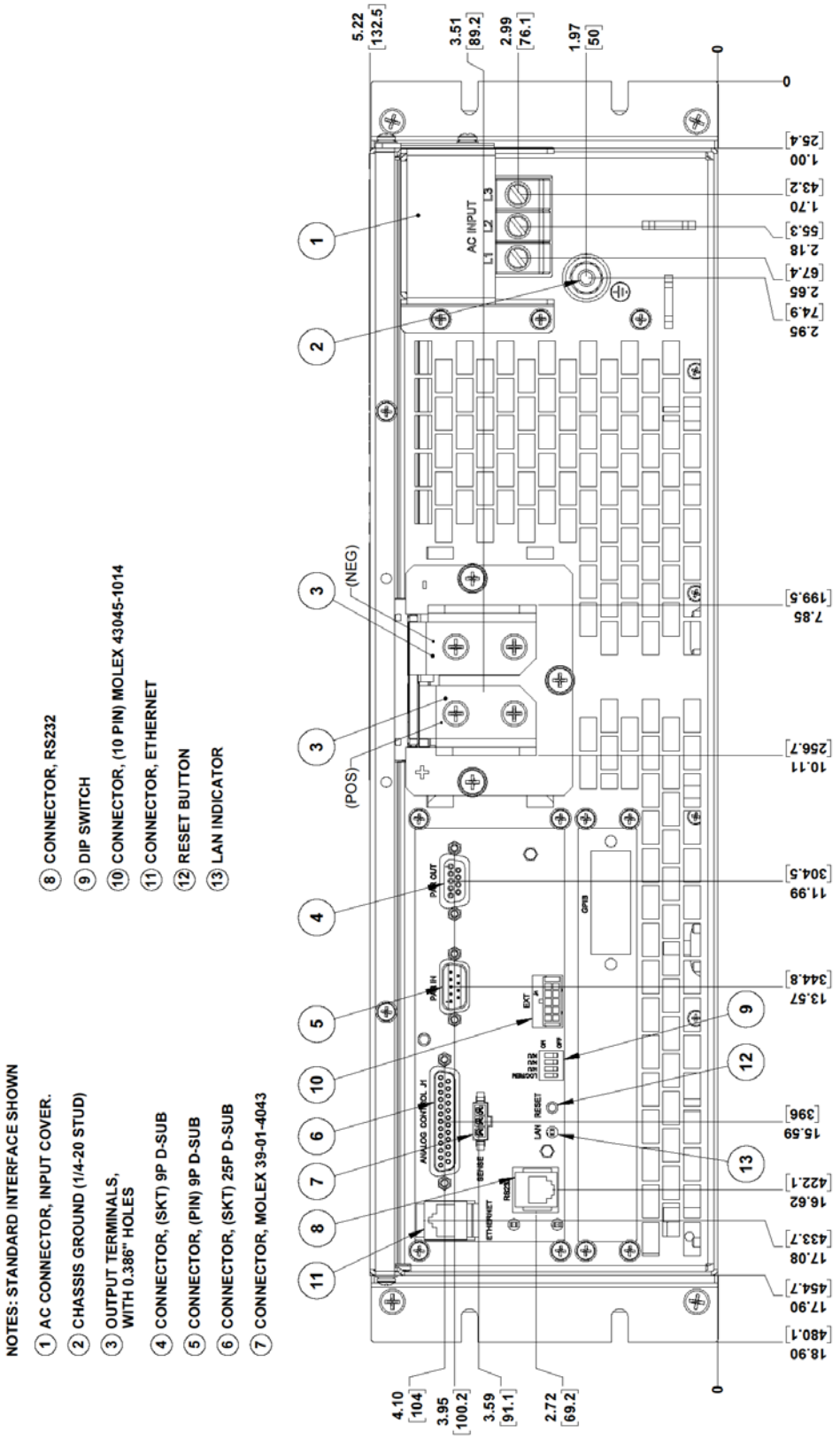


Figure 2-8. Rear Panel, Standard, 3U Models 40V-600V

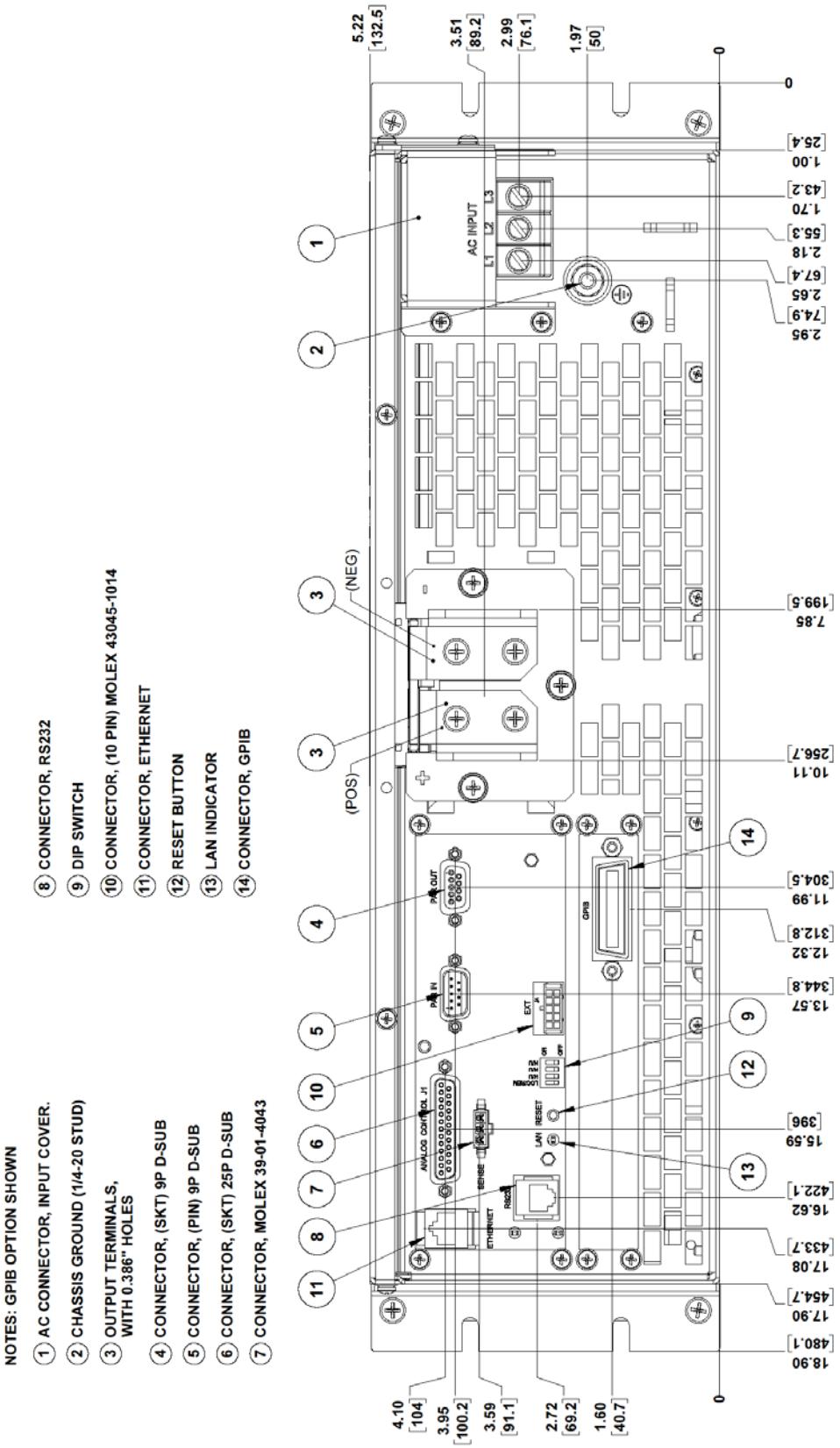


Figure 2-9. Rear Panel, GPIB Option, 3U Models 40V-600V

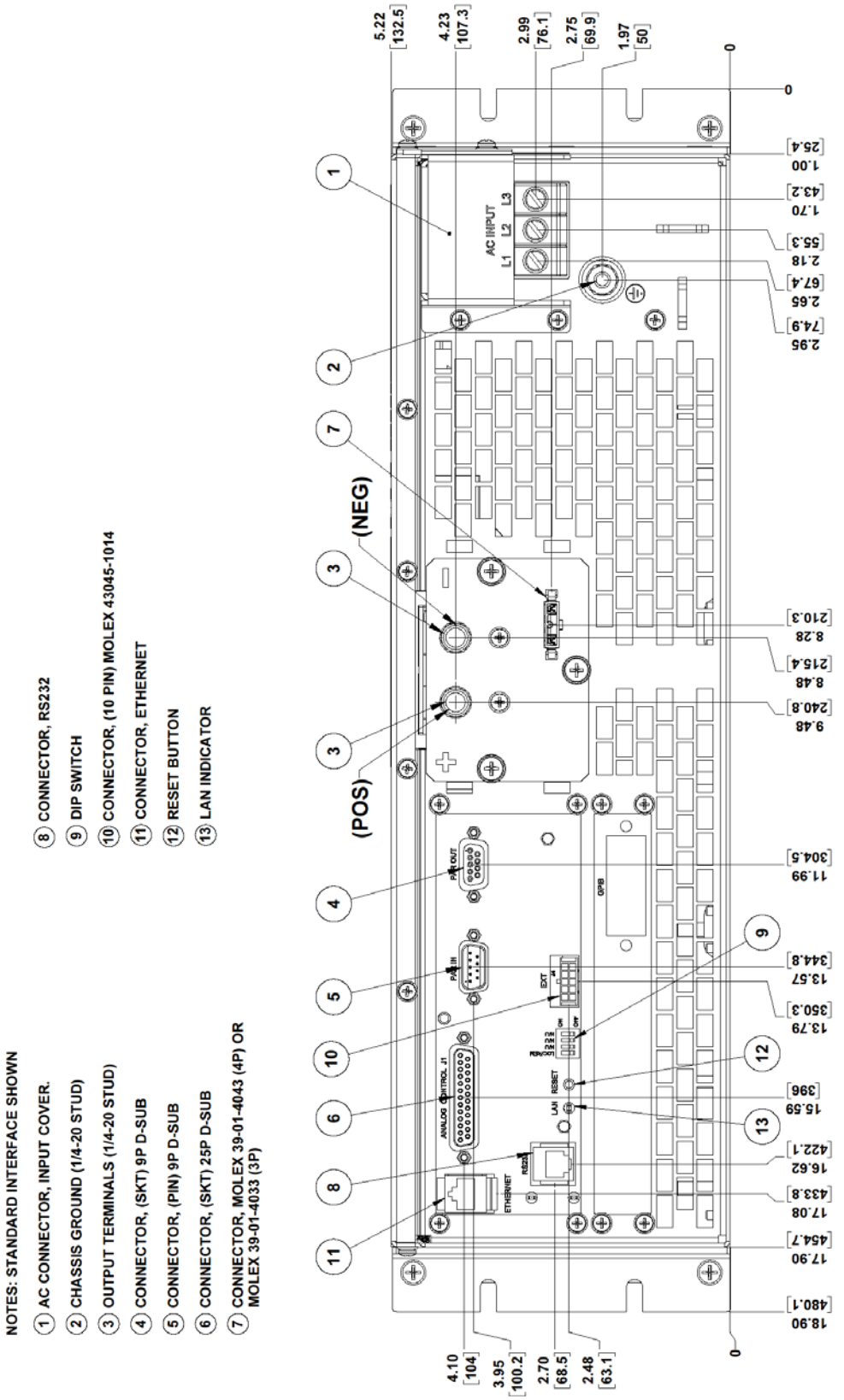


Figure 2-10. Rear Panel, Standard, 3U Models 800V and 1000V

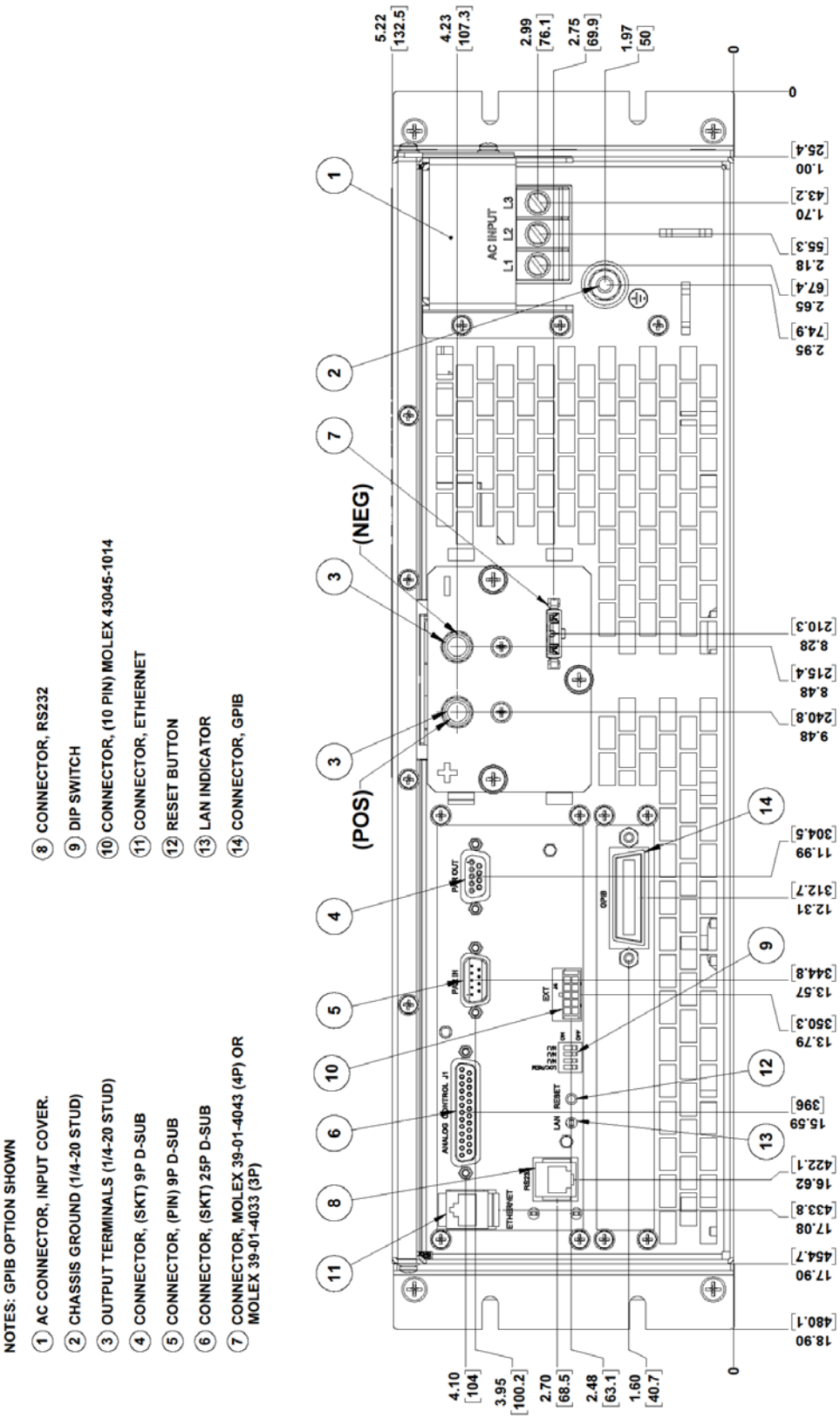


Figure 2-11. Rear Panel, GPIB Option, 3U Models 800V and 1000V

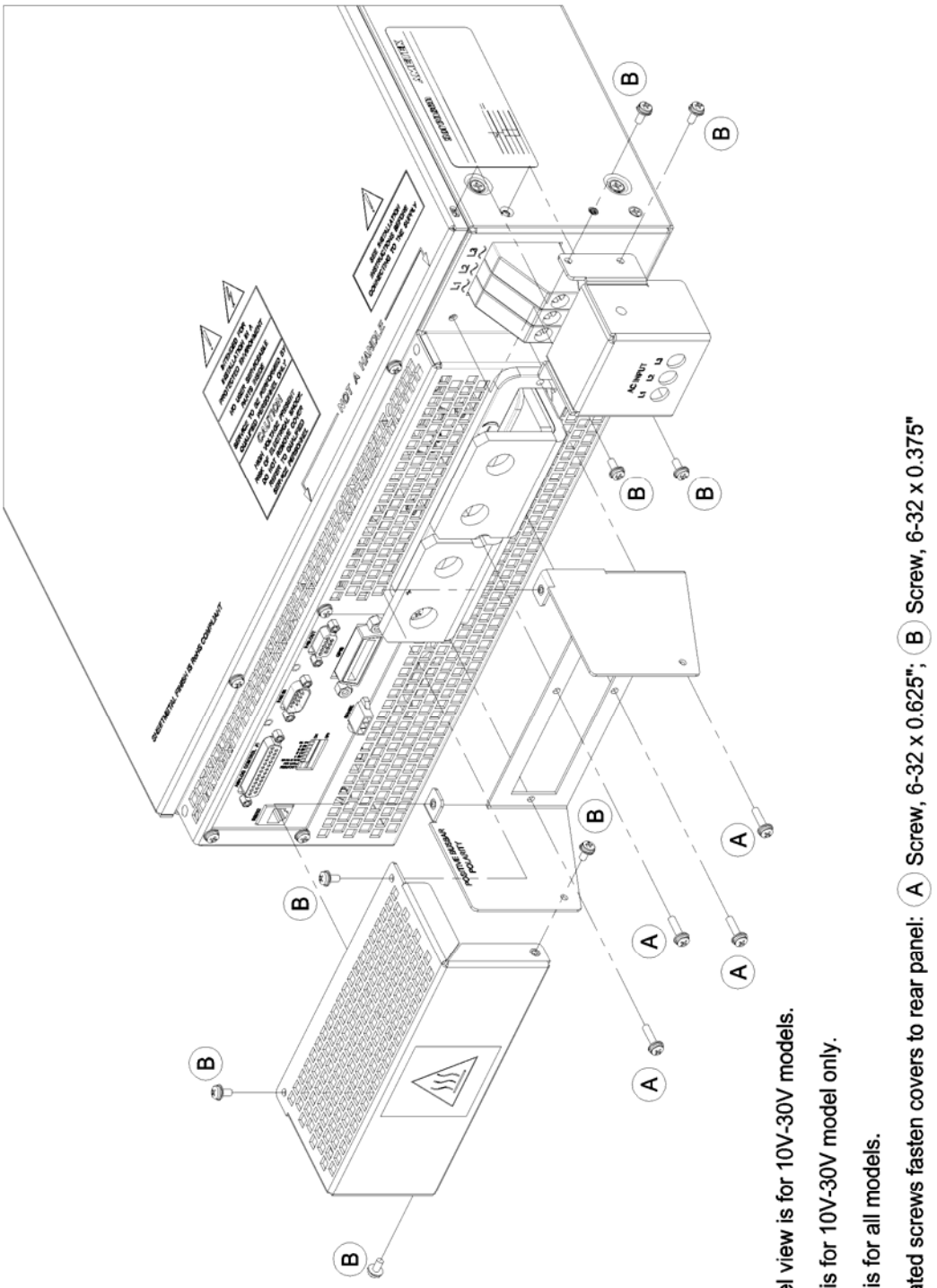


Figure 2-12. Instructions for Assembly of AC and DC Covers

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3
OPERATION

3.1 Introduction

The SGX Series is operated from the intuitive, easy-to-use front panel touch screen display. Provides Quick access to output programming parameters, measurements, sequencing, configuration and system settings from the touch screen interface. Functions and parameters can be directly selected from the touch screen or by using the encoder selector button. The following section provides detailed information of the controls, indicators, and the front panel menu functionalities for the operation of the power supply.

3.1.1 Front/Rear Panels

Figure 3-1 shows the front panel of the 3U models; the 6U models have the same controls and indicators. Figure 3-2 through Figure 3-7 show the rear panels of the 3U models, with their connectors and controls.

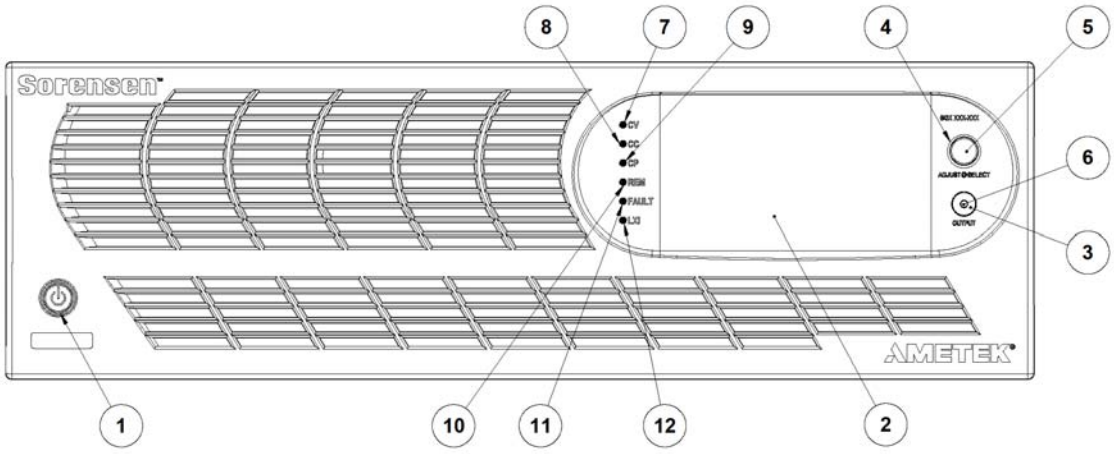


Figure 3-1. Front Panel Controls and Indicators (3U Model Shown)

WARNING!

The power-up factory default state is output enabled, where the output will be energized at the settings of voltage and current.

Item	Reference	Functional Description
1	ON/OFF Switch	Two–position switch turns the power supply on and off. WARNING! OFF position does not remove AC input from internal circuits or input terminal blocks. Disconnect external AC input before servicing unit.
2	Front Panel Display	TFT color graphics display with backlight and pressure-actuated touch-screen; menu-driven settings and functions.
3	Output Switch	Momentary switch that toggles the output power ON/OFF, and closes/opens the output isolation relay.
4	Rotary Encoder	Navigates between and within screens; scrolls through functions and selects numerical values; adjusts output parameters in real-time.
5	Rotary Encoder Switch	Momentary-action switch that selects functions and enters numerical values.
LED Mode Indicators		Indicates the mode that is active.
6	Output On	Output is turned on; indicator is integral with the OUTPUT switch.
7	Constant Voltage	Power supply presently in Constant-Voltage mode.
8	Constant Current	Power supply presently in Constant-Current mode.
9	Constant Power	Power supply presently in Constant-Power mode.
10	Remote	Supply presently controlled by remote digital interface.
11	Fault	Fault condition has occurred; output is shutdown, isolation relay is open, and output voltage is programmed to zero.
12	LXI	LXI status annunciation, LED will illuminate red when network connection is not present/Lost. Same LED blinks green when identifying the device through web page. On successful connection LED would be OFF.

Table 3–1. Front Panel Controls and Indicators

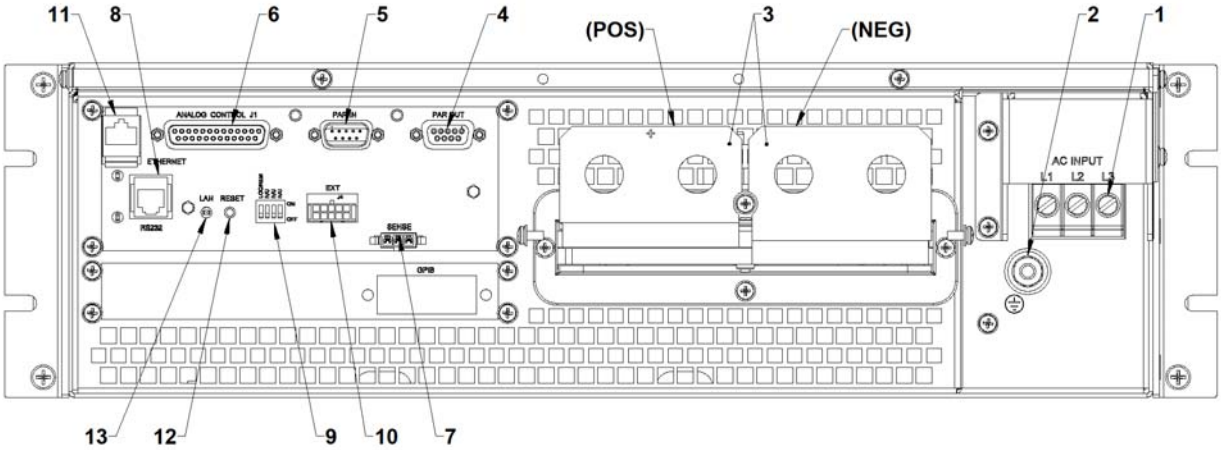


Figure 3-2. Rear Panel Interface, Standard, 3U Models 10V-30V

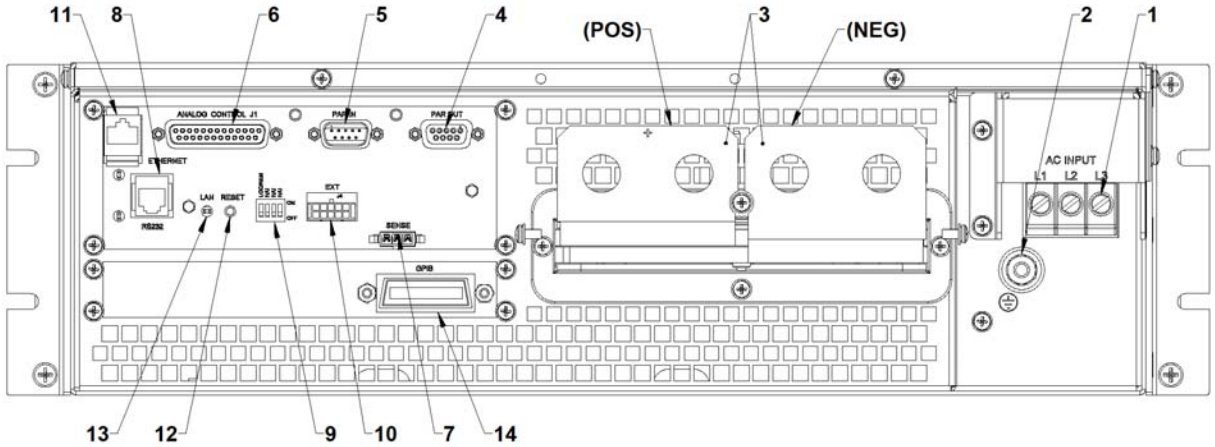


Figure 3-3. Rear Panel Interface, GPIB Option, 3U Models 10V-30V

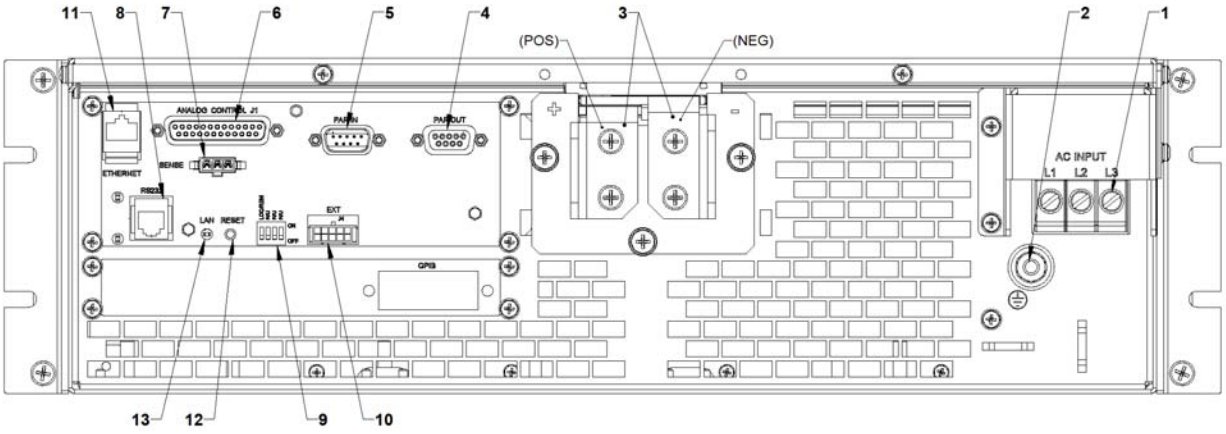


Figure 3-4. Rear Panel Interface, Standard, 3U Models 40V-600V

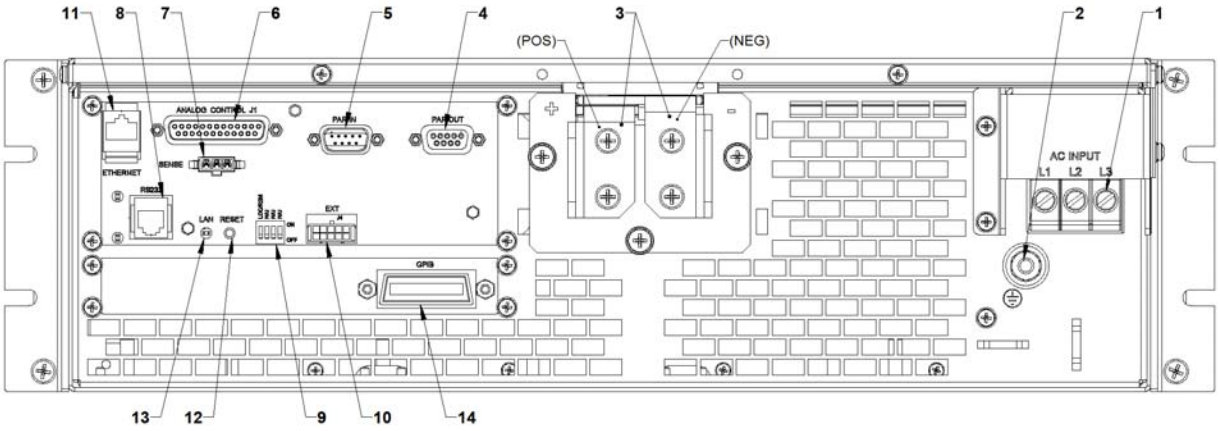


Figure 3-5. Rear Panel Interface, GPIB Option, 3U Models 40V-600V

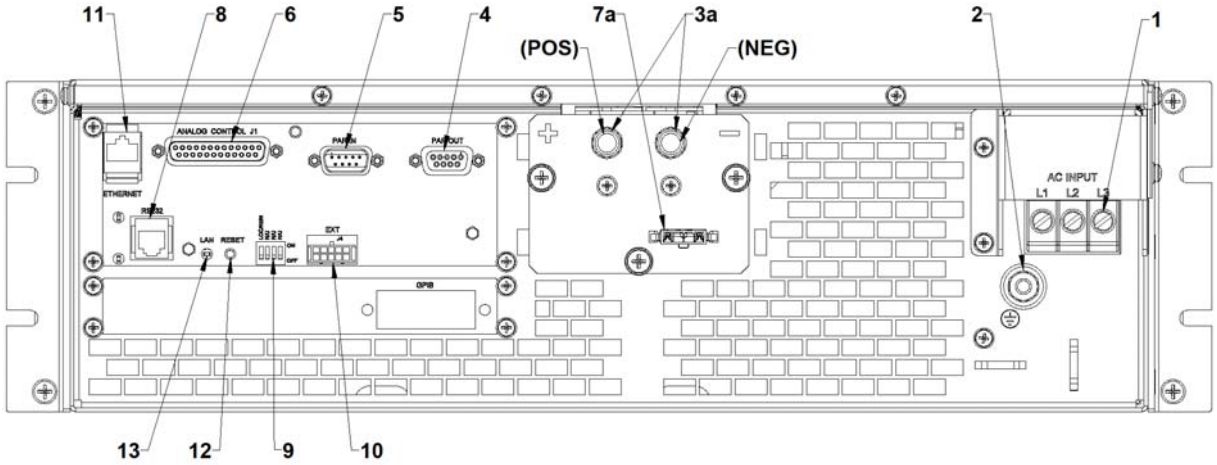


Figure 3-6. Rear Panel Interface, Standard, 3U Models 800V and 1000V

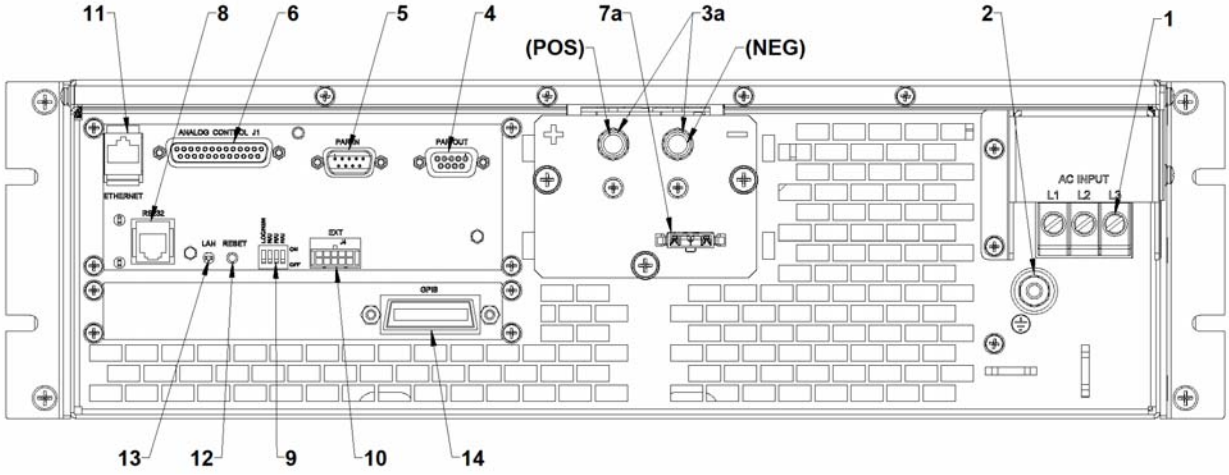


Figure 3-7. Rear Panel Interface, GPIB Option, 3U Models 800V and 1000V

Item	Reference	Functional Description
1	AC Input Connectors	Connection for 3-phase AC.
2	AC Input Safety Ground	Connection for safety ground wire.
3	DC Output Bus Bars	Positive (+) and negative (–) outputs.
3a	HV DC Output Studs	Positive (+) and negative (–) outputs for 800V and 1000V models only.
4	PAR OUT	Parallel Out connector of master unit for configuring parallel operation of units when connected to Parallel In connector of slave unit; see Section 3.12.
5	PAR IN	Parallel In connector of slave unit for configuring parallel operation of units when connected to Parallel Out connector of master unit; see Section 3.12.
6	ANALOG CONTROL	Remote Analog Interface connector, J1, for programming and monitoring signals of output, status indication, and remote shutdown signals; see Table 3–4 for individual pin descriptions.
7	SENSE Connector	Input connector, J3, for remote sensing of voltage at the load to compensate for line drop in load cables; see Section 3.10.
7a	HV SENSE Connector	Input connector, J3, for remote sensing of voltage at the load to compensate for line drop in load cables, 800V and 1000V models only; see Section 3.10.
8	RS-232 Connector†	RS-232 connector for remote digital control.
9	Configuration Switch†	Four–position DIP switch to configure the digital interface of the unit
10	External User Connector†	Input/ Output connector for external auxiliary digital control signals.
11	ETHERNET Connector†	Ethernet connector for remote digital control.
12	RESET Switch†	Reset switch to return configuration parameters to factory default settings; must be depressed until LAN LED is blinking.
13	LAN†	LED indicator: continuously on indicates Ethernet connection; off indicates no Ethernet connection; blinking indicates Instrument ID.
14	GPIB Connector†	GPIB connector for remote digital control.
Refer to Figure 3-2 through Figure 3-7. † Refer to the Programming Manual for details on the digital interface.		

Table 3–2. Rear Panel Connectors and Controls

3.2 Basic Front Panel Operation

The SGX power source provides extensive functionality and programmability, which could be exercised through the front panel, and the remote analog/digital control interface. This section provides basic details such as Navigation, Menu selection, Rotary encoder and Soft numeric keyboard which are common to all screens.

The SGX Series power supply is shipped from the factory configured for front panel (local) voltage/current/OVP control, and with the remote sense not connected (default to internal local voltage sensing at chassis output terminals). The remote sense leads must be connected externally by the user to achieve performance specifications. The Analog Control connector is supplied with a mating connector which has the remote output ON/OFF control signals jumpered (Pin-5 shorted to Pin-6) to allow the output to be enabled.

WARNING!

The power-up factory default state is output enabled, and the output will be energized with the settings of voltage and current at zero. At initial power-on a screen is displayed with a warning that the output will be enabled after countdown of a 10-second timer; during this state, the output Voltage and Current are programmed to zero, the Overvoltage Protection (OVP) is set to maximum, and the Output State is OFF. After the 10-second timer has elapsed, the Output State is changed to ON. Refer to Figure 3-15 for the warning screen that is displayed on the course of boot up of the power supply.

3.2.1 Initial Setup

Before connecting the unit to the AC mains, ensure that the front panel ON/OFF power switch is in the **OFF** position. Check the Analog Control (J1) mating connector on the rear panel to verify that Pins 5 and 6 (Remote Output On/Off) are shorted together. This is the default configuration installed from the factory. This jumper allows the output of the supply to be enabled from the front panel when the Output On/Off button is pressed.

3.2.2 Navigation and Selection

The front panel display of the SGX Series power source allows the user to select the various menus required to configure and operate the unit. Navigating through the various menus could be done using the touch-screen display or the rotary encoder. Tapping the display screen or clicking with the encoder on any menu or function that is highlighted (active) will enter that menu or execute that function.

The touch-screen utilizes resistive, pressure-actuated technology, and depends on pressure being applied to the top surface of the screen to detect the position of input.

A fingertip, fingernail, or stylus pen could be used. To prevent scratching the surface layer, do not use a hard or sharp tip, such as ball-point pen or mechanical pencil.

> **CAUTION!**
> Damage or scratching of the touch-screen could occur if excessive pressure is applied to the surface, or if objects with hard/sharp tips are used.

The present cursor position is always shown with a selection-box that has a highlighted border around a field, refer to Figure 3-8. Some screens have multiple pages, as indicated by the highlighted Arrow icons located on the right side of the screen. Tapping an Arrow, or selecting it with the rotary encoder and clicking the switch, scrolls the screen to the next page. When outside one of the HOME screens, tapping the Home icon will exit that screen and would return to the HOME screen. Refer to Figure 3-9 and Figure 3-8 respectively.

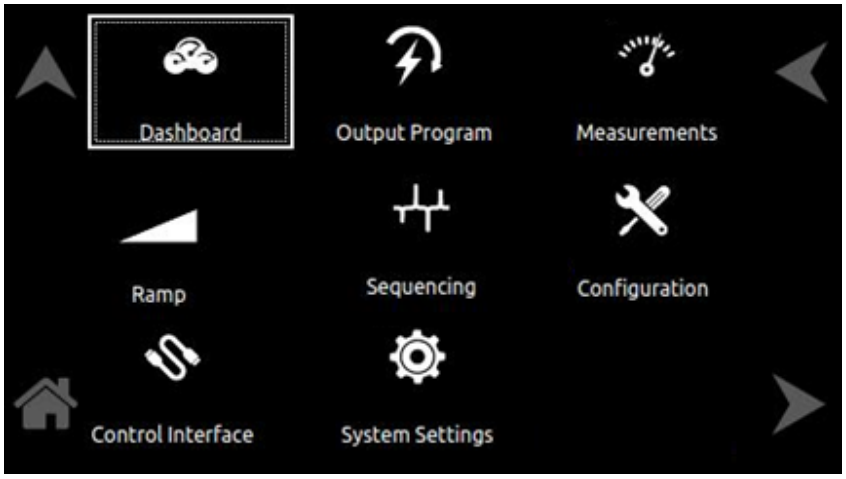


Figure 3-8. HOME Screen with Dashboard Highlighted

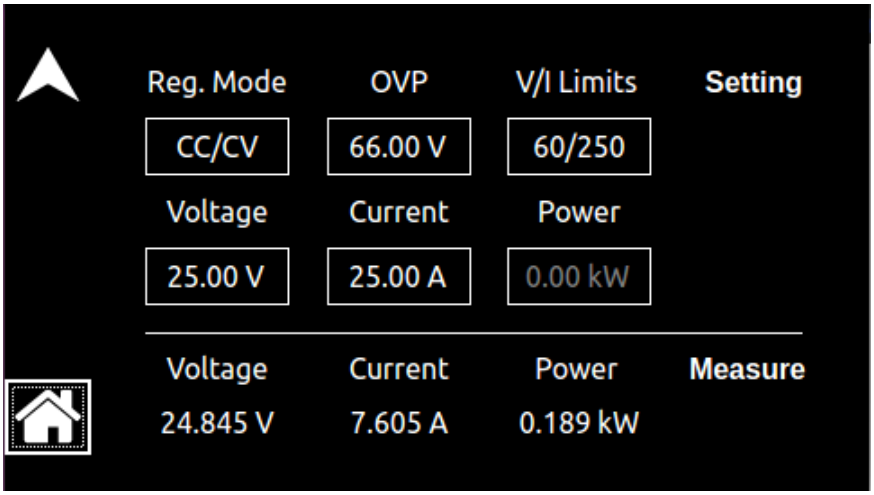


Figure 3-9. Dashboard Screen with Home Button Selected

Parameters that are adjustable have selection-fields where values could be entered. The parameter selection-field that is active has its border highlighted; refer to Figure 3-10, where the Dashboard Menu is shown with the voltage selection-field active. Tapping the selection-field box, selects that parameter for adjustment, and the screen changes to the numeric keypad that allows value entry; Refer to Figure 3-11 .

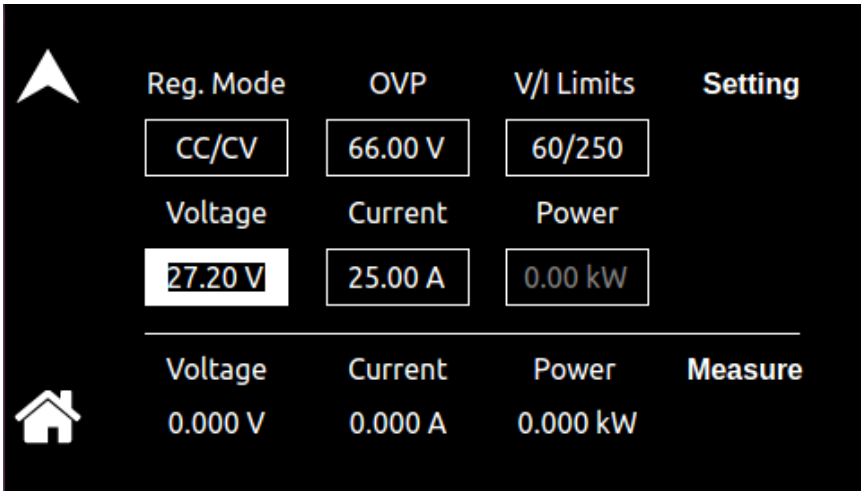


Figure 3-10. DASHBOARD Screen Menu with Voltage Selection-Field Active

3.2.3 Touch-Screen Numeric Keypad

The touch-screen has a keypad that allows numeric value entry; refer to Figure 3-11. After scrolling through menus until a parameter selection-field box is highlighted (active), tapping the selection-field selects it. Afterwards, the keypad screen will be displayed. Tapping numerical value keys, the decimal point key, or the polarity key, selects them, while the back-arrow key erases the last entry. To enter a negative value, first enter the number then the minus sign. The selected values appear in the upper-left parameter window, and the cursor moves to the next available position. Tapping the OK key enters the value to have it take effect.

Figure 3-11. Touch-Screen Numeric Keypad

Functions that accept a numeric value require that the value is within the allowed range, otherwise, an error will be generated, and the value will not be accepted.

3.2.4 Rotary Encoder

The rotary encoder provides a secondary way to navigate the display. It is used to select functions, change parameter values, and perform setup. It can be used to move between menu screens and between editable items within an individual menu screen.

The rotary encoder is located on the front panel and provides continuous adjustment in the clockwise and counter-clockwise rotation; refer to Figure 3-12. Turning the encoder knob allows sequential scrolling through each menu or function on a screen; the item that is active has its selection field-box highlighted. To select a choice, depress the encoder knob to engage the encoder momentary switch.

Figure 3-12. Rotary Encoder

The rotary encoder can operate in one of two distinct modes:

MODE	DESCRIPTION
NAVIGATE	The rotary encoder can be used to scroll through menu screen functions and settings. The current (active) selected item will be outlined in a highlighted selection-field box. As the encoder is rotated, the highlighted box will be scrolled through all items on a screen that could be selected; refer to Figure 3-8.
ADJUST/SELECT	After scrolling to a function, the rotary encoder knob is depressed to select the function (clicking on an item). Clicking on a selection-button will change its state (on or off), and clicking on a function or menu will select it and change to a screen that allows further value entry. Parameter values, such as voltage and current, are adjusted by selecting the parameter (clicking on it) to enable the selection-field (refer to Figure 3-8). If a parameter had been selected whose value could be adjusted, and the encoder switch is depressed, a screen will be displayed with a parameter selection-field highlighted that has a value entry window (refer to Figure 3-10). The rotary encoder could then be used to continuously adjust the parameter value, up and down, as the encoder is rotated. Click the encoder a second time to enter the value. If the OUTPUT switch is on, the output parameter will change when the encoder is clicked. The DASHBOARD screen menu has the capability for real-time adjustment of output parameters: the value of the parameters change as the rotary encoder is turned for immediate effect at the output. If the OUTPUT switch is on, the output parameter will change as the encoder is rotated. Refer to the DASHBOARD screen menu in Section 3.3.3 for a description of the parameters that have real-time adjustability. The rotary encoder could also be used with the numeric keypad to enter values. After selecting a parameter using the touch-screen, the numeric keypad will be displayed; refer to Figure 3-11. The rotary encoder could be used to select any of the items of the numeric keypad by scrolling through them and clicking on them with the encoder switch to select them. The active value is identified on the screen with a highlighted field-box, and the entered decimal places are shown in the upper-left window. The cursor moves to the next available position as values are entered. After the desired decimal places are entered sequentially, the OK key is clicked to execute the final value and have it take effect.

3.3 Front Panel Display Menu and Functionality

3.3.1 Power-Up Screens

At initial power-on, the display shows the SGX Splash screen, Refer to Figure 3-13, followed by the Start-Up screen with the manufacturer, model number, serial number, firmware revisions and last calibration date, Refer to Figure 3-14, and finally the Dashboard screen, Refer to Figure 3-17.

Figure 3-13. Splash Screen

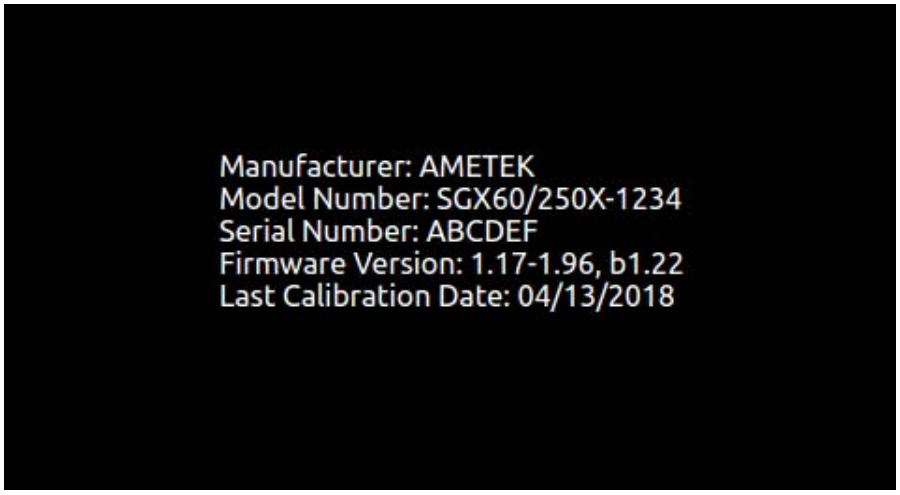


Figure 3-14. Power-On Screen Displaying Model & Version

If output is enabled in Power-ON Settings (PONS) screen, refer to Figure 3-35 and supply is in Local mode, a warning screen is shown, Refer to Figure 3-15, before the Dashboard Screen.
It warns the user that the output will be enabled at the end of 10 second countdown. The process can be aborted by pressing the ABORT button on the screen.
Once aborted, the output remains off until the user enables it with the Output On/Off button.

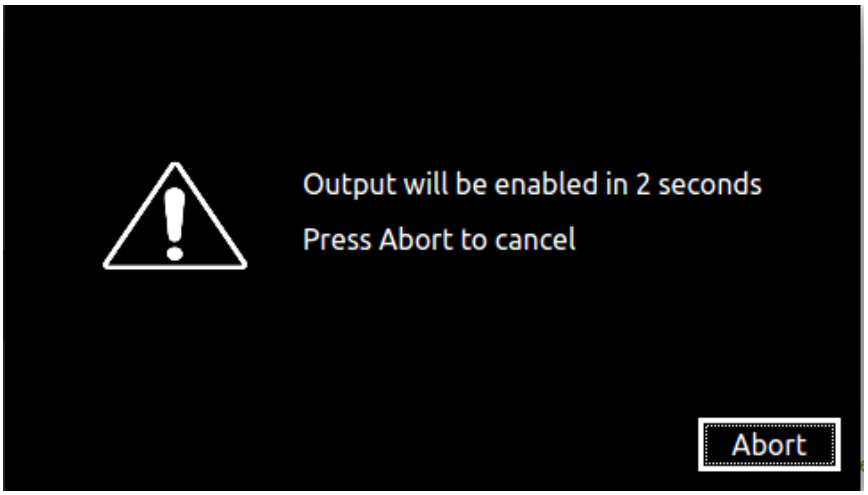


Figure 3-15. Output-Enabled Warning Screen

3.3.2 Home Screen Top-Level Menu

Selecting the Home icon or Up arrow will open the HOME screen of the menu structure. It is made up of menus, as follows: DASHBOARD, OUTPUT PROGRAM, MEASUREMENTS, RAMP, SEQUENCING, CONFIGURATION, CONTROL INTERFACE and SYSTEM SETTINGS.

Each menu of a screen could be selected by tapping its associated selection-field box through the touch-screen, or by selecting it with the rotary encoder and depressing (clicking) the rotary encoder SELECT switch. Refer to Figure 3-16.

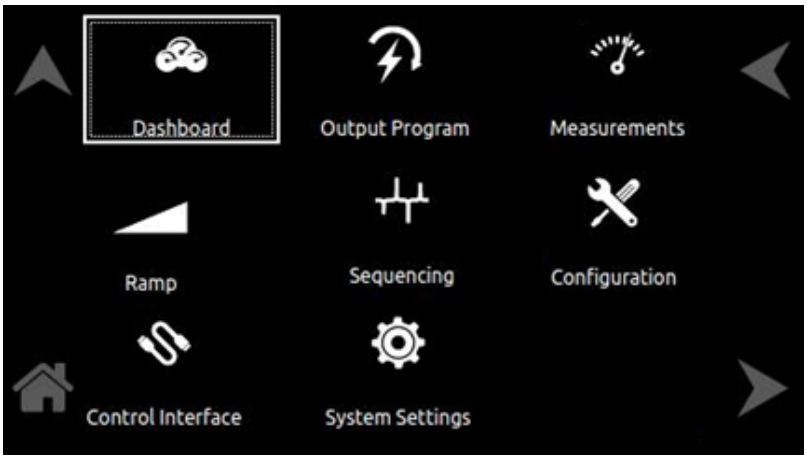


Figure 3-16. HOME Screen

There are four virtual buttons visible on a screen: UP, LEFT, and RIGHT arrows, and HOME icon. Those buttons that are highlighted are active for the screen being displayed. The arrow buttons will scroll to the next page of the menu structure in the direction indicated. The HOME button will return to the previous home screen that has the top-level menu from which a sub-menu was entered. The HOME button is no longer functional once a home screen is entered.

The following top-level menu choices can be accessed through the touch-screen:

Top-Level Screen Menu	Menu Description
DASHBOARD	Provides setting and measurement of output parameters: voltage, current and power (applicable only in Constant Power Mode). Also provides setting of Regulation mode, OVP, User V/I Limits.
OUTPUT PROGRAM	Provides setting of voltage, current, power (applicable only in Constant Power Mode) and OVP.
MEASUREMENTS	Provides measurement of output parameters: Voltage, Current and Power.
RAMP	Provides menu for Voltage and Current ramp
SEQUENCING	Provides setup, running, and saving of Sequences.
CONFIGURATION	Provides setup of Power-ON States (PONS), User V/I limit, Total System Current, Profiles, Regulation mode and Measurement Settings.
CONTROL INTERFACE	Provides setup of remote digital interfaces: RS232, GPIB, LAN
SYSTEM SETTINGS	Provides display of firmware versions, selection of language, hardware parameter limits, brightness of the display, and default screen timeout.

Table 3–3. Home Screen Menu Content

3.3.2.1 Navigating between Home Screen Menus

Each menu in the Home Screen can be reached in one of two ways:

- Tapping selected menu on Home Screen of the front panel touch-screen.
- Scrolling to menu with the encoder and depressing the encoder switch.

Tapping the Up-arrow button will return to the previously selected screen menu. Tapping the HOME button will return to the Home Screen.

3.3.3 Dashboard Screen Top-Level Menu

The DASHBOARD screen top-level menu is used to change output parameters and simultaneously view output measurements. The most commonly used output parameters are in the DASHBOARD screen menu. The DASHBOARD screen is the default menu that is displayed after power-on.

The top-level menu of the DASHBOARD screen (for CC/CV and CP mode) is shown in Figure 3-17 and Figure 3-18 respectively. Refer to Section 3.3.2.1 for navigating to Dashboard Screen.

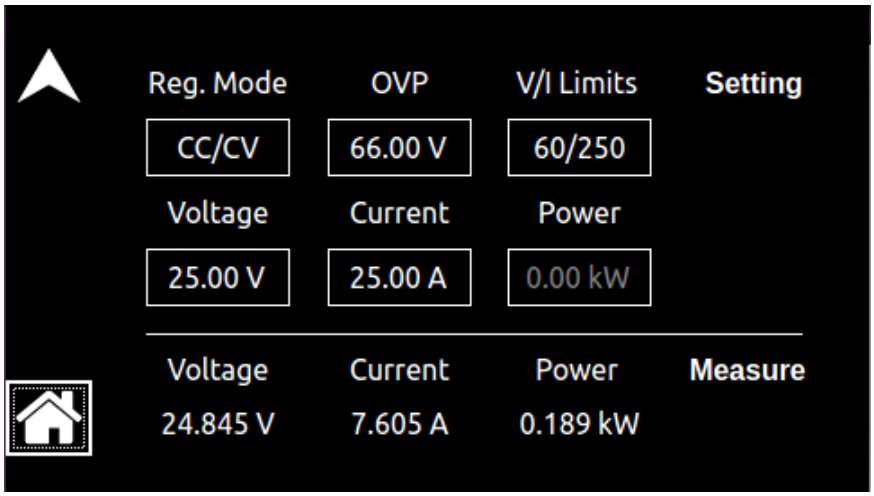


Figure 3-17. Dashboard Screen in CC/CV Mode

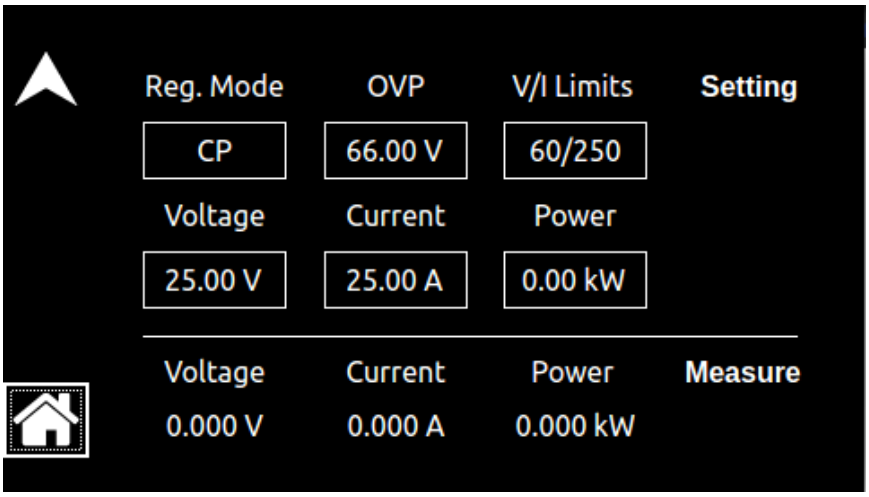


Figure 3-18. Dashboard Screen in CP Mode

The following selections are available in the DASHBOARD screen top-level menu.

Entry	Description
Setting	
VOLTAGE	Programs the output voltage of the supply in volts. Real-time setting is possible using the rotary encoder.
CURRENT	Programs the output current in amps. Real-time setting is possible using the rotary encoder.
POWER	Programs the power in constant power mode for power regulation in KW. Real-time setting is possible using the rotary encoder. **NOTE:** Power Settings is enabled only in Constant Power Mode.
OVP	Programs the overvoltage protection trip point in volts. Real-time setting is possible using the rotary encoder.
REG. MODE	Programs the Regulation mode of the supply. Refer to Figure 3-41. Valid arguments are: **Constant Voltage:** Supply regulates the output voltage at the set value and the current changes depend on the load requirement. If the regulation of the output voltage is not met due to change in load, it programs the output to zero after a programmable delay time. **Constant Current:** Supply regulates the output current at the set value. If the regulation of the output current is not met due to change in load, it programs the output to zero after a programmable delay time.

CC/CV: Supply switches between the constant current and constant voltage modes based on the load conditions, without making the output to zero.

Constant Power: Supply operates in Power Regulation mode.

V/I LIMITS Sets soft-limits for the output voltage and current to which the unit could be programmed using the front panel or remote digital interface; default is full-scale; Refer to Figure 3-37.

The soft limit prevents the supply from being inadvertently programmed above the soft limit, thus providing a method for protecting the load.

Measure

VOLTAGE Displays the floating-point value of the DC output voltage in volts.

CURRENT Displays the floating-point value of the DC output current in amps.

POWER Displays the floating-point value of the DC output power in KW.

3.3.3.1 Real-Time Parameter Adjustment

The DASHBOARD screen menu provides the capability for output parameter entry that has real-time, immediate effect on the output. This allows manual adjustment of the output parameters where tuning of a value is desired. Enabling this function requires clicking on a parameter selection-field box with the encoder switch to select the parameter and display its selection-field highlighted and with a value entry window (refer to Figure 3-19). The rotary encoder could then be used to continuously adjust the parameter value, up and down, as it is rotated. The value change takes immediate effect at the output.

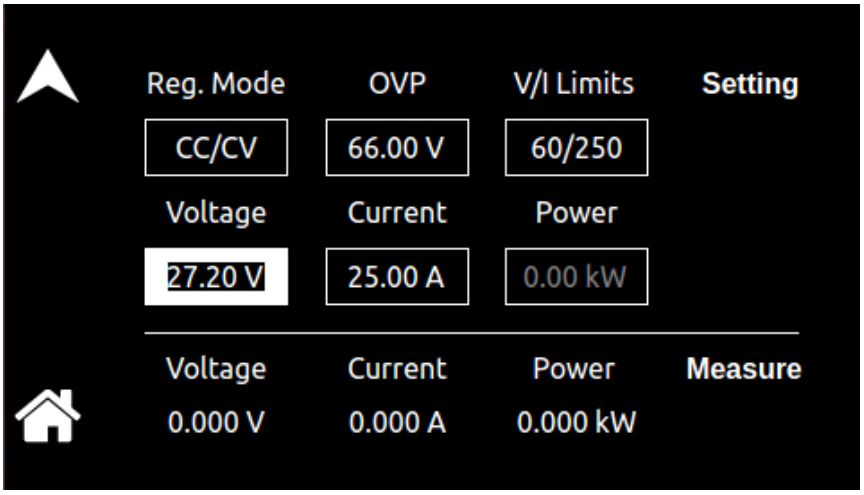


Figure 3-19. Real-Time, Immediate Output Parameter Adjustment

3.3.3.2 Default Screen

The Default screen provides measurement of the DC output voltage, current and power, refer to Figure 3-20. When in the Dashboard screen, and idle for an interval equal to a set time delay, the display will automatically switch to the Default screen. Tap anywhere on the screen to return to the Dashboard screen; Refer to Section 3.3.9 (Default Screen).

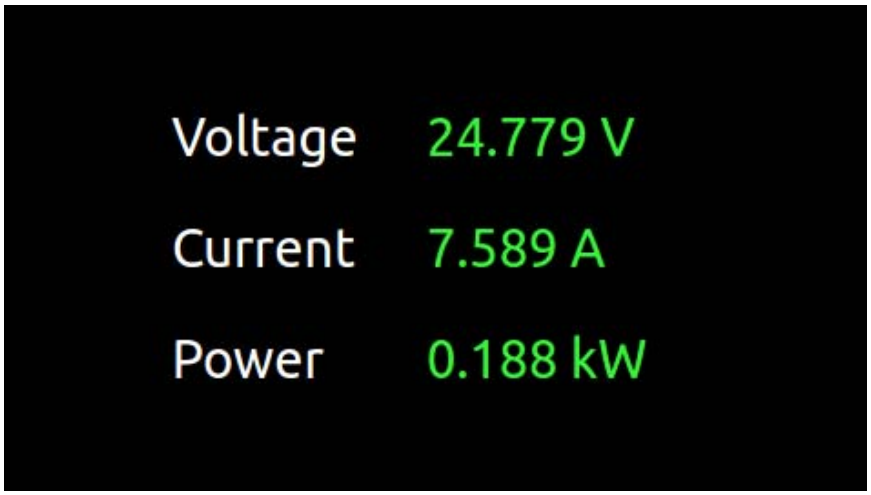


Figure 3-20. Default Screen

With the understanding of the dashboard screen features, user can perform basic functionality and verify the output voltage and output current in various modes of operation as described in Section 3.4.

3.3.4 Output Program Screen

The Output Program screen provides setting of the output Voltage, Current, OVP and Power of the supply.

In CC/CV, Constant Voltage and Constant Current regulation mode, power setting is disabled; Refer to Figure 3-21.

In Constant Power regulation mode, power setting is enabled; Refer to *Figure 3-22*.

Refer to Section 3.3.2.1 for navigating to Output Program Screen.

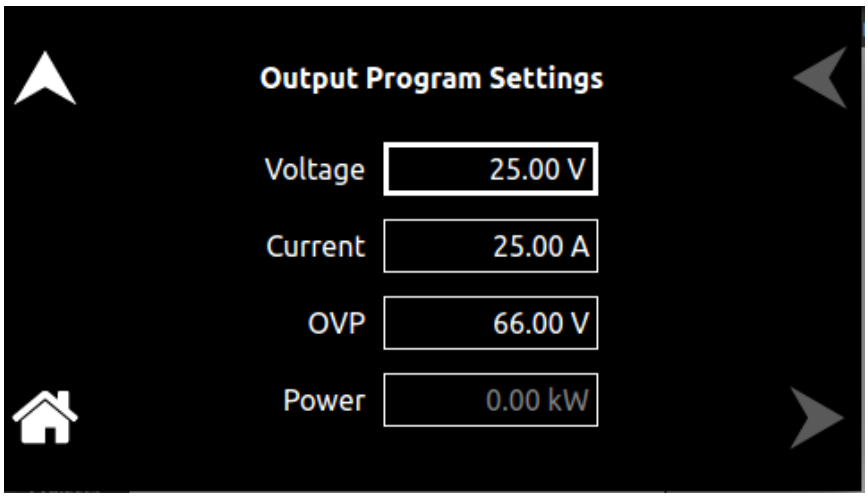


Figure 3-21. Output Program Screen

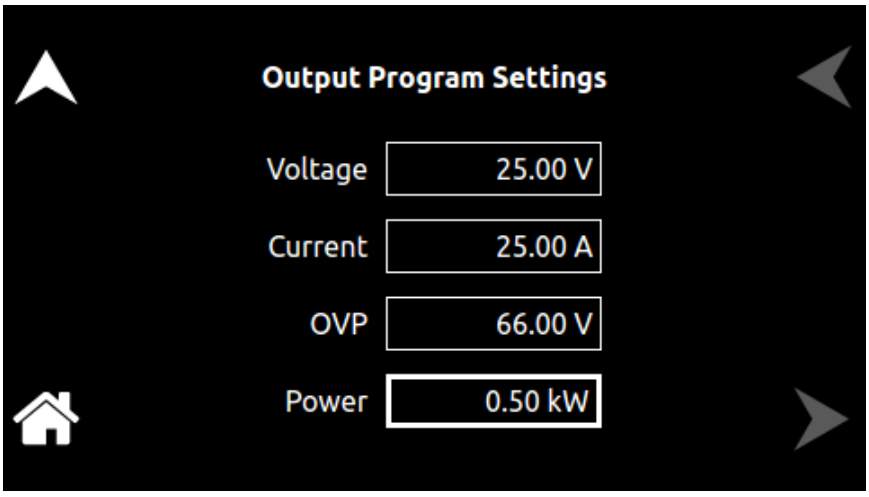


Figure 3-22. Output Program Screen in Constant Power Mode

3.3.5 Measurements Screen

The Measurements screen is used to display the floating-point value of the DC Output Voltage, Output Current and Output Power.
The Measurements screen is shown in refer to Figure 3-23.
Refer to Section 3.3.2.1 for navigating to Measurements Screen.

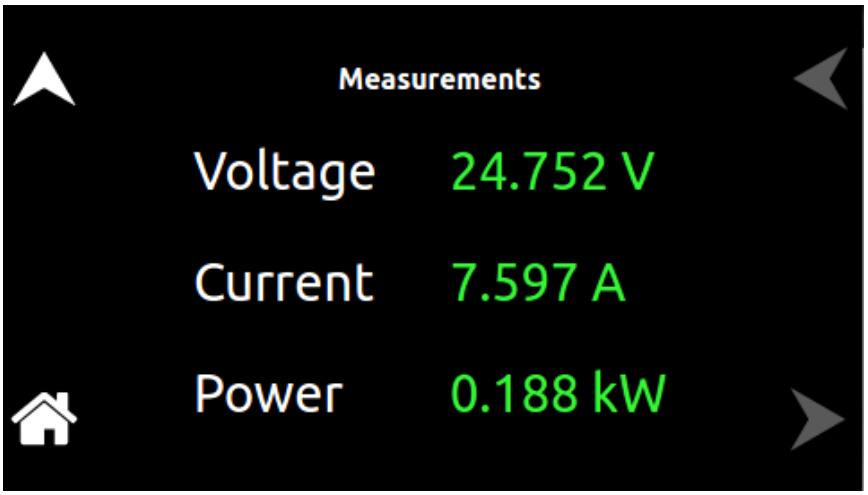


Figure 3-23. Measurements Screen

3.3.6 Ramp Screen

The Ramp Screen provides the functionality to create voltage and current Ramp.
The top-level menu of the Ramp screen is shown in refer to Figure 3-24 .
Refer to Section 3.3.2.1 for navigating to Ramp Screen.

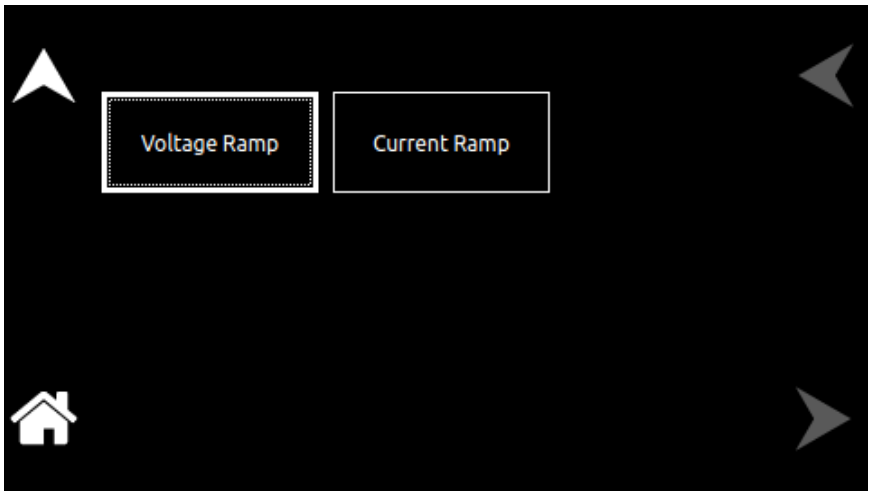


Figure 3-24. Ramp Screen Top Level Menu

The following menus are available in the Ramp top-level menu: Voltage Ramp and Current ramp.

3.3.6.1 Voltage Ramp

The Voltage Ramp menu allows to configure and execute voltage ramp, refer to Figure 3-25. The Voltage Ramp menu allows the selection of parameters such as Volt, To Volt, Curr, Time and Trigger.

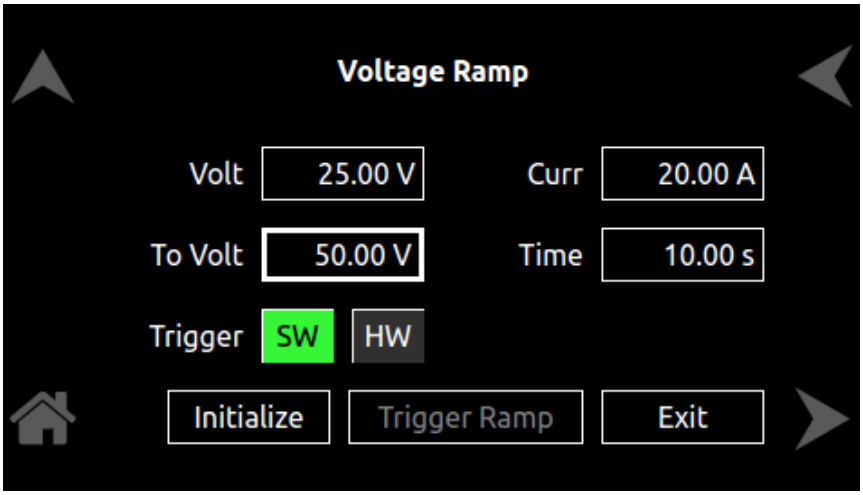


Figure 3-25. Voltage Ramp Screen

The Voltage Ramp menu has the following fields:

Entry	Description
Volt	Sets the start voltage for the ramp
To Volt	Sets the end voltage for the ramp.
Curr	Sets the Current limit for the ramp.
Time	Sets the time in seconds to reach from start volt to end volt.
Trigger	Sets the trigger mode for the ramp.
	In **SW (Software)** trigger mode, the ramp is generated as soon as the Trigger Ramp button is pressed.
	In **HW (Hardware)** trigger mode, the ramp will be generated when an active high pulse of 10ms is applied on the MOLEX connector pin-9 (ISO-COMMON) and pin-10 (TRIGGGER IN). Refer to Table 3–5 for PIN details.
Initialize	Initializes the set Ramp parameters**.** Refer to Figure 3-26.
	Press **OK** to return.

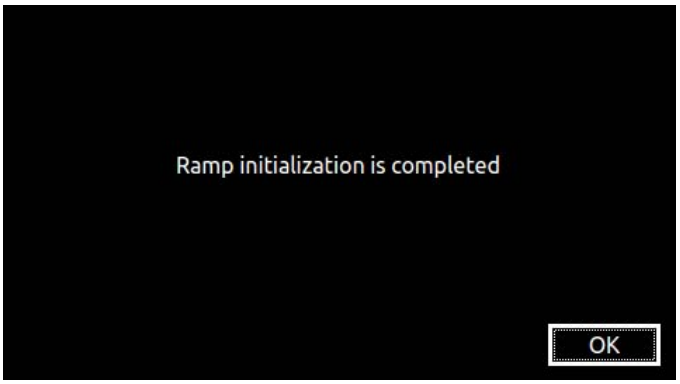


Figure 3-26. Ramp-Screen (Initialization)

Trigger Ramp Generates the ramp in **SW** trigger mode. **Trigger Ramp** button will only be enabled after **Initialize** button is pressed, Refer to Figure 3-27.

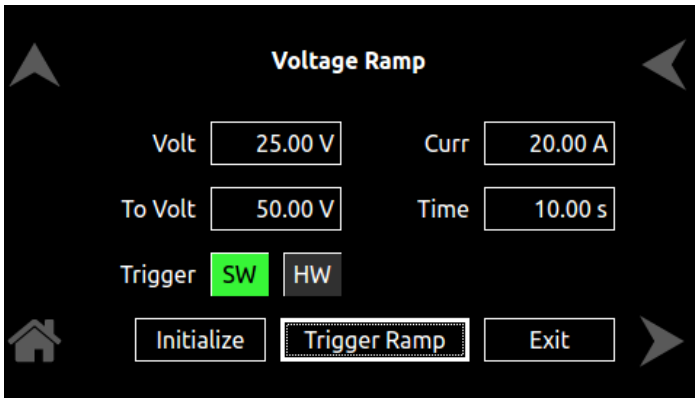


Figure 3-27. Voltage Ramp-Screen (SW Trigger)

Waiting for Trig This field is displayed after **Initialize** button is pressed in **HW** trigger Mode, refer to Figure 3-28. This shows that the supply is waiting for an active high pulse of 10ms on the MOLEX connector pin-9 (ISO-COMMON) and pin-10 (TRIGGGER IN) to generate the Voltage Ramp. Refer to Table 3–5 for PIN details.

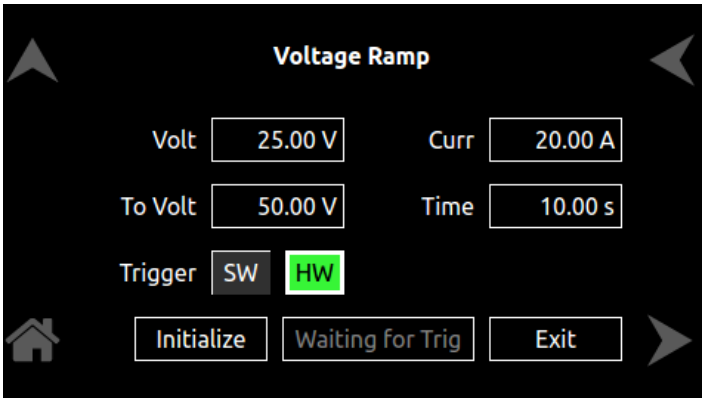


Figure 3-28. Voltage Ramp-Screen (HW Trigger)

Abort

In **SW** trigger mode, when **Trigger Ramp** button is pressed, **Trigger Ramp** button changes to **Abort** button.

In **HW** trigger mode, when external trigger is received, **Waiting for Trig** will change to **Abort** button**,** refer to Figure 3-29. Pressing the **Abort** button aborts the ramp.

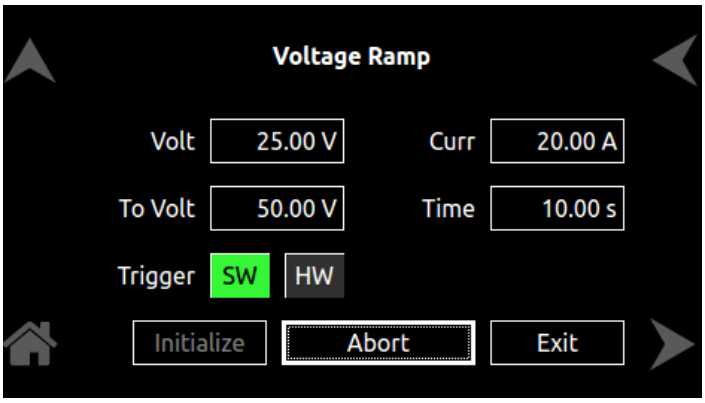


Figure 3-29. Voltage Ramp-Screen (Abort)

Exit

Exits the Voltage Ramp sub menu and return back to Ramp Screen Top level menu, refer to Figure 3-24.

NOTE: You cannot exit out of Voltage Ramp Screen using HOME and UP arrow, these buttons are disabled for the Voltage Ramp Screen; Refer to Figure 3-25.

Example 1: Creating a Voltage ramp using Software Trigger mode

- Set the **Volt** to 25V
- Set the **To Volt** to 50V
- Set the **Curr** to 20A
- Set the **Time** to 10s
- Select the Trigger mode as **SW** (software)
- Click on **Initialize**
- Click on **Trigger Ramp**
- Observe that **Trigger Ramp** button will change to **Abort** button
- Observe the voltage ramp signal using oscilloscope
- Clicking on the **Abort** button will abort the ramp.
- Clicking on the **Exit** button will exit the Voltage Ramp screen.

Example 2: Creating a Voltage ramp using Hardware Trigger mode

- Set the **Volt** to 25V
- Set the **To Volt** to 50V
- Set the **Curr** to 20A
- Set the **Time** to 10s
- Select the Trigger mode as **HW** (Hardware)
- Click on **Initialize**

- Observe that **Trigger Ramp** button will change to **Waiting for Trig**.
- Give an external trigger i.e. an active high pulse of 10ms on the MOLEX connector pin-9 (ISO-COMMON) and pin-10 (TRIGGGER IN) to generate the Voltage Ramp.
- Observe that **Waiting for Trig** will change to **Abort** button.
- Observe the voltage ramp signal using oscilloscope
- Clicking on the **Abort** button will abort the ramp.
- Clicking on the **Exit** button will exit the Voltage Ramp screen.

3.3.6.2 Current Ramp

The Current Ramp menu allows to configure and execute current ramp, refer to Figure 3-30. The Current Ramp menu allows the selection of parameters such as Curr, To Curr, Volt, Time and Trigger.

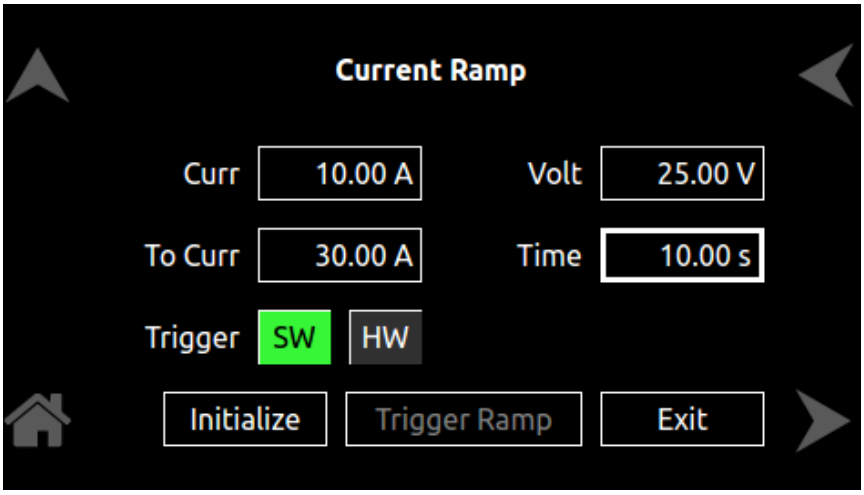


Figure 3-30. Current Ramp Screen

The Current Ramp menu has the following fields:

Entry	Description
Curr	Sets the start current for the ramp
To Curr	Sets the end current for the ramp.
Volt	Sets the volt limit for the ramp.
Time	Sets the time in seconds to reach from start current to end current.
Trigger	Sets the trigger mode for the ramp. In **SW (Software)** trigger mode, the ramp is generated as soon as the Trigger Ramp button is pressed.

In **HW (Hardware)** trigger mode, the ramp will be generated when an active high pulse of 10ms is applied on the MOLEX connector pin-9 (ISO-COMMON) and pin-10 (TRIGGGER IN).

Initialize Initializes the set Ramp parameters**.** Refer to Figure 3-26**.** Press **OK** to return.

Trigger Ramp Generates the ramp in **SW** trigger mode. This will only be enabled after **Initialize** button is pressed, refer to Figure 3-31.

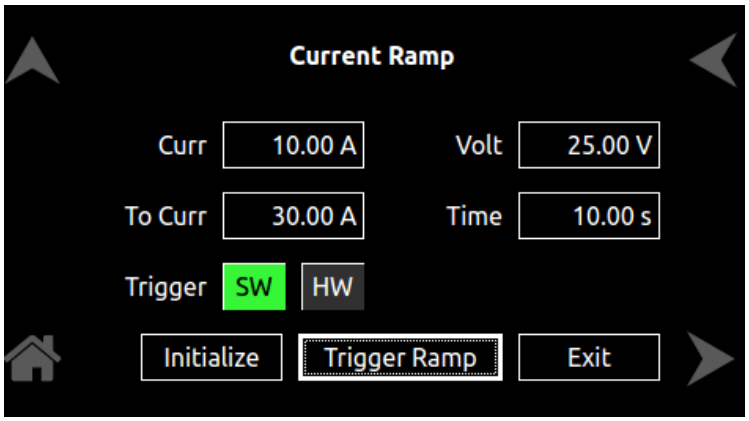


Figure 3-31. Current Ramp-Screen (SW Trigger)

Waiting for Trig This field is displayed after **Initialize** button is pressed in **HW** trigger Mode, refer to Figure 3-32. This shows that the supply is waiting for an active high pulse of 10ms on the MOLEX connector pin-9 (ISO-COMMON) and pin-10 (TRIGGGER IN) to generate the Current Ramp.

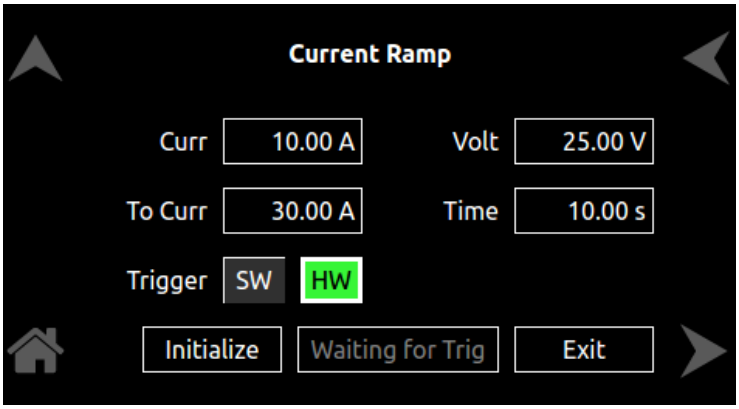


Figure 3-32. Current Ramp-Screen (HW Trigger)

Abort

In **SW** trigger mode, when **Trigger Ramp** button is pressed, it changes to **Abort** button.

In **HW** trigger mode, when external trigger is received, **Waiting for Trig** will change to **Abort** button**,** refer to Figure 3-33. Pressing the **Abort** button aborts the ramp.

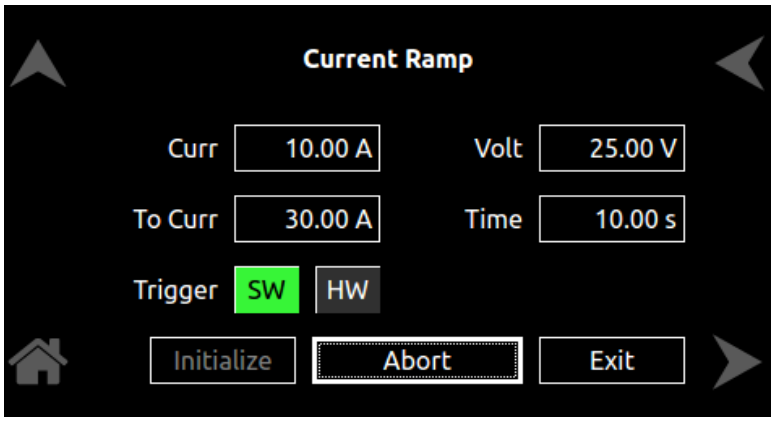


Figure 3-33. Current Ramp-Screen (Abort)

Exit

Exits the Current Ramp sub menu and return back to Ramp Screen Top level menu, refer to Figure 3-24.

NOTE: You cannot exit out of Current Ramp Screen using HOME and UP arrow, these buttons are disabled for the Current Ramp Screen; Refer to Figure 3-30.

Example 1: Creating a Current ramp using Software Trigger mode

- Set the **Curr** to 10A
- Set the **To Curr** to 30A
- Set the **Volt** to 25V
- Set the **Time** to 10s
- Connect an appropriate load to the supply
- Select the Trigger mode as **SW** (software)
- Click on **Initialize**
- Click on **Trigger Ramp**
- Observe that **Trigger Ramp** button will change to **Abort** button
- Observe the current ramp signal using oscilloscope
- Clicking on the **Abort** button will abort the ramp.
- Clicking on the **Exit** button will exit the Current Ramp screen.

Example 2: Creating a Current ramp using Hardware Trigger mode

- Set the **Curr** to 10A
- Set the **To Curr** to 30A
- Set the **Volt** to 25V
- Set the **Time** to 10s
- Connect an appropriate load to the supply

- Select the Trigger mode as **HW** (Hardware)
- Click on **Initialize**
- Observe that **Trigger Ramp** button will change to **Waiting for Trig**.
- Give an external trigger i.e. an active high pulse of 10ms on the MOLEX connector pin-9 (ISO-COMMON) and pin-10 (TRIGGGER IN) to generate the Current Ramp.
- Observe that **Waiting for Trig** will change to **Abort** button.
- Observe the current ramp signal using oscilloscope
- Clicking on the **Abort** button will abort the ramp.
- Clicking on the **Exit** button will exit the Current Ramp screen.

3.3.7 Configuration Screen

The Configuration screen provides power-on settings (PONS), set-up of User V/I Limits, Total System Current for paralleled operation, operation Profiles, Regulation Mode and Measurement Settings.
The top-level menu of the Configuration screen is shown in Figure 3-34.
Refer to Section 3.3.2.1 for navigating to Configuration Screen.

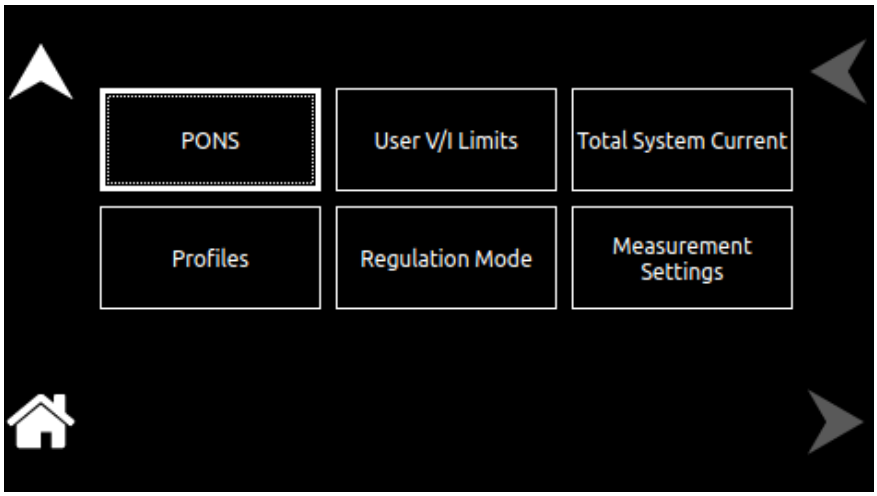


Figure 3-34. Configuration Screen Top-Level Menu

The following menus are available in the Configuration Screen top-level menu:

3.3.7.1 Power ON Settings (PONS)

The PONS Menu allows to set the Power-ON values, refer to Figure 3-35 . The PONS menu allows the setting of parameters such as Voltage, Current, OVP, Curr Avg Samples and Output ON/OFF.

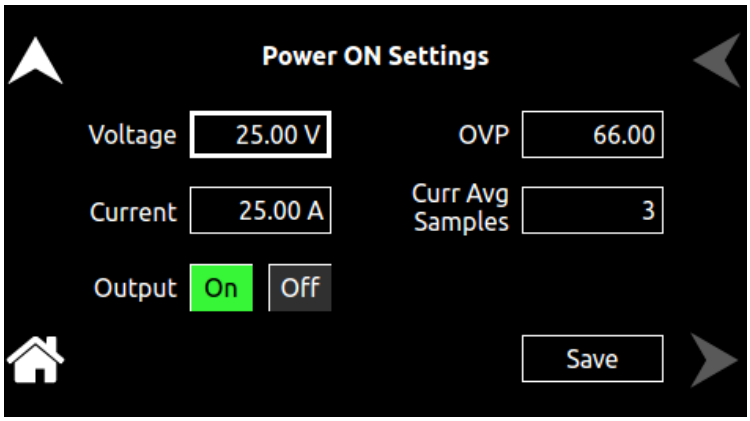


Figure 3-35. Power ON Settings Screen

The Power ON Settings menu has the following fields:

Entry	Description
Voltage	Sets the power-on default voltage.
Current	Sets the power-on default current.
OVP	Sets the power-on default value of the Over Voltage Protection.
Curr Avg Samples	Sets the number of readings to average together when returning the current readback readings. Allows to set a value between 3 to 9. The value of 3 (factory default) provides the fastest response time in the readings, but less rejection of noise.
Output	Sets the default output enable condition at power on. “ON” enables the output at next power on “OFF” disables the output at next power on
Save	Saves the settings to Non-Volatile Memory. Refer to Figure 3-36. These settings are applied at next Power-ON.

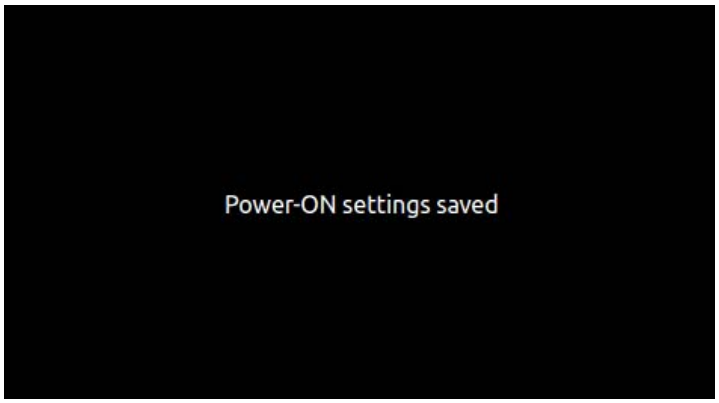


Figure 3-36. Power ON Settings (Save)

3.3.7.2 User V/I Limits

The **User V/I Limits** menu allows to set the soft-limits for output voltage and current to which the unit could be programmed using the front panel or remote digital interface; default is full scale, refer to Figure 3-37.

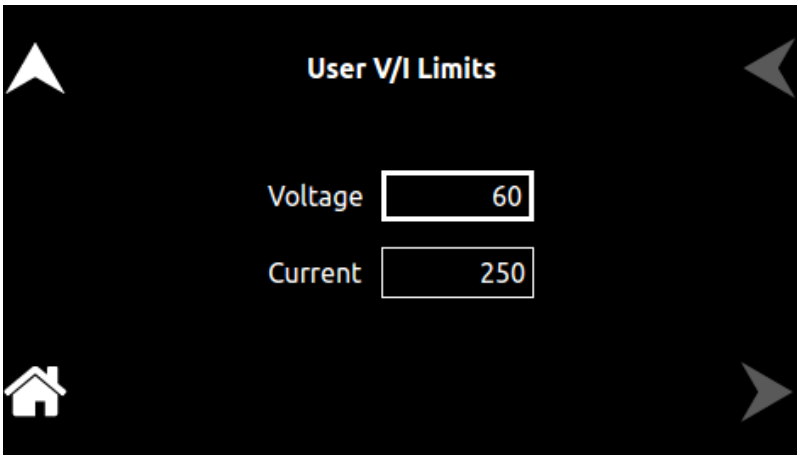


Figure 3-37. User V/I Limits Screen

The User V/I Limits menu has the following fields:

Entry	Description
Voltage	Sets the upper soft limit on the programmed output voltage. The soft limit prevents the supply from being inadvertently programmed above the soft limit, thus providing a method for protecting the load against damaging voltages.
Current	Sets the upper soft limit on the programmed output current. The soft limit prevents the supply from being inadvertently programmed above the soft limit, thus providing a method for protecting the load against damaging currents.

3.3.7.3 Total System Current

The **Total System Current** menu allows to set the total system current when the unit is being paralleled with other SGX series supplies, refer to Figure 3-38.

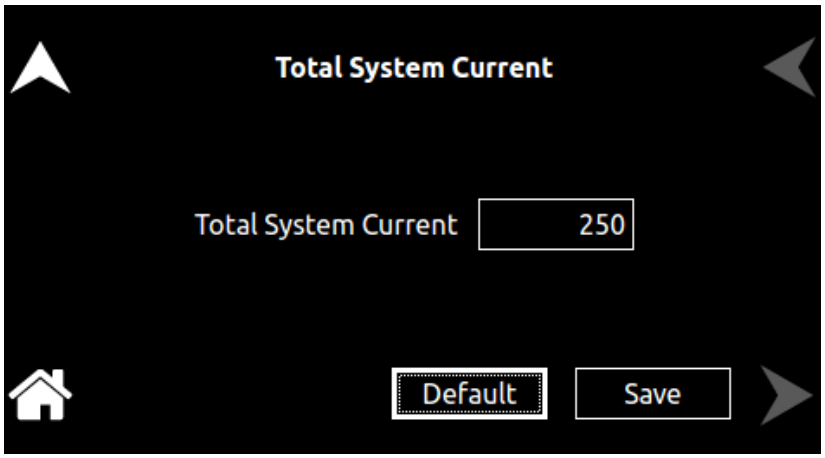


Figure 3-38. Total System Current Screen

The Total System Current menu has the following fields:

Entry	Description
Total System Current	Sets the total current for a paralleled system
Default	Resets Total System Current to the supply default value.
Save	Saves the Total System Current to Non-Volatile Memory to retain the value over Power cycle.

NOTE: Determine the Total System Current by adding the maximum current rating of all supplies in parallel.

3.3.7.4 Profiles Settings

The **Profiles** menu selects the operational state that can be applied to the power source. Refer to Figure 3-39.
It allows to set the values for Voltage, Current, OVP, Output ON/OFF state, that can be applied to the supply during its operation.

NOTE: Profile settings are not applied at Power-ON. For Power-ON settings, refer to the PONS menu. Refer to Section 3.3.7.1.

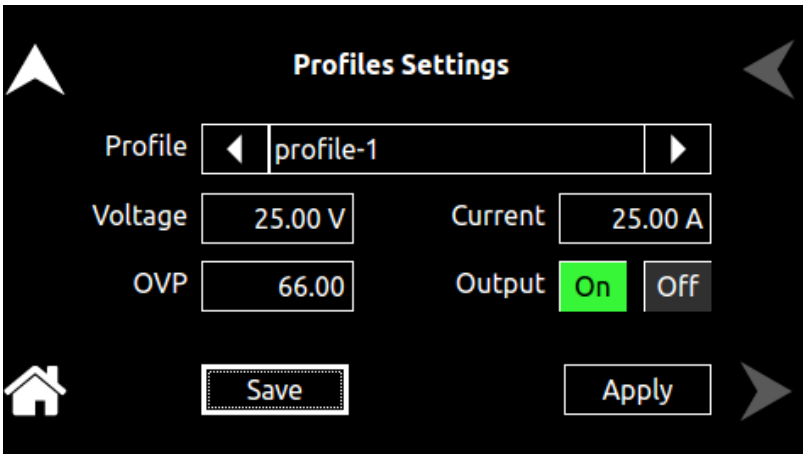


Figure 3-39. Profiles Settings Screen

The Profiles menu has the following fields:

Entry	Description
Profile	Displays the selected profile number. Up to 9 unique profiles could be stored; Use the left and right arrow buttons to navigate through different profiles.
Voltage	Sets the output voltage for the selected profile
Current	Sets the output current for the selected profile.
OVP	Sets the value of the Over Voltage Protection for the selected profile.
Output	Sets the output enable condition for the selected profile. “ON” enables the output “OFF” disables the output
Save	Saves the settings to Non-Volatile Memory.

Apply

Applies the selected the profile to the supply. If output condition is ON for the selected profile, Figure 3-40 will be displayed. Clicking on **Yes** will enable the output and **No** will disable the output.

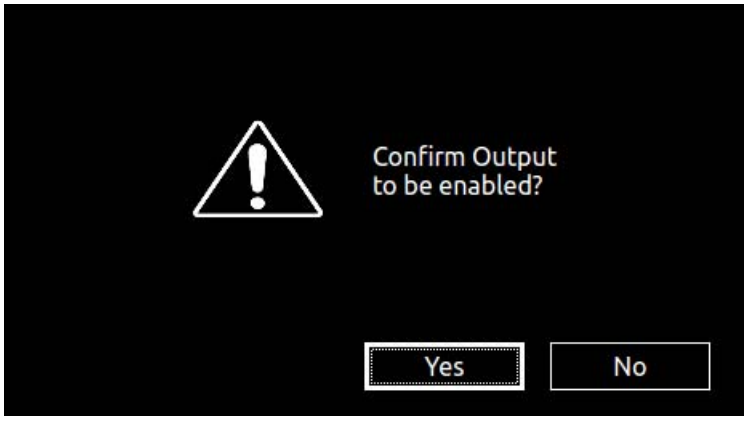


Figure 3-40. Profile Settings Screen (Output Enable)

3.3.7.5 Regulation Settings

The **Regulation Settings** Menu programs the Regulation mode of the supply. Refer to Figure 3-41.

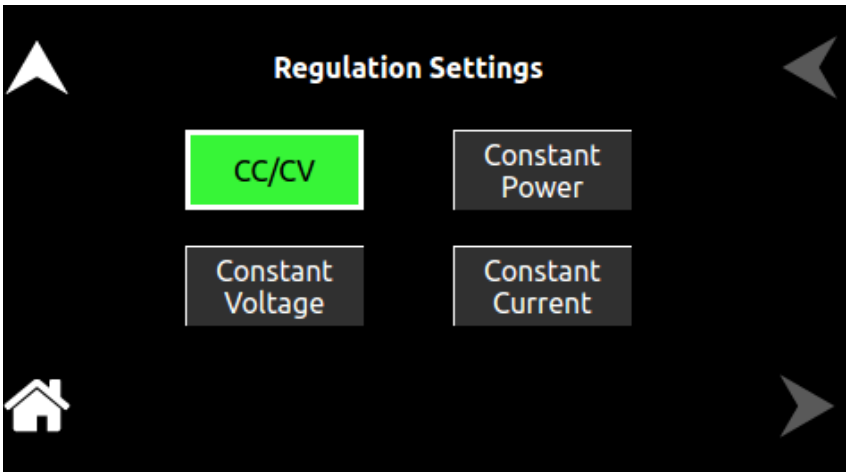


Figure 3-41. Regulation Settings Screen

The Regulation Settings menu has the following fields:

Entry	Description
Constant Power	Supply operates in Power Regulation mode.
Constant Voltage	Supply regulates the voltage at the set value. If the regulation is not met due to change in load, it programs the output to zero after a programmable delay time.
Constant Current	Supply regulates the current at the set value. If the regulation is not met due to change in load, it programs the output to zero after a programmable delay time.
CC/CV	Supply operates in Constant Voltage or Constant Current mode based on the load.
Delay	In **Constant Voltage** and **Constant Current** mode, sets the programmable time delay executed by the supply before programming the output to zero. Refer to Figure 3-42.

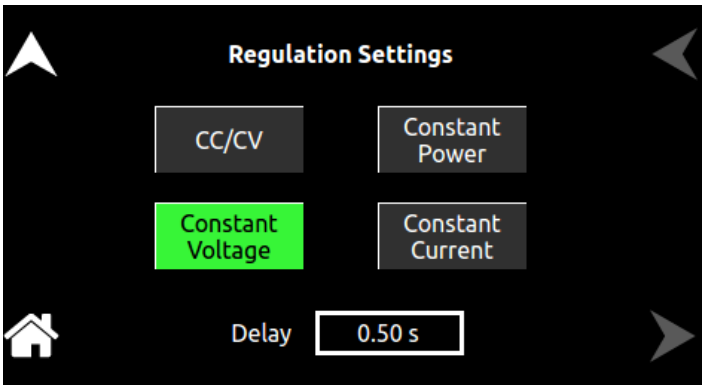


Figure 3-42. Regulation Settings Screen (Delay)

3.3.7.6 Measurement Settings

The **Measurement Settings** Menu sets the number of readings to average together to reduce noise in the readback. Refer to Figure 3-43.

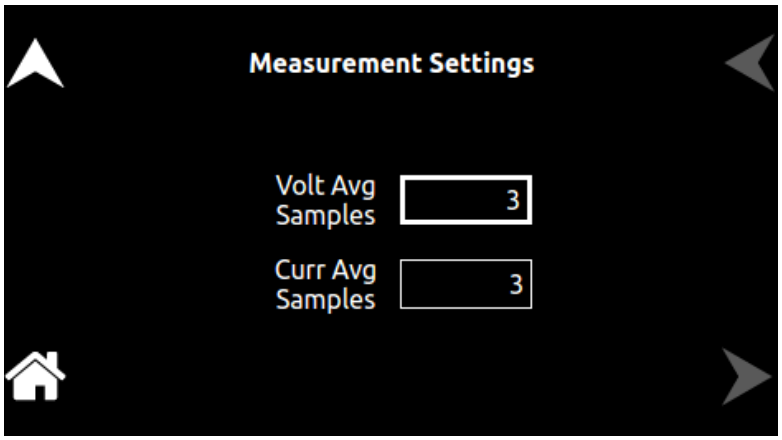


Figure 3-43. Measurement Settings Screen

The Measurement Settings menu has the following fields:

Entry	Description
Volt Avg Samples	Sets the number of voltage readings to average together to reduce noise in the voltage readback. Allows to set a value between 1 to 5.
Curr Avg Samples	Sets the number of current readings to average together to reduce noise in the current readback. Allows to set a value between 3 to 9. The value of 3 (factory default) provides the fastest response time in the readings, but less rejection of noise.

3.3.8 Control Interface Screen

The Control Interface screen provides the ability to configure the power source for remote control through the data communications interfaces. The top-level menu of the Control Interface screen is shown in Figure 3-44.

Refer to Section 3.3.2.1 for navigating to Control Interface Screen.

Figure 3-44. Control Interface Screen Top-Level Menu

The following menus are available in the Control Interface Screen top-level menu: RS232, GPIB, LAN.

3.3.8.1 RS232

Entry	Description
RS232	This has two sub-menus **RS232 Settings** and **RS232 Configure**, refer to Figure 3-45.

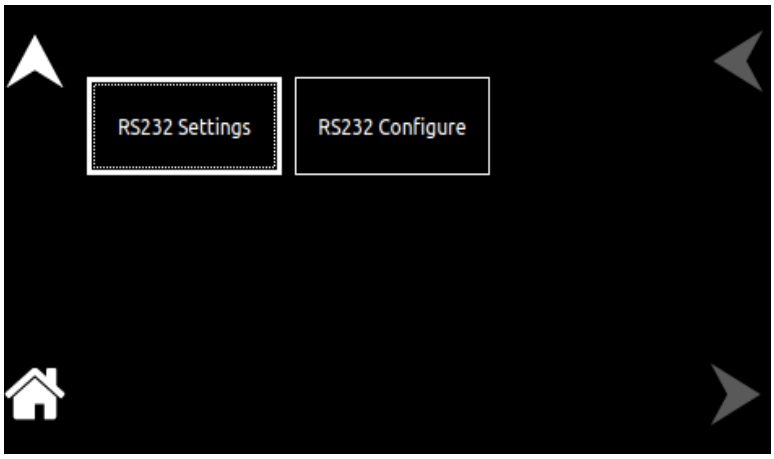


Figure 3-45. RS232 Screen

RS232 **Settings**: Lists the configured Baud Rate, Stop Bits, Bits and Parity for the RS232 digital interface, refer to Figure 3-46.

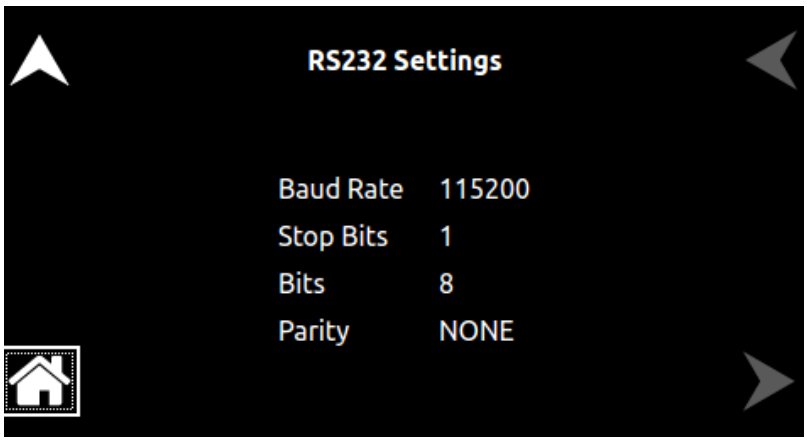


Figure 3-46. RS232 Screen (Settings)

RS232 **Configure**: Configures the RS-232C Baud Rate, refer to Figure 3-47. This setting must match those set for the communications port of the user external controller.

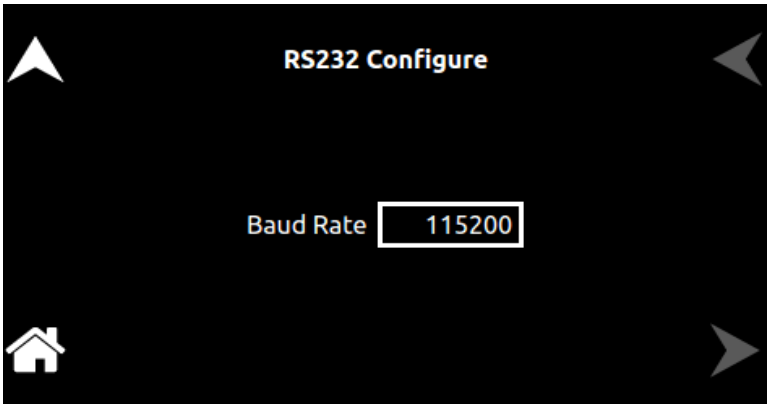


Figure 3-47. RS232 Screen (Configure)

Following are the Baud Rates supported: 9600, 19,200, 38,400, 57600 or 115,200 baud. Refer to Figure 3-48. The default setting is 19,200 baud.

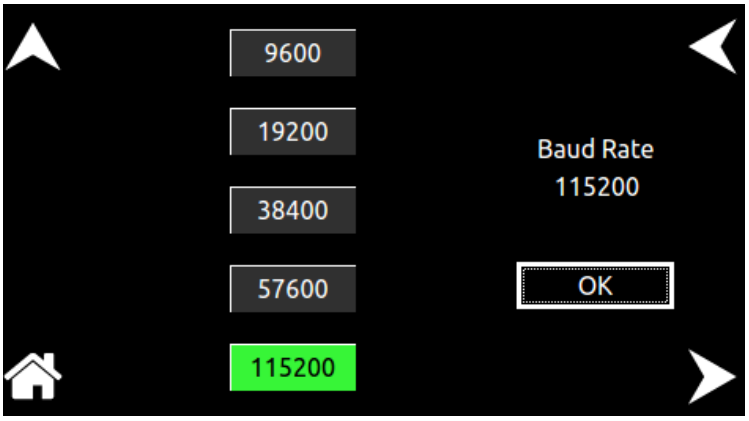


Figure 3-48. RS232 Screen (Baud Settings)

3.3.8.2 GPIB

GPIB

Sets the IEEE-488 Address; the default is 1. The address could be set from 1 through 31, refer to Figure 3-49.

Also allows to turn On/Off the Power ON Service Request. Power On SRQ set to On causes a GPIB service request to be sent to the computer, when the Power Supply is turned on. Factory Default value for Power On SRQ is Off.

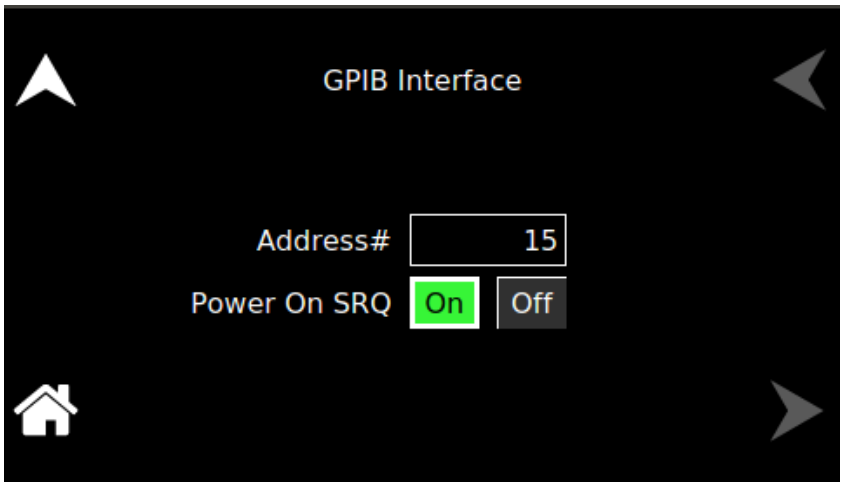


Figure 3-49. GPIB Screen

3.3.8.3 LAN

LAN

Configures the LAN (Ethernet) communications interface, refer to Figure 3-50.

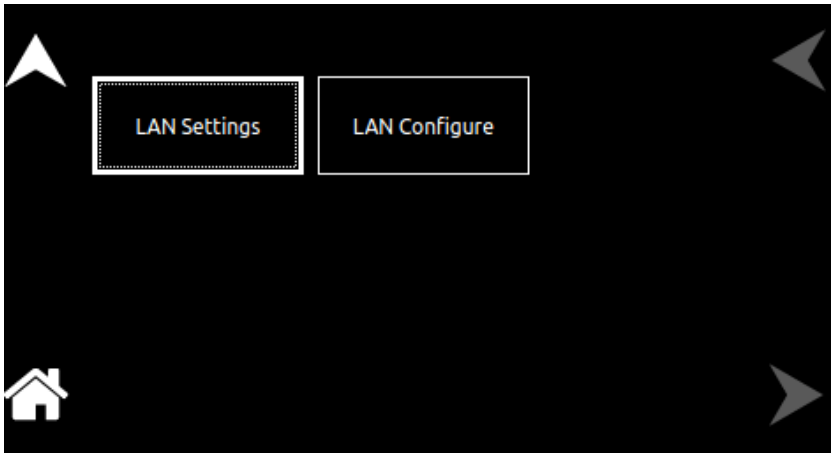


Figure 3-50. LAN Screen

LAN SETTINGS: Lists the configuration settings of the LAN interface. Refer to Figure 3-51.

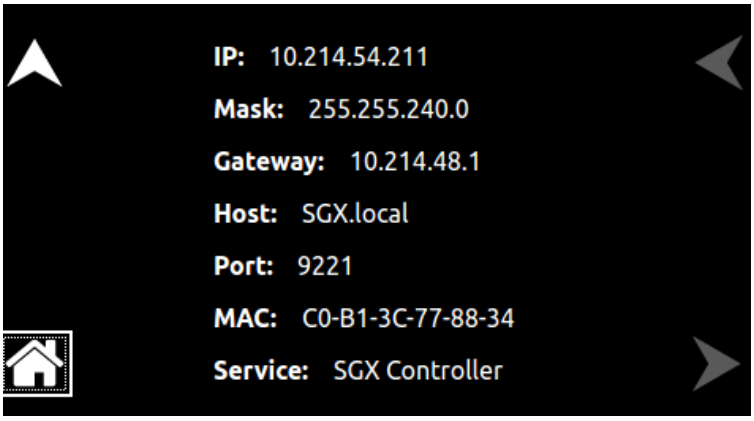


Figure 3-51. LAN Screen (Settings)

LAN CONFIGURE: Sets parameter values and controls operation of the LAN interface; refer to Figure 3-52.

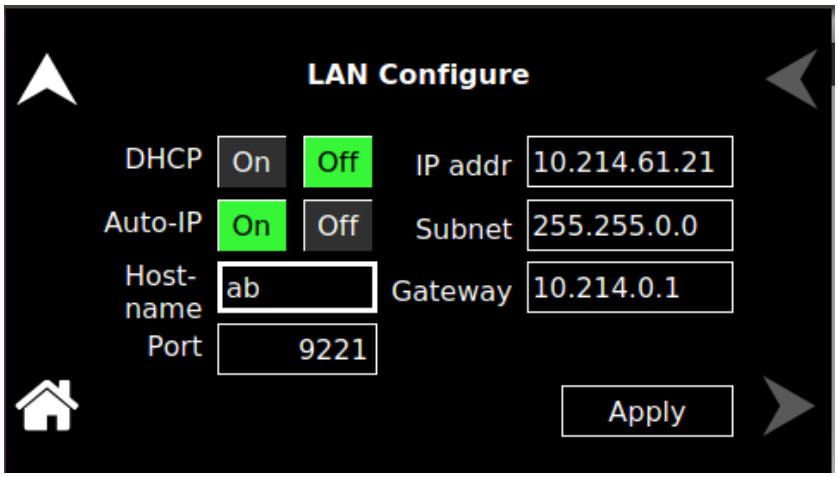


Figure 3-52. LAN Screen (Configure)

DHCP: Selects whether DHCP is enabled or disabled. Refer to Figure 3-53.

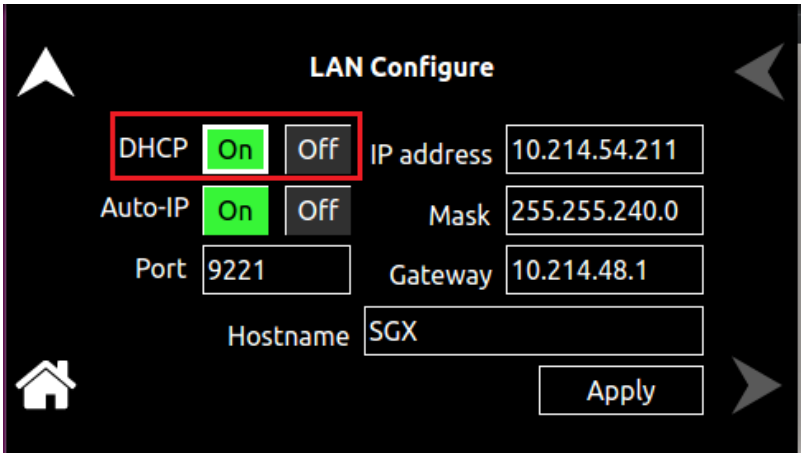


Figure 3-53. LAN Screen (DHCP)

Auto-IP: Enables or disable the Auto-IP configuration, when DHCP is ON. Refer to Figure 3-54.

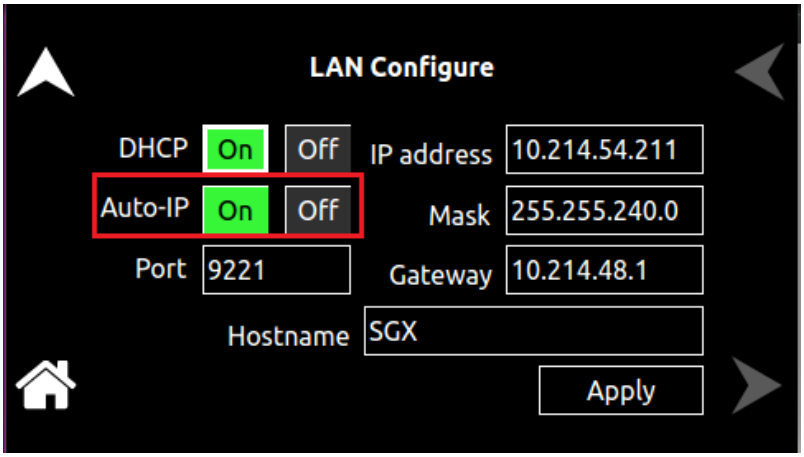


Figure 3-54. LAN Screen (Auto IP)

NOTE: When DHCP is selected, the IP address is assigned by the network DHCP server. If DHCP server fails to assign an IP address and Auto-IP is enabled, the unit gets an IP address in the range of 169.254.X.X.

IP Address: Sets the static IP address for the unit. Refer to Figure 3-55.

Figure 3-55. LAN Screen (IP Address)

Subnet Mask: sets the subnet mask for use in static IP configuration. Refer to Figure 3-56.

Figure 3-56. LAN Screen (Subnet Mask)

Gateway Address: Sets the gateway address for use in static IP configuration. Refer to Figure 3-57.

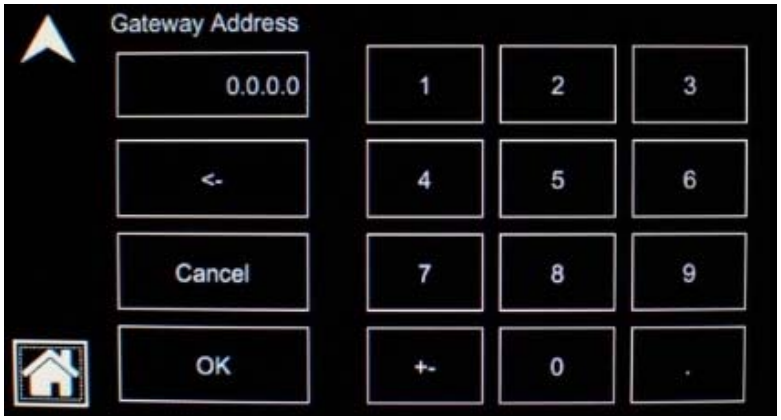


Figure 3-57. LAN Screen (Gateway Address)

NOTE: When DHCP is selected, the gateway address is assigned by the network DHCP server.

Port: sets the port number; the factory-default value is 9221. Refer to Figure 3-58**.**

Figure 3-58. LAN Screen (Port)

Host Name: allows setting a unique alpha-numeric host name. Refer Figure 3-59.

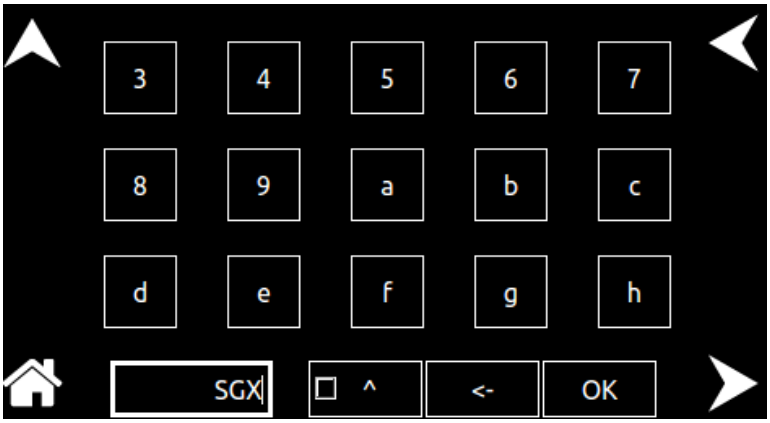


Figure 3-59. LAN Screen (Host Name)

Apply Now: Applies the LAN settings to the supply. Refer Figure 3-61.

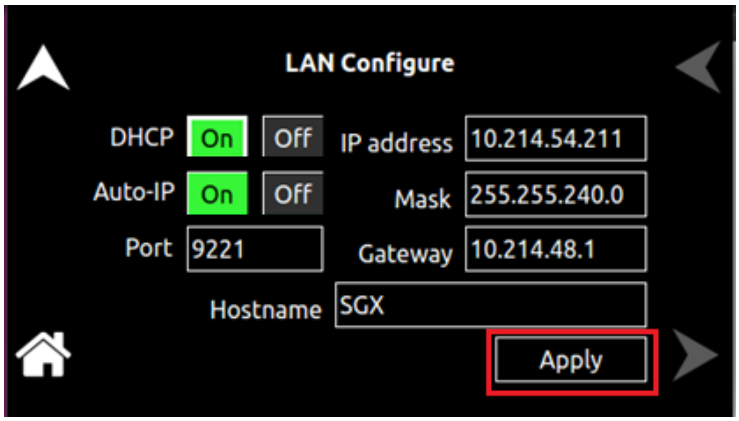


Figure 3-60. LAN Screen (Apply)

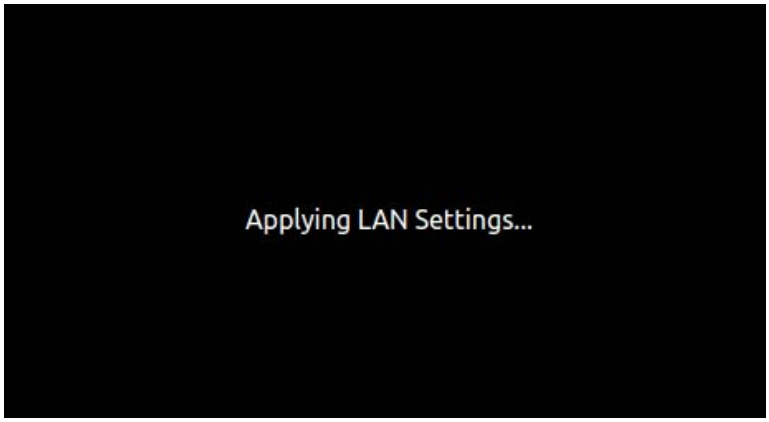


Figure 3-61. LAN Screen (Applying LAN Settings)

3.3.9 System Settings Screen

The System Settings screen provides information on Firmware Version, Hardware Limits, LCD Brightness, Default Screen Timeout and also allows to select the Language used on the display.

The top-level menu of the System Settings menu is shown in Figure 3-62.
Refer to Section 3.3.2.1 for navigating to System Settings Screen.

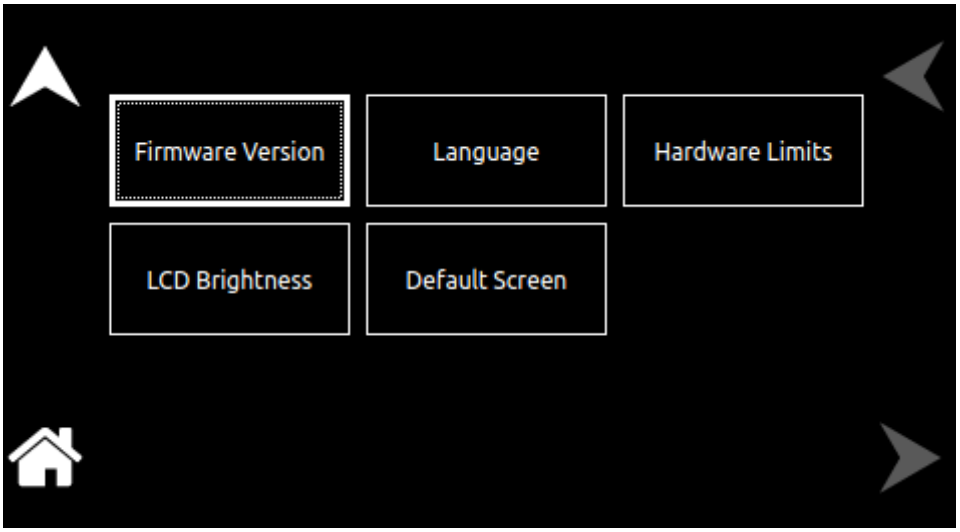


Figure 3-62. System Settings Screen Top-Level Menu

The following menus are available in the System Settings Screen top-level menu: Firmware Version, Language, Hardware Limits, LCD Brightness and Default Screen.

Entry	Description
Firmware Version	Displays information about the configuration of the power source. It has information such as manufacturer, model number, serial number, firmware version and Last Calibration Date. This information helps identify the unit. Refer to Figure 3-63**.**

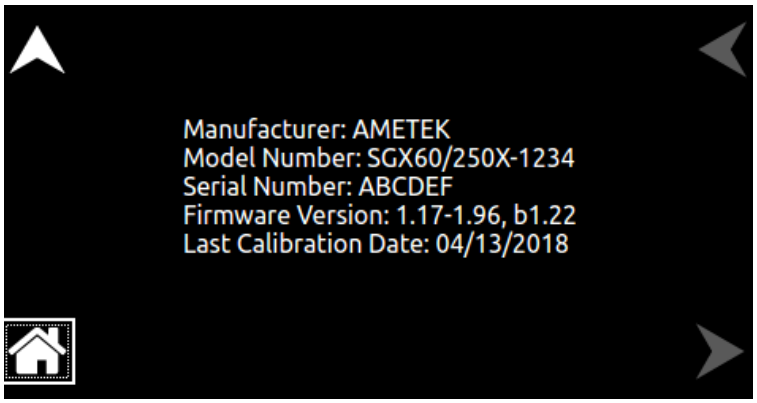


Figure 3-63. System Settings Screen (Version)

Language Selects the language of the display menus: German, English, Spanish, French, Russian, Japanese, Chinese, or Korean. Refer to Figure 3-64.

Figure 3-64. System Settings Screen (Language)

Hardware Limits Displays the hardware parameter limit values. Refer to Figure 3-65.

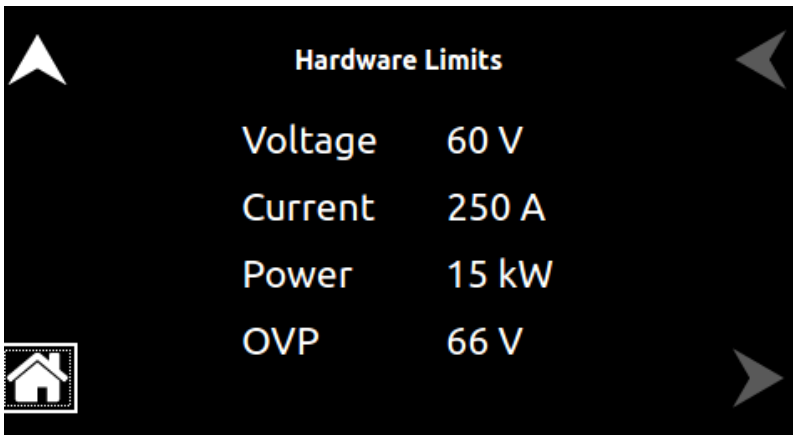


Figure 3-65. System Settings Screen (Hardware Limits)

LCD Brightness

Sets the brightness of the LCD backlight, as a percentage of the maximum that is available; the default setting is 70%. Tapping on the Right or Left arrow buttons, or selecting them with the encoder and clicking the encoder switch, will increment/decrement the brightness by 10%, respectively. Refer to Figure 3-66.

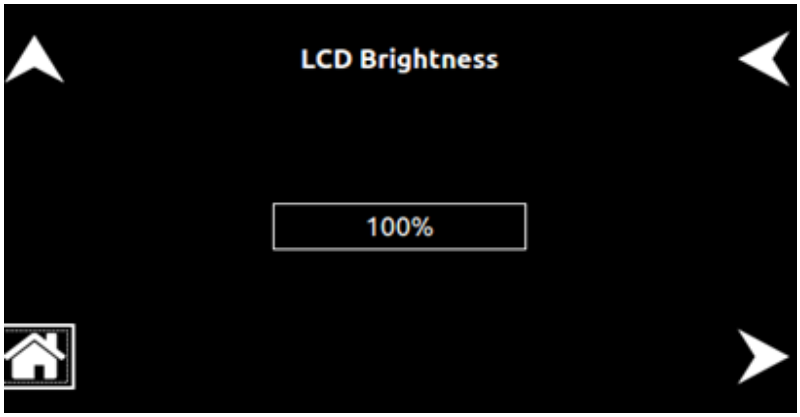


Figure 3-66. System Settings Screen (LCD Brightness)

Default Screen

Selects whether the Default screen (showing measured voltage, current and power) is enabled or disabled, refer to Figure 3-67 and Figure 3-68. It allows to set the time out if the default screen is enabled.

Timeout Interval: Selects the time, in seconds, for how long Dashboard screen must be inactive before the Default screen is displayed.

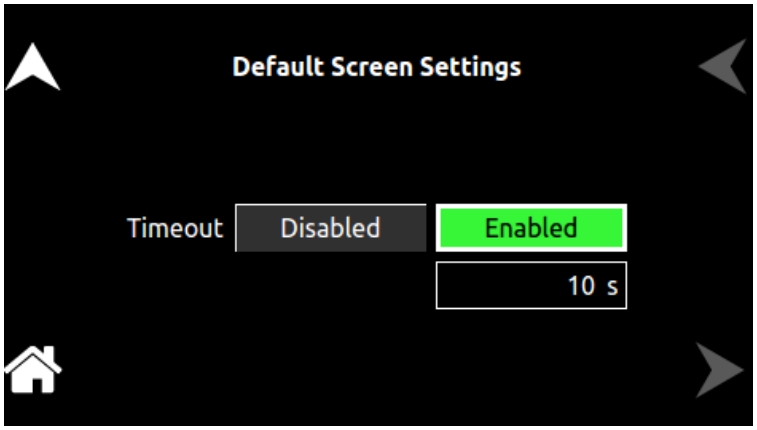


Figure 3-67. System Settings Screen (Default Screen Enabled)

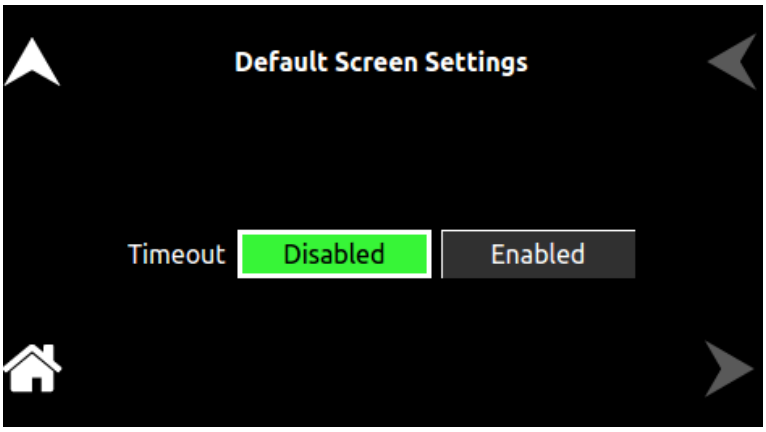


Figure 3-68. System Settings Screen (Default Screen Disabled)

3.3.10 Sequencing

The SGX sequencing function allows the user to set up the supply to automatically run a series of voltage, current and power mode operations. This is especially useful for setting up the supply to test to compliance standards, or unburdening the test computer in automated testing applications. Through RS-232, IEEE-488 or Ethernet, an external computer can trigger the sequences. Up to 50 sequences may be stored, with each sequence containing up to 20 individual steps. With the ability to string sequences together and an extensive list of step functions such as ramping, looping, goto and subroutine calls, the user can define a nearly infinite variety of test sequences.

Note: DO NOT use non-sequence-related SCPI commands while performing sequence operations.

Note: DO NOT use sequence SCPI commands as stand-alone commands outside a sequence.

CAUTION!

RESTRICTIONS ON SEQUENCE PROGRAMMING
In order to allow maximum flexibility for generating small incremental changes during a test sequence, the SGX allows 1 ms time resolution on each step. With this capability, however, it is possible to create output changes with fast slew rates, that could generate potentially damaging large currents, in the output capacitors of the unit; refer to the guideline note, below.

Note: *When creating test sequences, use the following guidelines to prevent damage to the unit:*

- Estimate the AC frequency and peak-to-peak voltage, V(PK-PK) of the desired test sequence.

- Convert the estimated V(PK-PK) to a % of maximum output voltage (e.g., if V(PK-PK) is 10V and maximum voltage of the supply is 100V, then %V(PK-PK) = 10%)
- Verify that the frequency and %V(PK-PK) do not exceed the values below:

Frequency	% V(PK-PK)
10Hz	25%
50Hz	5.0%
100Hz	2.5%
150Hz	1.67%
200Hz	1.25%

- Another consideration is the actual rise and fall capabilities of the output of the supply. Although damage will not occur, the shape of the output waveform will be affected by the rise/fall times in relation to programmed sequence settings. These vary widely depending on the load conditions; contact the factory for further information.

Note*: Contact the factory for detailed information if the desired waveform exceeds the recommended limits as discussed.*

3.3.10.1 Sequence Screen

The front panel display can also be used to program, test and run a sequence. The top-level menu of the Sequence Screen is shown in Figure 3-69. Refer to Section 3.3.2.1 for navigating to Sequence Screen.

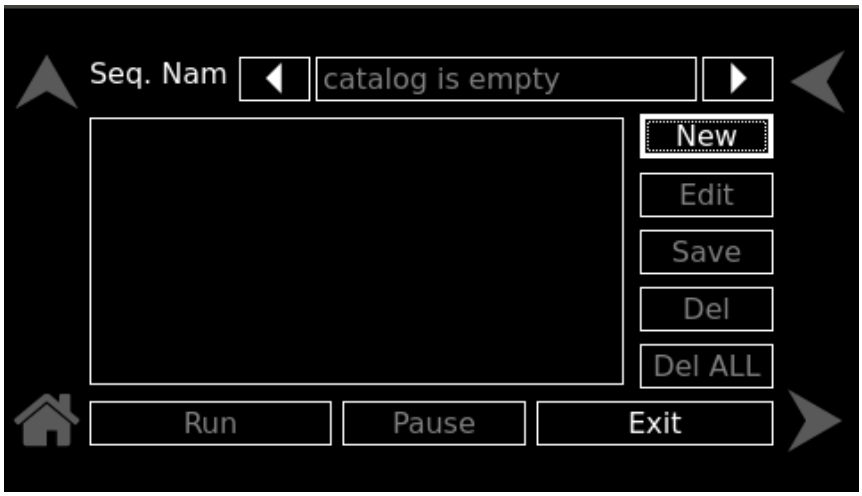


Figure 3-69. Sequence Screen Top Level Menu

The sequencing menu has the following fields:

Entry	Description
Seq.Nam	Displays the name of the currently selected sequence. Initially when no sequences are programmed in the supply, this field will show “catalog is empty”. Left and right arrows allow to navigate between different sequences programmed in memory.
New	Allows to create a new sequence. On tapping the New Button, a Keypad pops up, which allows the user to provide a name for the new sequence, refer to Figure 3-70. A sequence name must not be longer than 15 characters. Use the keypad to name the sequence. Press OK, and observe a screen asking for user confirmation pops up. Refer to Figure 3-71. Press Yes to create the sequence.

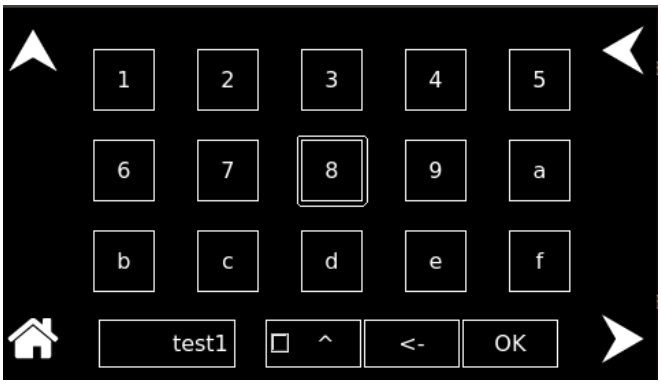


Figure 3-70. Sequence Screen (Seq. Nam editing)

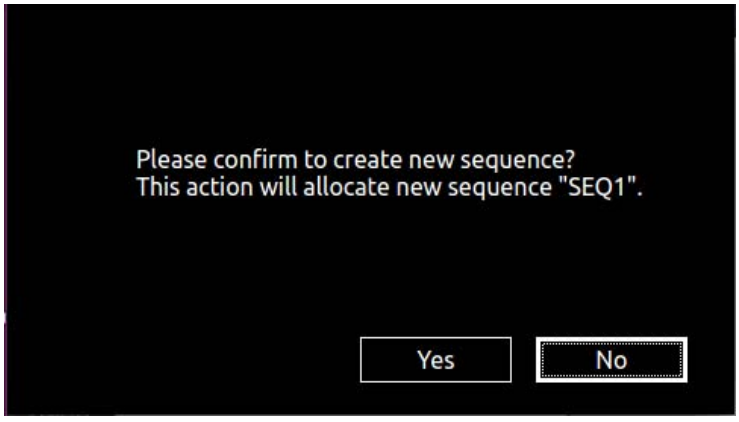


Figure 3-71. Sequence Screen (User Confirmation)

Edit

Programs the sequence command into the selected sequence at step# (1 to 20). Initially all the steps will be NOP for a newly created sequence. Refer to Figure 3-73 and Figure 3-73.

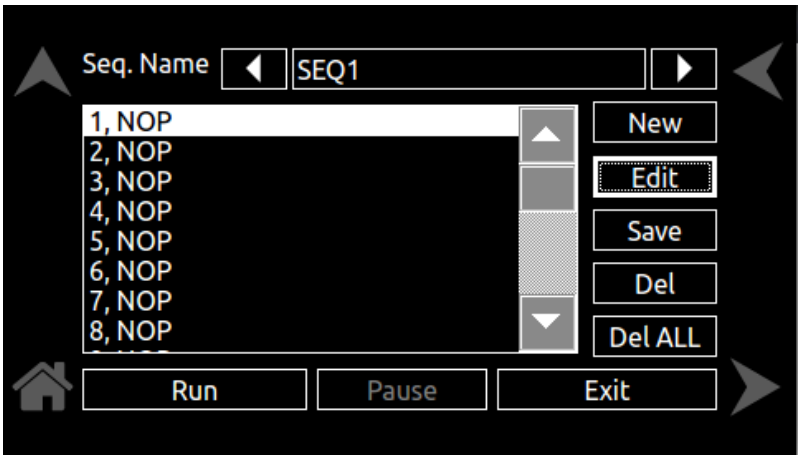


Figure 3-72. Sequence Screen (Edit Button Highlighted)

The following sequence commands are supported. Left and Right arrow buttons can be used to navigate between different sequence commands. Refer to Figure 3-73.

NOP

Programs the NOP (No Operation) sequence command. It is used as a placeholder in the test sequence, no values are changed during this step and it does not add time to the sequence. Refer to Figure 3-73.

Figure 3-73. Sequence Screen (NOP)

VIMODE

Programs the VIMODE sequence command into the selected sequence at <step#>. The following values are set by this command: Voltage, Current, OVP and Duration. Refer to Figure 3-74. Navigate to each editable item to input values for Voltage, Current, OVP and Duration. Click on Apply to program the step. Click on Cancel to go to previous screen.

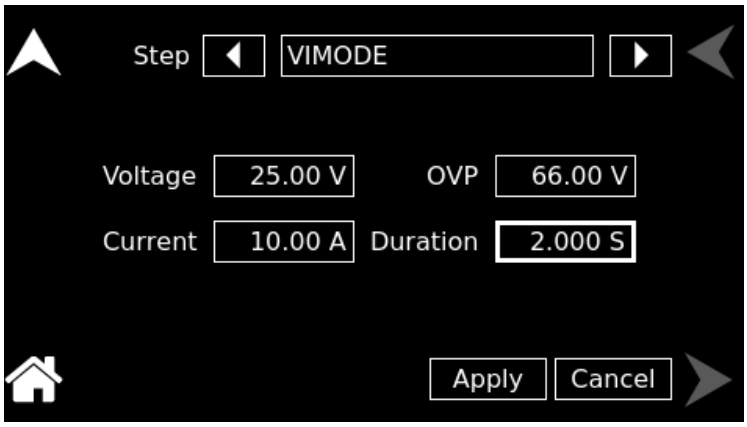


Figure 3-74. Sequence Screen (VIMODE)

RAMPTOV

Programs the RAMPTOV sequence command into the selected sequence at <step#>. The following values are programmed: Start Volt, End Volt, Curr, OVP and Duration. Refer to Figure 3-75. Click on Apply to program the step. Click on Cancel to go to previous screen.

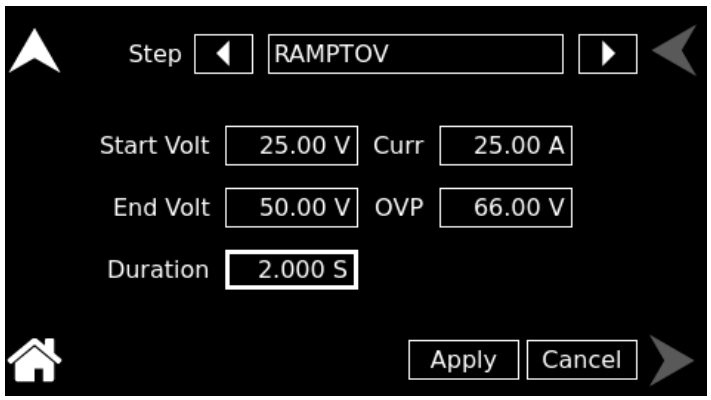


Figure 3-75. Sequence Screen (RAMPTOV)

RAMPTOC

Programs the RAMPTOC sequence command into the selected sequence at <step#>. The following values are programmed: Start Curr, End Curr, Volt, OVP and Duration. Refer to Figure 3-76. Click on Apply to program the step. Click on Cancel to go to previous screen.

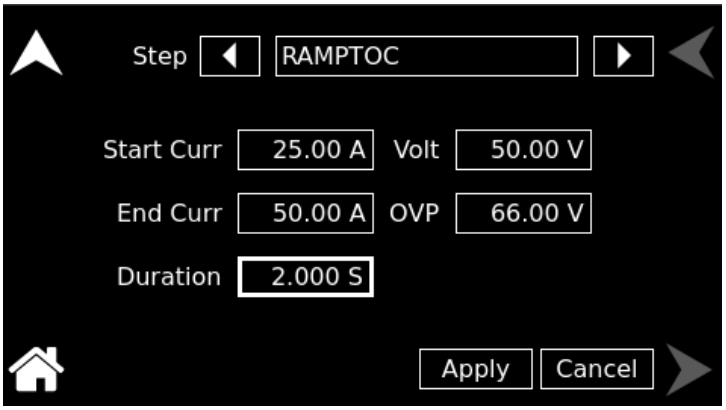


Figure 3-76. Sequence Screen (RAMPTOC)

Power Settings

Programs the constant power POWERSETTINGS sequence command into the selected sequence at <step#>. This operation is similar to the V/I Mode, except it sets the supply in a constant-power mode (See Section 3.8.5). The following values are programmed: Power (constant power limit), Volt limit, Curr limit, OVP and Duration. Refer to Figure 3-77. Click on Apply to program the step. Click on Cancel to go to previous screen.

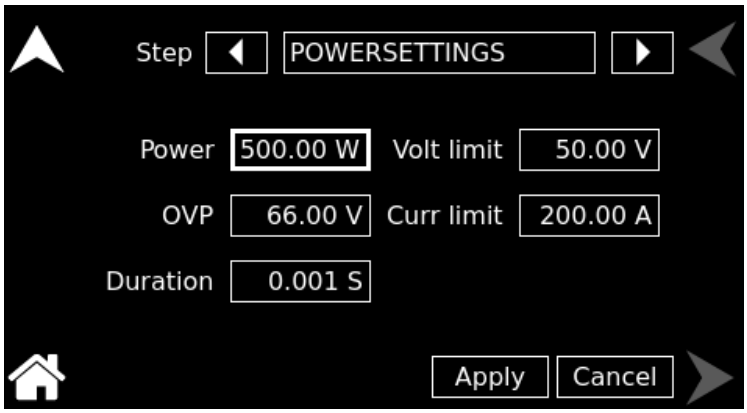


Figure 3-77. Sequence Screen (POWERSETTINGS)

REPEAT

Programs the REPEAT sequence command into the selected sequence at <step#>. Refer to Figure 3-78. This sequence command causes sequence execution to jump back to the starting location (i.e. step 1) and execute from there and continue repeating endlessly. To stop, click on Abort or Exit button. Refer to Figure 3-79.

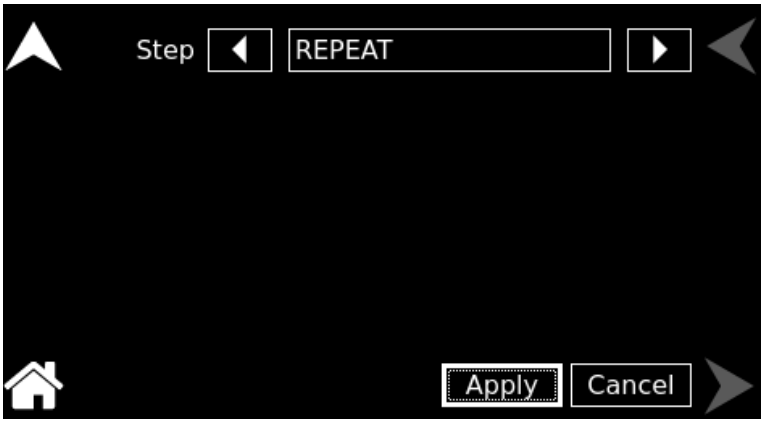


Figure 3-78. Sequence Screen (REPEAT)

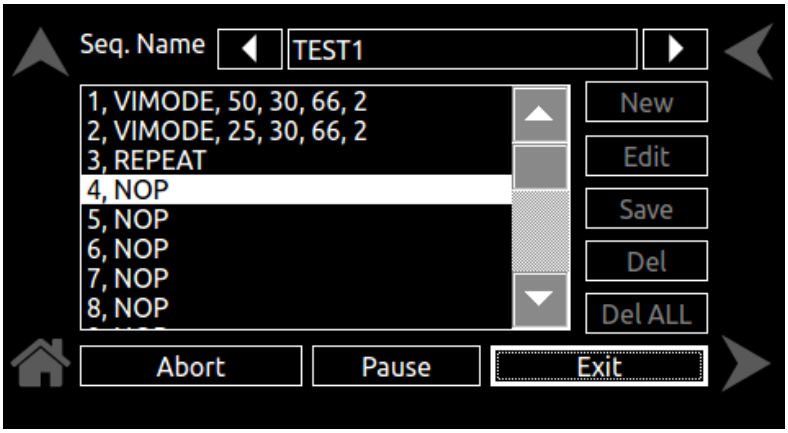


Figure 3-79. Sequence Screen (Running)

SUBCALL

Programs the SUBCALL sequence command into the selected sequence at <step#>. The SUBCALL sequence command causes sequence execution to jump to the beginning of a sub-sequence selectable using Seq field. Refer to Figure 3-80. Different sub-sequence can be selected using the Left and Right arrow buttons next to the Seq field. If the sub-sequence has a RETURN command at its end, then when the RETURN command is encountered, execution will resume at the step immediately following the SUBCALL.

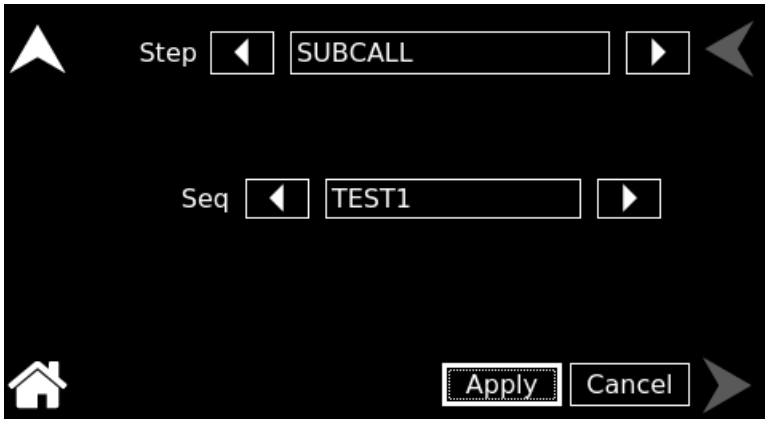


Figure 3-80. Sequence Screen (SUBCALL)

RETURN

Programs the RETURN sequence command into the selected sequence at <step#>. The RETURN sequence command, if it occurs in a sequence that was called with a SUBCALL command, causes execution to resume at the step immediately following the SUBCALL. If the RETURN command occurs in a sequence executed as the primary sequence (i.e., not a sub-sequence), then the RETURN shall be interpreted as though it were a STOP command.. Refer to Figure 3-81.

Figure 3-81. Sequence Screen (RETURN)

LOOP

Programs the LOOP sequence command into the selected sequence at <step#>. The LOOP sequence command, together with its associated <count> value and the NEXT sequence command, provides a means of repeating a set of sequence steps for a defined number of times. All sequence steps that exist between the LOOP sequence command and the NEXT sequence command shall be executed for <count> number of times. Refer to Figure 3-82 and Figure 3-83.

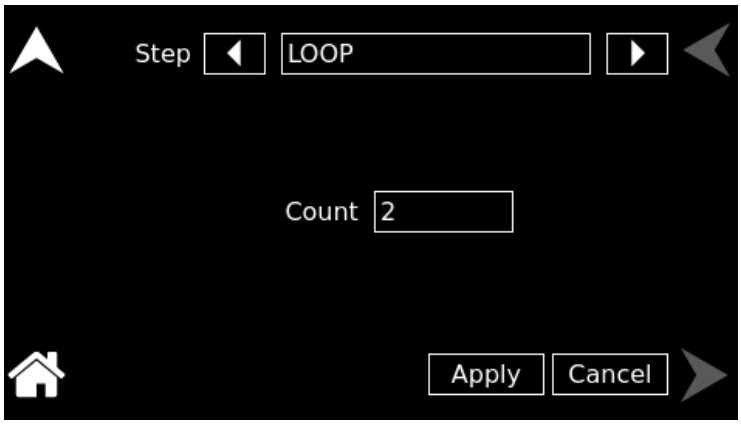


Figure 3-82. Sequence Screen (LOOP)

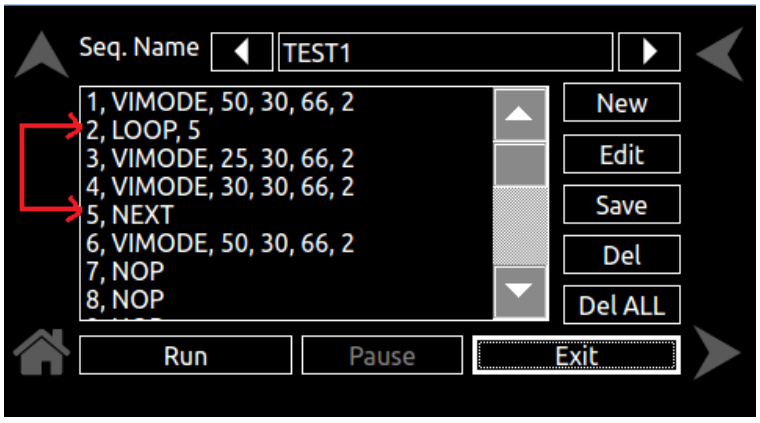


Figure 3-83. Sequence Screen (LOOP and NEXT)

NEXT

Programs the NEXT sequence command into the selected sequence at <step#>. The NEXT command must follow a matching LOOP command. The NEXT command causes sequence execution to resume at the matching LOOP command, with a count decreased by 1. Refer to Figure 3-84 and Figure 3-83. As per Figure 3-83, the commands between LOOP (step 2) and NEXT (step 5) will be repeated 5 times.

Figure 3-84. Sequence Screen (NEXT)

STOP

Programs the STOP sequence command into the selected sequence at <step#>. This sequence command causes sequence execution to stop while the unit remains at the state of the last command within the sequence. Refer to the Figure 3-85.

Figure 3-85. Sequence Screen (STOP)

GOTO

Programs the GOTO sequence command into the selected sequence at <step#>. During sequence execution, the effect of this sequence command is to cause execution to transfer to the beginning of the sequence selectable by Seq field. Different sequence can be selected using the Left and Right arrow buttons next to the Seq field. Refer to Figure 3-86.

Figure 3-86. Sequence Screen (GOTO)

Save

Saves the presently selected sequence to non-volatile memory for preservation while the power supply is off. Refer to Figure 3-87.

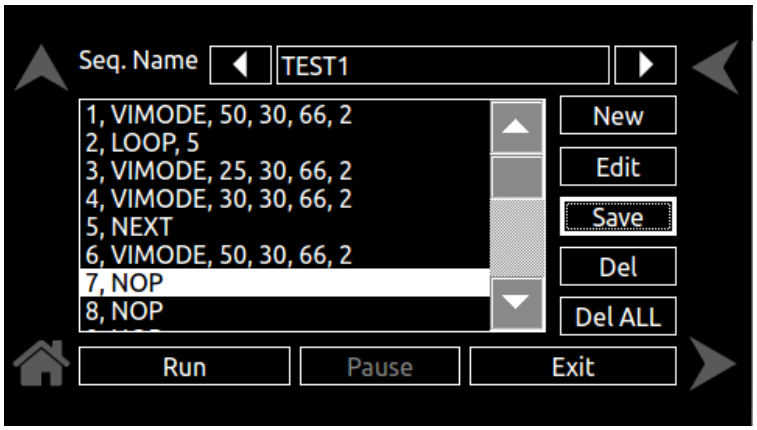


Figure 3-87. Sequence Screen (Save Button Highlighted)

Del

Causes the presently selected sequence to be deleted from ram and non-volatile memory. Its previously allocated memory goes back into the memory pool. Refer to Figure 3-88. On pressing Del, a screen asking for user confirmation pops up. Refer to Figure 3-89 .
Press Yes to delete the sequence.

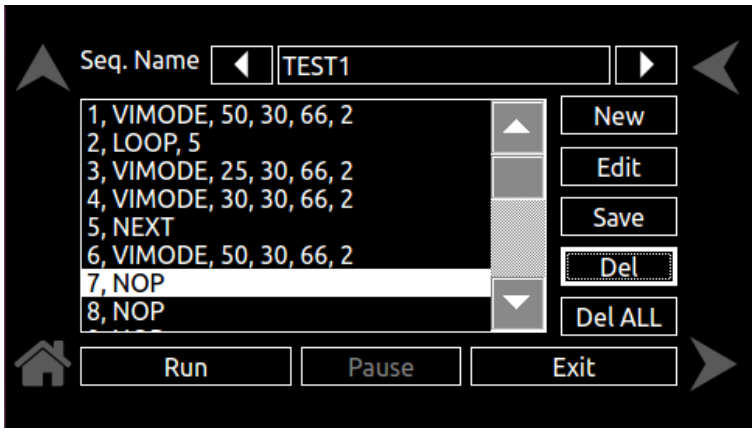


Figure 3-88. Sequence Screen (Del Button Highlighted)

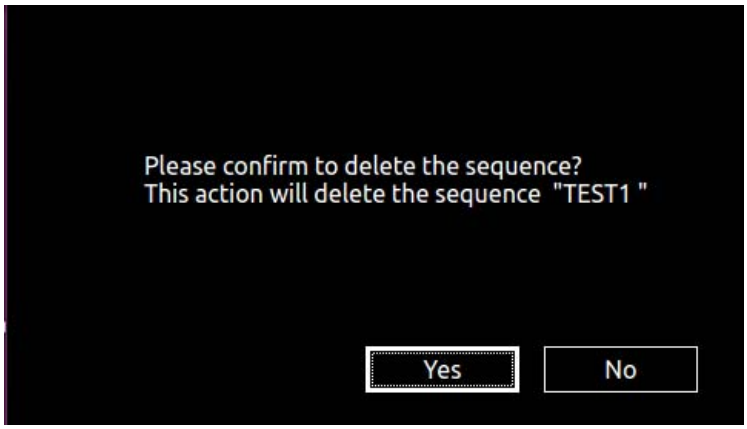


Figure 3-89. Sequence Screen (Del User Confirmation)

Del ALL

This command causes all defined sequences to be deleted from ram and non-volatile memory. Refer to Figure 3-90. On pressing Del ALL, a screen asking for user confirmation pops up. Refer to Figure 3-91. Press Yes to delete all the sequences.

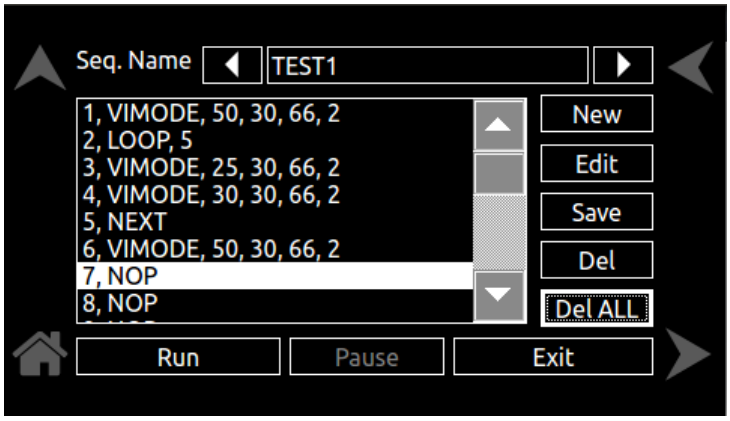


Figure 3-90. Sequence Screen (Del ALL Button Highlighted)

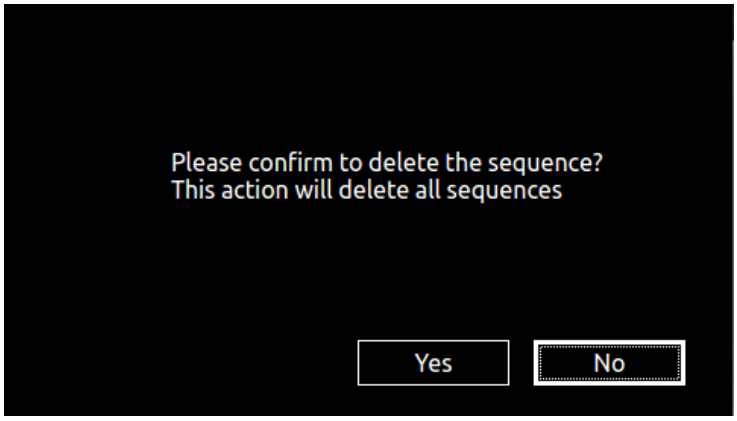


Figure 3-91. Sequence Screen (Del ALL User Confirmation)

Run

Runs or executes the selected sequence. Refer to Figure 3-92. When Run button is clicked, it changes to Abort button. Refer to Figure 3-93.

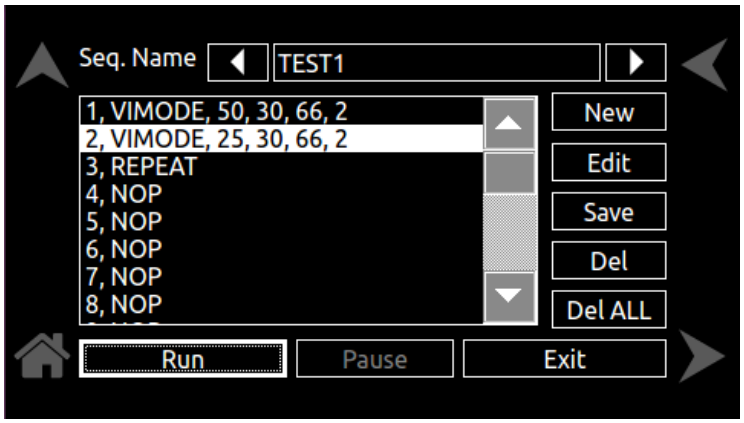


Figure 3-92. Sequence Screen (Run Button Highlighted)

Abort

Aborts the currently running sequence. Refer to Figure 3-93.

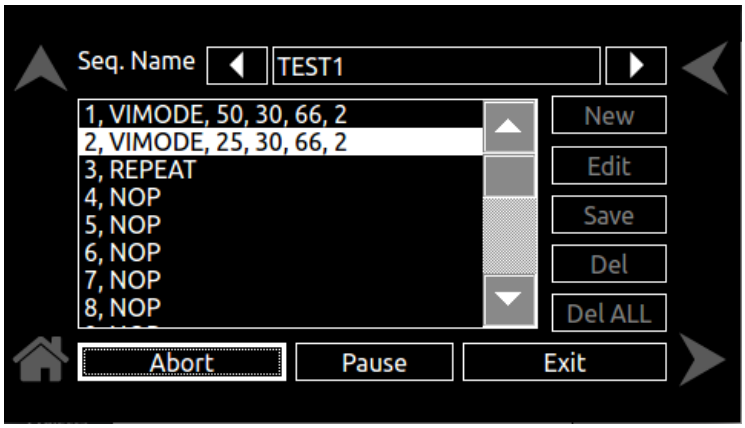


Figure 3-93. Sequence Screen (Abort Button Highlighted)

Pause

Suspends the currently running sequence. Refer to Figure 3-94. The Pause button changes to Resume. Refer to Figure 3-95.

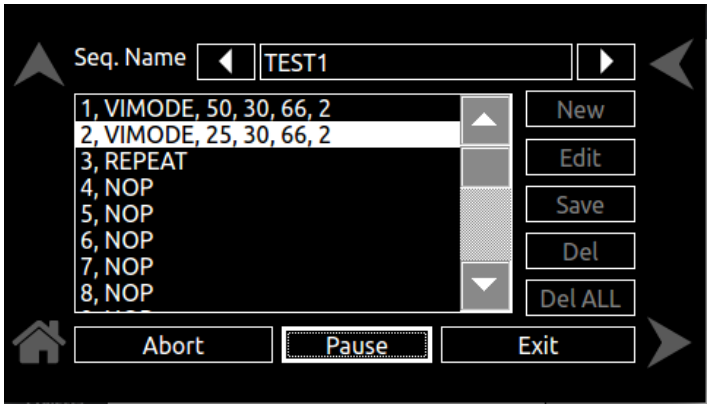


Figure 3-94. Sequence Screen (Pause Button Highlighted)

Resume

Resumes the currently paused sequence. Refer to Figure 3-95.

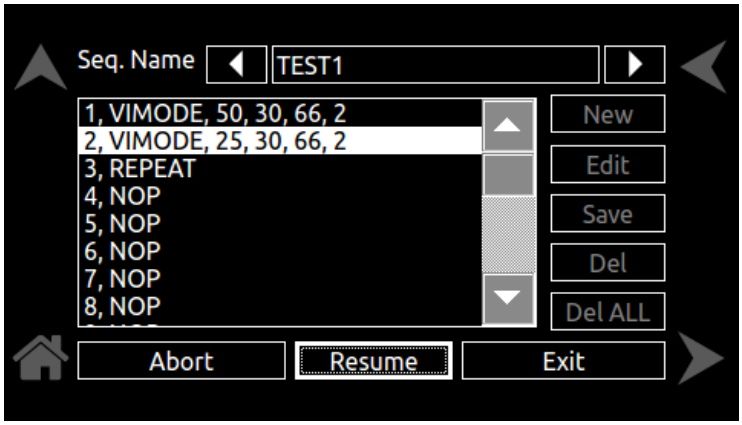


Figure 3-95. Sequence Screen (Resume Button Highlighted)

Exit

Exits the Sequence Screen menu and return back to Home Screen. Refer to Figure 3-96 and Figure 3-16 respectively. It also stops the currently running sequence (if any).

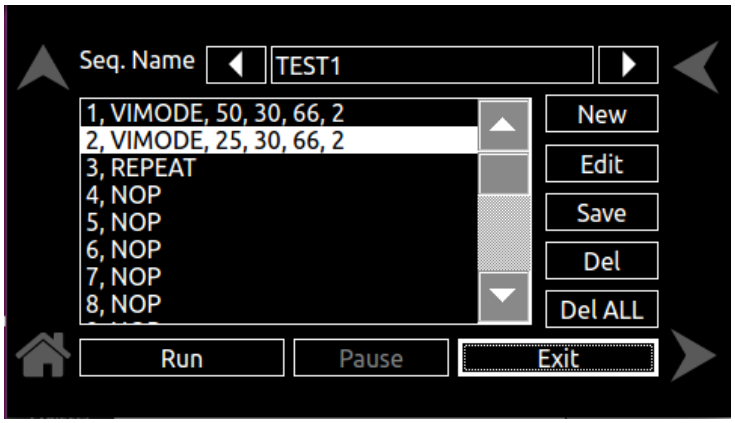


Figure 3-96. Sequence Screen (Exit Highlighted)

3.3.10.2 Sequencing Example

The following provides an example of programming and running a test sequence.

A typical burn-in sequence requires the voltage to the device-under-test (DUT) to ramp up to a nominal voltage, allow the unit to soak at that voltage for a period of time, then 'bump' up that voltage to another level, soak, etc., then return the output back to zero. In some cases, an on/off power cycle sequence may also be required. Figure 3-97 provides a graphical representation of this example burn-in sequence.

Figure 3-97. Burn-in Sequence Example

To begin programming a sequence it is important to know the exact settings for each step of the sequence. In this case, two sequences will be programmed: the first being the up/down ramp sequence, and the second the on/off sequence. The two will be strung together using a Goto command.

The example sequence will perform the following:

Sequence 1 – Up/Down Ramp

Step 1 – Ramp the output voltage from 0 V to 25V over a 1 s period
Step 2 – Hold the voltage at 25 V for 2 s
Step 3 – Ramp the voltage from 25 V to 50 V over a 500 ms period
Step 4 – Hold the voltage at 50 V for 2.5 s
Step 5 – Ramp the voltage from 50 V to 0 V over a 2 s period
Step 6 – Hold the voltage at 0 V for 2 s
Step 7 – Go to sequence 2

Sequence 2 – On/Off Loop

Step 1 – Begin a loop and set the count to 5
Step 2 – Turn on the voltage to 50 V for 2 s
Step 3 – Turn off the voltage for 2 s
Step 4 – Execute the Next loop until all 5 are complete
Step 5 – Stop the sequence

First program the Sequence 2, as it is used by Sequence 1. To program these sequences, do the following:

Sequence 2 – On/Off Loop

From the Home Screen, press Sequencing menu to enter the main Sequence Screen. Click on New to create a new sequence. Using the keypad, name the sequence as TEST02. Press OK and click Yes on the user confirmation screen. Observe that initially all steps will be NOP for sequence TEST02.

Step 1 – Begin a loop and set the count to 5
For Step-1, using the Edit menu, select the step as LOOP. Set the Count to 5. Click the Apply button to program the step.

Step 2 – Turn on the voltage to 50V for 2s
For Step-2, using the Edit menu, select the step as VIMODE. Set the OVP to 60V, Voltage to 50V, Current to 10A and Duration to 2s. Click the Apply button to program the step.

Step 3 – Turn off the voltage for 2 seconds
For Step-3, using the Edit menu, select the step as VIMODE. Set the OVP to 60V, Voltage to 0V, Current to 10A and Duration to 2s. Click the Apply button to program the step.

Step 4 – Execute the Next loop until all 5 are complete
For Step-4, using the Edit menu, select the step as NEXT. Click the Apply button to program the step.

Step 5 – Stop the sequence
For Step-5, using the Edit menu, select the step as STOP. Click the Apply button to program the step.

Click on Save button. This completes programming of the sequence TEST02. Refer to Figure 3-98.

Sequence 1 – Up/Down Ramp

From the Home Screen, press Sequencing menu to enter the main Sequence Screen. Click on New to create a new sequence. Using the keypad, name the sequence as TEST01. Press OK and click Yes on the user confirmation screen. Observe that initially all steps will be NOP for sequence TEST01.

Step 1 – Ramp the output voltage from 0V to 25V over a 1s period
For Step-1, using the Edit menu, select the step as RAMPTOV. Set the OVP to an appropriately high level (60V for this example), Start Volt to 0V, End Volt to 25V and Curr to a nominal 10A (for this example we assume there is no load – or a very light load – connected to the output). Set the time duration to 1s. Once these values are set, click the Apply button to program the step.

Step 2 – Hold the voltage at 25V for 2s
For Step-2, using the Edit menu, select the step as VIMODE. Set the OVP to 60 V, Voltage to 25V, Current to 10A and Duration to 2s. Click the Apply button to program the step.

Step 3 – Ramp the voltage from 25V to 50V over a 500ms period
For Step-3, using the Edit menu, select the step as RAMPTOV. Set the OVP to an appropriately high level (60V for this example), Start Volt to 25V, End Volt to 50V and Curr to a nominal 10A. Set the Duration to 0.5s. Click the Apply button to program the step.

Step 4 – Hold the voltage at 50V for 2.5s
For Step-4, using the Edit menu, select the step as VIMODE. Set the OVP to 60 V, Voltage to 50V, Current to 10A and Duration to 2.5s. Click the Apply button to program the step.

Step 5 – Ramp the voltage from 50V to 0 V over a 2s period
For Step-5, using the Edit menu, select the step as RAMPTOV. Set the OVP to an appropriately high level (60V for this example), Start Volt to 50V, End Volt to 0V and Curr to a nominal 10A. Set the Duration to 2s. Click the Apply button to program the step.

Step 6 – Hold the voltage at 0 V for 2 s
For Step-6, using the Edit menu, select the step as VIMODE. Set the OVP to 60V, Voltage to 0V, Current to 10A and Duration to 2s. Click the Apply button to program the step.

Step 7 – Go to sequence 2
For Step-7, using the Edit menu, select the step as GOTO. Select the Seq as TEST02. Click the Apply button to program the step.

Click on Save button. This completes programming of the sequence TEST01. Refer to Figure 3-99.
To run this sequence from Home Screen, click Sequencing menu to enter the Sequence Screen. Select TEST01 using Left and Right arrow buttons. Click Run button to run the TEST01. Observe the output on oscilloscope. The sequence should complete in approximately 30s.

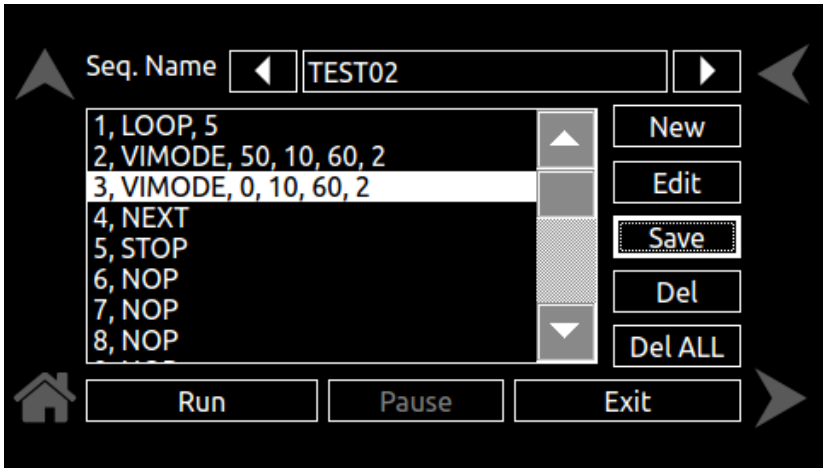


Figure 3-98. Sequence Screen (TEST02)

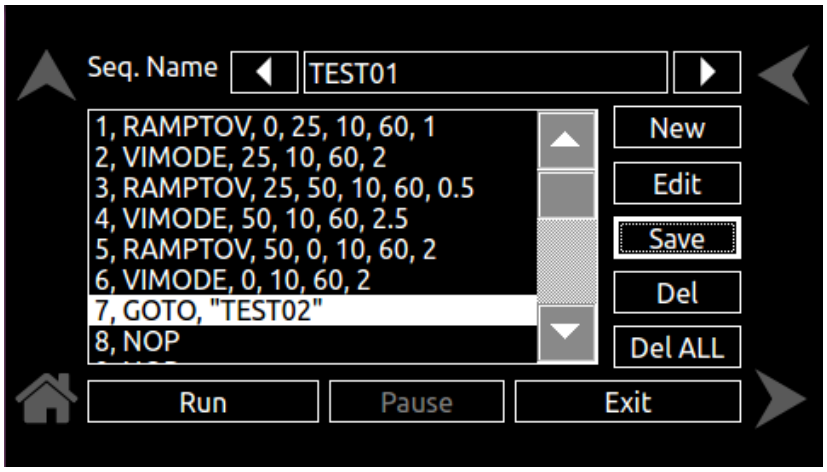


Figure 3-99. Sequence Screen (TEST01)

3.3.11 Warning Screen

The following warning screen may appear during the course of operation:

OVP Fault

OVP Fault occurs when the output voltage of the supply exceeds the OVP setting. When this occurs the output is disabled, and voltage and current output go to 0. To clear the display, press Clear OVP button. Refer to Figure 3-100. The display will return to Home Screen Menu, and the output will remain disabled.

Figure 3-100. OVP Warning Screen

Note: It is important to correct the condition that caused the OVP, prior to re-enabling the output.

Hard Fault

Hard Fault warns that a hardware fault has occurred in a power module, such as an overtemperature, under voltage of AC input, or converter failure. These conditions might clear themselves, however, if they continue to occur after pressing the clear Fault, contact the factory for service assistance. Refer to ***Figure 3-101***. The display will return to Home Screen Menu, and the output will remain disabled.

Figure 3-101. Hard Fault Screen

3.3.12 Local/Remote Screen

This screen is displayed when operation is controlled by computer. Pressing Set Local from Local/Remote screen returns the supply to Local Mode and Home Screen menu is displayed.

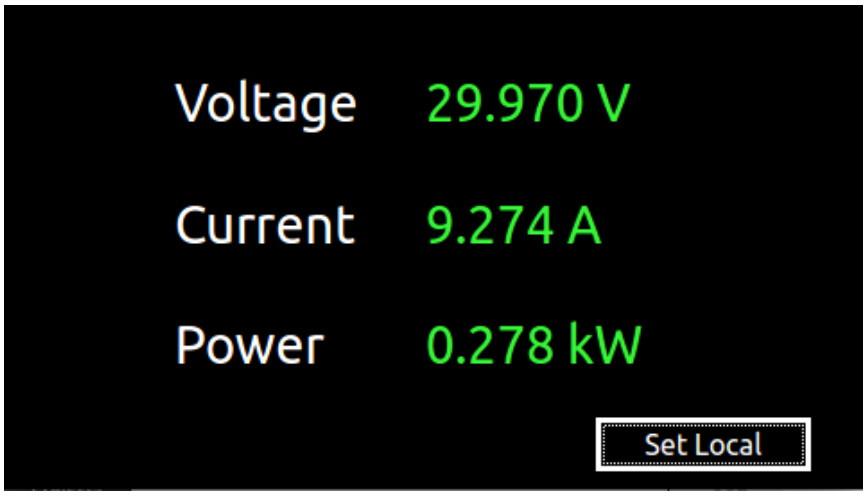


Figure 3-102. Local/Remote Screen

3.4 Output Verification

3.4.1 Constant-Voltage Mode Operation

In Constant-Voltage mode operation, the output voltage is regulated at the programmed value while the output current varies with the load requirements. The voltage could be programmed either through the front panel or by the remote analog voltage programming input. To verify operation in Constant-Voltage mode, follow these steps:

1. Ensure that there is no load connected to the output.
2. Ensure that the remote sense is connected to the output terminals.
3. Connect a digital voltmeter (DVM) across the rear panel positive and negative output terminals, observing the correct polarity. Make sure the DVM is in the DC voltage mode and the range is adequate to handle the full-scale voltage of the power supply.
4. Apply power to the AC mains input, and turn on the power supply.
5. If the Power ON Settings (PONS) had previously been configured to be OFF, when the supply reaches the Dashboard Screen, enable the output by pressing the “Output On/Off”.
6. Use the Dashboard Screen to program the Voltage, Current and OVP.
7. Program the Current to 10% of rated output by entering the value in the “Setting” section on the Dashboard Screen. Program the current above zero to enable supplying output current while in the constant-voltage mode.
8. On the Dashboard screen, rotate the rotary knob to select the “Voltage” text box in the “Setting” section. Press the rotary knob to highlight the voltage value. Rotate the rotary knob clockwise and observe both the voltage display in the “Measure” section on the Dashboard screen and output of the DVM begin to accelerate up. The output voltage should increase from 0 V to the maximum rated voltage of the supply. The voltage display in the “Measure” section on the Dashboard screen and DVM readings should track within the accuracies of the meter and the Dashboard.
9. Verify the front panel Constant Voltage Mode LED is on.
10. Program the Voltage and Current back to zero.
11. Turn the power supply off.

If Constant-Voltage mode operation did not function as indicated above, verify the setup and perform the check again. If the function continues to fail, contact the factory for assistance.

3.4.2 Constant-Current Mode Operation

In Constant-Current mode operation, the output current is regulated at the selected value while the output voltage varies with the load requirements. The current could be programmed either through the front panel or by the remote analog current programming input. To verify operation in Constant-Current mode, follow these steps:

1. If the output had been previously energized, allow 5 minutes for the output capacitors to discharge. Connect a high current DC ammeter across the rear panel positive and negative output terminals, observing the correct polarity. Select wire leads of sufficient current carrying capacity and an ammeter range compatible with the units maximum rated output current.

   Note: Verification that the supply could source rated output current, without measuring the current with an ammeter, but using only the front panel meter, could be performed by shorting the output terminals together.

2. Turn on the power supply.
3. If the Power ON Settings (PONS) had previously been configured to be OFF, when the supply reaches the Dashboard Screen, enable the output by pressing the “Output On/Off”.
4. Use the Dashboard Screen to program the Voltage, Current and OVP.
5. Program the Voltage to 10% of rated output by entering the in the “Setting” section on the Dashboard Screen. This programs the Voltage above zero to enable supplying output voltage while in the constant-current mode.
6. On the Dashboard screen, rotate the rotary knob to select the “Current” text box in the “Setting” section. Press the rotary knob to highlight the current value. Rotate the rotary knob clockwise and observe both the current display in the “Measure” section on the Dashboard screen and output of the DC ammeter begin to accelerate up. The output current should increase from 0 A to the maximum rated current of the supply. The current display in the “Measure” section on the Dashboard screen and DC ammeter readings should track within the accuracies of the meter and the Dashboard.
7. Verify the front panel Constant Current Mode LED is on.
8. Program the Voltage and Current back to zero.
9. Turn the power supply off.
10. Allow 5 minutes for the output capacitors to discharge and disconnect the ammeter or short from the output terminals.
11. If Constant-Current mode operation did not function as indicated above, verify the setup and perform the check again. If the function continues to fail, contact the factory for assistance.

3.4.3 Overvoltage Protection

The Overvoltage Protection (OVP) function allows the supply to shut down the output, if it were to exceed a preset voltage. This may be used to protect sensitive circuits or loads from damage caused by an excessive voltage on the output of the supply. The Overvoltage Protection (OVP) could be programmed either through the front panel or by the remote analog OVP programming input. To verify OVP operation, follow these steps:

1. Make sure there is nothing connected across the output terminals.

2. Turn on the power supply.

3. If the Power ON Settings (PONS) had previously been configured to be OFF, when the supply reaches the Dashboard Screen, enable the output by pressing the “Output On/Off”.

4. Use the Dashboard Screen to program the Voltage, Current and OVP.

5. Program the Current to 10% of rated output (program the current above zero to enable supplying output current while in the constant-voltage mode).

6. The factory default setting is approximately 110% of the maximum rated output of the supply. On the Dashboard screen, rotate the rotary knob to select the “OVP” text box in the “Setting” section. Press the rotary knob to highlight the OVP value. Rotate the rotary knob anti-clockwise till the OVP is programmed to about 80-90% of the maximum rated output voltage.

7. On the Dashboard screen, rotate the rotary knob to select the “Voltage” text box in the “Setting” section. Press the rotary knob to highlight the voltage value. Rotate the rotary knob clockwise and observe the voltage display in the “Measure” section on the Dashboard screen begin to accelerate up. When the output voltage exceeds the OVP trip point, the OVP Warning screen will be displayed with the voltage level reached at OVP trip. Refer to Figure 3-100. The Output State will be programmed to **OFF**, and the Voltage, Current, and OVP settings will retain their previous settings.

8. Press “Clear OVP” on OVP Warning screen and the fault screen will clear. The Dashboard screen will be displayed, and the output will remain disabled.

9. Using the Dashboard screen, program the OVP setting as appropriate for the application. If OVP is not used, then “OVP” programming may be set at maximum, approximately 110% of the rated output voltage of the supply.

10. If OVP mode did not function as indicated above, verify the setup and perform the check again. If the function continues to fail, contact the factory for assistance.

3.4.4 Constant-Power Mode

The Constant-Power Mode allows the supply to regulate the output to a constant power setting as opposed to the more common constant voltage or constant current modes of operation. (*Note: Constant Power mode is intended primarily for loads with response times greater than approximately 10ms*). While in this mode, the supply will continually adjust the voltage and current levels to attempt to maintain a constant power to the load. To provide additional protection for the load, voltage, and current limits may be set while in the Constant-Power mode. If the unit cannot regulate to the Constant Power setting due to load conditions, it will regulate either at the voltage or current limit depending on the load demand. Refer to Figure 3-103.

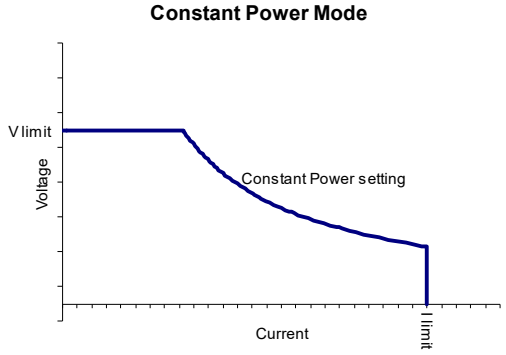


Figure 3-103. Constant-Power Example

3.5 Remote Analog Control Connector (J1)

The Analog Control connector of the Remote Analog Interface on the rear panel allows the unit to be configured for different operating configurations: front panel (local) and remote programming of voltage, current, and OVP, voltage and current monitoring, output enable/disable, etc. Refer to Figure 3-104 for the connector pin-out diagram. The setup and operating requirements of each configuration are provided in Sections 3.6 through 3.9.3.

The SGX also has the capability of providing summing of remote analog input with the set values on the front panel (or programmed values via the digital interface) for voltage, current and OVP. This capability provides a means to modulate a set value with the signal on the voltage, current and OVP analog input. If the user only desires to control the unit with the analog input, all the front panel values (V/I/OVP) or digital settings should be set to zero.

CAUTION!

If standard, Remote Non-Isolated Analog Interface programming is used, the programming return (J1-6 and J1-24) is at the same potential as the negative output terminal of the power supply (not isolated). Proper connection should be made to signal returns with respect to input programming equipment. Improper connection might result in ground/return loops and, as a result, internal power supply damage might occur; output current could then flow by way of the external connection to the J1 common (J1-6 and J1-24). Refer to Table 3–4.

3.5.1 Remote Analog Isolated Interface Control (Option)

The Remote Isolated Analog Interface control uses the same Analog Control connector (J1) as the standard interface. This option fully isolates remote control signals and allows control of units not connected to a common ground. Control ground is isolated from output power (output negative terminal), which protects against potential damage from systems with high electrical noise or large ground loop currents.

Note: Some standard, Non-Isolated Analog Interface programming signals are not available with this option; see Table 3–4 for details.

CAUTION!

The Remote Isolated Analog Interface option is not intended to allow operation of the power supply at excessive voltages. Operation of Isolated Analog Interface signals should be at SELV safety voltage conditions to chassis ground. Refer to section 1.2.3 for maximum terminal voltages.

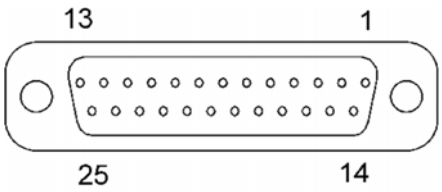


Figure 3-104. Analog Control Connector (J1) Pin-Out

Pin	Reference	Electrical Parameters	Functional Description
1	ISO ON/OFF	Zin ~ 6 kΩ in series with anode of opto-isolator LED	Isolated remote control input for output on/off with an applied AC/DC voltage source. A positive (+) 6-120 VDC or an AC input of 12- 240 VAC will enable (turn-on) the output of the supply. This control input is optically isolated from the output power negative terminal of the power supply (up to 500 VDC). Signal return is Pin J1-2 (ISO RTN). See Section 3.9.
2	ISO RTN	—	Isolated signal return for on/off control using Pins J1-1 and J1-14. Optically isolated from the output power negative terminal of the power supply (up to 500 VDC).
3	REM OV SET	Zin ~ 20 kΩ	Control input for remote programming of the overvoltage protection: 0.25-5.5 VDC = 5-110% of full-scale output voltage. Reset of an OVP condition is possible by applying an 10.5-13.3 VDC signal for 7 seconds. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal. See Section 3.8.
4	VP RTN	Zin ~ 10 kΩ	Voltage programming signal return to be used with Pins J1-9, J1-15 or J1-21; also must be externally connected to Pin J1-6 (COM) signal return when voltage programming is utilized. Circuit is electrically connected to the output power negative terminal.
5	ON/OFF	Zin ~ 10 kΩ pull-up to 15 VDC	Remote control input for output on/off: switch/relay contact closure or direct short-circuit from this terminal to Pin J1-6 (COM) signal return will enable (turn-on) the output of the supply; remote circuit must sink up to 1.5 mA from 15 VDC to enable. Circuit is electrically connected to the output power negative terminal. See Section 3.9.
6	COM †	—	Signal return. Internally connected to Pin J1-24. Circuit is electrically connected to the output power negative terminal.
7	I MON	Zout ~ 100 Ω	Monitor signal for output current: 0-10 VDC = 0-100% of full-scale output current. Minimum recommended load resistance is 100 kΩ. Circuit return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
8	V SET *	Zout ~ 100 Ω	Monitor signal for front panel voltage potentiometer setpoint: 0-5 VDC = 0-100% of full-scale setpoint. Minimum recommended load resistance is 100 kΩ. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
9	VP 5V	Zin ~ 10 kΩ	Control input for remote voltage programming using a voltage source: 0-5 VDC = 0-100% of full-scale output voltage. Do not exceed an input of 13.3 VDC. Signal return is Pin J1-4 or Pin J1-20 (VP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.7.
10	IP 5V	Zin ~ 10 kΩ	Remote control input for current programming using a voltage source: 0-5 VDC = 0-100% of full-scale output current. Do not exceed an input of 13.3 VDC. Signal return is Pin J1-23 or Pin J1-25 (IP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.6.

Pin	Reference	Electrical Parameters	Functional Description
11	ISET *	Zout ~ 100 Ω	Monitor signal for front panel current potentiometer setpoint: 0-5 VDC = 0-100% of full-scale setpoint. Minimum recommended load resistance is 100 kΩ. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
12	Not Used		
13			
14	ISO TTL/CMOS	Zin ~ 900Ω in series with anode of opto-isolator LED	Isolated remote control input for output on/off with a logic signal: a logic-high, 5 VDC TTL/CMOS signal will enable (turn-on) the output of the supply, and a logic-low signal disables (turns off) the output. This control input is optically isolated from the output power negative terminal of the power supply (up to 500 VDC). Signal return is Pin J1-2 (ISO RTN). See Section 3.9.
15	VP 10V	Zin ~ 20 kΩ	Remote control input for voltage programming using a voltage source: 0-10 VDC = 0-100% of full-scale output voltage. Do not exceed an input of 25 VDC. Signal return is Pin J1-4 or Pin J1-20 (VP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.7.
16	IP 10V	Zin ~ 20 kΩ	Remote control input for current programming using a voltage source: 0-10 VDC = 0-100% of full-scale output current. Do not exceed an input of 25 VDC. Signal return is Pin J1-4 or Pin J1-20 (VP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.6.
17	FAULT	Zout ~ 1 kΩ	Output signal for indicating a fault state: a logic-high state (approximately +10 VDC) indicates a fault has occurred in a power module, such as overtemperature, undervoltage of AC input, or converter failure; front panel Fault LED will also be lit. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
18	S/D FAULT	Zout ~ 100 Ω	Output signal for shutdown/fault state: a logic-high state indicates shutdown produced by an OVP condition, Power-On-Reset (POR), remote disable, or housekeeping supply fault. An 8 VDC minimum output signal is provided into a load of 10 kΩ load. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal. See Section 3.9.3.
19	V MON	Zout ~ 100 Ω	Monitor signal for output voltage: 0-10 VDC = 0-100% of full-scale output voltage. Minimum recommended load resistance is 100 kΩ. Circuit return Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
20	VP RTN	Zin ~ 10 kΩ	Voltage programming signal return to be used with Pins J1-9, J1-15 or J1-21; also must be externally connected to Pin J1-6 (COM) signal return when voltage programming is utilized. Circuit is electrically connected to the output power negative terminal.
21	VP RES *	1mA current source with	Current source of 1 mA for remote voltage programming using a resistance connected to signal return Pin J1-4 or Pin J1-20 (VP RTN): 0-5 kΩ = 0-100% of full-scale output voltage. Circuit

Pin	Reference	Electrical Parameters	Functional Description
		compliance voltage of ~ 10.8 V	is electrically connected to the output power negative terminal. See Section 3.7.
22	IP RES *	1mA current source with compliance voltage of ~ 10.8 V	Current source of 1 mA for remote current programming using a resistance connected to signal return Pin J1-23 or Pin J1-25 (IP RTN): 0- 5 kΩ = 0-100% of full-scale output current. Circuit is electrically connected to the output power negative terminal. See Section 3.6.
23	IP RTN	Zin ~ 10 kΩ	Current programming signal return which is to be used with Pins J1-10, J1-16 or J1-22; also must be externally connected to Pin J1-6 (COM) signal return when current programming is utilized. Circuit is electrically connected to the output power negative terminal.
24	COM †	—	Signal return. Internally connected to Pin J1-6. Circuit is electrically connected to the output power negative terminal.
25	IP RTN	Zin ~ 10 kΩ	Current programming signal return which is to be used with Pins J1-10, J1-16 or J1-22; also must be externally connected to Pin J1-6 (COM) signal return when current programming is utilized. Circuit is electrically connected to the output power negative terminal.

† With the option, Remote Isolated Analog Interface control, the control signal return is isolated from the output power negative terminal.

* Signals not available with the option, Remote Isolated Analog Interface control.

Table 3–4. Analog Control Connector (J1), Designations and Functions

3.6 Remote Current Programming

Remote current programming is summed with the front panel or digital setting; see Section 3.5. Remote current programming is used for applications that require the output current be programmed (controlled) from a remote instrument. An external resistance or external voltage source may be used as a programming device. When using remote current programming, a shielded, twisted-pair cable is recommended to prevent noise interference to programming signals.

3.6.1 Remote Current Programming by Resistance

The resistance-programming coefficient for output current is (100% rated output current) / 5 kΩ, with input at Pin J1-22 (IP RES) and return to Pin J1-23 (IP RTN). An internal current source, factory-set at 1 mA, from Pin J1-22 (IP RES) is utilized to drive the resistance. This produces a transfer function for output current, as follows:

Iout = R * (100% rated output current) / 5 kΩ), with R in ohms.

If multiple switches or relays are used to select resistors to program different current levels, make-before-break contacts are recommended.

Note: If an external resistance is used for remote programming, the current programming return Pin J1-23 (IP RTN), must be connected directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-105 for connection requirements.

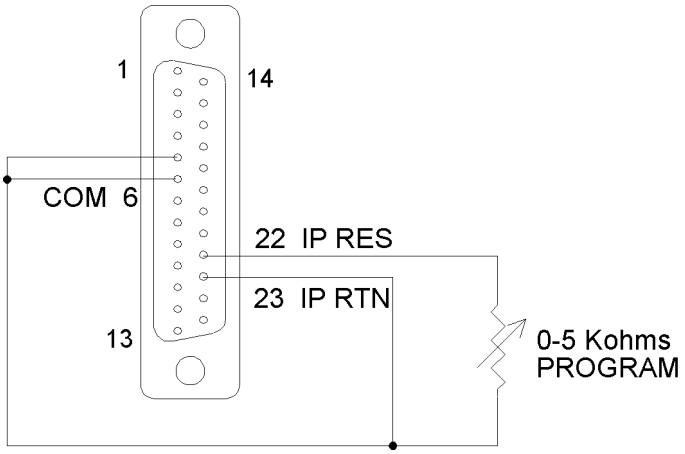


Figure 3-105. Remote Current Programming Using Resistance

3.6.2 Remote Current Programming by Voltage Source

Two inputs are provided for remote voltage-programming of the output current: 5 VDC full-scale and 10 VDC full-scale. The DC voltage source is connected between Pin J1-10 (IP 5 V) for 5 VDC source, or Pin J1-16 (IP 10 V) for 10 VDC source, and the return Pin J1-23 (IP RTN).

The corresponding voltage-programming coefficients for output current are (100% rated output current) / 5 VDC, or (100% rated output current) /10 VDC, from the respective inputs with return to Pin J1-23 (IP RTN). This produces transfer functions for output current, as follows:

Iout = Vdc * (100% rated output current) / 5 VDC), with Vdc in volts, or

Iout = Vdc * (100% rated output current) / 10 VDC), with Vdc in volts.

Note: The return Pin J1-23 (IP RTN) must be referenced directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-106 for connection requirements.

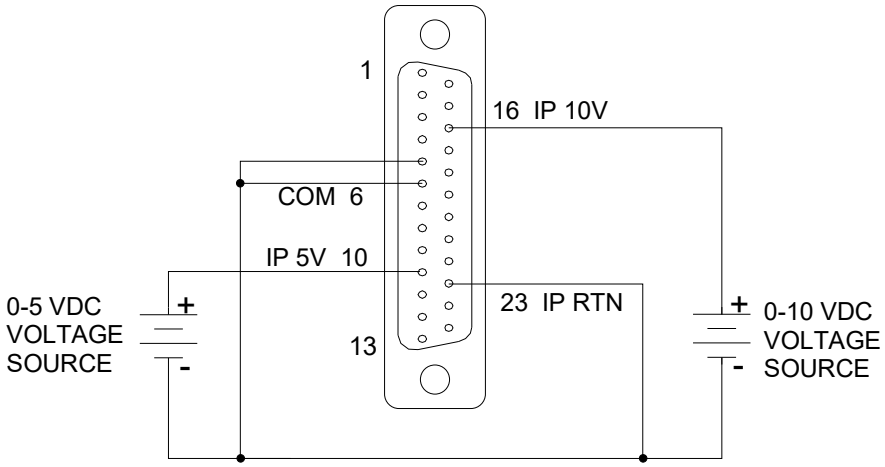


Figure 3-106. Remote Current Programming Using 0-5 VDC or 0-10 VDC Source

3.7 Remote Voltage Programming

Remote voltage programming is summed with the front panel or digital setting; see Section 3.5. Remote voltage programming configuration is used for applications that require the output voltage be programmed (controlled) from a remote instrument. An external resistance or external voltage source may be used as a programming device. When using remote voltage programming, a shielded, twisted-pair cable is recommended to prevent noise interference to programming signals.

3.7.1 Remote Voltage Programming by Resistance

The resistance-programming coefficient for output voltage is (100% rated output voltage) / 5 kΩ, with input at Pin J1-21 (VP RES) and return to Pin J1-20 (VP RTN). An internal current source, factory-set at 1 mA, from Pin J1-21 (VP RES) is utilized to drive the resistance. This produces a transfer function for output voltage, as follows:

Vout = R * (100% rated output voltage) / 5 kΩ), with R in ohms.

Note: If an external resistance is used for remote programming, the voltage programming return Pin J1-20 (VP RTN) must be connected directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-107 for connection requirements.

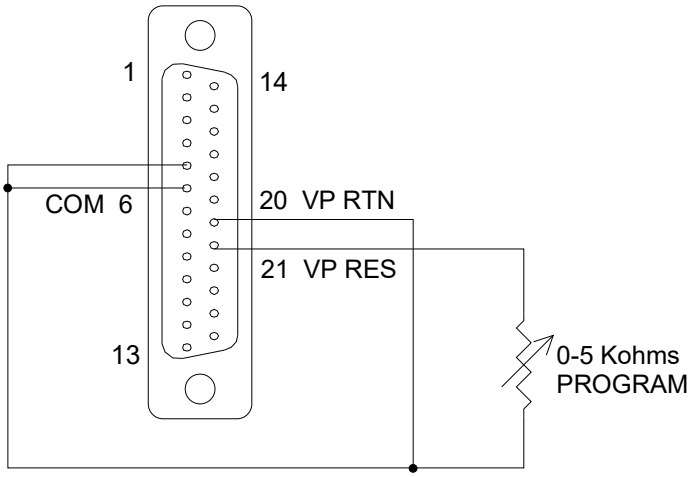


Figure 3-107. Remote Voltage Programming Using Resistance

3.7.2 Remote Voltage Programming by Voltage Source

Two inputs are provided for remote voltage-programming of the output voltage: 5 VDC full-scale and 10 VDC full-scale. The DC voltage source is connected between Pin J1-9 (VP 5 V) for 5 VDC source, or Pin J1-15 (VP 10 V) for 10 VDC source, and the return terminal J1-20 (VP RTN).

The corresponding voltage-programming coefficients for output voltage are (100% rated output voltage) / 5 VDC, or (100% rated output voltage) /10 VDC, from the respective inputs with return to Pin J1-20 (VP RTN). This produces transfer functions for output voltage, as follows:

Vout = Vdc * (100% rated output voltage) / 5 VDC), with Vdc in volts, or

Vout = Vdc * (100% rated output voltage) / 10 VDC), with Vdc in volts.

Note: The return terminal (VP RTN) must be referenced directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-108 for connection requirements.

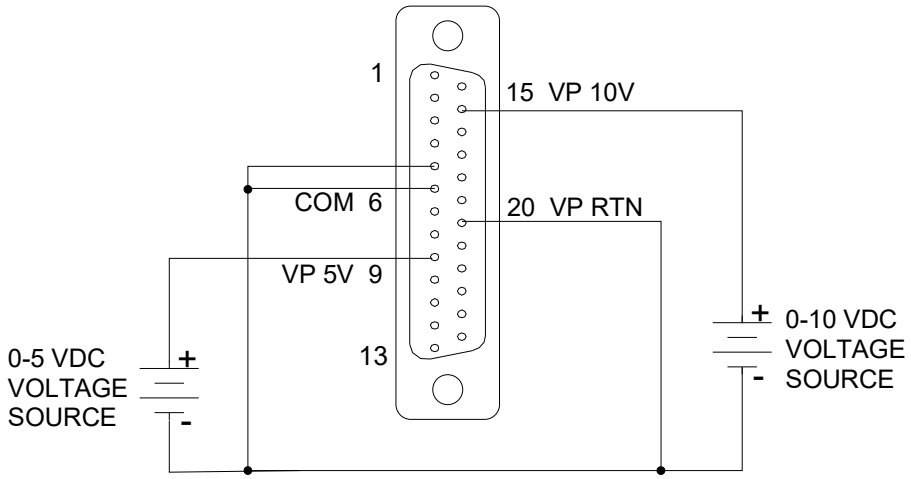


Figure 3-108. Remote Voltage Programming Using 0-5 VDC or 0-10 VDC Source

3.8 Remote Overvoltage Programming

> **CAUTION!**
> Do not program the remote overvoltage setpoint greater than 10% above the power supply rated voltage (5.5 VDC programming voltage source), as internal power supply damage might occur (except reset, see note below).

Remote Overvoltage Protection (OVP) programming is summed with the front panel or remote digital setting; see Section 3.9. A remote DC voltage source can be connected externally between Pins J1-3 (REM OV SET) and J1-6 (COM) to set the output overvoltage trip level. A 0.25-5.5 VDC signal equals 5-110% of rated output voltage. See Figure 3-109 for connection requirements.

Note: To reset an OVP, apply a 10.5–13.3 VDC signal to Pin J1-3 for a minimum of 7s.

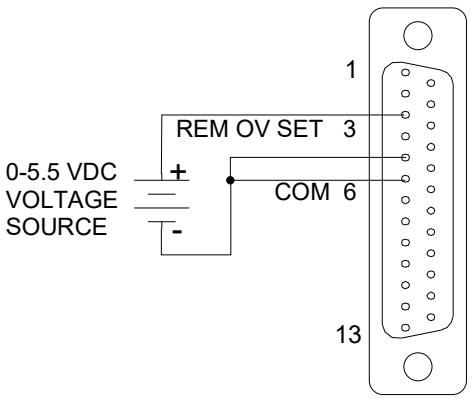


Figure 3-109. Remote Overvoltage Programming Using DC Voltage Source

3.9 Remote Output On/Off Control

Remote output on/off control may be accomplished by contact closure, or through an opto-isolated interface with external voltage sources, AC/DC or TTL/CMOS.

3.9.1 Remote Output ON/OFF by Contact Closure

Application of a contact closure between Pins J1-5 and J1-6 will enable the output. See Figure 3-110 for connection requirements.

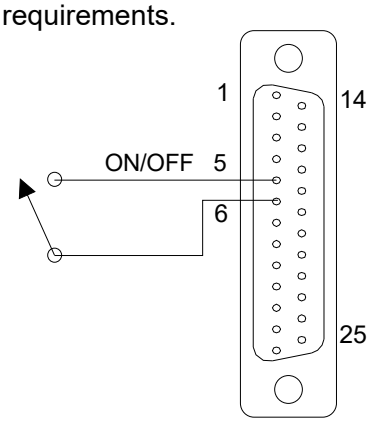


Figure 3-110. Remote Output On/Off Control by Contact Closure

3.9.2 Remote Output ON/OFF Control by External Source

Application of AC/DC voltage between Pins J1-1 and J1-2, or TTL/CMOS voltage between Pins J1-14 and J1-2, will turn on the power supply; this interface is opto-isolated from circuit common, Pins J1-6 and J1-24. See Figure 3-111 and Figure 3-112 for connection requirements.

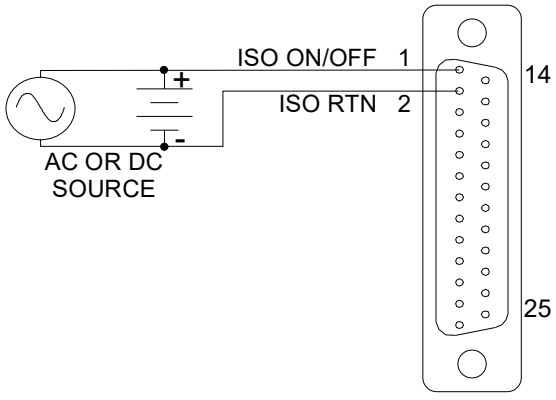


Figure 3-111. Remote Output On/Off Using Isolated AC or DC Source

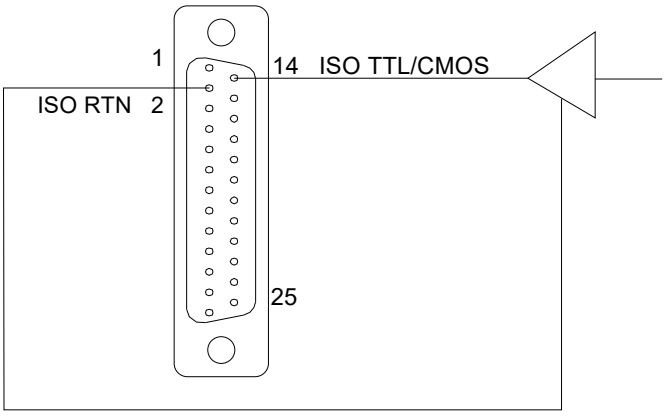


Figure 3-112. Remote Output On/Off Using Isolated TTL/CMOS Source

3.9.3 Remote Shutdown(S/D)

A remote +12 VDC voltage can be connected externally between Pin J1-18 (S/D Fault) and Pin J1-24 (COM) to disable, i.e., shut down the output of the power supply; see Figure 3-113. A low-level, or opening the +12 VDC signal, will allow the unit to revert to normal operation.

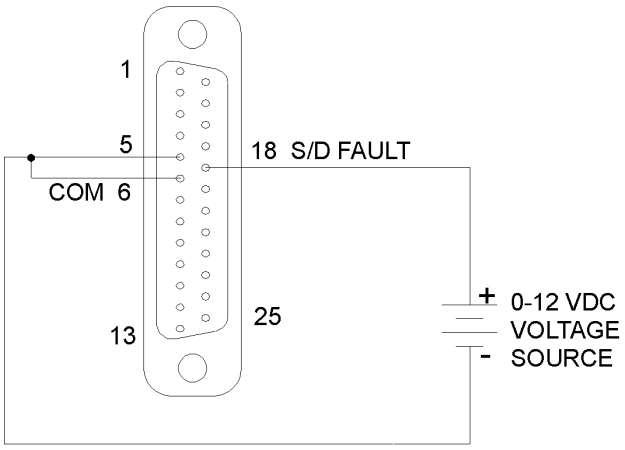


Figure 3-113. Remote Shutdown Using DC Voltage Source

3.10 Remote Sensing

Remote voltage sensing is recommended always, whether the sense leads are connected to the load or to the output terminals. Remote sensing is required to meet the performance specifications of the power supply. It is essential in applications where the load is located

some distance from the power supply, or the voltage drop of the power output leads significantly interferes with load regulation.

The voltage accuracy specifications are valid only with remote sense connected. Disconnecting the remote sense leads will introduce an error, with the output voltage increasing. The error occurs because an additional resistance (PTC local resistor network in Figure 3-114) is present in the circuit of the resistor divider for voltage sensing, to provide the default local sensing of the output voltage at the output terminals. When remote sense is connected the PTC local resistor network is short-circuited, effectively removing it from the circuit.

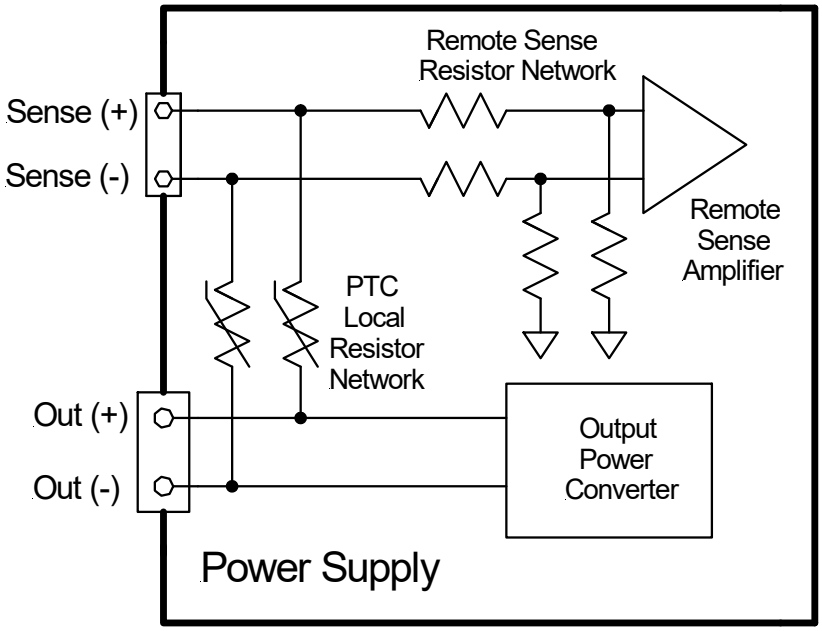


Figure 3-114. Remote Voltage Sensing Network

CAUTION!
If the power supply is operated with load power lines disconnected and remote sense lines connected, internal power supply damage might occur, since output load current could flow through the remote sense terminals.

To use remote voltage sensing, connect the power supply as described below in Figure 3-115 for 10V-800V models, and Figure 3-116 for the 1000V model. A shielded, twisted-pair cable is recommended to avoid potential noise interference.

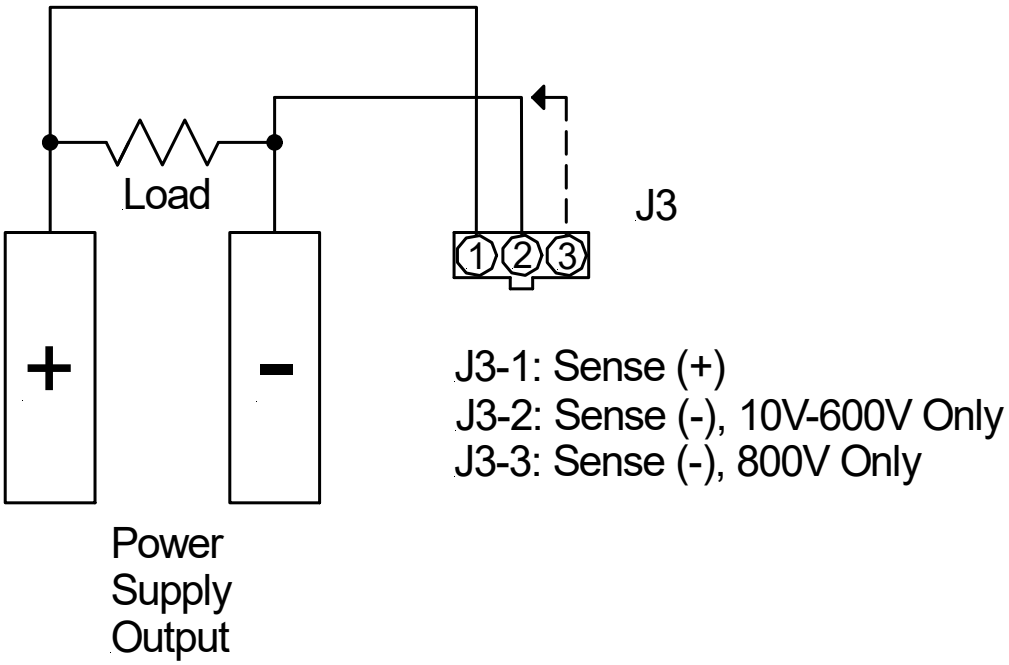


Figure 3-115. Remote Sense Connection at the Load, 10V-800V Models

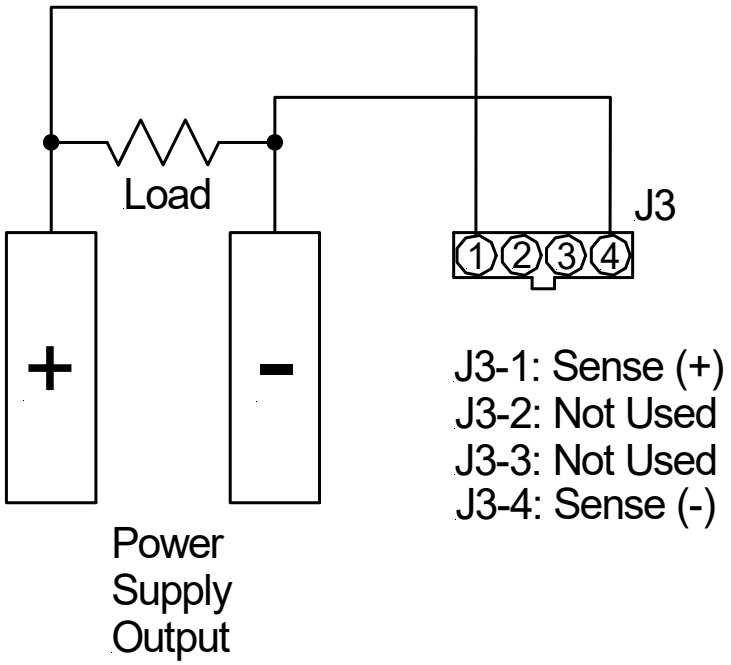


Figure 3-116. Remote Sense Connection at the Load, 1000V Model

3.11 Floating and Polarized Output

The SGX Series supply can be set up for a Positive or Negative supply, as well as standard operation as a floating output supply.

3.11.1.1 FLOATING OUTPUT

The output terminals are normally floating from chassis ground. No extra steps or connections are required for a floating output.

3.11.1.2 POSITIVE SUPPLY SETUP

Attach the negative output terminal to the supply chassis. The output reference is now chassis ground. When the output voltage is set or programmed, the supply will output a positive potential from chassis ground.

3.11.1.3 NEGATIVE SUPPLY SETUP

Attach the Positive output terminal to the supply chassis. The output reference is now chassis ground. When the output voltage is set or programmed, the supply will output a negative potential from chassis ground.

CAUTION!
The negative output terminal may be floated up to ±300V (PK), maximum, with respect to chassis ground. Exceeding the limit will be detected as a fault by a protective supervisory monitor and shutdown of the output will be executed; this condition will be latched, requiring reset to resume normal operation.

CAUTION!
Floating the negative output terminal subjects the internal control circuitry of the power supply to the same potential as present at the negative output terminal. In a unit with the standard Non-Isolated Analog Interface, the signals of control connector, J1, would float at the same potential as the negative output terminal. Damage might occur if the signals of the Non-Isolated Analog control connector are connected to an external ground referenced device, due to unintentional ground loop currents that this connection could generate. To correct ground loop problems, it is advised to use the optional Isolated Analog Interface in order to isolate the external signals from the internal control circuitry of the supply. Refer to the Section 1.2.3 for additional information.

3.12 Parallel and Series Operation

Parallel and series modes of operation are used for applications requiring more current or voltage than is available from a single power supply. To meet the requirements for greater output current or voltage, up to five supplies could be connected in parallel, or up to two supplies could be connected in series.

3.12.1 Parallel Operation

In order to connect up to five power supplies in parallel, use a “Master/Slave” daisy-chain wiring configuration as follows; refer to Figure 3-117:

(There are two separate 9-pin connectors on the upper left rear panel of each power supply, marked “PAR OUT” and “PAR IN”).

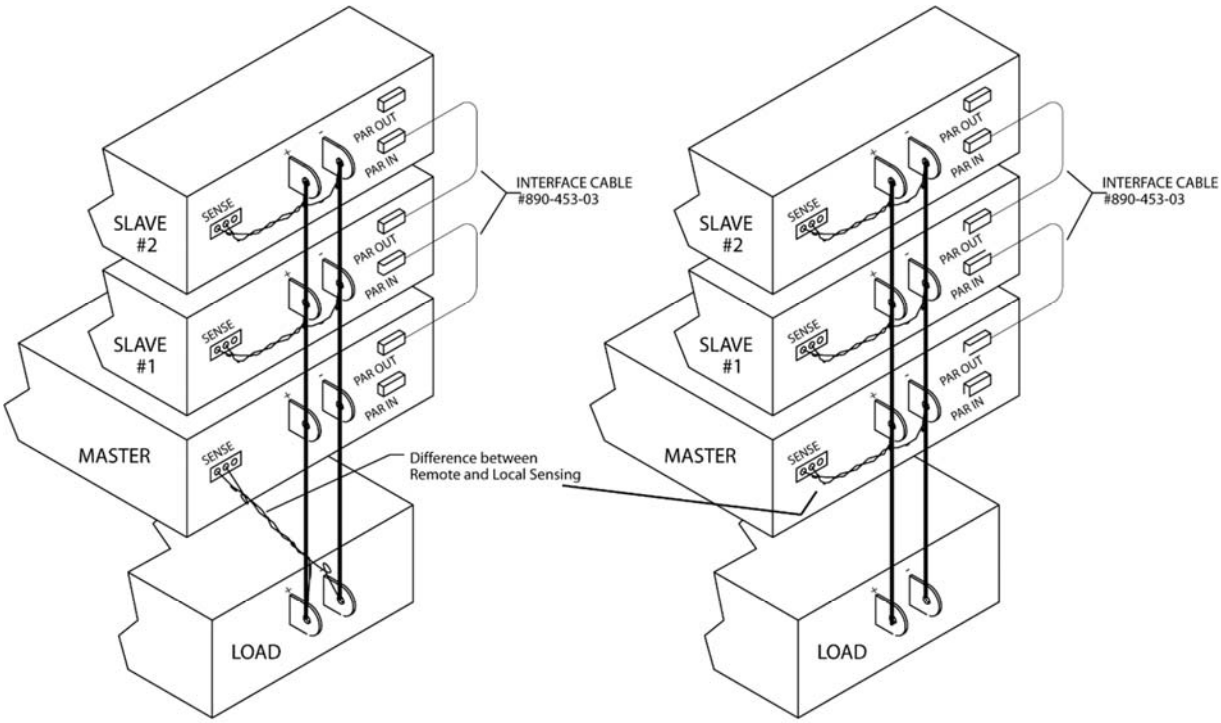
1. Programming, readback, and control is performed through the Master.
2. Beginning with the power supply that is to function as the Master, use an interface cable (P/N 890-453-03) to connect the PAR OUT connector on the designated Master power supply to the PAR IN connector on the second power supply (Slave 1).
3. On the second power supply (Slave 1), use another interface cable to connect the PAR OUT connector to the PAR IN connector of the third power supply (Slave 2). Continue these interconnections up to a maximum of 5 power supplies.
4. Connect the Positive output terminals of all the power supplies and the load.
5. Connect the Negative output terminals of all the power supplies and the load.
6. Confirm that there are no shorts between the Positive and Negative output terminals.
7. Referring to Figure 3-117, connect twisted-pair sense cables as follows; ensure that all twisted-pair cables are as short as possible:

   All slave units shall have twisted-pair cables from their sense terminals to their own output terminals.

   For remote sense at the load, the master unit shall have a twisted-pair cable from its own sense terminals to the load terminals.

   For remote sense at the output terminals (local sense connection), the master unit shall have a twisted-pair cable from its own sense terminals to the output terminals of its own chassis.

Note: The OVP circuit remains active for all units in parallel operation. If the units are set to different OVP levels, the paralleled system will trip according to the lowest setting. For ease of use, adjust the OVP levels for the slaves to maximum and adjust the master OVP level to the desired setting.



PARALLEL WITH REMOTE SENSING (block diagram)

NOTE: The voltage display on the slave units will be slightly higher than the master unit. The twisted pair cable length must be as short as possible.

PARALLEL WITH LOCAL SENSING (block diagram)

NOTE: The twisted pair cable length must be as short as possible.

Figure 3-117. Parallel Connection and Remote Sense

3.12.2 Series Operation

Series operation is used to obtain a higher aggregate output voltage using two units. Each supply is operated individually, and is set up as follows:

Connect the negative terminal (–) of one supply to the positive terminal (+) of the next supply; both units must be of the same model. The total voltage available is the sum of the maximum voltages of each supply. Each supply displays its own output voltage, and the load voltage is the sum of each front panel display.

CAUTION!

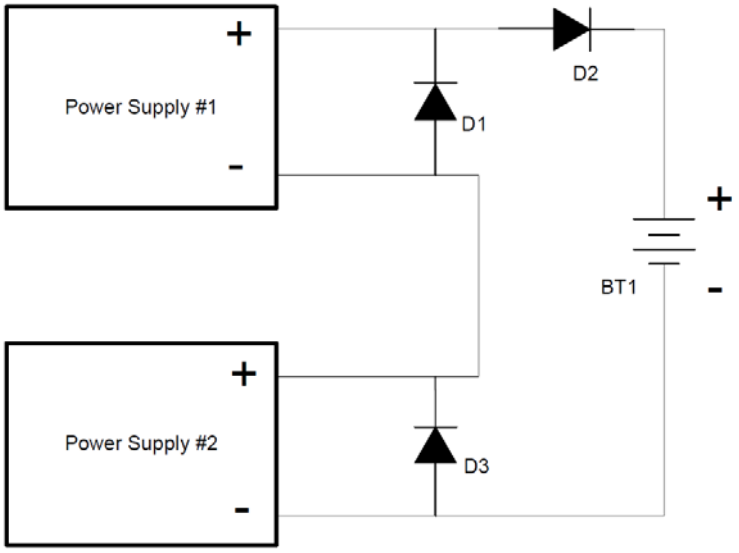
Under no condition should the negative (–) output terminal of any power supply exceed 300 V to chassis (earth) ground. This is limited by the isolation and creepage/clearance distances internal to the power supply construction. If a higher output voltage range is required, contact the factory for availability.

Note:

1. The maximum allowable current for a series string of power supplies is the rated output current of a single supply of the string.

2. Remote sensing **at the load** should **not** be used during series operation. Each power supply should have its remote sense leads connected to its own output terminals.

3. An anti-parallel diode (power diode capable of the maximum current of the series group, connected across the output, but reverse biased) is recommended to protect against sinking current into a supply should one supply be ON while another other is OFF, as shown in Figure 3-118. Diode D2 shown in the figure is optional, if the load has stored energy such as a battery (Refer to Section 2.6.1).



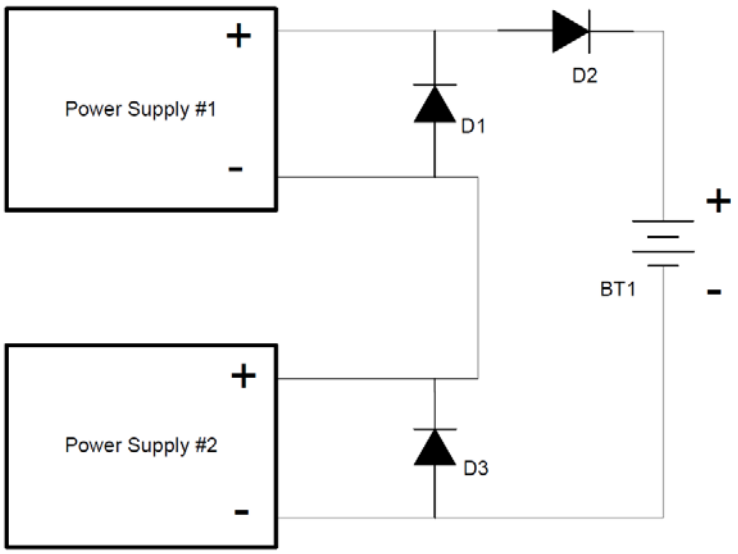


Figure 3-118. Series Connection with Anti-Parallel Diodes

3.13 External User Control Signal Connector

A10-pin Molex connector (Refer to Figure 3-119) located at the rear panel provides external auxiliary control signals to increase the user's operating control of the supply. The mating receptacle is Molex 43025-1000 with 10 female terminals. The Molex terminals accommodate AWG wire sizes from #20 - #24.

The relay outputs, when active, connect the POLARITY, ISOLATION and SENSE pins (Pins 6, 7 and 8) of the connector to the relay COMMON pin (Pin 5). The relays are rated at 120VAC/125VDC @ 1A. Any change in output (voltage, current, etc.) initiated by the user from the RS232, GPIB, or Ethernet interface, will generate a 10ms synchronization pulse at the rear panel User Control Signal Connector of the unit (TRIGGER OUT). Refer Programming manual for details of SCPI COMMANDS to exercise relay functionalities.

Pin	Signal Name	Functional Description	Electrical Characteristics
1	FOLDBACK	Output signal, active-low; asserted when in foldback mode; open-collector of opto-isolator transistor; emitter is connected to Pin-9.	60 VDC, max., 4 mA DC, max.
2	SHUTDOWN	Input signal, TTL active-high; immediate shutdown when signal is pulled high; open-anode of opto-isolator diode with internal 1kΩ series resistor; cathode is connected to Pin-9.	12 VDC, max., - 5 VDC, max. reverse voltage

Pin	Signal Name	Functional Description	Electrical Characteristics
3	FAULT	Output signal, active-low; asserted when a fault is recorded in the fault register; open-collector of opto-isolator transistor; emitter is connected to Pin-9.	60 VDC, max., 4 mA DC, max.
4	TRIGGER OUT	Output signal, active-low; synchronization pulse for 10 ms when a change in the output occurs; open-collector of opto-isolator transistor; emitter is connected to Pin-9.	60 VDC, max., 7 mA DC, max.
5	COMMON	Return for all relay contacts. Could be optionally connected to Pin-9.	Isolated from Pin-9
6	POLARITY	Output signal, asserted (internal relay contacts close to Pin-5, COMMON) when negative output polarity is programmed.	2 ADC, max., 30 VDC, max.
7	ISOLATION	Output signal, asserted (internal relay contacts close to Pin-5, COMMON) when the output isolation relay is programmed ON.	2 ADC, max., 30 VDC, max.
8	SENSE	Output signal, asserted (internal relay contacts close to Pin-5, COMMON) when the sense relay is programmed ON.	2 ADC, max., 30 VDC, max.
9	ISO COMMON	Return for all opto-isolator signals. Could be optionally connected to Pin-5, externally..	Isolated from Pin-5
10	TRIGGER IN	Input signal, TTL active-high; provides external hardware triggering of sequence functions and of voltage and current ramp functions; open-anode of opto-isolator diode with internal 1kΩ series resistor; cathode is connected to Pin-9.	12 VDC, max., - 5 VDC, max. reverse voltage

Table 3–5. External User Control Signal Connector Pinout

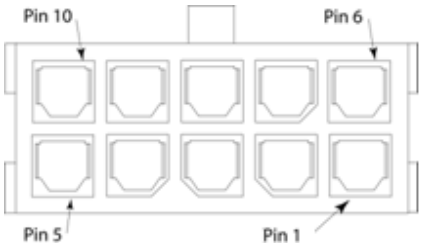


Figure 3-119. External User Connector Pinout (10-pin Molex, rear panel view)

4 CALIBRATION AND VERIFICATION

4.1 Introduction

This section provides calibration and verification procedures for the SGX Series power supplies.

4.1.1 Calibration and Verification Cycle

Annual calibration and verification is recommended. Calibrate only as needed.

4.1.2 Digital programming and readback calibration

Refer to the SGX programming manual for calibration of display readback and remote digital programming.

4.1.3 Analog control interface calibration (Standard and Isolated analog interface)

The analog control interface calibration requires opening of the chassis top cover and it should be carried out by service personnel only. Contact repair and maintenance service department for the same.

5
MAINTENANCE

5.1 Introduction

This chapter contains preventive maintenance information for the SGX Series power supplies.

WARNING!

All maintenance that requires removal of the cover of the unit should only be done by properly trained and qualified personnel. Hazardous voltages exist inside the unit. Disconnect the supply from the AC mains input before performing any maintenance. Service, fuse verification, and connecting of wiring to the chassis must be accomplished at least 5 *minutes* after AC input power has been removed with an external disconnect switch. Do not touch any circuits and/or terminals that are energized.

5.2 Preventive Maintenance

WARNING!

The OFF position of the front panel power switch does not remove AC input from internal circuits or input terminal blocks. Disconnect external AC input before servicing unit.

CAUTION!

For safe and continued operation of the SGX Series, always operate the unit in a temperature and humidity controlled, indoor area. Exposure to conductive contaminants or corrosive compounds/gases that could be ingested into the chassis could result in internal damage. Keep the rear and sides of the unit free of obstructions to ensure proper ventilation.

No routine maintenance on the SGX Series is required, aside from periodic cleaning of the unit and inspection, as required by the environmental operating conditions:

- Once a unit is removed from service, vacuum all air vents, including the front panel grill.
- Clean the exterior with a mild solution of detergent and water. Apply the solution onto a soft cloth, not directly to the surface of the unit. To prevent damage to materials, do not use aromatic hydrocarbons or chlorinated solvents for cleaning.
- Check external connections for integrity of insulation, loose contacts, and proper torque.
- If there is any evidence of short-circuits or arcing, overheating, or corrosion, contact the factory for recommended service.

5.3 Fuses

There are no user replaceable components in the power supply. Internal fuses are listed in Table 5–1. Fuses are sized for fault isolation, and, an open fuse might indicate that a circuit component has been damaged. Contact the factory for further assistance..

CAUTION!
To reduce the risk of fire or electrical shock, replace fuses only with the same type and rating.

Assembly	Reference	Rating	Manufacturer Part No.
Bias Supply PWA	F1, F2, F3	5 A, 600V	Littelfuse KLK-5
Power Module Converter Control PWA	F1, F2, F3	30 A, 600V	Littelfuse KLK-30

Table 5–1. Fuse Ratings

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