

# Sorensen

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*SGA Series*  
*DC Power Supplies*  
**Operation Manual**

**SORENSEN Power Supplies**  
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## CONDITIONS OF WARRANTY

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- Equipment purchased in the United States carries only a United States warranty for which repair must be accomplished at the Elgar factory.

**Sorensen**

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# SAFETY NOTICE

Before applying power to the system, verify that the SGA Series unit is configured properly for the user's particular application.



## WARNING!

**HAZARDOUS VOLTAGES IN EXCESS OF 280 VRMS, 600V PEAK MAY BE PRESENT WHEN COVERS ARE REMOVED. QUALIFIED PERSONNEL MUST USE EXTREME CAUTION WHEN SERVICING THIS EQUIPMENT. CIRCUIT BOARDS, TEST POINTS, AND OUTPUT VOLTAGES MAY BE FLOATING ABOVE (BELOW) CHASSIS GROUND.**

Installation and service must be performed by qualified personnel who are aware of dealing with attendant hazards. This includes such simple tasks as fuse verification.

**Ensure that the AC power line ground is connected properly to the SGA Series unit input connector or chassis. 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 input power is de-energized prior to connecting or disconnecting the input/output power cables.



During normal operation, the operator does not have access to hazardous voltages within the chassis. However, depending on the user's application configuration, HIGH VOLTAGES HAZARDOUS TO HUMAN SAFETY may be generated normally on the output terminals. Ensure that the output power lines are labeled properly as to the safety hazards and that any inadvertent contact with hazardous voltages is eliminated. To guard against risk of electrical shock during open cover checks, do not touch any portion of the electrical circuits. Even when the power is off, capacitors can retain an electrical charge. Use safety glasses during open cover checks to avoid personal injury by any sudden failure of a component.

Due to filtering, the unit has high leakage current to the chassis. Therefore, it is essential to operate this unit with a safety ground.

**Some circuits are live even with the front panel switch turned off. Service, fuse verification, and connection of wiring to the chassis must be accomplished at least five minutes after power has been removed via external means; all circuits and/or terminals to be touched must be safety grounded to the chassis.**

After the unit has been operating for some time, the metal near the rear of the unit may be hot enough to cause injury. Let the unit cool before handling.

Qualified service personnel need to be aware that some heat sinks are not at ground, but at high potential.

These operating instructions form an integral part of the equipment and must be available to the operating personnel at all times. All the safety instructions and advice notes are to be followed.

Neither Elgar Electronics Corporation, San Diego, California, USA, nor any of the subsidiary sales organizations can accept any responsibility for personal, material or consequential injury, loss or damage that results from improper use of the equipment and accessories.

**SAFETY SYMBOLS**



**CAUTION**  
Risk of Electrical Shock



**CAUTION**  
Refer to Accompanying Documents



Off (Supply)



Direct Current (DC)



Standby (Supply)



Alternating Current (AC)



On (Supply)



Three-Phase Alternating Current



Protective Conductor Terminal



Earth (Ground) Terminal



Fuse



Chassis Ground

## 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

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

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 Symbols on page iv).

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# SECTION 1 OVERVIEW

## 1.1 General Description

The Sorensen SGA Series power supplies are general-purpose power supplies designed specifically for laboratory test and systems applications requiring variable DC sources with good ripple and regulation characteristics. These power supplies are constant current/constant voltage supplies with an automatic crossover feature.

A variety of user interfaces are available, ranging from manual front-panel control and standard non-isolated remote analog control, to optional GPIB or isolated remote analog control.

## 1.2 Technical Specifications

The following sections provide environmental, electrical, and physical characteristics for the SGA Series power supplies.

### 1.2.1 Environmental Characteristics

*Note: The SGA Series power supplies are intended for indoor use only.*

Parameter	Specification
Temperature Coefficient	0.02%/°C of maximum output voltage rating for voltage set point. 0.03%/°C of maximum output current rating for current set point.
Ambient Temperature	
Operating	0 to 50°C
Storage	-25° to 65°C
Cooling	Internal fans. Units may be stacked without clearance.
Humidity	0 to 90% at 40°C, derate to 50% at 25°C (non-condensing)
Altitude	Operating full power available up to 5,000 feet (1,524m), derate 10% of full power for every 1,000 feet higher non-operating to 40,000 feet (12,192m)
Agency Approvals	CE Mark to EN61010 and EN61326 UL recognized to UL1012

## 1.2.2 Electrical Characteristics

Parameter	Specification
Input Power	
Voltage (Standard)	208/220 VAC $\pm$ 10% (tested to 187-242 VAC)
Voltage (Options)	380/400 VAC $\pm$ 10% (tested to 342-440 VAC) 440/480 VAC $\pm$ 10% (tested to 396-528 VAC)
Frequency	47 to 63 Hz
Phases	3-phase, 3-wire plus ground. Not phase rotation sensitive. Neutral not used.
Front Panel Meter Accuracy	
Voltage	$\pm$ 0.5% of full-scale + 1 digit
Current	$\pm$ 0.5% of full-scale + 1 digit
Load Regulation	(Specified at no load to full load, nominal AC input)
Voltage	0.02% of maximum output voltage
Current	0.1% of maximum output current
Line Regulation	(Specified $\pm$ 10% of nominal AC input, constant load)
Voltage	0.01% of maximum output voltage
Current	0.05% of maximum output current
Transient Response	A 50% step load will recover to within 0.75% of original value within 1 ms.
Down Programming	With no load the output will program from 100 to 10% in less than 1.5 seconds
Stability	$\pm$ 0.05% of set point after 8-hr. warm-up at fixed line, load, and temperature using remote sense
Remote Control/Monitor	On/Off control via contact closure, 6-120 VDC or 12-240 VAC, and TTL or CMOS switch, output voltage and current monitor, OVP limit set, summary fault status
Power Factor	>0.9 typical for 208/220VAC input >0.78 typical for 380/400VAC input >0.7 typical for 440/480VAC input
Efficiency	87% typical at full load, nominal line
Remote Programming	
Accuracy	
Constant Voltage	$\pm$ 0.25% of full-scale output (Vp5 input)

Parameter	Specification
Constant Current	±0.8% of full-scale output
Oversvoltage Protection (OVP)	±1% of full-scale output
Resistive	
Constant Voltage (0-100%)	0–5 kΩ
Constant Current (0-100%)	0–5 kΩ
Voltage	
Constant Voltage (0-100%)	0–5 VDC or 0–10 VDC
Constant Current (0-100%)	0–5 VDC or 0–10 VDC
Oversvoltage Protection (OVP) (0-110%)	0–5.5 VDC
Remote Sensing	Terminals are provided to sense output voltage at point of load. Maximum line drop 5% of rated voltage per line for 60-100V models, 2% of rated voltage per line for models 160V and greater.
<b>ISOLATED ANALOG CONTROL (OPTION)</b>	
Input to Output Isolation	500 V Compliant with maximum terminal float voltage. Recommended operation under SELV normal conditions.

## 1.2.3 SGA Series Voltage and Current Specifications

Voltage	Amperage						Ripple* RMS	Noise* P-P
	5 kW	10 kW	15 kW	20 kW	25 kW	30 kW		
0-60V	0-83A	0-167A	0-250A	0-333A	0-417A	0-500A	20 mV	75 mV
0-80V	0-63A	0-125A	0-188A	0-250A	0-313A	0-375A	20 mV	100 mV
0-100V	0-50A	0-100A	0-150A	0-200A	0-250A	0-300A	20 mV	100 mV
0-160V	0-31A	0-63A	0-94A	0-125A	0-156A	0-188A	25 mV	150 mV
0-200V	0-25A	0-50A	0-75A	0-100A	0-125A	0-150A	25 mV	175 mV
0-250V	0-20A	0-40A	0-60A	0-80A	0-100A	0-120A	30 mV	200 mV
0-330V	0-15A	0-30A	0-45A	0-61A	0-76A	0-91A	30 mV	200 mV
0-400V	0-12A	0-25A	0-38A	0-50A	0-63A	0-75A	30 mV	300 mV
0-600V	0-8A	0-17A	0-25A	0-33A	0-42A	0-50A	40 mV	350 mV

\* Ripple and noise specified at full load, nominal AC input

## 1.2.4 Physical Characteristics

Dimension	3U Models	6U Models
Width	19.00 in (48.3 cm)	19.00 in (48.3 cm)
Depth	25.12 in (63.8 cm)	25.12 in (63.8 cm)
Height	5.25 in (13.3 cm)	10.5 in (26.7 cm)
Weight	80 lbs (36 kg) maximum	160 lbs (73 kg) maximum

*Note: Specifications are subject to change without notice.*

# SECTION 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 meters. 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 Elgar Customer Service at 1-800-73ELGAR (1-800-733-5427).

## 2.2 Contents of Shipment

Depending on the model, configuration, and options available for your SGA Series power supply, the ship kit may include additional parts and accessories. At a minimum, the ship kit that accompanies your SGA Series power supply includes the following items:

- *SGA Series DC Power Supplies Operation Manual* (Elgar Document No. M550129-01)
- Sense mating connector (Molex P/N 39-01-4031) with loose contacts (Molex P/N 39-00-0182)
- J1 mating connector (Cinch P/N DB25P or equivalent) normally shipped attached to rear panel J1
- Back shell for J1 (DB25) mating connector (Cinch P/N DCH-B-001 or equivalent)
- Screw, lock washer, and nut for AC input and DC output connections:  
5–15 kW: ¼-20UNC-2B x ½", 4 ea AC input only  
20–30 kW: ¾-16UNC-2B x 7/8", 6 ea
- Black screw, 10-32UNC-2B x ½", front panel rack fastener:  
5–15 kW: 4 ea  
20–30 kW: 8 ea

If any of these parts are missing, please contact Elgar Customer Service at 1-800-73ELGAR (1-800-733-5427).

## 2.3 Input/Output Connections



### WARNING!

High voltage present! Risk of electrical shock. Do not remove cover. Refer to qualified service personnel.

Table 2–1 lists all external connections for the SGA Series models. Table 2–2 and Table 2–3 provide input and output connection descriptions by power supply type.

For permanently connected equipment, a readily accessible disconnect device shall be incorporated in the fixed wiring. For pluggable equipment, the socket outlet shall be installed near the equipment and shall be easily accessible.

Take precautions to ensure that the concentration of ozone is limited to a safe value. The recommended long-term exposure limit for ozone is 0.1 PPM (0.2 mg/m<sup>3</sup>).



### CAUTION!

For proper connection to the mains, a 100–amp circuit breaker or fuse for 3U units and a 200–amp circuit breaker or fuse for 6U units is required.



### WARNING!

Under no condition should the negative output terminal exceed 150V to earth ground.

## 2.4 Location and Mounting



### WARNING!

To reduce the risk of fire or electrical shock, install the SGA Series unit in a temperature and humidity controlled indoor area, free of conductive contaminants.



### 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 a raised ambient temperature greater than 50°C.



### CAUTION!

This unit is intended for installation in a protected environment. No user serviceable parts inside. Service to be performed by qualified personnel only.

The SGA Series models are designed to be mounted in a standard 19-inch equipment rack. If additional instrumentation is mounted in the rack, no additional clearance is required between the SGA series and other power supplies or instruments.

1. Support the unit using rack mount slides or appropriate L brackets (suggested parts are listed below).

Rack Mount Slide Kit:

- 5–15kW units Elgar P/N K550212-01
- 20–30kW units Elgar P/N K550213-01

2. Secure the unit in place using the screws provided.

2.4.1 6U Chassis Removal from Rack

The slides have a Front Disconnect Feature and lock at full extension.

To return the chassis back into the rack from full extension, depress the flat steel spring inward (located on the slides) and push the chassis back.

To disconnect and remove the chassis from the rack, depress the flat steel spring inward (located on the slides) and pull the chassis forward.



**WARNING!**

The 6U SGA Series unit weighs up to 160 lbs (73kg) depending on the model. A minimum three-person lift is required!

When the chassis is at full extension, the flat springs are located approximately one (1) inch behind the front EIA RETMA rails. Access the springs with a flat blade screwdriver or similar device to release from lock-out or to remove the chassis from the rack.

The slides can be mounted to the chassis with this spring oriented on the top or the bottom of the slide.

Table 2–1 provides details of the SGA Series input and output connectors and their functions.

Connector	Function	Connects To
FL1 – AC FL1 – AC FL1 – AC Chassis - GND	Prime AC Power Input See Table 2–2. Not phase rotation sensitive. Neutral not used.	208/220 VAC (Std) 380/400 VAC (Option) 440/480 VAC (Option) 47-63 Hz
Pos. Threaded Stud Neg. Threaded Stud Pos. Bus Bar Neg. Bus Bar	Output Power: 3U models (see Table 2–3)  6U models (see Table 2–3)	User load(s)
ANALOG CONTROL Connector (J1)	Control Interface	See Table 3–1 for description
Sense Connector	Used for remote sense	Refer to Section 3.5
Parallel In-Out	Used for parallel operation	Refer to Section 3.9

**Table 2–1. 5kW to 15kW and 20kW to 30kW Series Input/Output Connectors**



Power Supply Type	Connection Description
5 kW to 15 kW	Bus Bar with holes for 1/4"–20 bolts
20 kW to 30 kW	Bus Bar with holes for 3/8"–16 bolts

**Table 2–2. Input Connections**

Power Supply Type	Connection Description
5 kW to 15 kW $\geq 60V$	3/8" Threaded Studs
20 kW to 30 kW $\geq 60V$	Bus Bar with holes for 3/8" bolts

**Table 2–3. Output Connections**

*Note: Failure to observe the maximum torque specification indicated in the housing will void the warranty on the SGA Series unit.*

## 2.5 Wire Size

Care must be taken to properly size all conductors for the input and output of the power supply. The tables below will assist in determining the appropriate wire size for both the input and output connections Table 2–4 below gives *minimum* recommended wire size. This table is derived from the National Electrical Code; it is for reference only. Local laws and conditions may have different requirements. Note that these recommendations are for copper wire only. For higher ratings, wires can be paralleled; refer to the National Electrical Code.

Size	Temperature Rating of Copper Conductor			
	60°C	75°C	85°C	90°C
AWG MCM	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
	<b>Current Rating</b>			
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

Size	Temperature Rating of Copper Conductor			
	60°C	75°C	85°C	90°C
AWG MCM	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			
00	145	175	190	195
000	165	200	215	225
0000	195	230	250	260

**Table 2–4. Minimum Wire Size**

## 2.6 Wire Gauge Selection

The following guidelines assist in determining the optimum cable specification for your power applications. The same engineering rules apply whether going into or out of an electrical device. Thus, this guide applies equally to the input cable and output cable for this Sorensen instrument and application loads.

Power cables must be able to safely carry maximum load current without overheating or causing insulation destruction. It is important to everyday 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 the operating temperature. 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.

Avoid 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 Sorensen instrument. Frequently, these codes do not consider bundles of wire within a cable arrangement.

In high performance applications, as in motor start-up and associated inrush/ transient currents, additional consideration is required. The cable wire gauge must consider peak voltages and currents, which may be up to ten times the average values. An underrated wire gauge adds losses, which alter the inrush characteristics of the application and thus the expected performance.

Table 2–5 identifies popular ratings for DC power source cable wire gauges.

Column 1	Column 2	Column 3	Column 4
Size (AWG)	Amperes (Maximum)	Ohms/100 Feet (One Way)	IR Drop/100 Feet (Column 2 x Column 3)
14	15	0.257	3.85
12	20	0.162	3.24
10	30	0.102	3.06
8	40	0.064	2.56
6	55	0.043	2.36
4	70	0.025	1.75
2	95	0.015	1.42
1/0	125	0.010	1.25
3/0	165	0.006	1.04

**Table 2–5 Recommended Wire Gauge Selection Guide**

Refer to Table 2–6 for AC input current requirements and Section 1.2.3 for output current requirements.

Input V	Input Line Current						Unit of Measure
	5 kW	10 kW	15 kW	20 kW	25 kW	30kW	
208/220VAC	21	41	62	83	103	124	Amps AC per phase
380/400VAC	14	27	40	54	67	80	
440/480VAC	13	26	39	52	65	78	

**Table 2–6 Maximum AC Current Ratings**

Refer to Table 2–7 for input/output lug recommendations.

Lug Manufacturer	3U Models Input/Output	6U Models Input/Output
Panduit	“PN” Series or equivalent	“LCA” Series or equivalent

**Table 2–7 Recommended Lugs**

The recommended tools for installation and extraction of the sense connector are listed below in Table 2–8.

<b>Tool</b>	<b>Manufacturer</b>	<b>Manufacturer P/N</b>
Crimping Device	Molex	11-01-0197
Extracting Device	Molex	11-03-0044

**Table 2–8. Recommended Sense Connector Tools**

## 2.7 Load Considerations

### 2.7.1 Inductive Loads

To prevent damage to the power supply from inductive kickback, connect a 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 may occur, a second diode in series with the output is recommended to protect the power supply.

## 2.8 Outline Drawings

Figure 2–1 and Figure 2–2, next, show the outlines and overall dimensions of the 3U and 6U models of the SGA Series product line.

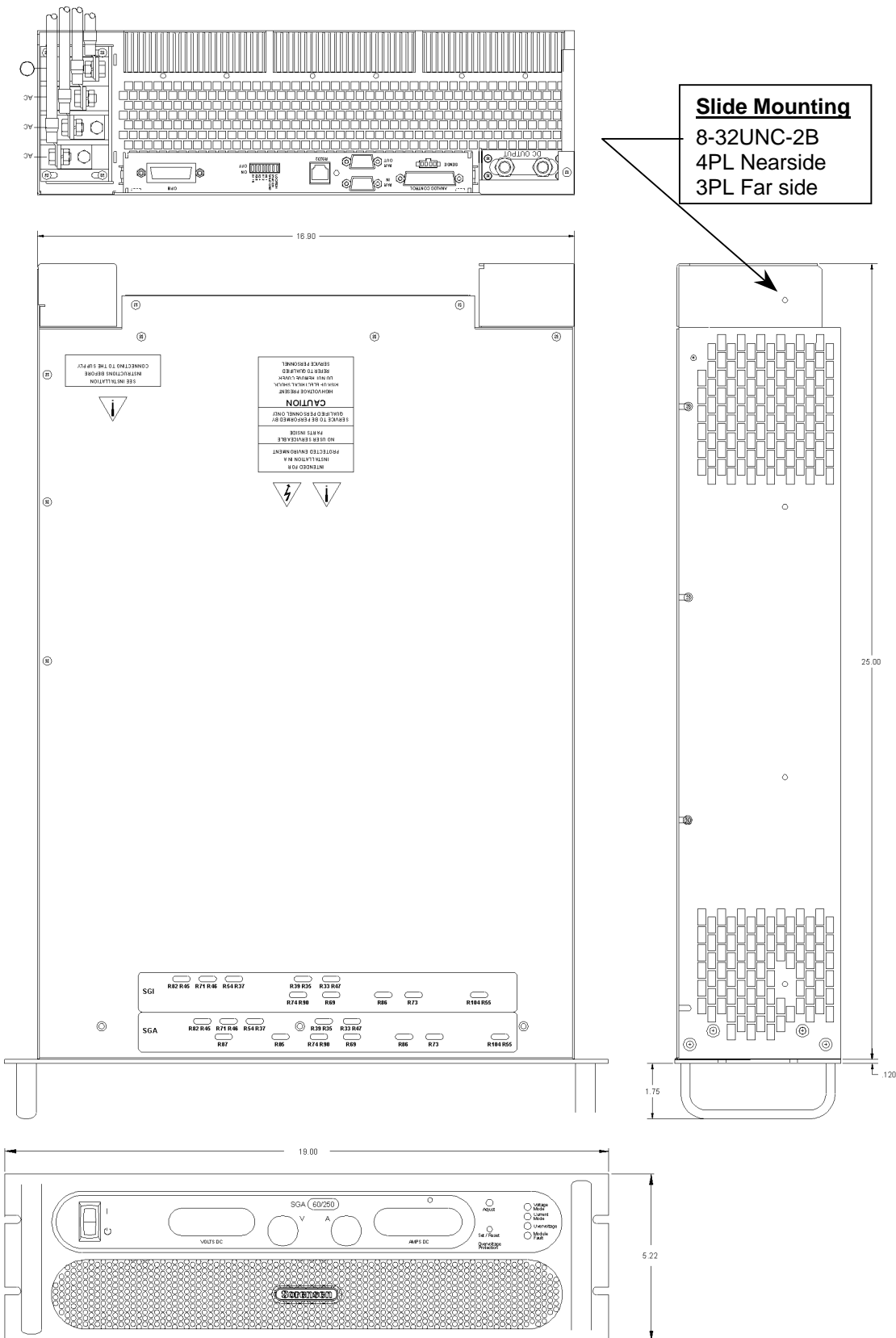


Figure 2-1. SGA Series Outline Drawing, 3U Models, 5kW to 15kW

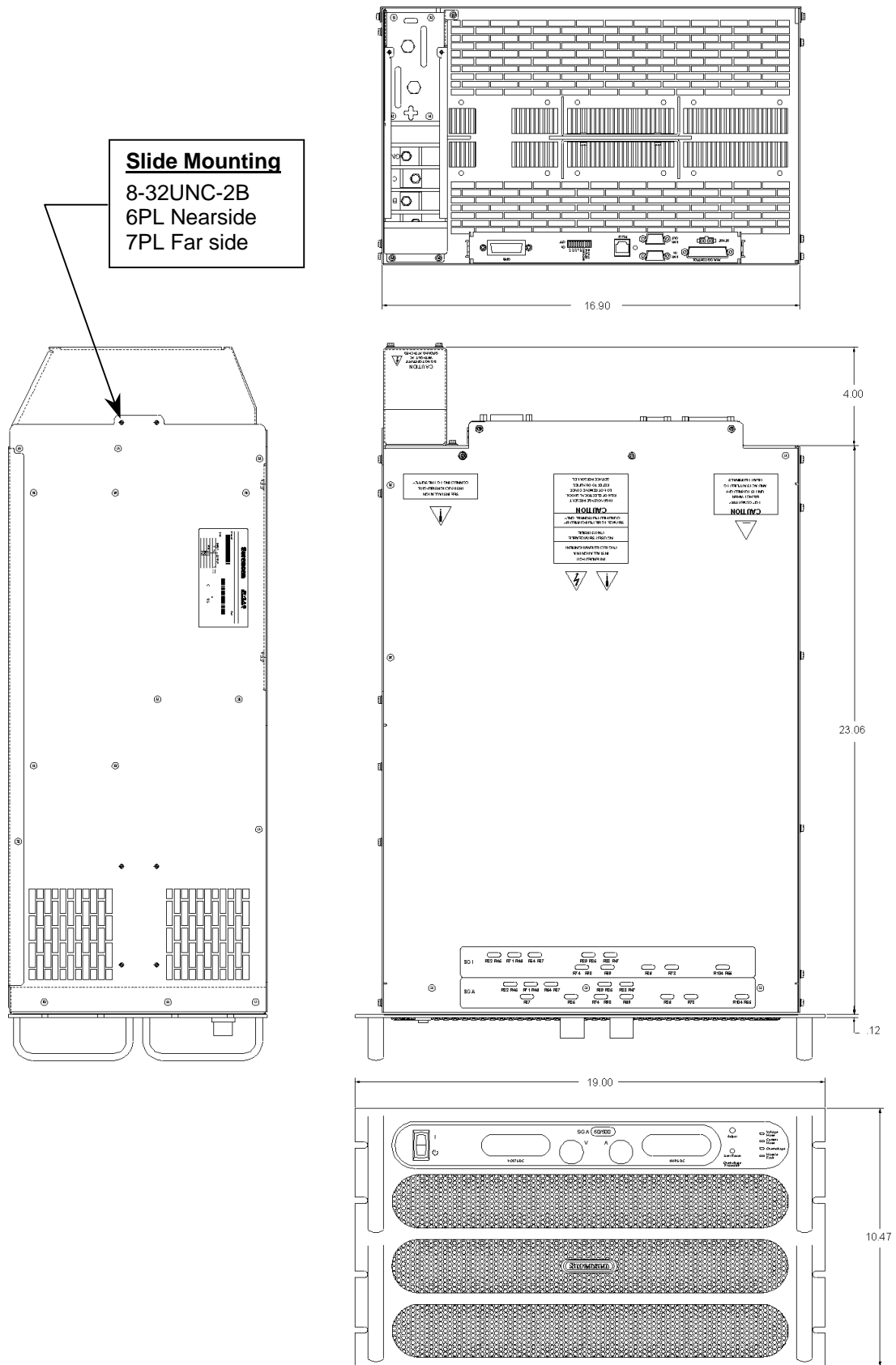
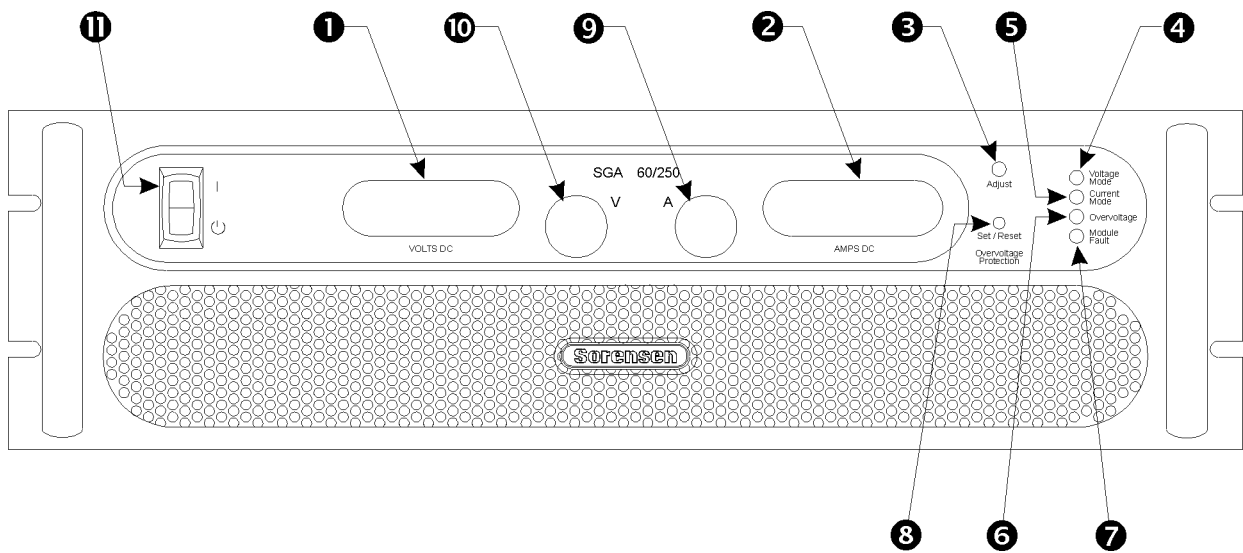


Figure 2–2. SGA Series Outline Drawing, 6U Models, 20kW to 30kW

## SECTION 3 OPERATION

### 3.1 Controls and Indicators


Refer to Figure 3–1 and the corresponding descriptions below for an explanation of front panel controls and indicators on the SGA Series power supply.



**Figure 3–1. Front Panel Controls and Indicators (3U model shown)**

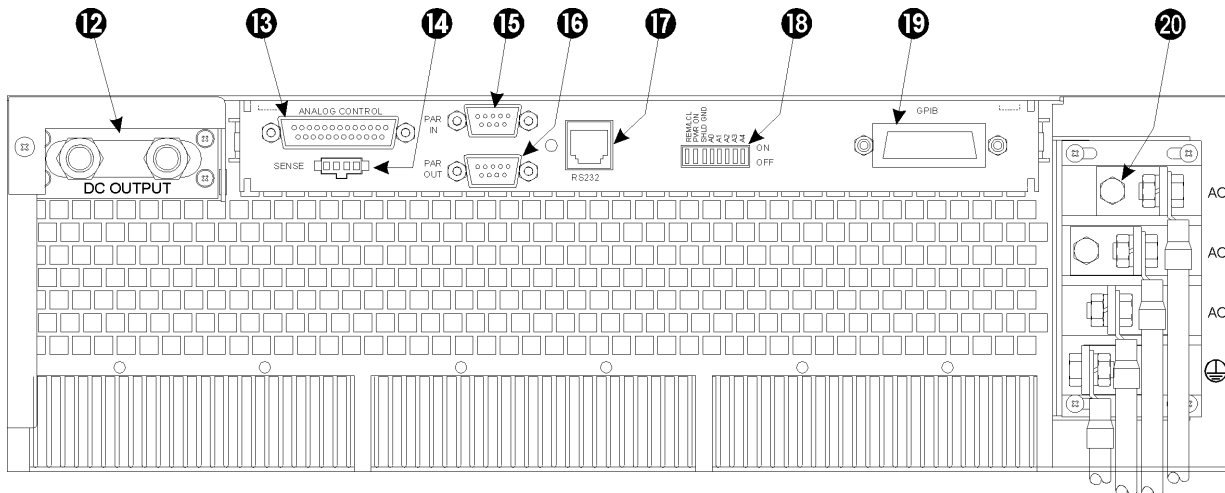
- 1** Voltage Display: 3½ digit green LED display indicates the DC output voltage of the supply. Display indicates the OVP setting when the SET/RESET OVERVOLTAGE PROTECTION button is pushed.
- 2** Current Display: 3½ digit green LED display indicates the DC output current of the supply.
- 3** ADJUST Overvoltage Potentiometer: Adjusts the overvoltage trip level.

- ④ **VOLTAGE MODE Indicator:** Green LED lights when in the constant–voltage mode of operation. When in the constant–voltage mode, the output voltage will regulate to the set value and the current value will vary with the load.
- ⑤ **CURRENT MODE Indicator:** Green LED lights when in the constant–current mode of operation. When in the constant–current mode, the output current will regulate to the set value and the output voltage will vary with the load.
- ⑥ **OVERVOLTAGE FAULT Indicator:** Red LED indicates output voltage has exceeded preset level, and power supply output is turned off.
- ⑦ **MODULE FAULT Indicator:** Yellow LED indicates an internal fault such as bias supply, thermal, or converter failure.
- ⑧ **SET/RESET OVERVOLTAGE PROTECTION Pushbutton:** Depress button to view OVP level. Push and hold for 4 seconds to reset OVP condition.
- ⑨ **CURRENT knob:** 10–turn adjustment sets the output current. (Optional shaft locks not shown. Please see Section 3.1.1).
- ⑩ **VOLTAGE knob:** 10–turn adjustment sets the output voltage. (Optional shaft locks not shown. Please see Section 3.1.1).
- ⑪ **ON/OFF Switch:** Two–position switch enables or disables the power supply.



**WARNING!**  
The OFF position of the power switch does not remove voltage from the input terminal blocks. Remove all external power before servicing the unit.

Refer to Figure 3–2 and the corresponding descriptions below for an explanation of rear panel connectors.



**Figure 3–2. Rear Panel Connectors (3U model shown)**

- ⑫ **DC OUTPUT:** Positive (+) and negative (–) outputs. Threaded studs for 5-15kW models; bus bars for 20-30kW models.



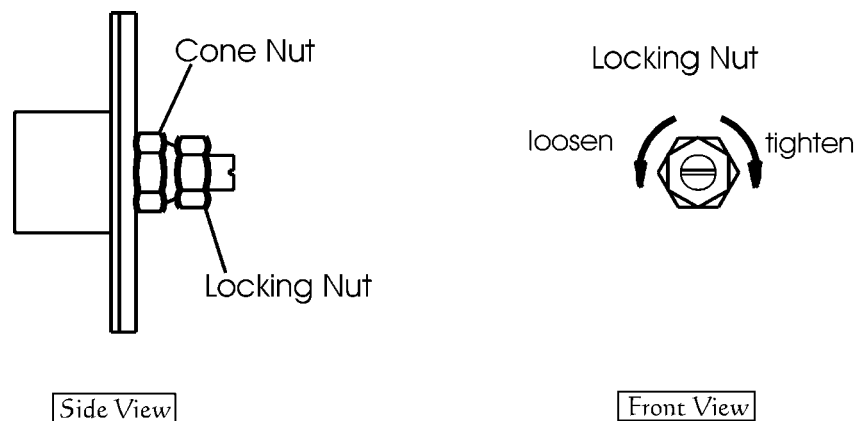
- 13 ANALOG CONTROL Connector (J1): I/O connector for input programming and analog output monitoring signals as well as status indication and remote shutdown signals. See Table 3–1 for individual pin descriptions.
- 14 SENSE Connector (J3): Input connector for load voltage sensing to correct for line drops in the load cables (see Section 3.5).
- 15 PARALLEL IN Connector: Allows master/slave configuration of up to five units when connected to another unit's PARALLEL OUT connector (see Section 3.9).
- 16 PARALLEL OUT Connector: Allows master/slave configuration of up to five units when connected to another unit's PARALLEL IN connector (see Section 3.9).
- 17 RS232 Connector: Optional RJ-11 connector for remote control.
- 18 Dipswitch: Eight–position dipswitch to configure an SGA Series unit with an IEEE option.
- 19 GPIB Connector: Optional connector for remote control.
- 20 AC Input Bus Bars: Connection for 3-phase AC and Ground.

### 3.1.1 Shaft Lock (Option)

This option replaces the standard control knobs with a two-piece shaft lock. These are installed over the voltage and current adjustment potentiometer shafts to prevent rotating under conditions of shock, vibration, or accidental contact. For adjustment, the following steps apply:

- Loosen the shaft by rotating the outer locking nut counter-clockwise with a 7/16-inch wrench.
- Adjust the shaft with a flat screwdriver to the desired output level.
- Tighten the outer locking nut, rotating clockwise, to approximately 5 LB-in (0.56 N-m).

NOTE: Take care not to over-torque the outer nut. Should the cone nut become loose or jammed with the outer locking nut, re-torque the cone nut with a 1/2-inch wrench to approximately 15 LB-in (1.69 N-m).



**Figure 3–3. Shaft Lock**

**CAUTION!**

Never completely loosen the cone nut, or remove the shaft lock from the chassis.

## 3.2 Local Operation

The SGA Series power supply is shipped from the factory configured for local voltage/current control and local voltage sensing. The ANALOG CONTROL connector is supplied with a mating connector with remote ON/OFF jumpered for ON (terminal 5 shorted to terminal 6).

Prior to turning the unit on, rotate the voltage and current potentiometers fully counterclockwise (minimum output). Then, turn the power ON and adjust the voltage and current to the desired output.

This section provides an overview of front panel operation and initial functional tests of the power supply.

### 3.2.1 Initial Setup

Before connecting the unit to an AC outlet, ensure that the front panel ON/OFF power switch is in the off position and that the voltage and current control knobs are fully counterclockwise. 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 to enable the output of the supply (see Section 3.6). This is the default configuration installed from the factory. Apply power to the AC mains input.

### 3.2.2 Voltage Mode Operation

When the supply is in the Voltage mode, the output voltage of the supply is controlled by the voltage knob on the front panel or by the remote voltage input. See Section 3.4. The Current knob (or remote current input) operates as a current limit. The output voltage is regulated at the selected value while the output current varies with the load requirements. To verify operation in voltage mode, follow the steps below:

- 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.
- Rotate the Current control knob about  $\frac{1}{2}$  turn clockwise (this sets the current limit at a nominal setting above 0 Amps)
- Turn on the power supply.
- Slowly rotate the Voltage knob clockwise and observe both the front panel voltage display and the output of the DVM. The minimum range should be from 0V to the maximum rated voltage output of the supply. The front panel display and DVM readings should track within the accuracies of the meter and the front panel display.
- Check that the green Voltage Mode indicator is on.

- Turn the Voltage knob and Current knob fully counterclockwise.
- Turn the power supply off.

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

### 3.2.3 Current Mode Operation

When the supply is in the Current Mode, the output current of the supply is controlled by the Current knob on the front panel or by the remote current input (see Section 3.3). The Voltage control knob (or remote voltage input) operates as a voltage limit. To verify operation in current mode, follow the steps below:

- 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: If a high current ammeter is not available, you may simply short the output terminals together. This will not harm the supply.
- Rotate the Voltage control knob about ½ turn clockwise (this sets the Voltage limit at a nominal setting above 0 Volts and forces the supply into current mode).
- Turn on the power supply.
- Slowly rotate the Current knob clockwise and observe both the front panel current display and the output of the ammeter. The minimum range should be from 0A to the maximum rated current output of the supply. The front panel display and ammeter readings should track within the accuracies of the meter and the front panel display.
- Check that the green Current Mode indicator is on.
- Turn the Voltage knob and Current knob fully counterclockwise.
- Turn the power supply off.
- Disconnect the ammeter or short from the output terminals.

If Current mode operation did not function as indicated above, recheck your setup and perform the check again. If the function continues to fail, contact the factory for assistance.

### 3.2.4 Overvoltage Protection

The Overvoltage Protection (OVP) function allows the supply to shutdown the output when it exceeds 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. To verify OVP operation, follow the steps below:

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

- Rotate the Current control knob about ½ turn clockwise (this sets the current limit at a nominal setting above 0 Amps)
- Turn on the power supply.
- Press and hold the Set/Reset Overvoltage Protection pushbutton on the front panel and observe the reading on the voltage display. This is the present setting of the OVP limit. The factory default setting is approximately 110% of the maximum rated output of the supply.
- While holding down the Set/Reset button, use a small adjustment screwdriver to adjust the OVP setting by turning the 4-turn recessed adjust potentiometer counterclockwise. As you adjust the potentiometer the reading on the voltage display should decrease (increase as you adjust in a clockwise direction).
- Set the OVP to about 80-90% of the maximum rated output voltage and note the OVP voltage value. Release the Set/Reset pushbutton.
- Rotate the Voltage knob clockwise until the voltage display indicates you are about 2-3% below the OVP voltage value noted above.
- Slowly continue to increase the output of the supply until you exceed the value of the OVP setting. At this point the OVP light should turn on and the output of the supply will turn off causing the output to go to 0 volts (as indicated on the voltage display).
- Turn the Voltage knob fully counterclockwise, then press and hold the Set/Reset pushbutton until the OVP light turns off.
- Reset the OVP setting as appropriate for your application per steps 4 and 5 above. If you do not chose to use OVP, then the OVP adjust may be set fully clockwise to approximately 110% of the rated output voltage of the supply.

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


### 3.2.5 Analog Control Connector (J1)

The ANALOG CONTROL connector on the rear panel allows the unit to be configured for different operating configurations: local and remote current programming, local and remote voltage programming, current and voltage output monitoring, output enable/disable, etc. The setup and operating requirements of each configuration are provided in Sections 3.3 through 3.8.

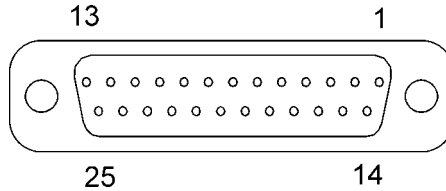
#### 3.2.5.1 Isolated Analog Control (Option)

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

**Note:** Some standard analog programming signals may not be available with this option. See Table 1.2.2 for details.

	<p><b>CAUTION!</b>                  This option is not intended to allow operation of the power supply at excessive voltages. Refer to Section 2 INSTALLATION for maximum terminal voltages.</p>
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Following are Figure 3–4 with the connector's pin-out diagram, and Table 3–1 with ANALOG CONTROL connector designations and functions:



**Figure 3–4. ANALOG CONTROL Connector (J1) Pin-out**

Designator	Schematic Symbol	Electrical Chars.	Functional Description
1	ISO ON/OFF	Zin ~ 6 kΩ	Isolated remote on/off. Externally supplied AC/DC voltage source for on/off control. A positive (+) 12 to 240 VAC or 6 to 120 VDC voltage will turn on the supply. This input control is optically isolated from the power supply circuit up to 500 VDC. See Section 3.6.
2	ISO RTN	—	Isolated circuit return used with isolated on/off control J1-1 and J1-14.
3	REM OV SET	Zin ~ 20 kΩ	Remote overvoltage set. A remote signal sets the over-voltage trip level. 0-5.5 VDC = 0-110%. Apply a 10.5 VDC to 13.3 VDC signal for 4 seconds to reset an OVP condition. See Section 3.7.
4	VP RTN	Zin ~ 10 kΩ	Voltage programming return. Used with J1-9, J1-15 or J1-21 and must be referenced to or within ±3V of the circuit common.
5	ON/OFF	Must sink ~1mA to enable	Remote on/off. Switch/relay contacts or a direct short between this terminal and circuit common turns on the unit.
6	COM †	-	Circuit Common. Same potential as the negative output terminal.

Designator	Schematic Symbol	Electrical Chars.	Functional Description
7	I MON	Zout ~ 100Ω	Output current monitor. 0-10 VDC equals 0-100% rated current. Minimum load resistance 10kΩ.
8	V SET *	Zout ~ 100Ω	0-5 VDC (0-100%) front panel voltage control monitor output. Minimum load resistance 10kΩ.
9	VP 5V	Zin ~ 10kΩ	Remote voltage programming using a 0-5 VDC source. Do not exceed 13.3 VDC.
10	IP 5V	Zin ~ 10kΩ	Remote current programming using a 0-5 VDC source. Do not exceed 13.3 VDC.
11	ISET *	Zout ~ 100Ω	0-5 VDC (0-100%) front panel current control monitor output. Minimum load resistance 10kΩ.
12	SENSE –	~ 1000Ω to neg (–) output terminal	Remote Sense (–) on 60 volts output units. (For new installations, use J3, recommended only for backward compatibility in existing systems.)
13	SENSE +	~ 1000Ω to pos (+) output terminal	Remote Sense (+) on <60 volts output units. (For new installations, use J3, recommended only for backward compatibility in existing systems.)
14	ISO TTL/CMOS	Zin ~ 2.2kΩ	Isolated TTL/CMOS on/off control. A high state TTL/CMOS voltage turns on the power supply, and a low state or open connection turns the supply off.
15	VP 10V	Zin ~ 20kΩ	Remote voltage programming using a 0-10 VDC source. Do not exceed 25 VDC.
16	IP 10V	Zin ~ 20kΩ	Remote current programming using a 0-10 VDC source. Do not exceed 25 VDC.
17	FAULT	Zout ~ 100Ω	Fault state output. A high state (approximately +10 VDC) indicates a converter, temperature or bias supply fault, and the LED on the front panel will illuminate.
18	S/D FAULT	Zout ~ 100Ω	Shutdown fault. This terminal goes to high state in the event of converter, temperature, overvoltage or bias supply fault. A 7 VDC to 13.3 VDC signal can be applied to this pin to shutdown the output of the unit. An 8 VDC minimum output signal is provided into a 10 kΩ minimum load, in the event of an internally generated shutdown.
19	V MON	Zout ~ 100Ω	Output voltage monitor. 0-10 VDC equals to 0-100% rated voltage. Minimum load resistance 10kΩ.

Designator	Schematic Symbol	Electrical Chars.	Functional Description
20	VP RTN	$Z_{in} \sim 10\Omega$	Voltage programming return. Used with J1-9, J1-15 or J1-21 and must be referenced to or within $\pm 3V$ of the circuit common.
21	VP RES *	$\sim 10.8V$ compliance	1 milliamp current source for remote voltage programming using resistance. 0-5k ohm resistor referenced to common will program the output voltage from 0-100%.
22	IP RES *	$\sim 10.8V$ compliance	1 milliamp current source for remote current programming using resistance. 0-5k ohm resistor referenced to common will program the output from 0-100%.
23	IP RTN	$Z_{in} \sim 10k\Omega$	Current programming return. Used with J1-10, J1-16 or J1-22 and must be referenced to or within $\pm 3V$ of the circuit common.
24	COM †	-	Circuit common. Same potential as the negative output terminal.
25	IP RTN	$Z_{in} \sim 10k\Omega$	Current programming return. Used with J1-10, J1-16 or J1-22 for remote current programming and must be referenced to or within $\pm 3V$ of the circuit common.

**Table 3–1. ANALOG CONTROL Connector (J1), Designations and Functions**

† Control ground is isolated from power ground with the isolated analog control (option). See Section 3.2.5.1

\* Signals not available with isolated analog control (option).



**CAUTION!**

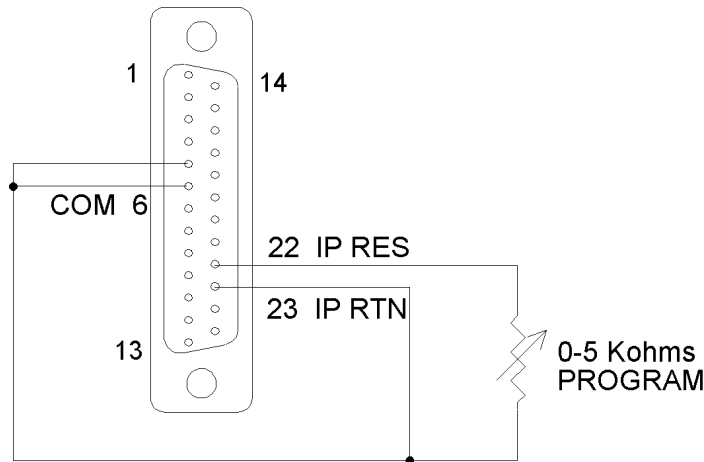
If standard analog programming is used, note the programming return (J1-6 & J1-24) is at the same potential as the negative output terminal of the power supply. Observance of return connections should be made with respect to input programming signal equipment. Improper connection may result in ground loops and as a result internal power supply damage may occur. (Output current then flows to chassis by means of external connection to the J1 common (J1-6 & J1-24)).

### 3.3 Remote Current Programming

Remote current programming is used for applications that require the output current be programmed (controlled) from a remote source. An external resistance or external voltage source may be used as a programming device. When using remote current programming, a shielded, twisted-pair, hookup wire is recommended to prevent noise interference with programming signals.

#### 1. Remote Current Programming Using Resistance:

The resistance coefficient for remote current programming is 5k ohms/100% rated output with respect to terminal J1-23 (IP RTN). The programming current from terminal J1-22 (IP RES) is factory set for 1 milliampere. This yields a coefficient of 1.0% of rated output current for each 50 ohms. If multiple switches or relays are used to program different levels, make-before-break contacts are recommended. Note that if an external resistance is used for remote programming, the current programming return (IP RTN), terminal J1-23, must be connected directly to or within  $\pm 3$  volts (see note) of the power supply common terminal, J1-24. See Figure 3-5 for connection requirements.

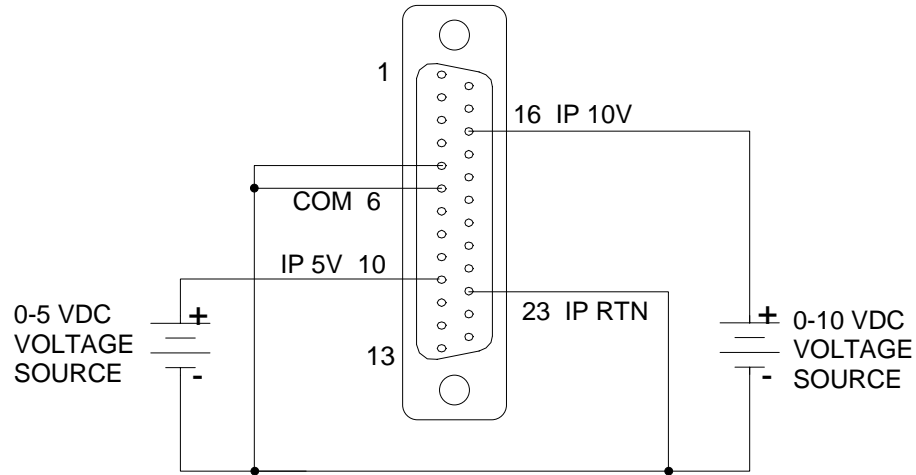


**Figure 3-5. Remote Current Programming Using Resistance**

#### 2. Remote Current Programming Using a 0-5 VDC or 0-10 VDC Voltage Source:

A DC voltage source for remote current programming is connected between J1-10 (IP 5V) or J1-16 (IP 10V) and the return terminal J1-23 (IP RTN). Note that the return terminal J1-23 (IP RTN) must be referenced directly to or within  $\pm 3$ V (see note) of the power supply common, J1-24. The voltage coefficient for 5V remote current programming is 50 millivolts = 1% of rated output, i.e., for a 300 amp model, each 50 millivolts of programming voltage equals 3 amps of output current. The voltage coefficient for 10V remote current programming is 100 millivolts = 1% of rated output, i.e., for a 300 amp model, each 100 millivolts of programming voltage equals 3 amps of output current. See Figure 3-6 for connection requirements.





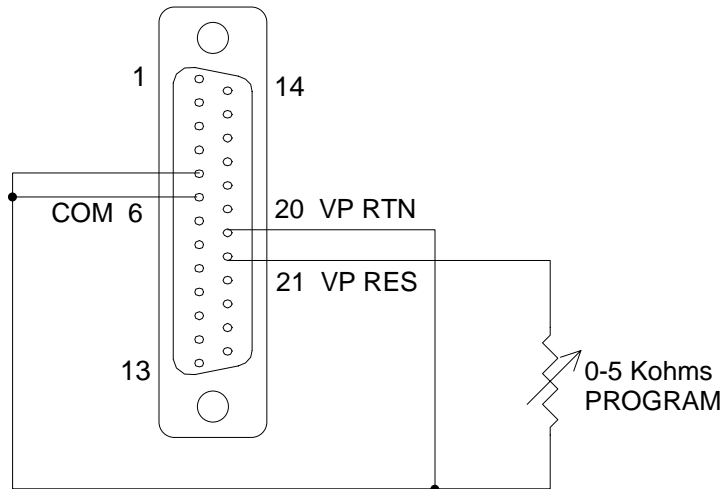
**Figure 3–6. Remote Current Programming Using 0-5 VDC or 0-10 VDC Voltage Source**

### 3.4 Remote Voltage Programming

Remote voltage programming configuration is used for applications that require the output voltage be programmed (controlled) from a remote source. An external resistance or external voltage source may be used as a programming device. When using remote voltage programming, a shielded, twisted-pair, hookup wire is recommended to prevent noise interference with programming signals.

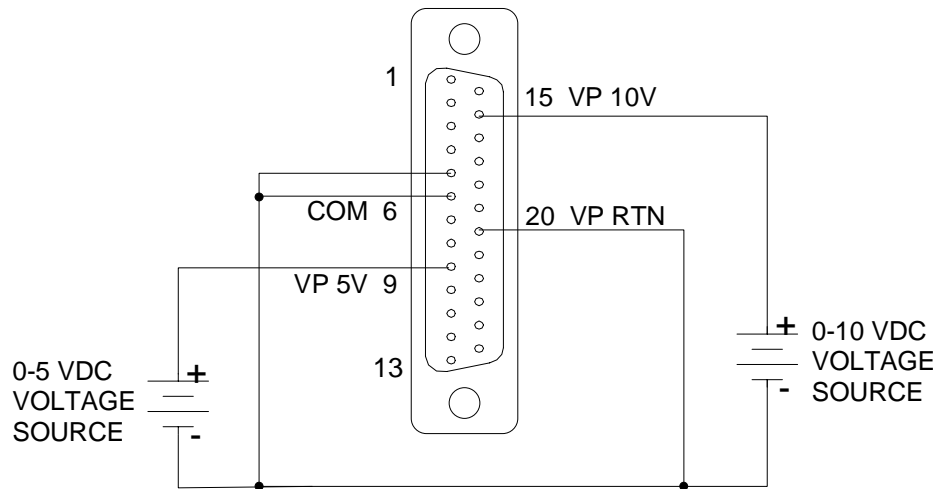
1. External Voltage Programming Using Resistance:

The resistance coefficient for remote voltage programming is 5k ohms/100% of rated output voltage with respect to the VP RTN, J1-20. The programming current from terminal J1-21 (VP-RES) is factory set to 1 milliampere. This yields a coefficient of 1.0% of rated output voltage for each 50 ohms. If multiple switches or relays are used to program different levels, make-before-break contacts are recommended. Note that if an external resistance is used for remote programming, the voltage programming return (VP RTN), terminal J1-20, must be connected directly to or within  $\pm 3$  volts (see note) of the power supply common terminal, J1-24. See Figure 3–7 for connection requirements.



**Figure 3–7. Remote Voltage Programming Using Resistance**

2. External Voltage Programming Using a 0-5 VDC or 0-10 VDC Voltage Source:  
 A DC voltage source for remote voltage programming is connected between J1-9 (VP 5V) or J1-15 (VP 10V) and the return terminal J1-20 (VP RTN). Note that the return terminal (VP RTN) must be referenced directly to or within  $\pm 3V$  (see note) of the power supply common, J1-24. The voltage coefficient for 5V remote voltage programming is 5 volts = 100% of rated output voltage. The voltage coefficient for 10V remote voltage programming is 10 volts = 100% of rated output voltage. See Figure 3–8 for connection requirements.



**Figure 3–8. Remote Voltage Programming Using 0-5 VDC or 0-10 VDC Voltage Source**

### 3.5 Remote Sensing

Remote voltage sensing is recommended at all times, whether you connect sensing leads to the load or directly to the output terminals. Remote sensing at the load provides the best load regulation.

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, remote voltage sensing should definitely be used.

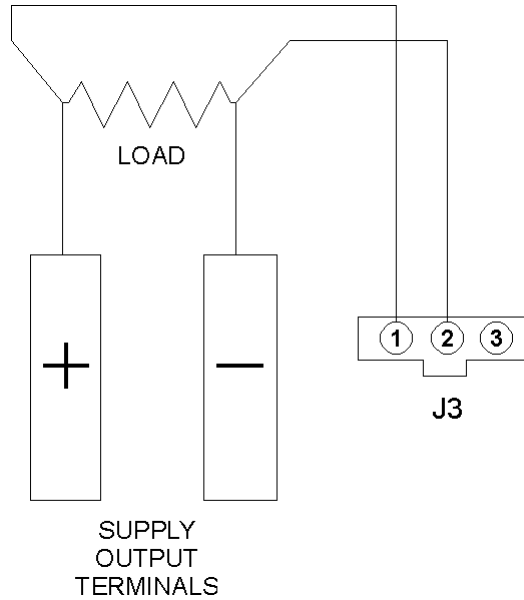


**CAUTION!**

If the power supply is operated with load power lines disconnected and sensing line connected, internal power supply damage may occur. (Output current then flows through sensing terminals.)

To use remote voltage sensing, connect the power supply as described below. See Figure 3–9 for connection requirements.

Connect sensing leads from the load positive to J3-1 and the load negative to J3-2. A shielded, twisted-pair, hookup wire is recommended to avoid potential noise interference.

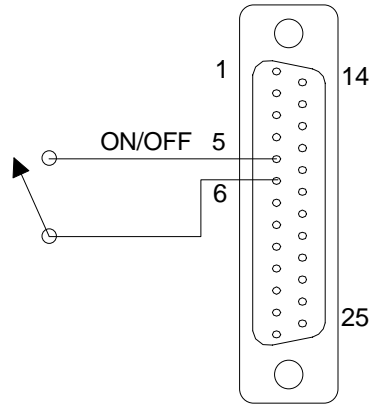


**Figure 3–9. Remote Sensing Operation at the Load**

### 3.6 Remote Output On/Off Control

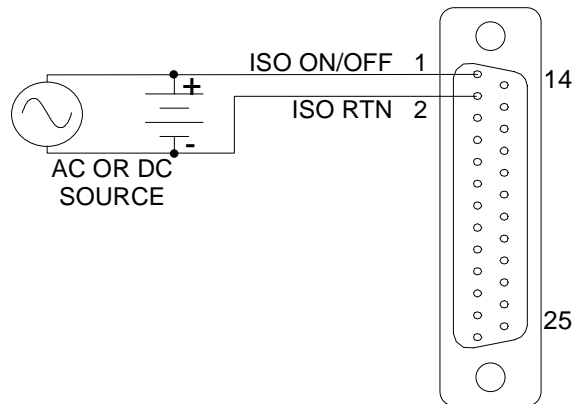
Remote on/off control may be accomplished by contact closure or by an isolated external AC/DC or TTL/CMOS voltage source.

1. Remote on/off by contact closure. Output is on when contacts (J1-5 and J1-6) are closed. See Figure 3–10 for connection requirements.

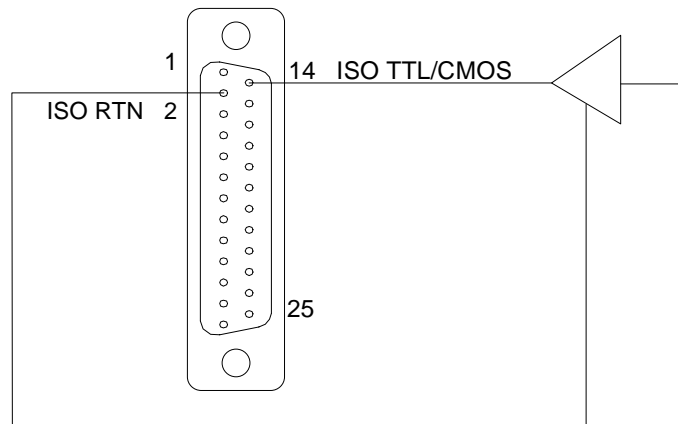


**Figure 3–10. Remote On/Off Control by Contact Closure**

2. Remote on/off control may be accomplished by an external 12 to 240 VAC or 6 to 120 VDC or TTL/CMOS source. Application of AC/DC or high state TTL/CMOS voltage will turn on the power supply. See Figure 3–11 and Figure 3–12 for connection requirements.



**Figure 3–11. Remote On/Off Using Isolated AC or DC Voltage Source**



**Figure 3–12. Remote On/Off Using Isolated TTL/CMOS Voltage Supply**

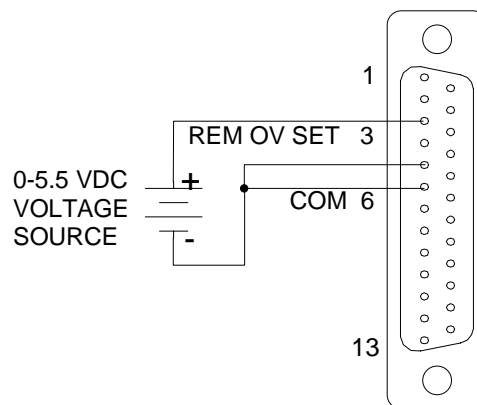
### 3.7 Remote Overvoltage Setpoint



**CAUTION!**

Do not program the remote overvoltage set point greater than 10% (5.5V) above the power supply rated voltage (except as noted) as internal power supply damage may occur.

A remote DC voltage source can be connected externally between terminals J1-6 (COM) and J1-3 (REM OV SET) to set the output overvoltage trip level. A 0-5.5 VDC signal equals 0-110% of rated output voltage. See Figure 3–13 for connection requirements.

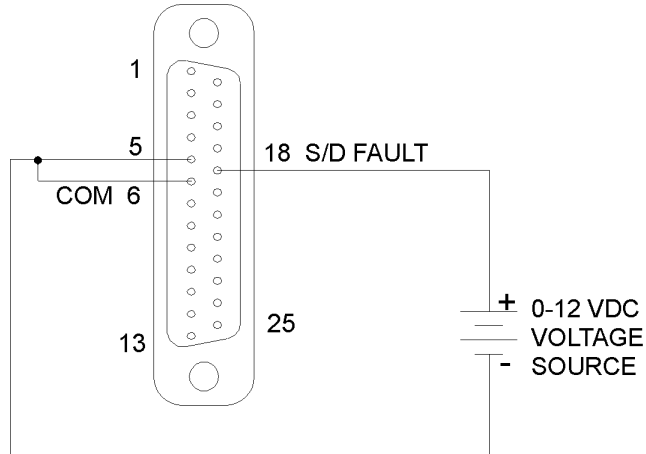


**Figure 3–13. Remote Overvoltage Set Using DC Voltage Source**

**Note:** The Remote OVP trip level will ALWAYS take precedence over the local trip level, even if the local OVP trip level is set to a lower value. To reset an OVP externally, apply a 10.5–13.3 VDC signal to J1-3 for a minimum of four (4) seconds.

### 3.8 Remote Shutdown (S/D)

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



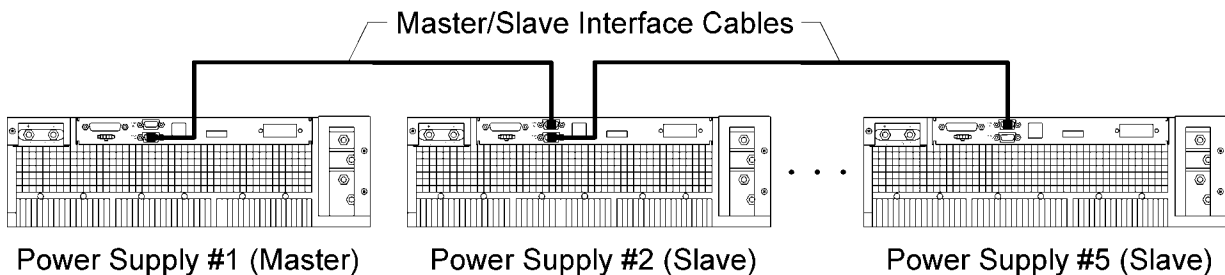
**Figure 3–14. Remote Shutdown Using DC Voltage Source**

### 3.9 Master/Slave Operation

The following 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 voltage or current, two supplies may be connected in series or up to five connected in parallel.

#### 3.9.1 Parallel Operation

In the parallel mode of operation, a master/slave configuration is established. Up to five power supplies may be paralleled using this configuration. To set up the parallel mode of operation, connect the interface cable (Elgar P/N 890-453-03) from the master unit to the slave unit(s), as shown below in Figure 3–15. Next connect the positive outputs of supplies together and the negative outputs of the supplies together. It is recommended that the outputs are connected together as close to the load as practical.



**Figure 3–15. Master/Slave Connection**

**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.*

### 3.9.2 Series Operation

Series operation is used to obtain a higher voltage single output supply using two units. Connect the negative terminal (–) of one supply to the positive terminal (+) of the next supply of the same model. The total voltage available is the sum of the maximum voltages of each supply (add voltmeter readings).

Notes:

1. Under no condition should the negative (–) output terminal of **any** power supply exceed 150V to Earth ground. This is limited by the creepage/clearance distances internal to the construction of the metal shell 25-pin 'D' connector mated to J3. If a higher output voltage range is required, contact the Sorensen Sales Department or Customer Service for availability.
2. The maximum allowable current for a series string of power supplies is the rated output current of a single supply in the string.
3. Remote sensing should **not** be used during series operation.

# SECTION 4

## VERIFICATION AND CALIBRATION

### 4.1 Introduction

This section provides verification and calibration procedures for the standard SGA Series power supplies and isolated analog control (option).

#### 4.1.1 Verification and Calibration Cycle

It is recommended that the power supply be calibrated and/or verified once each year of operation.

#### 4.1.2 Preparation



**WARNING!**

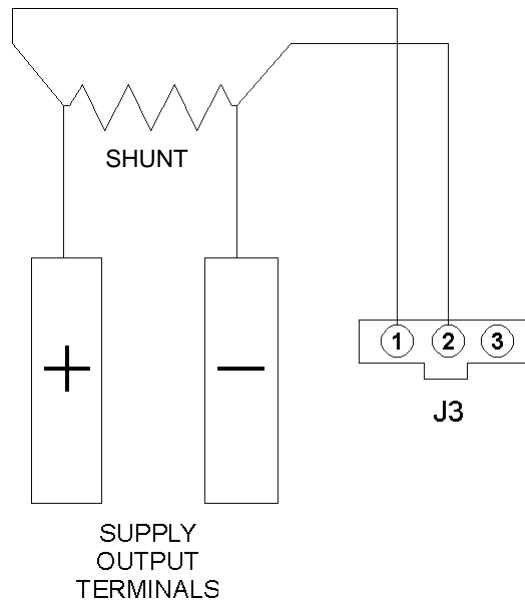
Hazardous voltages exist on the rear of the supply. Great care must be taken to avoid both the input terminals, and while the supply is enabled, the output terminals. Only authorized personnel should perform this procedure.

Due to the importance of accurate readings to performance, only technically trained personnel should perform calibration procedures.

The calibration and adjustment procedures require two digital multimeters. To set up for the calibration procedures, first perform the following:

- Remove prime AC power.
- Connect the power supply to a precision current shunt (as shown in Figure 4–1 below) capable of a minimum of 10% above full rated output. A fan may be required to cool the shunt.





**Figure 4–1. Precision Current Shunt**

## 4.2 Standard Verification and Calibration Procedure

All calibration potentiometers can be adjusted through access holes in the top cover of the SGA Series unit. It is **not** necessary to remove the top cover to perform the calibration procedures.

### 4.2.1 Current Mode

1. Set the SGA Series unit to operate in remote current programming mode using an external 0-5 Vdc voltage source as shown in Figure 3–6 in Section 3.3 Remote Current Programming.
2. Attach a precision meter across the shunt Kelvin terminals.
3. Attach a precision meter in parallel with the voltage programming source.
4. Set the voltage source to  $0.0V \pm 1mV$ .
5. Apply AC power and turn the front panel voltage set potentiometer fully clockwise and verify the current mode indicator is illuminated.
6. Verify the unit is set to  $0A \pm 0.8%$  of full-scale output. If necessary, adjust R55 for zero current through the shunt. (See Figure 4–2.)
7. Set the programming voltage to  $5.0V \pm 1mV$ .
8. Verify the unit is set to  $100\% \pm 0.8%$  of full-scale output current. If necessary, adjust R69 for 100% of full-scale current on the shunt.
9. Set the programming source for  $0.5V \pm 1mV$ .

10. Verify the unit is set to  $10\% \pm 0.8\%$  of full-scale output current. If necessary, adjust R55 for 10% of full-scale current on the shunt.
11. Repeat the steps above as required to obtain the required accuracy.
12. Set the programming source to obtain 100% output current on the shunt. Verify that the front panel meter displays  $100\% \pm 1\%$  of full-scale output current. If necessary adjust R85 such that the current display reads 100% current.

#### 4.2.2 Voltage Mode

1. Disable AC power to the unit. Remove the current shunt from the output and verify that there is no load attached.
2. Remove the precision meter leads from the current shunt and apply them across the output terminals.
3. Set the SGA series unit to operate in remote voltage programming mode using an external 0-5 Vdc voltage source as shown in Figure 3–8. in Section 3.4 Remote Voltage Programming.
4. Apply AC power and turn the front panel current set potentiometer fully clockwise and verify that the voltage mode indicator is illuminated.
5. Verify that the unit is set to  $0V \pm 0.25\%$  of full-scale output voltage. If necessary adjust R90 to obtain zero output volts. (See Figure 4–2.)
6. Set the programming source to  $5.0V \pm 1mV$ .
7. Verify that the unit is set to  $100\% \pm 0.25\%$  of full-scale output voltage. If necessary adjust R74 for 100% output voltage.
8. Set the programming source to  $0.5V \pm 1mV$ .
9. Verify that the unit is set to  $10\% \pm 0.25\%$  of full-scale output voltage. If necessary adjust R90 for 10% output voltage.
10. Repeat the steps above as required to obtain the required accuracy.
11. Set the programming source to obtain 100% output voltage. Verify the front panel meter displays  $100\% \pm 1\%$  of full-scale output voltage. If necessary adjust R73 such that the front panel voltage meter reads 100% output voltage.
12. Remove all connections to the remote analog control connector (J1), except the jumper between pins 5 and 6. This reverts the SGA series unit back to local, front panel control.
13. Turn the front panel voltage pot fully clockwise.
14. Verify that the front panel meter displays a minimum of 100.5% of full-scale output voltage. If necessary, adjust R74 such that the output voltage is 100.5% of rating.

**CAUTION!**

Hazardous voltages may be present on the output after the output is disabled due to stored capacitive charge. Allow 5 minutes to drain the output capacitive charge to safe levels before connecting or removing output wiring.

#### 4.2.3 Resistor Programming Current Sources

1. Disable AC power to the unit. Turn the front panel Voltage and Current knobs fully counterclockwise.
2. Connect the power supply to a precision current shunt (see Figure 4–1, Section 4.1.2 Preparation).
3. Set the SGA series unit to operate in remote current programming mode using resistance by connecting a 5K ohm (1% or better tolerance) resistor as shown in Figure 3–5 in Section 3.3 Remote Current Programming.
4. Attach a precision meter across the shunt Kelvin terminals.
5. Apply AC power and enable the unit via the front panel On/Off switch.
6. Verify there is  $5V \pm 1\%$  across the resistor. If necessary, adjust R45 to measure 5.00V read back on the voltmeter.
7. Disable AC power to the unit.
8. Set the SGA series unit to operate in remote voltage programming mode using resistance by connecting a 5K ohm (1% or better tolerance) resistor as shown in Figure 3–7 in Section 3.4 Remote Voltage Programming.
9. Apply AC power and enable the unit via the front panel On/Off switch.
10. Verify that there is  $5V \pm 1\%$  across the resistor. If necessary, adjust R71 to measure 5.00V read back on the voltmeter.
11. Disable AC power and remove all connections to the remote analog control connector (J1), except the jumper between pins 5 and 6.

### 4.3 Isolated Analog (Option) Verification and Calibration Procedure

All calibration potentiometers can be adjusted through access holes in the top cover of the SGA Series unit. It is **not** necessary to remove the top cover to perform the calibration procedures.

#### 4.3.1 Current Mode

1. Set the SGA series unit to operate in remote current programming mode using an external 0-5 Vdc voltage source as shown in Figure 3–6 in Section 3.3 Remote Current Programming.
2. Attach a precision meter across the shunt Kelvin terminals.
3. Attach a precision meter in parallel with the voltage programming source.
4. Set the voltage source to  $0.0V \pm 1mV$ .
5. Apply AC power and turn the front panel voltage set potentiometer fully clockwise and verify the current mode indicator is illuminated.
6. Verify that the unit is set to  $0A \pm 0.8%$  of full-scale output. If necessary, adjust R47 for zero current through the shunt (see Figure 4–1 in Section 4.1.2 Preparation).
7. Set the programming voltage to  $5.0V \pm 1mV$ .
8. Verify that the unit is set to  $100% \pm 0.8%$  of full scale output current. If necessary, adjust R33 for 100% of full scale current on the shunt.
9. Set the programming source for  $0.5V \pm 1mV$ .
10. Verify that the unit is set to  $10% \pm 0.8%$  of full scale output current. If necessary, adjust R47 for 10% of full scale current on the shunt.
11. Repeat the steps above as required to obtain the required accuracy.
12. Set the programming source to obtain 100% output current on the shunt. Verify that the front panel meter displays  $100% \pm 1%$  of full-scale output current. If necessary adjust R85 such that the current display reads 100% current.

#### 4.3.2 Voltage Mode

1. Disable AC power to the unit. Remove the current shunt from the output and verify that there is no load attached.
2. Remove the precision meter leads from the current shunt and apply them across the output terminals.
3. Set the SGA series unit to operate in remote voltage programming mode using an external 0-5 Vdc voltage source as shown in Figure 3–8. in Section 3.4 Remote Voltage Programming.
4. Apply AC power and turn the front panel current set potentiometer fully clockwise and verify that the voltage mode indicator is illuminated.
5. Verify that the unit is set to  $0V \pm 0.25%$  of full-scale output voltage. If necessary adjust R35 to obtain zero output volts. (See Figure 4–2.)
6. Set the programming source to  $5.0V \pm 1mV$ .

7. Verify that the unit is set to  $100\% \pm 0.25\%$  of full-scale output voltage. If necessary adjust R39 for 100% output voltage.
8. Set the programming source to  $0.5V \pm 1mV$ .
9. Verify that the unit is set to  $10\% \pm 0.25\%$  of full-scale output voltage. If necessary adjust R35 for 10% output voltage.
10. Repeat the steps above as required to obtain the required accuracy.
11. Set the programming source to obtain 100% output voltage. Verify the front panel meter displays  $100\% \pm 1\%$  of full-scale output voltage. If necessary adjust R73 such that the front panel voltage meter reads 100% output voltage.
12. Remove all connections to the remote analog control connector (J1), except the jumper between pins 5 and 6. This reverts the SGA series unit back to local, front panel control.
13. Turn the front panel voltage pot fully clockwise.
13. Verify that the front panel meter displays a minimum of 100.5% of full-scale output voltage. If necessary, adjust R74 such that the output voltage is 100.5% of rating.

**CAUTION!**

Hazardous voltages may be present on the output after the output is disabled due to stored capacitive charge. Allow 5 minutes to drain the output capacitive charge to safe levels before connecting or removing output wiring.

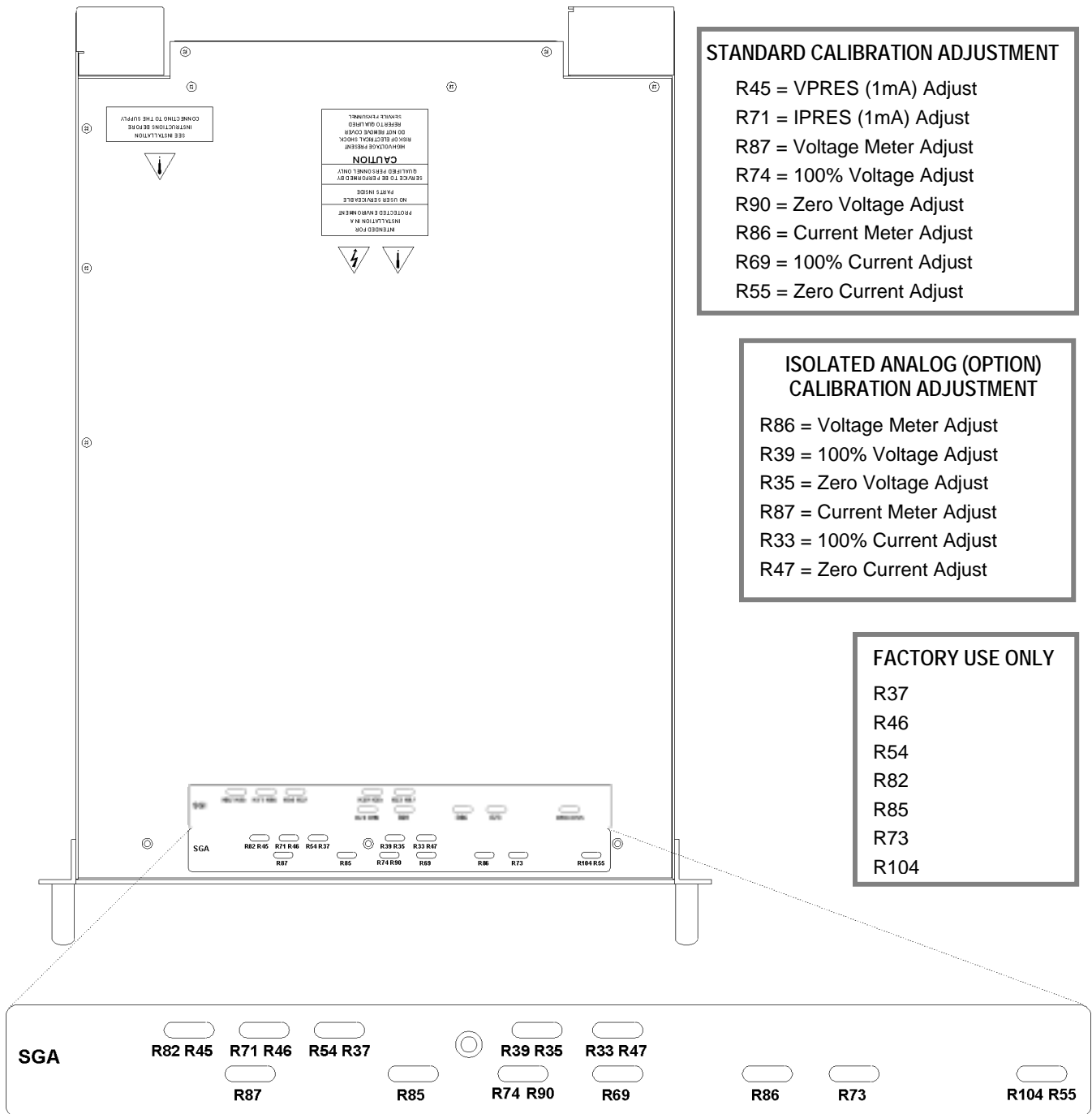


Figure 4-2. Potentiometer Locations

## SECTION 5 MAINTENANCE

### 5.1 Introduction

This chapter contains preventive maintenance information for the SGA 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 input power before performing any maintenance. Service, fuse verification, and connection of wiring to the chassis must be accomplished at least *five minutes* after power has been removed via external means; all circuits and/or terminals to be touched must be safety grounded to the chassis.

### 5.2 Preventive Maintenance

No routine maintenance on the SGA Series is required, aside from periodic cleaning of the unit when needed:

- 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.
- Low-pressure compressed air may be used to remove dust from in and around components on the printed circuit boards.



#### WARNING!

The OFF position of the power switch does not remove voltage from the input terminal blocks. Remove all external power before performing any service.

An annual inspection of the SGA Series unit is recommended. Table 5–1 lists the visual inspection checks to be performed, and the corrective action to be taken.

**Table 5–1. Recommended Annual Inspection**

Item	Inspect For	Corrective Action
External connector plugs and jacks	Looseness, bent or corroded contacts, damage or improper seating in mating connector	Clean contacts with solvent moistened cloth, soft bristle brush, small vacuum, or low compressed air.
		Replace connectors damaged, deeply corroded, or improperly seated in mating connector.
Chassis, fan, and extruded heatsinks	Dirt and corrosion	Clean with cloth moistened with soapy water.
External electrical wiring	Broken, burned or pinched wire; frayed, worn or missing insulation	Repair or replace defective wires.
External solder connections	Corrosion, loose, cracked, or dirty connections	Clean and resolder connections.
Dirt and moisture buildup	Short circuits, arcing, corrosion, overheating	Clean as required.
Front panel controls and meters	Dirt and corrosion	Clean with cloth moistened with soapy water.
		Use a Kimwipe tissue and GTC glass-cleaning compound to clean the meter faces.



**CAUTION!**

For safe and continued operation of the SGA Series, always operate the unit in a temperature and humidity controlled, indoor area, free of conductive contaminants. Remember to keep the rear and sides of the unit free of obstructions to ensure proper ventilation.



### 5.3 Fuses

There are no user replaceable components in the power supply.



**WARNING!**

Only properly trained and qualified personnel should remove the cover from the power supply. Service, fuse verification, and connection of wiring to the chassis must be accomplished at least *five minutes* after power has been removed via external means; all circuits and/or terminals to be touched must be safety grounded to the chassis.



**CAUTION!**

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

Internal fuses are listed in Table 5–2. Note, however, that failure of one of these fuses indicates a more serious problem has occurred. Please contact the factory for further assistance.

PCB Part No.	Reference	Value	Manufacturer Part No.
Bias Supply 5546335	F1, F2, F3	600 Volt, 5 Amp	Littelfuse KLK-5
Module Controller 5556210	F1	600 Volt, 30 Amp	Littelfuse KLKD30

**Table 5–2. Fuse Values**

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