



# **Sorensen**

## **Internal Analog Programming (APG) Interface for XT/HPD Series Programmable DC Power Supplies Operation Manual**

APG-XT  
APG-HPD



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# Important Safety Instructions

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

	<b>Hazardous voltages may be present when covers are removed. Qualified personnel must use extreme caution when servicing this equipment. Circuit boards, test points, and output voltages also may be floating above (below) chassis ground.</b>
	<b>The equipment used contains ESD sensitive parts. When installing equipment, follow ESD Safety Procedures. Electrostatic discharges might cause damage to the equipment.</b>

Only *qualified personnel* who deal with attendant hazards in power supplies, are allowed to perform installation and servicing.

Ensure that the AC power line ground is connected properly to the Power Rack 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.

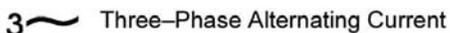
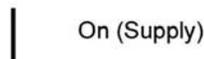
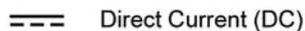
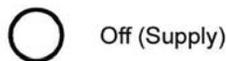
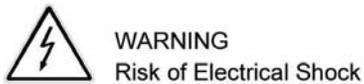
Always ensure that facility AC input power is de-energized prior to connecting or disconnecting any cable.

In 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 normally generated on the output terminals. The customer/user must ensure that the output power lines are labeled properly as to the safety hazards and that any 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.

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## SAFETY SYMBOLS



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**Product Family: Internal Analog Programming (APG) Interface for XT/HPD Series**

**Warranty Period: Five Years**

**WARRANTY TERMS**

AMETEK Programmable Power, Inc. ("AMETEK"), provides this written warranty covering the Product stated above, and if the Buyer discovers and notifies AMETEK in writing of any defect in material or workmanship within the applicable warranty period stated above, then AMETEK may, at its option: repair or replace the Product; or issue a credit note for the defective Product; or provide the Buyer with replacement parts for the Product.

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- is damaged by modifications, alterations or attachments thereto which are not authorized by AMETEK;
- is installed or operated contrary to the instructions of AMETEK;
- is opened, modified or disassembled in any way without AMETEK's consent; or
- is used in combination with items, articles or materials not authorized by AMETEK.

The Buyer may not assert any claim that the Products are not in conformity with any warranty until the Buyer has made all payments to AMETEK provided for in the Purchase Order Agreement.

**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**):
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Telephone: 800-733-5427, ext. 2295 or ext. 2463 (toll free North America)  
858-450-0085, ext. 2295 or ext. 2463 (direct)
  - **Outside the United States**, contact the nearest Authorized Service Center (ASC). A full listing can be found either through your local distributor or our website, [www.programmablepower.com](http://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.

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# About This Manual

This manual is for the internal APG (Analog Programming) interface card for the XT and HPD Series DC output power supplies. This manual provides you with descriptions and specifications, user options, and configuration instructions which enable you to manage the power supply from an external source.

This manual is designed for the user who is familiar with basic electrical theory especially as it applies to the operation of power supplies. This implies a recognition of Constant Voltage and Constant Current operation modes and the control of input and output power, as well as the observance of safe techniques while effecting supply or pin connections and any changes in switch settings.

Refer to your power supply manual for installation, configuration, and operating procedures for your power supply.

## Main Sections

**Section 1 Features and Specifications** Describes the power supply and lists its features and specifications.

**Section 2 Installation and Configuration** Goes through basic setup procedures. Describes inspection, and cleaning procedures. Includes additional options for calibration adjustment.

**Section 3 Operation** Details information on remote programming, indicators and protections.

## About This Manual

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## Contents

# Section 1. Features and Specifications

## Description

The Analog Programming (APG) Interface is an internal option card for analog programming of XT and HPD Series DC power supplies with a 0-10Vdc programming source or a 0-10k $\Omega$  resistance. A 25-pin female DSUB connector on the unit's rear panel enables connections to the card.

## Features

- Programming output voltage and/or current limit using a 0-10Vdc programming source or a 0-10k $\Omega$  resistance. Externally adjustable offset and range.
- Fixed programming of output voltage and/or current limit using an available 10V reference (10mA max source)
- 0-10V readback of output voltage and current with externally adjustable offset and range
- Status signals for programming mode, operating mode, OVP (over voltage protection) flag, and output fail flag
- Adjustable OVP with reset and flag
- TTL shutdown with selectable positive or negative logic
- Tracking for multiple supplies of the same output

## Specifications

Remote Analog Programming	0-10Vdc for 0-100% of rated voltage or current $\pm 0.1\%$ 0-10k $\Omega$ for 0-100% of rated voltage or current $\pm 0.1\%$
OVP Trip Range	3V to full output + 10%
Remote ON/OFF	2 to 25Vdc high. <0.8Vdc low. User-selectable logic
Tracking Accuracy	$\pm 1\%$

**Section 1. Features and Specifications**  
Specifications

# Section 2. Installation and Configuration

## Introduction

We usually install the APG interface in a power supply at the factory. Your local distributor or service center can also install the interface, especially for use in a previously-purchased supply already on site.

## Initial Inspection



### CAUTION

If you remove the unit's cover, use proper static control techniques to avoid damage to static-sensitive components on the printed circuit board.

---

On first receiving your unit, perform a quick physical check.

- Ensure each package contains a power supply with its APG interface board installed, and manuals for the power supply and the APG interface. Any additional parts shipped with the power supply will be identified in the supply's documentation.
- Inspect the unit for any signs of physical damage such as scratches, cracks, or broken switches, connectors, or displays.
- Check the printed circuit board and components if you suspect internal damage.

If the unit is damaged, save all packing materials and notify the carrier immediately. For additional information, please see the section titled, "Returning Power Supplies to the Manufacturer" in the manual shipped with your complete unit.

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### CAUTION

Use proper static control techniques to avoid damage to static-sensitive components on the printed circuit board.

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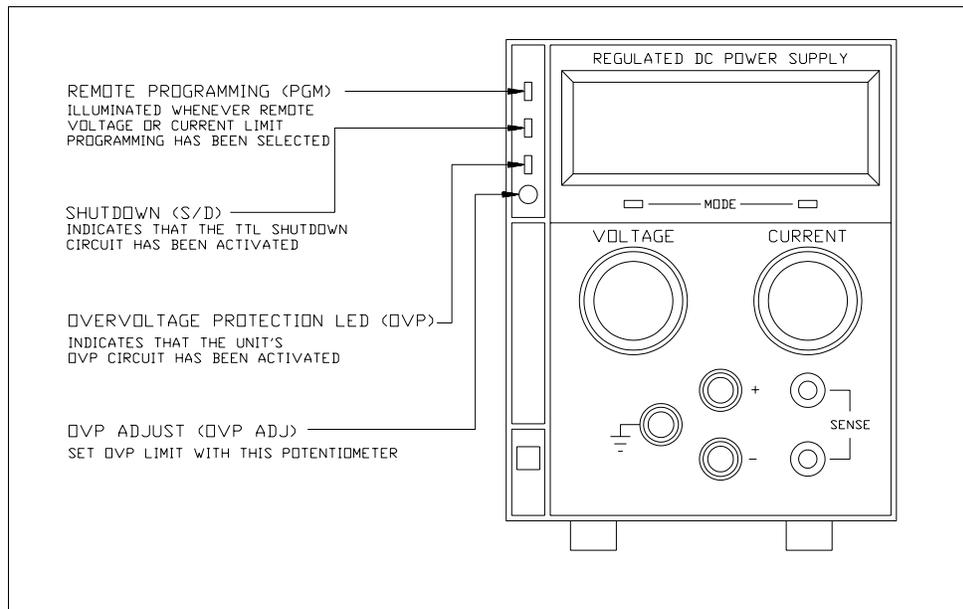
## Section 2. Installation and Configuration

### Configuring

## Configuring

Configure and adjust the analog programming interface installed in your XT or HPD DC power supply as indicated in this section. The front panel LEDs indicate when V or I programming is selected (PGM), when TTL shutdown has occurred (S/D), and when the supply exceeds the voltage trip point OVP). You can adjust the OVP right at the front panel. You will find the main programming option switch and connector on the unit's rear panel, see Figure 2.2.

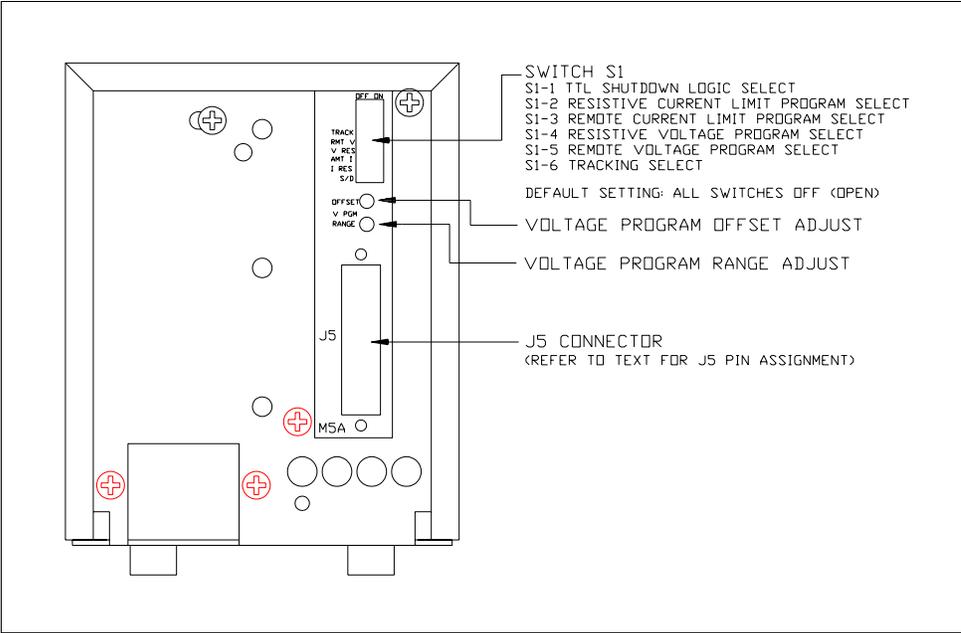
### Front panel



**Figure 2.1** XT/HPD Front Panel with APG Interface Installed  
(typical configuration)

**Section 2. Installation and Configuration**  
Configuring

**Rear Panel**



**Figure 2.2** XT/HPD Rear Panel with APG Interface

**Rear Panel Switch (S1) Defaults**

**Table 2.1** Rear Panel Switch S1 Default Settings

Setting	Function
S1-1	TTL Shutdown Logic Select (OPEN=negative logic, CLOSED=positive logic)
S1-2	Resistive Current Program Select
S1-3	Remote Current Program Select
S1-4	Resistive Voltage Program Select
S1-5	Remote Voltage Program Select
S1-6	Tracking Select

**Default:** Local control (all switches OPEN).

## Section 2. Installation and Configuration

### Rear Panel J5 Connector

#### Rear Panel J5 Connector

Make analog interface connections via the rear panel 25-pin female DSUB connector designated J5. To provide the lowest noise performance, we recommend you use shielded-twisted pair wiring for making connections from external circuits to the J5 connector. Use the shortest leads possible. Ground the shield to pin 6 (auxiliary ground) on the J5 connector or to the chassis via one of the J5 connector screws.

**Note:** In order to maintain isolation of power supply output, any programming source must also be an isolated source.

#### J5 Connector Pin Assignments

**Table 2.2** J5 Connector Pin Assignments

Pin	Function
1	Over Voltage Protection Flag
2	TTL Shutdown Return
3	Not Used
4	Program Return
5	Program Return
6	Auxiliary Ground
7	Remote Voltage Program Select*
8	Remote Current Program Select*
9	Voltage/Current Limit Mode Indicator
10	+ OUT
11	+ OUT
12	RTN
13	RTN
14	Not Used
15	TTL Shutdown
16	Current Limit Program
17	Voltage Program
18	Current Readback
19	Voltage Readback
20	+10 V Reference OUT (10 mA max.)
21	Output Fail Flag*
22	+ SNS
23	+ OUT
24	RTN
25	RTN SNS

\* Negative Logic: LOW = ACTIVE

### Calibration Adjustment

You can access most calibration potentiometers through the top of the unit, see Figure 2.3. The exceptions are Voltage Program OFFSET and RANGE which are on the unit's rear panel which can be seen on Figure 2.2.

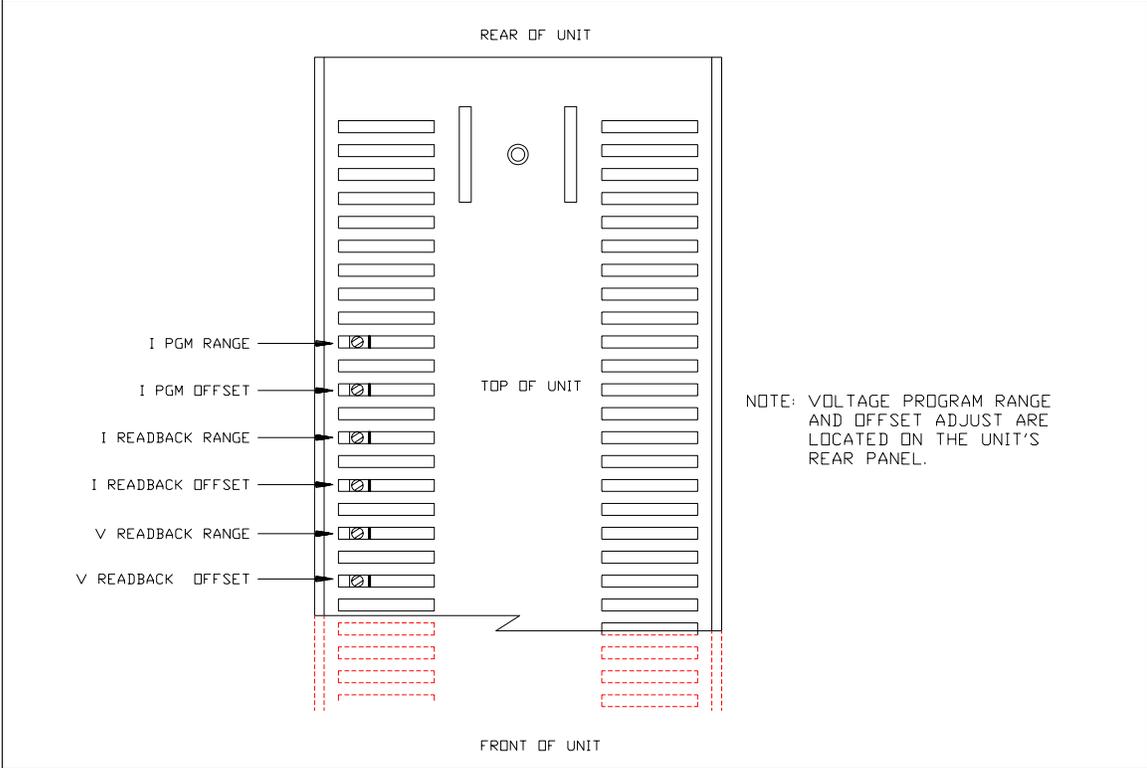


Figure 2.3 APG Interface Calibration Adjustment Locations

## **Section 2. Installation and Configuration**

### Calibration Adjustment

## Section 3. Operation

### Remote Programming

Remote programming allows control of the power supply's output voltage and/or current limit to shift from local operation at the front panel voltage and current controls to external analog input sources. As you vary the programming source, the power supply's output varies proportionally over its output range.

When you select remote voltage programming, the voltage control knob on the front panel will not work. The same situation applies when you select remote current programming: the remote option overrides the current control knob on the front panel.



#### CAUTION

The programming signal return is internally referenced to the return sense (RTN SNS) potential of the power supply. Therefore, you may connect the remote programming source return to the power supply circuit at ONLY ONE of the following nodes:

- APG Interface J5 connector pins 4 or 5 (program return), OR
- power supply output return when remote sense not used, OR
- power supply return sense (RTN SNS) when remote sense is connected.

If you do not observe this restriction, the power supply may operate erratically, or, fuse F1 on the APG Interface PCB assembly may blow.

In order to maintain isolation of power supply output, use a programming source which is also an isolated source.

---

### Programming Output Voltage with a 0-10Vdc Voltage Source

1. Select remote voltage programming by moving the rear panel switch S1-5 (remote voltage program select) to the ON (closed) position.  
Or, connect J5 pin 7 (remote voltage program select) to J5 pin 6 (auxiliary ground). As these two control functions are wired in parallel, they function as a logic OR.
2. Connect the voltage source between pin 17 (voltage program) and either pin 4 or pin 5 (program return).

### Section 3. Operation

#### Remote Programming

3. Vary the external voltage from 0-10Vdc to cause the power supply output to vary from 0-100% of rated output voltage. You may set the power supply's output current limit using another source or the front panel current limit control.

**Note:** Access the zero offset adjustment through the rear panel hole labelled OFFSET. Access the full scale calibration adjustment through the rear panel hole labelled RANGE. See Figure 2.2, pg. 15.

#### Programming Output Voltage with a 0-10k Resistance

1. Select remote voltage programming by moving the rear panel switch S1-5 (remote voltage program select) to the ON (closed) position.  
  
Or, connect J5 pin 7 (remote voltage program select) to J5 pin 6 (auxiliary ground). As these two control functions are wired in parallel, they function as a logic OR.
2. Set rear panel switch S1-4 (resistive voltage program select) to the ON (closed) position.
3. Connect a variable resistor between pin 17 (voltage program) and either pin 4 or pin 5 (program return).
4. Adjust the resistance from 0-10k $\Omega$  to vary the power supply output from 0-100% of rated output voltage. You may set the power supply's output current limit using another source or the front panel current limit control.

#### Programming Output Current with a 0-10 Vdc Voltage Source

1. Select remote current limit programming by moving the rear panel switch S1-3 (remote current program select) to the ON (closed) position.  
  
Or, connect J5 pin 8 (remote current program select) to J5 pin 6 (auxiliary ground). As these two control functions are wired in parallel, they function as a logic OR.
2. Connect the voltage source between J5 pin 16 (current program, positive) and either pin 4 or pin 5 (program return).
3. Vary the external voltage from 0-10Vdc to cause the power supply current limit to vary from 0-100% of rated output. You may set the power supply's output voltage using another source or the front panel voltage control.

Access the zero offset adjustment and full range scale adjustment through top cover slots as shown in Figure 2.3, pg. 17.

**Programming Output Current with a 0-10k Resistance**

1. Select remote current programming by external resistance by moving the rear panel switch S1-3 (remote current program select) to the ON (closed) position.  
Or, connect J5 pin 8 (remote current program select) to J5 pin 6 (auxiliary ground). As these two control functions are wired in parallel, they function as a logic OR.
2. Set rear panel switch S1-2 (resistive current program select) to the ON (closed) position.
3. Connect a variable resistance between J5 pin 16 and either pin 4 or pin 5 (program return).
4. Adjust the resistance from 0-10kΩ to vary the power supply current limit from 0-100% of rated output. You may set the power supply's output voltage using another source or the front panel voltage control.

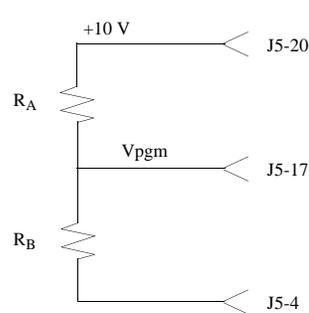
**Programming with a Fixed +10V Reference**

The APG Interface J5 connector provides a +10 V reference output at pin 20 for applications which require a fixed output voltage and/or current limit. The current from this output must be less than 10 mA.

To program output voltage:

1. Connect resistor A between J5 connector pin 20 (+10 V reference out) and pin 17 (voltage program).
2. Connect resistor B between pin 17 (voltage program) and either pin 4 or 5 (program return).

To program current limit, follow the procedure used to set up for programming output voltage, substituting pin 16 (current program) for pin 17.



$$V_o = \frac{V_{OMAX} R_B}{R_A + R_B}$$

Where:

$V_o$  = programmed output of power supply

$V_{OMAX}$  = rated maximum output of power supply

$$R_A + R_B \geq 1k$$

**Figure 3.1** Programming with a Fixed +10V Reference

## Section 3. Operation

### Readback and Status Indicators

## Readback and Status Indicators

### Voltage and Voltage Readback

#### Current Readback

- Connect a meter between J5 connector pin 19 (voltage readback) and either pin 4 or 5 (program return).

**Range:** 0-10V = 0-100% full rated voltage output of power supply

#### Current Readback

- Connect a meter between J5 connector pin 18 (current readback) and either pin 4 or 5 (program return).

**Range:** 0-10V = 0-100% full rated current output of power supply

**Note:** The voltage and current readback signals have adjustable offset and range. These adjustments are accessible from the top of the power supply (see Figure 2.3, pg. 17). The adjustments are independent of other power supply calibrations or adjustments such that APG readback can be zero and range calibrated without affecting other power supply parameters.

### Operating Mode Status

- Connect voltmeter between J5 connector pin 9 (voltage/current limit mode indicator) and pin 6 (auxiliary ground).

**Voltage Mode:** active low open collector

**Current Mode:** high impedance open collector

### Remote Programming Status

Remote programming status is available via J5 connector pins 7 (remote voltage program select) and 8 (remote current program select). Reference to J5 connector at either pin 4 or 5 (program return).

J5-7 LOW = Remote Voltage Program, HIGH=Local Front Panel Control

J5-8 LOW = Remote Current Program, HIGH=Local Front Panel Control

### Output Fail Flag

The Output Fail Flag (J5 connector pin 21) signal is HIGH (open collector) when any one of the following conditions is true:

- AC input to the power supply is below operating limits.
- Over voltage protection is activated.
- TTL shutdown is active.
- Sense line protect circuit is active (excessive load line drop or load line(s) not connected or fuse(s) in power supply blown).

## Overvoltage Protection (OVP)

The OVP circuit is designed to protect the load in the event of a remote programming error, incorrect voltage control adjustment, or power supply failure. The protection circuit monitors the output and reduces the output voltage and current to zero whenever a preset voltage limit is exceeded. A red LED on the front panel indicates when the OVP circuit has been activated. Set the OVP trip level at the front panel.

**OVP Flag** When the OVP has been activated, a signal of nominal +10V through 10k will be present at pin J5-1. When no OVP condition exists, this signal will be 0V.

### Setting the OVP Trip Level

1. Turn the power supply OFF.
2. Insert a small, flat-bladed screwdriver through the OVP ADJ (OVP Adjust) hole in the front panel to turn the adjusting screw fully clockwise (one-turn screw).
3. Turn the unit ON and set the output to the desired trip voltage.
4. Slowly turn the adjusting screw counterclockwise until the red OVP indicator lamp lights.
5. Turn the POWER switch to OFF.
6. Turn the voltage control knob to minimum.
7. Turn the POWER switch back ON and increase the voltage to check that the power supply shuts off the output at the set voltage. Reference to J5 connector pin 6 (auxiliary ground).
8. Reset the OVP circuit after activation by removing the overvoltage condition and powering the unit OFF and back ON, or, by momentarily activating the TTL remote shut down circuit. See “TTL Shutdown” for information about shut down circuit operation.

### Section 3. Operation

#### TTL Shutdown

### TTL Shutdown

TTL Shutdown allows the output of the power supply to be disabled by a logic level signal. This input is optically isolated from the power supply output and will withstand a highpot test potential of 600Vac minimum. When TTL shutdown is activated, the front panel LED comes on.

- Connect the signal source between J5 connector pins 15 (TTL shutdown/positive) and 2 (TTL shutdown return/negative).
- Set rear panel switch S1-1 (TTL shutdown) to ON (closed) to obtain positive logic (high signal enables output). The factory-set default is switch OPEN for negative logic (high signal disables power supply output).

Switch SW1-1 Setting	TTL Signal Level	Output Condition
OPEN (Negative logic)	HIGH	OFF
	LOW	ON
CLOSED (Positive logic)	HIGH	ON
	LOW	OFF

**Notes:** Minimum activation signal required: 2V at 500 $\mu$ A

Maximum activation signal allowed : 25Vdc

## Tracking

For tracking +/- outputs, use the following set-up:

- Set slave unit rear panel switch S1-5 (remote voltage program select) and switch S1-6 (tracking select) to ON (closed).
- Connect master return (J5 connector pins 12, 13, or 24) to slave +OUT (J5 connector pins 10, 11, or 23).
- Connect master +OUT (J5 connector pins 10, 11, or 23) to slave voltage program input (J5 connector pin 17).

Notes:

1. Master/slave power supplies must have the same output ratings.
2. Set switch S2 on the slave unit's APG Interface PCB to the correct model number (factory preset). This requires that you remove the power supply cover.
3. Slave tracking can be calibrated by adjusting the unit's offset and range potentiometers. See "Calibration Adjustment" on page 17.
4. As the slave is referenced to the master's output, the noise and ripple on the slave may increase. In addition, if the master's output decreases due to current limit acting, the output voltage of the slave will follow.

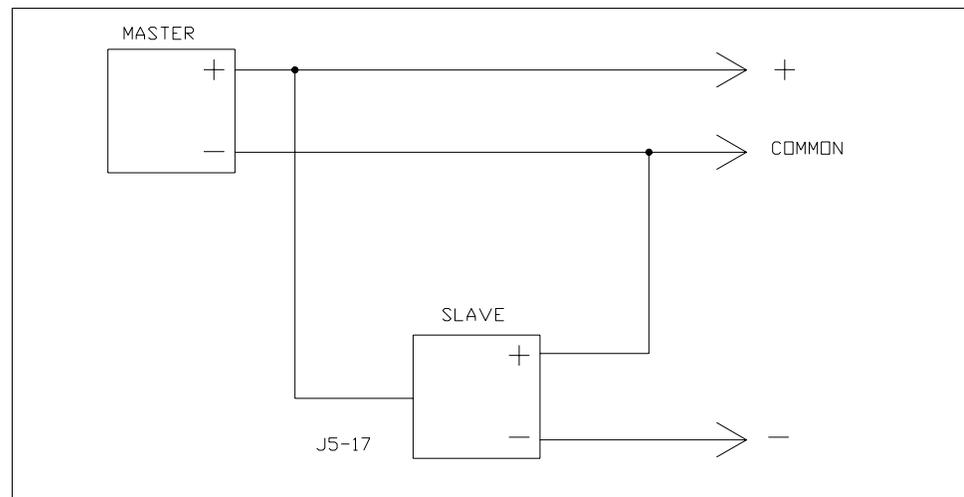


Figure 3.2 Master/Slave Tracking Configuration

### **Section 3. Operation**

Tracking

# Section 4. Calibration

## Introduction



### **WARNING**

Exercise caution when using and servicing power supplies. High energy levels can be stored at the output voltage terminals on all power supplies in normal operation. In addition, potentially lethal voltages exist in the power circuit and the output connector of power supplies which are rated at 40V and over. Filter capacitors store potentially dangerous energy for some time after power is removed.

---

You can calibrate the GPIB interface by adjusting the signal levels on the interface card so that they correspond to the expected signal levels on the power supply's main assembly. You may need to recalibrate the interface if you replace parts either on the interface board or on the main power supply board, or if the unit falls out of specification due to component aging drifts.

You can calibrate the GPIB Interface for:

- Voltage program
- Voltage readback
- Current program
- Current readback
- Overvoltage protection

The calibration procedures in this section are designed to be performed at an ambient temperature of  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

## Section 4. Calibration

### Calibration Setup

#### Calibration Setup

1. Disconnect the supply's AC power.
2. Disconnect the load from the power supply you want to calibrate.
3. Remove the cover to access the GPIB Interface PCB calibration potentiometers.
4. Ensure the power supply is connected for local sensing (factory default).
5. Connect a digital voltmeter (DVM) for voltage or OVP calibration, or, a current shunt rated for the full output current of the supply and a DVM for current calibration. See [Figure 4.1, Voltage Calibration Setup](#) or [Figure 4.2, Current Calibration Setup](#).
6. Ensure the correct IEEE primary address has been set (rear panel switches SW1-8 to SW 1-4). See [“IEEE-488 Primary Address Selection” on page 24](#) for information on address selection.
7. Set the power supply to REMOTE mode (rear panel switch SW1-1 ON).
8. Connect the IEEE controller to the power supply at connector J8.
9. Reconnect the AC power. Turn unit ON and allow the unit to warm up for 30 minutes.

## Voltage Mode Calibration

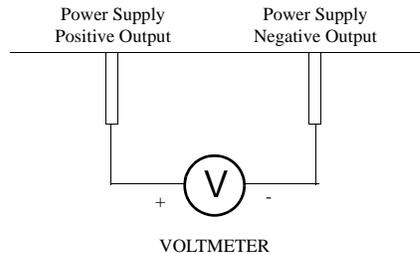


Figure 4.1 Voltage Calibration Setup

### Voltage Program

1. Connect the unit to the digital voltmeter as shown in [Figure 4.1](#). See also [“Calibration Setup” on page 48](#), step 4.
2. Program the output to 5% of full scale voltage by sending the following command string from the computer:  
VSET2;ISET25 (for 1kW Model 40-25)
3. Adjust voltage programming offset potentiometer R28 (VOFF) until the external meter reading is within the power supply's voltage program accuracy specification. Refer to specification tables in [Section 1](#).

**Example:**  $\pm 75\text{mV} \pm(0.3\% (5\% \text{ of } 40\text{V}))$  (for 1kW Model 40-25)

4. Program the output to full scale voltage by sending:  
VSET40;ISET25 (for 1kW Model 40-25)
5. Adjust voltage programming full scale potentiometer R51 (VADJ) until the external meter reading is within the power supply's voltage program accuracy specification. Refer to specification tables in [Section 1](#).

**Example:**  $\pm 75\text{mV} \pm(0.3\% \text{ of } 40\text{V})$  (for 1kW Model 40-25)

6. Repeat steps 2 to 5 (between VOFF and VADJ) for best linearity.

## Section 4. Calibration

### Voltage Mode Calibration

#### Voltage Readback

1. Connect the unit to the digital voltmeter (DVM) as shown in [Figure 4.1](#). (Optional step)
2. Program the output to 5% of full scale by sending the following command string from the computer:

VSET2;ISET25 (for 1kW Model 40-25)

3. Perform a readback operation of the output voltage from the computer:

VOUT?

4. Adjust the voltage readback offset potentiometer R50 (VZERO) until the readback value is within specification. Refer to the voltage readback accuracy specification in [Section 1](#).

**Example:**  $\pm 75\text{mV} \pm (0.3\% (5\% \text{ of } 40\text{V}))$  (for 1kW Model 40-25)

5. Program the output to full scale voltage by sending:

VSET40;ISET25 (for 1kW Model 40-25)

6. Adjust the voltage readback full scale potentiometer R49 (VGAIN) until the readback voltage value is within specification. Refer to the voltage readback accuracy specification in [Section 1](#).

**Example:**  $\pm 75\text{mV} \pm (0.3\% \text{ of } 40\text{V})$  (for 1kW Model 40-25)

7. Repeat steps 2 (VZERO) to 5 (VGAIN) for best linearity.

## Current Mode Calibration

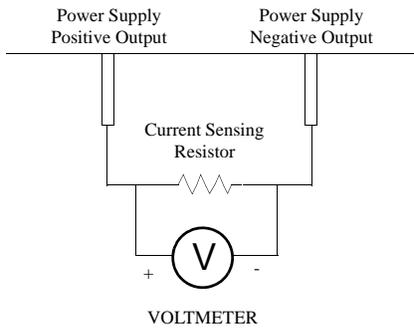


Figure 4.2 Current Calibration Setup

### Current Program

1. Ensure the current shunt has been connected to the power supply as shown in Figure 4.2. See also “Calibration Setup” on page 48, step 4.
2. Program the output to 5% of full scale current by sending the following command string from the computer:  
VSET40;ISET1.25 (for 1kW Model 40-25)
3. Adjust current programming offset potentiometer R27 (IOFF) until the meter reading is within the power supply's current program accuracy specification. Refer to specification tables in Section 1.

**Example:**  $\pm 140\text{mA} \pm (0.15\% (5\% \text{ of } 25\text{A}))$  (for 1kW Model 40-25)

4. Program the output to full scale current by sending:  
VSET40;ISET25 (for 1kW Model 40-25)
5. Adjust current programming full scale potentiometer R47 (IADJ) until the meter reading is within the power supply's current specification. Refer to specification tables in Section 1.

**Example:**  $\pm 140\text{mA} \pm (0.15\% \text{ of } 25\text{A})$  (for 1kW Model 40-25)

6. Repeat steps 2 to 5 (between IOFF and IADJ) for best linearity.

## Section 4. Calibration

### Current Mode Calibration

- Current Readback**
1. Ensure the current shunt has been connected to the power supply as shown in [Figure 4.2](#). See also “[Current Calibration Setup](#)” on [page 51](#), step 4. Connecting a DVM is optional.
  2. Program the output to 5% of full scale current by sending the following command string from the computer:  
VSET40;ISET1.25 (for 1kW Model 40-25)
  3. Perform a readback operation of the output current from the computer:  
IOUT?
  4. Adjust the current readback offset potentiometer R38 (IZERO) until the readback value is within the current readback accuracy specification. Refer to specification tables in [Section 1](#).  
**Example:**  $\pm 140\text{mA} \pm (0.15\% (5\% \text{ of } 25\text{A}))$  (for 1kW Model 40-25)
  5. Program the output to full scale current by sending:  
VSET40;ISET25 (for 1kW Model 40-25)
  6. Perform a readback operation of the output current from the computer:  
IOUT?
  7. Adjust the current readback full scale potentiometer R45 (IGAIN) until the readback current value is within specification. Refer to specification tables in [Section 1](#).  
**Example:**  $\pm 140\text{mA} \pm (0.15\% \text{ of } 25\text{A})$  (for 1kW Model 40-25)
  8. Repeat steps 2 (IZERO) to 7 (IGAIN) for best linearity.

## Over Voltage Protection (OVP) Calibration

1. Connect the unit as for voltage mode calibration. See [Figure 4.1](#). See “[Calibration Setup](#)” on page 48, step 4. (Optional step.)
2. Program the OVP setting to 50% of the full scale voltage by sending the following command string from the computer:  
OVSET20 (for 1kW Model 40-25)
3. Program the output voltage to about 40% of the OVP set value by sending:  
VSET16;ISET25 (for 1kW Model 40-25)
4. Increment the programmed output voltage from the computer until the OVP fires. The red OVP LED on the front panel will light up.
5. Clear the supply settings by sending:  
CLR
6. and reset the OVP condition with:  
RST
7. The OVP trip point is in specification if the meter value shown when OVP fires is within the total of the set trip point  $\pm$  the OVP program accuracy specification for the power supply model. See [Section 1](#).

**Example:** 20V  $\pm$  400mV (for 1kW Model 40-25)

8. If the OVP trip point was out of specification, adjust potentiometers R19 (OVSPREF, coarse adjustment) and R23 (OVPOFF, fine adjustment). Repeat steps 2 to 5 until the unit operates within specified values again.
9. Check for linearity by testing the OVP trip point at 10% and 90% of full scale voltage.

## **Section 4. Calibration**

### Over Voltage Protection (OVP) Calibration