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**APG-XT
APG-HPD**

Operating Manual

**Internal APG (Analog
Programming) Interface
for XT/HPD Series
Programmable DC
Power Supply**

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Operating Manual for

**Internal APG (Analog
Programming) Interface
for XT 60 Watt and
HPD 300 Watt Series
Programmable DC
Power Supply**

Limited Warranty

What does this warranty cover and how long does it last?

This Limited Warranty is provided by Xantrex Technology, Inc. (“Xantrex”) and covers defects in workmanship and materials in your **Internal APG Interface card**. This warranty lasts for a Warranty Period of **5 years** from the date of purchase at point of sale to you, the original end user customer.

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Phone:	604 422 8595
Toll Free North America:	1 800 667 8422
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- The dated dealer invoice or purchase receipt showing original equipment manufacturer (OEM) status, or
- The dated invoice or purchase receipt showing the product exchanged under warranty

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- c. the product if repairs have been done to it other than by Xantrex or its authorized service centers (hereafter "ASCs");
- d. the product if it is used as a component part of a product expressly warranted by another manufacturer;
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WARNING: Please refer to your product user manual for limitations on uses of the product.
Limitations on Use Specifically, please note that this power supply is not intended for use in connection with life support systems and Xantrex makes no warranty or representation in connection with any use of the product for such purposes.

Xantrex Technology, Inc.
8999 Nelson Way
Burnaby, British Columbia
Canada V5A 4B5

Information About Your Power Supply Please record the following information when you first open your Power Supply package:

Model Number	_____
Serial Number	_____
Purchased From	_____
Purchase Date	_____

Release Release 1.0 (2002-07)

Warnings and Cautions

Warnings and cautions are defined and formatted in this manual as shown below.



WARNING

Describes a potential hazard which could result in injury or death, or, a procedure which, if not performed correctly, could result in injury or death.



CAUTION

Describes a procedure which, if not performed correctly, could result in damage to data, equipment, or systems.

Power Supply Safety



WARNING—High Energy and High Voltage

Exercise caution when using and calibrating a power supply. High energy levels can be stored at the output voltage terminals on a power supply in normal operation. In addition, potentially lethal voltages exist in the power circuit and on the output and sense connectors of a power supply with a rated output greater than 40 V. Filter capacitors store potentially dangerous energy for some time after power is removed.



CAUTION

Operate the power supply in an environment free of flammable gases or fumes. To ensure that the power supply's safety features are not compromised, use the power supply as specified in this manual and do not substitute parts or make any unauthorized modifications. Contact the service technician for service and repair help. Repairs must be made by experienced service technicians only.

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.

Manual Revisions

The current release of this manual is listed below. Updates may be issued as an addendum.

Release 1.0 (2002-07)

About This Manual

Contents

	About This Manual	vii
Section 1.	Description	11
Features and Specifications	Features	11
	Specifications	11
Section 2.	Introduction	13
Installation and Configuration	Initial Inspection	13
	Configuring	14
	Front panel	14
	Rear Panel	15
	Rear Panel Switch (S1) Defaults	15
	Rear Panel J5 Connector	16
	J5 Connector Pin Assignments	16
	Calibration Adjustment	17
Section 3.	Remote Programming	19
Operation	Programming Output Voltage with a 0-10Vdc Voltage Source	19
	Programming Output Voltage with a 0-10k Resistance	20
	Programming Output Current with a 0-10 Vdc Voltage Source	20
	Programming Output Current with a 0-10k Resistance	21
	Programming with a Fixed +10V Reference	21
	Readback and Status Indicators	22
	Voltage and Current Readback	22
	Operating Mode Status	22
	Remote Programming Status	22
	Output Fail Flag	22
	Overvoltage Protection (OVP)	23
	OVP Flag	23
	Setting the OVP Trip Level	23
	TTL Shutdown	24
	Tracking	25

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 Ω 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 Ω 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 Ω 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.



CAUTION

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

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

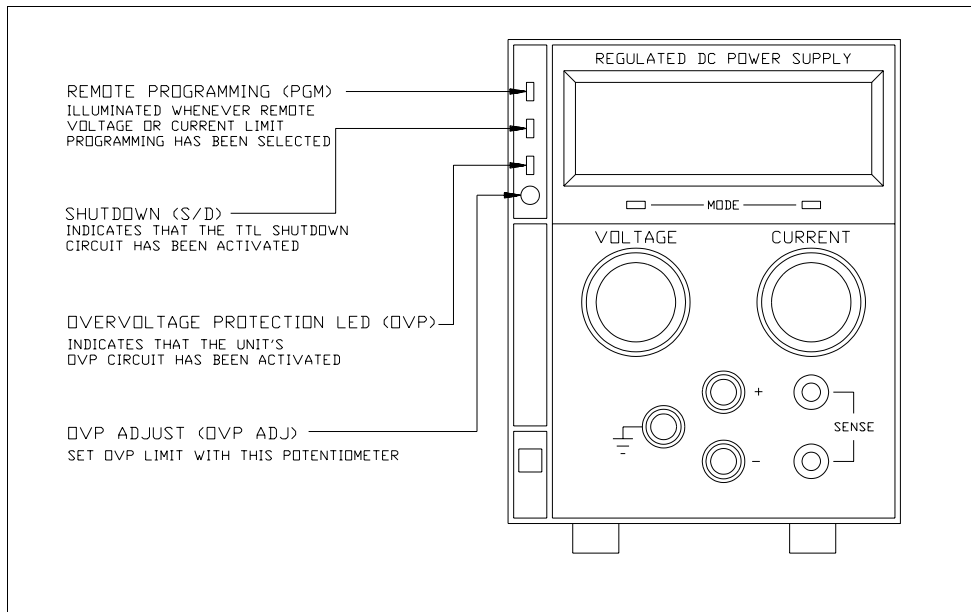


Figure 2.1 XT/HPD Front Panel with APG Interface Installed
(typical configuration)

Rear Panel

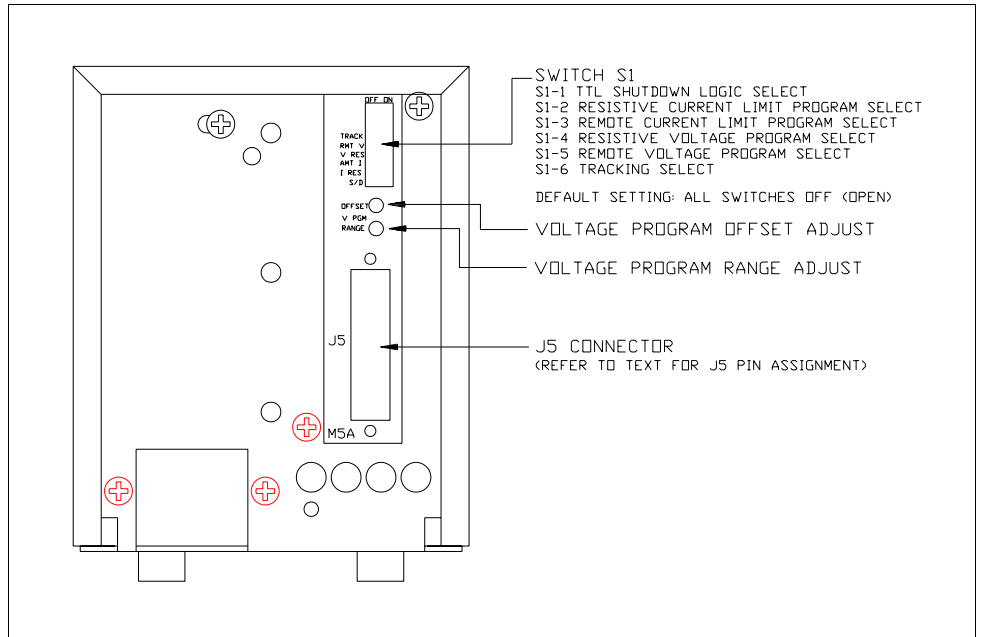


Figure 2.2 XT/HPD Rear Panel with APG Interface

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.

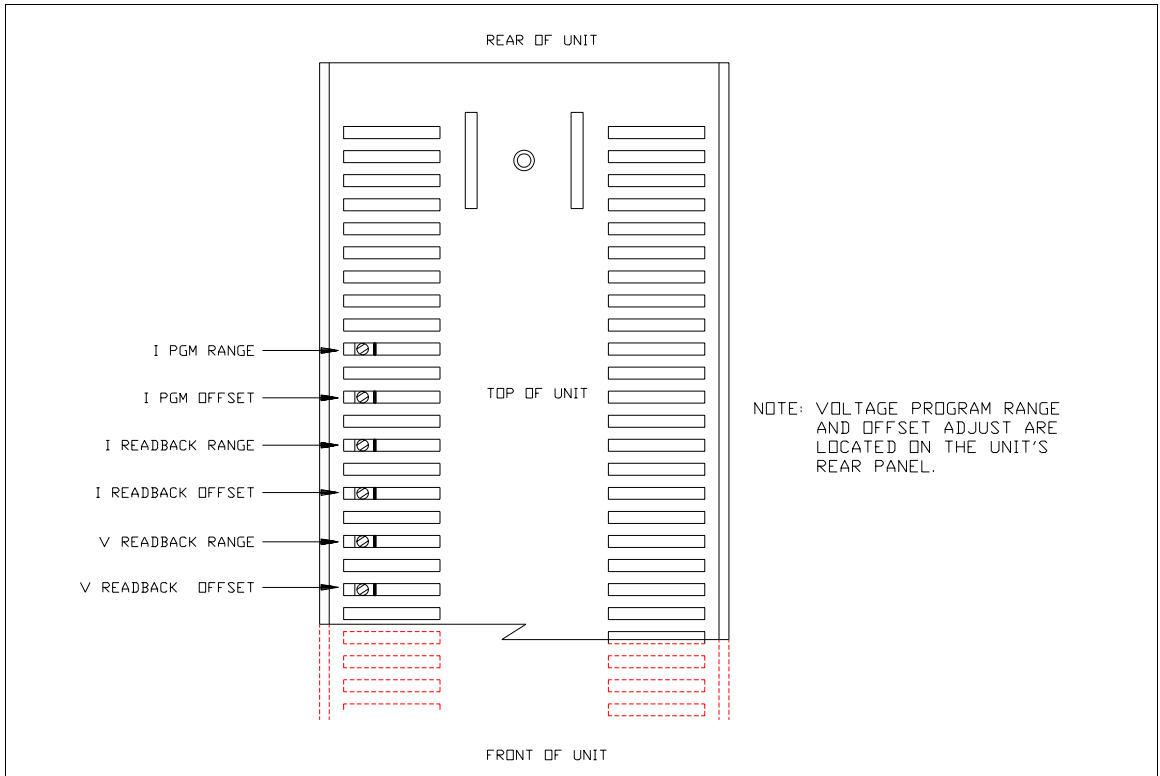


Figure 2.3 APG Interface Calibration Adjustment Locations

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 Ω 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.

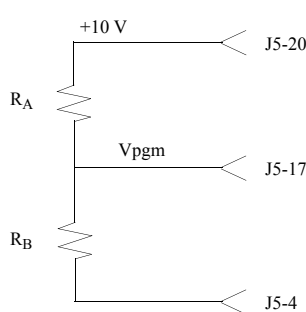
Programming with a Fixed +10V Reference

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 μ A

Maximum activation signal allowed : 25Vdc

Section 3. Operation

Tracking

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