



Sorensen

XHR 1000 Watt Series Programmable DC Power Supply

Operation Manual

XHR 7.5-130
XHR 20-50
XHR 33-33
XHR 40-25
XHR 60-18
XHR 100-10
XHR 150-7
XHR 300-3.5
XHR 600-1.7

About AMETEK

AMETEK Programmable Power, Inc., a Division of AMETEK, Inc., is a global leader in the design and manufacture of precision, programmable power supplies for R&D, test and measurement, process control, power bus simulation and power conditioning applications across diverse industrial segments. From bench top supplies to rack-mounted industrial power subsystems, AMETEK Programmable Power is the proud manufacturer of Elgar, Sorensen, California Instruments and Power Ten brand power supplies.

AMETEK, Inc. is a leading global manufacturer of electronic instruments and electromechanical devices with annualized sales of \$2.5 billion. The Company has over 11,000 colleagues working at more than 80 manufacturing facilities and more than 80 sales and service centers in the United States and around the world.

Trademarks

AMETEK is a registered trademark of AMETEK, Inc. Sorensen is a trademark owned by AMETEK, Inc. Other trademarks, registered trademarks, and product names are the property of their respective owners and are used herein for identification purposes only.

Notice of Copyright

XHR 1000 Watt Series Programmable DC Power Supply Operation Manual © 2007 AMETEK Programmable Power, Inc. All rights reserved.

Exclusion for Documentation

UNLESS SPECIFICALLY AGREED TO IN WRITING, AMETEK PROGRAMMABLE POWER, INC. ("AMETEK"):

- (a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.
- (b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSSES, DAMAGES, COSTS OR EXPENSES, WHETHER SPECIAL, DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION. THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK, AND
- (c) REMINDS YOU THAT IF THIS MANUAL IS IN ANY LANGUAGE OTHER THAN ENGLISH, ALTHOUGH STEPS HAVE BEEN TAKEN TO MAINTAIN THE ACCURACY OF THE TRANSLATION, THE ACCURACY CANNOT BE GUARANTEED. APPROVED AMETEK CONTENT IS CONTAINED WITH THE ENGLISH LANGUAGE VERSION, WHICH IS POSTED AT WWW.PROGRAMMABLEPOWER.COM.

Date and Revision

February 2009 Revision C

Part Number

TM-XROP-01XN



Contact Information

Telephone: 800 733 5427 (toll free in North America)
858 450 0085 (direct)
Fax: 858 458 0267
Email: sales@programmablepower.com
service@programmablepower.com
Web: www.programmablepower.com

This page intentionally left blank.

Important Safety Instructions

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

	<p>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.</p>
	<p>The equipment used contains ESD sensitive parts. When installing equipment, follow ESD Safety Procedures. Electrostatic discharges might cause damage to the equipment.</p>

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.

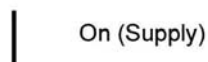
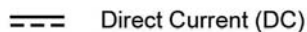
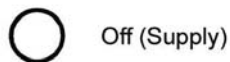
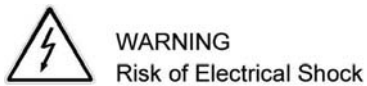
Always ensure that facility AC input power is de-energized prior to connecting or disconnecting any cable.

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.

Neither AMETEK Programmable Power Inc., San Diego, California, USA, nor any of the subsidiary sales organizations can accept any responsibility for personnel, material or inconsequential injury, loss or damage that results from improper use of the equipment and accessories.

SAFETY SYMBOLS



This page intentionally left blank.

Product Family: XHR 1000 Watt Series Programmable DC Power Supply

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.

The Buyer will, at its expense, return the defective Product or parts thereof to AMETEK in accordance with the return procedure specified below. AMETEK will, at its expense, deliver the repaired or replaced Product or parts to the Buyer. Any warranty of AMETEK will not apply if the Buyer is in default under the Purchase Order Agreement or where the Product or any part thereof:

- is damaged by misuse, accident, negligence or failure to maintain the same as specified or required by AMETEK;
- 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**):
 - **In the USA**, contact the AMETEK Repair Department prior to the return of the product to AMETEK for repair:
Telephone: 800-733-5427, ext. 2295 or ext. 2463 (toll free North America)
858-450-0085, ext. 2295 or ext. 2463 (direct)
 - **Outside the 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, 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.

This page intentionally left blank.

Contents

	About This Manual	vii
	List of Figuresxi
	List of Tables	xiii
Section 1. Features and Specifications	Description	15
	Features and Options	15
	Front Panel Controls	16
	Rear Panel Connectors and Switch	18
	Rear Panel Illustrations	18
	SW1 Programming Switch	19
	J2 Programming Connector	20
	Specifications	23
	Electrical Specifications	23
	Additional Electrical Specifications	26
	Input Conditions	26
	Electrical Characteristics	27
	Remote Programming and Monitoring	27
	Environmental Specifications	28
	Approvals	28
	Mechanical Specifications	29
	Dimensions	30
Section 2. Installation	Basic Setup Procedure	31
	Inspection, Cleaning, and Packing	32
	Initial Inspection	32
	Periodic Cleaning	32
	Returning Power Supplies to the Manufacturer	33
	Return Material Authorization Policy	33
	Packaging for Shipping or Storage	34
	Location, Mounting, and Ventilation	35
	Rack Mounting	35
	Ventilation	35
	AC Input Power	36
	Functional Tests	37
	Equipment Required	37
	Power-on Check	37
	Voltage Mode Operation Check	37
	Current Mode Operation Check	38
	Front Panel Function Check	38
Load Connection	39	
Load Wiring	39	
Making Load Connections	41	
Inductive Loads	42	
Connecting Single Loads	45	
Connecting Multiple Loads	45	

	Local and Remote Sensing	48
	Sense Wiring	48
	Local Sensing	48
	Using Remote Sensing	48
Section 3.	Standard Operation	51
Local	Operating Modes and Automatic Crossover	51
Operation	Shipped Configuration (Local Control Mode)	53
	Setting Output Voltage and Current Limit	53
	Using Multiple Supplies	54
	Configuring Multiple Supplies for Series Operation	55
	Configuring Multiple Supplies for Parallel Operation	56
	Configuring Multiple Supplies for Split Supply Operation	57
	Using Over Voltage Protection (OVP)	59
	Front Panel OVP Operation	59
	Resetting the OVP Circuit	60
	Using the Shutdown Function	61
	STANDBY Switch	61
	Controlling the Shutdown Function via the J2 Connector	61
	Over Temperature Protection (OTP)	63
	User Diagnostics	64
	Emergency Shutdown	64
	Unusual or Erratic Operation	64
	Troubleshooting for Operators	64
Section 4.	Remote Analog Programming of Output Voltage and Current Limit	67
Remote	Remote Programming Options	67
Operation	Remote Analog Programming Procedure	68
	Sample Configuration	70
	Remote Monitoring of Output Voltage and Current	71
	Readback Signals	71
	Using the Isolated Programming (ISOL) Interface Option	72
	ISOL Specifications	72
	ISOL Setup and Operating Instructions	73
	ISOL Calibration	73
Section 5.	Calibration Setup	75
Calibration	Service Environment and Precautions	75
	Equipment Required	75
	Front Panel Calibration	76
	Additional Setup	76
	Voltmeter Calibration	76
	Ammeter Calibration	77
	Over Voltage Protection (OVP) Calibration	77
	Calibrating for Programming Accuracy	78
	Voltage Programming Circuit Calibration	79
	Current Programming Circuit Calibration	79
	Calibrating for Readback Accuracy	80
	Output Voltage Monitor Circuit Calibration	81
	Output Current Monitor Circuit Calibration	82

List of Figures

Figure 1.1	Power Supply Front Panel	17
Figure 1.2	Rear Panel with Bus Bar.	18
Figure 1.3	Rear Panel with High Voltage Output Connector	19
Figure 1.4	SW1 Programming Switch	19
Figure 1.5	J2 Programming Connector	21
Figure 1.6	Dimensional Drawings	30
Figure 2.1	Shipping or Storage Carton Label	34
Figure 2.2	Maximum Load Wire Length for 1 V Line Drop.	40
Figure 2.3	Bus Bar Shield	42
Figure 2.4	Typical Load Connection Hardware	43
Figure 2.5	Output Connector	44
Figure 2.6	Single Load with Local Sensing (Default)	45
Figure 2.7	Single Load with Remote Sensing	45
Figure 2.8	Multiple Loads with Local Sensing	46
Figure 2.9	Multiple Loads with Remote Sensing	47
Figure 2.10	Connecting Remote Sense Lines	50
Figure 3.1	Operating Modes	52
Figure 3.2	Series Operation of Multiple Supplies.	55
Figure 3.3	Parallel Operation of Multiple Supplies.	56
Figure 3.4	Split Supply Operation of Multiple Supplies	57
Figure 3.5	Split Supply Operation of Multiple Supplies	58
Figure 3.6	Shutdown Programming with Active Low Signal	62
Figure 3.7	Shutdown Programming with Active High Signal	62
Figure 4.1	Connecting Programming Sources to J2 Connector	70
Figure 4.2	Sample Analog Programming Configuration	70
Figure 4.3	0-5 Vdc Output Voltage and Current Monitoring.	71
Figure 4.4	0-10 Vdc Output Voltage and Current Monitoring.	72
Figure 5.1	Front Panel Calibration Locations.	76
Figure 5.2	Voltage and Current Programming Calibration Locations	78
Figure 5.3	Voltage Current and Monitor Calibration Locations	80

List of Figures

List of Tables

Table 1.1	SW1 Switch Functions	20
Table 1.2	Electrical Specifications for 7.5 V to 40 V Models	24
Table 1.3	Electrical Specifications for 60 V to 600 V Models	25
Table 2.1	Basic Setup Procedure	31
Table 2.2	Power Cords	36
Table 2.3	Current Carrying Capacity for Wiring	39
Table 3.1	Shipped Configuration (Local Control Mode)	53
Table 3.2	Switch Settings for Shutdown Circuit Logic	61
Table 3.3	Switch Settings for Over Temperature Recovery Options	63
Table 3.4	Quick Diagnostics	65
Table 4.1	Power Supply Settings for Different Programming Sources	69
Table 4.2	Power Supply Settings for Remote Monitoring of Readback Signals	71

List of Tables

Section 1. Features and Specifications

Description

The 1000 watt DC output power supplies provide low noise, precisely regulated, variable DC output. Typically they are used for bench and automated test equipment (ATE) applications. Each unit includes over voltage protection and thermal shutdown as standard features. Universal AC input allows you to use line voltages globally without resetting switches or adding options. Built-in power factor correction gives you full output power from low current/low voltage outlets, reduces power line interference, and allows you to meet international regulations.

You can select from several remote control choices for either analog or digital control. For analog control, choose from standard analog control or optional 4-channel isolated programming. Digital control options include RS-232 control or GPIB programming. You can use the power supply on your benchtop or rack mounted; each supply occupies less than 3-1/2 in. (2 U) of vertical space. Whether you are powering batteries, development circuits, and magnet coils or running ATE systems, the power supply provides the precision and power that you need.

Features and Options

- Models available with voltage ranges from 0-7.5 Vdc to 0-600 Vdc; current ranges from 0-1.7 A to 0-130 A.
- Internal power factor correction allows operation from a standard 120 Vac, 15 A outlet.
- Thermal shutdown, latching or auto reset.
- Front panel control of Over Voltage Protection (OVP).
- Simultaneous digital display of both voltage and current.
- Ten-turn front panel voltage and current controls for high resolution setting of the output voltage and current from zero to the rated output.
- Automatic mode crossover into current or voltage mode.
- Front panel push button control of output standby mode, and preview of voltage, current, or OVP set points. Front panel LED indicators for voltage and current mode operation, OVP, remote programming mode, and shutdown.
- Multiple units can be connected in parallel or in series to provide increased current or voltage.

Features and Specifications

Front Panel Controls

- Remote analog voltage and current limit programming with selectable programming ranges.
- External monitor signals for output voltage and current.
- Isolated analog remote programming control of the output voltage or current and isolated readback of output voltage and current with the optional ISOL interface.
- Optional internal GPIB or RS-232 computer control for complete remote programming and readback capability.

Front Panel Controls

See Figure 1.1 to review the controls, LEDs, and meters located on the power supply's front panel. Check the following sections for additional descriptions of front panel controls and functions.

- [“Mechanical Specifications” on page 29](#)
- “Functional Tests” on page 37
- “Local Operation” on page 51

Features and Specifications
Front Panel Controls

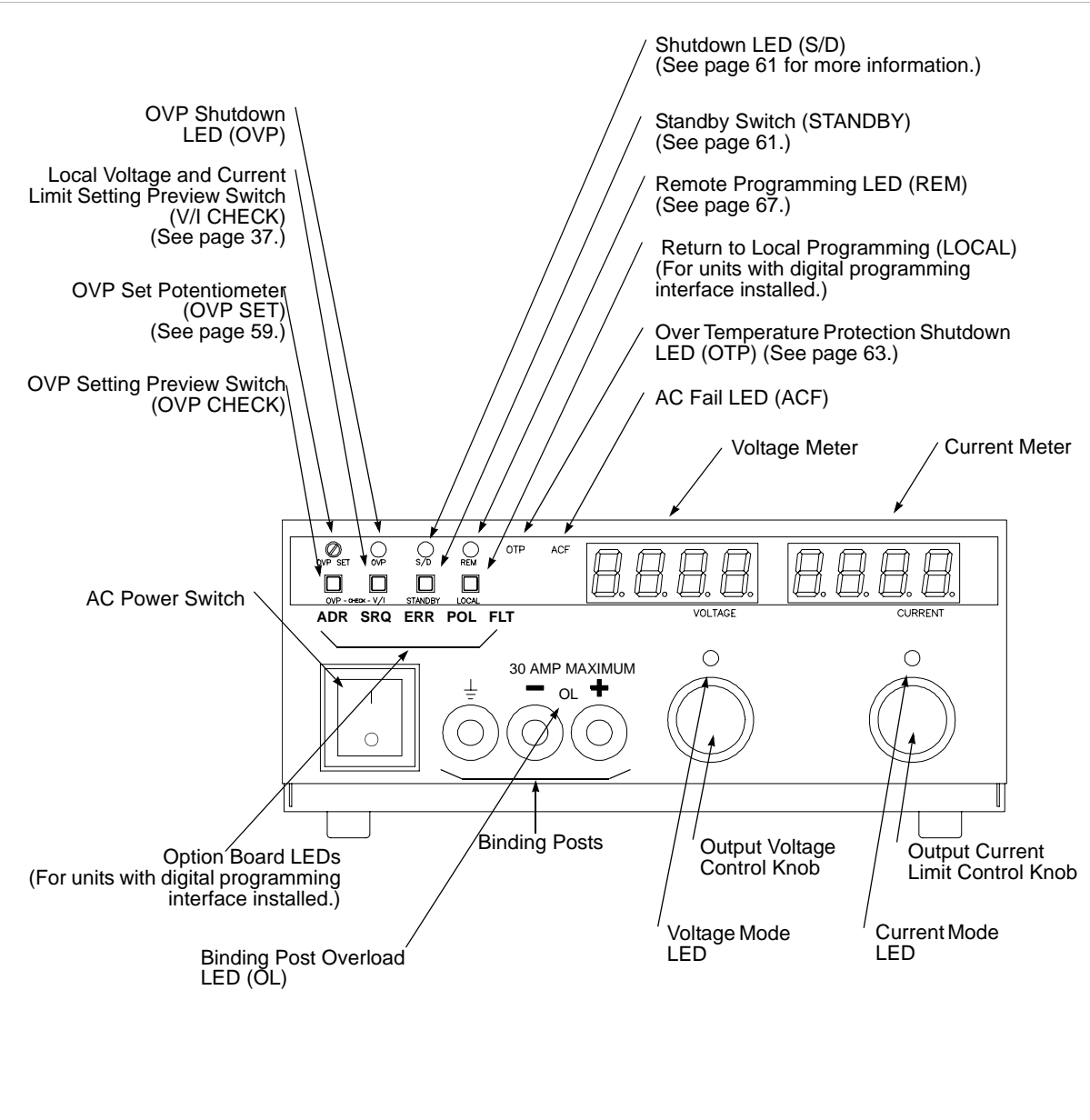


Figure 1.1 Power Supply Front Panel
(For all models.)

Features and Specifications

Rear Panel Connectors and Switch

Rear Panel Connectors and Switch

The output terminals for the low voltage models (7.5 V to 40 V) are bus bars. The high voltage models (60 V to 600 V) use a wire clamp connector. See Figure 1.2 and Figure 1.3 to identify the switches and connectors on the rear panel.

Use the SW1 Programming, Monitoring, and Shutdown Select switch and the J2 Programming, Monitoring, and Sense connector to choose among several remote programming and monitoring options. See the following sections for more information about remote programming:

- “SW1 Programming Switch” on page 19
- “J2 Programming Connector” on page 20
- Section 4. Remote Operation

Rear Panel Illustrations

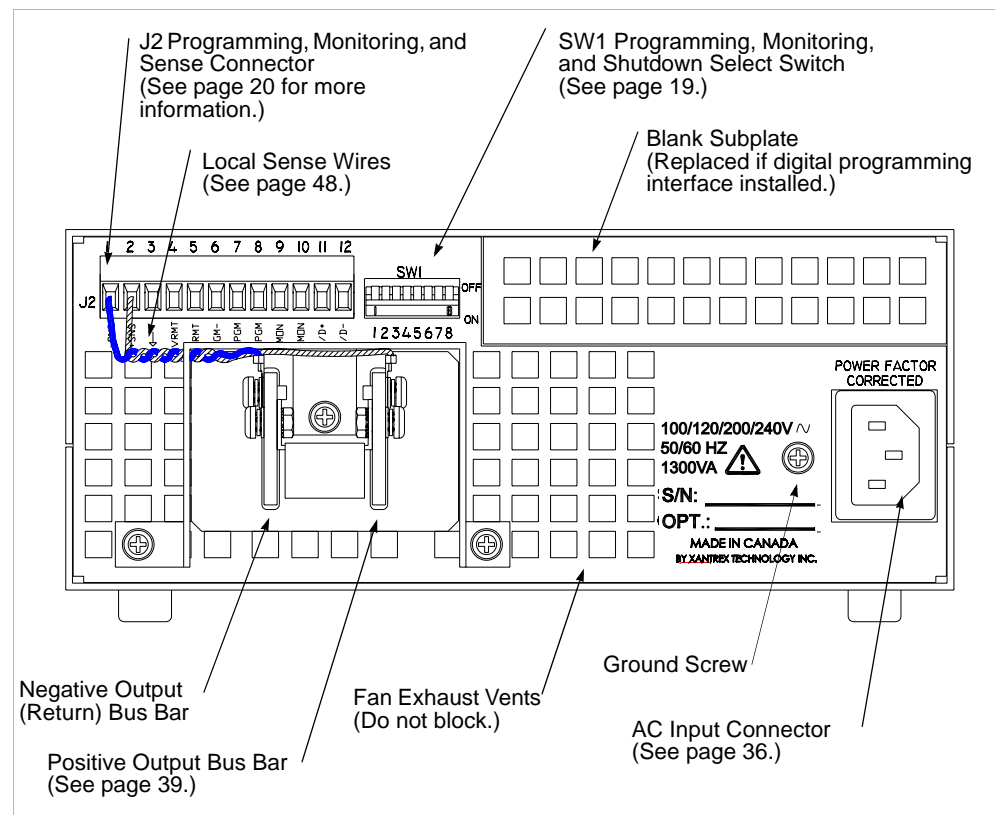


Figure 1.2 Rear Panel with Bus Bar
(For 7.5 V to 40 V models.)

Features and Specifications

Rear Panel Connectors and Switch

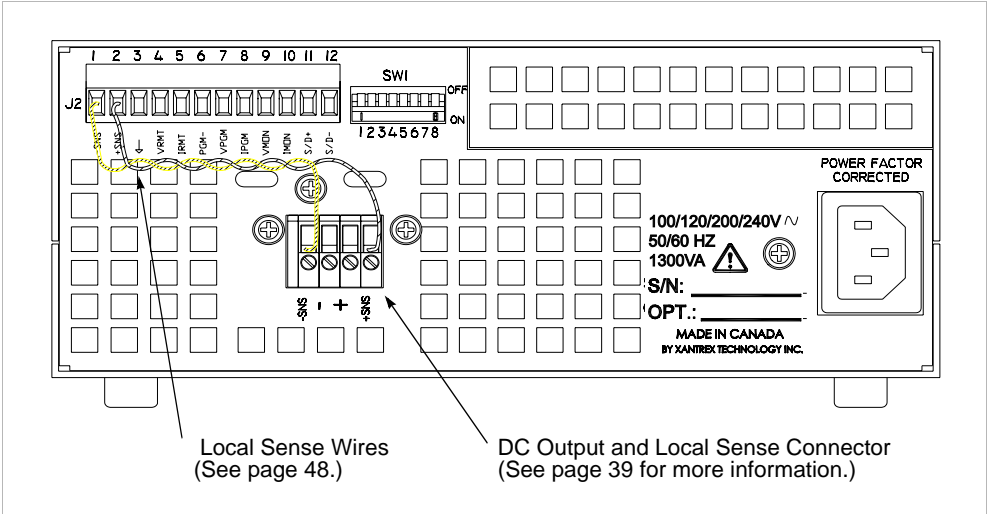


Figure 1.3 Rear Panel with High Voltage Output Connector
(For 60 V to 600 V models.)

SW1 Programming Switch

The SW1 Programming, Monitoring, and Shutdown Select switch is an 8-position piano DIP switch located on the power supply's rear panel. The SW1 switch enables you to choose:

- Output voltage and current limit programming scales
- Output voltage and current monitor scales
- Remote shutdown circuit logic
- Resistive programming of output voltage or current limit
- Over temperature shutdown mode

The power supply is shipped with the SW1 switch set in the default operating configuration, as illustrated in Figure 1.4.

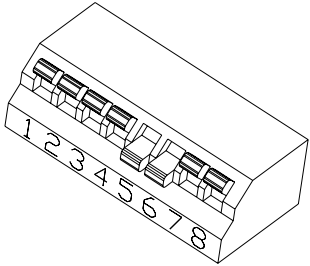


Figure 1.4 SW1 Programming Switch
(Shown in its default configuration.)

Features and Specifications

Rear Panel Connectors and Switch

See Table 1.1 for a list of the functions assigned to each SW1 switch.

Table 1.1 SW1 Switch Functions

Switch	Function	OFF (Open) ¹	ON (Closed) ¹
SW1-1	1 mA current source for resistive programming of output voltage.	<u>Voltage source programming</u>	Resistive programming
SW1-2	1 mA current source for resistive programming of output current limit.	<u>Voltage source programming</u>	Resistive programming
SW1-3	Output voltage programming source range select.	<u>0-5 V</u>	0-10 V
SW1-4	Output current limit programming source range select.	<u>0-5 V</u>	0-10 V
SW1-5	Output voltage monitor range select.	0-10 V	<u>0-5 V</u>
SW1-6	Output current monitor range select.	0-10 V	<u>0-5 V</u>
SW1-7	Remote shutdown logic select.	<u>HIGH=OFF</u>	HIGH=ON
SW1-8	Over temperature shutdown reset mode select.	<u>Auto reset</u>	Latch OFF

1. Factory defaults underlined.

Resetting the Switches The rear panel is labelled with OFF at the top of the switch and ON at the bottom. Any of the eight switches on SW1 is OFF (OPEN) when it has been flipped up to break contact, ON (CLOSED) when flipped down to close contact.

Before making any changes to the switch settings, disable the power supply output. Either turn OFF the supply, or place the supply in shutdown mode by pressing the front panel STANDBY button to its ON position. Once output is disabled, use any small, straight-bladed screwdriver to change the switch settings.

J2 Programming Connector

The J2 Programming, Monitoring, and Sense connector is a 12-terminal wire clamp connector located on the power supply's rear panel. The J2 connector provides access to the following functions:

- remote programming of output voltage and/or current limit
- remote monitoring of calibrated readback signals for output voltage and output current
- remote control of the shutdown function using 2.5-15 V or TTL-compatible signals
- remote sensing of output voltage

Features and Specifications

Rear Panel Connectors and Switch

See Figure 1.5 to identify the function of each of the 12 terminals on the J2 connector.

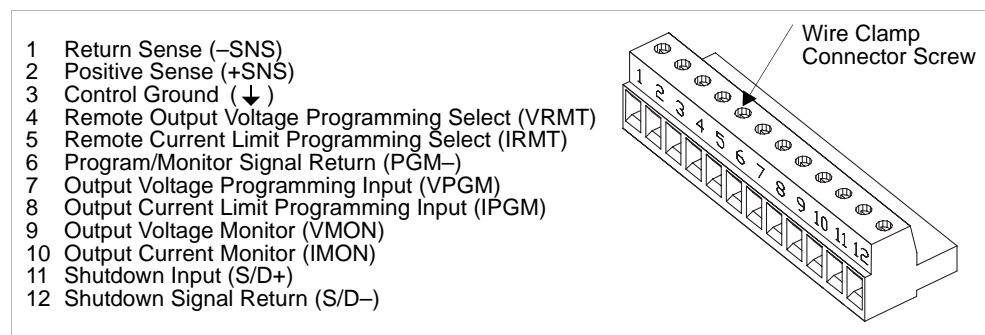


Figure 1.5 J2 Programming Connector

Making J2 Connections



CAUTION

To maintain the isolation of the power supply output and prevent ground loops, use an isolated (ungrounded) programming source when operating the power supply via remote analog control at the J2 connector.



CAUTION

Do not attempt to bias the Program/monitor signal return (J2-6) relative to the power supply output return, as they are connected internally. Use the Isolated Programming (ISOL) option for control from programming sources at potentials differing from the supply output return.

Make connections to the J2 connector using its screw-type wire clamps. Before making any connections, turn the power supply OFF and wait until the front panel displays have gone out. You can unplug the connector from the back of the unit in order to make it easier to install the required wiring.

Features and Specifications

Rear Panel Connectors and Switch

Wiring



WARNING

There is a potential shock hazard at the output and J2 terminals when using a power supply with a rated output greater than 40 V. Use load wiring with a minimum insulation rating equivalent to the maximum output voltage of the power supply. For example, select TEW-105, 105 °C, 600 V wiring for use with a 600 V, 1.7 A model power supply

For lowest noise performance, make connections to the J2 connector with either individually or group shielded 18-22 AWG (0.3-0.8 mm²) wire. Maintain the shield to within 1.5in. (40 mm) of the end of each wire. Strip 0.26.in (6.5 mm) of insulation, insert into the correct terminal, and tighten the wire clamp. You must ground the shield(s) to the power supply chassis with a connection less than 1.5.in (40 mm) long.

Specifications

Electrical Specifications Specifications are warranted over a temperature range of 0 to 40 °C with default local sensing.

The tables on the following pages post maximum values for model-dependent specifications.

Specifications which are different due to measurements being taken at the front panel binding posts are identified, where they occur, in the tables.

Specifications are subject to change without notice.

Features and Specifications

Specifications

Table 1.2 Electrical Specifications for 7.5 V to 40 V Models

Models	7.5-130	20-50	33-33	40-25
Output Ratings:				
Output Voltage	0-7.5 V	0-20 V	0-33 V	0-40 V
Output Current	0-130 A	0-50 A	0-33 A	0-25 A
Output Power	975 W	1000 W	1089 W	1000 W
At the front panel binding posts:				
Output Current	0-30 A	0-30 A	0-30A	
Output Power	225 W	600 W	990 W	
Line Regulation: ¹				
Voltage (0.01% of Vmax + 2 mV)	3 mV	4 mV	5 mV	8 mV
Current (0.01% of Imax + 1 mA)	14 mA	6 mA	4.3 mA	2.8 mA
Load Regulation: ²				
Voltage (0.01% of Vmax + 2 mV)	3 mV	4 mV	5 mV	6 mV
Current (0.05% of Imax + 1 mA)	66 mA	26 mA	18 mA	14 mA
At the front panel binding posts:				
Voltage	650 mV	650 mV	650 mV	500 mV
Meter Accuracy:				
Voltage (1% of Vmax + 1 count)	0.09 V	0.3 V	0.43 V	0.5 V
Current (1% of Imax + 1 count)	1.4 A	0.6 A	0.43 A	0.35 A
Output Noise and Ripple (V):				
rms	10 mV	10 mV	7.5 mV	7.5 mV
p-p (0-20 MHz)	70 mV	70 mV	75 mV	75 mV
At the front panel binding posts:				
p-p (0-20 MHz)	250 mV	250 mV	350 mV	350 mV
Drift (8 hours): ³				
Voltage (0.05% of Vmax)	3.75 mV	10 mV	16.5 mV	20 mV
Current (0.1% of Imax)	130 mA	50 mA	33 mA	25 mA
Temperature Coefficient: ⁴				
Voltage (0.02% of Vmax/°C)	1.5 mV	4 mV	6.6 mV	8 mV
Current (0.03% of Imax/°C)	39 mA	15 mA	9.9 mA	7.5 mA
Maximum Remote Sense Line Drop Compensation ⁵				
	3 V/line	5 V/line	5 V/line	5 V/line
OVP Adjustment Range: (5% to 110% of Vmax)				
	0.375-8.25 V	1-22 V	1.65-36.3 V	2-44 V
Efficiency ⁶				
	81%	83%	83%	83%

1. For input voltage variation over the AC input voltage range, with constant rated load.

2. For 0-100% load variation, with constant nominal line voltage. Measured at the rear panel output connector unless stated otherwise.

3. Maximum drift over 8 hours with constant line, load, and temperature, after 30-minute warm-up.

4. Change in output per °C change in ambient temperature, with constant line and load.

5. Line drop is subtracted from total voltage available at supply output.

6. Typical efficiency at 115 Vac input and rated output power.

Table 1.3 Electrical Specifications for 60 V to 600 V Models

Models	60-18	100-10	150-7	300-3.5	600-1.7
Output Ratings:					
Output Voltage	0-60 V	0-100 V	0-150 V	0-300 V	0-600 V
Output Current	0-18 A	0-10 A	0-7 A	0-3.5 A	0-1.7 A
Output Power	1080 W	1000 W	1050 W	1050 W	1020 W
Line Regulation: ¹					
Voltage (0.01% of Vmax + 2 mV)	8 mV	12 mV	17 mV	32 mV	62 mV
Current (0.01% of Imax + 1 mA)	2.8 mA	2 mA	1.7 mA	1.3 mA	1.2 mA
Load Regulation: ²					
Voltage (0.01% of Vmax + 2 mV)	8 mV	12 mV	17 mV	32 mV	62 mV
Current (0.05% of Imax + 1 mA)	10 mA	6 mA	4.5 mA	3 mA	2 mA
At the front panel binding posts:					
Voltage	400 mV	300 mV	200 mV	100 mV	62 mV
Meter Accuracy:					
Voltage (1% of Vmax + 1 count)	0.7 V	1.1 V	1.6 V	4 V	7 V
Current (1% of Imax + 1 count)	0.19 A	0.11 A	0.08 A	0.05 A	0.03 A
Output Noise and Ripple (V):					
rms	10 mV	10 mV	20 mV	30 mV	120 mV
p-p (0-20MHz)	75 mV	100 mV	150 mV	250 mV	500 mV
At the front panel binding posts:					
p-p (0-20MHz)	400 mV	400 mV	450 mV	500 mV	700 mV
Drift (8 hours): ³					
Voltage (0.05% of Vmax)	30 mV	50 mV	75 mV	150 mV	300 mV
Current (0.05% of Imax)	18 mA	10 mA	7 mA	3.5 mA	1.7 mA
Temperature Coefficient: ⁴					
Voltage (0.02% of Vmax/°C)	12 mV	20 mV	30 mV	60 mV	120 mV
Current (0.03% of Imax/°C)	5.4 mA	3 mA	2.1 mA	1.1 mA	0.48 mA
Maximum Remote Sense Line Drop Compensation ⁵					
	5 V/line	5 V/line	5 V/line	5 V/line	5 V/line
OVP Adjustment Range (5% to 110% of Vmax)					
	3-66 V	5-110 V	7.5-165 V	15-330 V	30-660 V
Efficiency ⁶					
	84%	84%	85%	85%	85%

1. For input voltage variation over the AC input voltage range, with constant rated load.
2. For 0-100% load variation, with constant nominal line voltage. Measured at the rear panel output connector unless stated otherwise.
3. Maximum drift over 8 hours with constant line, load, and temperature, after 30-minute warm-up.
4. Change in output per °C change in ambient temperature, with constant line and load.
5. Line drop is subtracted from total voltage available at supply output.
6. Typical efficiency at 115 Vac input and rated output power.

Features and Specifications

Additional Electrical Specifications

Additional Electrical Specifications

Voltage Mode Transient Response (Time for the output voltage to recover within 0.5% of its previous level after a step change in load current of up to 50% of the rated output.)	1 ms
Time delay from power on until output stable	4 s maximum

Input Conditions

Rated AC Input Voltage	100/120/200/220/230/240 Vac (nominal)
Maximum AC Input Rating	1300 VA
Operational AC Input Voltage Range	85-250 Vac; power factor corrected. Derate maximum output power to 900 W for AC input less than 95 V.
Maximum Input Current	13 A maximum at 100 Vac, 11 A maximum at 120 Vac, 6 A maximum at 220 Vac.
Input Frequency Range	47–63 Hz
Power Factor	0.99 minimum for full load and 120 Vac input

Electrical Characteristics

Switching Frequency	7.5 V to 300 V models: nominal 125 kHz (250 kHz output ripple) 600 V model nominal 62.5 kHz (125 kHz output ripple)
Output Hold-up Time	Greater than 10 ms with interruption of AC line, for nominal AC input and full load.
Maximum Voltage Differential from output to safety ground	±600 Vdc
Isolation Voltage	Input to output: 1350 Vac

Remote Programming and Monitoring

Remote Start/Stop and Interlock	2.5-15 V signal or TTL-compatible input, selectable logic. Input impedance: 1 k (in series with one diode drop).
Remote Analog Programming (Full Scale Input)	Voltage and current programming inputs (source must be isolated): 0-5 k, 0-10 k resistances; 0-5 V (default), 0-10 V voltage sources; Input impedance (V and I): approximately 475 k.
Remote monitoring	Output voltage and current: 0-5 V, 0-10 V (default); Output impedance (V and I): approximately 221 Ω; Output short circuit current: approximately 50 mA.
Remote Programming and Monitoring Accuracy	1% zero to full scale output for the default range.
Maximum Remote Sense Line Drop Compensation. (Line drop must be deducted from the supply's maximum output voltage.)	7.5 V models: 3 V/line. 20 V to 600 V models: 5 V/line.
Isolated Program and Readback (V & I) (Optional)	0-5 V (ISOL interface). Input impedance: 200 k. Output impedance: 21 Ω
Digital Control (Optional)	RS-232, GPIB or GPIB-M (multichannel)

Features and Specifications

Environmental Specifications

Environmental Specifications

Operating Ambient Temperature	0 to 40 °C.
Storage Temperature Range	– 40 ° to 85 °C
Humidity Range	Up to 80% RH, non-condensing
Operating Altitude	Up to 6,500 feet (2000 m)
Installation Category	II
Pollution Degree	2

Approvals

Units marked with c(CSA)us are CSA certified to:
Canadian safety standard CAN/CSA C22.2 No. 61010.1-92 and
USA safety standard UL 61010B-1.

Units marked with CE meet:
EMC Directive (standards EN50081-2 and EN50082-1) and
Low Voltage Directive (safety standard IEC 61010:1990 +A.1:1992 +A.2:1995).

Meets FCC part 15 Class A limits for radio emissions.

Meets Canadian EMC standard ICES-001, Class A limits.

Mechanical Specifications

Front Panel Voltage and Current Control	10-turn voltage and current potentiometers
Front Panel Voltage Control Resolution	0.02% of maximum voltage
Front Panel Voltage and Current Meters	3.5-digit numeric LED displays (for accuracy specifications, see Table 1.2 and Table 1.3)
AC Input Connector Type	IEC 320 Connector, appropriate power cord for destination country.
Front Panel Output	5-way binding posts: maximum current limit 30 A
OVP Control	Screwdriver-set potentiometer on front panel
Input Fuses	20 A, 250 V, 5 x 20 mm slow fuses, location: A5 PCB, F321, 325; 0.005 A, 250 V, 5 x 20 mm fast fuse, location: A3 PCB, F1.
Main Output Connector	7.5 V to 40 V models: nickel-plated copper bus bars; 60 V to 600 V models: 4-terminal wire clamp connector for DC output and local sense.
Analog Programming, Monitoring, and Sense Connector (2-piece)	12-terminal wire clamp connector
Chassis Ground	Chassis ground screw located on rear panel for bonding connections
Cooling	Fan cooled. Air exhausts to rear. Over temperature shutdown: automatic restart or latch off (switch-selectable).
Mounting	Optional rack mount pan. (RM3-XHR)
Size (one unit)	87.0 mm H x 214.6 mm W x 472.2 mm D (3.425in. H x 8.45in. W x 18.59in. D)
Weight (one unit)	Approximately 6.4 kg (14 lb.)

Features and Specifications

Dimensions

Dimensions

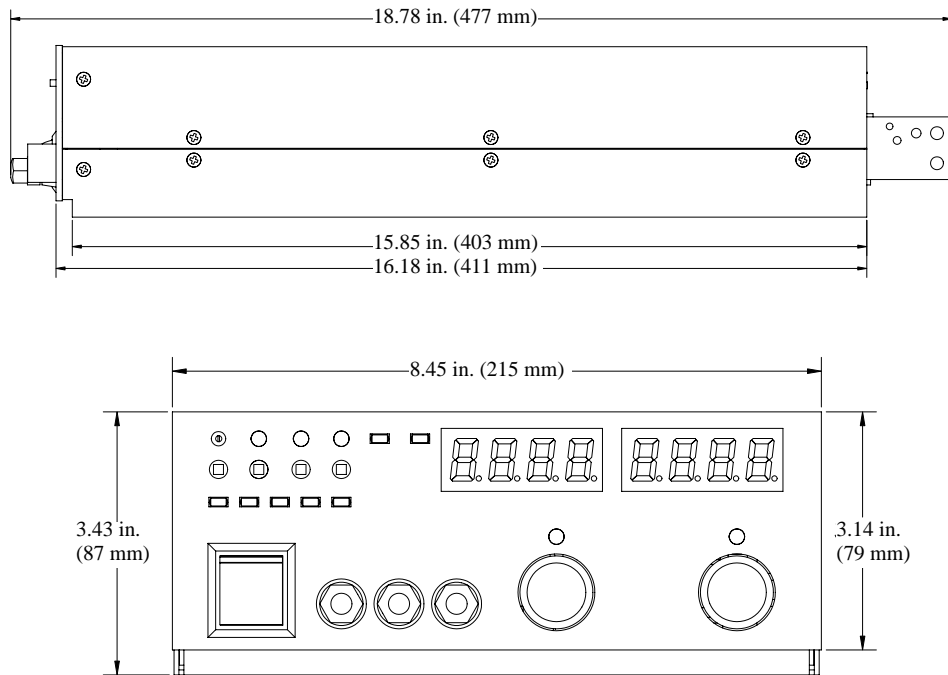


Figure 1.6 Dimensional Drawings
(Dimensions given are nominal.)