



**OPERATING MANUAL
TSF, RSF, TSG, RSG, TSJ & RSJ
SIGMA SERIES
FRONT-ENDS/RECTIFIERS**

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OPERATING MANUAL

SIGMA SERIES FRONT ENDS/RECTIFIERS

1.0 INTRODUCTION

This operating manual should be read through carefully before installing and operating the Sigma (TSF/RSF/TSG/RSG/TSJ/RSJ) Series front-ends/rectifiers.

The Sigma Series is an advanced-design, front-end/rectifier switching power supply with a high current output and a 5VDC 100mA independent standby output. Maximum continuous output power is 300-650 watts depending on exact model, with available voltages of 12, 24 or 48VDC, respectively (13.6, 27.2 or 54.4VDC for the rectifier versions).

These Sigma Series front-ends/rectifiers are ultra-compact, only 1.6 inches high, 3.3 inches wide (1U x2U) and 11 inches deep, producing up to 9.5 watts per cubic inch power density. The units come in two versions: chassis-mount units (SF, SG & SJ) and hot-swap units with mounting brackets and retention screws. See Figure 1.

Sigma Series incorporates control and monitoring features including enable and inhibit inputs, AC power fail and DC power good signals, overtemperature warning and remote sensing. The front panel has an LED status indicator for DC Power Good. The output has single-wire, current sharing capability.

Three 19-inch, 1U-high racks/shelves are available to hold up to four Sigma Series units connected in parallel to give up to 1950 watts with 3+1 redundancy or 2600 watts with non-redundant operation. The racks/shelves feature dual A/B inputs and single or dual A/B DC outputs depending on rack/shelf model.

2.0 SIGMA SERIES FEATURES

The following is a summary of the important features of the Sigma Series front-ends/rectifiers:

- ◆ Includes Isolated 5V, 100mA Standby Output
- ◆ Hot-Swap or Chassis Mount Versions
- ◆ 12, 24, or 48 VDC Front End Outputs
- ◆ 13.6, 27.2 or 54.4VDC Rectifier Outputs
- ◆ Up to 650W Module Power
- ◆ Up to 2600W Rack/Shelf Power



Figure 1. Sigma Series Front-End/Rectifier Modules



Figure 2. Front Panel of the Front End/Rectifier

- ◆ Dual A/B AC Input
- ◆ Single or Dual A/B DC Output
- ◆ LED DC Good Indicator
- ◆ Up to 11.2 Watts/Cubic Inch Power Density
- ◆ Power Factor Corrected
- ◆ Ultra-Compact: 1U x 2U Profile
- ◆ Single, Hot-Swappable Connector
- ◆ Staged Pin Lengths
- ◆ ORing Diode on Output
- ◆ 1U, 19" Racks/Shelves Hold 4 Units*
- ◆ Active Current Sharing
- ◆ Universal 85 to 264VAC Input
- ◆ Class B EMI Input Filter
- ◆ I²C Serial Data Bus Option
- ◆ Optimized Thermal Management
- ◆ No Minimum Load
- ◆ Control & Monitoring Features

*TSF, RSF, TSG, RSG, TSJ, RSJ Models

3.0 SUMMARY OF PRODUCT LINE

3.1 Standard Models

Delete "T" prefix to model no. for chassis mount version.

OUTPUT VOLTAGE	OUTPUT CURRENT	MAX. OUTPUT POWER	INPUT VOLTAGE	MODEL NUMBER
54.4VDC	12.0A 10.1A 7.4A	653W 550W 400W	85-264VAC	RSJ48/12 RSG48/10 RSF48/7
48VDC	13.5A 11.5A 8.3A	650W 550W 400W	85-264VAC	TSJ7000 TSG7000 TSF7000
27.2VDC	18.4A 12.9A	500W 350W	85-264VAC	RSG24/18 RSF24/13
24VDC	20.8A 14.7A	500W 350W	85-264VAC	TSG5000 TSF5000
13.6VDC	33.0A 22.1A	450W 300W	85-264VAC	RSG12/33 RSF12/22
12VDC	37.5A 25.0A	450W 300W	85-264VAC	TSG3000 TSF3000

3.2 19-INCH RACKS/SHELVES

NOTE: The table does not show the independent 5V, 100mA standby output which is standard on all models.

MAX. NO. MODULES	MAX. POWER	MAX. CURRENT	OUTPUT DC BUS	AC INPUTS	AC INLETS	MODEL NUMBER
4	2,600W	150A	SINGLE	DUAL A/B	4-C14	TSGR1U4A
4	2,600W	150A	SINGLE	DUAL A/B	2-C20	TSGR1U4B
4	2,600W	150A	DUAL A/B	DUAL A/B	2-C20	TSGR1U4C

3.3 Options

CODE	OPTION
-Z	I ² C Serial Data Bus

NOTE: Add Option Code as suffix to model no. of both modules and racks/shelves.

4.0 SAFETY WARNINGS

- 4.1 These power supplies have hazardous external and internal voltages. They should be handled, tested and installed only by qualified technical persons who are trained in the use of power systems and are well aware of the hazards involved.
- 4.2 The input terminals are at hazardous voltage potentials. Do not touch this area when power is applied.
- 4.3 When operating this power supply, the chassis ground terminal must be connected to safety ground by means of a three-wire AC power line to minimize electrical shock hazard and to ensure low EMI (electromagnetic interference).
- 4.4 The internal voltages are at hazardous potentials. The power supply cover should not be removed. There are no user-serviceable components in these units. Removing the cover of the power supply will void the warranty.

5.0 WARRANTY

All products of UNIPOWER Corporation are warranted for two (2) years from date of shipment against defects in material and workmanship. This warranty does not extend to products which have been opened, altered or repaired by persons other than persons authorized by the manufacturer or to products which become defective due to acts of God, negligence or the failure of customer to fully follow instructions with respect to installation, application or maintenance. This warranty is extended directly by the manufacturer to the buyer and is the sole warranty applicable. EXCEPT FOR THE FOREGOING EXPRESS WARRANTY, THE MANUFACTURER MAKES NO WARRANTY, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. As the sole and exclusive remedy under this warranty, the manufacturer, at its option, may repair or replace the non-conforming product or issue credit, provided the manufacturer's inspection establishes the existence of a defect. To exercise this remedy, the buyer must contact the manufacturer's Customer Service Department to obtain a Return Material Authorization number and shipping instructions. Products returned without prior authorization will be returned to buyer. All products returned for repair must be shipped freight prepaid to UNIPOWER. If the buyer fails to fully comply with the foregoing, the buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property or any other incidental or consequential losses) shall be available to the buyer.

6.0 UNPACKING AND INSPECTION

- 6.1 This front-end/rectifier was carefully tested, inspected and packaged for shipment from our factory. Upon receipt of the unit it should be carefully unpacked and inspected for any damage in shipment.
- 6.2 If there is evidence of damage, do not attempt to test the unit. The freight carrier should be notified immediately and a claim for the cost of the power supply should be filed with the carrier for direct reimbursement. Be sure to include the model and serial number of the damaged unit in all correspondence with the freight carrier. Also save the shipping carton and packing material as evidence of damage for the freight carrier's inspection.
- 6.3 UNIPOWER Corporation will cooperate fully in case of any shipping damage investigation.
- 6.4 Always save the packing materials for later use in shipping the unit. Never ship the power supply without proper packing.

7.0 FRONT PANEL DESCRIPTION

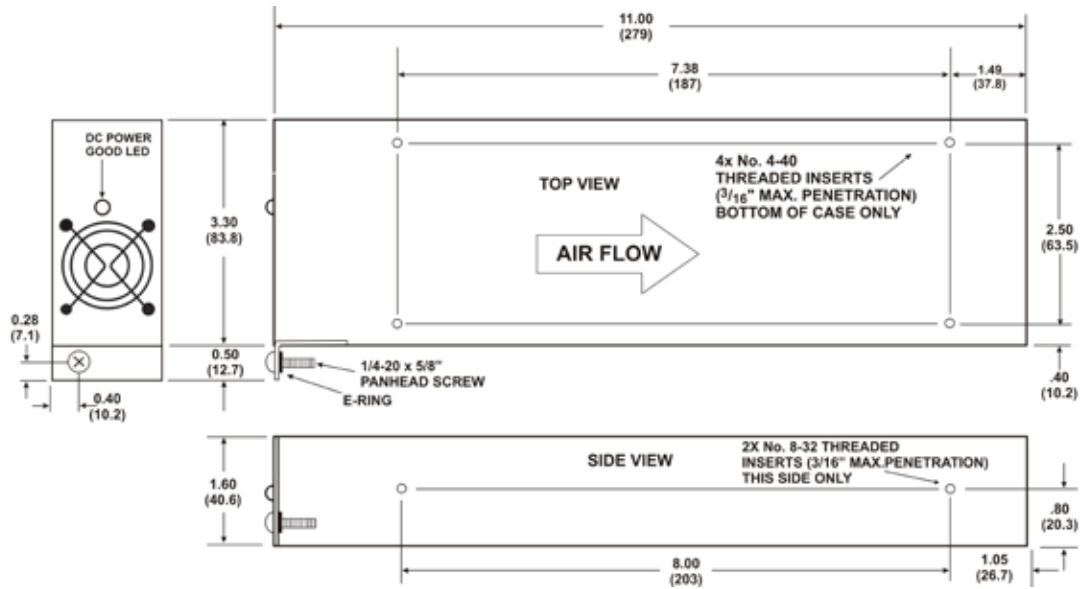
The front panel of the Sigma Series is shown in Figure 2. To the left of the grille is the DC Power Good LED (green). For the hot-swap versions there is a mounting bracket on the right side of the front panel. This has a panhead screw for securing the unit to the rack/shelf.

8.0 FRONT-END/RECTIFIER MODULE SPECIFICATIONS

Typical at 120/230VAC Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Total Output Power, Continuous, Max.	300-650 Watts
Voltage Adjustment Range, Min.	±5%
Total Regulation ¹ ,	2.0%
Total Regulation ¹ , 5V Standby Supply	5.0%
Ripple & Noise, Pk-Pk ²	1%
Holdup Time	10mS
Dynamic Response ³	300µS
Temperature Coefficient	±0.02%/°C
Minimum Load	0A
Overload Protection.....	Auto Recovery
Overvoltage Protection	Latched Shutdown
Remote Sense	Up to 0.25V Per Wire
Current Share	±10% Full Load Rating



NOTE: The chassis mount versions do not have mounting bracket with retention panhead screw. Maximum torque on the threaded inserts is 6 inch-pounds.

Figure 3. Mechanical Dimensions of Front End/Rectifier

Standby Output	+5V, 100mA
DC Power Good Signal	Logic Low
AC Power Fail Signal.....	Logic High
Inhibit.....	Logic Low
Enable	Logic Low
Overtemperature Warning	Logic High

INPUT SPECIFICATIONS

Input Voltage Range	85-264VAC
Power Factor	0.99
Input Frequency	47-63Hz
Inrush Current Limiting	30A Peak
Harmonic Distortion	EN61000-3-2
Input Protection	Internal Fuse, 10A

GENERAL SPECIFICATIONS

Efficiency ⁴	85-90% at Full Load
Switching Frequency, PFC Converter	48-110kHz
Output Converter.....	275kHz Nominal
Conducted EMI	EN55022 Curve B FCC20780 pt. 15J Curve B
Isolation, Class I, min. ⁵	
Input-Output	3000VAC
Input-Ground	1500VAC
Output-Ground	50VDC
Input Immunity, Conducted	
Fast Transients, Line-Line	±2kV (EN61000-4-4 Level 3)
Surges, Line-Line	±2kV (EN61000-4-5 Level 3)
Surges, Line-Ground	±4kV (EN61000-4-5 Level 4)
MTBF (Bellcore)	200,000 Hours
Safety Standards	EN60950-1, UL60950-1, CSA22.2 No.60950-1

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature.....	-20°C to +70°C Ambient
Derating.....	2.5% / °C, 50°C to 70°C
Storage Temperature.....	-40°C to +85°C
Cooling	Integral Ball Bearing Fan

PHYSICAL SPECIFICATIONS

Case Material	Aluminum
Dimensions, Inches(mm).....	1.6 H x 3.3 W x 11.0 D (40.6 x 83.8 x 279.4)
Weight	2.10 lbs. (0.95 kg.)

NOTES:

1. No load to full load, including line regulation and load regulation.
2. 20MHz bandwidth. Measure with 0.1µF ceramic and 10µF tantalum capacitors in parallel across the output.
3. <4% deviation recovering to within 1% for 25% load change.
4. Typical efficiency is at low end of range for 12V output and at high end of range for 48V output.
5. Input-output isolation figure is for isolation components only. 100% production Hipot tested.

9.0 DESCRIPTION OF FEATURES & OPTIONS

FEATURE / OPTION	DESCRIPTION
Power Factor Correction	The input current is a sine wave in-phase with the input voltage to give a power factor of 0.99. Input current total harmonic distortion meets EN61000-3-2.
Wide Range AC Input	The AC input range is continuous from 85 to 265VAC, 47-63Hz, for worldwide operation.
EMI Input Filter	This filter suppresses conducted noise from the supply back onto the AC line. The filter meets FCC20780 part 15J Curve B and EN55022 Curve B.
Inrush Current Limiting	When the unit is turned on, the initial input current is limited to a peak value of 30 amperes AC. This is accomplished by thermistor current limiting.
Thermal Protection	If the unit overheats internally, it will automatically shut down. The DC Power Good LED turns off. The Overtemperature Warning goes HI and the DC Power Good signal goes HI. After a few minutes the unit will cool down and automatically start up again.
Current Sharing	The Sigma Series front end/rectifier module will automatically current share with another identical unit. A single-wire connection provides this. The output actively current shares with an accuracy of 10% of full load output current for a total load of 50% to 100%.
ORing Diodes	A diode in series with the output protects the output of parallel-connected modules. If one output fails to a short or to a lower than normal output voltage, the other output is not affected. Also when hot-swapping units in the rack/shelf, the diode prevents a glitch in the output voltage while the output is still rising on the inserted unit. The 5V, 100mA standby output also has an ORing diode.
5V, 100mA Standby Output	This is an independent output which is not controlled by the Enable or Inhibit inputs. This output also has an ORing diode and can be paralld with another module's Standby Output.
Overvoltage Protection	The output is protected from overvoltage due to fault conditions in the unit. Overvoltage protection is set at approximately 10% above the nominal output voltage level. The result is a latched shutdown of the unit. It is reset by cycling the AC input off and then back on.

FEATURE / OPTION	DESCRIPTION
Hot-Swap Connectors	The hot-swap connectors used in both the module and rack/shelf are specifically designed for hot-swap applications. They have staged pin engagement for safety and optimum operation. The chassis ground pin makes first contact, followed by the AC and signal pins. The enable pin makes last contact, turning the unit on (provided it is not “inhibited”).
Hot-Swap Operation	Hot-swap operation means that a module can be removed and replaced while the rack/shelf is powering the load. If the rack/shelf is operated in a redundant mode, hot-swap replacement will not affect the output voltage.
Output Protection	Output current limiting protects the output of the module from damage due to an overload or short circuit condition. This protection is continuous, without damage, and recovery is automatic when the overload is removed. Current limiting begins at about 105% of rated output current.
LED Indicator	The DC Power Good indicator is a green LED showing that the output voltage is present and within operating range.
Control and Monitoring Signals	For detailed descriptions of Enable/Inhibit, Current Share, Remote Sense AC Power Fail and DC Power Good signals, see Section 15, Description of Control and Monitoring Signals.

10.0 MECHANICAL SPECIFICATIONS

The mechanical dimensions of the front end/rectifier are shown in Figure 3. Please note the maximum torque on the threaded inserts.

11.0 SAFETY AND INDUSTRY STANDARDS

11.1 The front end/rectifier meets the following safety certifications:

STANDARD	AGENCY
UL60950-1	UL
CSA22.2 No.60950-1	CUL
EN60950-1	DEMKO

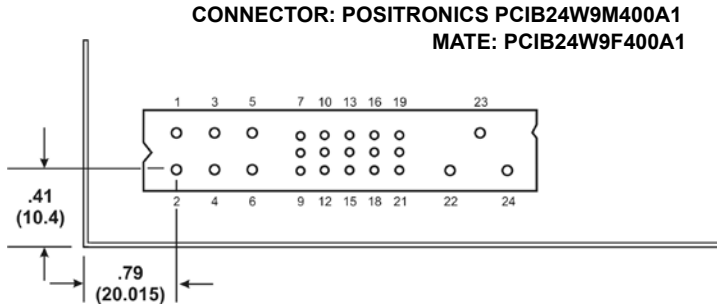
11.2 The module is CE marked to indicate conformance to the European Union’s Low Voltage Directive.

- 11.3 Input conducted EMI meets FCC20780 part 15J Curve B and EN55022 Curve B.
- 11.4 The input immunity, conducted, meets the following. Input fast transients, line-to-line, meet EN61000-4-4 Level 3; input surges, line-to-line, meet EN61000-4-5 Level 3; and input surges, line-to-ground, meet EN61000-4-5 Level 4.

12.0 OPERATING INFORMATION

- 12.1 **Input Voltage and Connection.** The front end/rectifier operates off world-wide AC input voltages in the range of 85 to 264 VAC at 47 to 63 Hz. The three-wire AC connection is made to pins 22-24 on the Positronics connector. See the connector diagram and Pin Connections table in Figure 4.
- 12.2 **Output Connections.** The output voltage is provided on pins 1 to 4 of the Positronics connector. Two pins (1 & 2) are connected together internally for the +V Out; two other pins (3 & 4) are connected together internally for the -V Out.
- 12.3 **Mating Interface Board.** Figure 5 shows a mating interface board which is available for simplifying the testing of a front end/rectifier module. As shown in the photograph, provision is made for input and output connections, and also for the control and monitoring signals. In addition there are LED status indicators and a switch for programming the I²C address.
- 12.4 **Output Voltage.** The output voltage is factory set to its nominal value to an accuracy of $\pm 1\%$. The voltage can be more accurately adjusted to a value within a $\pm 5\%$ range by means of external components as shown in Figure 6(a) or (b).
- 12.5 **Output Power.** The maximum continuous output power is from 300 to 550 watts, depending on model number. The 5V standby output produces 0.5 watts.

The maximum output power of a module may be drawn at up to 50°C ambient temperature. Above 50°C the total output power must be derated by 2.5%/°C. See Figure 7. The maximum operating ambient temperature is 70°C, at which the total output power must be derated by 50%.



PIN CONNECTIONS			
PIN	FUNCTION	PIN	FUNCTION
1	+V Out	13	Module Present
2	+V Out	14	GA1
3	-V Out	15	AC Power Fail
4	-V Out	16	V Trim
5	+ Sense	17	Overtemp. Warning
6	- Sense	18	Current Share
7	Enable	19	Current Monitor
8	GA2	20	+5V Standby
9	GA0	21	DC Power Good
10	Inhibit	22	Chassis Ground
11	SDA	23	AC Line
12	SCL	24	AC Neutral

MATING CONNECTOR KIT
Order Kit No. 775-1449-0000

MATING INTERFACE BOARD
Order Kit No. 009-3901-0000

***NOTE:** For unit to operate, pin 7 must be at logic LO or shorted to pin 6. For proper operation the following pins must be connected together: + V Out pins (1 & 2); - V Out pins (3 & 4). Pins 8, 9, 11, 12 & 14 are I²C signals when that option is present. The +5V standby return is to -Sense (pin 6). All signals are referenced to -Sense (pin 6).

Figure 4. Connector and Pin Connections to Module

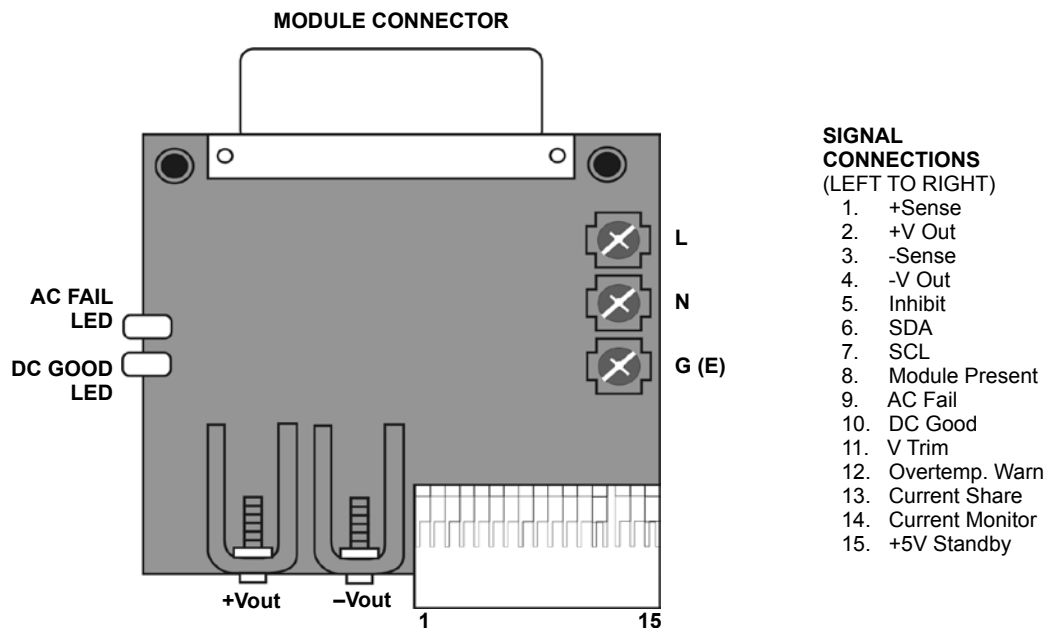
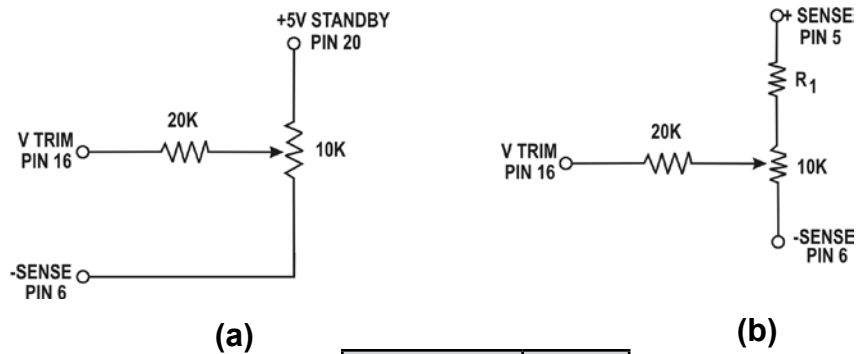


Figure 5. Mating Interface Board (No. 009-3901-0000)



OUTPUT	R1*
12 - 13.6V	12k
24 - 27.2V	33k
48 - 54.4V	75k

* Resistors are 5%, 1/8 W.

Figure 6. Output Voltage Adjustment Methods

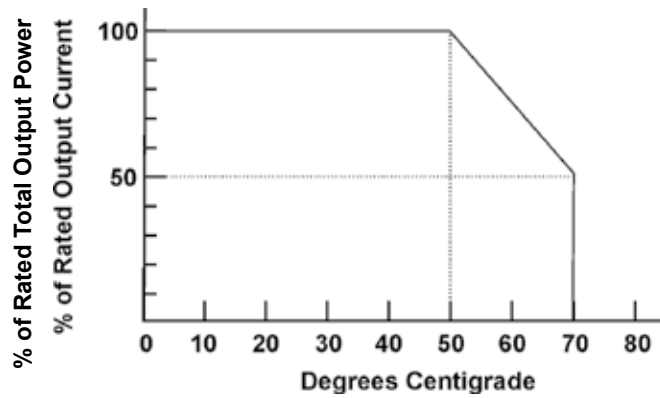


Figure 7. Rated Total Output Power vs. Ambient Temperature

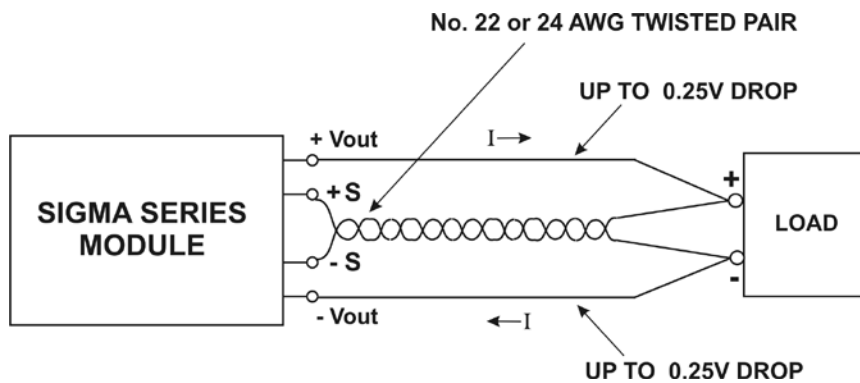


Figure 8. Remote Sensing Connection

- 12.6 Output Overload Protection.** The module output is protected from damage due to an overload or short circuit condition. This protection is continuous and without damage; recovery is automatic when the overload or short circuit condition is removed. The unit incorporates a “straight line” method of current limiting. When the output current reaches an overload threshold, the voltage begins to drop sharply so that the current, with a given overload impedance, forces the voltage to a level which maintains the current at an equilibrium point.
- 12.7 Remote Sensing.** Remote sensing connections are made to pins 5 and 6 on the Positronics connector. Remote sensing is not available on the Standby +5V, 100mA output. Remote sensing is used to regulate the output voltage at the point of load by compensating for the voltage drop in the wires to the load. The +Sense lead (Pin 5) must be connected to the + side of the load and the -Sense lead (Pin 6) to the -side of the load. The sense leads should be a color-coded, twisted pair of AWG no. 22 or 24 copper wire. See Figure 8.
- Remote sensing can compensate for a total voltage drop of 0.5V, or 0.25V per load wire. The sense leads should not exceed 10 feet (3 meters) in length. If remote sensing is not required, the sense leads may be left open for local sensing at the output terminals. **Be careful not to reverse the sense lead connections, as this could damage the output.**
- 12.8 Control & Supervisory Signals.** All control and supervisory signals are accessible at the Positronics connector on the back of the unit. See Figure 4. See Section 15 for a complete description of these input and output signals.
- 12.9 Alarm Signals.** Among the control and supervisory signals are three logic alarms: AC Power Fail, DC Power Good and Overtemperature Warning. These are logic signals referenced to -Sense, Pin 6 on the Positronics connector. AC Power Fail is a logic LO when AC input power is present. This signal goes to a HI 4 milliseconds before the outputs go out of regulation and stays HI for typically 15 msec. DC Power Good is a logic LO when the output is present and in regulation and goes to a HI when there is output failure. Overtemperature Warning is normally a logic LO but goes to a HI when the internal air temperature reaches a critical level just prior to the unit shutting down.

13.0 PARALLEL OPERATION

13.1 Parallel Connection. Two or more front ends/rectifiers can be operated in parallel by connecting their outputs in parallel and connecting their current share terminals together (pin 18). The compatible racks/shelves permit conveniently operating two to four units in parallel in either a 1+1, 2+1 or 3+1 redundant mode, or in non-redundant mode.

13.2 Redundant Operation. Connecting four modules in parallel, with or without a compatible 19-inch rack/shelf, so that the full output load current can be carried by three units results in 3+1 redundant operation. While operating normally, the load current is shared approximately equally between the four units. Should one unit fail, the full load is then maintained by the other three units. The failed unit can then be replaced (hot-swap) without affecting the load current. This operation is facilitated by the ORing diode on the output. 3+1 redundancy with quick replacement of a failed unit results in virtually infinite MTBF. 1+1 or 2+1 redundancy works the same way except that the full load is carried by one or two of the units, respectively.

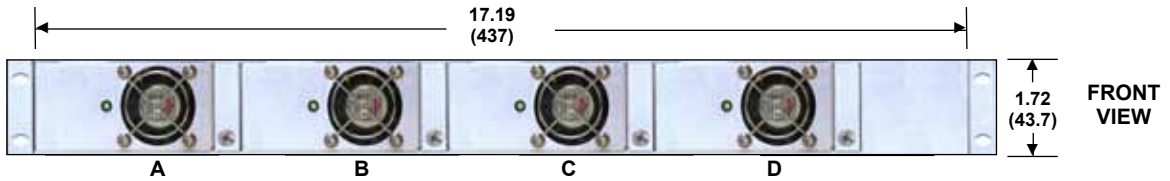
13.3 Non-Redundant Operation. Higher output load currents can be realized by operating two to four units in the non-redundant mode to achieve up to 2200 watts output. The units are connected in parallel the same as before. In this case if one unit fails, the load will lose power since only part of the load current can now be supplied by the remaining unit(s), which will go into current limit. The failed unit can be quickly replaced, however, without turning the power off (hot-swap) to restore load current.

14.0 COMPATIBLE 19-INCH RACKS/SHELVES

14.1 There are three 19-inch compatible racks/shelves. All hold up to four front end/rectifier modules. See Figure 9. These racks/shelves have the following features:

- Dual A/B AC Inputs
- Single or Dual A/B DC Outputs
- Standard 19-Inch Width
- Only 1U High
- Hot-Swap Operation
- Hold up to 4 Modules
- Up to 2600 Watts Non-Redundant

SPECIFICATIONS, TSGR1U4 RACKS/SHELVES, 19-INCH



SINGLE BUS
DC OUT
DUAL A/B AC IN



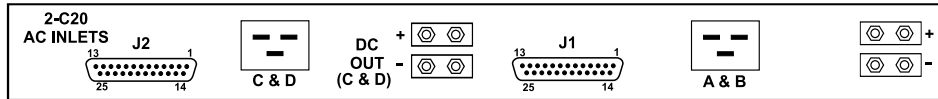
DC
OUT
**TSGR1U4A
BACK VIEW**

SINGLE BUS
DC OUT
DUAL A/B AC IN



DC
OUT
**TSGR1U4B
BACK VIEW**

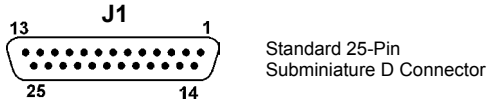
DUAL A/B BUS
DC OUT
DUAL A/B AC IN



DC
OUT
(A & B)
**TSGR1U4C
BACK VIEW**

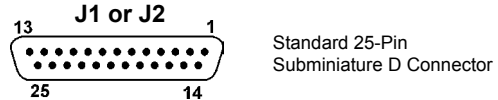
RACKS/SHELVES ARE 13.95 INCHES (354MM DEEP)

SINGLE DC OUTPUT BUS



J1 SIGNAL CONNECTOR			
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	AC Power Fail - A
2	N.C.	15	DC Power Good - A
3	Overtemp. Warn. - A	16	AC Power Fail - B
4	Overtemp. Warn. - B	17	DC Power Good - B
5	Overtemp. Warn. - C	18	AC Power Fail - C
6	Overtemp. Warn. - D	19	DC Power Good - C
7	V Adjust - D	20	AC Power Fail - D
8	+5V Standby	21	DC Power Good - D
9	SDA	22	-Sense
10	Current Share	23	-Sense
11	+Sense	24	V Adjust - A
12	V Adjust - B	25	V Adjust - C
13	SCL		

DUAL DC OUTPUT BUSES



J1 or J2 SIGNAL CONNECTORS			
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	AC Power Fail - A or C
2	N.C.	15	DC Power Good - A or C
3	Overtemp. Warn.- A or C	16	AC Power Fail - B or D
4	Overtemp. Warn.- B or D	17	DC Power Good - B or D
5	—	18	—
6	—	19	—
7	—	20	—
8	+5V Standby	21	—
9	SDA	22	-Sense
10	Current Share	23	-Sense
11	+Sense	24	V Adjust - A or C
12	V Adjust - B or D	25	—
13	SCL		

NOTE: Standby return is connected to -Sense lead
current rating of +5V standby is 100mA. All
signals are referenced to -Sense lead.

Figure 9. TSGR1U4 Compatible Racks/Shelves

- Up to 1950 Watts, 3+1 Redundant
- Current-Shared Outputs
- IEC60320 AC Inputs
- I²C Serial Data Bus Option
- 19- or 23-Inch Mounting with Universal Brackets

14.2 Ordering Guide

MAX. NO. MODULES	MAX. CURRENT	OUTPUT DC BUS	AC INPUTS	AC INLETS	MODEL NUMBER
4	150A	SINGLE	DUAL A/B	4-C14	TSGR1U4A
4	150A	SINGLE	DUAL A/B	2-C20	TSGR1U4B
4	150A	DUAL A/B	DUAL A/B	2-C20	TSGR1U4C

CODE	OPTION
-Z	I ² C Serial Data Bus

NOTE: Add Option Code as suffix to model no. on both modules and racks/shelves.

14.3 Description of Rack/Shelves. There are three different compatible racks/shelves for the front-end/rectifier modules. See Figure 9. The first, model TSGR1U4A, has four IEC60320 C14 AC inlets, one for each module, and a single DC output bus bar. The second, model TSGR1U4B, has two C20 AC inlets, one for A & B modules and one for C & D modules. It also has a single DC output bus bar. The third, model TSGR1U4C, has two C20 AC inlets and two DC output bus bars. All three racks/shelves are 13.95 inches (354mm) deep.

14.4 Dual A/B Inputs and Outputs. The TSGR1U4C is a true dual A/B rack/shelf since both AC inputs and DC outputs are dual A/B. This means that this rack/shelf can have two different DC outputs if desired. The A and B modules can have one DC output voltage while the C and D modules have a different DC output voltage.

14.4 Signal Connectors J1 and J2. On the first two racks/shelves, A and B suffixes, there is a single J1 connector for input and output control and monitoring. J1 connections are shown in the left table of Figure 9. For the C suffix racks/shelves there are two signal connectors, J1 and J2, one for each side of the A/B system. The connections are shown in the right table of Figure 9. Note that J1 is for modules A and B, and J2 is for modules C and D. The control and monitoring signals are described in detail in Section 15.

15.0 DESCRIPTION OF MODULE CONTROL AND MONITORING SIGNALS

SIGNAL	PINS	DESCRIPTION
± Sense	5 & 6	These remote sense leads should be connected as a twisted pair to the respective + and - load points to provide regulation at the point of load. The correct polarities must be maintained.
Enable	7	A logic LO or short to Pin 6 enables (turns on) the unit. A logic HI or open inhibits (turns off) the unit. This input is referenced to - Sense, Pin 6. This pin must be activated to a logic LO or short for the module to operate.
I ² C Data	8, 9, 11, 12, 14	These pins are for implementing the optional I ² C Serial Data Bus to provide operating data on the module. Contact factory for further information.
Inhibit	10	A logic LO or short to Pin 6 turns off the output; a logic HI or open at this pin turns on the output. This input is referenced to -Sense, Pin 9.
Module Present	13	This pin is connected to -Sense and can be used with a mating socket to indicate whether the module is present.
AC Power Fail	15	A logic LO indicates the AC power is present; a logic HI indicates AC power failure. The signal goes HI 4 msec. before the output goes out of regulation and stays HI typically for 15 msec. The equivalent circuit is an NPN transistor collector with a 10K ohm resistor to +5V. This signal is referenced to - Sense, Pin 6.
External Trim	16	This is the connection for the output external trim. The voltage can be adjusted over a ±5% range from nominal using the external circuits shown in Figure 6.
Overtemperature Warning	17	A logic HI at this output indicates an overtemperature condition inside the unit. The HI occurs a few milliseconds before the unit shuts down. This output is referenced to -Sense, Pin 6.
Current Share	18	This analog signal is used to connect to the same pin of another identical module to share output currents. Output currents between units are shared within an accuracy of 10% of full load current over a 50% to 100% load range. This signal is referenced to - Sense, Pin 6.
Current Monitor	19	This is an analog voltage proportional to the module output current.
Standby Supply	20	This is a +5VDC, 100mA auxiliary output for powering external control or other circuits. The return is to -Sense, Pin 6. This output is not controlled by the Enable or Inhibit inputs.
DC Power Good	21	A logic LO indicates that the unit is operating properly with output voltage in its controllable range. A logic HI indicates output failure. The equivalent circuit is an NPN transistor collector with a 10K ohm resistor to +5V. This signal is referenced to - Sense, Pin 6.

16.0 INSTALLATION

- 16.1 Mounting.** The front end/rectifier module can either be mounted in the 19-inch rack (hot-swap models) and secured by means of the retention bolt or it can be mounted (chassis mount models) on another metal chassis by means of no. 4-40 screws into the four threaded inserts on the bottom of the unit or by no. 8-32 screws into the two threaded inserts on the right side of the case. Maximum penetration for each is 3/16-inch. Maximum torque on each insert is 6 inch-pounds. See Figure 3.
- 16.2 Input Power Connections.** AC input power connections are made to pins 22, 23 and 24 of the Positronics connector. A three-wire AC line cord should be used with the safety ground connected to pin 22. See Figure 4.
- 16.3 DC Output Connections.** The DC output connections for the module are shown in Figure 4. The output uses two paralleled pins on the Positronics connector, namely pins 1 and 2 for +V out and pins 3 and 4 for -V out.
- 16.4 Control and Monitoring Signal Connections.** These connections are made to various pins from 5 to 21 on the Positronics connector on the unit. See Figure 4. Details for these functions are given in Section 15.
- 16.5 Cooling.** The front end/rectifier module is cooled by a 38mm DC ball bearing fan. For proper cooling, the area in front of the fan and the back of the unit should be kept clear for unimpeded air flow.

17.0 MAINTENANCE

No routine maintenance is required on the front end/rectifier modules except for periodic cleaning of dust and dirt around the fan. A small vacuum nozzle should be used for this.

18.0 FRONT END/RECTIFIER MODULE SETUP AND TESTING

- 18.1** The front end/rectifier module can be initially tested mounted in a rack/shelf or on a test bench. If several units are to be used in a rack/shelf, they should first be individually tested in Position A (left side) of the rack/shelf. The Mating Interface Board (No. 009-3901-0000) should be used for testing a module outside the rack/shelf.

- 18.2** With the input power source turned off, connect AC input power wires to the L,N and G terminals on the Mating Interface Board, or in case of the rack/shelf to the AC inlet on the A side of the rack/shelf. Make sure that the safety ground wire is connected. Do not touch the output terminals when AC input power is present.
- 18.3** Connect a resistive power load across the proper output terminals. The load should be 20% to 50% of full load value and can be either a power resistor or electronic load set to the resistive mode. Make sure that the power resistor has adequate heat sinking and cooling.
- 18.4** Connect a color-coded, twisted pair (no. 22 or 24 AWG) from the remote sense pins or terminals to the load. **The +Sense pin must go to the positive side of the load and the -Sense pin to the negative side of the load. If a module is tested by means of a mating connector to the module's Positronic connector, then the Enable pin (pin 7) must be connected to the -Sense pin (pin 6) for the unit to operate.** When using the Mating Interface Board or the rack/shelf, the Enable pin is automatically connected to - Sense. The units are then controlled by the Inhibit inputs.
- 18.5 Checking Front Panel LEDs.** With the module connected to the Mating Interface Board on the bench or in Position A of the rack/shelf, turn on (or plug in) the AC power source. The DC Power Good (to left of fan) green LED should turn on.
- 18.6 Checking the Output Voltage.** Measure the output voltage at the load with a digital voltmeter. The voltage should be within $\pm 1\%$ of its nominal value.
- 18.7 Checking the Inhibit Input.** Unplug the input power source. Connect a wire from the Inhibit input (Pin 5 on the Mating Interface Board or Pin 1 of J1 on the rack/shelf connector) to - Sense, (Pin 3 on the Mating Interface Board or Pin 22 of J1 on the rack/shelf).

Turn the AC input power source back on. The DC Power Good green LED should remain off. Check the output voltage with a digital voltmeter. It should read zero volts.

18.8 Checking the AC Power Fail and DC Power Good Signals. Next check the voltage on the AC Power Fail pin (Pin 9 on the Mating Interface Board or Pin 14 of J1 on the rack/shelf connector) with respect to - Sense (Pin 3 of the Mating Interface Board or Pin 22 of J1 on the rack/shelf). The voltage should be a logic LO, +0.5V or less. Finally, check the voltage on the DC Power Good pin (Pin 10 of the Mating Interface Board or Pin 15 of J1 on the rack/shelf) with respect to - Sense. The voltage should be a logic HI, approximately +5V.

Disconnect the wire from the Inhibit to - Sense. The DC Power Good green LED should turn on. Check the output voltage on the DC Power Good pin as described above. The voltage should be a logic LO, +0.5V or less.

18.9 Testing the Other Front End/Rectifier Modules. For a rack/shelf with two or more units, the other modules should be plugged into Position A in the rack/shelf and tested in the same manner as above in Sections 18.2 to 18.8.

18.10 Testing the Complete Front End/Rectifier Rack/Shelf. With the input AC power source off or disconnected, insert all modules into the rack/shelf. Connect a resistive power load of approximately full load value for a single module times N-1 (where N is the total number of modules), across the output. Connect a color-coded, twisted pair of remote sense leads to the load, **being careful to connect the correct polarity.**

Turn on or plug in the AC input power source to all modules. Check the voltage across the load with a digital voltmeter. The voltage should be within about $\pm 1\%$ of its **nominal value. The DC Power Good green LED should be on for all units.**

While the rack/shelf is operating, disengage module A (left one) and check the output voltage. It should be very close to the previous value, and the DC Power Good green LED should remain on for the other modules which are now carrying the full power load. Re-insert module A and repeat the procedure by disengaging module B, then C, then D. The complete rack/shelf has now been shown to operate properly in the redundant mode with hot swapping. Disconnect the AC input power source.

In the case of rack/shelf TSGR1U4C, which has dual A/B outputs, each side of the rack/shelf must be tested separately, in the manner described above, but with two modules in each side.

19.0 TROUBLESHOOTING GUIDE

19.1 If you encounter difficulties in getting the front end/rectifier modules or the complete rack/shelf to operate properly, go through the following troubleshooting guide.

19.2 Table 19-1. Front End/Rectifier Module and Rack/Shelf Troubleshooting

SYMPTOM	POSSIBLE CAUSE	ACTION TO TAKE
No output, DC Good LED off.	No AC power.	Check connection to AC power source. Check source circuit breakers.
No output, DC Good LED off.	Remote Enable in OFF mode.	Make sure module Pin 7 (Enable) is at logic LO or connected to - Sense, Pin 6, of the Positronics connector.
No output, DC Good LED off.	Shorted output.	Check for short and remove.
No output, DC Good LED off.	Overvoltage protection (OVP) has latched.	Reset output by cycling the input power OFF for 10 seconds and then back ON.
No output, DC Good LED off.	Overtemperature protection is activated.	Allow unit to cool down for about 10 minutes. It will then start up automatically. Check to see if the cooling fan is operating.
No output, DC Good LED off.	Total output load is too large for the unit's capacity.	Reduce load to proper level.

19.3 If none of the above actions solves the problem, call UNIPOWER Corporation at 954-346-2442 Ext. 315 for help and try to resolve the problem over the telephone.

ULTRA-COMPACT 1Ux2U FRONT-ENDS & RECTIFIERS

Up to 650 Watts with PFC and Integral Hot Swap Provision

FEATURES

- Front-End or Rectifier Versions
- Includes Isolated 5V, 100mA Standby Output
- Fan Speed Varies with Load & Temp.
- Low Fan Noise at Nominal Load
- Hot-Swap Operation
- Dual A/B AC Inputs
- Dual A/B DC Outputs
- 12, 24 or 48 VDC Outputs
- Class B Conducted EMI
- DC Good LED
- I²C Serial Data Bus Option
- Up to 11.2 Watts/Cubic Inch
- 1U x 2U Profile: 1.6 x 3.3 Inches
- Single, Hot-Swappable Connector
- Staged Pin Engagement
- ORing Diode on Output
- 19" Rack/Shelf Holds 4 Units*
- 19- or 23-Inch Rack Mounting
- Up to 2,200W Total Output
- Active Current Sharing
- Universal 85 to 264VAC Input
- Control & Monitoring Features

*RSF, RSG, RSJ, TSF, TSG & TSJ Models

Sigma Series



Chassis Mount



Hot-Swap

1U High, 2U Wide
1.6"H x 3.3"W x 11.0"D
(41 x 84 x 279 mm)



TSGR1U4 Rack/Shelf, 19"



LVD73/23/EEC

TWO-YEAR WARRANTY

Patent Protected

STANDARD MODELS

Delete "T" prefix to model no. for chassis mount version.

OUTPUT VOLTAGE	OUTPUT CURRENT	MAX. OUTPUT POWER	INPUT VOLTAGE	MODEL NUMBER
54.4VDC	12.0A 10.1A 7.4A	653W 550W 400W	85-264VAC	RSJ48/12 RSG48/10 RSF48/7
48VDC	13.5A 11.5A 8.3A	650W 550W 400W	85-264VAC	TSJ7000 TSG7000 TSF7000
27.2VDC	18.4A 12.9A	500W 350W	85-264VAC	RSG24/18 RSF24/13
24VDC	20.8A 14.7A	500W 350W	85-264VAC	TSG5000 TSF5000
13.6VDC	33.0A 22.1A	450W 300W	85-264VAC	RSG12/33 RSF12/22
12VDC	37.5A 25.0A	450W 300W	85-264VAC	TSG3000 TSF3000

NOTE: The table does not show the independent 5V, 100mA standby output which is standard on all models.

CODE	OPTION
-Z	I ² C Serial Data Bus

NOTES:

- Add Option Code as suffix to model no. of module.
- In the case of RSF/RSG/RSJ, only for use with DSC1000 and in Gravitas X75.

SAFETY STANDARDS

UL60950-1
CSA22.2, No. 60950-1
EN60950-1

19-INCH RACK / SHELVES

MAX. NO. MODULES	MAX. POWER	MAX. CURRENT	OUTPUT DC BUS	AC INPUTS	AC INLETS	MODEL NUMBER
4	2,200W	150A	SINGLE	DUAL A/B	4-C14	TSGR1U4A
4	2,200W	150A	SINGLE	DUAL A/B	2-C20	TSGR1U4B
4	2,200W	150A	DUAL A/B	DUAL A/B	2-C20	TSGR1U4C

www.unipowercorp.com

SPECIFICATIONS, 1U x 2U FRONT ENDS/RECTIFIERS

Typical at Nominal 115/230VAC Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Total Output Power, Continuous, Max 300-650 Watts
 Voltage Adjustment Range, Min. ±5%
 Total Regulation¹, 2.0%
 Total Regulation, Standby Supply 5.0%
 Ripple & Noise, Pk-Pk² 1%
 Holdup Time 10mS
 Dynamic Response³ 300µS
 Temperature Coefficient ±0.02%/°C
 Minimum Load 0A
 Overload Protection Auto Recovery
 Overvoltage Protection Latched Shutdown
 Remote Sense Up to 0.25V Per Wire
 Current Share ±10% Full Load Rating
 Standby Output +5V, 100mA
 DC Power Good Signal Logic Low
 AC Power Fail Signal Logic High
 High Inhibit Logic Low
 Enable Logic Low
 Overtemp. Warning Logic High

INPUT SPECIFICATIONS

Input Voltage Range 85-264VAC
 Power Factor 0.99
 Input Frequency 47-63Hz
 Inrush Current Limiting 30A Peak
 Harmonic Distortion EN61000-3-2
 Input Protection Internal Fuse, 10A

GENERAL SPECIFICATIONS

Efficiency⁴ 85-90% at Full Load
 Switching Frequency, PFC Converter 48-110kHz
 Output Converter 275kHz Nominal
 Conducted EMI EN55022 Curve B
 FCC20780 pt 15J Curve B
 Isolation, Class I, min.⁵
 Input-Output 3000VAC
 Input-Ground 1500VAC
 Output-Ground 50VDC
 Input Immunity, Conducted
 Fast Transients, Line-Line ±2kV (EN61000-4-4 Level 3)
 Surges, Line-Line ±2kV (EN61000-4-5 Level 3)
 Surges, Line-Ground ±4kV (EN61000-4-5 Level 4)
 MTBF (Bellcore) 200,000 Hours
 Safety Standards..EN60950, UL160950, CSA22.2 No.60950

ENVIRONMENTAL SPECIFICATIONS

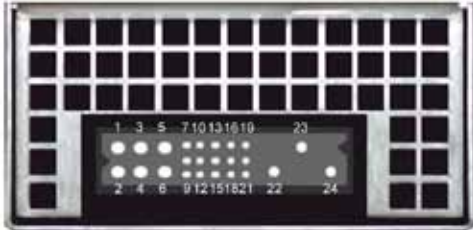
Operating Temperature -20°C to 70°C Ambient
 Derating 2.5% / °C, 50°C to 70°C
 Storage Temperature -40°C to +85°C
 Cooling Integral Ball Bearing Fan

PHYSICAL SPECIFICATIONS

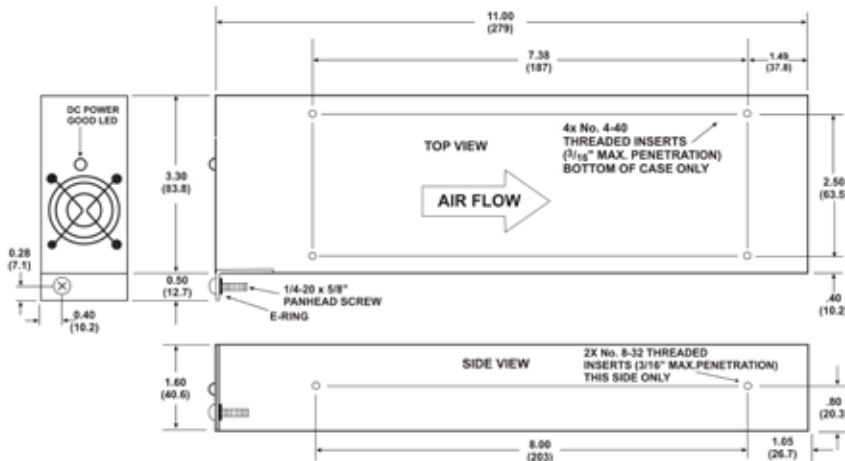
Case Material Aluminum
 Dimensions, Inches(mm) 1.6 H x 3.3 W x 11.0 D
 (40.6 x 83.8 x 279.4)
 Weight 2.10 lbs. (0.95 kg.)

- NOTES:**
1. No load to full load, including line regulation and load regulation.
 2. 20MHz bandwidth. Measure with 0.1µF ceramic and 10µF tantalum capacitors in parallel across the output.
 3. <4% deviation recovering to within 1% for 25% load change.
 4. Typical efficiency is at low end of range for 12V output and at high end of range for 48V output.
 5. Input-output isolation figure is for isolation components only. 100% production Hipot tested.

BACK VIEW
CONNECTOR: POSITRONICS PCIB24W9M400A1
MATE: PCIB24W9F400A1



CASE OUTLINE



NOTE: SF, SG and SJ models do not have bracket and panhead screw.

PIN CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	+V Out	13	Module Present
2	+V Out	14	GA1
3	- V Out	15	AC Power Fail
4	- V Out	16	V Trim
5	+ Sense	17	Overtemp. Warning
6	- Sense	18	Current Share
7	Enable	19	Current Monitor
8	GA2	20	+5V Standby
9	GA0	21	DC Power Good
10	Inhibit	22	Chassis Ground
11	SDA	23	AC Line
12	SCL	24	AC Neutral

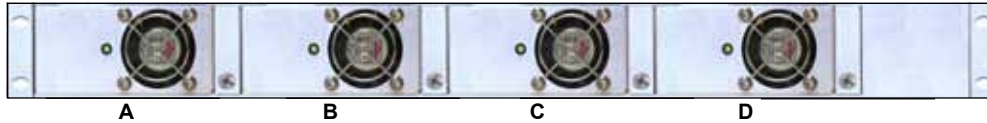
NOTES: For unit to operate, pin 7 must be at logic LO or shorted to pin 6. For proper operation the following pins must be connected together: + V Out pins (1&2); -V Out pins (3&4). Pins 8, 9, 11, 12 & 14 are I²C signals when that option is present. The +5V standby return is to -Sense (pin 6). All signals are referenced to -Sense (pin 6).

MATING INTERFACE BOARD

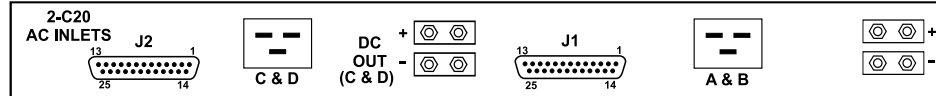
Order Kit Number
 009-3901-0000

ALL DIMENSIONS IN INCHES (mm).
 All specifications subject to change without notice.

SPECIFICATIONS, TSGR1U4 RACKS/SHELVES, 19-INCH

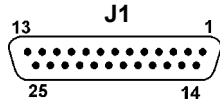

FRONT VIEW
**SINGLE BUS
DC OUT
DUAL A/B AC IN**

**DC OUT TSGR1U4A
BACK VIEW**
**SINGLE BUS
DC OUT
DUAL A/B AC IN**

**DC OUT TSGR1U4B
BACK VIEW**
**DUAL A/B BUS
DC OUT
DUAL A/B AC IN**

**DC OUT TSGR1U4C
(A & B) BACK VIEW**

RACK/SHELF DEPTH IS 13.88 INCHES (353 MM). THERE ARE PLASTIC SAFETY COVERS OVER THE DC OUTPUT BUS BARS.

SINGLE DC OUTPUT BUS


 Standard 25-Pin
Subminiature D Connector

J1 SIGNAL CONNECTOR			
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	AC Power Fail - A
2	N.C.	15	DC Power Good - A
3	Overtemp. Warn. - A	16	AC Power Fail - B
4	Overtemp. Warn. - B	17	DC Power Good - B
5	Overtemp. Warn. - C	18	AC Power Fail - C
6	Overtemp. Warn. - D	19	DC Power Good - C
7	V Adjust - D	20	AC Power Fail - D
8	+5V Standby	21	DC Power Good - D
9	SDA	22	-Sense
10	Current Share	23	-Sense
11	+Sense	24	V Adjust - A
12	V Adjust - B	25	V Adjust - C
13	SCL		

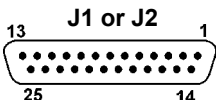
MAXIMUM RATED OUTPUT FOR 4 MODULES

MODULES	NON-REDUNDANT	3+1 REDUNDANT
RSG12/33	13.6VDC @ 132.0A 1800W	13.6VDC @ 99.0A 1350W
RSG24/18	27.2VDC @ 73.6A 2000W	27.2VDC @ 55.2A 1500W
RSJ48/12	54.4VDC @ 48.0A 2611W	54.4VDC @ 36.0A 1958W
TSG3000	12.0VDC @ 150.0A 1800W	12.0VDC @ 112.5A 1350W
TSG5000	24.0VDC @ 83.2A 2000W	24.0VDC @ 62.4A 1500W
TSJ7000	48.0VDC @ 54.0A 2611W	48.0VDC @ 40.8A 1958W

AC LINE CORDS: Order by Part No.

V/A	TSGR1U4 SUFFIX	NEMA PLUG	LENGTH FT/M	PART NO.
125/15	A	5-15	6/1.83	364-1412-0000
125/20	B, C	5-20	8/2.44	364-1416-0000
250/15	A	6-15	6/1.83	364-1414-0000
250/20	B, C	6-20	8/2.44	364-1413-0000

DUAL DC OUTPUT BUSES


 Standard 25-Pin
Subminiature D Connector

J1 or J2 SIGNAL CONNECTORS			
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	AC Power Fail - A or C
2	N.C.	15	DC Power Good - A or C
3	Overtemp. Warn.- A or C	16	AC Power Fail - B or D
4	Overtemp. Warn.- B or D	17	DC Power Good - B or D
5	—	18	—
6	—	19	—
7	—	20	—
8	+5V Standby	21	—
9	SDA	22	-Sense
10	Current Share	23	-Sense
11	+Sense	24	V Adjust - A or C
12	V Adjust - B or D	25	—
13	SCL		

Rack Adaptor Modules: Order by Part No.

Type	Function	PART NO.
Relay Adaptor	Converts TTL level DC Good signal to Form-C dry contact. (See separate datasheet for details.)	009-1005-0000
I ² C Adaptor	Required when using RSF/RSG Series rectifiers with DSC1000 Controller. Specify Z option for rectifier modules. (See DSC1000 Manual for full details.)	009-1001-0000

NOTES:

- All connections are made to the rear of the rack/shelf. The TSGR1U4A has one C14 AC inlet per module. The "B" and "C" rack versions have one C20 AC inlet per two modules.
- Standby return is connected to -Sense lead. Current rating of +5V standby is 100mA. All signals are referenced to -Sense lead.
- Module A is on the left and module D on the right, as seen from the front of the rack/shelf. From the rear, the rightmost AC inlet(s) go to modules A & B as shown.
- For rack/shelf "A" and "B" versions, all four module DC outputs are connected in parallel. For the "C" version, module A and B outputs are paralleled and module C and D outputs are paralleled. Module A & B signals go to J1; module C & D signals go to J2.
- All racks/shelves come with universal mounting brackets for 19- or 23-inch rack mounting.
- For details on the I²C function (option Z), contact the factory. I²C signals are on J1 & J2 pins 9 & 13.