



**OPERATING MANUAL
RANGER SERIES
FRONT-ENDS & RECTIFIERS**

www.unipowerco.com

Manual No. ranger-2
ranger-man-rev2-0414.indd

**© 2014 UNIPOWER LLC
All Rights Reserved**

Contents

1.0	INTRODUCTION	4
2.0	STANDARD FEATURES	5
3.0	SUMMARY OF PRODUCT LINE	5
4.0	SAFETY WARNINGS.....	6
5.0	WARRANTY (summary)	6
6.0	UNPACKING AND INSPECTION.....	6
7.0	MODULE SPECIFICATIONS	7
8.0	FRONT PANEL DESCRIPTION	7
9.0	DESCRIPTION OF OPERATION	8
10.0	MECHANICAL SPECIFICATIONS.....	10
11.0	SAFETY AND INDUSTRY STANDARDS.....	11
13.0	PARALLEL OPERATION	14
14.0	MODULE INSTALLATION	15
15.0	COMPATIBLE POWER SHELVES.....	16
16.0	MECHANICAL DIMENSIONS	18
17.0	SHELF INSTALLATION.....	19
18.0	MAINTENANCE	19
19.0	SETUP AND TESTING	20
20.0	TROUBLESHOOTING GUIDE	21

FIGURES

Figure 1	19" (3-bay) & 23" (4-bay) Power Shelves with Modules.....	4
Figure 2	Front Panel View.....	7
Figure 3	Ranger Module Dimensions	10
Figure 4	Ranger Module Connector Detail	12
Figure 5	Connection Diagram for Parallel Operation (3 modules).....	14
Figure 6	RRS2U-23 Rear View.....	16
Figure 7	AC & Ground Connections.....	17
Figure 8	DC Bus Bar Connections	17

OPERATING MANUAL

Ranger SERIES FRONT-ENDS & RECTIFIERS

1.0 INTRODUCTION

This Operating Manual should be read through carefully before installing and operating the Ranger Series Front-Ends & Rectifiers.

Ranger Series are hot-swappable, modular front-ends and rectifiers which produce up to 2720 watts output. There are 15 different models with different output voltages and power levels. Companion 19-inch and 23-inch shelves hold up to three or four modules respectively allowing operation in 2+1 or 3+1 redundant mode. The modules have automatic load sharing and output ORing diodes so they can be hot-swapped while the system is operating. Module output voltage can be controlled by 0V to +5V analog input.

Green LEDs indicate AC and DC power good. The rectifiers also have control and monitoring features and a +5V standby output. Operating temperature range is -20°C to +70°C.

Figure 1 below shows a Ranger module and three modules installed into one of the power shelves.

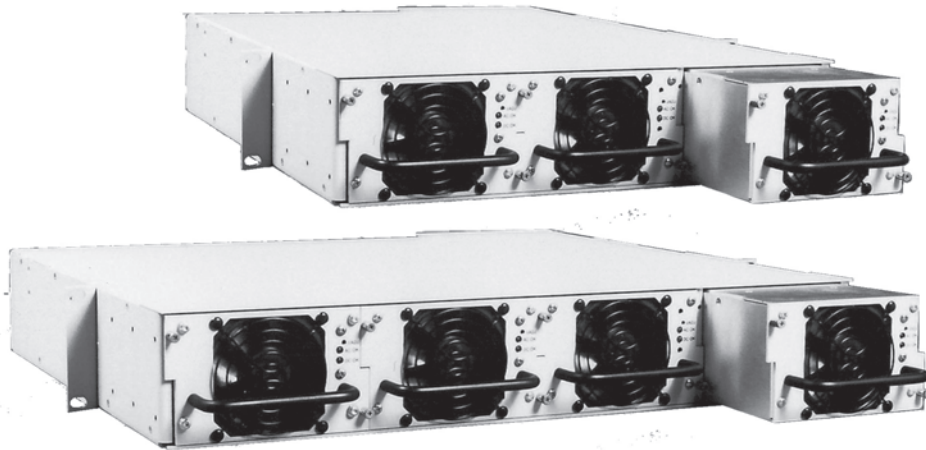


Figure 1 - 19" (3-bay) & 23" (4-bay) Power Shelves with Modules

2.0 STANDARD FEATURES

- ◆ 2U- High: 1.72”
- ◆ -20°C to +70°C Operation
- ◆ 85 to 264VAC or 100 to 420VDC Input
- ◆ Up to 2720W Module Output
- ◆ Up to 10880W Shelf Output
- ◆ >0.98 Power Factor
- ◆ Output Voltages: 12VDC to 54.4VDC
- ◆ 87% Efficiency
- ◆ Power Density to 11W/Cu. Inch
- ◆ Hot Swappable
- ◆ Integral ORing Diodes
- ◆ Class B EMI Filter
- ◆ LED Indicators
- ◆ I²C Serial Data Option
- ◆ 19- or 23-Inch Rack Mounting

3.0 SUMMARY OF PRODUCT LINE

3.1 Standard Modules

FRONT-END / RECTIFIER MODULES

MAX. POWER	OUTPUT VOLTAGE	OUTPUT CURRENT	AC INPUT VOLTAGE ¹	AC INPUT CURRENT ²	MODEL NO. ³
2720W 1360W	54.4VDC	50.0A 25.0A	170-264V 85-264V	14.3A 14.2A / 7.1A	RRSI48/50 RRPI48/25
2500W 2000W 1200W	48.0VDC	52.1A 41.7A 26.0A	170-264V 170-264V 85-264V	13.1A 10.4A 12.5A / 6.25A	TRSI7000 TRRI7000 TRPI7000
2500W 2000W 1200W	28.0VDC	89.3A 71.4A 44.6A	170-264V 170-264V 85-264V	13.1A 10.4A 12.5A / 6.25A	TRSI6000 TRRI6000 TRPI6000
2720W 1360W	27.2VDC	100.0A 50.0A	170-264V 85-264V	14.3A 14.2A / 7.1A	RRSI24/100 RRPI24/50
2500W 2000W 1200W	24.0VDC	41.7A 29.2A 21.9A	170-264V 170-264V 85-264V	13.1A 10.4A 12.5A / 6.25A	TRSI5000 TRRI5000 TRPI5000
1360W 1200W	13.6VDC 12.0VDC	100.0A 104.2A	85-264V 85-264V	14.2A / 7.1A 12.5A / 6.25A	RRPI12/100 TRPI3000

Notes:

1. Below 90VAC input, derate output power by 10%.
1200W & 1360W units will also operate from 100-420VDC. Other units are limited to 200-420VDC.
2. Input currents shown are nominal values at 120VAC/240VAC as appropriate.
3. To specify I²C Serial Communications append -Z to the model number. Specify also on shelf.
In the case of RRSI & RRPI, only for use with the DSC1000.

3.2 Power Shelves

SHELF SYSTEMS

MAX. POWER	DESCRIPTION	MAX. CURRENT	MODEL NO. ^{1,2}
10880W	4-Bay, Terminal Block AC Connection	400A	RRS2U-23
8160W	3-Bay, Terminal Block AC Connection	300A	RRS2U-19

Notes:

1. Blanking panel for unused position, order pt. no. 256-1652-0000.
2. To specify I²C Serial Communications append -Z to the model number.
Required for modules with -Z option fitted.
In the case of RRSI & RRPI, only for use with the DSC1000.

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 (summary)

Ranger Series Front-Ends and Rectifiers are warranted for three (3) 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.

For a complete text of UNIPOWER's warranty conditions please request a copy from your local Sales Office.

6.0 UNPACKING AND INSPECTION

- 6.1 This unit was carefully tested, inspected and packaged for shipment from our factory. Upon receipt the unit should be carefully unpacked and inspected for any damage in shipment.
- 6.2 If there is evidence of damage, do not attempt to install the unit. The freight carrier should be notified immediately and a claim for the cost of the unit 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 LLC 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 this unit without proper packing.

7.0 MODULE SPECIFICATIONS

The following specifications are typical at 25°C unless otherwise noted.

INPUT

Voltage Range	See Model Table
Power Factor	>0.98
Total Harmonic Distortion, Max.	5%
Frequency	47-63Hz
Inrush Current Limiting, Max.	25A Peak
EMI Filter, Conducted	FCC20780 pt. 15J Curve B EN55022 Curve B
Fast Transients	EN61000-4-4
Surges	EN61000-4-5
Remote Adjust	0 to +5V
Input Protection ¹	Internal Fuse

OUTPUT

Current & Voltage	See Table
Output Power	1200-2720W
Voltage Adjustment Range	±10%
Standby Output	+5V@100mA
Line & Load Regulation, Max.	1%
Holdup Time	20msec.
Overvoltage Protection	Latch Off
Filtering: Wideband Noise, 20MHz BW	
48V/54.4V	500mV pk-pk
24V/27.2V	250mV pk-pk
12V/13.6V	125mV pk-pk
Current Limit	105-110% Rated Current
Efficiency	85-87%

SAFETY

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

STATUS INDICATORS

AC GOOD	Green LED
DC GOOD	Green LED

ALARM SIGNALS (Logic LO, TTL compatible)

ACOK	AC present, 5V standby operating
DCOK	output within -10% of nominal @ 48, 24 or 12VDC

SERIAL COMMUNICATIONS

I ² C	Optional, append add -Z to model number
------------------------	---

ENVIRONMENTAL

Operating Temp. Range	-20°C to +70°C
.....	-40°C start-up, reduced performance
Output Current Derating	2.5%/°C, 50°C to 70°C
Storage Temp. Range	-40°C to + 85°C
Environment	Pollution Degree 2
Humidity	0% to 95%, Non-Condensing
ESD	Bellcore GR-1089-Core and EN61000-4-2
MTBF, 35°C (Bellcore)	200,000 Hours
Cooling	Integral Ball Bearing Fans

PHYSICAL SPECIFICATIONS

Case Material	Aluminum
Case Dimensions, Inches (mm)	3.3 H x 4.9 W x 13.1 D (84 x 124 x 333)
Weight	10.15 lbs. (4.6 kg.)

Notes:

1. External protection required when operating from HVDC.

8.0 FRONT PANEL DESCRIPTION

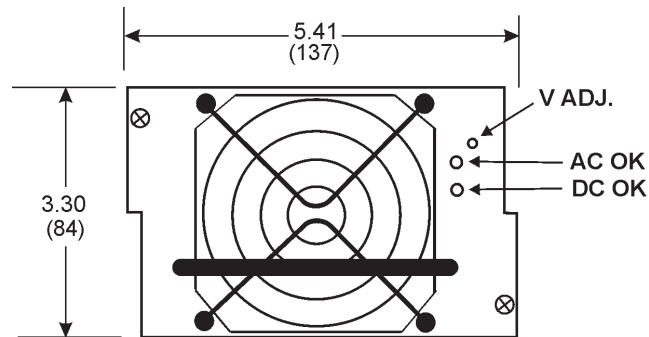


Figure 2 - Front Panel View

8.1 FRONT PANEL INDICATORS

The two green front panel indicators together indicate the status of the power module.

The top hand LED represents the ACOK signal and will mimic the state of this signal.

The bottom hand LED represents the DCOK signal and will mimic the state of this signal.

For normal operation both LEDs should be illuminated.

9.0 DESCRIPTION OF OPERATION

9.1 Power Outputs

The power output terminals provide the main output power of the unit. The output voltage is adjustable by means of a potentiometer accessible through the front panel of the module or by using the analogue remote adjust pin. Note that all of the power pins must be used for correct operation and to avoid overheating of the connector. The power output terminals are isolated from chassis ground to a maximum voltage of 2000Vdc.

9.2 I/O Signals

The # symbol in the following text is used to denote an active low signal.

9.2.1 Sense +Ve, Sense -Ve

The sense signals are intended to be connected to the point of load so that voltage drop in the load cables can be compensated for. The amount of compensation is limited to 0.5V per wire. Care must be taken when using the sense signals as if the power connections to the load are interrupted by disconnection or circuit breaker with the senses still connected then damage may occur to the power supply and sense wiring. Sense +Ve and Sense -Ve are internally connected to the module output power terminals using 10 Ohm resistors so that if the senses are not connected the output will still be regulated.

9.2.2 Current Share

This is an analog control signal, made up of the current share signals of all modules connected together. Output currents between modules are shared within an accuracy of 10% of full load current over a 50% to 100% load range. The return path for this signal is -Ve Sense which should also be connected between all modules for correct sharing operation.

9.2.3 Current Monitor

This analogue signal provides a voltage proportional to the output load current of the module. The return path for this signal is -Ve Sense. The full scale voltage for nominal full load current is 5.0V. The return path for this signal is -Ve Sense.

9.2.4 Remote Adjust

This signal can be used to adjust the output voltage. The return path for this signal is -Ve Sense.

A zero to +5V input represents approximately 45 to 58V output for a 48V/54.4V module, 22.5 to 29V for a 24V/27.2V module or 11.5 to 14.5 for a 12V/13.6V module. This input should be driven from a source impedance less than 100 ohms.

If remote adjust is not required, the pin can be left open circuit.

9.2.5 +5V Standby

This is the standby supply. The 5V supply is always present when the AC is within the operating range of the module. The maximum current available from is 100mA. The return for this power rails is Sense -Ve. This standby supply has an internal ORing diode so that it may be connected together with other 5V standby rails directly on the backplane.

9.2.6 #AC Good

A logic LO (sinks 2mA) indicates the AC input is present and the PFC converter stage has output. A logic HI indicates AC input or PFC converter failure. The return path for this signal is -Ve Sense. The AC Good signal will give typically 2ms of warning at full load before the output loses regulation. This signal is internally pulled up to +5V via a 10k resistor. To ensure correct functioning it should be pulled up externally to +5V Standby via a 2k2 resistor.

9.2.7 #DC Good

This signal provides an output that indicates that the DC output voltage is below a defined threshold. This level is nominally 90% of the nominal output voltage. A logic LO (sinks 2mA) indicates that the unit is operating properly with output voltage in its controllable range. The return path for this signal is Sense -Ve. This signal is internally pulled up to +5V via a 10k resistor. To ensure correct functioning it should be pulled up externally to +5V Standby via a 2k2 resistor.

9.2.8 #Thermal Alarm/Warning

A logic HI is normal. A logic LO (sinks 2mA) indicates thermal shutdown and occurs 100 msec. before the module shuts down. The return path for this signal is Sense -Ve. This signal is internally pulled up to +5V via a 10k resistor. To ensure correct functioning it should be pulled up externally to +5V Standby via a 2k2 resistor.

9.2.9 Enable/Interlock

This signal is used to enable the power supply. It has a short pin on the connector and is intended to control hot-plugging to avoid burning connector pins caused by arcing of high currents. The return path for this signal is Sense -Ve. The Enable pin **MUST** be connected to sense -Ve on the backplane for correct operation.

9.2.10 #Inhibit

A logic LO (sinking 5mA) or a short to -Sense signal on this pin will turn the main output off.

10.0 MECHANICAL SPECIFICATIONS

The mechanical dimensions of the Ranger module are shown below.

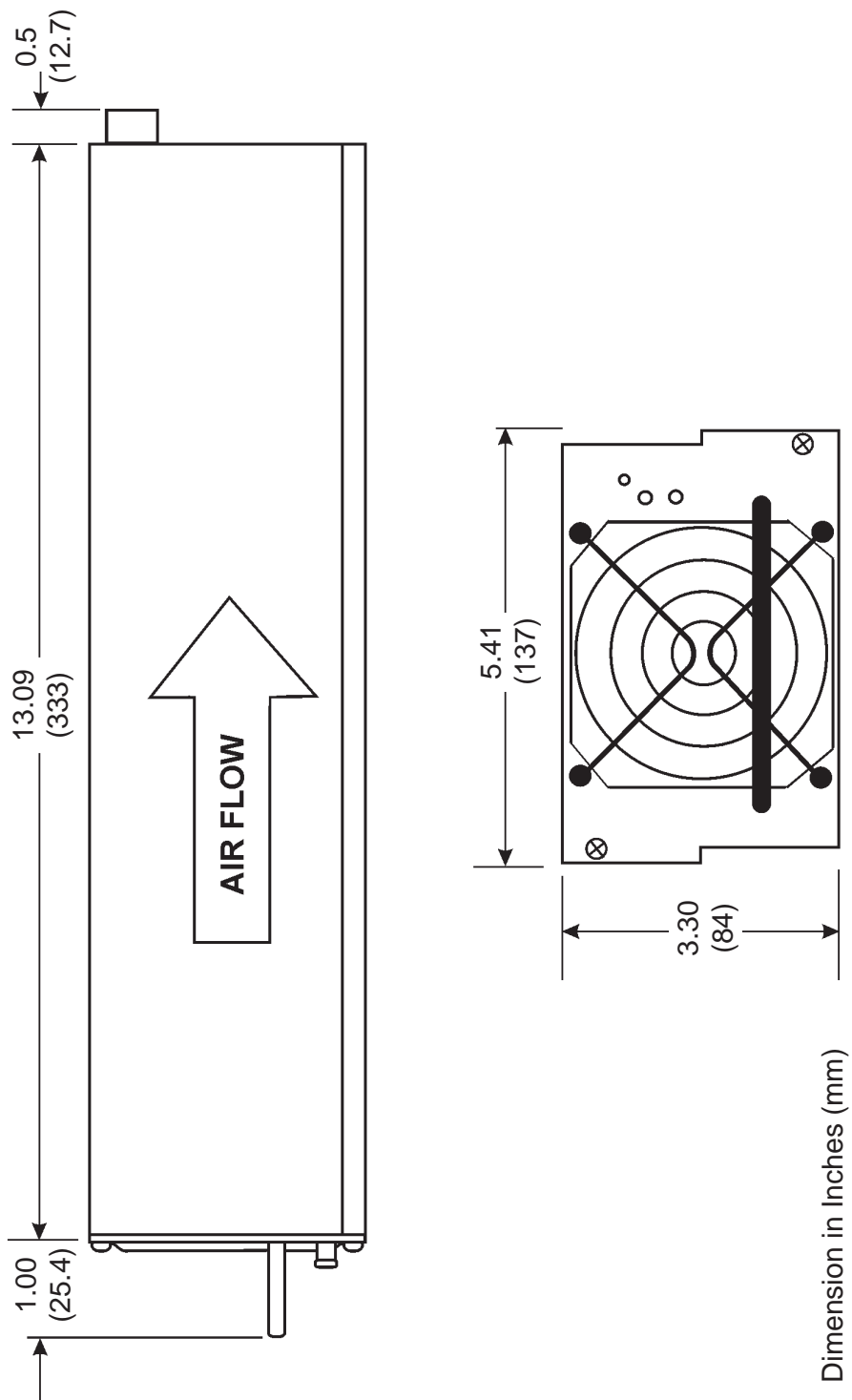


Figure 3 - Ranger Module Dimensions

11.0 SAFETY AND INDUSTRY STANDARDS

11.1 Ranger modules and power shelves meet the following safety standards:

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

11.2 Ranger modules and power shelves are CE Marked to indicate conformance with the European Union's Low Voltage Directive.

11.3 Input conducted EMI meets FCC20780 part 15J Curve B and EN55022 Curve B.

11.4 Input harmonics, meets EN61000-3-2 Class D

11.5 Immunity, meets the following:

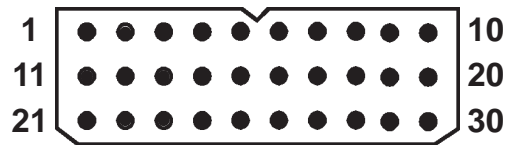
Input fast transients, line to line – EN61000-4-4, level 3, criteria A
Input surges, line to line – EN61000-4-5, level 3, criteria A
Input surges, line to ground – EN61000-4-5, level 4, criteria A
ESD – EN61000-4-2, level 4, criteria A
Radiated – EN61000-4-3, criteria A (10V/m)
Dips, Interruptions & Variations – EN61000-4-11, criteria B/C

12.0 OPERATING INFORMATION

12.1 Input Voltage and Connection - The Ranger Series operates from worldwide AC input voltages in the range of 85 to 264 VAC (1200/1360W units) or 180-264VAC depending on model at 47 to 63 Hz. The three-wire AC connection is made to pins 1, 12 & 21 on the rear mounted Positronic connector. See the connector diagram and Pin Connections table in Figure 4.

1200/1360W units will also operate from 100-420VDC while the remainder will operate from 200-420VDC.

12.2 Output Connections - The main output is provided on pins 1 to 6 on the connector. Three pins (1 to 3) are connected together internally for the +V Out; three other pins (4 to 6) are connected together internally for the V Return. The output is fully floating and may be configured for positive or negative operation.



Positronics PLC30M8000

Mating Connector: PLC30F7000

Order Kit No.: 775-1427-0000

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	AC Neutral	11	N.C.	21	AC Line
2	N.C.	12	AC Ground	22	N.C.
3	+5V 100mA Aux.	13	-Sense	23	Current Monitor
4	DC Good	14	AC Good	24	Thermal Warning
5	Inhibit	15	Enable/Interlock	25	Current Share
6	+Sense	16	-Sense	26	Remote Adjust
7	-DC Out	17	-DC Out	27	-DC Out
8	-DC Out	18	-DC Out	28	-DC Out
9	+DC Out	19	+DC Out	29	+DC Out
10	+DC Out	20	+DC Out	30	+DC Out

Figure 4 – Ranger Module Connector Detail

Notes:

1. For proper operation all +DC Out pins must be connected together and all -DC Out pins must be connected together.
2. For unit to operate, pin 15 must be at logic LO or shorted to pin 16.

12.3 Output Voltage - The output voltage is factory set to its nominal value to an accuracy of $\pm 1\%$. The voltage can be adjusted to any value within the range $\pm 10\%$ of nominal using the trim potentiometer or the remote adjust input (section 9.2.4).

12.5 Output Power & Current - The table on page 5 shows the maximum output power and current ratings for the various models.

When the output voltage is adjusted below the nominal voltage shown in the table the maximum current indicated will apply. Conversely, when the output voltage is adjusted above the nominal voltage shown the maximum power indicated will apply.

The maximum output power may be drawn up to $+50^{\circ}\text{C}$ air inlet temperature. Above $+50^{\circ}\text{C}$ the total output power must be derated by $2.5\%/^{\circ}\text{C}$, up to an absolute maximum air inlet temperature of $+70^{\circ}\text{C}$. Note that dependent on actual airflow through the unit output power may be further limited or a temperature alarm indicated at lower temperatures.

12.6 Overvoltage Protection - The power supply has a fixed internal O.V.P. protection circuit. The O.V.P. level is approximately 130% of the nominal output voltage.

12.7 Overcurrent and short circuit protection - The power supply will provide a constant current limit in the event of an overload on the output.

12.8 Remote Sensing - Remote sensing connections are made to pins 6, 13 and 16 on the connector. Remote sensing is not available on the +5V Standby 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 6) must be connected to the +Ve side of the load and the - Sense lead (pin 13 or 16) to the -Ve side of the load. The sense leads should be a color-coded, twisted pair of AWG no. 22 or 24 copper wire.

Remote sensing can compensate for a total voltage drop of 1V, or 0.5V 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 unit.

12.9 Alarm, Control & Supervisory Signals – All alarm, control and supervisory signals are available on the connector at the rear of the unit. See section 9.2 for a complete description.

All logic signals are TTL level compatible are referenced to -Ve Sense.

13.0 PARALLEL OPERATION

- 13.1 Parallel Connection** - Two or more Ranger modules can be operated in parallel by connecting their outputs in parallel and connecting their current share terminals together (pin 25). The Ranger 19-inch rack power shelves permit conveniently operating two or three units in parallel in either redundant mode or non-redundant mode while the 23-inch shelves permit two, three or four.
- 13.2 Redundant Operation** - Connecting two Ranger modules in parallel, with or without the compatible 19-inch or 23-inch rack, so that the full output load current can be carried by one unit results in 1+1 redundant operation. While operating normally, the load current is shared approximately equally between the two units. Should one Ranger module fail, the full load is then maintained by the other unit. The failed unit can then be replaced (hot-swap) without affecting the load current. This operation is facilitated by an ORing diode built into the module. 1+1 redundancy with quick replacement of a failed unit results in virtually infinite MTBF. 2+1 redundancy works the same way except that the full load is carried by two out of three units respectively.
- 13.3 Non-Redundant Operation** - Higher output load currents can be realized by operating two or three modules in the non-redundant mode to achieve up to 5440 watts for two modules or 8160 watts for three modules or 10880 watts for four modules. 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 module(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.

The number of Ranger modules that can be operated in parallel is 16. The most convenient way to parallel large numbers of units is to connect multiple Ranger power shelves in parallel.

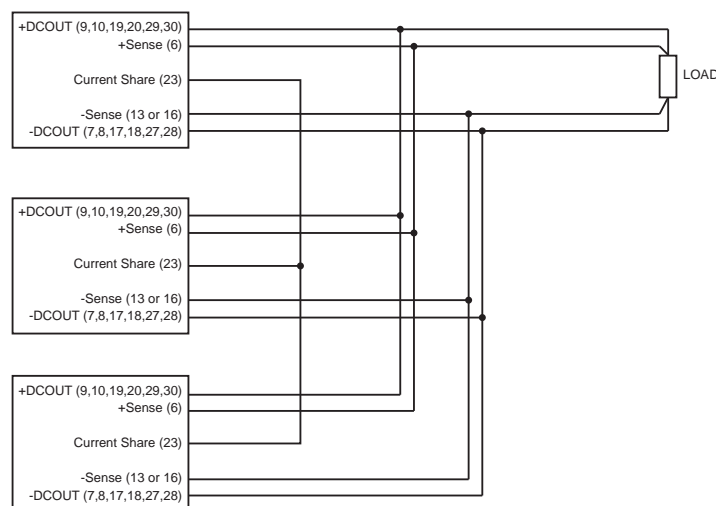


Figure 5 – Connection Diagram for Parallel Operation (3 modules)

14.0 MODULE INSTALLATION

Ranger Series modules are designed for mounting into the Ranger Series power shelves or similar OEM housing. Fixing in place is achieved by means of two captive screws.

For non hot-swap applications we recommend the GR Series Bulk Power Front-Ends. See the [datasheet](#) or call sales for details.

15.0 COMPATIBLE POWER SHELVES

There are two compatible power shelves offering various input connections. These power shelves have the following features:

- Standard 19-Inch or 23-Inch Rack-Mounting
- 2U High
- Hot-Swap Operation
- Holds up to three (19-Inch) or four (23-Inch) Ranger Modules

15.1 Ordering Guide

SHELF SYSTEM ORDERING GUIDE

MAX. POWER	DESCRIPTION	MAX. CURRENT	MODEL NO. ^{1,2}
10880W	4-Bay Terminal Block AC Connection	400A	RRS2U-23
8160W	3-Bay Terminal Block AC Connection	300A	RRS2U-19

Notes:

1. Blanking panel for unused position, order pt. no. 256-1652-0000.
2. To specify I²C Serial Communications append **-Z** to the model number.
Required for modules with -Z option fitted.
In the case of RRSI & RRPI, only for use with the DSC1000.

15.2 Connection Details – A rear view of the RRS2U-23 is shown in figure 7 below.

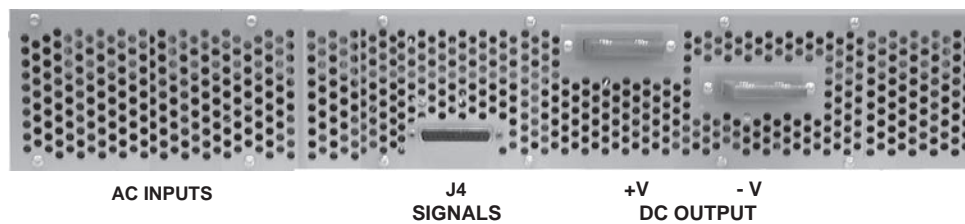


Figure 6 – RRS2U-23 Rear View

AC inputs are supplied separately to each module via terminal block connections which are behind a safety cover which is removed using four screws. Detail of these connections and the safety ground are shown in figure 8. The 4-bay RRS2U-23 provides four Live and Neutral connections as shown while the RRS2U-19 has only three.

For HVDC input applications the +Ve should be connected to the L terminals and the –Ve should be connected the N terminals for each module respectively.

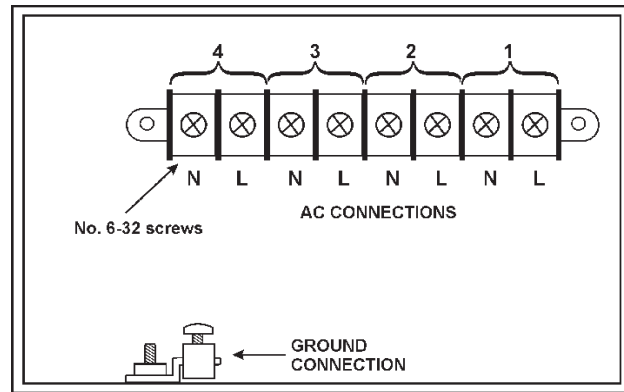


Figure 7 – AC & Ground Connections

The DC output is supplied on a two bus bars. The maximum capacity of these bus bars is 400A. Details are shown in figure 9.

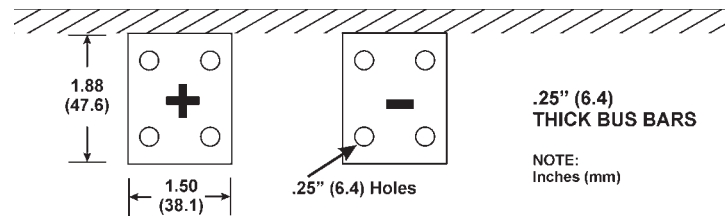
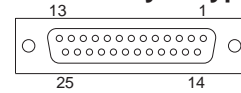


Figure 8 – DC Bus Bar Connections

J1 is a 25-way D-type socket providing the alarm, control and supervisory signals. The following table and figure show the pinout for these connectors. Details of each pin function can be found in section 9.2.

PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	AC Good-1
2	Thermal Alarm-1	15	DC Good-1
3	Current Monitor-1	16	AC Good-2
4	Thermal Alarm-2	17	DC Good-2
5	Current Monitor-2	18	AC Good-3
6	Thermal Alarm-3	19	DC Good-3
7	Current Monitor-3	20	AC Good-4*
8	Thermal Alarm-4*	21	DC Good-4*
9	Current Monitor-4*	22	N.C.
10	Current Share	23	-Sense
11	+Sense	24	Remote Adjust - 1
12	Remote Adjust - 2	25	Remote Adjust - 3
13	Remote Adjust - 4*		

J1 – 25-Way D-Type



* These pins are used only on the RRS2U-23. On the RRS2U-19 they are No Connection.

16.0 MECHANICAL DIMENSIONS

MODEL NUMBER	HEIGHT	WIDTH	TOTAL DEPTH
RRS2U-19	3.5"	17.2" (437mm)	19.9"
RRS2U-23	(89mm)	21.2" (538mm)	(505mm)

All shelves are supplied with mounting kits for 19" and 23" relay racks / cabinets as appropriate.

17.0 SHELF INSTALLATION

17.1 Mounting - Ranger Series rack-mount power shelves are provided with rack- brackets that allows them to be mounted into a 2U high space in either 19-inch or 23-inch racks as appropriate. The brackets can be located at various positions in the side of the shelf to allow for offset mounting in the rack.

17.2 Input Power Connections – Input power connections are made to the Terminal Blocks (AC or HVDC) mounted at the rear of the power shelf. Each module position has its own input connector or terminals. The minimum suitable cable size for these connections is 14AWG or equivalent. It is recommended that each input feed is protected by its own circuit breaker. Once connections have been made the safety covers should be re-fitted.

17.5 DC Output Connections – DC output connections are provided at the rear of the power shelf on two bus bars. The output polarity can be configured either positive or negative as desired. DC cables should be rated to handle at least 400A.

17.5.1 Connecting Multiple Shelves in Parallel - Up to four power shelves can be connected together to create higher capacity power systems than can be achieved with a single shelf.

17.6 Signal Connections – These connections are made to the D-type connector described in section 15. Wire size for all signal connections should be 22-24AWG.

17.6.1 Connecting Multiple Shelves in Parallel - To ensure proper power sharing between parallel connected power shelves it is important to make sure that current share and –Ve Sense are connected between each shelf. See sections 13.3 for details.

17.7 Cooling – The Ranger power modules incorporate DC ball bearing fans. Airflow is from the front to rear with exhaust ventilation holes at the rear of the power shelf. To minimise obstruction to ventilation there should be a minimum of 3 inches (76mm) free space behind and in front of the power shelf when it is installed in the rack. UNIPOWER also recommends that any equipment mounted directly above the Ranger power shelf should be shorter in overall depth so as to not obstruct any ventilation holes in the top surface.

18.0 MAINTENANCE

No routine maintenance is required on the Ranger series except for periodic cleaning of dust and dirt around the front ventilation grill. A small vacuum nozzle should be used for this purpose.

19.0 SETUP AND TESTING

- 19.1** The Ranger can be initially tested mounted in a rack or on a test bench. If two or more units are to be tested in a rack, they should first be individually tested one position of the rack.
- 19.2** With the input power source turned off, connect input power wires to the module mating connector or in the case of a power shelf the terminal block on the position of the rack being used. Make sure that the safety ground wire is connected. Do not touch the output terminals when input power is present.
- 19.3** Connect a resistive power load across the proper output pins, terminals or bus bars. The load should be 20% to 50% of the 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.
- 19.4** Connect a color-coded, twisted pair (22 or 24AWG) from the remote sense pins to the load. The +Ve Sense must go to the positive side of the load and the –Ve Sense to the negative side of the load. Also connect the Enable/Interlock pin to the -Ve Sense. This must be done for the unit to operate. When using a power shelf, the Enable pin is automatically connected to -Ve Sense. The units are then controlled by the Inhibit inputs.
- 19.5** **Checking Front Panel LEDs** - With the Ranger module on the bench or in the power shelf, turn on (or plug in) the power source. Both LEDs should be on.
- 19.6** **Checking the Output Voltage** - Measure the output voltage at its load with a digital voltmeter. The voltage should be within $\pm 1\%$ of its nominal value.
- 19.7** **Checking the Inhibit Input** - Unplug the input power source. Connect a wire from the Inhibit input to –Ve Sense. Turn the input power source back on. The left ACOK LED should be on and the right DCOK LED should remain off. Check the output voltage with a digital voltmeter. It should read zero volts.
- 19.8** **Checking the AC OK and DC OK Signals** - Next check the voltage on the AC OK pin with respect to –Ve Sense. The voltage should be a logic LO, +0.5V or less. Finally, check the voltage on the DC OK pin with respect to –Ve Sense. The voltage should be a logic HI, approximately +5V. These signals need pull-up resistors to 5V Standby using 10K Ohm resistors.
- Disconnect the wire between the Inhibit and –Ve Sense pins. The bottom DCOK LED should turn on. Check the output voltage on the DC OK pin as described above. The voltage should be a logic LO, +0.5V or less.
- 19.9** **Testing other Ranger modules** - For a power shelf with two, three or four Ranger modules, the other modules should be plugged into the rack and tested in the same manner as above in Sections 19.2 to 19.8.

- 19.10 Testing the Complete Power System** - With the input power source off or disconnected, insert all Ranger modules into the power shelf. Connect a resistive power load of approximately 80% of full load value for a single Ranger across the output. Connect a color-coded, twisted pair of remote sense leads to the load, being careful to connect the correct polarity.
- 19.11** Turn on or plug in the input power source. Check the voltage across the load with a digital voltmeter. The voltage should be within about $\pm 1\%$ of its nominal value. Both LEDs should be on for all units.
- 19.12** While the rack is operating, disengage one module and check the output voltage. It should be very close to the previous value and the LEDs should be on for the remaining modules which are now carrying the load. Re-insert the module and repeat the procedure by disengaging and re-engaging the other modules in turn. The complete power shelf has now been shown to operate properly in the redundant mode with hot swapping. Disconnect the input power source.

20.0 TROUBLESHOOTING GUIDE

If you encounter difficulties in getting the rectifier modules or shelf to operate properly, go through the following troubleshooting guide.

SYMPTOM	POSSIBLE CAUSE	ACTION TO TAKE
No output, AC Good and DC Good LEDs off.	No input power.	Check connection to AC source. Check AC source circuit breakers.
No output, DC Good LED off, AC Good LED on.	Inhibit in OFF mode.	Make sure J1 Pin 1 (Inhibit) open and not connected to Pin 23 (-Sense) or output ground.
No output, DC Good LED off, AC Good LED on.	Shorted output.	Check for short and remove.
No output, DC Good LED off, AC Good LED on.	Overvoltage protection (OVP) has latched.	Reset output by cycling the AC input OFF for 20 seconds, and then back ON.
No output, DC Good LED off, AC Good LED on.	Overtemperature protection is activated on one or more rectifier modules.	Check the Thermal Alarm output of each module for a logic LO, indicating activated thermal protection. Allow module to cool down for about 10 minutes. Check to see if the cooling fans are operating.
No output, DC Good LED off, AC Good LED on.	Output load is too great for the number of rectifier modules.	Reduce load to proper level.

If none of the above actions solves the problem, call UNIPOWER for help and try to resolve the problem over the telephone:

US: + 1 954-346-2442

UK: +44 1903 768200

This document is believed to be correct at time of publication and UNIPOWER LLC accepts no responsibility for consequences from printing errors or inaccuracies. Specifications are subject to change without notice.

RANGER SERIES

AC & HVDC INPUT

FRONT-ENDS & RECTIFIERS

DESCRIPTION

RANGER Series are hot-swappable, modular rectifiers and Front-Ends which produce up to 2720W. Rectifiers versions provide 25 or 50 Amperes at 54.4VDC (48V versions), 50 or 100 Amperes at 27.2VDC (24V versions) or 100 Amperes at 13.6VDC (12V version). Front-Ends offer 12V at 1250W and 24V or 48V at 1250W, 2000W & 2500W.

These switching rectifier modules are compact with up to 11 watts/cu.inch power density, taking up only 3.5 inches (two rack spaces) of height. They are ideally suited for both wireless and wireline applications.

Three modules in a 19-inch shelf produce up to 300A or 7500W while four modules in a 23-inch shelf produce up to 400A or 10,000W.

The modules have automatic load sharing and ORing diodes, so they can be added or replaced while the system is operating. The output voltage of each module can be adjusted over via a potentiometer on the front panel, or all modules can be adjusted simultaneously from a remote analog input.

FEATURES

- ◆ 2U- High: 35"
- ◆ -20°C to +70°C Operation
- ◆ 85 to 264VAC or 90 to 420VDC Input
- ◆ Up to 2720W Module Output
- ◆ Up to 10880W Shelf Output
- ◆ 0.99 Power Factor
- ◆ Output Voltages: 12 to 54.4VDC
- ◆ Hot Swappable with Integral ORing Diodes
- ◆ LED Indicators
- ◆ 19- or 23-Inch Rack Mounting

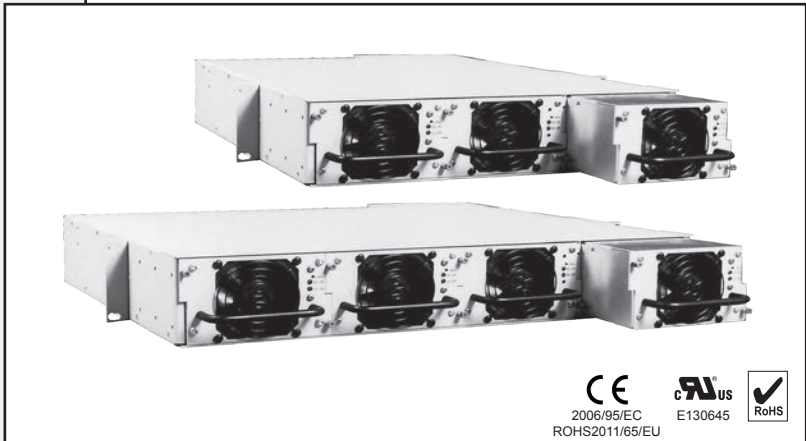
THREE YEAR WARRANTY

SAFETY CERTIFICATIONS

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

www.unipowerco.com

NORTH AMERICA CALL: +1-954-346-2442 • EUROPE CALL: +44 (0)1903 768200



FRONT-END / RECTIFIER MODULES

MAX. POWER	OUTPUT VOLTAGE	OUTPUT CURRENT	AC INPUT VOLTAGE ¹	AC INPUT CURRENT ²	MODEL NO. ^{3,4}
2720W 1360W	54.4VDC	50.0A 25.0A	170-264V 85-264V	14.3A 14.2A / 7.1A	RRSI48/50 RRPI48/25
2500W 2000W 1250W	48.0VDC	52.1A 41.7A 26.0A	170-264V 170-264V 85-264V	13.1A 10.4A 12.5A / 6.25A	TRSI7000 TRRI7000 TRPI7000
2500W 2000W 1250W	28.0VDC	89.3A 71.4A 44.6A	170-264V 170-264V 85-264V	13.1A 10.4A 12.5A / 6.25A	TRSI6000 TRRI6000 TRPI6000
2720W 1360W	27.2VDC	100.0A 50.0A	170-264V 85-264V	14.3A 14.2A / 7.1A	RRSI24/100 RRPI24/50
2500W 2000W 1250W	24.0VDC	104.2A 83.3A 52.1A	170-264V 170-264V 85-264V	13.1A 10.4A 12.5A / 6.25A	TRSI5000 TRRI5000 TRPI5000
1360W	13.6VDC	100.0A	85-264V	14.2A / 7.1A	RRPI12/100
1250W	12.0VDC	104.2A	85-264V	12.5A / 6.25A	TRPI3000

Notes:

1. All 1250/1360W units will also operate from 90-420VDC while the remainder will operate from 170-420VDC.
2. Input currents shown are nominal values at 120VAC/240VAC as appropriate.
3. To specify I²C Serial Communications append -Z to the model number.
In the case of RRSI & RRPI, only for use with the DSC1000 and in X410/X610 systems.
4. For chassis-mount applications see the GRSI Series [DATASHEET](#).

SHELF SYSTEM ORDERING GUIDE

MAX. POWER	DESCRIPTION	MAX. CURRENT	MODEL NO. ¹
8,160W	19" Rack-mount - 3-bay	300A	RRS2U-19
10,880W	23" Rack-mount - 4-bay	400A	RRS2U-23

Notes:

1. To specify I²C Serial Communications append -Z to the model number.
In the case of RRSI & RRPI modules, only for use with the DSC1000.

SHELF ACCESSORIES ORDERING GUIDE

J1 Mating Connector Kit	775-1441-0000
I ² C Adaptor - Required when using with DSC1000 Controller.	009-1000-0000
Blank Panel - Used to blank off unused modules slots.	256-1652-0000

SPECIFICATIONS, MODULE

Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

INPUT

Voltage Range.....	See Model Table
Power Factor.....	>0.98
Total Harmonic Distortion, Max.....	5%
Frequency.....	47-63Hz
Inrush Current Limiting, Max.....	25A Peak
EMI Filter, Conducted.....	FCC20780 pt. 15J Curve B EN55022 Curve B
Fast Transients.....	EN61000-4-4 level 3
Surges	
Line-Line.....	EN61000-4-5 level 2
Line-Ground.....	EN61000-4-5 level 3
Remote Adjust.....	0 to +5V
Input Protection ¹	Internal Fuse, 20A

OUTPUT

Current & Voltage.....	See Table
Output Power.....	1250-2720W
Voltage Adjustment Range	
Rectifier Models	
48V nominal.....	45-58VDC
24V nominal.....	22.5-29VDC
12V nominal.....	11.25-14.5VDC
Front-End Models.....	±10%
Standby Output.....	+5V@250mA
Line & Load Regulation, Max.....	1%
Holdup Time.....	20msec.
Overvoltage Protection.....	Latch Off
Filtering: Wideband Noise, 20MHz BW	
48V/54.4V.....	500mV pk-pk
24V/27.2V.....	250mV pk-pk
12V/13.6V.....	125mV pk-pk
Current Limit.....	105-110% Rated Current
Efficiency.....	85-87%

SAFETY

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

STATUS INDICATORS

AC GOOD.....	Green LED
DC GOOD.....	Green LED

ALARM SIGNALS (Logic LO, TTL compatible)

ACOK.....	AC present, 5V standby operating
DCOK.....	output within -10% of nominal

SERIAL COMMUNICATIONS

I²C..... Optional, append add -Z to model number

ENVIRONMENTAL

Operating Temp. Range.....	-20°C to +70°C
	-40°C start-up, reduced performance
Output Current Derating.....	2.5%/°C, 50°C to 70°C
Storage Temp. Range.....	-40°C to + 85°C
Environment.....	Pollution Degree 2
Humidity.....	0% to 95%, Non-Condensing
ESD.....	Bellcore GR-1089-Core and EN61000-4-2
MTBF, 35°C (Bellcore).....	200,000 Hours
Cooling.....	Integral Ball Bearing Fans
Acoustic Noise @ 1m (module) ²	70dB

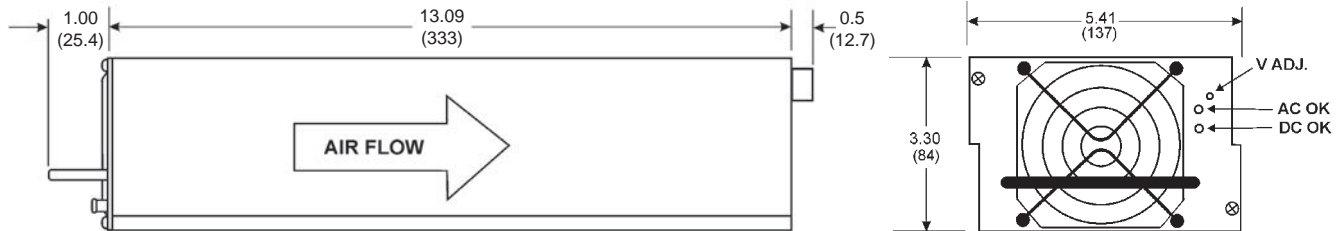
PHYSICAL SPECIFICATIONS

Case Material.....	Aluminum
Case Dimensions, Inches (mm).....	3.30 H x 4.9 W x 13.1 D (84 x 124 x 333)
Weight.....	10.15 lbs. (4.60 kg.)

Notes:

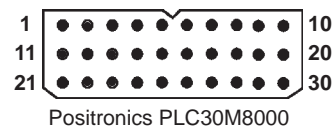
1. External protection required when operating from HVDC.

DIMENSIONS



MATING CONNECTOR

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	AC Neutral	11	N.C.	21	AC Line
2	N.C.	12	AC Ground	22	N.C.
3	+5V 100mA Aux.	13	-Sense	23	Current Monitor
4	DC Good	14	AC Good	24	Thermal Warning
5	Inhibit	15	Enable/Interlock	25	Current Share
6	+Sense	16	-Sense	26	Remote Adjust
7	-DC Out	17	-DC Out	27	-DC Out
8	-DC Out	18	-DC Out	28	-DC Out
9	+DC Out	19	+DC Out	29	+DC Out
10	+DC Out	20	+DC Out	30	+DC Out



Positronics PLC30M8000

Mating Connector: PLC30F7000

Order Kit No.: 775-1427-0000

I²C SERIAL BUS SPECIFICATIONS

Three forms of data are available via the I²C serial bus, allowing the user to monitor the actual status of an individual unit, manage system loading through measurement of the actual load on the output and also control inventory through an inbuilt EEPROM containing specific data about each individual unit. The implementation of I²C that has been utilized in **RANGER** is a subset of more complete implementations such as IPMI. The following information provides the information required by the system designer to make decisions on how to utilize the available information within his overall system philosophy.

I²C DEVICES EMPLOYED

PCF8574 - An 8-bit digital register manufactured by Philips.
24C02 - A 256 byte EEPROM manufactured by ST.

PCF8591 - A Quad A/D converter manufactured by Philips.
MAX6633 - A 12-bit temperature measurement device manufactured by Maxim.

For detailed information about the operation of these devices please consult the original manufacturers' datasheets.

ELECTRICAL INTERFACE

Addressing (GA0, GA1 and GA2)

Three external address lines are employed allowing up to eight **RANGER** modules to be addressed on a single I²C bus. Module addressing is achieved through hard-wiring the address lines to -Sense or the +5V auxiliary supply via a 100-ohm resistor on the system back-plane. In this way it is the location or position of the module rather than any particular module that is identified by an individual address.

Serial Clock (SCLK)

This line is clocked by the processor which controls the I²C serial bus. It should be tied to +5V via a pull-up resistor in the range 3k to 10k.

Serial Data (SDA)

This line is a bidirectional data line. It should be tied to +5V via a pull-up resistor in the range 3k to 10k.

BUS speed

The I²C interface as used in **RANGER** is designed to run with a serial clock speed 100kHz.

OPERATION AND FUNCTION

Digital Functions

Digital status functions are provided by a PCF8574 8-bit I/O port device. When this device is read by the serial bus controller a single 8-bit word provides the following information:

BIT	FUNCTION	GOOD STATE	MEANING
0	Input Power Fail	0	A "1" provides warning of input supply failure.
1	Output Power Good	0	Vout is within specified limits.
2	Temperature Warning	1	Temperature exceeds normal operating limit.
3	Fan #1 Good	1	Fan running at >80% nominal speed.
4	Fan #2 Good	1	Fan running at >80% nominal speed.
5	-	1	Not used
6	-	1	Not used
7	Temperature Alarm	1	Ambient temperature exceeds 70°C, unit switched off. Also indicates OVP and Inhibit activated.

PCF8527 slave address

BIT	7	6	5	4	3	2	1	0
VALUE	0	1	0	0	A2	A1	A0	R/W

Note: If a zero is written to bit 7 in a data byte, the unit will be inhibited. The default state is enabled.

EEPROM Functions

The EEPROM is a 2048 bit (256 byte) device which is preprogrammed at the factory with the following data:

ADDRESS RANGE	DATA
0-15	Model Number
16-31	Manufacturing Part Number
32-47	Serial Number
48-63	Modification Level
64-79	Manufacturer
80-95	Country of Manufacture
96-255	Not Used

Notes:
 Data is organized such that each field of data can be accessed by a page read (16 bytes).

Customers may specify other data to special order.

EEPROM slave address

BIT	7	6	5	4	3	2	1	0
VALUE	1	0	1	0	A2	A1	A0	R/W

Analogue Functions

Analogue status functions are provided by two PCF8591 4-channel 8-bit A/D converter devices. When these devices are read by the serial bus controller a single 8-bit word provides the following information:

Device: U1			
A/D	FUNCTION	A/D	FUNCTION
1	Vout voltage	3	not used
2	Vout current	4	not used

PCF8591 slave address

BIT	7	6	5	4	3	2	1	0	Device
VALUE	1	0	0	1	A2	A1	A0	R/W	U1

The PCF8591 devices initially require a control byte (04 Hex) to be written to the configuration register. This control byte sets the device so that on each successive read the data from the next A/D is read. Note that on each read a conversion is started for a particular channel and the result will be read from the previous channel, thus the first result from a sequence of reads should always be discarded.

A/D Converter Scaling

To obtain a correct voltage or current measurement it is necessary to employ a scaling factor in the controlling software. Note that all voltage measurements are made inside the PSU module, before the 'ORing' diodes, and are typically 0.5V higher than the actual module output voltage. The following calculation should be employed:

$$\text{Value} = (\text{byte read} \times \text{scaling factor})$$

Output Voltage	Scaling	Tolerance	
48V	0.24	±2%	V Measure (U1 A/D Chan. 1)
48V	0.125	±10% *	I Measure (U1 A/D Chan. 2)

* percentage of full scale

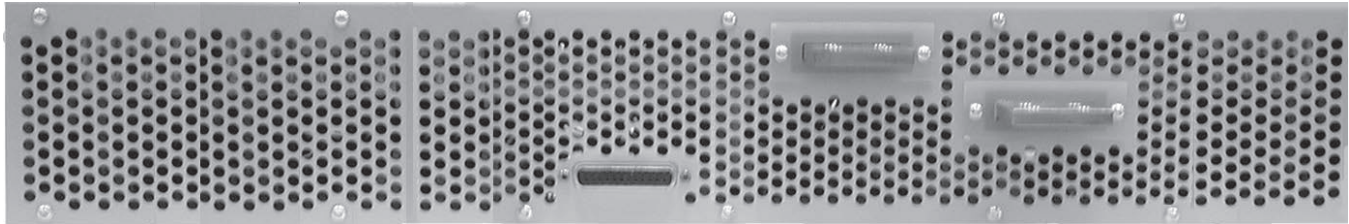
Temperature Measurement Functions

The internal temperature of the unit is measured using a MAX6633. This device provides a 12-bit measurement at a resolution of 0.0625°C.

MAX6633 slave address

BIT	7	6	5	4	3	2	1	0
VALUE	1	0	0	0	A2	A1	A0	0

SPECIFICATIONS, RACKS/SHELVES REAR VIEW

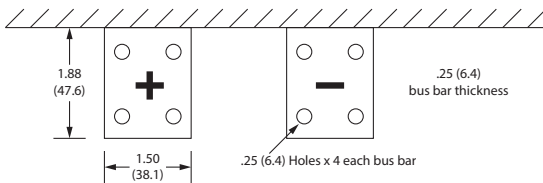

AC INPUTS
**J4
SIGNALS**
**+V - V
DC OUTPUT**
NOTES:

- All electrical connections are made to the rear of the rack.
There is one set of terminals for each module behind the access panel.
- Module A is on the left, module B in the left-center (center on 19"), module C on the right-center (right on 19") and module D is on the right (not present on 19") as seen from the rack front.
- The outputs of all modules are connected in parallel in the rack.
- Outputs are on two bus bars as detailed below.

SHELF DIMENSIONS

MODEL NUMBER	HEIGHT	WIDTH	TOTAL DEPTH
RRS2U-19	3.5" (89mm)	17.2" (437mm)	19.9" (505mm)
RRS2U-23		21.2" (538mm)	

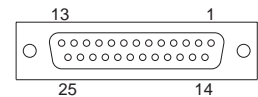
Supplied with mounting kits for 19" and 23" relay racks / cabinets.

OUTPUT BUS BAR DETAILS

SHIPPING WEIGHTS
 Shelf: 15.0 lbs. (6.8Kg)
 Modules: 8.0 lbs. (3.6Kg)

SHIPPING DIMENSIONS
 Shelf: 22" (559mm) x 22" (559mm) x 3" (76mm)
 Module: 15" (381mm) x 7" (178mm) x 5" (127mm)

J4 CONNECTION DETAILS

SIGNAL CONNECTOR - J1			
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	AC Good-1
2	Thermal Alarm-1	15	DC Good-1
3	Current Monitor-1	16	AC Good-2
4	Thermal Alarm-2	17	DC Good-2
5	Current Monitor-2	18	AC Good-3
6	Thermal Alarm-3	19	DC Good-3
7	Current Monitor-3	20	AC Good-4*
8	Thermal Alarm-4*	21	DC Good-4*
9	Current Monitor-4*	22	N.C.
10	Current Share	23	-Sense
11	+Sense	24	Remote Adjust - 1
12	Remote Adjust - 2	25	Remote Adjust - 3
13	Remote Adjust - 4*		


25-way D-type Socket

* These pins are used only on the RRS2U-23. On the RRS2U-19 they are No Connection.

MAXIMUM OUTPUT CAPACITY

RRS2U-19

3 MODULES NON-REDUNDANT			3 MODULES REDUNDANT		
VOLTAGE	CURRENT	POWER	VOLTAGE	CURRENT	POWER
12V	312.6A	3750W	12V	208.4A	2500W
24V	312.6A	7500W	24V	208.4A	5000W
28V	267.9A	7500W	28V	178.6A	5000W
48V	156.3A	8160W	48V	104.2A	5440W

RRS2U-23

4 MODULES NON-REDUNDANT			4 MODULES REDUNDANT		
VOLTAGE	CURRENT	POWER	VOLTAGE	CURRENT	POWER
12V	400.0A	4800W	12V	312.6A	3750W
24V	400.0A	10880W	24V	312.6A	7500W
28V	357.2A	10000W	28V	267.9A	7500W
48V	208.4A	10000W	48V	156.3A	8160W