OPERATING MANUAL
AURO-HE SERIES
FRONT-ENDS & RECTIFIERS

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1.0 INTRODUCTION

This Operating Manual should be read through carefully before installing and operating the **auro-he** Series Front-Ends and Rectifiers.

auro-he is UNIPOWER's new generation high efficiency hot-swappable, modular Front-Ends and Rectifiers producing up to 1500 watts output power. There are 3 standard models at 48VDC and 54.4VDC output. The modules are ultra-compact with power density up to 18.75 watts per cubic inch. The modules have automatic load sharing and active output ORing circuit so they can be hot-swapped while the system is operating. An I²C Serial bus, common with other UNIPOWER products, is included as standard.

Front panel mounted LEDs indicate AC input and DC output status and a +5V @ 1A standby output is also included. Operating temperature range is -20°C to +70°C, but units will start-up at as low as -40°C with reduced performance.

auro-he modules can be fully integrated into an OEM host system or alternatively installed into one of 4 different 1U high 19" rack-mount power shelves. These power shelves may be connected in parallel for increased system capacity.

Figure 1 below shows an **auro-he** module and four modules installed into one of the power shelves.

Figure 1 – auro-he Module & Power Shelf

2.0 STANDARD FEATURES

- 92% Efficiency
- 1U High: 1.6”
- -40°C to +70°C Operation
- Wide Range AC & HVDC Input
- Up to 1500W Output
- >0.98 Power Factor
- Output Voltages: 48VDC and 54.4VDC
- Power Density to 18.75W/Cu. Inch
- Hot Swappable
- Integral Active Output ORing Circuit
- Class B EMI Filter
- LED Indicators
- I²C Serial Bus
- Variable Speed Cooling Fans

3.0 SUMMARY OF PRODUCT LINE

3.1 STANDARD MODULES

MAXIMUM POWER	OUTPUT VOLTAGE	OUTPUT CURRENT	AC INPUT VOLTAGE [1, 2]	AC INPUT CURRENT [3]	MODEL NUMBER [4]
1523W	54.4VDC	28.00A	180-264V	7.4A	RAUQ48/28-Z
1197W	54.4VDC	22.00	85-264V	11.0A / 5.8A	RAUQ48/22-Z
1500W 1200W	48.0VDC	31.25A 25.00A	180-264V 85-132V	7.4A 11.0A	TAUQ7000-Z

Notes:
1. Models showing two output current levels with two AC input ranges will operate over the full range from 85VAC to 264VAC, automatically limiting output current according to the actual input voltage range applied.
2. All units will also operate from 90-420VDC, taking into account the same conditions as in note 1.
3. Input currents shown are nominal values at 120VAC/240VAC as appropriate.
4. For special requirements the I²C interface can be removed (consult sales).

3.2 POWER SHELVES

MAXIMUM POWER	DESCRIPTION	MAXIMUM CURRENT	MODEL NUMBER
6000W	Single Output Bus - IEC60320-C14 AC Input	125A	TAUQR1U4A
6000W	Single Output Bus – Terminal Block AC Input	125A	TAUQR1U4B
6000W	Dual Output Bus - IEC60320-C14 AC Input	62.5A / 62.5A	TAUQR1U4C
6000W	Dual Output Bus – Terminal Block AC Input	62.5A / 62.5A	TAUQR1U4D

Note: Blanking panel kit for unused position, order part number 775-1501-0000.

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)

auro-he 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

INPUT

Voltage Range ..... See Model Table
Power Factor ..... >0.98
Total Harmonic Distortion, Max. 5%
Frequency 47-63Hz
Inrush Current Limiting, Max. ..... 50A 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, 20A

OUTPUT

Current & Voltage ..... See Table
Output Power 1200-1500W
Voltage Adjustment Range 30-60V
Standby Output ..... +5V@1A
Line & Load Regulation, Max. 2%
Holdup Time ..... 10msec.
Overvoltage Protection ..... Latch Off
Filtering: Wideband Noise, 20MHz BW 1%
Current Limit [2] ..... 105-115% Rated Current
Efficiency (48VDC @ 1500W rated)
100% Load ..... to 91.0%
75% Load ..... to 92.0%
40% Load ..... to 91.0%

SAFETY STANDARDS

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 (open drain, TTL compatible)

ACOK ..... AC present, 5V standby operating
DCOK ..... DC output within -10% of nominal
TEMPOK ..... Internal temperature within limits

SERIAL COMMUNICATIONS

I²C ..... Fitted as standard

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) 40-65dB

PHYSICAL SPECIFICATIONS

Case Material ..... Steel
Case Dimensions, Inches (mm) ..... 1.60 H x 4.00 W x 12.50 D
(40.6 x 102 x 317.5)
Weight ..... 4.2 lbs. (1.9 kg.)

Notes:

1. External protection required when operating from HVDC.
2. Subject to absolute power limit of 1500W + tolerance.

8.0 FRONT PANEL DESCRIPTION

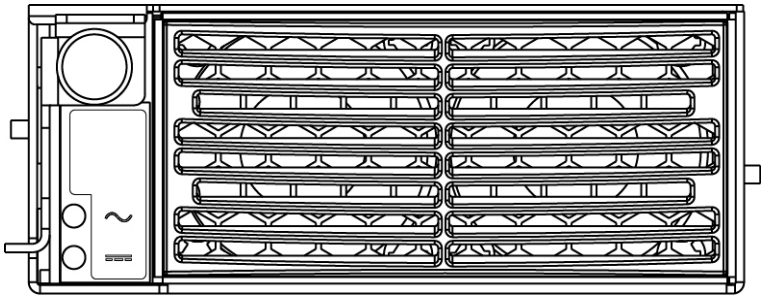


Figure 2 – Front Panel Detail

8.1 FRONT PANEL INDICATORS

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

The top LED represents the ACOK signal and will mimic the state of this signal. The bottom 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 top cover 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 0.25V 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.

Signal return is internally connected to Sense -Ve and should be used as the return path for all of the I/O signals and standby supply to avoid voltage drops causing errors in the sensed voltage.

9.2.2 Current Share

This signal is connected between all modules required to share a load. This signal is capable of driving up to 16 modules. The return path for this signal is signal return and signal return 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 signal return. The full scale voltage for nominal full load current is 5.0V.

9.2.4 Signal Return

This is the return path for the module signals. It is internally connected to sense –Ve.

9.2.5 Remote Adjust

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

The characteristic of remote adjust varies for different models. The table below shows the typical characteristic for the Front-End model TAUQ7000-Z which has its default output set to 48.00V. If remote adjust is not required, the pin can be left open circuit.

Remote Adjust Voltage	Output Voltage
0	45.8
0.5	46.2
1.0	46.7
1.5	47.1
2.0	47.6
2.5	48.0
3.0	48.5
3.5	49.0
4.0	49.5
4.5	50.0
5.0	50.4

9.2.6 5VSB

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 5VSB pin is 1A. The return for this power rails is signal return. This standby supply has an internal ORing diode so that it may be connected together with other 5VSB rails directly on the backplane.

9.2.7 #ACOK

This signal provides an open drain output that indicates the status of the AC input. The signal is normally low for the OK state. The output is capable of supporting voltages of up to 30V and will sink current up to 30mA. The return path for this signal is signal return. The #ACOK signal will give typically 2ms of warning at full load before the output loses regulation.

9.2.8 #DCOK

This signal provides an open drain output that indicates that the DC output voltage is below a defined threshold. This level is nominally 90% of the nominal output voltage. The signal is normally low for the OK state. The output is capable of supporting voltages of up to 30V and will sink current up to 30mA. The return path for this signal is signal return.

9.2.9 #TEMPOK

This signal provides an open drain output that indicates that the power supply internal temperatures are within a safe operating range. The OK state is for temperatures less than 80°C. The signal is normally low for the OK state. The output is capable of supporting voltages of up to 30V and will sink current up to 30mA. The return path for this signal is signal return.

9.2.10 #Module Present

This signal can be used to detect if a module is present. It is connected to signal return when the module is present. This signal can sink up to 30mA.

9.2.11 #Enable

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 signal return. The #Enable pin should be connected to sense -Ve on the backplane for correct operation.

9.2.12 Inhibit

This signal can be used to control the main output of the power supply in order to turn it on and off. A low signal on this pin will turn the main output off. The control pin is returned to signal return. The driving circuit should be capable of sinking and sourcing at least 0.5mA.

9.2.13 SCL, SDA

These are the serial data bus (I^2C) signals used for digital communication when that option (-Z) is fitted.

9.2.14 GA0, GA1, GA2

These are the I^2C interface address lines. They are used to set the hardware address of each module on the backplane. Each module should have a unique address when connected using the same serial bus.

The address lines should either be tied high (to 5VSB) for '1' or low (signal return) for '0'. The return path for these lines is signal return.

9.3 Timing

The following table and diagram give details of signal and power timing during power up and power down cycles.

Value	Min.	Typ.	Max.	Description
T_{ACON_DELAY}	540ms	600ms	660ms	Delay from AC input voltage applied to output in regulation
T_{VOUT_HOLDUP}	10ms	12ms	-	Time from loss of AC input to DC output voltage falling to 90% of original value. Timing given is for 1500Watt load on 48V model.
T_{VSB_HOLDUP}	20ms	30ms	-	Time from loss of AC input to VSB going out of regulation. Typical timing for full load on all outputs.
T_{VSB_ON}	160ms	180ms	200ms	Delay from AC input voltage applied to VSB in regulation.
T_{ACOK_ON}	160ms	180ms	200ms	Time from AC input voltage applied to ACOK being low (good)
T_{ACOK_OFF}	9ms	10ms	11ms	Time from loss of AC input to ACOK output being high. Timing given is for 1500Watt load on 48V model.
T_{ON_RISE}		8ms		Time for DC output to rise to final regulated value.
T_{5VSB_RISE}	160ms	150ms	190ms	Time for 5VSB to rise to final regulated voltage.
$T_{INHIBIT\_DELAY\_ON}$		0ms		Time from INHIBIT pin going high to main output coming on.
$T_{INHIBIT\_DELAY\_OFF}$		0ms		Time from INHIBIT pin going low to main output going off.
T_{DCOK_ON}	540ms	600ms	660ms	Time from main output beginning to rise and DCOK going low (with default 50ms rise time of main output).
T_{DCOK_OFF}	14ms	16ms	18ms	Time from main output going out of regulation to DCOK going high (typical at 1500Watt load on 48V model).
T_{DCOK_FALL}	50ns	100ns	1000ns	Time for DCOK signal to transition from high to low*
T_{DCOK_RISE}	1µs	2µs	10µs	Time for DCOK signal to transition from low to high*
T_{ACOK_FALL}	50ns	100ns	1000ns	Time for ACOK signal to transition from high to low*
T_{ACOK_RISE}	1µs	2µs	10µs	Time for ACOK signal to transition from low to high*
T_{TEMPOK_FALL}	50ns	100ns	1000ns	Time for TEMPOK signal to transition from high to low*
T_{TEMPOK_RISE}	1µs	2µs	10µs	Time for TEMPOK signal to transition from low to high*

*ACOK, DCOK & TEMPOK pulled up to 5V with 10kOhm resistor.

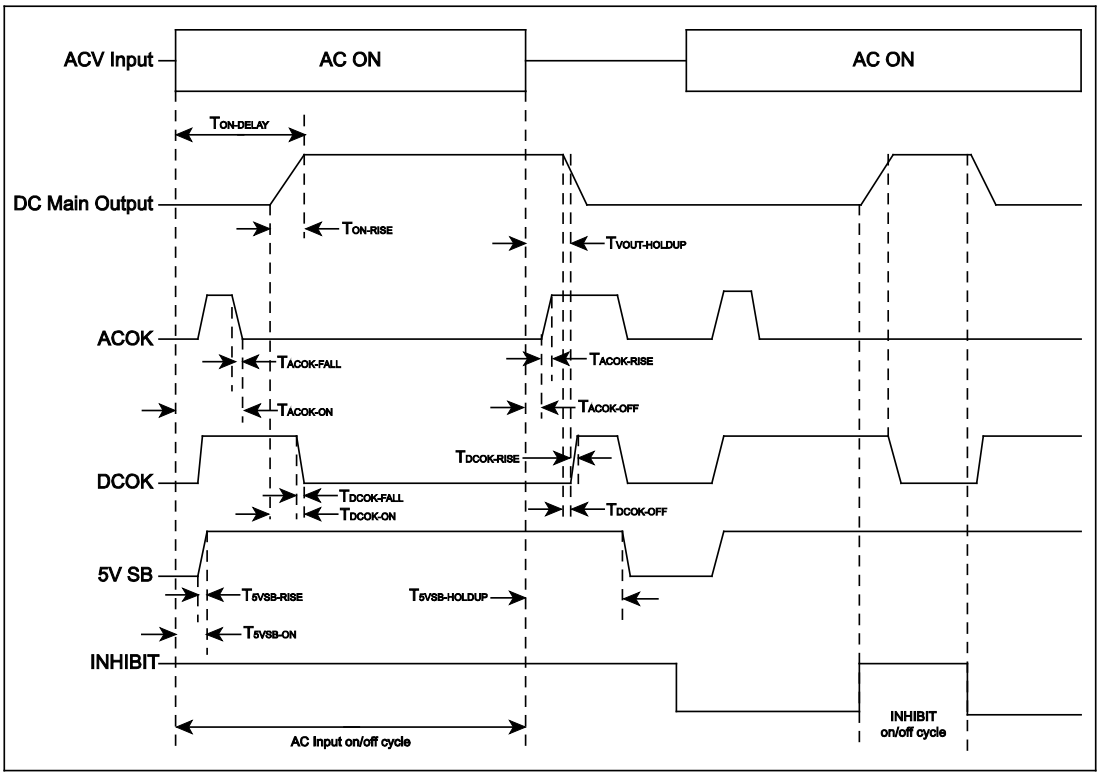


Figure 3 – Timing Diagram

10.0 MECHANICAL SPECIFICATIONS

The mechanical dimensions of the **auro-he** module are shown.

Note that **auro-he** modules are designed for hot-swap applications only and are not provided with any fixing points.

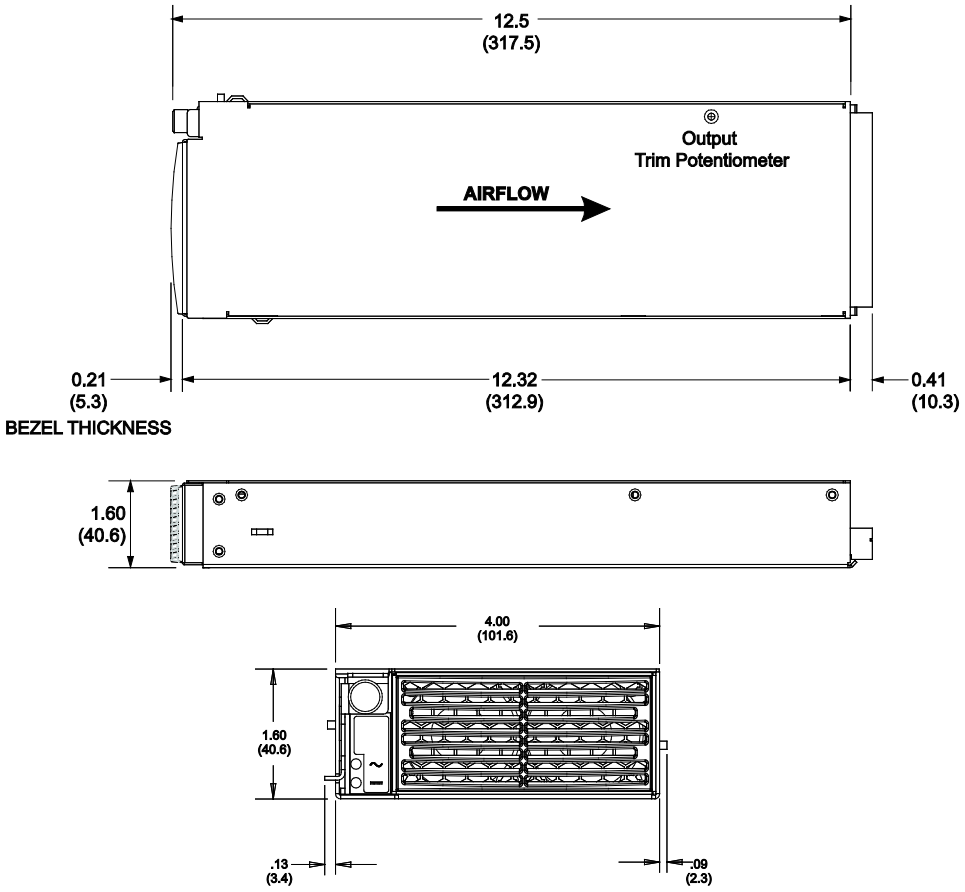


Figure 4 – auro-he Module Dimensions

11.0 SAFETY AND INDUSTRY STANDARDS

11.1 **auro-he** 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 **auro-he** 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 **auro-he** Series operates from worldwide AC input voltages in the range of 85 to 264 VAC at 47 to 63 Hz. There are restrictions to the available total output power when operating at low line, 85-132VAC. The three-wire AC connection is made to pins P1, P2 & P3 on the rear mounted connector. See the connector diagram and Pin Connections table in Figure 5.

12.2 **Output Connections** - The main output is provided on pins P4 to P9 on the connector. Three pins (P4 to P6) are connected together internally for the +V Out; three other pins (P7 to P9) are connected together internally for the V Return. The output is fully floating and may be configured for positive or negative operation.

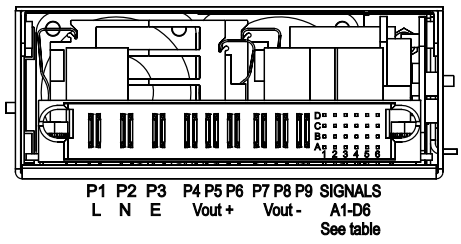


Figure 5 – Module Rear View showing connection details

PIN	FUNCTION	PIN	FUNCTION
A1	#Module Present	C1	Sense +Ve *
A2	Not used	C2	Current Monitor *
A3	Not used	C3	GA1
A4	Signal Return *	C4	5V Standby *
A5	Not used	C5	#DC OK
A6	Not used	C6	SCL
B1	Sense –Ve	D1	Remote Adjust *
B2	#Inhibit	D2	Current Share *
B3	GA2	D3	GA0
B4	Signal Return *	D4	Not used
B5	#Temp OK	D5	#AC OK
B6	SDA	D6	#Enable

* Referenced to –Ve Sense

12.3 **Mating Interface Board -** Figure 6 shows a mating interface board which is available for simplifying the testing of an **auro-he** module. As shown in the photograph, provision is made for input and output connections as well as the control and monitoring signals and I²C interface.

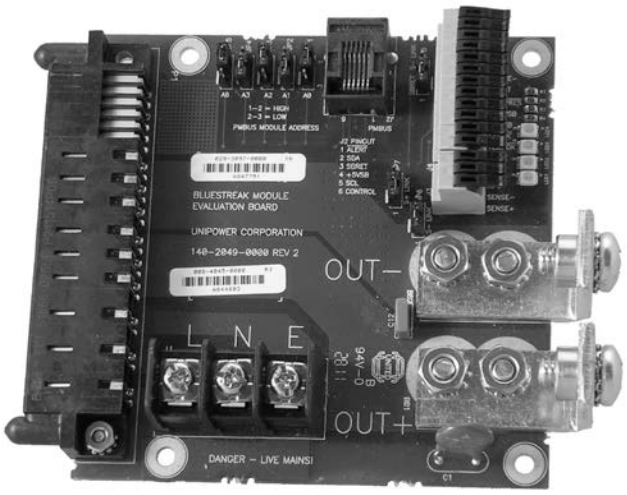


Figure 6 – Mating Interface Board

12.4 **Output Voltage** - The output voltage is factory set to its nominal value to an accuracy of ±1%. The voltage can be adjusted to any value within the range ±5% of nominal using the trim potentiometer (see figure 4 on page 13) or the remote adjust input (section 9.2.5).

12.5 **Output Power & Current** - The following table shows the maximum output power and current ratings for the various models:

MODEL NUMBER	OUTPUT VOLTAGE	MAXIMUM POWER	MAXIMUM CURRENT	INPUT VOLTAGE
RAUQ48/28-Z	54.4VDC	1523W	28.00A	180-264VAC
RAUQ48/22-Z	54.4VDC	1197W	22.00A	85-264VAC
TAUQ7000-Z	48.0VDC	1500W 1200W	31.25A 25.00A	180-264VAC 85-132VAC

Models showing two output power levels with dual AC input ranges automatically limit the output current according to the actual input voltage present. All units will also operate from 90-420VDC, taking into account these same conditions.

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°C air inlet temperature. Above +50°C the total output power must be derated by 2.5%/°C, up to an absolute maximum air inlet temperature of +70°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 59.4V nominally

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. If the output voltage of the power supply falls below around 30V, the power supply will enter a 'hiccup' mode of operation. Removing the overload or short circuit will allow normal operation to resume automatically.

12.8 **Remote Sensing** - Remote sensing connections are made to pins B1 and C1 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 C1) must be connected to the +Ve side of the load and the - Sense lead (pin B1) 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 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 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 Signal Return and are isolated from the main DC output.

12.10 I²C Serial Bus – This is available on the connector at the rear of the unit. See section 20 for details.

13.0 PARALLEL OPERATION

13.1 Parallel Connection - Two or more **auro-he** modules can be operated in parallel by connecting their outputs in parallel and connecting their current sense terminals together (pin D2). The **auro-he** 19-inch rack power shelves permit conveniently operating two, three or four units in parallel in either redundant mode or non-redundant mode.

13.2 Redundant Operation - Connecting two **auro-he** modules in parallel, with or without the compatible 19-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 **auro-he** 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 active ORing circuit built into the module. 1+1 redundancy with quick replacement of a failed unit results in virtually infinite MTBF. 2+1 or 3+1 redundancy works the same way except that the full load is carried by two out of three or three out of four units respectively.

13.3 Non-Redundant Operation - Higher output load currents can be realized by operating two or three or four modules in the non-redundant mode to achieve up to 3000 watts for two modules, 4500 watts for three modules or 6000 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 **auro-he** modules that can be operated in parallel is 16. The most convenient way to parallel large numbers of units is to connect multiple **auro-he** 19-inch rack power shelves in parallel.

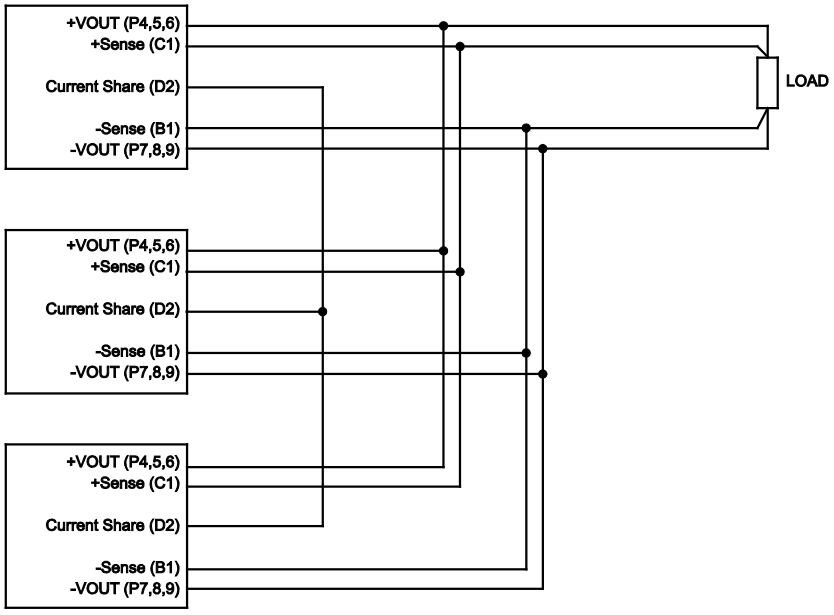


Figure 7 - Connection Diagram for Parallel Operation

14.0 INSTALLATION

auro-he Series modules are designed for mounting into the **auro-he** Series power shelves or similar OEM housing. Fixing in place is achieved by means of a latching mechanism that is also used to push the module home into the mating connector.

For OEMs wishing to install the auro-he modules in their own system enclosure detailed dimension information is available as a 3D CAD model. Please consult your nearest sales office.

A mating interface board is available for module evaluation or testing, see section 12.3 on page 15 of this manual.

15.0 COMPATIBLE 19-INCH POWER SHELVES

There are four 19-inch compatible power shelves with single and dual bus configurations being available. These power shelves have the following features:

- Standard 19-Inch Rack-Mounting
- Only 1U High
- Hot-Swap Operation
- Holds up to Four **auro-he** Modules
- Single or Dual Output Bus
- Terminal Block or IEC Connectors for AC Input

15.1 Ordering Guide

MAXIMUM POWER	DESCRIPTION	MAXIMUM CURRENT	MODEL NUMBER
6000W	Single Output Bus - IEC60320-C14 AC Input	125A	TAUQR1U4A
6000W	Single Output Bus – Terminal Block AC Input	125A	TAUQR1U4B
6000W	Dual Output Bus - IEC60320-C14 AC Input	62.5A / 62.5A	TAUQR1U4C
6000W	Dual Output Bus – Terminal Block AC Input	62.5A / 62.5A	TAUQR1U4D

15.2 Single Bus Power Shelves – Rear views of the single bus types are shown in figures 8a and 8b below.

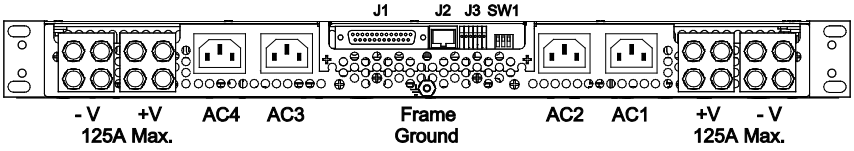


Figure 8a – Model TAUQR1U4A with IEC Connectors

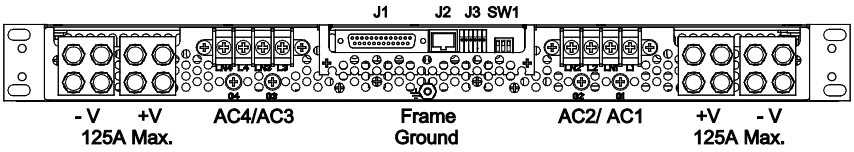


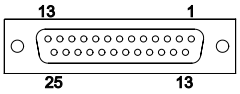
Figure 8b – Model TAUQR1U4B with Terminal Block Connections

AC inputs are supplied separately to each module either via IEC60320-C14 connectors or terminal block connections. The DC output is supplied on two pairs of bus bars which are internally connected inside the unit. Each pair has a maximum current capacity of 125A. For installations where greater than 125A output current is required it is necessary to use both pairs of bus bars for connection to the load.

J1 is a 25-way D-type socket providing the alarm, control and supervisory signals. J2 is an RJ25 socket providing connections for the I²C Serial Bus. J3 is a spring clamp terminal block providing two connections each for +Ve Sense, -Ve Sense and Current Share. This facilitates easy daisy-chaining of these connections where two or more power shelves are being connected in parallel. The following tables and figures 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	#ACOK – 1
2	Not used	15	#DCOK – 1
3	#TEMPOK – 1	16	#ACOK – 2
4	#TEMPOK – 2	17	#DCOK – 2
5	#TEMPOK – 3	18	#ACOK – 3
6	#TEMPOK – 4	19	#DCOK – 3
7	Remote Adjust – 4	20	#ACOK – 4
8	5V Standby [1]	21	#DCOK – 4
9	#MODULE PRESENT – 1	22	Sense –Ve
10	#MODULE PRESENT – 2	23	Signal Return
11	#MODULE PRESENT – 3	24	Remote Adjust – 1
12	Remote Adjust - 2	25	Remote Adjust - 3
13	#MODULE PRESENT - 4		

J1 – 25-Way D-Type



NOTES: 1. Current rating of +5V standby is 1A per module.

PIN	FUNCTION	PIN	FUNCTION
1	Not used	4	5V Standby
2	SDA	5	SCL
3	Signal Return	6	Inhibit

J2 – RJ25

PIN	FUNCTION	PIN	FUNCTION
1	Sense +Ve	4	Sense +Ve
2	Sense -Ve	5	Sense -Ve
3	Current Share	6	Current Share

J3 – Spring Clamp

SW1 provides a facility to alter the I²C Serial Bus address of the power shelf. The following table defines the switch settings.

S1-3 GA2	Device	MODULE			
		1	2	3	4
OFF	PCF8574	0x40	0x42	0x44	0x46
OFF	PCF8591	0x90	0x92	0x94	0x96
OFF	24C02	0xA0	0xA2	0xA4	0xA6
OFF	MAX6633	0x80	0x82	0x84	0x86
ON	PCF8574	0x48	0x4A	0x4C	0x4E
ON	PCF8591	0x98	0x9A	0x9C	0x9E
ON	24C02	0xA8	0xAA	0xAC	0xAE
ON	MAX6633	0x88	0x8A	0x8C	0x8E

Note: Module numbers 1 to 4 are left to right when viewed from the front (fan grille) end.

15.3 Dual Bus Power Shelves – Rear views of the dual bus types are shown in figures 9a and 9b below.

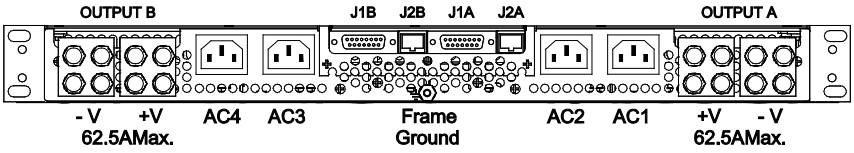


Figure 9a – Model TAUQR1U4C with IEC Connectors

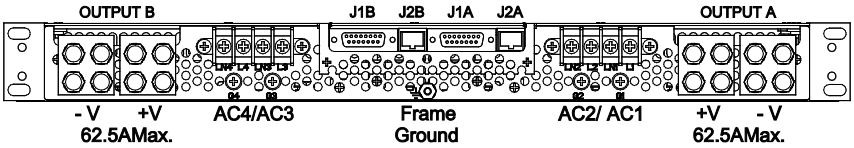


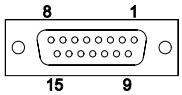
Figure 9b – Model TAUQR1U4D with Terminal Block Connections

AC inputs are supplied separately to each module either via IEC60320-C14 connectors or terminal block connections. The DC output is supplied on two pairs of bus bars, one pair for the A Bus one pair for the B Bus. The A Bus is fed from modules installed in positions A1 and A2 while the B Bus is fed from modules installed in positions B1 and B2. Each pair has a maximum current capacity of 125A. The two buses are fully isolated from each other and may be configured for different combinations of output voltage and/or polarity.

J1A and J1B are 15-way D-type sockets providing the alarm, control and supervisory signals for modules installed in the A and B side respectively. J2A and J2B are RJ25 sockets providing the I²C Serial Bus for modules installed in the A and B side respectively. The following tables and figures show the pin-out for these connectors. Details of each pin function can be found in section 9.2.

PIN	FUNCTION A SIDE – J1A	PIN	FUNCTION B SIDE – J1B
1	Inhibit	1	Inhibit
2	Note used	2	Not used
3	#TEMPOK – 2	3	#TEMPOK – 2
4	#TEMPOK – 1	4	#TEMPOK – 1
5	Remote Adjust - 2	5	Remote Adjust - 2
6	Remote Adjust – 1	6	Remote Adjust – 1
7	5V Standby [1]	7	5V Standby [1]
8	#ACOK – 2	8	#ACOK – 2
9	#DCOK – 2	9	#DCOK – 2
10	#ACOK – 1	10	#ACOK – 1
11	#DCOK – 1	11	#DCOK – 1
12	Sense –Ve	12	Sense –Ve
13	Signal Return	13	Signal Return
14	Sense +Ve	14	Sense +Ve
15	Current Share	15	Current Share

J1A & J1B – 15-Way D-Type



NOTES: 1. Current rating of +5V standby is 1A per module.

PIN	FUNCTION A SIDE – J2A	PIN	FUNCTION B SIDE – J2B
1	Not used	1	Not used
2	SDA	2	SDA
3	Signal Return	3	Signal Return
4	5V Standby	4	5V Standby
5	SCL	5	SCL
6	Inhibit	6	Inhibit

J2A & J2B – RJ25

Note that dual bus shelves have fixed I²C Serial Bus addresses as follows:

Device	MODULE			
	1	2	3	4
PCF8574	0x4C	0x4E	0x4C	0x4E
PCF8591	0x9C	0x9E	0x9C	0x9E
24C02	0xAC	0xAE	0xAC	0xAE
MAX6633	0x8C	0x8E	0x8C	0x8E

16.0 MECHANICAL DIMENSIONS

Figure 11 below shows outline dimensions for the **auro-he** Series Power Shelves.

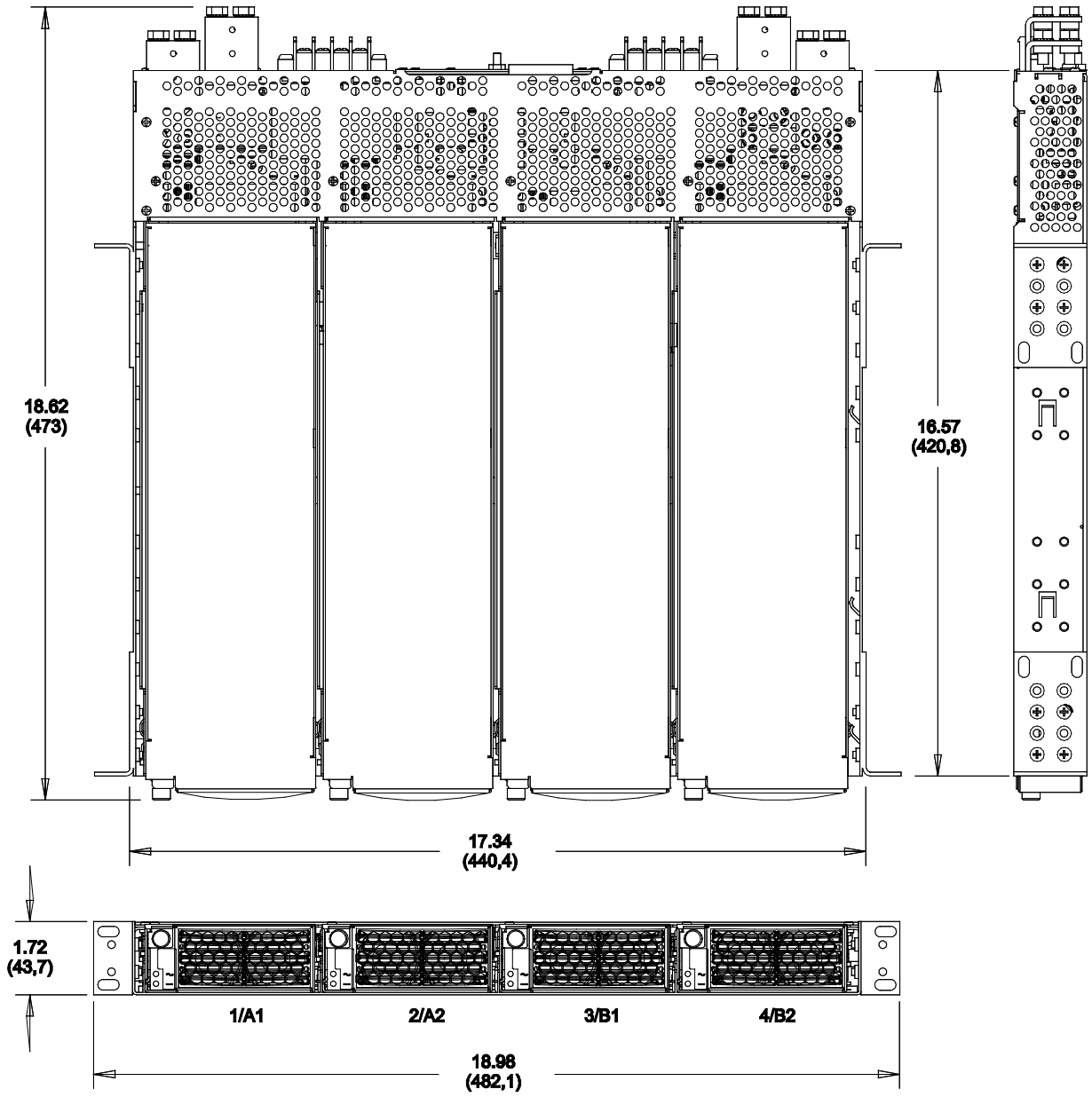


Figure 10 – auro-he Power Shelf Outline

17.0 INSTALLATION

17.1 **Mounting - auro-he** Series 19-inch rack-mount power shelves are provided with universal rack- brackets that allows them to be mounted into a 1U high space in both 19-inch and 23-inch racks. The brackets can be located at various positions in the side of the shelf to allow for offset mounting in the rack.

To minimise obstruction to ventilation UNIPOWER advises that any equipment mounted directly above the **auro-he** power shelf should be shorter in overall depth.

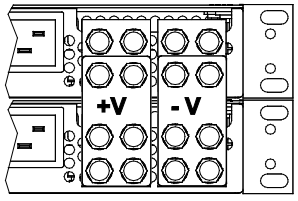
17.2 **Input Power Connections** – Depending on the exact model AC input power connections are made to the IEC60320-C14 or Terminal Blocks mounted at the rear of the power shelf. Each module position has its own input connector or terminals. For models incorporating IEC60320-C14 connectors UNIPOWER can supply various line cords; see the current datasheet for details. For models with Terminal Block connections a 3-wire connection is required for each module position that is to be used. 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. When using the version with Terminal Blocks the supplied safety covers should be fitted.

17.5 **DC Output Connections** – DC output connections are provided at the rear of the power shelf on two pairs of bus bars. Each pair is rated to carry a maximum of 125A. On single bus power shelves the bus bars are connected internally thus allowing a total output current of 400A maximum when both bars are used. On dual bus power shelves the two pairs of bus bars are isolated from each other and thus allow side A to have different voltage modules installed to side B. In all cases the output polarity can be configured either positive or negative as desired. Dual bus shelves will allow for a true A+B supply to equipment requiring such a facility. UNIPOWER can supply various pre-made DC load cables; see the current datasheet for available options. Users wishing to fabricate their own DC cables should note that such cables should be rated to handle at least 125A.

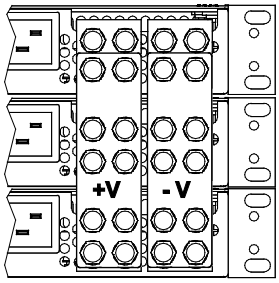
17.5.1 Connecting Multiple Shelves in Parallel

Up to four power shelves can be connected together to create higher capacity power systems than can be achieved with a single shelf. UNIPOWER offers bus bar linking kits as follows:

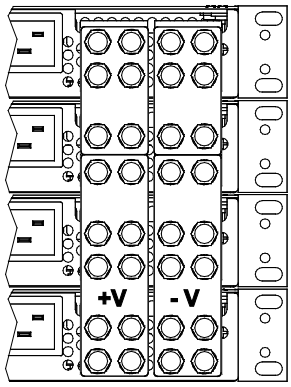
2 shelf kit, part number 775-1509-0020. Contains two short link bars, one for connecting the two positive bus bars together and one for connecting the two negative bus bars together. The two link bars are identical and interchangeable.



3 shelf kit, part number 775-1509-0030. Contains two long link bars, one for connecting the three positive bus bars together and one for connecting the three negative bus bars together. The two link bars are identical and interchangeable.



4 shelf kit, part number 775-1509-0040. Contains two short link bars and two long link bars. One short link bar and one long link bar are required for connecting the four positive bus bars together and similarly for connecting the four negative bus bars together. In each case the long bar is used to connect the bus bars from three of the shelves and the short link bar is used to connect the fourth shelf.



Note that each bus bar pair has a maximum current capacity of 125A. For systems where the total possible current capacity exceeds 125A it is necessary to fit link bars kits to both pairs of bus bars on the power shelves. It is also necessary to ensure that the equipment being powered is connected to the system in such a way that no more than 125A can be taken from each bus bar pair.

On dual bus shelves the A and B sides are galvanically isolated and one link bars kit is required for each side.

17.6 Signal Connections – These connections are made to the D-type and spring clamp terminal connectors 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 signal return are connected between each shelf. See sections 15.2 and 15.3 for details on single and dual bus shelves respectively.

17.7 **Cooling** – The **auro-he** power modules incorporate two DC ball bearing fans that are speed controlled according to the internal temperature of the unit. 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 **auro-he** 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 **auro-he** 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 **auro-he** 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 in Position 1 (left side) of the rack.

19.2 With the input power source turned off, connect input power wires to the AC input terminals of the mating interface board, the **auro-he** mating connector or in the case of a power shelf the input connector or terminal block on the A side of the rack. Make sure that the safety ground wire is connected. Do not touch the output terminals when AC 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 pin to the -Ve Sense. This must be done for the unit to operate. When using the mating interface board or 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 **auro-he** module on the bench or in Position A of 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 ±1% of its nominal value.

19.7 **Checking the Inhibit Input** - Unplug the input power source. Connect a wire from the Inhibit input to Signal Return. Turn the input power source back on. The top ACOK LED should be on and the botton 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 Signal Return. The voltage should be a logic LO, +0.5V or less. Finally, check the voltage on the DC OK pin with respect to Signal Return. The voltage should be a logic HI, approximately +5V. These signals need pull-up resistors to 5VSB using 10K Ohm resistors.

Disconnect the wire between the Inhibit and Signal Return 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. Note that when using a mating interface board this may have LEDs connected to these signals.

19.9 **Testing other auro-he modules** - For a power shelf with two, three or four **auro-he** modules, the other modules should be plugged into Position 1 in 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 **auro-he** modules into the power shelf. Connect a resistive power load of approximately 80% of full load value for a single **auro-he** across the output. Connect a color-coded, twisted pair of remote sense leads to the load, being careful to connect the correct polarity.

Note the comments in section 9.2.1 regarding circuit breakers or fuses in the output power feed.

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 ± 1% of its nominal value. Both LEDs should be on for all units.

19.12 While the rack is operating, disengage module 1 (left one) and check the output voltage. It should be very close to the previous value and the LEDs should remain on for module 2 (and 3 and 4) which are now carrying the load. Re-insert module 1 and repeat the procedure by disengaging and re-engaging modules 2, 3 and 4 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 USING THE I²C SERIAL BUS INTERFACE

The I²C interface that is incorporated into the **auro-he** includes facilities to monitor various operating parameters within the unit and transmit these to a host computer on demand over an industry standard I²C Serial bus.

Three forms of data are available. These allow 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 **auro-he** is a subset of more complete implementations such as IPMI. The information that follows should provide enough information for system designers to make decisions on how to utilize the available information within their overall system philosophy.

20.1 I²C devices employed

20.1.1 PCF8574 - is an 8-bit digital register manufactured by Philips that is used to provide various module status information.

20.1.2 PCF8591 - T is a Quad A/D converter manufactured by Philips that is used to provide output voltage and current readings.

20.1.3 24C02 - is a 256 byte EEPROM manufactured by ST used to store inventory information. The content of this device can be altered or added to at time of manufacture to meet specific user needs.

20.1.4 MAX6633 – is a 12-bit temperature measurement device manufactured by Maxim that provides an indication of the internal temperature of the **auro-he** module.

20.2 Electrical Interface

20.2.1 Addressing (GA0,GA1,GA2)
Three external address lines are employed allowing up to eight **auro-he** 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.

20.2.2 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.

20.2.3 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.

20.2.4 Bus speed

The I²C bus as used in **auro-he** is designed to run with a serial clock speed 100kHz.

20.3 Operation and Functions

20.3.1 Digital Functions

Digital status functions are provided by a PCF8574 8-bit I/O port device. When this device is read by the I²C bus controller a single 8-bit word provides the information given in the following table.

BIT	FUNCTION	GOOD STATE	MEANING
0	Input Power Fail	0	A "1" provides warning of input supply failure.
1	Output Power Good	0	Output voltage is within specified limits.
2	Temperature Warning	0	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.

PCF8574 slave address

BIT	7	6	5	4	3	2	1	0
VALUE	0	1	0	0	GA2	GA1	GA0	R/W

HEX ADDRESS RANGE

0x40 – 0x4E

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

20.3.3 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 I²C bus controller a single 8-bit word provides the information given in the following table.

Device U1			
A/D	FUNCTION	A/D	FUNCTION
1	Output voltage	3	Not used
2	Output current	4	Not used

PCF8591 slave address – device U1

BIT	7	6	5	4	3	2	1	0
VALUE	1	0	0	1	GA2	GA1	GA0	R/W

HEX ADDRESS RANGE

0x90 – 0x9E

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' devices, and are typically 0.2V higher than the actual module output voltage. The calculation given in the following table should be employed.

Value = (byte read x scaling factor)

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

*of full scale

20.3.4 EEPROM Functions

The EEPROM is a 2048 bit (256 byte) device which is pre-programmed at the factory with the data given in the following table.

Note that other data may specified to special order. Please consult sales.

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

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

24C02 slave address

BIT	7	6	5	4	3	2	1	0
VALUE	1	0	1	0	GA2	GA1	GA0	R/W

HEX ADDRESS RANGE

0xA0 – 0xAE

20.3.5 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	1	0	GA2	GA1	GA0	0

HEX ADDRESS RANGE

0x80 – 0x8E

For further information or support in using the I²C serial bus features incorporated into the **auro-he** series please contact applications support.

21.0 TROUBLESHOOTING GUIDE

21.1 If you encounter difficulties in getting a **auro-he** module or complete power system to operate properly please check all connections carefully and use the following as a troubleshooting guide.

a) If the ACOK LED is ON, the DCOK LED is OFF and there is no voltage on the output then the unit will be inhibited. To enable the unit make sure that the Inhibit input is connected to the +5V Standby supply.

b) If the ACOK LED is ON, the DCOK LED is OFF and the voltage on the output is low then the output has been set below the DCOK detection point. If the remote adjust feature is being used ensure that the control voltage is set at a level sufficient to bring the output voltage within limits.

c) If both LEDs are OFF and the +5V standby supply is present then there is a fault with the unit and it should be returned for repair.

d) If both LEDs are OFF and the +5V standby supply is present then the input supply is not reaching the unit. Check that any breakers in the supply side have not tripped.

Please note that there are no user serviceable parts inside either the modules or the shelves and that opening either will void the warranty.

If you are still unable to resolve any problem call your nearest UNIPOWER sales office for support:

US +1 954 346 2442

UK +44 (0)1903 768200

UNIPOWER
Powering Technology

auro-he SERIES
AC & HVDC INPUT HIGH EFFICIENCY FRONT-ENDS & RECTIFIERS

DESCRIPTION

auro-he is UNIPOWER's new generation high efficiency hot-swappable, modular Front-Ends and Rectifiers producing up to 1500 watts output power. There are 3 standard models at 48VDC and 54.4VDC output. The modules are ultra-compact with power density up to 18.75 watts per cubic inch. The modules have automatic load sharing and active output ORing circuit so they can be hot-swapped while the system is operating. An I²C Serial bus common with other UNIPOWER products is included as standard.

Front panel mounted LEDs indicate AC input and DC output status and a +5V @ 1A standby output is also included. Operating temperature range is -20°C to +70°C, but units will start-up at as low as -40°C with reduced performance.

FEATURES

- 92% Efficiency
- 1U High: 1.6"
- -40°C to +70°C Operation
- Wide Range AC & HVDC Input
- Up to 1500W Output
- >0.98 Power Factor
- Output Voltages: 48VDC and 54.4VDC
- Power Density to 18.75W/Cu. Inch
- Hot Swappable
- Integral Active Output ORing Circuit
- Class B EMI Filter
- LED Indicators
- I²C Serial Bus
- Variable Speed Cooling Fans

THREE YEAR WARRANTY

SAFETY STANDARDS

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

FRONT-END / RECTIFIER MODULES

MAX. POWER	OUTPUT VOLTAGE	OUTPUT CURRENT	AC INPUT VOLTAGE [1, 2]	AC INPUT CURRENT [3]	MODEL NO. [4]
1523W	54.4VDC	28.00A	180-264V	7.4A	RAUQ48/28-Z
1197W	54.4VDC	22.00A	85-264V	11.0A/5.8A	RAUP48/22-Z
1500W 1200W	48.0VDC	31.25A 25.00A	180-264V 85-132V	7.4A 11.0A	TAUQ7000-Z

Notes:
1. Models showing two output current levels with two AC input ranges will operate over the full range from 85VAC to 264VAC, automatically limiting output current according to the actual input voltage range applied.
2. All units will also operate from 90-420VDC, taking into account the same conditions as in note 1.
3. Input currents shown are nominal values at 120VAC/240VAC as appropriate.
4. For special requirements the I²C interface can be removed (consult sales).

MODULE ACCESSORIES

DESCRIPTION	PART NUMBER		
	UNIPOWER	TYCO	FCI
Mating Connector	355-3368-0000	6450372-1	51816-025
Evaluation Board	009-4045-0000		

4-BAY 19" SHELF SYSTEM ORDERING GUIDE

MAX. POWER	DESCRIPTION	MAX. CURRENT	MODEL NO.
6000W	Single Output Bus IEC60320-C20 AC Input	125A	TAUQR1U4A
6000W	Single Output Bus Terminal Block AC Input	125A	TAUQR1U4B
6000W	Dual Output Bus IEC60320-C20 AC Input	62.5A/62.5A	TAUQR1U4C
6000W	Dual Output Bus Terminal Block AC Input	62.5A/62.5A	TAUQR1U4D

Blanking kit for unused position, order pt. no. 775-1501-0000.

www.unipowerco.com

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

UNIPOWER
Powering Technology

SPECIFICATIONS

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.	50A 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, 20A

OUTPUT

Current & Voltage	See Table
Output Power	1200-1500W
Voltage Adjustment Range	±5%
Standby Output	+5V@1A
Line & Load Regulation, Max.	2%
Holdup Time	10msec.
Overvoltage Protection	Latch Off
Filtering: Wideband Noise, 20MHz BW	1%
Current Limit [2]	105-115% Rated Current
Efficiency (48VDC @ 1500W rated)	
100% Load	to 91.0%
75% Load	to 92.0%
40% Load	to 91.0%

SAFETY STANDARDS 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 (open drain, TTL compatible)

$\overline{\text{ACOK}}$	AC present, 5V standby operating
$\overline{\text{DCOK}}$	DC output within -10% of nominal @ 48VDC
$\overline{\text{TEMPOK}}$	Internal temperature within limits

SERIAL COMMUNICATIONS

I²C	Fitted as standard

ENVIRONMENTAL

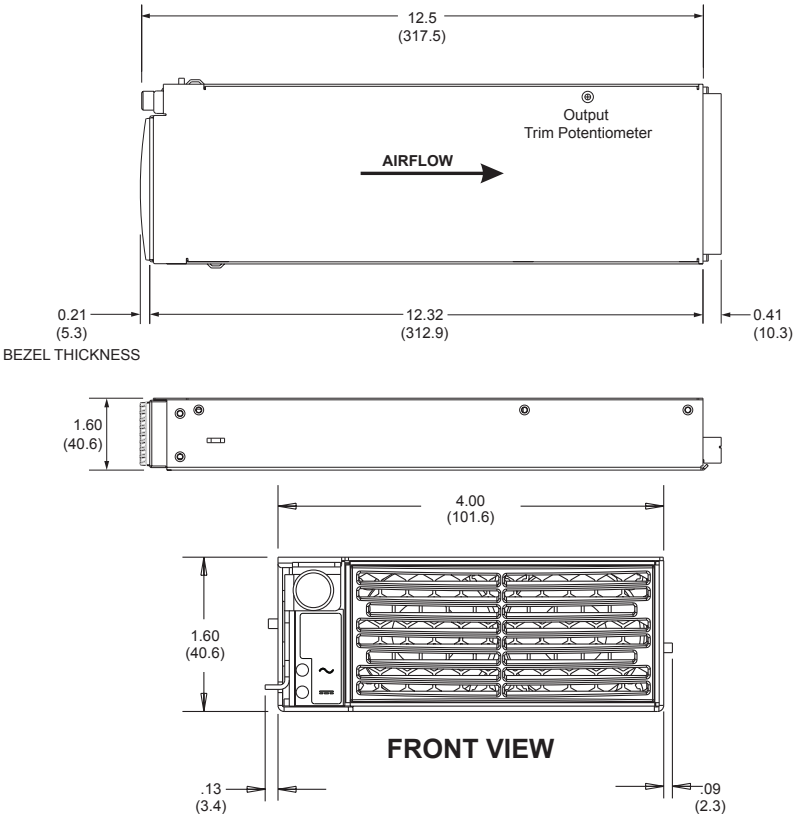
Operating Temp. Range	-20°C to +70°C
	-40°C start-up, reduced performance
Output Current Derating	2.5%/°C, 50°C to 70°C
Storage Temp. Range	-40°C to + 85°C
Environment	Pollution Degree 2
Humidity	0% to 95%, Non-Condensing
ESD	Bellcore GR-1089-Core and EN61000-4-2
MTBF, 35°C (Bellcore)	200,000 Hours
Cooling	Integral Ball Bearing Fans
Acoustic Noise @ 1m (module)	40-65dB

PHYSICAL SPECIFICATIONS

Case Material	Steel
Case Dimensions, Inches (mm)	1.60 H x 4.00 W x 12.50 D
	(40.6 x 102 x 317.5)
Weight	4.2 lbs. (1.9 kg.)

Notes:
1. External protection required when operating from HVDC.
2. Subject to absolute power limit of 1500W + tolerance.

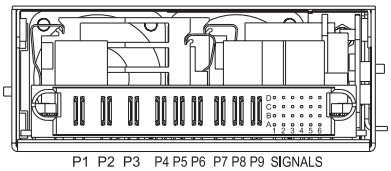
OUTLINE DRAWING



FRONT VIEW

ALL DIMENSIONS IN INCHES (mm).

REAR VIEW (with connection details)



SIGNAL PIN CONNECTIONS			
PIN	**FUNCTION**	**PIN**	**FUNCTION**
A1	$\overline{\text{MODULE PRESENT}}$	C1	Sense +Ve [1]
A2	Not Used	C2	Current Monitor [1]
A3	Not Used	C3	GA1
A4	Signal Return [1]	C4	5V Standby [1]
A5	Not Used	C5	$\overline{\text{DCOK}}$
A6	Not Used	C6	SCL
B1	Sense -Ve	D1	Remote Adjust [1]
B2	$\overline{\text{Inhibit}}$	D2	Current Share [1]
B3	GA2	D3	GA0
B4	Signal Return [1]	D4	Not Used
B5	$\overline{\text{TEMPOK}}$	D5	$\overline{\text{ACOK}}$
B6	SDA	D6	$\overline{\text{ENABLE}}$

NOTES:
1. Referenced to -Ve Sense.

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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 **auro-he** 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 **auro-he** 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 **auro-he** 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:
Value = (byte read x 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

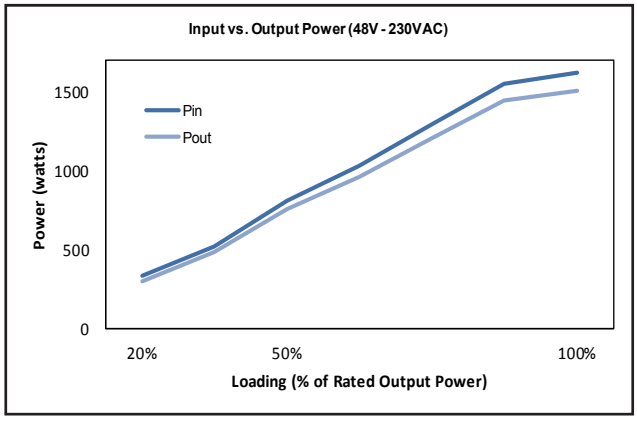
Temperature Measurement Functions
The internal temperature of the unit is measured using a MAX6633. This device provides a 12-bit measurement at a resolution of 0.0625°C.

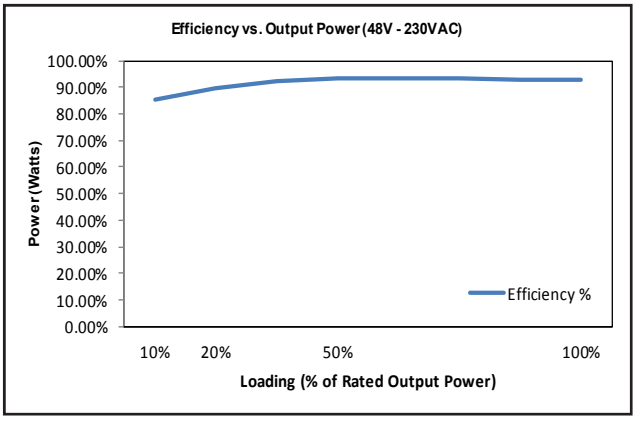
MAX6633 slave address

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

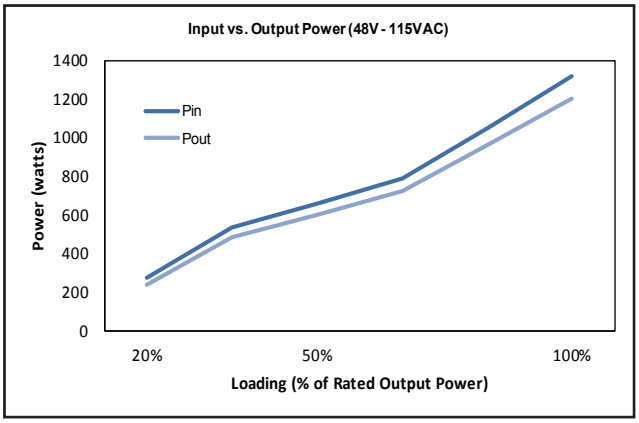
EFFICIENCY TEST RESULTS

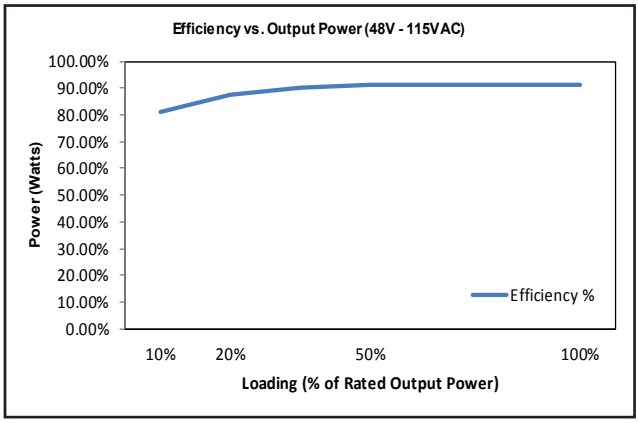
230VAC Input		48V Output		
Load (%)	Fraction of Load	Input Watts	Output Watts	Efficiency
10%	Low	176.27	150	85.10%
20%	Light	335.72	300	89.36%
50%	Typical	805.23	750	93.14%
100%	Full	1614.06	1500	92.93%





115VAC Input		48V Output		
Load (%)	Fraction of Load	Input Watts	Output Watts	Efficiency
10%	Low	148.4	120	80.97%
20%	Light	275.4	240	87.25%
50%	Typical	659.4	600	91.09%
100%	Full	1317.4	1200	91.18%





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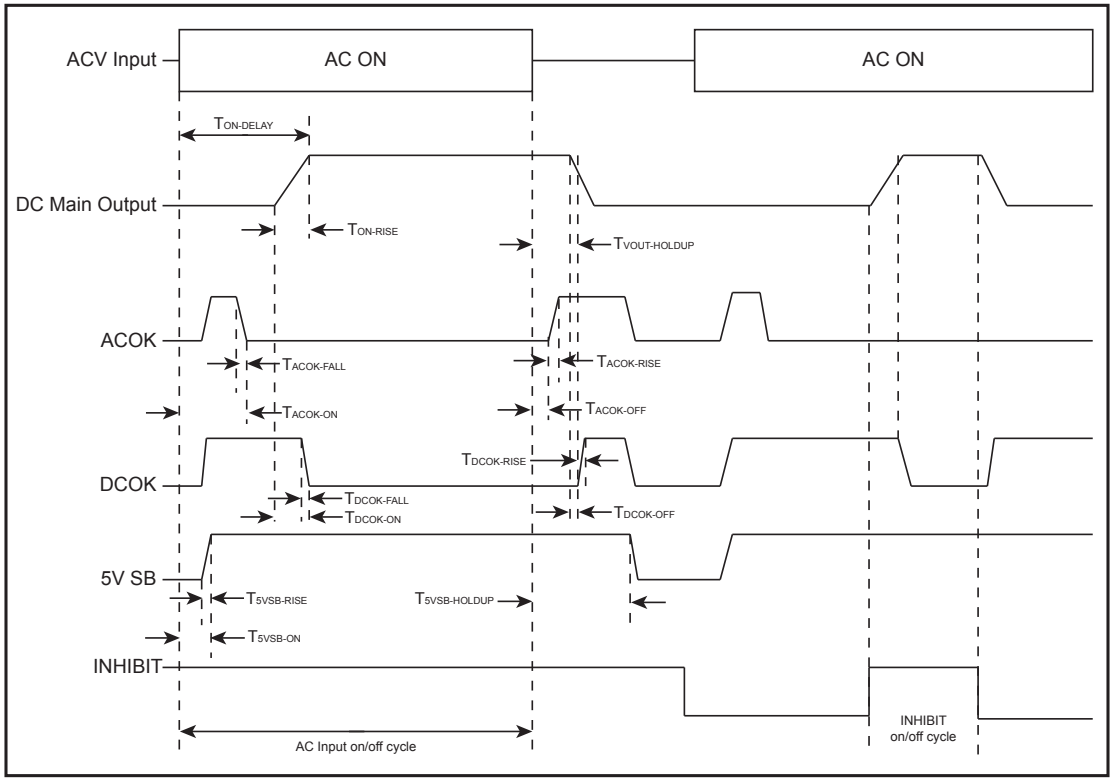
auro-he Timings

Value	Min.	Typ.	Max.	Description
TACON_DELAY	540ms	600ms	660ms	Delay from AC input voltage applied to output in regulation
TVOUT_HOLDUP	10ms	12ms	-	Time from loss of AC input to DC output voltage falling to 90% of original value. Timing given is for 1500Watt load on 48V model.
TVSB_HOLDUP	20ms	30ms	-	Time from loss of AC input to VSB going out of regulation. Typical timing for full load on all outputs.
T5VSB_ON	160ms	180ms	200ms	Delay from AC input voltage applied to VSB in regulation.
TACOK_ON	160ms	180ms	190ms	Time from AC input voltage applied to ACOK being low (good)
TACOK_OFF	9ms	10ms	11ms	Time from loss of AC input to ACOK output being high. Timing given is for 1500Watt load on 48V model.
TON_RISE		8ms		Time for DC output to rise to final regulated value. This is reprogrammable with PMBus.
T5VSB_RISE	160ms	150ms	190ms	Time for 5VSB to rise to final regulated voltage.
TINHIBIT_DELAY_ON		0ms		Time from INHIBIT pin going high to main output coming on.
TINHIBIT_DELAY_OFF		0ms		Time from INHIBIT pin going low to main output going off.
TDCOK_ON	540ms	600ms	660ms	Time from main output beginning to rise and DCOK going low (with default 50ms rise time of main output).
TDCOK_OFF	14ms	16ms	18ms	Time from main output going out of regulation to DCOK going high (typical at 1500Watt load on 48V model).
TDCOK_FALL	50ns	100ns	1000ns	Time for DCOK signal to transition from high to low*
TDCOK_RISE	1µs	2µs	10µs	Time for DCOK signal to transition from low to high*
TACOK_FALL	50ns	100ns	1000ns	Time for ACOK signal to transition from high to low*
TACOK_RISE	1µs	2µs	10µs	Time for ACOK signal to transition from low to high*
TTEMPOK_FALL	50ns	100ns	1000ns	Time for TEMPOK signal to transition from high to low*
TTEMPOK_RISE	1µs	2µs	10µs	Time for TEMPOK signal to transition from low to high*

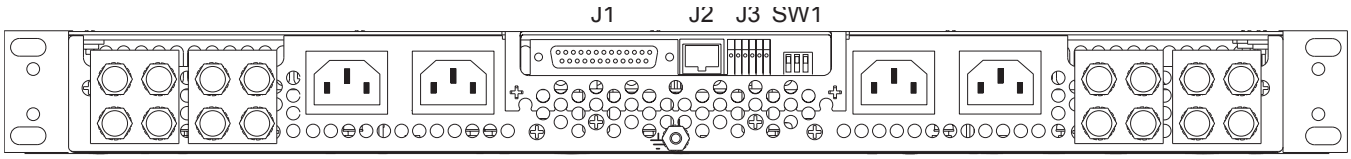
*ACOK, DCOK & TEMPOK pulled up to 5V with 10kOhm resistor.



SPECIFICATIONS, RACKS/SHELVES

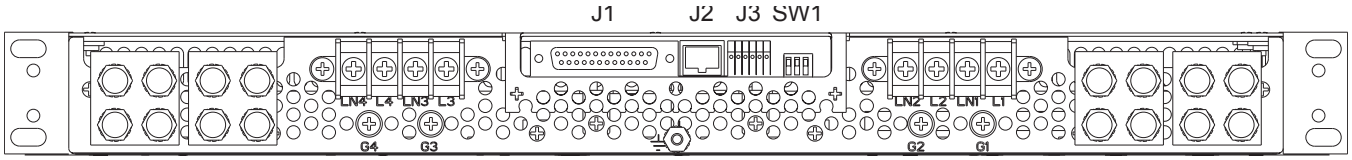
REAR PANEL DETAIL

TAUQR1U4A - 125A Single Bus Output / IEC60320-C14 Input



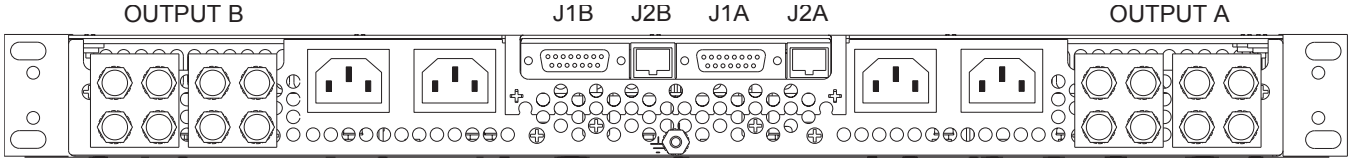
- V 125A Max. | +V | AC4 | AC3 | Frame Ground | AC2 | AC1 | +V 125A Max. | - V

TAUQR1U4B - 125A Single Bus Output / Screw Terminal Input



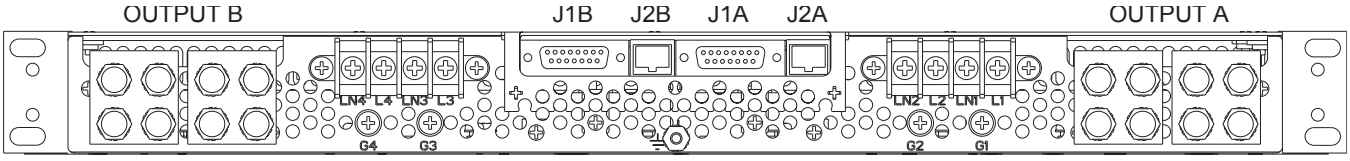
- V 125A Max. | +V | AC4/AC3 | Frame Ground | AC2/ AC1 | +V 125A Max. | - V

TAUQR1U4C - 62.5A Dual Bus Output / IEC60320-C14 Input



- V 62.5AMax. | +V | AC4 | AC3 | Frame Ground | AC2 | AC1 | +V 62.5AMax. | - V

TAUQR1U4D - 62.5A Dual Bus Output / Screw Terminal Input



- V 62.5AMax. | +V | AC4/AC3 | Frame Ground | AC2/ AC1 | +V 62.5AMax. | - V

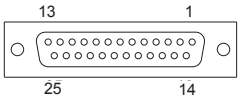
NOTES:

1. Single bus shelves are provided with two pairs of output bus bars that are connected together internally. The maximum current capacity of each pair is 125A.
2. J1 is a 25-way D-Type socket. J1A and J1B are 15-way D-Type sockets.
3. J2 is an RJ25 socket.
3. J3 is a spring-clamp terminal block accepting wire size 20-26AWG.
4. Dual bus shelves are not normally intended for parallel operation and have fixed I²C bus addresses. Consult factory for parallel operation and/or alternate I²C bus addressing.
5. Various line cords are available for use with TAUQR1U4A and TAUQR1U4C. Consult sales for availability.
6. Protective covers are provided as standard for the DC output terminals and the input terminal block inputs.
7. For HVDC input applications UNIPOWER recommends TUAQR1U4B or TAUQR1U4D.

CONNECTION DETAILS

TAUQR1U4A & TAUQR1U4B

SIGNAL CONNECTOR - J1			
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	$\overline{\text{ACOK}}$ - 1
2	Not Used	15	$\overline{\text{DCOK}}$ - 1
3	$\overline{\text{TEMPOK}}$ - 1	16	$\overline{\text{ACOK}}$ - 2
4	$\overline{\text{TEMPOK}}$ - 2	17	$\overline{\text{DCOK}}$ - 2
5	$\overline{\text{TEMPOK}}$ - 3	18	$\overline{\text{ACOK}}$ - 3
6	$\overline{\text{TEMPOK}}$ - 4	19	$\overline{\text{DCOK}}$ - 3
7	Remote Adjust [2] - 4	20	$\overline{\text{ACOK}}$ - 4
8	5V Standby [1]	21	$\overline{\text{DCOK}}$ - 4
9	$\overline{\text{MODULE PRESENT}}$ - 1	22	Sense -Ve
10	$\overline{\text{MODULE PRESENT}}$ - 2	23	Signal Return
11	$\overline{\text{MODULE PRESENT}}$ - 3	24	Remote Adjust [2] - 1
12	Remote Adjust [2] - 2	25	Remote Adjust [2] - 3
13	$\overline{\text{MODULE PRESENT}}$ - 4		



25-way D-type Socket

SIGNAL CONNECTOR - J2			
PIN	FUNCTION	PIN	FUNCTION
1	Not Used	4	5V Standby
2	SDA	5	SCL
3	Signal Return	6	Inhibit

RJ25 Socket

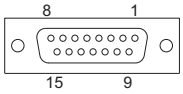
SIGNAL CONNECTOR - J3			
PIN	FUNCTION	PIN	FUNCTION
1	Sense +Ve	4	Sense +Ve
2	Sense -Ve	5	Sense -Ve
3	Current Share	6	Current Share

Spring-Clamp Terminal Block

ADDRESS SWITCH - SW1	
SW	FUNCTION
1	GA0
2	GA1
3	GA2

TAUQR1U4C & TAUQR1U4D

SIGNAL CONNECTORS - J1A & J1B			
J1A		J1B	
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit - A	1	Inhibit - B
2	Not Used	2	Not Used
3	$\overline{\text{TEMPOK}}$ - 2	3	$\overline{\text{TEMPOK}}$ - 4
4	$\overline{\text{TEMPOK}}$ - 1	4	$\overline{\text{TEMPOK}}$ - 3
5	5V Standby [1] - A	5	5V Standby [1] - B
6	Remote Adjust [2] - 2	6	Remote Adjust [2] - 2
7	Remote Adjust [2] - 1	7	Remote Adjust [2] - 1
8	$\overline{\text{ACOK}}$ - 2	8	$\overline{\text{ACOK}}$ - 4
9	$\overline{\text{DCOK}}$ - 2	9	$\overline{\text{DCOK}}$ - 4
10	$\overline{\text{ACOK}}$ - 1	10	$\overline{\text{ACOK}}$ - 3
11	$\overline{\text{DCOK}}$ - 1	11	$\overline{\text{DCOK}}$ - 3
12	Sense -Ve - A	12	Sense -Ve - B
13	Signal Return - A	13	Signal Return - B
14	Sense +Ve [2] - A	14	Sense +Ve [2] - B
15	Current Share [2] - A	15	Current Share [2] - B



15-way D-type Sockets x 2

SIGNAL CONNECTORS - J2A & J2B			
J2A		J2B	
PIN	FUNCTION	PIN	FUNCTION
1	Not Used	1	Not Used
2	SDA - A	2	SDA - B
3	Signal Return - A	3	Signal Return - B
4	5V Standby [1] - A	4	5V Standby [1] - B
5	SCL - A	5	SCL - B
6	Inhibit - A	6	Inhibit - B

RJ25 Sockets x 2

NOTES:
1. Current rating of +5V standby is 1A per module.
2. Referenced to -Ve Sense.

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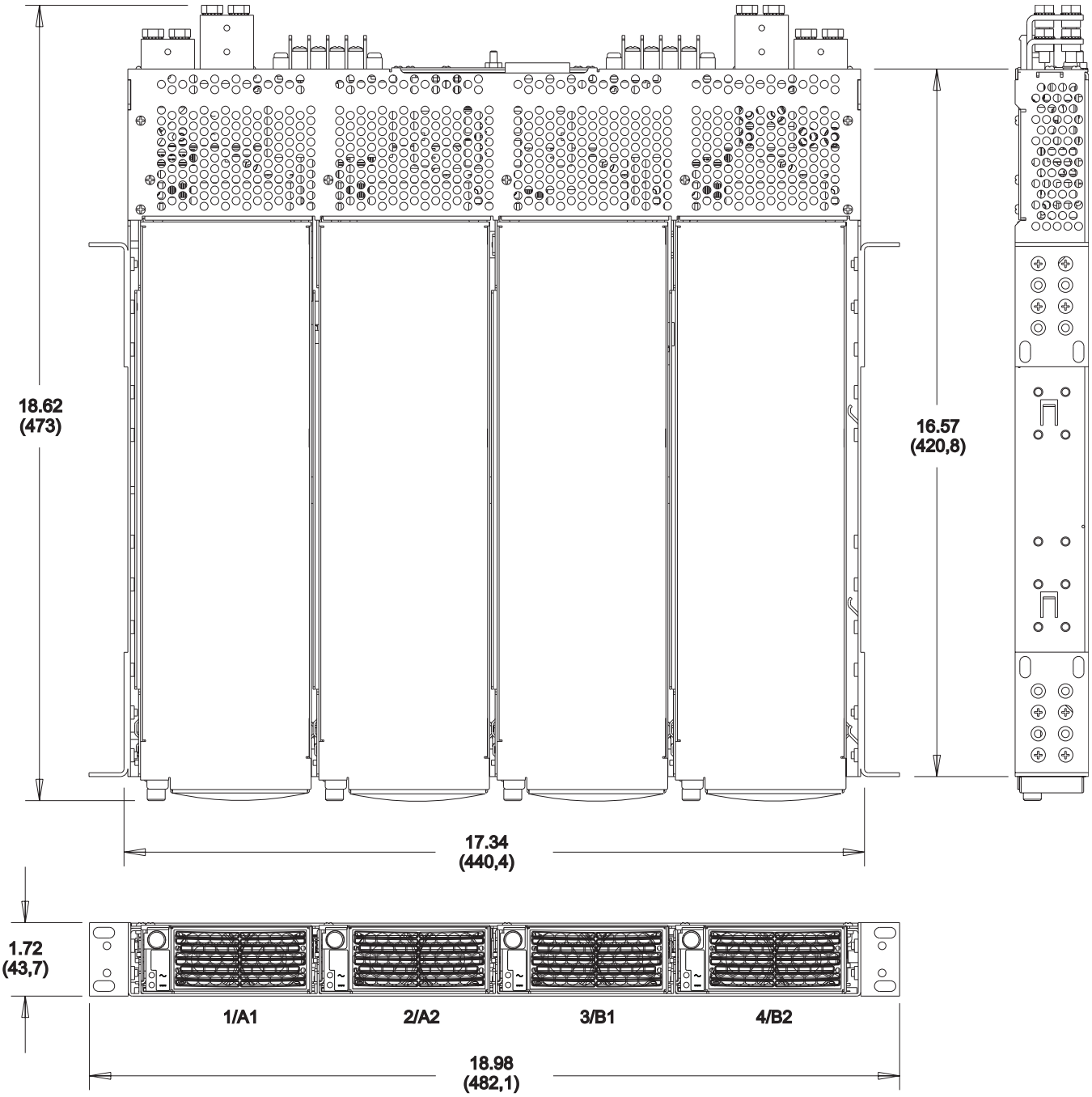
MECHANICAL



WEIGHTS
Shelf: 12.1 lbs. (5.5Kg)
Modules (each): 4.2 lbs. (1.9Kg)

ALL DIMENSIONS IN INCHES (mm).

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ALARM & COMMUNICATIONS ADAPTORS

RELAY ALARM ADAPTOR	Part No.: 009-1005-0000	Datasheet WEB Link	Notes
	Plugs directly into the 25 way D-Type signal connector J1 (J2) and converts DC good signal for each module to a Form-C volts-free relay contact output. The module allows daisy chaining of parallel connected shelves for share bus and remote sense. NOTE: Compatible only with single bus models TAUQR1U4A and TAUQR1U4B.	PDF	

SNMP ALARM TRAP ADAPTOR	Part No.: 009-1006-0000	Datasheet WEB Link	Notes
	Plugs directly into the 25 way D-Type signal connector J1 (J2). Monitors DC Good signal of each power module. Plugs directly into the 25 way DType signal connector J1 (J2). Monitors DC Good signal of each power module. When an alarm occurs or clears a built-in processor sends an SNMP alarm trap to the monitoring host and can send an email message. Allows daisy chaining of parallel connected shelves for share bus and remote sense connections. NOTE: Compatible only with single bus models TAUQR1U4A and TAUQR1U4B.	PDF	MIB files (.exe) Setup guide

AC CORDS, DC CABLES & POWER SHELF LINK BARS

AC LINE CORDS - 120V 15A	Part No.: 364-1412-0000	NEMA 5-15	IEC-C13
One cord per power module for TAUQR1U4A or TAUQR1U4C shelf. Cord length 6ft (1.83m)			
AC LINE CORDS - 240V 15A	**Part No.: 364-1414-0000**	**NEMA 6-15**	**IEC-C13**
One cord per power module for TAUQR1U4A or TAUQR1U4C shelf. Cord length 6ft (1.83m)			
AC LINE CORDS - 120/240V 15A	**Part No.: 364-1421-0000**	**ROJ-LEADS**	**IEC-C13**
One cord per power module for TAUQR1U4A or TAUQR1U4C shelf. Cord length 6ft (1.83m) REQUIRES CUSTOMER SUPPLIED PLUG			
DC CABLE KIT - 1 to 1 LUG 30"	**Part No.: 775-1497-1130**	**Start Lug**	**End Lug**
Pair of Black / Red #1AWG copper cable (600V 100A) 30" (76cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55". (Use two sets in parallel for bus currents from 100A to 125A.)			
DC CABLE KIT - 1 to 2 LUG 30"	**Part No.: 775-1497-1184**	**Start Lug**	**End Lug**
Pair of Black / Red #1AWG copper cable (600V 100A) 30" (76cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55", spacing 0.63". (Use two sets in parallel for bus currents from 100 to 125A.)			
DC CABLE KIT - 2 to 2 LUG 30"	**Part No.: 775-1497-1230**	**Start Lug**	**End Lug**
One pair Black / Red #1AWG copper cable (600V 100A) 30" (76cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55", spacing 0.63". (Use two sets in parallel for bus currents from 100A to 125A.)			
DC CABLE KIT - 1 to 1 LUG 84"	**Part No.: 775-1497-1284**	**Start Lug**	**End Lug**
One pair Black / Red #1AWG copper cable (600V 100A) 84" (213cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55". (Use two sets in parallel for bus currents from 100A to 125A.)			
DC CABLE KIT - 1 to 2 LUG 84"	**Part No.: 775-1497-2230**	**Start Lug**	**End Lug**
One pair Black / Red #1AWG copper cable (600V 100A) 84" (213cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55", spacing 0.63". (Use two sets in parallel for bus currents from 100A to 125A.)			
BUS BAR LINK KIT - 2 SHELF	**Part No.: 775-1509-0020**	**Notes**	
Set of copper linking bars pre-drilled to connect the output bus bars on two power shelves. (Use two kits when linking dual bus shelves or single bus shelves when system current exceeds 63.5A.)		Operating Manual PDF see pages 24 & 25 for details	
BUS BAR LINK KIT - 3 SHELF	**Part No.: 775-1509-0030**		
Set of copper linking bars pre-drilled to connect the output bus bars on three power shelves. (Use two kits when linking dual bus shelves or single bus shelves when system current exceeds 63.5A.)			
BUS BAR LINK KIT - 4 SHELF	**Part No.: 775-1509-0040**		
Set of copper linking bars pre-drilled to connect the output bus bars on four power shelves. (Use two kits when linking dual bus shelves or single bus shelves when system current exceeds 63.5A.)			

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