RADIAN TPCMQ48 SERIES

48VDC Input 1RU Rack-Mount DC-DC Front-Ends

12VDC @ 650W | 24/27VDC @ 700W | 48/54VDC @ 1000W

INDUSTRIES & APPLICATIONS

Telecom · Cable · Utilities · Government · Industrial

FEATURES

- Isolated 5V, ¼ A Standby Output
- Hot-Swap Operation
- 12, 24 or 48 VDC Output
- Up to 3000 Watts System Output
- Remote Output Adjustment
- Wide Range 40 to 60VDC Input
- Integral LED Status Indicators
- -20°C to +70°C Operating
- I²C Serial Data Bus Option
- Up to 12.5 Watts/Cubic Inch Power Density
- Low Profile: 1.6 Inches High
- Single Hot-Swappable Connector
- Reverse Air Flow Option
- Staged Pin Engagement
- ORing Diode on Output
- 1U, 19" Rack/Shelf Holds 3 Units
- 19- or 23-Inch Rack Mounting
- Active Current Sharing
- Optimized Thermal Management
- No Minimum Load
- Control & Monitoring Features

TPCMQ48 Series Module

1U High
1.6" x 5" x 10"
(41 x 127 x 254 mm)

Three-Unit Rack/Shelf
TPCMQR1U3-48
TPCMQR1U3-48H

E130645 LVD2006/95/EC ROHS2011/65/EU

THREE-YEAR WARRANTY
Patent Protected

STANDARD MODULES

OUTPUT POWER	OUTPUT VOLTAGE	OUTPUT CURRENT	INPUT CURRENT	MODULE NUMBER	RACK/SHELF NUMBER
650W	12VDC	54.2A	16.5A @ 48VDC	TPCMQ48-12/54	TPCMQR1U3-48
700W	24VDC 27.2VDC	29.2A 25.7A	16.6A @ 48VDC 19.9A @ 40VDC	TPCMQ48-24/29 TPCMQ48-27/26	
1000W	48VDC 54.4VDC	20.8A 18.4A	20.8A @ 48VDC 25.0A @ 40VDC	TPCMQ48-48/21 TPCMQ48-54/18	TPCMQR1U3-48H or LTPCMQR1U3-48H

NOTES:
1. System rack and hot-swap modules must be ordered separately.
2. Racks mount in 19" and 23" frames.
3. DC output terminations on the -48 and -48-H differ, see page 5.
4. LTPCMQR1U3-48H rack is a UL Listed version, consult sales for further details.
5. The table does not show the independent 5V, ¼A standby output which is standard on all modules.

OPTIONS

CODE	DESCRIPTION	OUTPUT DERATING	APPLICABILITY
R	Reverse Air Flow (Back to Front)	20%	All modules
Z	I²C Serial Data Bus	N/A	All modules TPCMQR1U3-48

NOTE: TPCMQR1U-48H and LTPCMQR1U3-48H will accept modules both with and without the I²C option, but modules should not be mixed.

SAFETY CERTIFICATIONS

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

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SPECIFICATIONS

Typical at Nominal 48VDC Input, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS

Total Output Power, Continuous, Max	see table page 1
Voltage Adjustment Range, Min	-25% to +10%
Total Regulation[1]	2.0%
Total Regulation, Standby Supply	5.0%
Ripple & Noise, Pk-Pk[2]	200mV
Voice Band Noise	<32dBrnC
Dynamic Response[3]	300µS
Temperature Coefficient	±0.02%/°C
Minimum Load	0A
Current Limit	105% Rated Current
Overload Protection	Auto Recovery
Overvoltage Protection	Latched Shutdown
Remote Sense	Up to 0.25V Per Wire
Current Share	±10% Full Load Rating
Standby Output	+5V, 250mA
Output Power Good Signal	Logic Low
Input Power Fail Signal	Logic High
Inhibit	Logic Low
Enable	Logic Low
Thermal Warning	Logic High

INPUT SPECIFICATIONS

Input Voltage Range	40-60VDC
Inrush Current Limiting	10A Peak
Input EMI Filter	Standard
Analog Voltage Adjust	0 to +5V
Input Immunity, Conducted	
Fast Transients, Line-Line	±500V (EN61000-4-4)
Surges, Line-Line	±500V (EN61000-4-5)
Surges, Input Ground	±500V (EN61000-4-5)
Input Protection 12/24Vout	Internal Fuse, 30A
48Vout	requires external protection

GENERAL SPECIFICATIONS

Efficiency[4]	
12/24Vout	82-88% at Full Load
48Vout	up to 90% at Full Load
Switching Frequency	210kHz Nominal
Isolation, Class I, min.[5]	
Input-Output	2121VDC
Input-Ground	1000VDC
Output-Ground	100VDC
MTBF (Bellcore)	200,000 Hours
Safety Standards	EN60950-1, UL60950-1, CSA22.2 No.60950-1

ENVIRONMENTAL SPECIFICATIONS

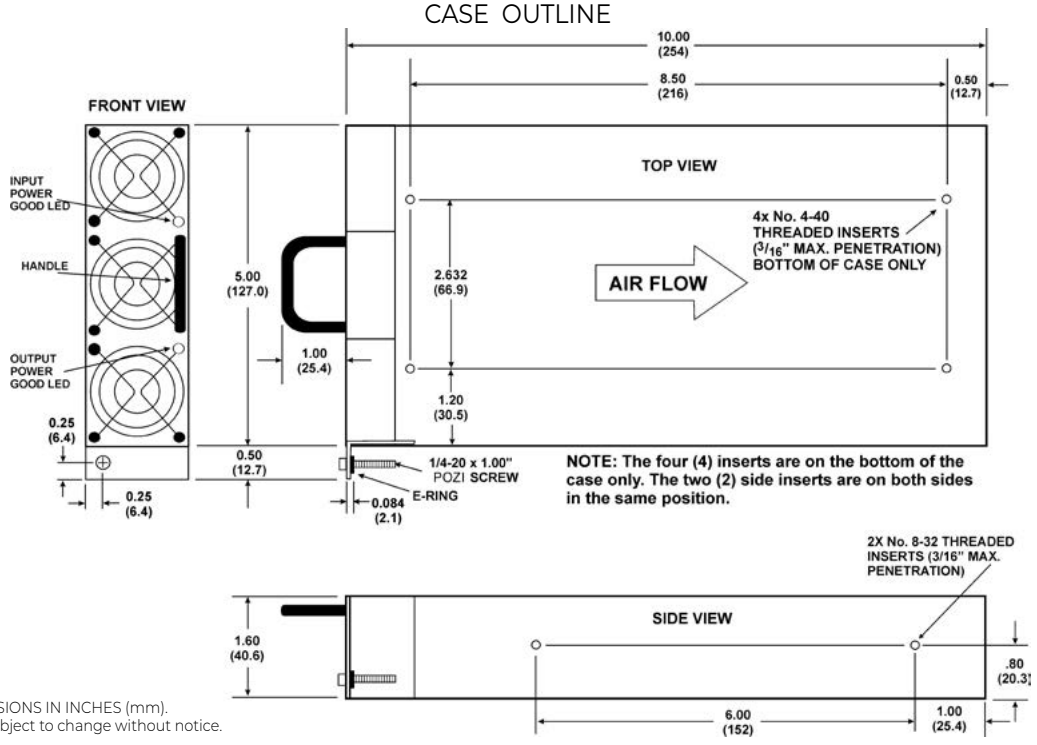
Operating Temperature	-20°C to 70°C Ambient
Derating	2.5%/°C, 50°C to 70°C
Storage Temperature	-40°C to +85°C
Cooling	Integral Ball Bearing Fans

PHYSICAL SPECIFICATIONS

Case Material, Module & Rack/Shelf	Aluminum
Dimensions, Inches(mm)	
Module	1.6 H x 5.0 W x 10.0 D (40.6 x 127 x 254)
Rack/Shelf	1.72H x 19.00 W x 11.56 D (44 x 483 x 294)
Weight	
Module	3.15 lbs. (1.43 kg.)
Rack/Shelf	4.15 lbs. (1.88 kg.)

NOTES:
1. No load to full load, including line regulation and load regulation.
2. Whichever is greater. 20MHz bandwidth. Measure with 0.1µF ceramic and 10µF tantalum capacitors in parallel across the output.
3. <4% deviation recovering to within 1% for 25% load change.
4. Typical efficiency is at low end of range for 12V output and at high end of range for 24V output.
5. Input-output isolation figure is for isolation components only. 100% production Hipot tested input to ground.

CASE OUTLINE

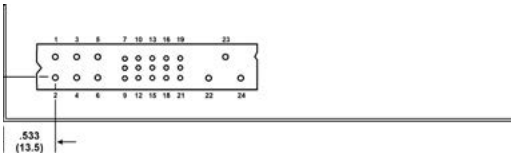


ALL DIMENSIONS IN INCHES (mm).
All specifications subject to change without notice.

MODULE PIN CONNECTIONS

12V, 24V and 27.2V Models

MODULE CONNECTOR: POSITRONICS PCIM26W11M400A1
MATING CONNECTOR: POSITRONICS PCIM26W11F400A

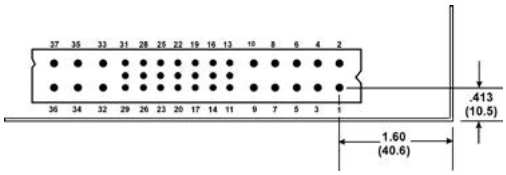


PIN CONNECTIONS			
PIN	FUNCTION	PIN	FUNCTION
1	+V Out	14	Output Power Good/ADD GA1
2	+V Out	15	Input Power Fail
3	+V Out	16	Remote Adjust
4	-V Out	17	Overtemp. Warning/ADD GA0
5	-V Out	18	Current Share
6	-V Out	19	Current Monitor/ADD GA2
7	Enable	20	+ 5V Standby
8	+Sense	21	Standby Return
9	- Sense	22	Chassis Ground
10	Inhibit	23	Chassis Ground
11	Spare/SDA	24	- DC Input
12	Spare/SCL	25	- DC Input
13	- Sense	26	+ DC Input

NOTES:
1. For unit to operate, pin 7 must be at logic LO or shorted to pin 9.
2. For proper operation the following pins must be connected together: All V Out pins (1-3); all V Return pins (4-6).
3. Pins 11, 12, 14, 17 & 19 carry I²C functions when the I²C option is fitted.

48V and 54.4V Models

MODULE CONNECTOR: POSITRONICS PCIM37W16RM400A1
MODULE CONNECTOR: POSITRONICS PCIM37W16RF400A1



PIN CONNECTIONS			
PIN	FUNCTION	PIN	FUNCTION
1	-DC Input	20	Module Present
2	-DC Input	21	N.C.
3	-DC Input	22	Input Power Fail
4	-DC Input	23	N.C.
5	+DC Input	24	GA2
6	+DC Input	25	GA1
7	+DC Input	26	SCL
8	+DC Input	27	SDA
9	Chassis Ground	28	GAO
10	Chassis Ground	29	Remote Adjust
11	N.C.	30	-Sense
12	Standby Return	31	+Sense
13	+5V Standby	32	-V Out
14	Output Power Good	33	-V Out
15	Overtemp. Warning	34	-V Out
16	Inhibit	35	+V Out
17	Enable	36	+V Out
18	Current Share	37	+V Out
19	Current Monitor		

NOTES:
1. For unit to operate, pin 17 must be at logic LO or shorted to pin 30.
2. For proper operation the following pins must be connected together: all +V Out pins (35-37); all -V Out pins (32-34).
3. Pins 24-28 carry I²C functions when the I²C option is fitted.

EVALUATION BOARDS & MATING CONNECTORS

MODULE EVALUATION BOARD	Models	Part Number
Plugs directly into the TPCMQ48 module connector to provide industrial connections for testing and evaluation. Provides DC in and DC out plus alarm connections. Includes 2 LEDS to indicate DC in and DC out status.	TPCMQ48-12/54 TPCMQ48-24/29 TPCMQ48-27/26	009-0280-0009
	TPCMQ48-48/21 TPCMQ48-54/18	use connector shown below
MODULE MATING CONNECTORS		**Part Number**
Right angle PCB mount - Connector for use in OEM design chassis. Positronic part number: PCIM26W11F400A.	TPCMQ48-12/54 TPCMQ48-24/29 TPCMQ48-27/26	354-0094-0009
Right angle PCB mount - Connector for use in OEM design chassis. Positronic part number: PCIM37W16RF400A1.	TPCMQ48-48/21 TPCMQ48-54/18	354-1686-0000

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 TPCMQ48 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 TPCMQ48 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 TPCMQ48 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)

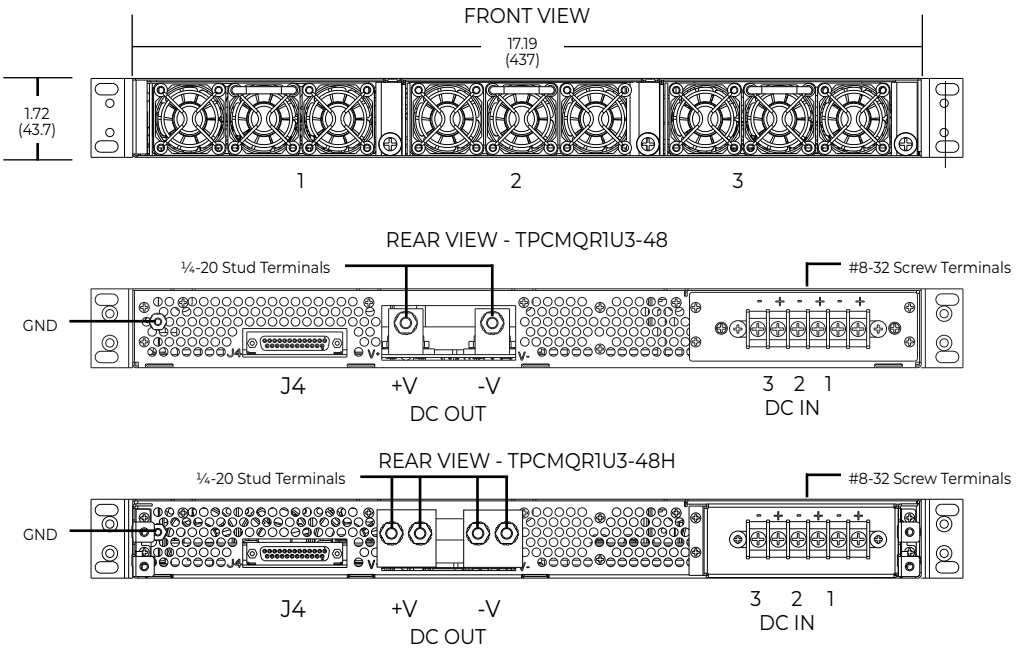
* percentage of full scale

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

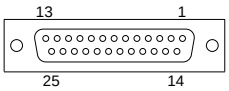
SPECIFICATIONS, RACKS/SHELVES



J4 PIN CONNECTIONS			
PIN	FUNCTION	PIN	FUNCTION
1	Inhibit	14	Input Power Fail - 1
2	Overtemp. Warning - 1	15	Output Power Good - 1
3	Current Monitor - 1	16	Input Power Fail - 2
4	Overtemp. Warning -2	17	Output Power Good - 2
5	Current Monitor - 2	18	Input Power Fail - 3
6	Overtemp. Warning - 3	19	Output Power Good - 3
7	Current Monitor - 3	20	Module Present -1
8	+5V Standby	21	Module Present - 2
9	SDA	22	Module Present - 3
10	Current Share	23	- Sense
11	+Sense	24	Remote Adjust -1
12	Remote Adjust - 2	25	Remote Adjust - 3
13	SCL		

NOTES:
1. Standby return is connected to -Sense lead. Current rating of +5Vstandby is 250mA.
2. All signals are referenced to -Sense lead. Pins 9 and 13 are I^2C outputs when that option is present.

J4 SIGNAL CONNECTOR



Standard 25-Pin
Subminiature D Connector

MAXIMUM RATED OUTPUT - 3 MODULES IN TPCMQR1U3-48H		
MODULES	NON-REDUNDANT	2+1 REDUNDANT
TPCMQ48H-48/21	48VDC @ 62.4A	48VDC @ 41.6A
TPCMQ48H-54/18	54.4VDC @ 55.2A	54.4VDC @ 36.8A

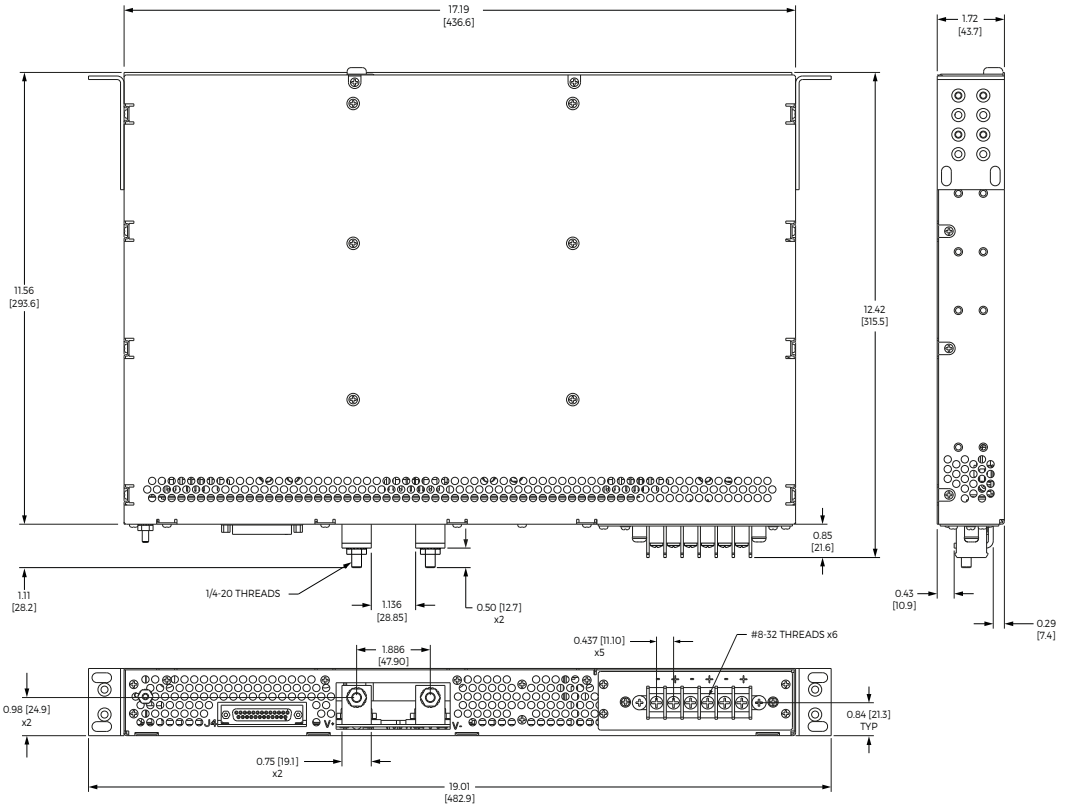
MAXIMUM RATED OUTPUT - 3 MODULES IN TPCMQR1U3-48		
MODULES	NON-REDUNDANT	2+1 REDUNDANT
TPCMQ48-12/24	12VDC @ 150.0A	12VDC @ 108.4A
TPCMQ48-24/29	24VDC @ 87.6A	24VDC @ 58.4A
TPCMQ48-27/26	27.2VDC @ 77.1A	27.2VDC @ 51.4A

ACCESSORY KITS		
Type	Function	PART NO.
Single Feed Adaptor TPCMQR1U3-48	Each kit contains 2 bars to link the 3 x +Ve and 3 x -Ve input terminals respectively.	775-1528-0000
Single Feed Adaptor TPCMQR1U3-48H		Standard
Module Position Blanking Kit	Used to blank off unused module slots. One fitted as standard.	775-1450-0010
DC bus bar converter TPCMQR1U3-48H	Converts output bus bars from 2 post to 4 post terminations.	775-1507-0000

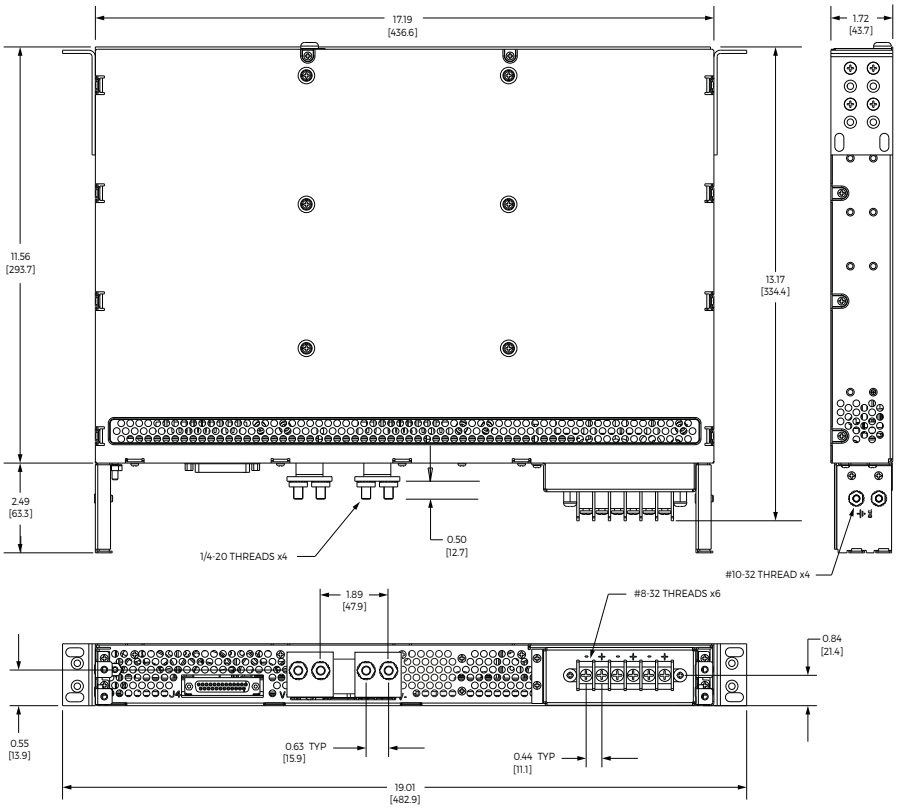
NOTES:

1. All connections are made to the rear of the rack/shelf. The modules are 1, 2, 3, from left to right as seen from the front of the rack/shelf.
2. All module outputs are connected in parallel in the rack/shelf with active current sharing between them.
3. There is a separate DC input for each module, but the inputs may be paralleled by means of an adaptor kit. See accessories list opposite.
4. The Module Present outputs (J4 pins 20, 21 & 22) are grounded (to -Sense) when the module is plugged in and open when the module is out.

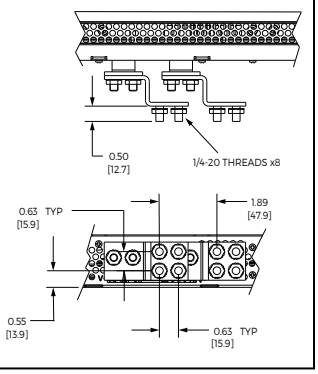
OUTLINE DRAWING - TPCMQR1U3-48 RACK/SHELF



OUTLINE DRAWING - TPCMQR1U3-48H RACK/SHELF



DETAIL SHOWING FOUR POST ADAPTORS FITTED

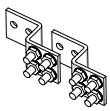


ALARM & COMMUNICATIONS ADAPTORS

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.		

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.		MIB files (.exe) Setup guide

DC CABLES

DC CABLE KIT - 1 to 1 LUG 30"	Part No.: 775-1497-1130	Start Lug	End Lug
Pair of Black / Red #4AWG copper cable (600V 125A) 30" (76cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55".			
DC CABLE KIT - 1 to 2 LUG 30"	Part No.: 775-1497-1230	Start Lug	End Lug
Pair of Black / Red #4AWG copper cable (600V 125A) 30" (76cm) with lug terminations and heat shrink. Hole size 0.25", tongue w = 0.55", spacing 0.63"			
DC CABLE KIT - 2 to 2 LUG 30"	Part No.: 775-1497-2230	Start Lug	End Lug
One pair Black / Red #4AWG copper cable (600V 125A) 30" (76cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55", spacing 0.63"			
DC CABLE KIT - 1 to 1 LUG 84"	Part No.: 775-1497-1184	Start Lug	End Lug
One pair Black / Red #4AWG copper cable (600V 125A) 84" (213cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55"			
DC CABLE KIT - 1 to 2 LUG 84"	Part No.: 775-1497-1284	Start Lug	End Lug
One pair Black / Red #4AWG copper cable (600V 125A) 84" (213cm) with lug terminations and heat shrink. Hole size 0.25", tongue width 0.55", spacing 0.63"			
4 POST ADAPTOR KIT	Part No.: 775-1507-0000		
2 to 4 post converter kit for output bus bars on TPCMQr1U3-48H.			

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