



FEATURES

- RoHS compliant
- 2000W (220Vac), 1200W (110Vac) Output power
- 48V Main output, 3.3V, 5V or 12V standby output
- 1U sized; dimensions 12" x 4.75" x 1.6"
- 21.9 Watts per cubic inch density
- N+1 redundancy capable, including hot-docking
- Active current sharing on main output
- Over-voltage, over-current, over-temperature protection
- Internal cooling fans
- I²C Bus Interface with status indicators
- Optional 1U x 19" power-shelf

PRODUCT OVERVIEW

The **D1U-W-2000** is a 2000 Watt, power-factor-corrected (PFC) front-end power supply for hot-swapping redundant systems. The main output is 48V and standby output of either 12V, 5V or 3.3V. Packaged in 1U low profile, it is designed to deliver reliable bulk power to servers, workstations, storage systems or any 48V distributed power architecture systems requiring high power density. The highly efficient electrical and thermal design with internal cooling fans supports reliable operation conditions. The D1U-W-2000 is designed to auto-recover from over-temperature faults. Status information is provided with front panel LEDs, logic signals and I²C management interface. Three units can be packaged into an optional 19" 1U power shelf to provide up to 6.0kW of power.

The **S1U-3X** is a 1U x 19" EIA Rack Mount Power Shelf designed for holding three D1U Front End Power Supplies in current sharing applications. It is intended for distributed power architecture applications in the Servers, Storage Networking and Data Communications markets. There are two lug terminal connections for #2 AWG cabling for the DC output. System connection through the I²C bus reports the performance status of the power supplies within the power shelf. Two Power Shelves can operate in parallel by an optional Shelf-to-Shelf cable, doubling the power output to the maximum capability of 12kW for two 48V power shelves.

SELECTION GUIDE

| Part Number | Power Output High Line AC | Power Output Low Line AC | Main Output | Standby Output | Airflow |
|--------------------|---------------------------|--------------------------|-------------|----------------|---------------|
| D1U-W-2000-48-HC2C | 2000W | 1200W | 48V | 3.3V | Back to front |
| D1U-W-2000-48-HA2C | 2000W | 1200W | 48V | 5V | Back to front |
| D1U-W-2000-48-HB2C | 2000W | 1200W | 48V | 12V | Back to front |
| Part Number | Description | | | | |
| S1U-3X-16-A-48-RC | Power shelf for 48V D1U | | | | |

INPUT CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-------------------------------|----------------------------|------|-------|------|-------|
| Input Voltage Operating Range | Low Line AC | 90 | | 140 | Vac |
| | High Line AC | 180 | | 264 | |
| Input Frequency | | 47 | 50/60 | 63 | Hz |
| Turn-on Input Voltage | Ramp up | 78.5 | | 86.5 | Vac |
| Turn-off Input Voltage | Ramp down | 70.5 | | 78 | |
| Maximum Input Current | Low Line AC 90Vac | | | 15 | Arms |
| | High Line AC 180Vac | | | 10 | |
| Inrush Current | Cold start between 0-1msec | | | 90 | Apk |
| Power Factor | Output load >90% | 95% | | | |
| | Output load >50% | 75% | | | |

OUTPUT VOLTAGE CHARACTERISTICS

| Output Voltage | Parameter | Conditions | Min. | Typ. | Max. | Units |
|----------------|-------------------------------------|-----------------|-------|------|-------|--------|
| 48V | Voltage Set Point Accuracy | | | 48 | | Vdc |
| | Line and Load Regulation | | 46.54 | | 49.44 | |
| | Ripple Voltage & Noise ¹ | 20MHz Bandwidth | | | 480 | mV p-p |
| | Output Current | | 2 | | 41.3 | A |
| | Load Capacitance | | | | 10000 | µF |
| 3.3Vsb | Voltage Set Point Accuracy | | | 3.3 | | Vdc |
| | Line and Load Regulation | | 3.2 | | 3.4 | |
| | Ripple Voltage & Noise ¹ | 20MHz Bandwidth | | | 50 | mV p-p |
| | Operating Range | | 0 | | 4.5 | A |
| | Load Capacitance | | | | 1530 | µF |
| 5Vsb | Voltage Set Point Accuracy | | | 5 | | Vdc |
| | Line and Load Regulation | | 4.85 | | 5.15 | |
| | Ripple Voltage & Noise ¹ | 20MHz Bandwidth | | | 50 | mV p-p |
| | Operating Range | | 0 | | 4 | A |
| | Load Capacitance | | | | 1530 | µF |
| 12Vsb | Voltage Set Point Accuracy | | | 12 | | Vdc |
| | Line and Load Regulation | | 11.6 | | 12.4 | |
| | Ripple Voltage & Noise ¹ | 20MHz Bandwidth | | | 120 | mV p-p |
| | Operating Range | | 0 | | 1.7 | A |
| | Load Capacitance | | | | 1530 | µF |



| OUTPUT CHARACTERISTICS | | | | | |
|--|--|------|------|------------|-------|
| Parameter | Conditions | Min. | Typ. | Max. | Units |
| Remote Sense | | | 240 | | mV |
| Efficiency | 220Vac | | 90.6 | | % |
| Output Rise Monotonicity | Overshoot less than 10% for all outputs, no voltage negative between 10% to 95% during ramp up | | | | |
| Start-up Time | AC ramp up | | 1.5 | | s |
| | PS_On activated | | 150 | | ms |
| Transient Response | 48V Ramp 1A/ μ s, 50% load step | | | ± 2700 | mV |
| | 3.3Vsb Ramp 1A/ μ s, 50% load step | | | ± 165 | |
| | 5Vsb Ramp 1A/ μ s, 50% load step | | | ± 250 | |
| | 12Vsb Ramp 1A/ μ s, 50% load step | | | ± 600 | |
| Current sharing accuracy (up to 6 in parallel) | At 100% load | | | ± 10 | % |
| Hot Swap Transients | All outputs within regulation | | | | |
| Hold-up Time | Max. load, nominal Vin | 17 | | | ms |

| GENERAL CHARACTERISTICS | | | | | |
|-----------------------------|--|------|------|------|---------|
| Parameter | Conditions | Min. | Typ. | Max. | Units |
| Storage Temperature Range | Non-condensing | -40 | | 70 | °C |
| Operating Temperature Range | | 0 | | 50 | |
| Operating Humidity | Non-condensing | 10 | | 90 | % |
| Storage Humidity | | 5 | | 90 | |
| Shock | 30G non operating | | | | |
| Sinusoidal Vibration | 0.5G, 5 – 500 Hz operating | | | | |
| MTBF | Calculated per Bellcore at Ta=30°C | 200 | | | Khrs |
| | Demonstrated | 200 | | | Khrs |
| Acoustic | ISO 7779-1999 | | | 60 | dB LpAm |
| Safety Approvals | c-CSA-us (CSA 60950-1-03/UL 60950-1, First Edition) TUV approval (Bauart) EN 60950-1:2001 | | | | |
| Input Fuse | Power Supply has internal 20A/250V fast blow fuse on the AC line input | | | | |
| Material Flammability | UL 94V-0 | | | | |
| Switching Frequency | 90KHz for Boost PFC Converter 165KHz for Main Output Converter 200KHz for Standby Output Converter | | | | |
| Weight | 2.1kg | | | | |

| PROTECTION CHARACTERISTICS | | | | | | |
|----------------------------|------------------|--------------|------|------|------|-------|
| Output Voltage | Parameter | Conditions | Min. | Typ. | Max. | Units |
| 48V | Over-temperature | Auto-restart | 55 | | 65 | °C |
| | Over Voltage | Latching | 54 | | 59 | V |
| | Over Current | Latching | 44 | | 50 | A |
| 12Vsb | Over Voltage | Latching | 13 | | 14 | V |
| | Over Current | Latching | 2.5 | | 3 | A |
| 3.3Vsb | Over Voltage | Latching | 3.57 | | 4.02 | V |
| | Over Current | Latching | 6.5 | | 8 | A |
| 5Vsb | Over Voltage | Latching | 5.6 | | 6 | V |
| | Over Current | Latching | 5 | | 7 | A |

¹ Ripple and noise are measured with 0.1 μ F of ceramic capacitance and 10 μ F of tantalum capacitance on each of the power supply outputs. The output noise requirements apply over a 0 Hz to 20 MHz bandwidth. A short coaxial cable with 50ohm scope termination is used.

| ISOLATION CHARACTERISTICS | | | | | |
|---|---|------|------|------|-------|
| Parameter | Conditions | Min. | Typ. | Max. | Units |
| Insulation Safety Rating / Test Voltage | Input to Output - Reinforced | 3000 | | | Vrms |
| | Input to Chassis - Basic | 1500 | | | Vrms |
| Isolation | Output to Chassis | | | | |
| | Output to Output | | | | |
| Material Flammability | UL 94V-0 | | | | |
| Grounding | Main Output Return and Standby Output Return are connected internally. 100kΩ resistor parallel with 100nF capacitor is connected between Return and power supply chassis. Main Output Return should be connected to the System Chassis. | | | | |

| CONTROL SIGNALS | | |
|----------------------------|-----------------|--|
| Status | Conditions | Description |
| LED | Off | No AC input to all PS |
| | Flashing Yellow | Power Supply Failure |
| | Flashing Green | Main Output Absent |
| | Green | Power Supply Good |
| I ² C Registers | Status | PS-ON, PGOOD, ACOK, PS_BAD, FANFAIL, OT Warning & shutdown, AC Range |
| | Output Fault | 48V OV, 48V UV, 48V OC, Vsb Fail, Fan1 Fail, Fan2 Fail |
| | 48V Output | 8 bit scaled output voltage |
| | 48V | 8 bit scaled output current |
| | Fan1 Monitor | 8 bit scaled output current |
| | Fan2 Monitor | 8 bit scaled output current |

| EMISSIONS AND IMMUNITY | | |
|----------------------------------|--------------------------------------|---|
| Characteristic | Description | Criteria |
| Harmonics | IEC/EN 61000-3-2 | |
| Voltage Fluctuation and Flicker | IEC/EN 61000-3-3 | |
| Emission Conducted | FCC 47 CFR Parts 15/CISPR 22/EN55022 | Class A, 6dB margin |
| Emission Radiated | FCC 47 CFR Parts 15/CISPR 22/EN55022 | Class A, 6dB margin |
| ESD | IEC/EN 61000-4-2 | 4kV contact discharge |
| | | 8kV operational air discharge |
| | | 15kV non-operational air discharge |
| Electromagnetic Field | IEC/EN 61000-4-3 | |
| Electrical Fast Transients/Burst | IEC/EN 61000-4-4 | |
| Surge | IEC/EN 61000-4-5 | 1kV/2kV, Performance Criteria B |
| RF Conducted Immunity | IEC/EN 61000-4-6 | 3 Vac, 80% AM, 1kHz, Performance Criteria A |
| Magnetic Immunity | IEC/EN 61000-4-8 | 3 A/m |
| Voltage dips, interruptions | IEC/EN 61000-4-11 | |

OUTPUT CONNECTOR AND SIGNAL SPECIFICATION

DC and Signal Connector: Tyco Part # 1-6450332-7, or FCI PowerBlade # 51732-028

| | | P1 | P2 | P3 | P4 | P5 | P6 | x1 | x2 | x3 | x4 | x5 | |
|--|------------------|------------------|------------------|------------------|------------------|------------------|----|---------|-------------------------|-------------------------|------------------------|------------------------|---|
| | V _{OUT} | V _{OUT} | V _{OUT} | V _{RTN} | V _{RTN} | V _{RTN} | | AC_OK | P_GOOD | V _{SB} +OUT | V _{SB} RETURN | V _{SB} RETURN | D |
| | | | | | | | | PS_ON | V _{SB} +OUT | V _{SB} +OUT | V _{SB} RETURN | V _{SB} RETURN | C |
| | | | | | | | | I_SHARE | I ² C ADRO | I ² C ADR1 | I ² C ADR2 | PS_PRESENT | B |
| | | | | | | | | PS_KILL | V _{OUT} SENSE+ | V _{OUT} SENSE- | I ² C DATA | I ² C CLOCK | A |

| Pin Assignment | Signal Name | Description | High Level Low Level | I Max |
|----------------|------------------------|--|---|----------------|
| P1, P2, P3 | V _{OUT} | Main output voltage | | |
| P4, P5, P6 | V _{RTN} | Main output voltage, return | | |
| A2 | Sense + | V _{OUT} remote sense, positive node input, connected to the +ve load point | | |
| A3 | Sense - | V _{OUT} remote sense, negative node input, connected to the -ve load point | | |
| C2, C3, D3 | V _{SB} | Standby voltage output | | |
| C4, C5, D4, D5 | V _{SB} Return | Standby voltage, return, tied internally to Output Return | | |
| B1 | I_Share | Active load sharing bus | 0 – 8V | -4 mA / +5 mA |
| D1 | AC_OK | Input AC Voltage “OK” signal output (Internal pull up is 10kΩ to Vsb) | >2.4V (active, OK) <0.4V | +4 mA -2 mA |
| D2 | P_Good | Power good signal output (Internal pull up is 10kΩ to Vsb) | >2.4V (active, Good) <0.4V | +4 mA -2 mA |
| A1 | PS_Kill | Floating pin will turn off P/S (shorter pin, last-make and first-break contact for hot plugging). This signal overrides PS-On in disabling the Main Output | >2.1V (open, or Vsb) <0.7V (active, PS:On) | N/A |
| B5 | PS_Present | Internally tied to Vsb return | 0 V | |
| C1 | PS_On | Internal 1K ohm pull-up to Vsb, (accepts open collector/drain drive), This signal to be pulled low to turn-on power supply | >2.1V (open, or Vsb) <0.7V (active, PS:On) | -4 mA -1 mA |
| A4 | I ² C Data | I ² C serial data bus | Vsb | |
| A5 | I ² C Clock | I ² C serial clock bus | Vsb | |
| B2 | I ² C Adr0 | Address input 0, internal pull-up to Vsb | >2.1V, < Vsb <0.8V | ±1 mA |
| B3 | I ² C Adr1 | Address input 1, internal pull-up to Vsb | >2.1V, <Vsb <0.8V | ±1 mA |
| B4 | I ² C Adr2 | Address input 2, internal pull-up to Vsb | >2.1V, <Vsb <0.8V | ±1 mA |

D1U MATING CONNECTORS

| 48V D1U mating connector | Press Fit | | Solder ² | |
|--------------------------|--------------------|--------------------|---------------------|--------------------|
| | Straight | Right Angle | Straight | Right Angle |
| MPS | N/A | Pending | N/A | 36-0440026-0 |
| FCI | 51742-10602000CALF | 51762-10602000CBLF | 51742-10602000AALF | 51762-10602000ABLF |
| Tyco | TBD | TBD | TBD | TBD |

² Solder connector recommended for board thickness of <0.090

CONNECTOR TO CUSTOMER SYSTEM

Signal Connector: MOLEX # 39-28-5204 OR TYCO # 281282-1

Mating Connector: MOLEX # 0039521204

| Pin Assignment | Signal Name | Description | High Level Low Level | I Max |
|----------------|-------------------------------------|---|---|------------------|
| 1 | AC_OK1 ¹ | Input AC Voltage 'OK' signal output for the 2nd shelf | open drain < 0.7V | - 2 mA + 4 mA |
| 2 | P_Good1 ² | Power good signal output for the 2nd shelf | open drain < 0.7V | - 2 mA + 4 mA |
| 3 | PS_On1 ³ | Power enable for the 2nd shelf | > 2.1V (open, or Vsb) < 0.7V (active, PS:On) | - 1 mA - 4 mA |
| 4 | NOT USED | | | |
| 5 | AC_OK0 ¹ | Input AC Voltage "OK" signal output for the local shelf | open drain < 0.7V | - 2 mA + 4 mA |
| 6 | P_Good0 ² | Power good signal output for the local shelf | open drain < 0.7V | - 2 mA + 4 mA |
| 7 | PS_On0 ³ | Power enable for the local shelf | > 2.1V (open, or Vsb) < 0.7V (active, PS:On) | - 1 mA - 4 mA |
| 8 | NOT USED | | | |
| 9 | I ² C Adr2 | Address input 2 | > 2.1V, < Vsb < 0.8V | ± 1 mA |
| 10 | I ² C Clock ⁴ | I ² C serial clock bus | Vsb | |
| 11 | I ² C Data ⁴ | I ² C serial data bus | Vsb | |
| 12 | I_SHARE | | | |
| 13 | SENSE + ⁵ | | | |
| 14 | SENSE - ⁵ | | | |
| 15 | Vsb | Standby voltage output | | |
| 16 | Vsb | Standby voltage output | | |
| 17 | Vsb | Standby voltage output | | |
| 18 | GND | GROUND | | |
| 19 | GND | GROUND | | |
| 20 | GND | GROUND | | |

All control signals are with respect to Ground. Negative currents exit the power supply.

¹ Signal goes low when any one of the three power supplies loses AC

² Signal goes low when any one of the three power supplies fail

³ In a standalone shelf (without I²C control) Pull this pin to GND to turn on three power supplies at the same time. With I²C control, leave this signal float and Use I²C to turn on one power supply at a time.

⁴ Recommended 10KOhm pull up resistor to host 3.3 or 5V rail

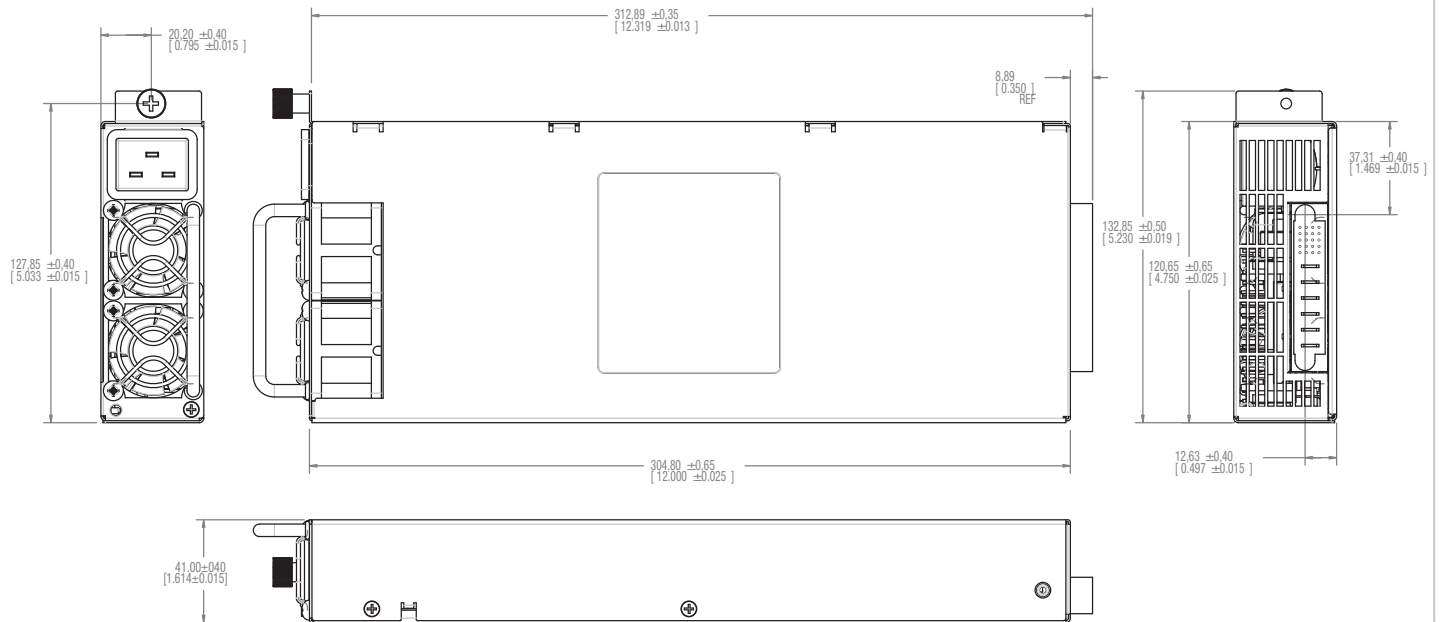
⁵ Short Sense+ to +Vout and Sens- to GND at the point of load

SHELF TO SHELF CONNECTION

Signal Connector: MOLEX # 39-28-5164 OR TYCO # 281281-1

| Pin Assignment | Signal Name | Description | High Level Low Level | I Max |
|----------------|-------------------------------------|---|---|------------------|
| 1 | AC_OK1 ¹ | Input AC Voltage 'OK' signal output for the 2nd shelf | open drain < 0.7V | - 2 mA + 4 mA |
| 2 | P_Good1 ² | Power good signal output for the 2nd shelf | open drain < 0.7V | - 2 mA + 4 mA |
| 3 | PS_On1 ³ | Power enable for the 2nd shelf | > 2.1V (open, or Vsb) < 0.7V (active, PS:On) | - 1 mA - 4 mA |
| 4 | NOT USED | | | |
| 5 | NOT USED | | | |
| 6 | I ² C Clock ⁴ | I ² C serial clock bus | Vsb | |
| 7 | I ² C Data ⁴ | I ² C serial data bus | Vsb | |
| 8 | I_SHARE | | | |
| 9 | SENSE + ⁵ | | | |
| 10 | SENSE - ⁵ | | | |
| 11 | Vsb | Standby voltage output | | |
| 12 | Vsb | Standby voltage output | | |
| 13 | Vsb | Standby voltage output | | |
| 14 | GND | GROUND | | |
| 15 | GND | GROUND | | |
| 16 | GND | GROUND | | |

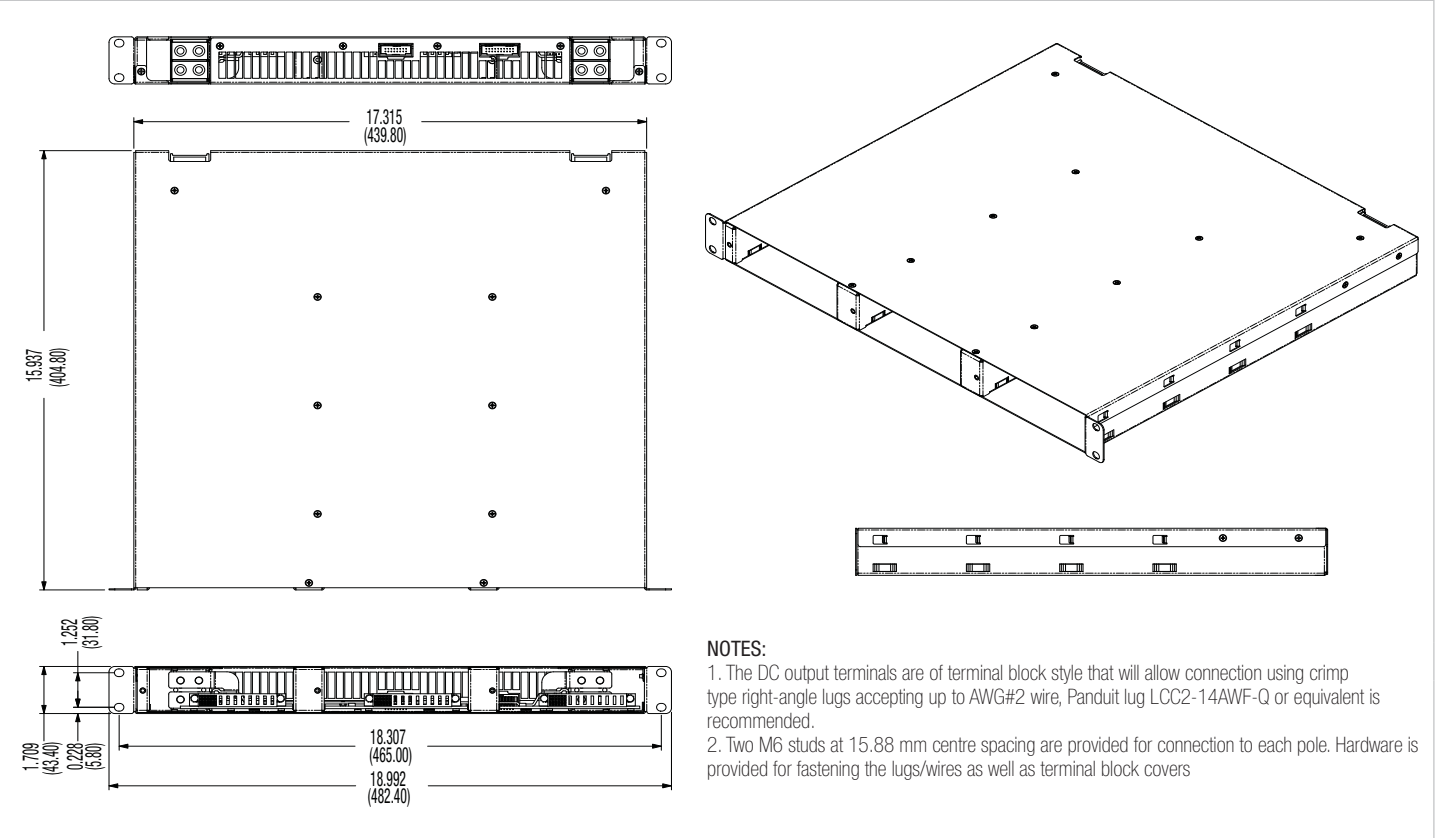
MECHANICAL DIMENSIONS - D1U-W-2000-48-Hx



AC Input Connector: The AC input connector is standard IEC320 C20 (20A)

Dimensions: 12.00" L x 4.75" W x 1.6" H (40.7H x 120.6W x 304.90mm)

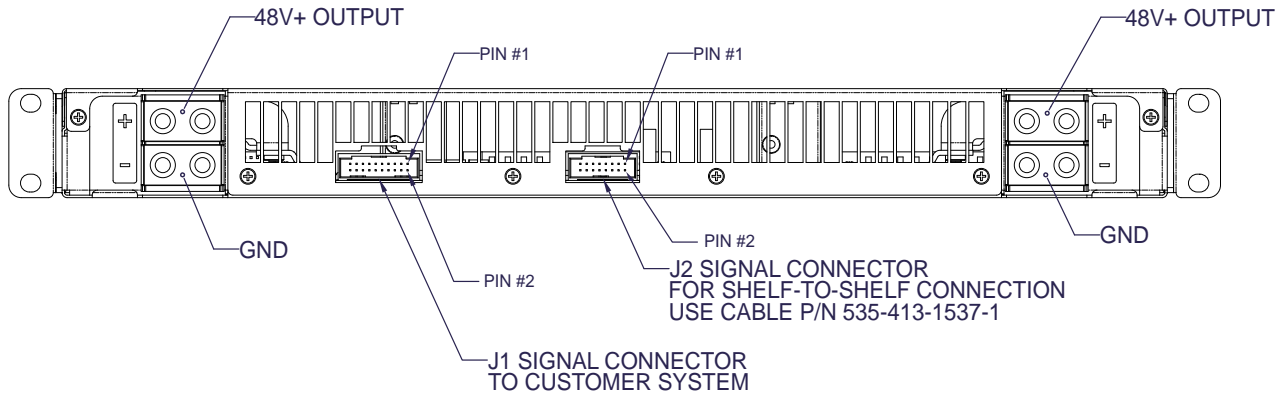
MECHANICAL DIMENSIONS - S1U Power Shelf



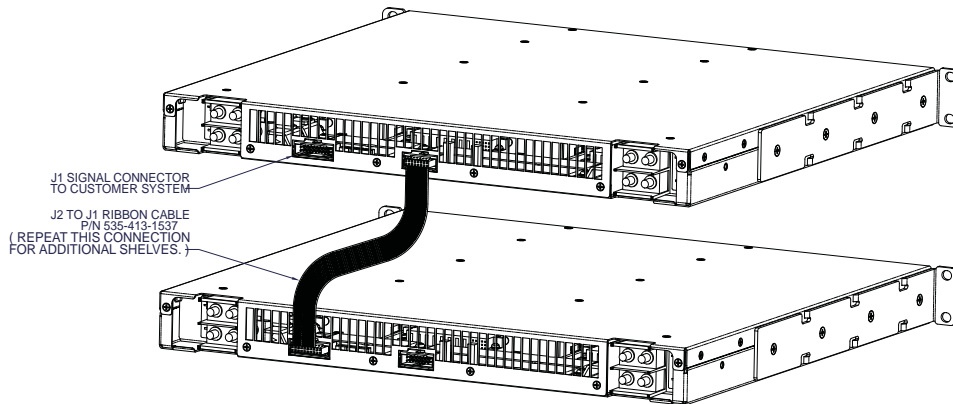
NOTES:

1. The DC output terminals are of terminal block style that will allow connection using crimp type right-angle lugs accepting up to AWG#2 wire, Panduit lug LCC2-14AWF-Q or equivalent is recommended.
2. Two M6 studs at 15.88 mm centre spacing are provided for connection to each pole. Hardware is provided for fastening the lugs/wires as well as terminal block covers

S1U PIN CONNECTORS - BACK VIEW



SHELF TO SHELF CONNECTION



OPTIONAL ACCESSORIES

| Description | Part Number |
|-------------------------------|--------------|
| 48V D1U output connector card | D1U-48-CONC |
| Shelf to shelf cable | 535-413-1537 |

APPLICATION NOTES

| Document Number | Description |
|-----------------|----------------------------|
| ACAN-29 | D1U Communication Protocol |

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