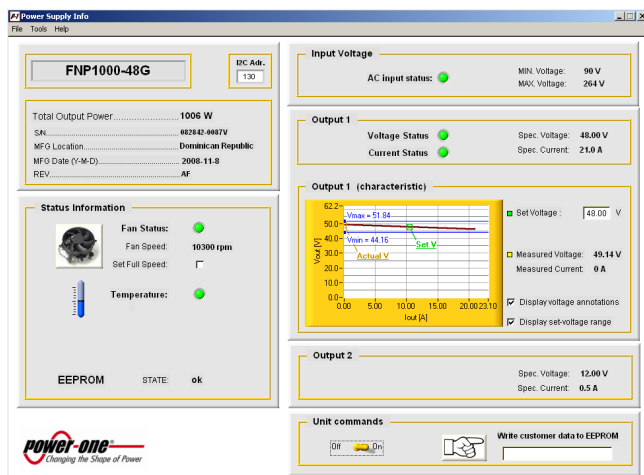


## 600-to-5000-Watt Front-End Power Solutions



(600, 850, or 1000 Watts)

**I<sup>2</sup>C Management Software:** All FNP front-ends can be controlled via Power-One's GUI-driven I<sup>2</sup>C Management software and an I<sup>2</sup>C-to-USB interface (P/N HZZ02002G). An I<sup>2</sup>C Programming Manual describes the complete range of parameters that can be programmed to these front-ends. This manual is available by searching on "FNP600" at [www.power-one.com](http://www.power-one.com).



## Description

The FNP600/850/1000 power factor corrected (PFC) front ends provide (depending on model) either a 12 VDC or a 48 VDC output for telecom, datacom, and other distributed power applications. Their small 1U by 2U size allows for configurations of either height in hot-swap redundant systems while their internal fan and cooling design permits wide use with reliable operation.

Status is provided with front panel LEDs, logic signals, and via the I<sup>2</sup>C management interface bus. In addition, the I<sup>2</sup>C bus can enable the power supply, control fan speed, and on the 12 VDC models it allows for adjusting the output voltage from 7 to 12 VDC. This powerful feature allows the same power supply to be used in various applications where bus voltages driving isolated dc-dc converters and POL regulators may be different.

Also, the FNP850-12R is uniquely designed with airflow from the rear of the power supply to the front. This airflow direction supports those critical applications where space limitations and/or higher ambient temperatures near the rear of the rack system, prohibit the discharge of higher temperature airflow from regular front-to-rear cooled power supplies.

The FNP600/850/1000's meet international safety requirements and are CE marked to the Low Voltage Directive (LVD).



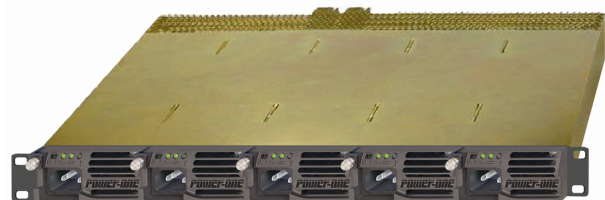
## Features

- RoHS lead free solder and lead solder exempted products are available
- High density front-ends 10.5 to 16.1 W/in<sup>3</sup>
- Universal input voltage range (90-264 VAC) with PFC
- 1U or 2U height configurations
- Droop current share with ORing FETs
- I<sup>2</sup>C interface status and control
- Standby voltage of 12 VDC @ 0.5 A
- Overtemperature, overload, and overvoltage protection
- Status LEDs: AC OK, DC OK, Overtemperature
- FNP850-12 model has airflow direction from front-to-rear or from rear-to-front (-12R model)
- ON/OFF Enable switch - shuts OFF Vo1; Vaux and fan are operational.

## Applications

- Telecom
- Datacom
- Distributed power systems

FNR-5 Power Shelf



FNR-5-48G Power Shelves provide up to 5000 watts in a 19" rack.  
(See the Rack section for power shelf details.)

## **Model Selection**

| Model                           | Nominal Output Voltage (VDC) <sup>1</sup> | Adjustment Range (VDC) | Maximum Output Current (Amps) | Line Regulation (%) | Load Regulation (%) <sup>2</sup> | Ripple & Noise pk-pk % <sup>3</sup> | Compatible Shelf |
|---------------------------------|-------------------------------------------|------------------------|-------------------------------|---------------------|----------------------------------|-------------------------------------|------------------|
| <b>FNFP600-12</b>               | 12<br>12 (Standby)                        | 7 to 12<br>N/A         | 51<br>0.5                     | 0.17<br>8           | 6<br>8                           | 1<br>1                              | FNR-5-12         |
| <b>FNFP850-12</b>               | 12<br>12 (Standby)                        | 7 to 12<br>N/A         | 73<br>0.5                     | 0.17<br>8           | 6<br>8                           | 1<br>1                              | FNR-5-12         |
| <b>FNFP850-12R</b> <sup>4</sup> | 12<br>12 (Standby)                        | 7 to 12<br>N/A         | 73<br>0.5                     | 0.17<br>8           | 6<br>8                           | 1<br>1                              | FNR-5-12         |
| <b>FNFP600-48</b>               | 48<br>12 (Standby)                        | 44 to 50.5<br>N/A      | 12.6<br>0.5                   | 0.17<br>8           | 6<br>8                           | 1<br>1                              | FNR-5-48         |
| <b>FNFP1000-48</b>              | 48<br>12 (Standby)                        | 44 to 50.5<br>N/A      | 21<br>0.5                     | 0.17<br>8           | 6<br>8                           | 1<br>1                              | FNR-5-48         |

<sup>1</sup> Models with 5V and 3.3V standby voltages are also available. (Contact factory.)

<sup>2</sup> Primary 12V and 48V outputs have built-in droop regulation.

<sup>3</sup> Maximum peak-to-peak noise expressed as a percentage of output voltage; 20 MHz bandwidth.

<sup>4</sup> FNFP850-12R model has airflow from rear to front.

## **Ordering Information**

| Options                             | Suffixes to Add to Part Number                    |
|-------------------------------------|---------------------------------------------------|
| RoHS lead solder exemption          | No RoHS suffix character required.                |
| RoHS compliant for all 6 substances | Add "G" as the last character of the part number. |

## **Input Specifications**

| Parameter            | Conditions/Description                             | Min.            | Nom. | Max. | Units |
|----------------------|----------------------------------------------------|-----------------|------|------|-------|
| AC Input Voltage     | Single-phase continuous input range.               | 90              |      | 264  | VAC   |
| Input Frequency      | AC input.                                          | 47              |      | 63   | Hz    |
| Hold-up Time         | After last AC line peak at full power. At 115 VAC. | 20 <sup>1</sup> |      |      | ms    |
| Input Current        | At full-rated load. At 90 VAC.                     |                 |      | 14   | A rms |
| Inrush Surge Current | Internally limited. Vin = 230 VAC. 25 °C           |                 |      | 34   | A pk  |
| Power Factor         | Per EN61000-3-2                                    | 0.97            |      |      | W/VA  |

<sup>1</sup> FNFP1000-48 model has a hold-up time of 16 ms.

## Output Specifications

| Parameter                                                     | Conditions/Description                                                                                                                                                                            | Min.                 | Nom.                     | Max.                   | Units                  |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------|------------------------|------------------------|
| Efficiency: FNP600-48<br>FNP1000-48<br>FNP600-12<br>FNP850-12 | Full rated load at 230 VAC input.                                                                                                                                                                 | 88<br>88<br>84<br>84 | 89.5<br>89.5<br>87<br>87 |                        | %                      |
| Minimum Load                                                  | Minimum loading required to maintain regulation.                                                                                                                                                  | 0                    |                          |                        | A                      |
| Output Power FNP1000<br>FNP850<br>FNP600                      |                                                                                                                                                                                                   |                      |                          | 1006<br>856<br>600     | W                      |
| Overshoot                                                     | Output voltage overshoot at turn-on.                                                                                                                                                              |                      |                          | 3                      | %                      |
| Transient Response                                            | Maximum recovery time to within 1% of initial set point due to a 50% load change, 1A/μs.<br>12V or 48V output:<br>Standby output:<br><br>Maximum deviation: 12V or 48V output:<br>Standby output: |                      |                          | 400<br>2<br><br>2<br>4 | μs<br>ms<br><br>%<br>% |
| Turn-On Delay                                                 | Time required for initial output voltage stabilization after application of AC input..                                                                                                            |                      |                          | 1.5                    | Sec                    |
| Output Regulation                                             | See Model Selection table.                                                                                                                                                                        |                      |                          |                        |                        |

## Protection

| Parameter                                                                    | Conditions/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Min.            | Nom.         | Max.        | Units |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|-------------|-------|
| Overvoltage Protection                                                       | FNP600-12 & FNP850-12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 14.4            | 15           | 15.6        | V     |
|                                                                              | FNP600-12:<br>FNP850-12:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8.75<br>8.44    | 9.04<br>8.75 | 9.33<br>9.1 | V     |
|                                                                              | FNP600-48 & FNP1000-48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 57 <sup>1</sup> |              | 60          | V     |
| Overcurrent Protection<br><br>(Power supply recovers when short is removed.) | FNP600-12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 54<br>0.55      | 56<br>0.75   | 61<br>1.0   | A     |
|                                                                              | FNP850-12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 77<br>0.55      | 80<br>0.75   | 88<br>1.0   | A     |
|                                                                              | FNP600-48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 13<br>0.75      | 14           | 16<br>1.75  | A     |
|                                                                              | FNP1000-48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 22<br>0.75      | 23           | 25<br>1.75  | A     |
| Short-Circuit Protection                                                     | Power supply recovers when short is removed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |              |             |       |
| Overtemperature/<br>Fan Failure Warning                                      | FNP 12V or 48V Vo1 supply output will shut down in the event of an overtemperature condition or blocked fan rotor. Supply's fan and Vaux are active. Power supply will recover when OT condition is removed. Amber OT LED will turn ON to indicate fault condition.<br><br>OT/Fan Fail is an open-collector signal with 20-mA pull-down. High signal indicates a normal operating condition. Output will go low at least 100 ms before OT condition shuts down the power supply. Internally pulled up to 5V with a 5.1 kΩ resistor. Note. <sup>2</sup> |                 |              |             |       |

<sup>1</sup> FNP1000-48 overvoltage protection range is 56 V minimum and 60 V maximum.

<sup>2</sup> A pull-up to 3.3V can be achieved by terminating the logic signal with a 10 kΩ resistor to logic ground.

## Control and Monitoring

| Parameter                   | Conditions/Description                                                                                                                                                                                                                                                                                                                                   | Min. | Nom. | Max. | Units |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| DC OK                       | TTL open-collector signal with active 20-mA pull-down. Represents percent of output voltage where signal is OK. Below this voltage, a signal high condition indicates an output which is out of tolerance. Green DC OK LED on front panel indicates normal operation. <sup>1</sup> Internally pulled up to 5V with a 5.1 kΩ resistor. Note. <sup>2</sup> | 90   |      | 110  | %     |
| Input Power Fail Warning    | TTL open-collector signal with active 20-mA pull-down. High indicates an input power fail. Power Fail Warning will turn OFF green AC OK LED. Represents the time after warning signal before Vout drops to 95% due to loss of input power. <sup>1</sup> Internally pulled up to 5V with a 5.1 kΩ resistor. Note. <sup>2</sup>                            | 5    |      |      | ms    |
| Power Supply Present Signal | Resistance of connection to logic ground which allows user to determine if power supply is present. <sup>1</sup>                                                                                                                                                                                                                                         |      | 10   |      | Ω     |
| Current Share               | FNP600-12:                                                                                                                                                                                                                                                                                                                                               |      |      | 5    | A     |
|                             | FNP850-12:                                                                                                                                                                                                                                                                                                                                               |      |      | 7    |       |
|                             | FNP600-48:                                                                                                                                                                                                                                                                                                                                               |      |      | 2    |       |
|                             | FNP1000-48:                                                                                                                                                                                                                                                                                                                                              |      |      | 2    |       |
| Remote Sense                | Total voltage compensation for cable losses with respect to the main output.                                                                                                                                                                                                                                                                             |      |      | 0.5  | V     |
| Output Enable               | Open circuit or logic high from ENA pin to Vo1 RTN shuts OFF Vo1; Vaux and fan are operational. Logic low (2 mA sink capability) or jumper will turn ON Vo1 within 500 ms. Open circuit voltage on enable pin is 3.3 VDC. Externally applied voltage to the enable pin should NOT exceed 7 VDC. Signal is referred to as Logic Return (LRTN).            |      |      |      |       |

<sup>1</sup> Also available on I<sup>2</sup>C data line.

<sup>2</sup> A pull-up to 3.3V can be achieved by terminating the logic signal with a 10 kΩ resistor to logic ground.

## I<sup>2</sup>C Bus Management Interface

|                                 |                                                                                                                                                     |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Static</b>                   | Includes static information such as: part number and revision level, output rating, serial number, date code, and manufacturing location.           |
| <b>Status</b><br>(Logic 1 or 0) | Power Supply OK.<br>AC Input OK.<br>DC Output OK.<br>Power Supply Seated.<br>Overtemperature.<br>Overcurrent.<br>Fan OK.                            |
| <b>Real-Time Monitoring</b>     | Output voltage (main output) 0.1V LSD.<br>Output current (main output) 0.1A LSD.<br>Time in service.                                                |
| <b>Control Signals</b>          | Enable for main output.<br><br>Output voltage to: (0.01V resolution on 12V supplies; 0.05V resolution on all 48V supplies).<br><br>Fan speed level. |

### Safety, Regulatory, and EMI Specifications

| Parameter                       | Conditions/Description                                                                                                                                | Min.                              | Nom. | Max. | Units           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------|------|-----------------|
| Agency Approvals                | UL60950-1 (UL), CSA C22.2 60950-1 (cUL), EN60950-1 (TUV), IEC60950-1 and CE (LVD)                                                                     |                                   |      |      |                 |
| Electromagnetic Interference    | FCC CFR title 47 Part 15<br>Sub-Part B,<br>EN55022/CISPR 22.                                                                                          | Conducted:<br>Radiated:<br>B<br>A |      |      | Class           |
| Harmonics                       | Per IEC61000-3-2.                                                                                                                                     | A                                 |      |      | Class           |
| Voltage Fluctuation and Flicker | Per IEC61000-3-3.                                                                                                                                     | Pass                              |      |      |                 |
| ESD Susceptability              | Per EN61000-4-2, Level 4. Criterion B                                                                                                                 | 8                                 |      | .    | kV              |
| Radiated Susceptability         | Per EN 61000-4-3, Level 3. Criterion A                                                                                                                | 10                                |      | .    | V/M             |
| EFT/Burst                       | Per EN 61000-4-4, Level 4. Criterion B                                                                                                                | ±4                                |      | .    | kV              |
| Input Transient Protection      | Per EN 61000-4-5, Class 3. Criterion B<br>Line-to-Line:<br>Line-to-Ground:                                                                            | 1<br>2                            |      | .    | kV              |
| RF Conducted Disturbances       | Per EN 61000-4-6, Level 3. Criterion A                                                                                                                | 10                                |      | .    | V               |
| Voltage Interruptions           | Per EN 61000-4-11, performance criterion B 30%.<br>Per EN 61000-4-11, performance criterion C 60%.<br>Per EN 61000-4-11, performance criterion C 95%. | 10<br>100<br>5                    |      | .    | ms<br>ms<br>Sec |
| Voltage Sag Immunity            | Per SEMI F47-0999 > 100 VAC.<br>No output voltage interruption.                                                                                       |                                   |      | .    |                 |
| Leakage Current                 | Per EN60950-1. At 240 VAC:                                                                                                                            |                                   |      | 3.5  | mA              |

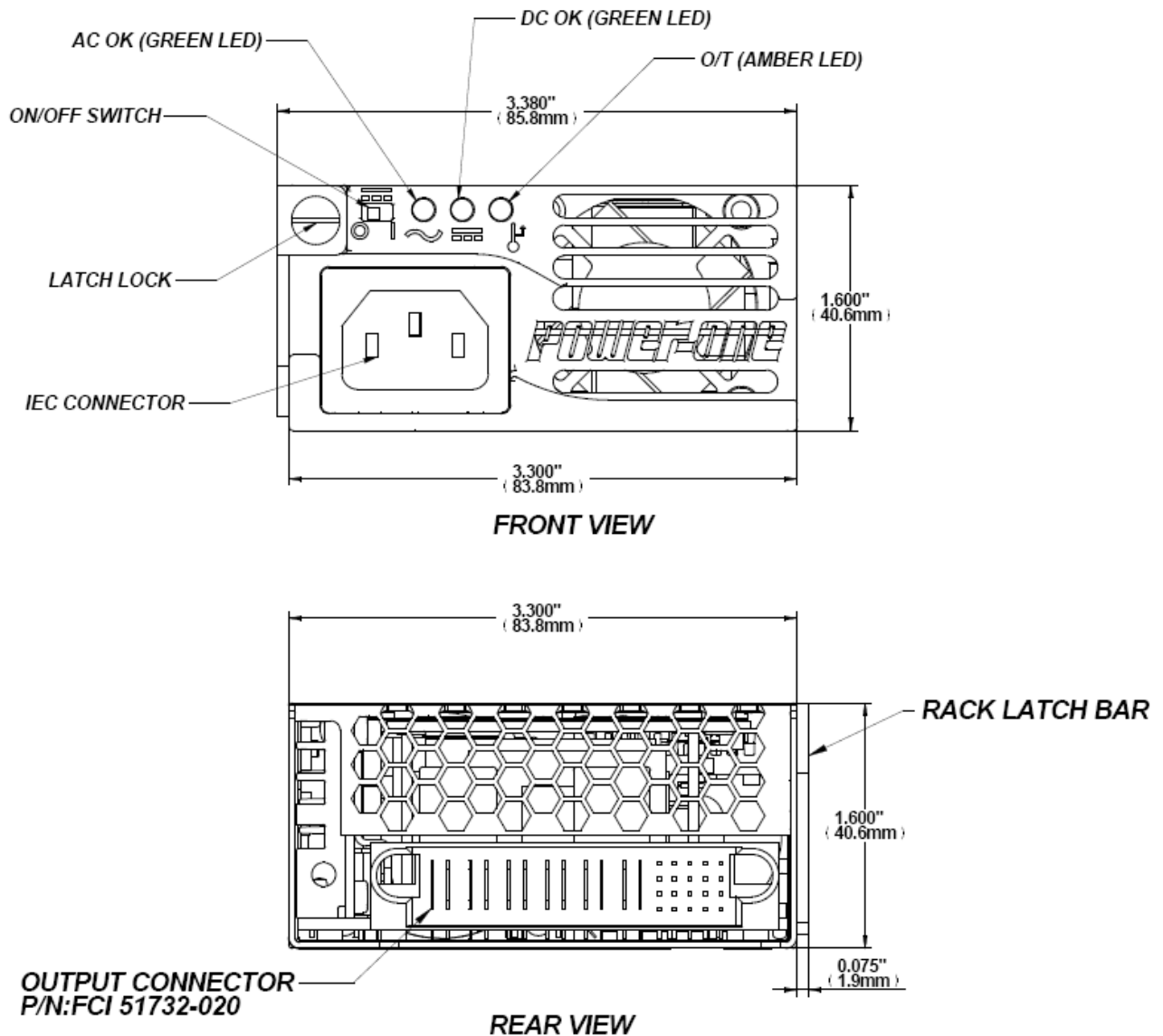
### Environmental Specifications

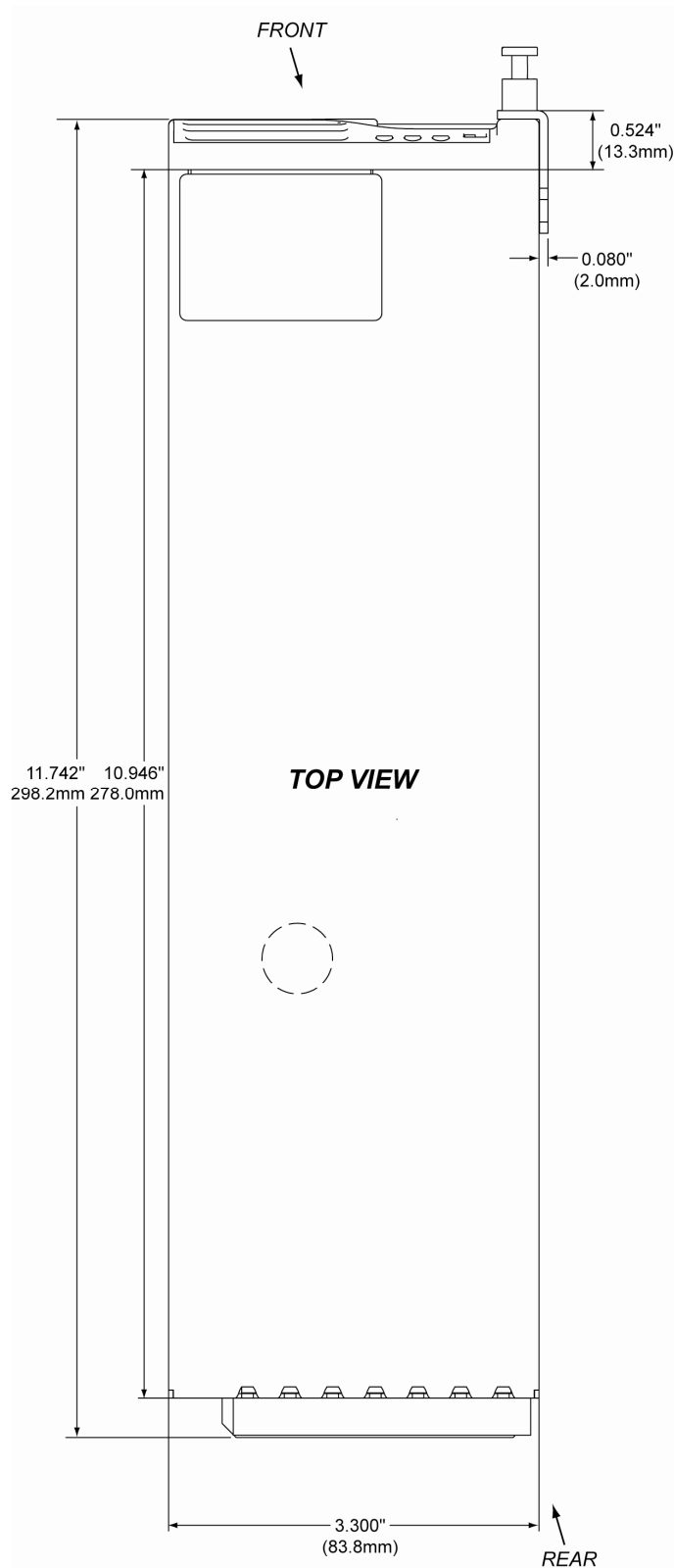
| Parameter               | Conditions/Description                                           | Min.                                                                       | Nom.        | Max.           | Units            |
|-------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------|-------------|----------------|------------------|
| Altitude                | Operating.<br>Non-Operating.                                     |                                                                            |             | 10K<br>40K     | ASL ft<br>ASL ft |
| Operating Temperature   | FNP600-12:<br>FNP850-12:<br>FNP600-48:<br>FNP1000-48:            | Internal DC fan for cooling. At 100% load:<br>At 50% load:                 | 0<br>0      | 50<br>70       | °C               |
|                         | FNP850-12R:                                                      | Internal DC fan for cooling. At 100% load:<br>At 94% load:<br>At 50% load: | 0<br>0<br>0 | 40<br>50<br>70 | °C               |
| Storage Temperature     |                                                                  | -40                                                                        |             | 85             | °C               |
| Temperature Coefficient | 0 °C to 70 °C (after 15-minute warm-up).                         |                                                                            |             | 0.02           | %/°C             |
| Relative Humidity       | Non-condensing                                                   |                                                                            |             | 95             | %RH              |
| Shock                   | Operating: half-sine, 10 ms, 3-axis.                             |                                                                            |             | +20            | Gpk              |
|                         | Non-Operating: half-sine, 10 ms, 3-axis.                         |                                                                            |             | +40            | Gpk              |
| Vibration               | Operating: swept sine 5-2000-5 Hz, 5-32 Hz, 0.02iDA, 32-2000 Hz. |                                                                            |             | 1              | Gpk              |
|                         | Non-operating: random 10-2000 Hz.                                |                                                                            |             | 6.15           | Grms             |

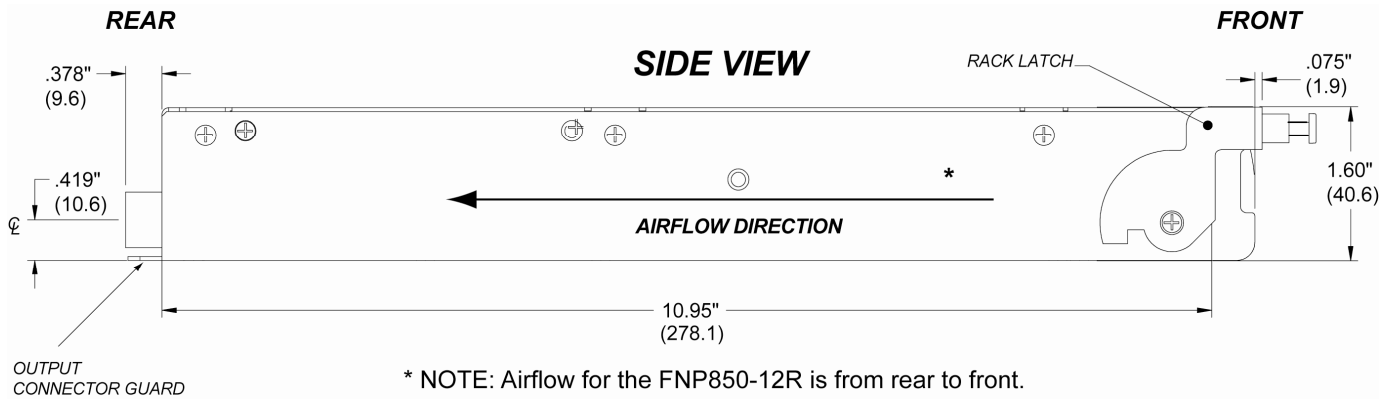
### Reliability

| Parameter | Conditions/Description                                                    | Min.                     | Nom. | Max. | Units             |
|-----------|---------------------------------------------------------------------------|--------------------------|------|------|-------------------|
| MTBF      | (Calculated) MILHDBK 217F Ground Benign.<br>Demonstrated.<br>Useful Life. | 100 000<br>250 000<br>10 |      |      | hrs<br>hrs<br>yrs |

## Mechanical Drawings







## Connector Information

### Power Supply:

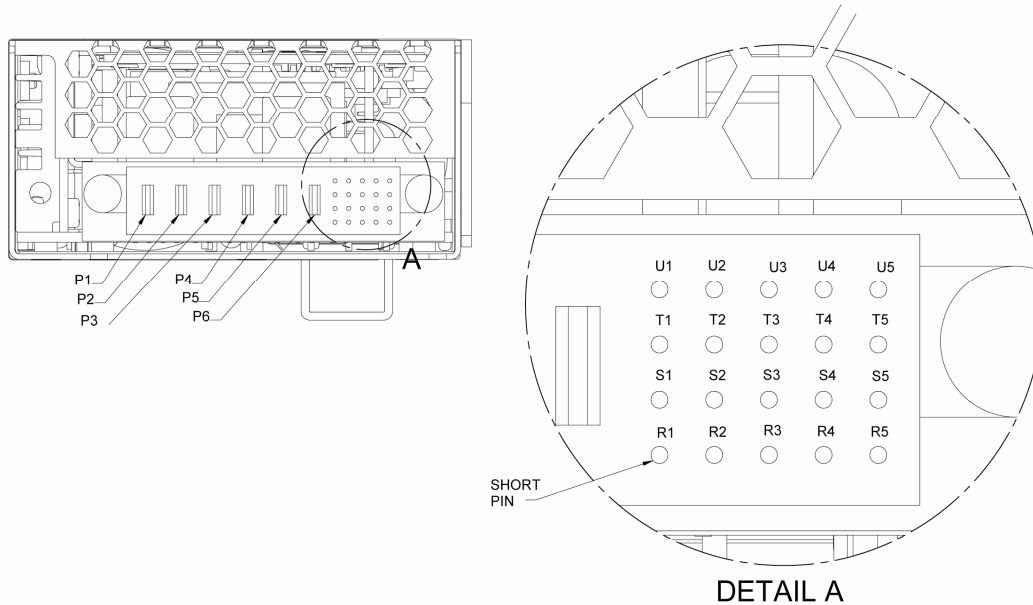
Input - IEC 320 input (Male) standard line cord connection  
Output - P/N FCI 51732-020LF

### Mating Connections:

Input - IEC 320 output (Socket) Standard line cord (15A)  
Output - P/N: FCI 51742-10602000AALF (Backplane)  
P/N: FCI 51762-10602000AALF (Right Angle)

## Input IEC Connector

| Input                   | Location |
|-------------------------|----------|
| Chassis (Safety) Ground | Ground   |
| Line 1 (Line)           | L        |
| Line 2 (Neutral)        | N        |



### Output Pin Assignments

| Signal                              | Pin Location | Ground Reference                    | Note                                                                               |
|-------------------------------------|--------------|-------------------------------------|------------------------------------------------------------------------------------|
| Over Temperature / Fan Fail         | U1           | Logic Ground (LRTN)                 | Open collector 20mA,int.pull-up 5.11kΩ to 5V DC                                    |
| AC Power Fail Warning               | U2           | Logic Ground (LRTN)                 | Open collector 20mA,int.pull-up 5.11kΩ to 5V DC                                    |
| Power Supply Present                | U3           | Logic Ground (LRTN)                 | 10Ω resistance int. connected to LRTN                                              |
| Output Voltage Fault                | U4           | Logic Ground (LRTN)                 | Open collector 20mA,int.pull-up 5.11kΩ to 5V DC                                    |
| Internal Ground                     | U5           | Internal Ground (SRTN) <sup>2</sup> |                                                                                    |
| ADDR0, I <sup>2</sup> C Address Bus | T1           | Internal Ground (SRTN)              |                                                                                    |
| ADDR1, I <sup>2</sup> C Address Bus | T2           | Internal Ground (SRTN)              |                                                                                    |
| ADDR2, I <sup>2</sup> C Address Bus | T3           | Internal Ground (SRTN)              |                                                                                    |
| ADDR3, I <sup>2</sup> C Address Bus | T4           | Internal Ground (SRTN)              |                                                                                    |
| ADDR4, I <sup>2</sup> C Address Bus | T5           | Internal Ground (SRTN)              |                                                                                    |
| DATA, I <sup>2</sup> C Data Line    | S1           | Logic Ground (LRTN)                 |                                                                                    |
| CLOCK, I <sup>2</sup> C Clock Line  | S2           | Logic Ground (LRTN)                 |                                                                                    |
| Auxiliary Power +12V                | S3           | Aux Ground                          |                                                                                    |
| Auxiliary Power Ground              | S4           | Aux Ground                          |                                                                                    |
| Logic Ground                        | S5           | Logic Ground (LRTN)                 |                                                                                    |
| Output Enable <sup>1</sup>          | R1           | Logic Ground (LRTN)                 | Open circuit or "High" to LRTN shuts OFF Vo1                                       |
| Vsense+                             | R2           | Vsense-                             |                                                                                    |
| Vsense-                             | R3           | Vsense-                             |                                                                                    |
| Output Margin                       | R4           | Internal Ground (SRTN)              | OPTIONAL; External resistance needed to adjust Vo1 lower than it is set originally |
| Active Current share                | R5           | Internal Ground (SRTN)              | OPTIONAL                                                                           |
| Vout+                               | P1, P2, P3   | Vsense-                             |                                                                                    |
| Vout-                               | P4, P5, P6   | Vsense-                             |                                                                                    |

<sup>1</sup> Short pin length

<sup>2</sup> SRTN (Internal Ground) is internally connected to Vout-

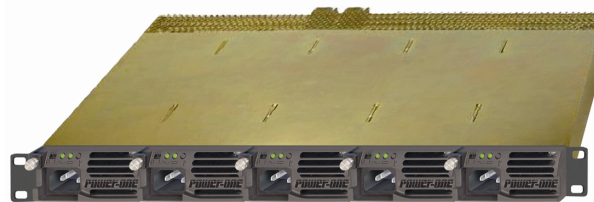


## Racks

### (FNR-5-12G and FNR-5-48G Power Shelves)

Each rack (power shelf) is 1U high with backplane and designed for up to five front-end models in parallel or in n+1 operation. Each power shelf has:

- Output terminals with two M4-screws on each power tab.
- Two fast-on contacts for system earthing.
- Address coding over five pole DIP switch on each unit, 37-pin D-Sub connector with I<sup>2</sup>C-lines, monitoring signals and support functions.
- Provides a start-up synchronization circuit and EMV filters.

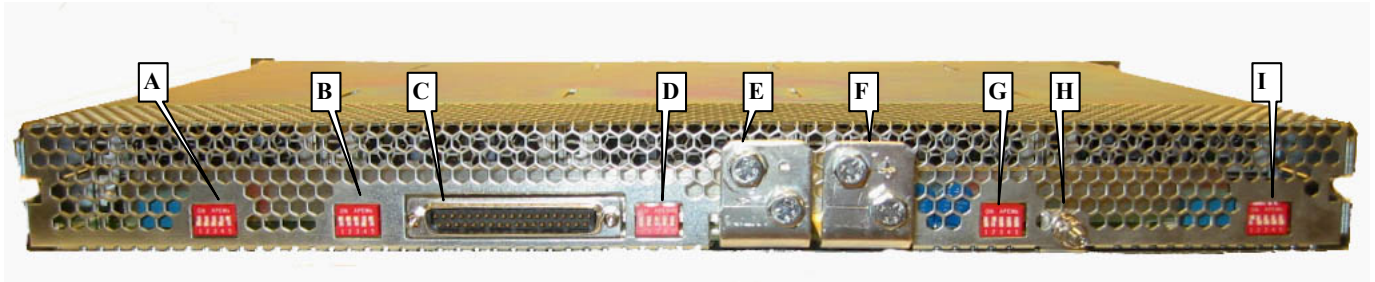


**FNR-5-12G and FNR-5-48G Power Shelf Front View**

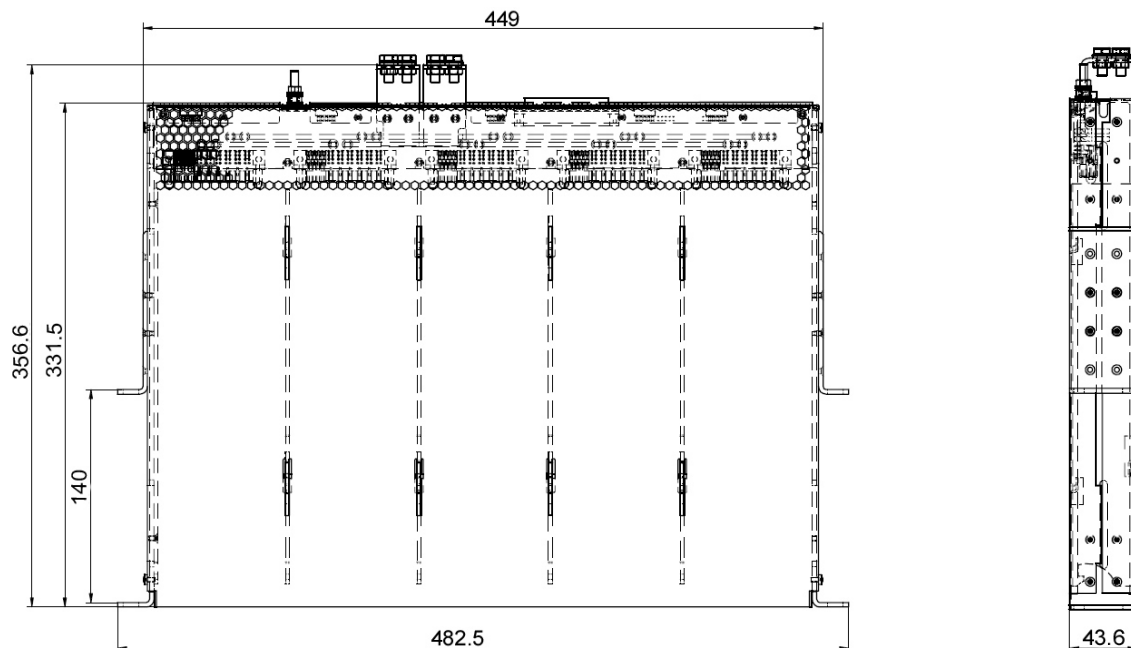
### Overall Mechanical Dimensions (FNR-5-12G and FNR-5-48G Power Shelves)

|                                               |                                                       |
|-----------------------------------------------|-------------------------------------------------------|
| FNR-5-12 & FNR-5-48 Mechanical Data (W, H, D) | 17.68" (449 mm) x 1.72" (43.6 mm) x 13.05" (331.5 mm) |
|-----------------------------------------------|-------------------------------------------------------|

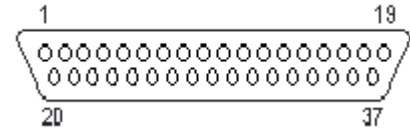
**Output Connector Descriptions (FNR-5-12G & FNR-5-48G)**



| Location | Description                                                        |
|----------|--------------------------------------------------------------------|
| A        | 5-Bit DIP switch for I <sup>2</sup> C addressing of PSU 1          |
| B        | 5-Bit DIP switch for I <sup>2</sup> C addressing of PSU 2          |
| C        | 37-pin SUB-D connector, controlling and auxiliary power (output 2) |
| D        | 5-Bit DIP switch for I <sup>2</sup> C addressing of PSU 3          |
| E        | Output 1 minus                                                     |
| F        | Output 1 plus                                                      |
| G        | 5-Bit DIP switch for I <sup>2</sup> C addressing of PSU 4          |
| H        | Earth connection                                                   |
| I        | 5-Bit DIP switch for I <sup>2</sup> C addressing of PSU 5          |



**Mechanical Data (FNR-5-12G and FNR-5-48G Power Shelves)**



**SUB-D Output Connector Pinout and Signal Specification**

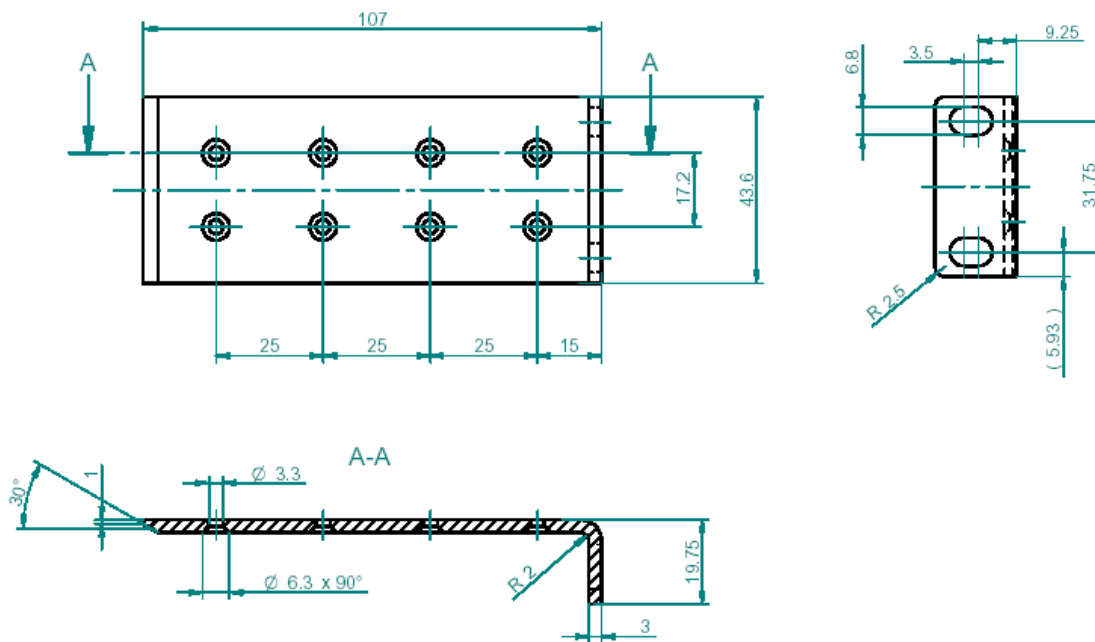
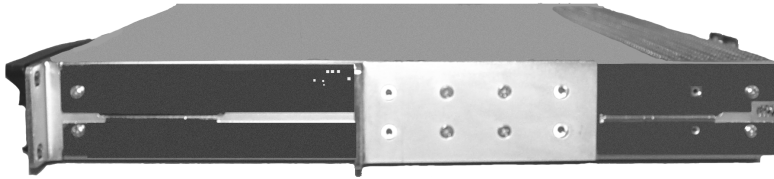
| Output Connector Description         | Pin Location | Type                                                                                                   | Low level<br>High level   | V max<br>I max      |
|--------------------------------------|--------------|--------------------------------------------------------------------------------------------------------|---------------------------|---------------------|
| Overtemperature / Fan Fail PSU1      | 1            | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| Power Supply Present PSU 1           | 2            | Resistor 10 $\Omega$ connected to logic GND                                                            | Open<br>Pull up           | 10 V<br>10 mA       |
| Power Supply Present PSU 2           | 3            | Resistor 10 $\Omega$ connected to logic GND                                                            | Open<br>Pull up           | 10 V<br>10 mA       |
| Open                                 | 4            |                                                                                                        |                           |                     |
| Overtemperature / Fan Fail PSU 3     | 5            | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| AC Fail / Power down warning PSU 3   | 6            | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| Power Supply Present PSU 3           | 7            | Resistor 10 $\Omega$ connected to logic GND                                                            | Open<br>Pull up           | 10 V<br>10 mA       |
| DC Fail / Output voltage fault PSU 3 | 8            | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| Overtemperature / Fan Fail PSU 2     | 9            | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| NC                                   | 10, 11       |                                                                                                        |                           |                     |
| Output inhibit PSU 1-5               | 12           | Active low (DC-DC stage off when pin is open or on high potential)<br>Referenced to logic GND          | <0.8 V<br>>2.0 V          | 10 V<br>3.5 mA      |
| V sense +                            | 13           | Open or connected to Vo1+ at the load<br>Internally (PSU) connected to Vo1+ over 100 $\Omega$          |                           | dU < 3 Vpp<br>30 mA |
| V sense -                            | 14           | Open or connected to Vo1- at the load<br>Internally (PSU) connected to Vo1- over 100 $\Omega$          |                           | dU < 3 Vpp<br>30 mA |
| NC                                   | 15           |                                                                                                        |                           |                     |
| AC Fail/ Power-down warning PSU 4    | 16           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| DC Fail/ Output voltage fault PSU 4  | 17           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| AC Fail/ Power-down warning PSU 5    | 18           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| DC Fail/ Output voltage fault PSU 5  | 19           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| AC Fail/ Power-down warning PSU 1    | 20           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |
| DC Fail/ Output voltage fault PSU 1  | 21           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA       |

**SUB-D Output Connector Pinout and Signal Specification (continued)**

| Output Connector Description              | Pin Location | Type                                                                                                                                                                                                | Low level<br>High level   | V max<br>I max |
|-------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------|
| AC Fail/<br>Power-down warning<br>PSU 2   | 22           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND                                                                                              | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA  |
| DC Fail/<br>Output voltage fault<br>PSU 2 | 23           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND                                                                                              | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA  |
| DATA, I2C data line                       | 24           | I2C compatible signal referenced to logic GND                                                                                                                                                       | 5 V or 3.3 V logic        | -              |
| CLOCK, I2C clock line                     | 25           | I2C compatible signal referenced to logic GND                                                                                                                                                       | 5 V or 3.3 V logic        | -              |
| Auxiliary power +12 V (Output 2)          | 26           | Vo2+ Aux output, insulated from main output                                                                                                                                                         | -                         | -              |
| Auxiliary power ground (Output 2)         | 27           | Vo2- Aux output, insulated from main output                                                                                                                                                         | -                         | -              |
| Logic Gnd                                 | 28           | Auxiliary GND, Need to be external connected Vo2-.. Wire separately from auxiliary and main output GND to minimize noise and avoid voltage drops on signal- and I2C return. Leave open if not used. | -                         | -              |
| Output margin PSU 1                       | 29           | Open or connected to V sense- V sense- (+8 % Vo1) or V sense+ (-8 % Vo1)                                                                                                                            | -<br>-                    | 60V<br>-       |
| Output margin PSU 2                       | 30           | Open or connected to V sense- V sense- (+8 % Vo1) or V sense+ (-8 % Vo1)                                                                                                                            | -<br>-                    | 60V<br>-       |
| Output margin PSU 3                       | 31           | Open or connected to V sense- V sense- (+8 % Vo1) or V sense+ (-8 % Vo1)                                                                                                                            | -<br>-                    | 60V<br>-       |
| Output margin PSU 4                       | 32           | Open or connected to V sense- V sense- (+8 % Vo1) or V sense+ (-8 % Vo1)                                                                                                                            | -<br>-                    | 60V<br>-       |
| Output margin PSU 5                       | 33           | Open or connected to V sense- V sense- (+8 % Vo1) or V sense+ (-8 % Vo1)                                                                                                                            | -<br>-                    | 60V<br>-       |
| Overtemperature /<br>Fan Fail PSU 4       | 34           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND                                                                                              | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA  |
| Power Supply Present<br>PSU 4             | 35           | Resistor 10 $\Omega$ connected to logic GND                                                                                                                                                         | Open<br>Pull up           | 10 V<br>10 mA  |
| Overtemperature /<br>Fan Fail PSU 5       | 36           | OC-output, protected by 16 V Zener diode and a 10 $\Omega$ resistor in series, referenced to logic GND                                                                                              | <0.4 V @ 20 mA<br>Pull up | 15 V<br>20 mA  |
| Power Supply Present<br>PSU 5             | 37           | Resistor 10 $\Omega$ connected to logic GND                                                                                                                                                         | Open<br>Pull up           | 10 V<br>10 mA  |

**Accessories:**

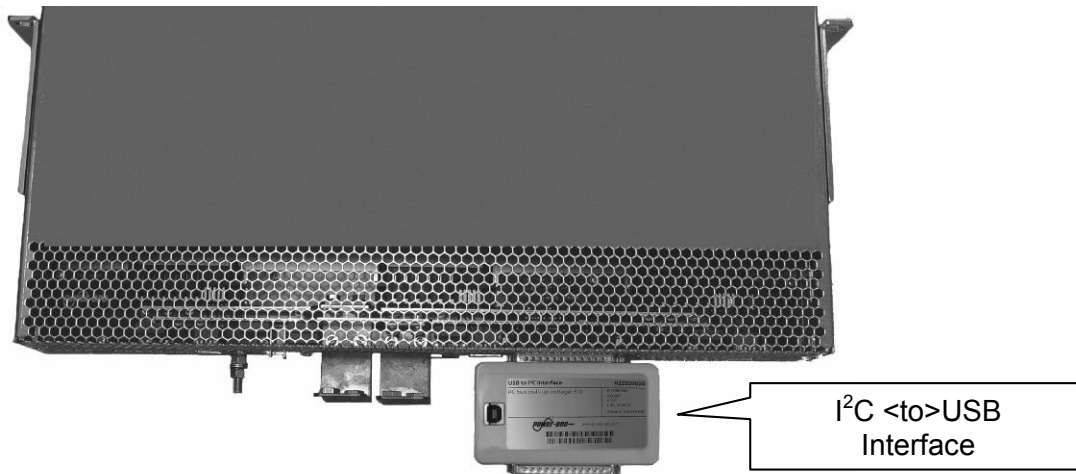
Center Angular Brackets are set in the middle for shelf mounting:



Center Angular Bracket sets can be ordered: Power-One part no.: HZZ01222

Note: Each Center Angular Bracket set contains 2 brackets and 8 screws.

**I<sup>2</sup>C to USB Interface Demonstration Kit HZZ02002G:**



An I<sup>2</sup>C to USB Interface Demonstration Kit can be ordered: Power-One part no.: **HZZ02002G**

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