

FNR-5-12G AC-DC Power Shelf Preliminary Data Sheet

4250 Watts, 12VDC



Features

- Standard configurations are RoHS compliant for all six substances
- Wide-input voltage range of 85-264 VAC
- Simple installation and operation
- Auto-select power limits ¹
- High-density rack design
- 1U high: 17.7" x 1.7" x 13" dimensions
- Standby voltage 12 VDC/0.5A
- Highly-efficient topology
- I²C interface status and control
- I²C voltage and current setting
- Analog output voltage setting
- Overtemperature, output overvoltage, and output overcurrent protection
- ORing circuit for true redundant operation
- Status LEDs: AC OK, DC OK, Fan Fail/Overtemperature Fail



Applications

- Telecom, datacom, and distributed power systems

Description

The FNR-5-12G modular power shelf provides large power system features in a very cost-effective, 19" rack-mounted form factor. Its very small dimensions allow configuration of up to three power supplies in a 1U rack. This shelf-power solution provides rectification, system management, and power distribution, while maintaining high reliability and offering flexibility for future expansion. The FNR-5-12G shelves are based on the use of hot-swappable AC-DC supplies.

Highly-efficient thermal design of the FNR-5-12G and internal fan cooling permit its use in wide operating voltage and temperature ranges to provide very high reliability. Each power supply provides status information with front panel LEDs, logic signals, and via an I²C management interface. In addition, the I²C bus can enable the power supply, control the fan speed, adjust the output voltage, and set the output current limit.

Model Configuration

Model configuration	Input voltage VAC auto selected	Output 1		Output 2		Rated power W
		V _{o nom} VDC	I _{o max} ADC	V _{o nom} VDC	I _{o max} ADC	
5 x FNP850-12 in parallel	85– 264	12	365	12	0.5	4256
4 x FNP850-12 in parallel	85– 264	12	293	12	0.5	3406
3 x FNP850-12 in parallel	85– 264	12	219	12	0.5	2556
2 x FNP850-12 in parallel	85– 264	12	146	12	0.5	1706
1 x FNP850-12	85– 264	12	73	12	0.5	866

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Absolute Maximum Ratings

Stress in excess of the absolute maximum ratings may cause performance degradation, adversely effect long-term reliability, or cause permanent damage to the converter.

Parameter	Conditions/Description	Min	Max	Unit
Operating ambient temperature	$V_{i\ min}-V_{i\ max}$, $I_{o\ nom}$, cooling by internal fan @ 100 % load @ 50 % load	0	50	°C
		0	70	°C
Storage temperature	Non-operational	-40	85	°C

Environmental, Mechanical, & Reliability Specifications

Parameter	Conditions/Description	Min	Nom	Max	Unit
Altitude	Operating			10 k	ASL Ft.
	Non-Operating			40 k	ASL Ft.
Relative humidity, non-condensing	Operating	10		90	% RH
	Storage	5		95	% RH
Shock	IEC/EN 60068-2-27, 11 ms			40	G _{pk}
Sinusoidal vibration	IEC/EN 60068-2-6 2-8 Hz 8-200 Hz 200-500 Hz		7.5		ml
			2		G _{pk}
			4		G _{pk}
					G _{rms}
Random vibration	10-2000 Hz		6.15		G _{rms}

Safety Specifications

Maximum electric strength testing is performed in the factory according to EN 550116, IEC/EN 60950.

Parameter	Conditions/description	Min	Nom	Max	Unit
Agency approvals	CE Mark for LVD				
Insulation safety rating	Output to case	Functional			
Electric strength test voltage	Output to case	0.5			kVDC
	Output 1 to output 2	0.1			kVDC

EMC Specification with 3 FNP850-12 supplies in parallel

Parameter	Description	Criterion
Electrostatic discharge	IEC/EN 61000-4-2, level 4 (contact/air)	8/15 kV, Performance criterion B
Electromagnetic field	IEC/EN 61000-4-3, level 3	10 V/m, Performance criterion A
Electrical fast transients/burst	IEC/EN 61000-4-4, level 3 (in/out)	2/1 kV, Performance criterion B
Surge	IEC/EN 61000-4-5, level 3 (L/L, L/E)	½ kV, Performance criterion B
Voltage dips and interruptions	IEC/EN 61000-4-11	Performance criterion A Performance criterion B Performance criterion A Performance criterion B Performance criterion A Performance criterion B
	Dip 30 %, 100 ms	
	Dip 30 %, 200 ms	
	Dip 60 %, 20 ms	
	Dip 60 %, 100 ms	
	Dip > 95 %, 20 ms	
	Dip > 95 %, 100 ms	
RF conducted immunity	IEC/EN 61000-4-6	10 VAC, AM 80 %, 1 kHz Performance criterion A
Emissions conducted	CISPR 22/EN 55022/EN 61204	Class B
Emissions radiated	CISPR 22/EN 55022/EN 61204	Class A
Harmonics	IEC/EN 61000-3-2	Class B
Voltage fluctuation and flicker	IEC/EN 61000-3-3	Pass

Output Specification

Specification is valid for input voltage, load, and temperature ranges, unless otherwise stated.

Parameter	Conditions/Description	Min	Nom	Max	Unit
Nominal output voltage	$I_o = 16.1$ A per unit		12		VDC
Output voltage trimming (via I ² C or with external resistor)	Adjustable (each supply)	-8		+8	% $V_{o1\ nom}$
Nominal current output 1 with 5 x FNP850-12	$I_{o1\ nom}$ @ $V_i = 85$ VAC – 264 VAC, P_o 4.25 kW		365		ADC
Nominal current output 1 with 4 x FNP850-12	$I_{o1\ nom}$ @ $V_i = 85$ VAC – 264 VAC, P_o 3.4 kW		292		ADC
Nominal current output 1 with 3 x FNP850-12	$I_{o1\ nom}$ @ $V_i = 85$ VAC – 264 VAC, P_o 2.55 kW		219		ADC
Nominal current output 1 with 2 x FNP850-12	$I_{o1\ nom}$ @ $V_i = 85$ VAC – 264 VAC, P_o 1.7 kW		146		ADC
Nominal current output 1 with 1 x FNP850-12	$I_{o1\ nom}$ @ $V_i = 85$ VAC – 264 VAC, P_o 850 W		73		ADC
Nominal current output 2	$I_{o2\ nom}$ @ $V_i = 85$ VAC – 265 VAC, P_o 6 W		0.5		ADC
Current limit output (per unit)	$I_{o2\ max}$ @ $V_i = 85$ VAC – 265 VAC	77	80	88	ADC
Current limit output 2 (all units)	$I_{o2\ max}$ @ $V_i = 85$ VAC – 265 VAC	0.5	0.75	1.0	ADC
Start-up time	Time required for output within regulation after initial application of AC-input ($V_{i\ nom}, I_{o\ nom}$) after removal of inhibit ($V_{i\ nom}, I_{o\ nom}$)		100	1.5	s ms
Current share	Difference in current between two supplies for V_{o1} above 10 % load.			7	ADC

Control

Specification is valid for input voltage, load, and temperature ranges, unless otherwise stated.

Parameter	Conditions/description
I ² C digital bus	Monitors alarm functions and sets parameters.
PS remote shutdown / Inhibit pin	TTL compatible signal, inhibited when open contact, high or at TTL logic “1” Signal referenced to logic return (LRTN). Externally applied voltage to the enable pin should NOT exceed 7 VDC.
Power supply OK (I ² C)*	AC OK & DC OK & no overcurrent & no overtemperature & fans working
DC current fail (I ² C)*	Overcurrent on I_{o1}
AC fail / Power down warning (I ² C & OC)*	Provides a warning that the input power has failed at least 5 ms before the output falls out of regulation. Open collector signal with 20 mA pull-down capability, referenced to logic return (LRTN). AC fail will go high or open during power fail condition and will go low when input is within the operating range. A Power Fail warning will turn off the green AC OK LED.
DC fail / Output voltage fault (I ² C & OC)*	Internal undervoltage and overvoltage supervision of V_{o1} . Open collector signal with 20 mA pull-down capability, referenced to logic return (LRTN). DC fail will go high or open if V_{o1} is < 90% or > 110% of $V_{o1\ set}$, measured in front of the ORing FETs. A green LED on the front panel indicates normal operation. The LED will flash if in parallel operation V_{o1} is OK, but the supply is disabled.

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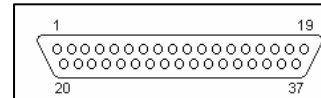
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Parameter	Conditions/description
Temperature warning (I ² C & OC)*	I ² C critical temperature warning: Indicates that the operating temperature has reached [T _{shut-down} - 10K] I ² C & OC overtemperature warning: Indicates if the supply is in overtemperature shutdown. Open collector signal with 20 mA pull-down capability, referenced to logic return (LRTN). The OC-output will go low 100 ms before an overtemperature condition shuts down the power supply. An amber LED on the front panel indicates overtemperature or fan fail.
DC voltage monitoring (I ² C)*	Monitors the output voltage V _{o1} : Accuracy ± 0.45 V over setting range, temperature and load.
DC current monitoring (I ² C)*	Monitors the output current I _{o1} : Accuracy ± 0.4A over setting range.
C voltage trimming (I ² C or external resistor)*	Output voltage trimming V _{o1} : ± 8 % of V _{o set} Setting accuracy over I ² C: ± 50mV at V _{o nom} , ± 150mV over setting range.
Fan speed control (I ² C)*	Two fan speed levels automatically set depending on the internal temperature. The fan speed can be set to full speed or automatic control.
Fan OK (I ² C & OC)*	Indicates if fan is operating or has failed.
Synch. startup pin	Overcurrent signal which can be used for synchronous start-up of supplies in parallel or to recover from an overload condition. (See application note).

* Provided over the I²C interface (I²C) or as open collector signal on the output connector (OC).
For detailed Information on I²C, please see document "FNP850 I2C Programming Manual " or use the Power-One I²C Management Interface.

SUB-D Output Connector Pin out and Signal Specification



Output Connector Description	Pin Location	Type	Low level High level	V max I max
Overtemperature / Fan Fail PSU1	1	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
Power Supply Present PSU 1	2	Resistor (1 kΩ) connected to logic GND	Open Pull up	10 V 10 mA
Power Supply Present PSU 2	3	Resistor (1 kΩ) connected to logic GND	Open Pull up	10 V 10 mA
Open	4			
Overtemperature / Fan Fail PSU 3	5	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
AC Fail / Power down warning PSU 3	6	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
Power Supply Present PSU 3	7	Resistor (1 kΩ) connected to logic GND	Open Pull up	10 V 10 mA
DC Fail / Output voltage fault PSU 3	8	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
Overtemperature / Fan Fail PSU 2	9	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 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) Referenced to logic GND	<0.8 V >2.0 V	10 V 3.5 mA
V sense +	13	Open or connected to V _{o1+} at the load Internally (PSU) connected to V _{o1+} over 100 Ω		dU < 3 V _{pp} 30 mA

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Output Connector Description	Pin Location	Type	Low level High level	V max I max
V sense -	14	Open or connected to V_{o1-} at the load Internally (PSU) connected to V_{o1-} over 100 Ω		$dU < 3 V_{pp}$ 30 mA
NC	15			
AC Fail/ Power-down warning PSU 4	16	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
DC Fail/ Output voltage fault PSU 4	17	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
AC Fail/ Power-down warning PSU 5	18	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
DC Fail/ Output voltage fault PSU 5	19	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
AC Fail/ Power-down warning PSU 1	20	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
DC Fail/ Output voltage fault PSU 1	21	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
AC Fail/ Power-down warning PSU 2	22	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
DC Fail/ Output voltage fault PSU 2	23	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
DATA, I ² C data line	24	I ² C compatible signal referenced to logic GND	5 V or 3.3 V logic	-
CLOCK, I ² C clock line	25	I ² C compatible signal referenced to logic GND	5 V or 3.3 V logic	-
Auxiliary power +12 V (Output 2)	26	V_{o2+} Aux output, insulated from main output	-	-
Auxiliary power ground (Output 2)	27	V_{o2-} Aux output, insulated from main output	-	-
Logic Gnd	28	Auxiliary GND, Need to be external connected V_{o2-} . Wire separately from auxiliary and main output GND to minimize noise and avoid voltage drops on signal- and I ² C return. Leave open if not used.	-	-
Output margin PSU 1	29	Open or connected to V_{sense-} $V_{sense-} (+8 \% V_{o1})$ or $V_{sense+} (-8 \% V_{o1})$	- -	60V -
Output margin PSU 2	30	Open or connected to V_{sense-} $V_{sense-} (+8 \% V_{o1})$ or $V_{sense+} (-8 \% V_{o1})$	- -	60V -
Output margin PSU 3	31	Open or connected to V_{sense-} $V_{sense-} (+8 \% V_{o1})$ or $V_{sense+} (-8 \% V_{o1})$	- -	60V -
Output margin PSU 4	32	Open or connected to V_{sense-} $V_{sense-} (+8 \% V_{o1})$ or $V_{sense+} (-8 \% V_{o1})$	- -	60V -
Output margin PSU 5	33	Open or connected to V_{sense-} $V_{sense-} (+8 \% V_{o1})$ or $V_{sense+} (-8 \% V_{o1})$	- -	60V -
Overtemperature / Fan Fail PSU 4	34	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA

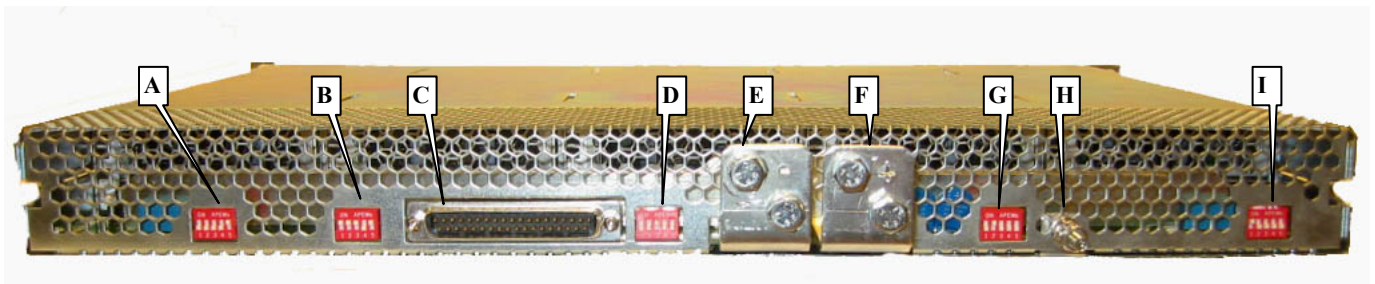
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Output Connector Description	Pin Location	Type	Low level High level	V max I max
Power Supply Present PSU 4	35	Resistor (1 k Ω) connected to logic GND	Open Pull up	10 V 10 mA
Overtemperature / Fan Fail PSU 5	36	OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series, referenced to logic GND	<0.4 V @ 20 mA Pull up	15 V 20 mA
Power Supply Present PSU 5	37	Resistor (1 k Ω) connected to logic GND	Open Pull up	10 V 10 mA

Output Connector Descriptions



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

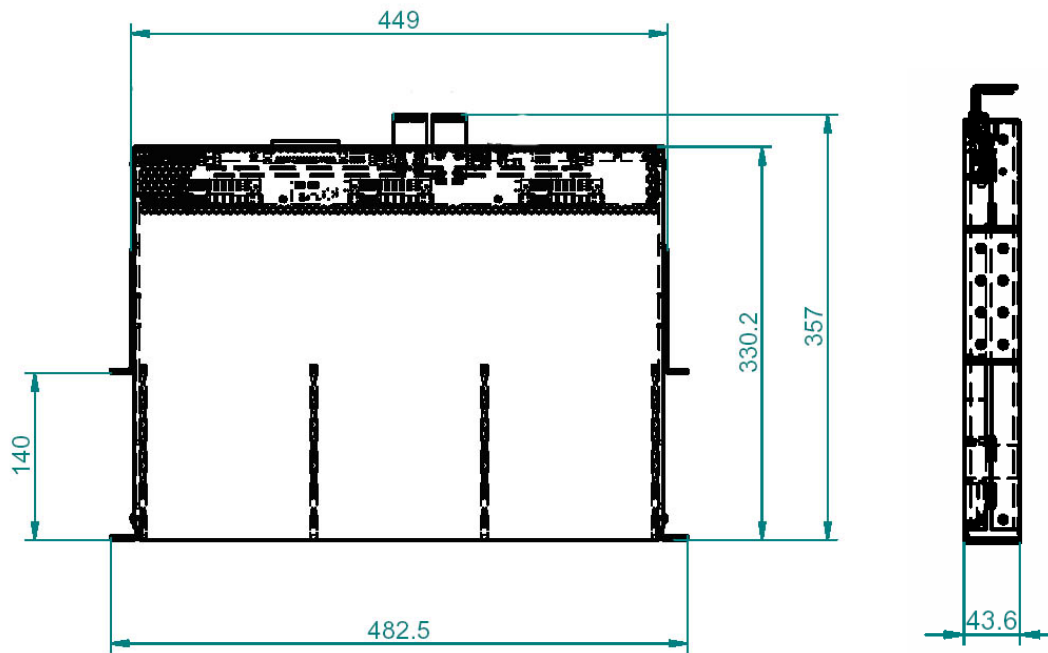
Cooling:

Sufficient airflow through the power supply must be ensured to achieve best cooling results. DO NOT block or obstruct the airflow at the rear of the unit by placing large components directly at the output connector.



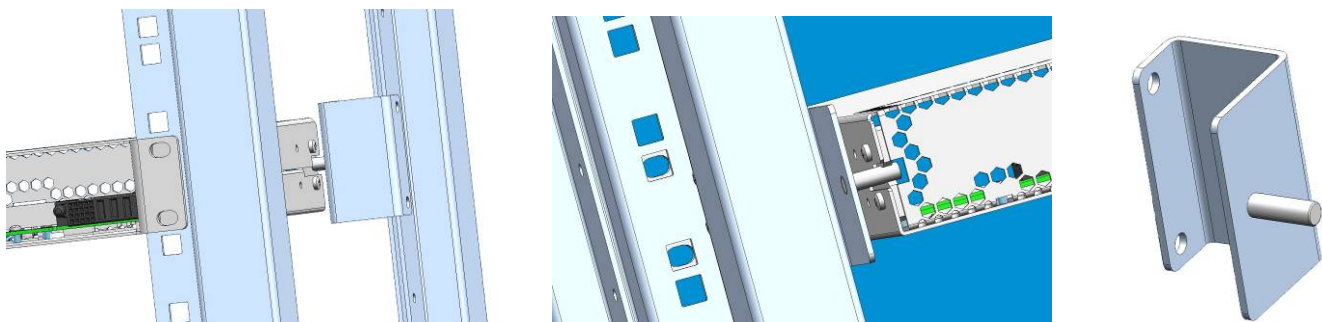
Mechanical Data

Mechanical Data (H, W, D)	17.7" (449mm) x 1.7" (43.6mm) x 13" (279.4mm)
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Back Shelf holding device

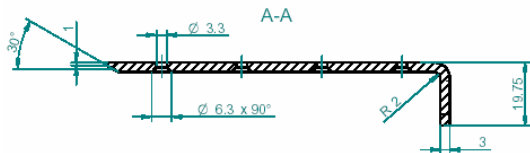
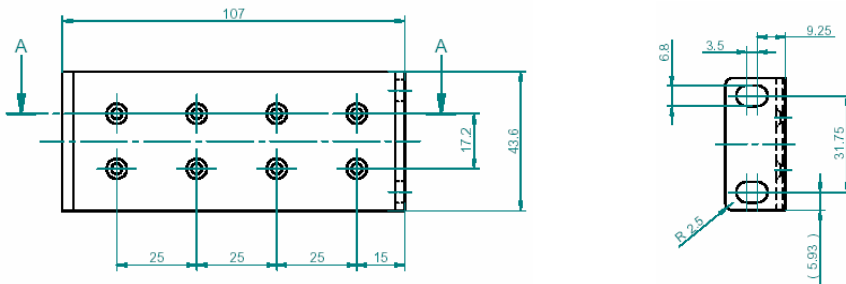
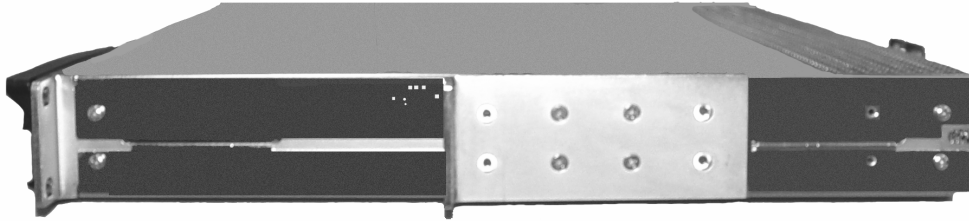
The Shelf can be alternatively mounted rear side into the frame.





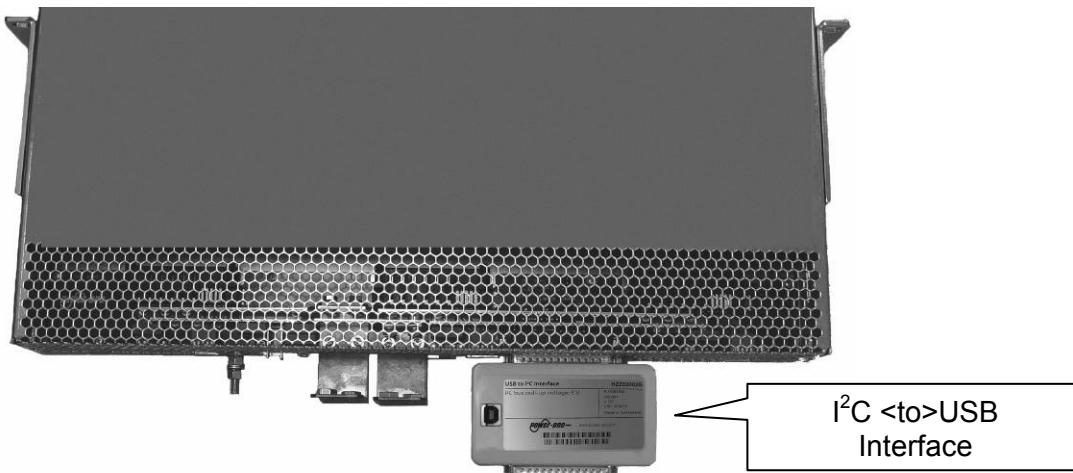
Accessories:

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



Center Angular Bracket sets can be ordered: Power-One part no.: HZZ01222-G
 Note: Each Center Angular Bracket set contains 2 brackets and 8 screws.

I²C to USB Interface Demonstration Kit HZZ02002G:



An I²C to USB Interface demonstration Kit can be ordered: Power-One part no.: **HZZ02002G**

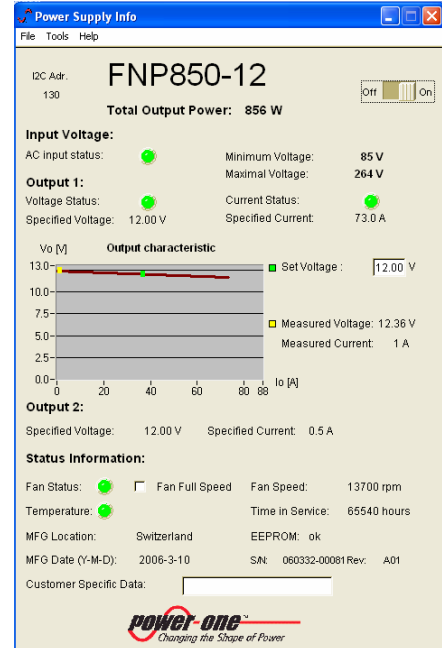
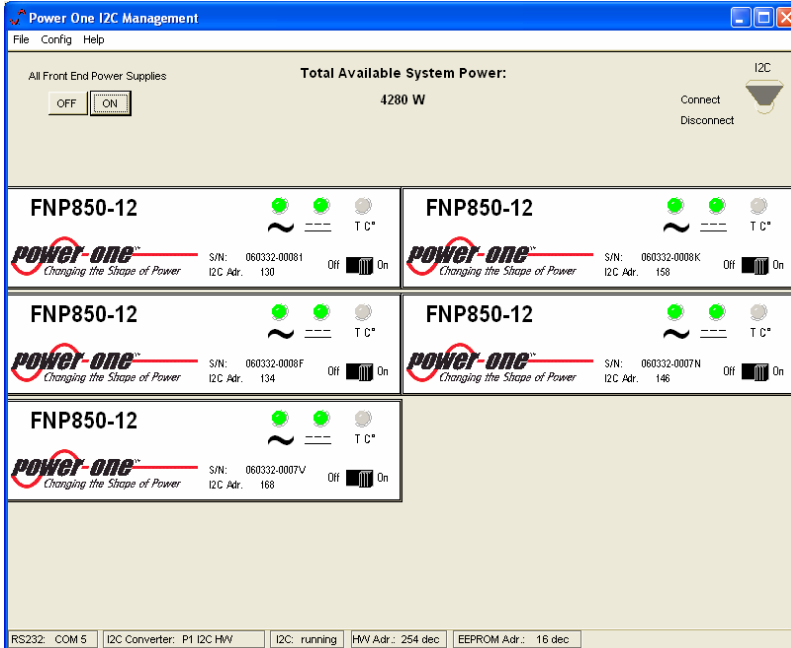
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Software:

Via an I²C Management software tool and the interface HZZ02002G all power supplies can be controlled. The Software tool HZZ02002SW is available on the Power One website www.power-one.com.



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