

FXP1500-32G

AC-DC Power Supply

FXR-3-32G Power Shelf



Key Features & Benefits

- 28 VDC, 32 VDC and 36 VDC output voltage preset via VID pins
- Margining via I²C
- Active current/load sharing
- Wide input voltage range 85-264 VAC
- Highly-efficient topology yields 89% at 230 VAC
- 1U high: 5.6" x 1.6" x 12" cassette
- Input fuse protected I²C interface status and control
- High density design:13.4W/in³
- Up to 4500 W in a 1U-high, 19-inch wide rack
- Standby voltage 5 VDC/1A
- Adjustable output voltage
- Overtemperature, output overvoltage and output overcurrent protection
- ORing circuit for true redundant operation
- Status LEDs: AC OK, DC OK, Fan Fail/Overtemperature Fail
- Auto select power limits

The FXP1500-32G is a 1500 watt, power factor corrected (PFC) front-end, which provides a user-adjustable 32 VDC (26-38 VDC range) main output for test & measurement, RF amplifiers and transmitters, factory automation, semiconductor equipment, and other distributed power applications. The FXP1500-32G provides for true hot-swap with AC and DC connections at the rear of the model and can be used for redundant system applications. Its very small dimensions allow configuration of up to three units in a 1U rack (up to 4500 W).² The highly-efficient thermal design with internal fan cooling permits its use in wide operating voltage and temperature ranges to provide very high reliability.

Status information is provided with front panel LEDs, logic signals, and via the 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.

The FXP1500-32G meets international safety standards and displays the CE-Mark for the European Low Voltage Directive (LVD).

Applications

- Test & Measurement,
- RF Amplifiers & Transmitters
- Factory Automation
- Semiconductor & LD-MOS Based Equipment
- other Distributed Power Applications

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Europe, Middle East

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FXP1500-32G

Model Selection

| MODEL | INPUT VOLTAGE VAC AUTO SELECTED ¹ | OUTPUT 1 | | OUTPUT 2 | | RATED POWER W | COMPATIBLE SHELF ² |
|-------------|--|---------------------------|---------------------------|---------------------------|---------------------------|---------------------|----------------------------------|
| | | I _o nom VDC | I _o max ADC | I _o nom VDC | I _o max ADC | | |
| FXP1500-32G | 85 – 264 | 32 | 46.9 | 5 | 1 | 1505 ³ | FXR-3-32G |

- ¹ The available output power is automatically adjusted depending on the input voltage.
² 1U standard rack FXR-3-32G for FXP1500-32G is available from Bel Power Solutions.
³ Automatic derating of main output below 108 VAC to: I_o max = 37.5 A (1200 W).

Absolute Maximum Ratings

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

| PARAMETER | CONDITIONS/DESCRIPTION | MIN | MAX | UNIT |
|-------------------------------|--|-----|------------|------------|
| Input voltage | Continuous Transient, 60 ms max. | | 264 300 | VAC VAC |
| Operating ambient temperature | V _i min - V _i max, I _o nom, cooling by internal fan 100 % load from 0 to 50°C linear derating to 50% load from 50°C to 70°C | 0 | 70 | °C |
| Storage temperature | Non-Operating | -40 | 85 | °C |

Input Specification

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

| PARAMETER | CONDITIONS/DESCRIPTION | MIN | NOM | MAX | UNIT |
|---------------------------|---|------|-------|-----|-----------------|
| Input Voltage | | 85 | 230 | 264 | VAC |
| Input Frequency | | 47 | 50/60 | 63 | Hz |
| Turn-On Input Voltage | Ramping up | 79 | - | 85 | VAC |
| Turn-Off Input Voltage | Ramping down | 70 | - | 78 | VAC |
| Inrush Current Limitation | 115/230 VAC acc. ETS 300 132-1 < 100 ms | | | 50 | A _{pk} |
| Hold-Up Time | After last AC line peak, V _i = 230 VAC, P _o nom | 20 | | | ms |
| Power Factor | V _i nom, I _o nom | 0.95 | | | W/VA |
| Efficiency | V _i = 230 VAC, V _o nom, I _o nom, T _c = 25°C | 89 | 89.5 | | % |
| Max Input Current | | | | 20 | Arms |

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Output Specification

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

| PARAMETER | CONDITIONS/DESCRIPTION | MIN | NOM | MAX | UNITS | |
|--|---|---------|---------------|------|----------------------|----------------------|
| Total Output Voltage Range | Adjustable via T4, T5 pins & I ² C | 26 | | 38 | VDC | |
| Output Voltage Set Point | Adjustable via T4, T5 pins (LL = 28 V, LH = HL = 32 V, HH = 36 V) | | 28 | | VDC | |
| | | | 32 | | VDC | |
| | | | 36 | | VDC | |
| Output Voltage Trimming | Adjustable via I ² C from any set point. Note: all changes to V _{O1} made via I ² C are volatile and are lost upon power cycling the PSU | -2 | | +2 | VDC | |
| Overvoltage Protection Latching | 28V set point 32V set point 36V set point | | 35 | | VDC | |
| | | | 40 | | VDC | |
| | | | 45 | | VDC | |
| Nominal Current Output 1 | I _{O1 nom} @ V _i = 105 VAC – 264 VAC, P _o 1.5 kW | | 28V set point | 46.9 | ADC | |
| | | | 32V set point | 46.9 | ADC | |
| | | | 36V set point | 41.7 | ADC | |
| Nominal Current Output 2 | I _{O1 nom} @ V _i = 85 VAC – 105 VAC, P _o 1.2 kW | | 28V set point | 42.9 | ADC | |
| | | | 32V set point | 37.5 | ADC | |
| | | | 36V set point | 33.4 | ADC | |
| Nominal Current Output 2 | I _{O2 nom} @ V _i = 85 VAC – 265 VAC, P _o 5 W | | 1.0 | | ADC | |
| Current Limit Output 1 | I _{O1 max} @ V _i = 105 VAC – 264 VAC high droop I _{O1 max} @ V _i = 85 VAC – 105 VAC high droop | | 48.8 | | ADC | |
| | | hic-cup | 50.8 | | ADC | |
| | | hic-cup | 39.0 | | ADC | |
| Current Limit Output 2 | I _{O2 max} @ V _i = 85 VAC – 265 VAC | | 1.3 | | ADC | |
| Static Line Regulation Output 1 | V _i min - V _i max, 50 % I _{o nom} | -0.5 | | 0.5 | % V _{O nom} | |
| Static Load Regulation Output 1 (Droop Characteristic) | V _i = 230 V, 0-100 % I _{o nom} V _o : full load (46.9 ADC) to no load | | 31.68 | 32 | 13.6 | mV/A |
| | | | -1.0 | | 32.32 | VDC |
| Dynamic Load Regulation | Load change 1 % <-> 100 % I _{o nom} , dI _o /dt = 1 A/μs Voltage deviation (droop + over- or undershoot) Max. recovery time to within 1 % of V _{O1 nom} | | -4 | | +4 | % V _{O nom} |
| | | | | | 2000 | |
| 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 |
| | | | | | | |
| Output Voltage Ripple & Noise | V _{i nom} , I _{o nom} , 20 MHz bandwidth V _{O1} V _{O2} | | | | 320 | mV _{pp} |
| | | | | | 50 | mV _{pp} |
| Remote Sense | Total compensation for cable losses | | | 500 | mV | |
| Active Current Share | Difference in current between two units for V _{O1} above 10 % load. Active current share pin with its 1kΩ internal impedance enables control of output voltage. Voltage on this pin is proportional to output current, 2V at I _{O1 nom} | | | 5 | ADC | |

Protection

| PARAMETER | CONDITIONS/DESCRIPTION | MIN | NOM | MAX | UNIT |
|--|--|-----|-----|--|------|
| Input Fuse | Not user accessible | | | 25AF | |
| Inrush Current Limitation | | | | with NTCs | |
| Output | | | | No-load, short circuit, and overload proof | |
| Overvoltage Protection Latching ¹ | Absolute | | 40 | | V |
| Over-Temperature Protection | Automatic power shutdown at T _C | | 95 | | °C |

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Controls and Indicators

| PARAMETER | TYPE ⁴ | CONDITIONS/DESCRIPTION |
|---|---------------------------|---|
| Visual Status Indication | FP | LED indicators ⁵ <ul style="list-style-type: none"> • DC OK (green) • AC OK (green) • Fan fail & Over-temperature (amber) |
| I ² C Communication Bus | OC[S1, S2] | <ul style="list-style-type: none"> • Monitors alarm functions and allows control of specific parameters. • Uses standard Philips two wire bus (SCL and SDA signal lines) |
| I ² C Communication Bus Addressing | OC[T1-T3] | Three lines provide up to 8 separate PSU I ² C addresses |
| PS Present Pin | OC[U3] | <ul style="list-style-type: none"> • Used by system to indicate a PSU is installed in a system shelf • Contact closure to logic ground (internal pull-down resistor of 1 kΩ) • TTL compatible signal, inhibited when open contact, high or at TTL logic “1” • Signal referenced to logic return (LRTN) |
| PS Main Output Remote Shutdown | OC[R1] FP | Two position switch in series with OC signal (logical AND) allows local enable/disable; “0” Position => PS disabled; “1” Position => PS Enabled |
| Power Supply OK | I ² C | AC OK & DC OK & no overcurrent & no over-temperature & fans working |
| DC Current Fail | I ² C | Reports over-current condition on main output, I _{O1} |
| AC Fail / Power Down Warning | OC[U2] & I ² C | <p>Provides a warning that the input power has failed at least 5 ms before the output falls out of regulation (<90% V_{O1} set).</p> <ul style="list-style-type: none"> • 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 front panel green AC OK LED. <p>Internal under-voltage and overvoltage supervision of V_{O1}.</p> <ul style="list-style-type: none"> • Open collector signal with 20 mA pull-down capability, referenced to logic return (LRTN). |
| DC fail / Output Voltage Fault | OC[U4] & I ² C | <ul style="list-style-type: none"> • DC fail will go high or open if V_{O1} < 90% or V_{O1} > 110% of V_{O1} set, measured in front of the ORing FETs. • Green LED on the front panel indicates normal operation; LED will flash if in parallel operation V_{O1} is OK, but the unit is disabled. |
| Critical Temperature Warning/Fan Fail | OC[U1] & I ² C | <p>Indicates the PSU operating temperature has reached [T_{shut-down} – 10K] Indicates if the unit is in over-temperature shutdown.</p> <ul style="list-style-type: none"> • Open collector signal with 20 mA pull-down capability, referenced to logic return (LRTN). • The OC-output will go low 100 ms before an over-temperature condition shuts down the unit. • An amber LED on the front panel indicates over-temperature or fan fail. |
| DC Voltage Monitoring | I ² C | Monitors the main output voltage, V _{O1} , seen at the output connector. Accuracy is ±1% over setting range and temperature. |
| DC Current Monitoring | I ² C | Monitors the output current I _{O1} : Accuracy ± 1% over the load range. |
| Active Current Share Interconnect | OC[R4] | Line must be connected to all paralleled PSUs to allow active current share functionality between units |
| V _{O1} Presets | OC[T4,T5] | <p>Output voltage is preset per programming of T4, T5</p> <ul style="list-style-type: none"> • T4/T5 = LOW / LOW => V_{O1}=28VDC • T4/T5 = LOW / HIGH = HIGH / LOW => V_{O1}=32VDC • T4/T5 = HIGH / HIGH => V_{O1}=36VDC |
| V _{O1} Voltage Trimming (Margining) | I ² C | <p>Output voltage trimming Vo1: ±2 VDC</p> <p>Setting accuracy over I²C: ± 50mV at V_{O1}nom, ± 150 mV over setting range</p> |
| 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 via I ² C command. |
| Fan OK/FAIL | OC[U1] & I ² C | Indicates if the cooling fans are operating or have failed. |
| Synchronized Startup Pin | OC[R5] | Overcurrent signal which can be used for synchronous startup of units in parallel or to recover from an overload condition. |

⁴ Abbreviations used:

OC[#] => Hardwired signal accessible at PSU output connector, with pin number reference

FP => Provided by devices located on PSU Front panel

I²C => Signal provided over I²C communication system.

Detailed I²C information is available from the specific model's I²C Manual found on the Bel Power Solutions web site.

⁵ See LED Function table for further details

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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 |
| Temperature Coefficient | 0 °C to 70 °C (after 15 min warm-up) | | | 0.02 | %/K |
| Shock | IEC/EN 60068-2-27, 11 ms | | | 40 | g _{pk} |
| | IEC/EN 60068-2-6 | | | | |
| Sinusoidal Vibration | 2-8 Hz | | 7.5 | | mil |
| | 8-200 Hz | | 2 | | g _{pk} |
| | 200-500 Hz | | 4 | | g _{pk} |
| Random Vibration | 10-2000 Hz | | 6.15 | | grms |
| MTBF | Calculated per Bellcore (SR-332, Issue 1): GB 25°C | 230 | | | kh kh |
| | Demonstrated | 250 | | | |

Safety Specifications

Maximum electric strength testing is performed in the factory according to EN50514, IEC/EN60950-1 2nd ed. and UL/CSA60950-1 2nd ed. Input-to-output electric strength tests should not be repeated in the field. Bel Power Solutions will not honor any warranty claims resulting from electric strength field tests.

| PARAMETER | CONDITIONS/DESCRIPTION | MIN | NOM | MAX | UNIT |
|--------------------------------|---|-------------------|-----|------------|------|
| Agency Approvals | Approved to the latest edition of the following standards: CSA/UL60950-1, EN60950-1 and IEC60950-1; CE Mark for LVD | | | | |
| Insulation Safety Rating | Input to case | | | Basic | |
| | Input to output | | | Reinforced | |
| | Output to case | | | Functional | |
| Electric Strength Test Voltage | Input to case | 2.121 | | | kVDC |
| | Input to output | Note ⁶ | | | kVDC |
| | Output to case | 0.1 | | | kVDC |
| | Output 1 to output 2 | 0.1 | | | kVDC |

⁶ Subassemblies are pre-tested with 4.2 kVDC in accordance with EN50514 and IEC/EN60950-1 2nded.

EMC Specification

| 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 (L/L, L/E) | 2 / 1 kV, Performance criterion B |
| Surge | IEC/EN 61000-4-5, level 3 (L/L, L/E) | 1 / 2 kV, Performance criterion B |
| Voltage Dips & Interruptions | IEC/EN 61000-4-11 | |
| | Dip 30 %, 100 ms | Performance criterion A |
| | Dip 30 %, 200 ms | Performance criterion B |
| | Dip 60 %, 20 ms | Performance criterion A |
| | Dip 60 %, 100 ms | Performance criterion B |
| | Dip > 95 %, 20 ms | Performance criterion A |
| 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 & Flicker | IEC/EN 61000-3-3 | Pass |
| Voltage Sag | SEMI F47-0200 (High Line 230V) | Pass |

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Output Connector Pinning and Signal Specification

| OUTPUT CONNECTOR DESCRIPTION | OC PIN # | TYPE | SIGNAL REFERENCE | LOW LEVEL HIGH LEVEL | V MAX I MAX |
|---|------------|--|--|---------------------------|-------------------|
| Over-temperature / Fan Fail | U1 | OC-output, protected by 16 V Zener diode and a 10Ω resistor in series | LGND | <0.4 V @ 20 mA Pull up | 15 V 20 mA |
| AC Fail / Power Down Warning | U2 | | | <0.4 V @ 20 mA Pull up | 15 V 20 mA |
| Power Supply Present | U3 | 1KΩ Resistor connected to logic GND | LGND | Open Pull up | 10 V 10 mA |
| DC Fail / Output Voltage Fault | U4 | OC-output, protected by 16 V Zener diode and a 10Ω resistor in series | LGND | <0.4V @ 20 mA Pull up | 15 V 20 mA |
| Internal Ground (INT GND) | U5 | Used only for ADDR _x and V _{O1} set. Do not connect the internal grounds in systems with several units. | Connected to V _{O1} - line before the output filter | - | - |
| ADDR0 I2C Address Bus | T1 | High = internal 10 KΩ PU to 5V=> Logic 1 Low = connect to INT GND => Logic 0 | INT GND | Logic 1 Logic 0 | 5V 0V |
| ADDR1 I2C Address Bus | T2 | | | | |
| ADDR2 I2C Address Bus | T3 | | | | |
| VO1 set | T4 | | | | |
| VO1 set | T5 | | | | |
| SDA, I2C Serial Data Line | S1 | I ² C compatible signal referenced to logic GND 5 V or 3.3 V logic | LGND | Logic 1 Logic 0 | 5V 0V |
| SCL, I2C Serial Clock Line | S2 | | | | |
| Auxiliary Power +5 V | S3 | V _{O2+} output, isolated from main output | Aux output is floating | - | - |
| Auxiliary Power +5 VRTN | S4 | Aux output return; ground isolated from main output | | | |
| Logic Ground (LGND) | S5 | Internally connected to Aux GND through 10Ω resistor. Wire LGND separately from Aux RTN and main output GND to minimize noise on signals and I ² C bus. Leave open if not used. | - | - | - |
| Output Inhibit R1 | R1 | PS active when pulled low (DC-DC stage off when left open) | LGND | <0.8 V >2.0 V | 10 V 3.5 mA |
| V Sense + | R2 | Open or connected to V _{O1+} at the load Internally connected to V _{O1+} via 100 Ω. | - | - | dV<3 Vpp 30 mA |
| V Sense - | R3 | Open or connected to V _{O1-} at the load Internally connected to V _{O1-} via 100 Ω. | - | - | dV<3 Vpp 30 mA |
| Active Current Share | R4 | This pin must be interconnected to pin R4 of all other paralleled PSUs for proper operation of active current share function | - | - | 2V |
| Synchronized Startup (for paralleled units) | R5 | Open or connected to synch startup circuit | V _{O1} - at the OC | | 12V 2mA |
| V _{O1-} | P1, P3, P5 | Main output - pins | - | - | - |
| V _{O1+} | P2, P4, P6 | Main output + pins | - | - | - |
| INPUT CONNECTOR DESCRIPTION | OC PIN # | TYPE | | | |
| Protection Earth | P1 | PE | | | |
| Phase | P2 | L | | | |
| Neutral | P3 | N | | | |

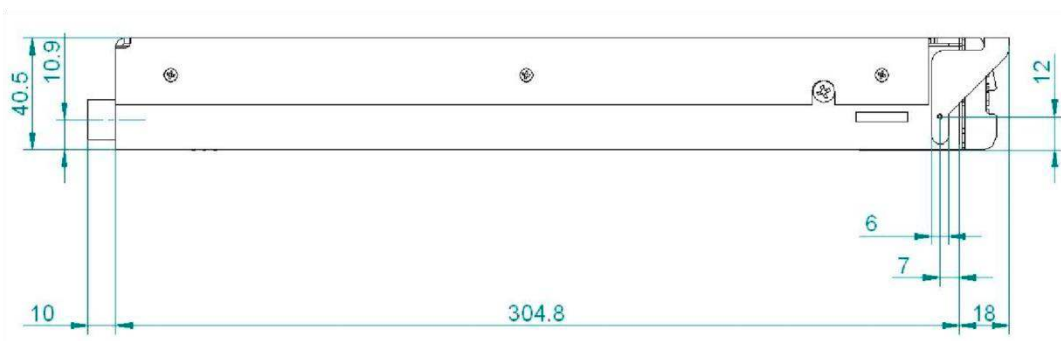
FXP1500-32G

LED Indicator Functionality

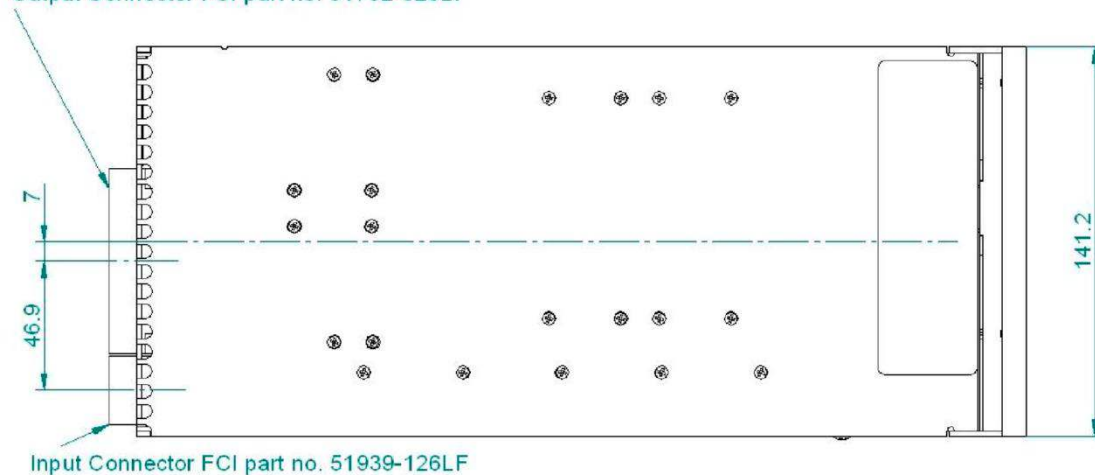
| CONDITION | POWER FAIL (AC OK) | OUTPUT GOOD (DC OK) | FAN FAIL AND OVER - TEMPERATURE |
|---------------------------------------|--------------------|---------------------|---------------------------------|
| Normal Operation | Green | Green | OFF |
| Power Supply is Inhibited | Green | OFF | Amber |
| Input AC is Low | OFF | OFF | Amber |
| Input AC is Low or Missing | OFF | OFF | Amber/OFF |
| Over-Temperature | Green | OFF | Amber |
| Output Overload (In regulation) | Green | Green | OFF |
| Output Overloaded (Out of Regulation) | Green | OFF | OFF |
| Fan Not Running | Green | OFF | Amber |
| Power Supply Failed | OFF | OFF | OFF/ Amber |

Mechanical Data

Mechanical Dimensions (W x H x D): 5.6" (141.2 mm) x 1.6" (40.5 mm) x 12" (304.8 mm)



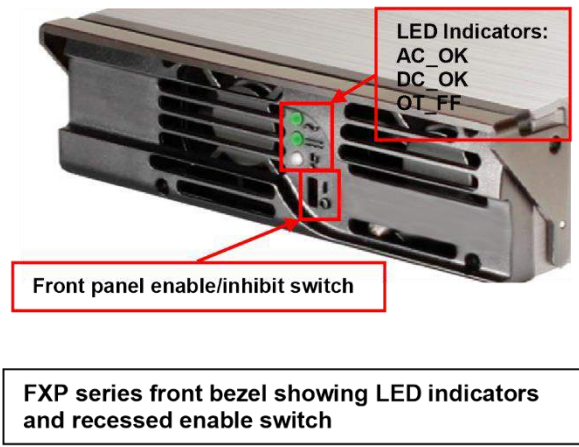
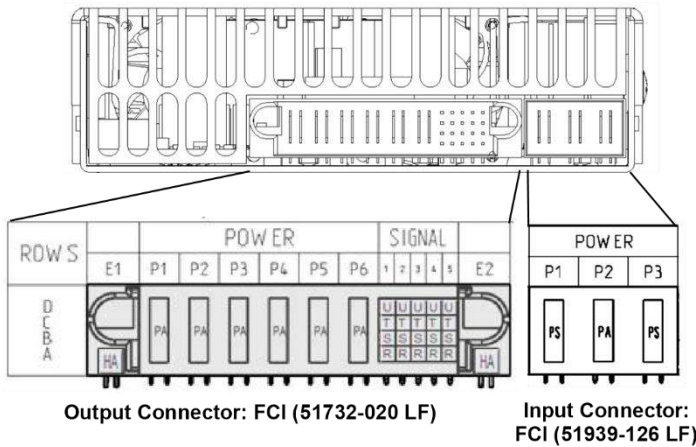
Output Connector FCI part no. 51732-020LF



Input Connector FCI part no. 51939-126LF

FXP1500-32G

Input & Output Connector Description



Female ledge connector: Manufacturer: FCI
 Output connector Part No.: 51762-106020000AA LF (Horizontal)
 Output connector Part No.: 51742-106020000AA LF (Vertical)
 Input connector Part No.: 51915-056LF (Horizontal)
 Input connector Part No.: 51940-099LF (Vertical)
 Information on availability under <http://www.stkcheck.com/evs/fcielectronics/fcisearch.asp>

Paralleling Front-Ends

For parallel use in minimal configuration systems, only the inhibit pins must be shorted to logic GND. All other pins can be left open. The power supplies will share the output current automatically (droop current share).
 For parallel applications without I²C bus, but the use of all other features, it is recommended to connect all logic GND's on a backplane together, to connect all V_{o2-}, all V_{o2+} and to leave the internal GND's open.
 The sense wires can be left open or connected to a common load point, the synch-start pin can be left open or connected to a synch-start circuit, the inhibit pins can be connected together or used individually. All I²C signals (T1-T5, S1, and S2) can be left open.
 Use of a small foil capacitor > 3μF directly at the power outputs of each unit is recommended in order to prevent voltage drops at the hot plug. For additional information on paralleling see the following Rack (Power Shelf) section.

Cooling

To achieve best cooling results sufficient airflow through the unit must be ensured. Do not block or obstruct the airflow at the rear of the unit by placing large components directly at the output connector.



FXP1500-32G

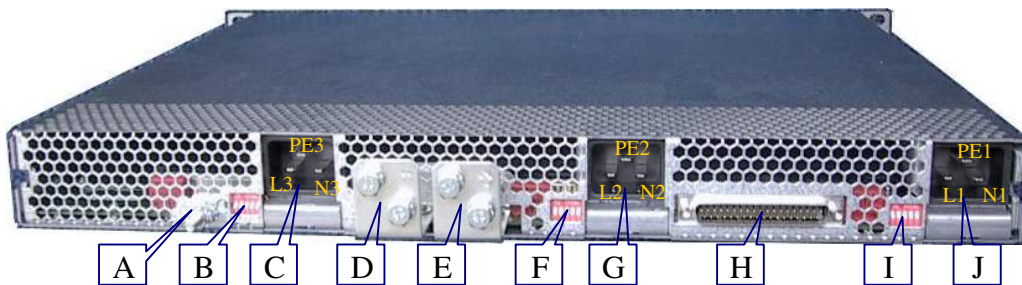
FXR-3-32G Power Shelf

- Each rack (power shelf) is 1U high with backplane and designed for up to three front-end models in parallel or in n+1 operation. Each power shelf has:
- Generous copper bus bars for low-loss current distribution.
- 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 I²C-lines, monitoring signals and support functions.
- Provides a start-up synchronization circuit and EMV filters.
- Overall Mechanical Dimensions (W x H x D): 17.7" (449.6 mm) x 1.7" (43.1 mm) x 14" (355.6 mm)



FXR-3-32G Power Shelf Front View

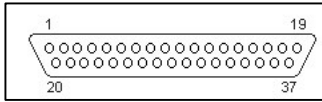
Output Connector Descriptions (FXR-3-32G)



| LOCATION | DESCRIPTION | |
|----------|--|--|
| A | Earth connection | |
| B | 5-bit DIP switch, pins 1,2,3 for I ² C addressing and pins 4,5 for Vo setting of PSU #3 | |
| C | Mains connector of PSU #3 | |
| D | Output 1 Minus | |
| E | Output 1 Plus | |
| F | 5-bit DIP switch, pins 1,2,3 for I ² C addressing and pins 4,5 for Vo setting of PSU #2 | |
| G | Mains connector of PSU #2 | |
| H | 37-pin SUB-D connector, control, sense, check and Auxiliary power (Output 2) | |
| I | 5-bit DIP switch, pins 1,2,3 for I ² C addressing and pins 4,5 for Vo setting of PSU #1 | |
| J | Mains connector of PSU #1 | |

FXP1500-32G

SUB-D Output Connector Pinout and Signal Specification



| OUTPUT CONNECTOR DESCRIPTION | OC PIN | TYPE | SIGNAL REFERENCE | LOW LEVEL HIGH LEVEL | V MAX I MAX |
|--|--------|---|-------------------------------|---------------------------|---------------------|
| Over-temperature / Fan Fail PSU1 | 1 | OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series | LGND | <0.4 V @ 20 mA Pull up | 15 V 20 mA |
| Power Supply Present PSU 1 | 2 | Resistor (1 kΩ) connected to LGND | LGND | Open Pull up | 10 V 10 mA |
| Power Supply Present PSU 2 | 3 | | | | |
| Spare | 4 | | | | |
| Over-temperature / Fan Fail PSU 3 | 5 | OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series | LGND | <0.4 V @ 20 mA Pull up | 15 V 20 mA |
| AC Fail / Power down warning PSU 3 | 6 | | | | |
| Power Supply Present PSU 3 | 7 | Resistor (1 kΩ) connected to logic GND | LGND | 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 | LGND | <0.4 V @ 20 mA Pull up | 15 V 20 mA |
| Overtemperature / Fan Fail PSU 2 | 9 | | | | |
| Synch._Start_A | 10 | Sync_start_A , Active high The signals of several racks can be connected together in such a way that all supplies will be inhibited until the last supply has recovered from its overcurrent condition | LGND | <7V off < 9V | 15V 10mA |
| Open | 11 | | | | |
| Output inhibit PSU 1-3 | 12 | DC-DC stage ON when pin is open or connected to LGND DC-DC stage OFF when pin is connected on high potential | LGND | <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 | V _{O1+} | | dV < 3 Vpp 30 mA |
| V sense - | 14 | Open or connected to V _{O1-} at the load Internally (PSU) connected to V _{O1-} over 100 Ω | V _{O1-} | | dV < 3 Vpp 30 mA |
| Open | 15 | | | | |
| NC | 16 | | | | |
| NC | 17 | | | | |
| NC | 18 | | | | |
| NC | 19 | | | | |
| AC Fail/ Power-down warning PSU 1 | 20 | OC-output, protected by 16 V Zener diode and a 10 Ω resistor in series | LGND | <0.4 V @ 20 mA Pull up | 15 V 20 mA |
| DC Fail/ Output voltage fault PSU 1 | 21 | | | | |
| AC Fail/ Power-down warning PSU 2 | 22 | | | | |
| DC Fail/ Output voltage fault PSU 2 | 23 | | | | |
| SDA, I ² C data line | 24 | I ² C compatible signal | LGND | 5 V or 3.3 V logic | |
| SCL, I ² C clock line | 25 | I ² C compatible signal | LGND | 5 V or 3.3 V logic | |
| V _{O2+} = +5 V (Auxiliary power) | 26 | V _{O2+} Aux output, insulated from main output | Aux output is isolated supply | | |
| V _{O2-} = +5 VRTN (Auxiliary power) | 27 | V _{O2-} Aux output, insulated from main output | | | |

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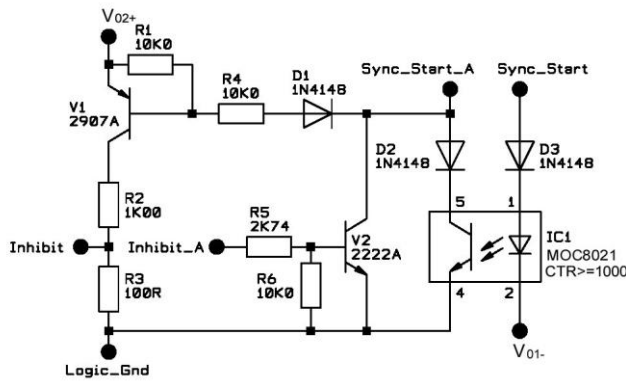
FXP1500-32G

| | | | | | |
|----------------------|----|--|---|--|----|
| Logic Gnd (LGND) | 28 | 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. | Internally connected to V ₀₂₋ Auxiliary GND via 10 Ω | | |
| Active current share | 29 | This pin must be interconnected to all other parallel shelves for proper operation of active current share function. | | | 2V |
| NC | 30 | | | | |
| NC | 31 | | | | |
| NC | 32 | | | | |
| NC | 33 | | | | |
| NC | 34 | | | | |
| Internal Ground PSU1 | 35 | Used only for ADDR _x and V ₀₁ set. Do not connect the internal grounds in the system with several units. | Connected to V ₀₁₋ line before the output filter | | |
| Internal Ground PSU2 | 36 | | | | |
| Internal Ground PSU3 | 37 | | | | |

Synchronized Start-Up Circuit for Paralleling Operation

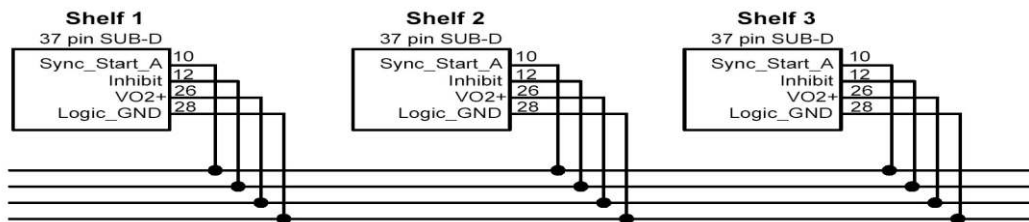
The FXP1500-32G power supply exhibit an overcurrent hiccup behavior. This means if either of these supplies reaches an overcurrent limit, the output voltage will immediately turn OFF and after a delay turn ON again. In parallel use, all power supplies have to start synchronized because of the internal hiccup behavior. Otherwise, the supply which has reached overcurrent first will go to hiccup; this will overload the other supplies, which then will also go to hiccup. When the first supply has recovered from hiccup (hiccup dead time), the others remain in hiccup. This will immediately drive the first one into hiccup once again. This means that without a start-up circuit, a system with several power supplies can never recover from an overload condition or start-up into full load.

The following additional circuit, required to reach synchronized startup, is already implemented inside the FXR-3-32G shelf.



Synch Start-up Connection between Shelves

The following connection between the shelves is required to achieve a parallel operation. The synch-start circuits inside the shelves inhibit all power supplies until the last one has recovered from its overcurrent condition and then synchronize the restart of the outputs.



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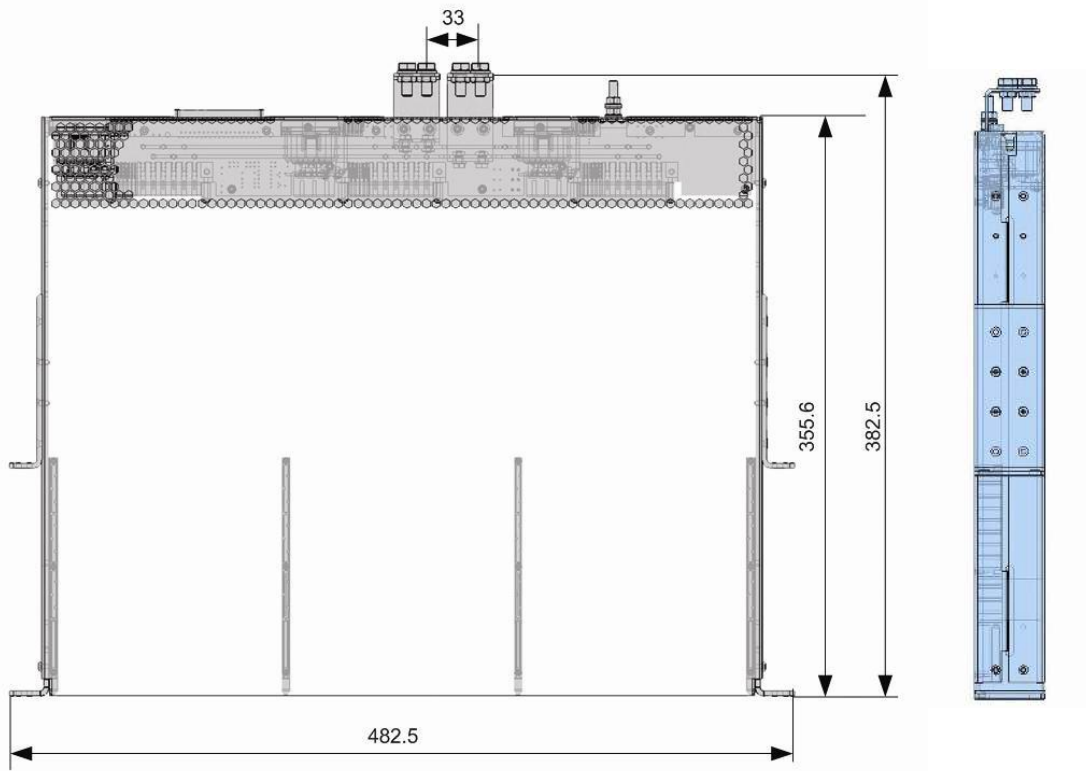
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Synch Start-up Circuit Description

| DESCRIPTION | PIN LOCATION, DEFINITION | TYPE | SIGNAL REFERENCE | LOW LEVEL HIGH LEVEL | V MAX I MAX |
|--|--------------------------|--|--|----------------------|----------------|
| Auxiliary power +5 V (Output 2) | 26 | V _{O2+} , Aux output, insulated from main output | | | |
| Logic ground | 28 | Logic_GND , Internally connected over 10 Ω to V _{O2-} , (Auxiliary power ground (Output 2)) | Internally connected over 10 Ω to V _{O2-} | | |
| Output inhibit_A PSU 1-3 | 12 | Inhibit_A, DC-DC stage ON when pin is open or connected to LGND DC-DC stage OFF when pin is connected on high potential | LGND | <0.8 V >2.0 V | 10 V 3.5 mA |
| Synch. Startup 1 PSU 1-3 | R5 (at PSU OC) | The synch_start pin is connected to the over-current signal of the PSU1-3. In the case of an overcurrent shutdown, this signal goes high. | Vo1- | <7V off > 9V | 15V 10mA |
| Synch. Startup_A Rack FXR-3-32G 1-N Pin on the D-Sub connector on the backplane | 10 | Sync_start_A, Active high The signals of several racks can be connected together in such a way that all supplies will be inhibited until the last supply has recovered from its overcurrent condition. | LGND | | |

NOTE: The Sync-Start pins can be wired together only if the power supplies are connected with a minimal voltage drop on power ground as achieved on a backplane with massive copper bus bars. If there is a less ideal connection, it is recommended to use an opto-coupler for each unit (IC1, D3, D2).

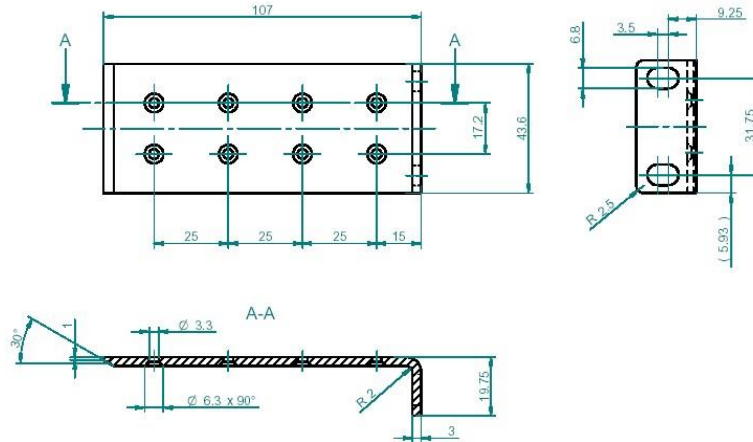
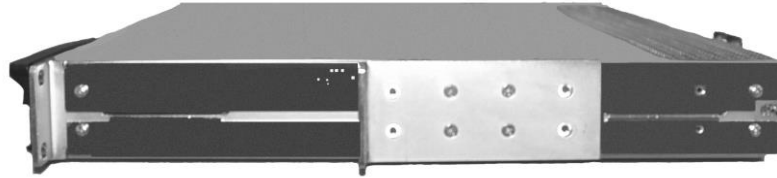
Mechanical Data (FXR-3-32G Power Shelf)



FXP1500-32G

Accessories

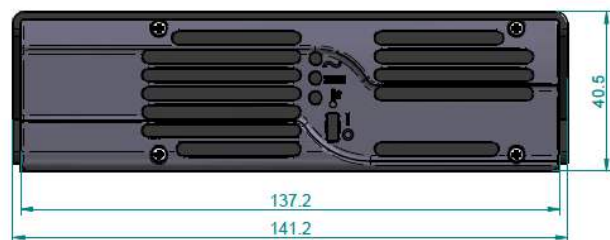
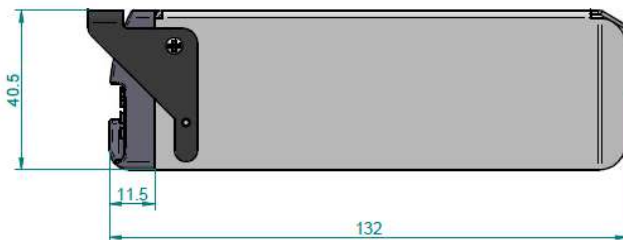
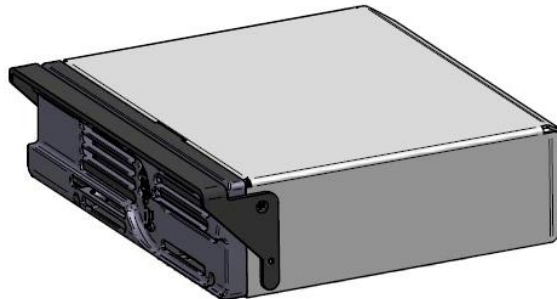
Center Angular Brackets are set in the middle for shelf mounting:



Center Angular Bracket sets can be ordered: Bel Power Solutions part no.: HZZ01222

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

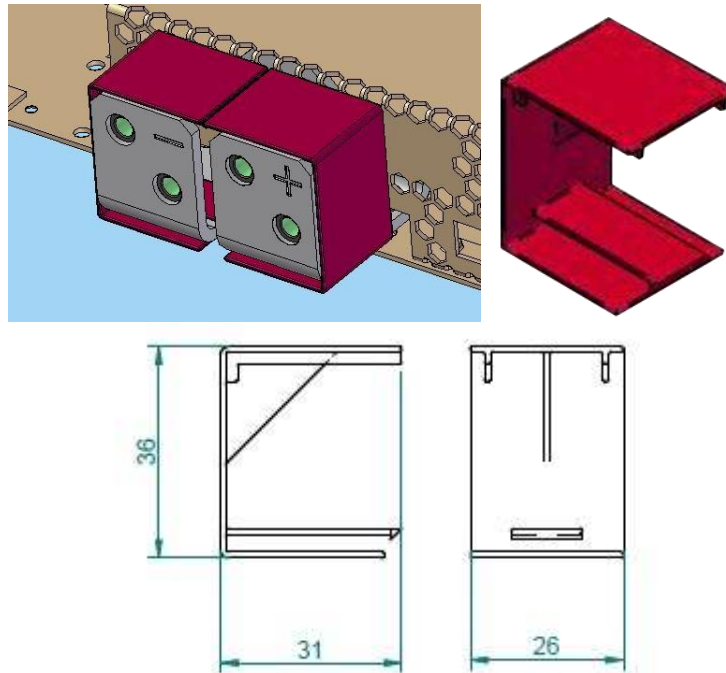
Filler for covering of the empty shelf slots



Filler can be ordered: Bel Power Solutions part no.: XAK.00043.0

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Plastic cover set for the bus bars:



Plastic cover set can be ordered: Bel Power Solutions part no.: XEB.00031.0

Note1: Available upon special request.

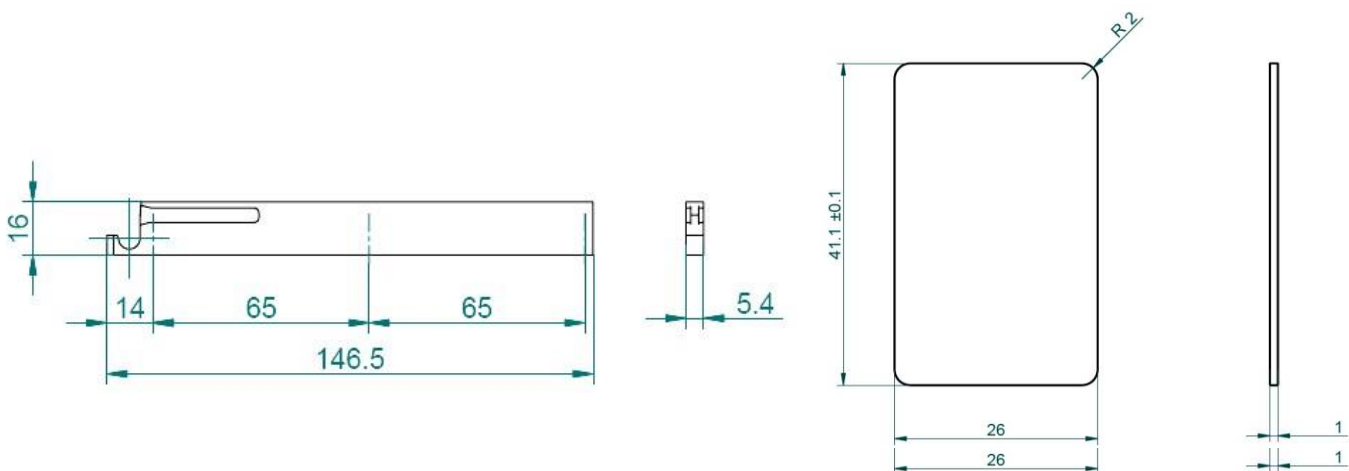
Note2: Each plastic cover set contains 2pcs.

Fulcrum

The handle has been designed to allow easy plug-in and -out in a rack system. The handle (lever) fits into a counter piece (fulcrum) which is fixed to the bottom of the rack. During the plug, the fulcrum holds the unit down and guides it towards the output connector. The Bel Power Solutions part number of the fulcrum and its associated mounting accessories is: HZZ01223.

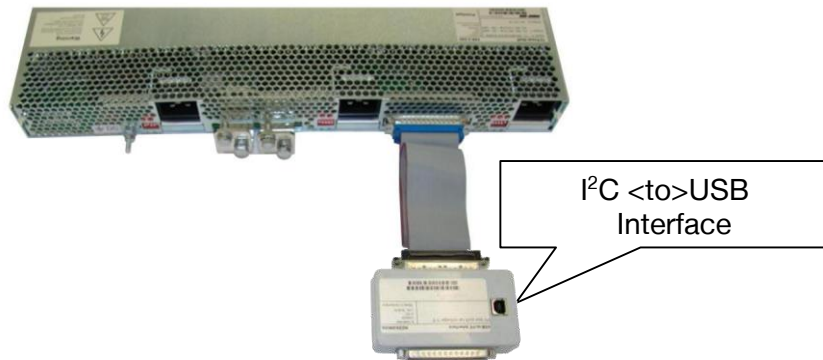
Individual fulcrum sets can be also ordered: Bel Power Solutions part no.: HZZ01223.

Note: Each HZZ01223 set contain 2 fulcrums, 2 supports, and mounting accessories.



FXP1500-32G

I²C to USB Interface HZZ02002G



I²C Management Software: All FNP and FXP front-ends can be controlled via Bel Power Solutions GUI-driven I²C Management software and an I²C-to-USB interface (P/N HZZ02002G). An I²C Programming Manual describes the complete range of parameters that can be programmed to the FXP1500/1800 front-ends. This manual is available by searching on "FXP1500" at www.belpowersolutions.com.

For more information on these products consult: tech.support@psbel.com

NUCLEAR AND MEDICAL APPLICATIONS - Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.

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