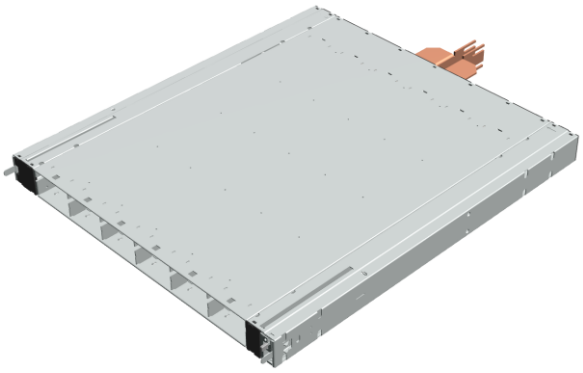
SPSTET4-01

Power Shelf

SPSTET4-01 power-shelf solutions provide rectification, system management, and power distribution, while maintaining high reliability and offering flexibility for future expansion.

The power shelf can be configured with up to six hot-swap capable TET4000-48-069RA AC/DC-DC power supplies that convert 3-phase AC mains power into a main output of 54.5 VDC for powering IT racks, OCP racks and Data centers.

The shelf has an optional slot for Network Attached Controller for providing control functions and monitoring through a 10/100 MB base Ethernet port and can be connected directly to the data center management network.



RoHS Compliant

Key Features & Benefits

- Two 3-Phase inputs, one AC inlet powers 3 power modules.
- Modules are hot-swap capable
- Modules support CAN communication interface for control, programming and monitoring with CAN communication protocol
- Modules implement the following protections: Overtemperature, output overvoltage and output overcurrent
- RoHS Compliant

Applications

- IT racks
- OCP racks
- Data centers

1. ORDERING INFORMATION

MODEL	INPUT AND OUTPUT CONFIGURATION
SPSTET4-01	3-phase, 200-277 / 346-480 VAC Line to Line input with Neutral line Single output blade for +54.5 V output.
SPSTET4-01C	3-phase, 200-277 / 346-480 VAC Line to Line input with Neutral line Single output blade for +54.5 V output. Network Attached Controller included

2. TECHNICAL DATA

PARAMETER	DESCRIPTION / CONDITION
Input	3-phase, 200-277 / 346-480 VAC Line to Line input with Neutral [1]
AC Inlet Configuration	3 power modules are powered from one AC inlet
Redundant Configuration	5+1 configuration
Rated Power	19260 W [2]
Output Connection	1 set of output blade for +54.5 VDC output
Standby Output	60 W (Standby output 12 V / 5 A)
Communication	CAN Interface / Ethernet – SNMPv3/ HTTPs / USB 2.0
NAC1016-0x	Network Attached Controller: Ethernet – SNMPv3 / HTTP

3. SAFETY WARNING

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies Bel Power Solutions Inc. from all claims arising from the handling or use of the goods. Persons handling the product(s) must have electronics training and observe good engineering practice standards.

CAUTION: Multiple power source. Disconnect all power cords before servicing.

4. REFERENCE DOCUMENTS

DOCUMENT NUMBER	DESCRIPTION
BCD.00883	TET4000-48-069RA Datasheet
BCA.00231.0	TET4000-48-069RA CAN Communication Manual
BCA.00253.0	Network Attached Controller Documentation
BCA.00254.0	SPSTET4-0x CAN Communication Manual
BCA.00255.0	SPSTET4-0x HID Communication Manual
BCM.00TBD	Installation Instruction SPSTET4-01

[1] Power modules are connected Line to Neutral.
[2] Rated Power is reduced as per current share accuracy characteristic. See TET4000-48-069RA Datasheet.

5. OVERVIEW

The SPSTET4-01 Power Shelf is a 1OU height power shelf. It can be configured with up to six hot-swap capable TET4000-48-069RA AC/DC-DC power supplies that convert standard AC mains power into a main output of 54.5 VDC for powering IT racks, OCP racks and Data centers.

The CAN communication is routed through the CAN BUS inside the shelf. PSU Modules support CAN communication interface for control, programming and monitoring with the CAN communication protocol.

The shelf has a slot for network attached controller (NAC) for providing control functions and monitoring through a 10/100 MB base Ethernet port and can be connected directly to the data center management network. It is hot-pluggable and supplied via the 12 V standby provided by the power supplies in the shelf. The controller can be configured through a web interface; the monitoring and control functions are accessed through SNMPv3.

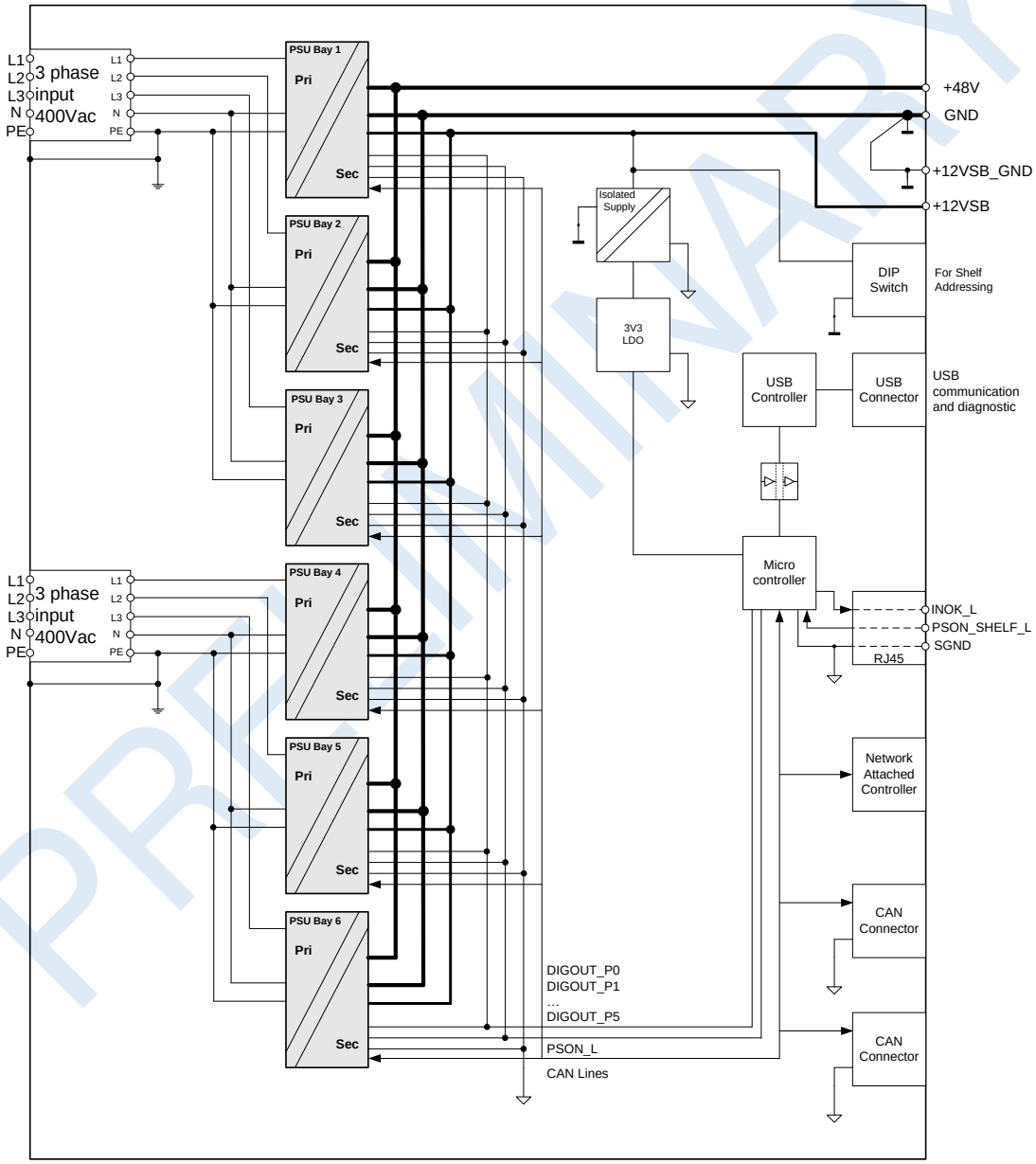


Figure 1. SPSTET4-01 Block Diagram

6. INPUT SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
Input Connector (J106, J107)					
AC Nominal Input Voltage	Line to Line input		400 / 480		VAC
AC Input Voltage Ranges	Line to Neutral input	180		300	VAC
Max Input Current	per line			23	Arms
Input Frequency		47	50 / 60	63	Hz

7. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
Main Output V1 (Output Bus Bar)					
Nominal Output Voltage			54.5		VDC
Voltage Regulation	Programmable PSU module	-12		+6.5	% Vout nom
Nominal Output Power	5+1 configuration, $T_a < 45°C$			19200	W
Derated Output Power	5+1 configuration, $T_a = 55\ °C$			14400	W
Nominal Output Current	5+1 configuration, $T_a < 45°C$			352	ADC
Derated Output Current	5+1 configuration, $T_a = 55\ °C$			264	ADC
Standby Output VSB (J23)					
Output Voltage			12		VDC
Voltage Regulation		-5		+5	% Vout nom
Output Power				60	W
Output Current				5	ADC

7.1 PROTECTION (PER MODULE)

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
Input Fuses (L+N)	Not user accessible, fast-acting (F)		30		A
OV Threshold V_1	Hardware protection	64	67	70	VDC
OV Latch Off Time V_1				1	ms
Nominal Power Limitation	Vin > 180Vac, Ta ≤ 45°C, V_1 ≥ 48 VDC	4000	4100		W
Nominal Current Limitation	Vin > 180Vac, Ta ≤ 45°C, V_1 ≥ 48 VDC	73	76		A
Power Limit Blanking Time	Time until power limit is reduced to nominal value		5		ms
Power limit during oversubscription V_1	Maximum duration 5 ms	4400	4500		W
Current limit during Oversubscription V_1	Maximum duration 5ms	83	86		A
Max Short Circuit Current V_1	V_1 < 10 VDC			83 [3]	A
Short Circuit Latch Off Time	Time to latch off when in short circuit or output under voltage (V_1 < 42 VDC)		20		ms
UV Threshold V_1	Output under voltage protection	42.5	43	43.5	VDC
V_1 Output under voltage protection delay time	$V_1 < V_{1\ UV}$		20		ms
Over Temperature on Critical Points	Inlet Ambient Temperature PFC Primary Heatsink Temperature Secondary Sync Mosfet Temperature Secondary OR-ing Mosfet Temperature			TBD	°C
UV Threshold V_{SB}	Output under voltage protection standby	11	11.2	11.3	VDC
Current Limitation V_{SB}	Standby over current limit		5.5		A

[3] Limit doesn't include effects of main output capacitive discharge

7.2 LOGIC SIGNALS

PSON_SHELF_L signal is an internally pulled-up input signal (3.3 V) to enable / disable the main output V1 of the Shelf. This active-low pin is also used to clear any latched fault condition, this is similar to the PSON_L on the PSU level. The internal INOK_L_Px signal of each individual module is fed to the backplane microcontroller for modules synchronized AC startup. This allows the shelf to start up with load > 4000 W during AC application. The microcontroller provides an INOK_L output signal. INOK_L is low when there is at least one module supplied with correct input voltage.
A pull up resistor of 10kΩ to 3.3 V within the shelf provides the high level voltage for the INOK_L signal.

RJ45 PIN OUTS (J15)	FUNCTION	DESCRIPTION
1	NC	NC
2	NC	NC
3	NC	NC
4	NC	NC
5	INOK_L	INOK signal: active-low
6	NC	NC
7	PSON_SHELF_L	Power shelf on input: active-low
8	SGND	Signal ground

Table 1. Signal Connector (RJ45) Pin Out

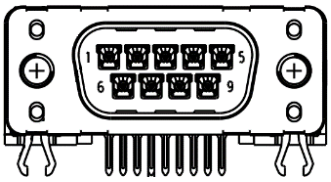
7.3 CAN COMMUNICATION

The PSU Modules are individually set to six fixed different address. CAN communication for the PSU Modules are described in more detail in document BCA.00231. The CAN communication to the PSU Modules are routed through CAN BUS. The PSON function of the shelf can also be controlled by a command similar to PMBus® command sent to the backplane Controller, see document BCA.00254.0 for further information and the table below.

There are 2 CAN connectors for daisy chain operations.

The current share between different shelves is achieved by daisy chain connection of the CAN connectors.

Dsub 9 PIN OUTS (J13, J14)	FUNCTION	DESCRIPTION
1	NC	NC
2	CAN_L	Dominant Low
3	CAN_GROUND	Ground
4	NC	NC
5	CAN_SHIELD	Shield, Optional
6	CAN_GROUND	Ground, Optional
7	CAN_H	Dominant High
8	NC	NC
9	NC	NC



Front View

7.4 PSU / SHELF ADDRESSING

The PSU address inside shelf are configurable via DIP Switch (S1);

The Default Shelf Controller Node address is 0x0F.

POSITION 1	POSITION 2	POSITION 3	PSU Address PSU1, PSU2...PSU6		
			PSU1	PSU2	PSU6
ON	ON	ON	0x01	0x02	0x06
OFF	ON	ON	0x11	0x12	0x16
ON	OFF	ON	0x21	0x22	0x26
OFF	OFF	ON	0x31	0x32	0x36
ON	ON	OFF	0x41	0x42	0x46
OFF	ON	OFF	0x51	0x52	0x56
ON	OFF	OFF	0x61	0x62	0x66
OFF	OFF	OFF	0x71	0x72	0x76

NOTE: SPSTET4-0x CAN Communication Manual, see document BCA.00254.0

Table 2. DIP Switch Setting (S1)

7.5 NETWORK ATTACHED CONTROLLER (optional)

The Network Attached Controller is a shelf level controller providing monitoring and control functions through a 10/100 MB base Ethernet port and can be connected directly to the data center management network. It is hot-pluggable and supplied via the 12 V redundant standby provided by the power supplies in the shelf. The controller can be configured through a web interface; the monitoring and control functions are accessed through SNMP.

See BCA.00253.0 for Network Attached Controller Documentation.

7.6 CONTROL LEDs

Each PSU front-end module has 2 LEDs to indicate status condition. LED number one is green and indicates AC power is on or off, while LED number two is bi-colored: green and yellow and indicates DC power presence or fault situations.

OPERATING CONDITION	LED SIGNALING
AC LED	
AC Line within range	Solid Green
AC Line UV condition	Off
DC LED[4]	
V_1 or V_{SB} out of regulation Over temperature shutdown Output over voltage shutdown (V_1 or V_{SB}) Output under voltage shutdown (V_1 or V_{SB}) Output over current shutdown (V_1 or V_{SB})	Solid Yellow
Invalid Node Id	Blinking Yellow
Power Supply Turned Off	Blinking Green
Normal Operation	Solid Green
PSU back-supplied	Blinking Yellow
Otherwise	All LEDs off

[4] The order of the criteria in the table corresponds to the testing precedence in the controller. LEDs are only available if sufficient input voltage is applied for operation of the internal supply circuits.

7.7 USB CONNECTOR TYPE B (J16)

This is used for Bel Power Diagnostic thru Bel Power Solutions I²C Utility GUI. This connection also provides access to Firmware boot loading of the PSU Modules.

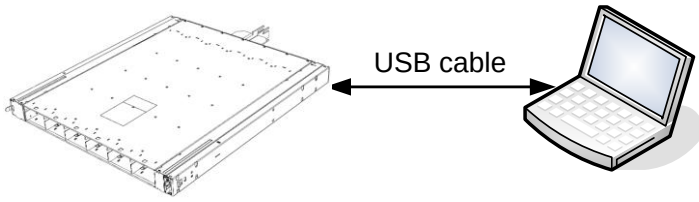


Figure 2. Connection

7.8 +12VSB CONNECTOR (J23)

+12VSB output is capable of delivering 5 A.

PIN OUTS (J23)	FUNCTION	DESCRIPTION
1, 3	VSB_GND	+12VSB return
2, 4	VSB	+12VSB output

Front View (J23)

8. SAFETY, REGULATORY AND EMC SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITION	CRITERION
Agency Approvals Pending	Approved to the latest revisions/amendments of the following standards: UL 62368-1 2nd edition CAN/CSA-C22.2 No. 62368-1 2nd edition IEC 62368-1 2nd edition EN 62368-1 2nd edition	Approved by independent body (see CE Declaration)
Insulation	Input (L/N) to case (PE) Input (L/N) to output Output to case (PE)	Basic Reinforced Functional
Creepage / Clearance (*d*c)	Primary (L/N) to protective earth (PE) Primary to secondary	
Electrical Strength Test	Input to case Input to output (tested by manufacturer only)	Min. 2121 VDC Min. 4242 VDC
Max. Leakage Current	AC input voltage of TBD VAC, Line to Neutral, AC line frequency of 50 Hz and ambient temperature of 25 °C.	TBD mA
Conducted Emission	EN55022 / CISPR 22: 0.15 … 30 MHz, QP and AVG	Class A
Radiated Emission	EN55022 / CISPR 22: 30 MHz … 1 GHz, QP	Class A
Harmonic Emissions (per module)	IEC61000-3-2, Vin = 230 VAC, 50 Hz, 100% Load (per module)	Class A
Acoustical Noise	Sound power statistical declaration (ISO 9296, ISO 7779, IS9295) @ 50% load	TBD dBA
AC Flicker	IEC / EN 61000-3-3, d_{max} < 3.3%	PASS
ESD Contact Discharge	IEC / EN 61000-4-2, ±8 kV, 25+25 discharges per test point (metallic case, LEDs, connector body)	A
ESD Air Discharge	IEC / EN 61000-4-2, ±15 kV, 25+25 discharges per test point (non-metallic user accessible surfaces)	A
Radiated Electromagnetic Field	IEC / EN 61000-4-3, 10 V/m, 1 kHz/80% Amplitude Modulation, 1 µs Pulse Modulation, 10 kHz…2 GHz	A
Burst	IEC / EN 61000-4-4, level 3 AC port ±2 kV, 1 minute DC port ±1 kV, 1 minute	A

Surge	IEC / EN 61000-4-5 Line to earth: level 3, ±2 kV Line to line: level 2, ±1 kV	A
RF Conducted Immunity	IEC/EN 61000-4-6, Level 3, 10 Vrms, CW, 0.1 … 80 MHz	A
Voltage Dips and Interruptions (per module)	IEC/EN 61000-4-11 (per module) 1: Vi 230 VAC, 100% Load, Dip 100%, Duration 12 ms 2: Vi 230 VAC, 100% Load, Dip 100%, Duration < 150 ms 3. Vi 230 VAC, 100% Load, Dip 100%, Duration > 150 ms	A V1: B, VSB: A B

9. ENVIRONMENTAL SPECIFICATIONS

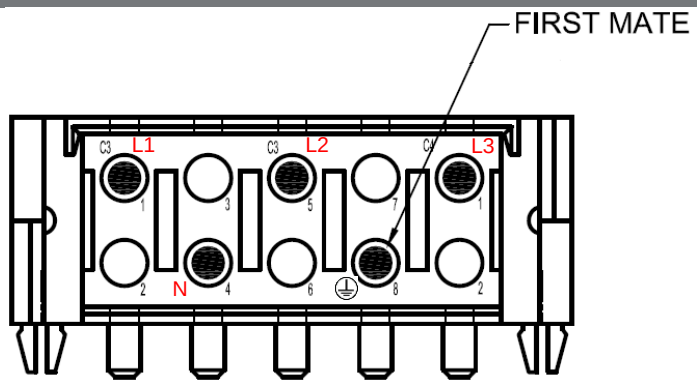
PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
Operating Temperature	@ full load, up to 4000 m: @ full load, up to 1800 m: @ 75% load, up to 1800 m:	0 0 0		+35 +45 +55	°C
Non-Operating Temperature		-40		+70	°C
Humidity	Operating: @ at 40 °C, non-condensing Non-Operating: non-condensing	7 5		93 95	%RH
Altitude	Operating: Non-Operating:			4000 13000	m
Shock	Operating: 11 ms half-sine shocks in Z axis 10+ve, 10-ve Non-Operating: 11 ms half-sine shocks in Z axis 10+ve, 10-ve		5 30		g
Vibration	Operating: 0.2 g_{rms} random Non-Operating: 1 g_{rms} random	5 2		500 200	Hz
Acoustic Noise Emissions	@ normal operation, and 50% load sharing Fan speed			TBD TBD	dBA rpm
Cooling	When equipped with operating PSUs			50	Pa

10. MECHANICAL SPECIFICATIONS

PARAMETER	SPSTET4-01
Dimensions (W x H x D)	534.5 x 46.5 x 600 (overall: 436.5 x 47 x 710 mm)
Weight (Shelf only)	9 kg
Weight (6 PSU installed)	25 kg

10.1 CONNECTORS

DESCRIPTION	REFERENCE DESIGNATOR	TYPE	MANUFACTURER	MPN
Input Connector	J106, J107	3-phase input	Positronic Industries	SP5YYE48M0LN9A1/AA-PA1067
USB Connector	J16	USB – B type	Tyco	292304-1
Logic Signal Connector	J15	RJ45	FCI Connectors	87180-088LF
+12VSB output connector	J23		Molex	39-30-0040
CAN Connector	J13, J14	D-SUB 9 Male	Harting	09661227802

SHELF	HIGH VOLTAGE CONNECTOR PIN ASSIGNMENT
3-Phase Input Connector (J106, J107)	 Front View
MPN	SP5YYE48M0LN9A1/AA-PA1067
Mating Part	SP5YYE1F0091/AA

10.2 SPSTET4-01 MECHANICAL DATA: (Note: finished good may look different from images.)

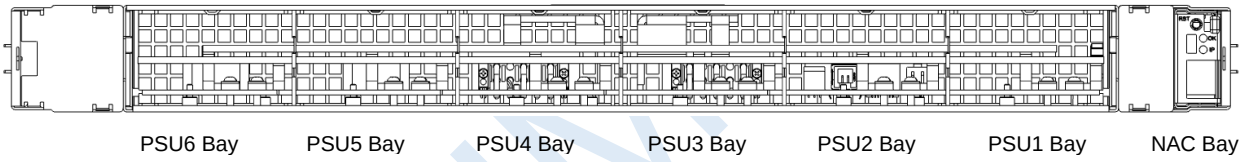


Figure 3. SPSTET4-01 Front View

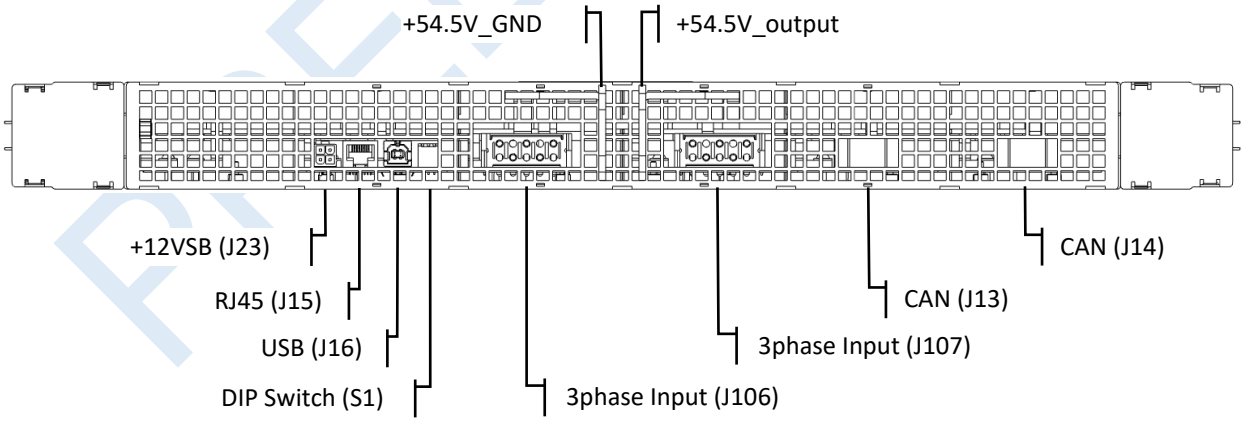


Figure 4. SPSTET4-01 Rear View

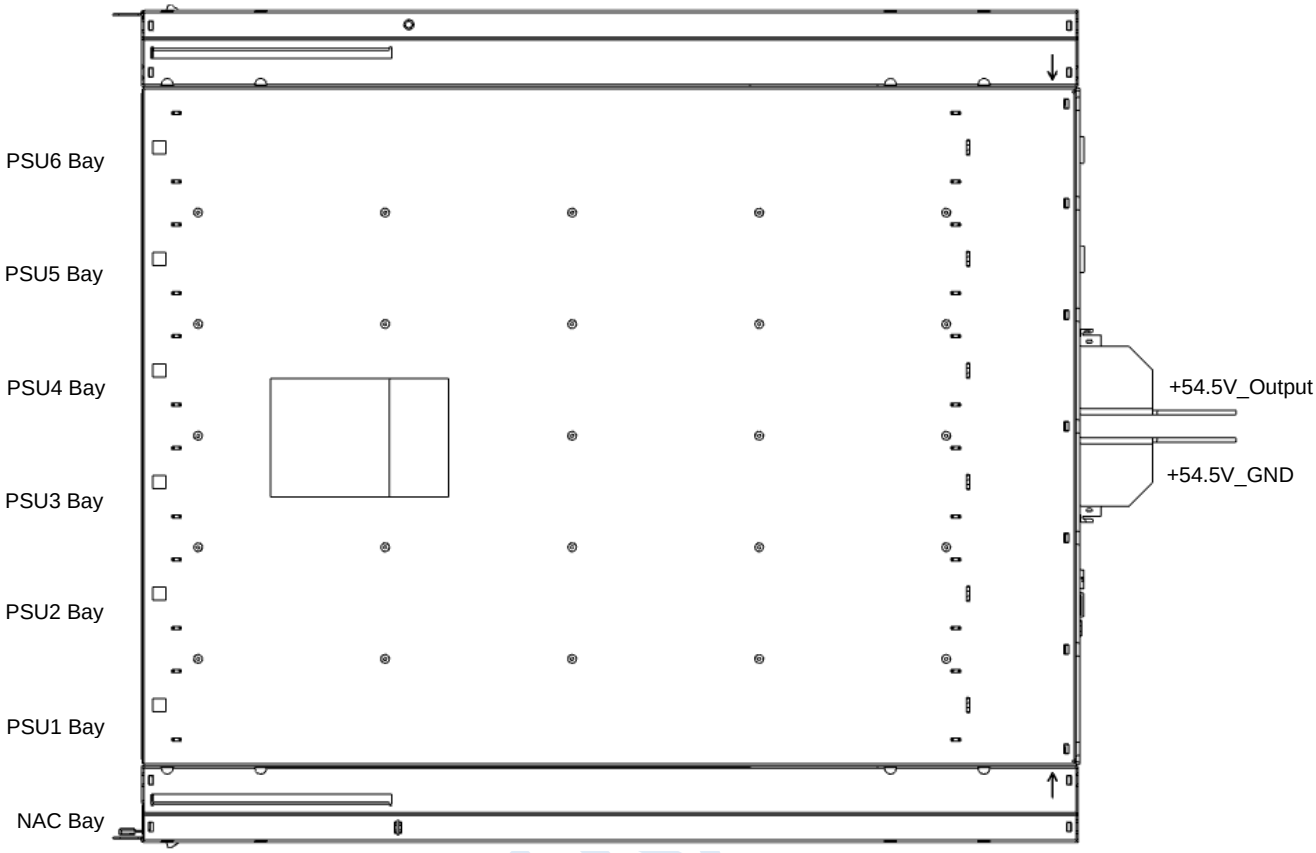


Figure 5. SPSTET4-01 Top View

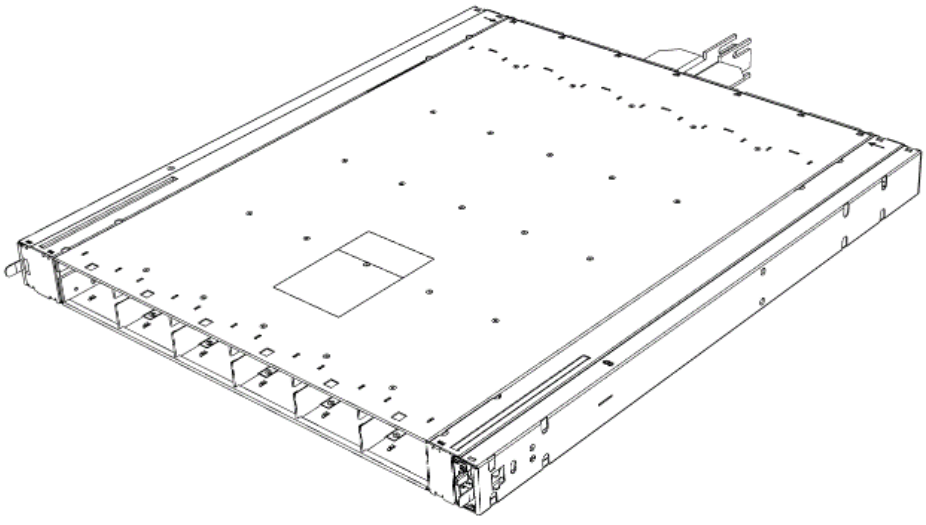


Figure 6. SPSTET4-01 Isometric View

11. ACCESSORIES

ITEM	DESCRIPTION	ORDERING PN	SOURCE
	I²C Utility Windows Vista/7/8 compatible GUI to program, control and monitor PFE Front-Ends (and other I²C units)	N/A	belfuse.com/power-solutions

12. REVISION HISTORY

REV	DESCRIPTION	PRODUCT VERSION	DATE	AUTHOR
001	PRELIMINARY: Initial Draft	V001	31.05.2018	GS

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.
TECHNICAL REVISIONS - The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

bel POWER SOLUTIONS & PROTECTION
a bel group

Asia-Pacific +86 755 298 85888
Europe, Middle East +353 61 225 977
North America +1 408 785 5200

