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Project Olympus
Power and Management Distribution Unit Specification

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Revision History

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7/9/2019			1.1	Version 1.1 Removing outdated tables and references. Not published.
12/9/2019		A	1.2	Version 1.2 Added Universal Power Cord Assembly

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1 Overview of the Project Olympus Power and Management Distribution Unit (PMDU) Specification

This document describes the Project Olympus Power and Management Distribution Unit (PMDU).

The PMDU is a sheet metal enclosure that mounts to the Project Olympus rails without the use of tools, and provides front-facing, blind-mate connectors having both power and signal contacts for each sub assembly U. As Project Olympus sub assemblies are inserted in the rack, they plug into the PMDU via the hotplug blind-mate connectors.

The PMDU shall have two Universal input bulkhead mount connectors for VAC Feed A and VAC Feed B. The Universal connector is a 7-pin connector comprised of earth ground and 3 phase pairs rated at 250VAC 50VAC per pair. The Universal connectors are both 4 wire and 5 wire facility cable assemblies at the desired voltage and amperage rating. The PMDU take both the VAC Feed A and VAC Feed B and distributes the 6 phase pairs to each sub-assembly.

The PMDU also monitors and reports the voltage, current and power for each of the 6 phase pairs. The PMDU shall be able report values to the management system. The management system shall issue a threshold value and the PMDU shall compared measured values to the assigned threshold and changing states of discrete outputs from the PMDU to the management system when thresholds are exceeded on each phase.

The PMDU shall come in two sizes, 42U and 48U. The facility to Universal fuse power cord shall come in two options: 5 Wire 415VAC 30A/32A, 4 Wire 208VAC 50A

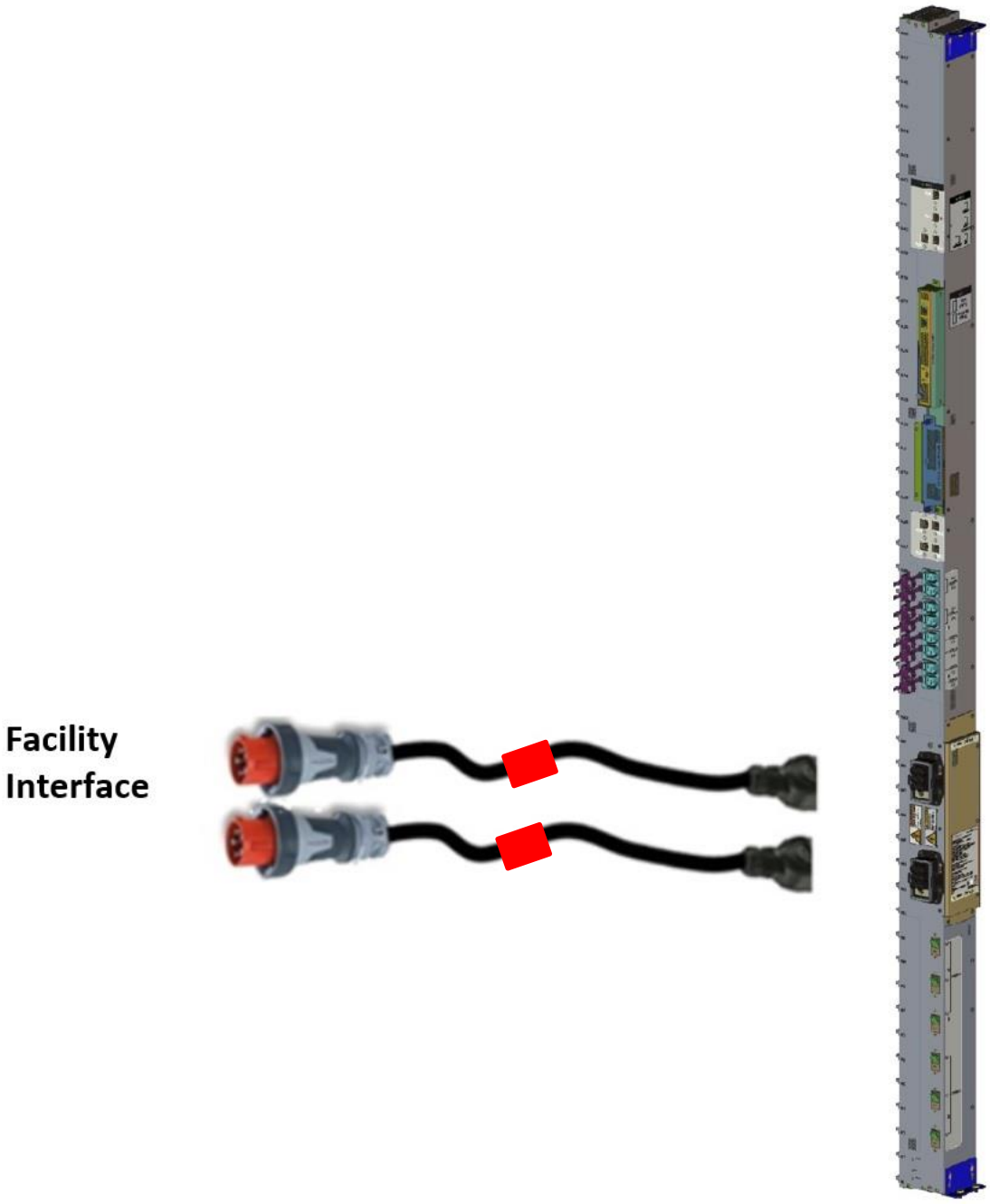


Figure 1. PMDU General Layout

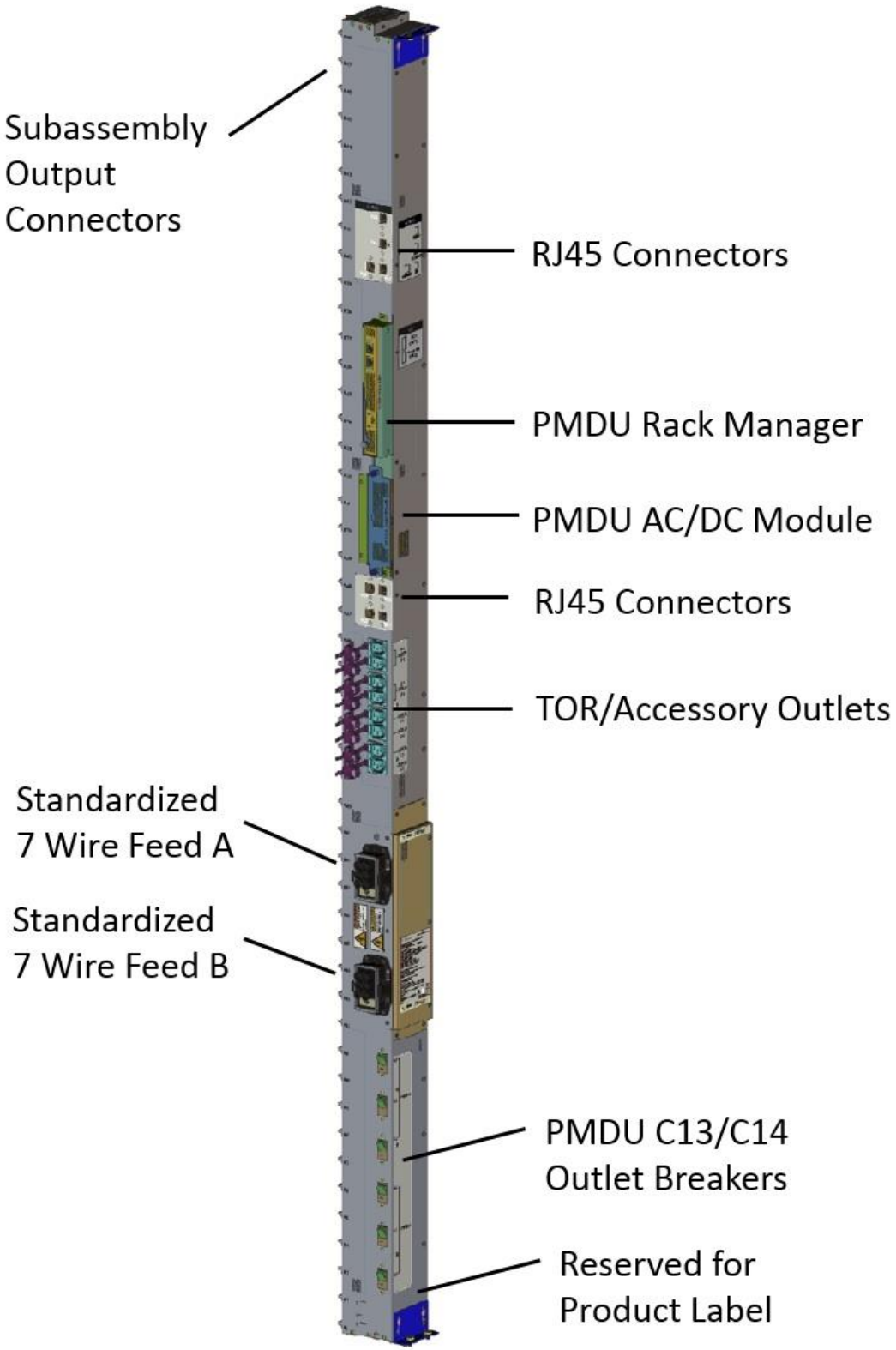


Figure 2. PMDU General Description

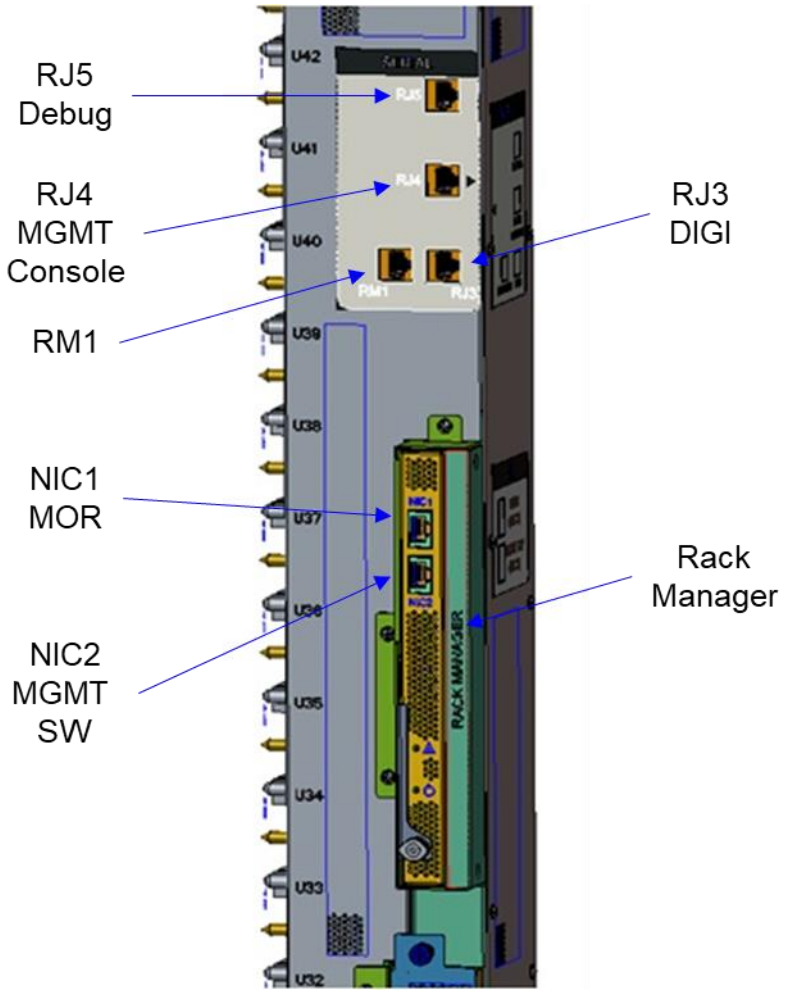


Figure 3. PMDU General Description, Rack Manager and RJ45 Network Ports

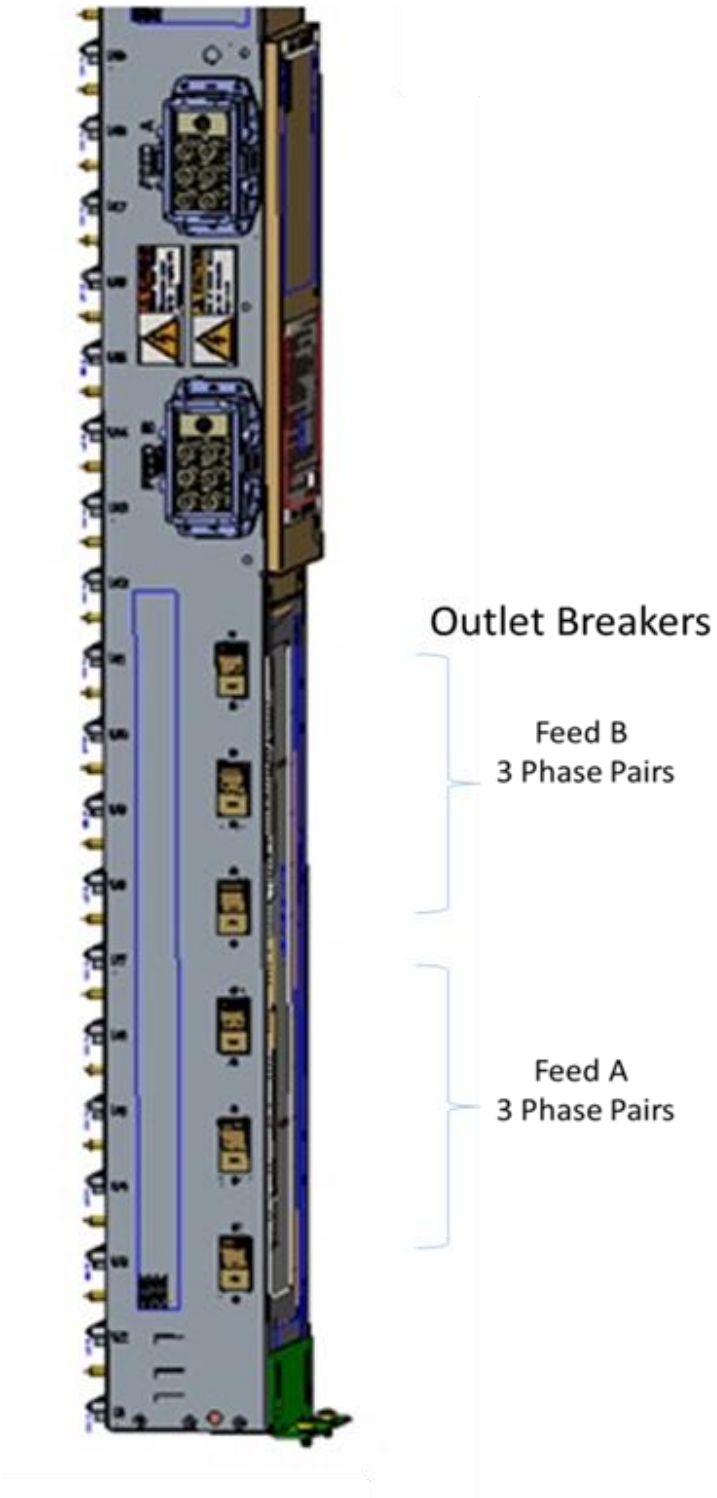


Figure 4. PMDU Outlet Breaker Identification and Location

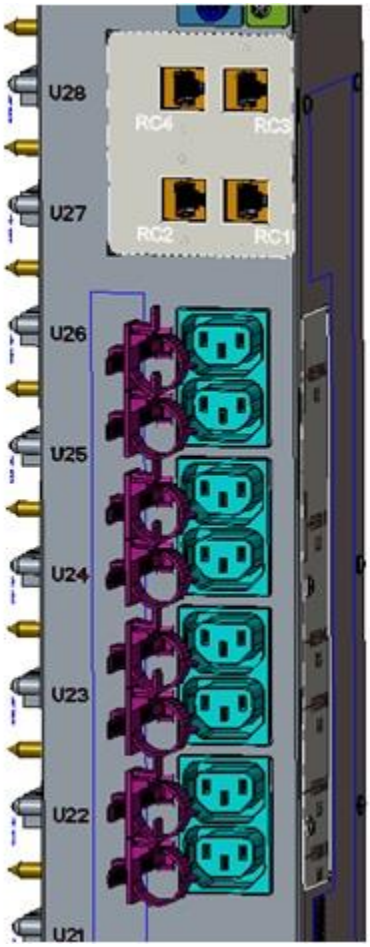


Figure 5. PMDU Outlet and RJ45 Relay Control Location

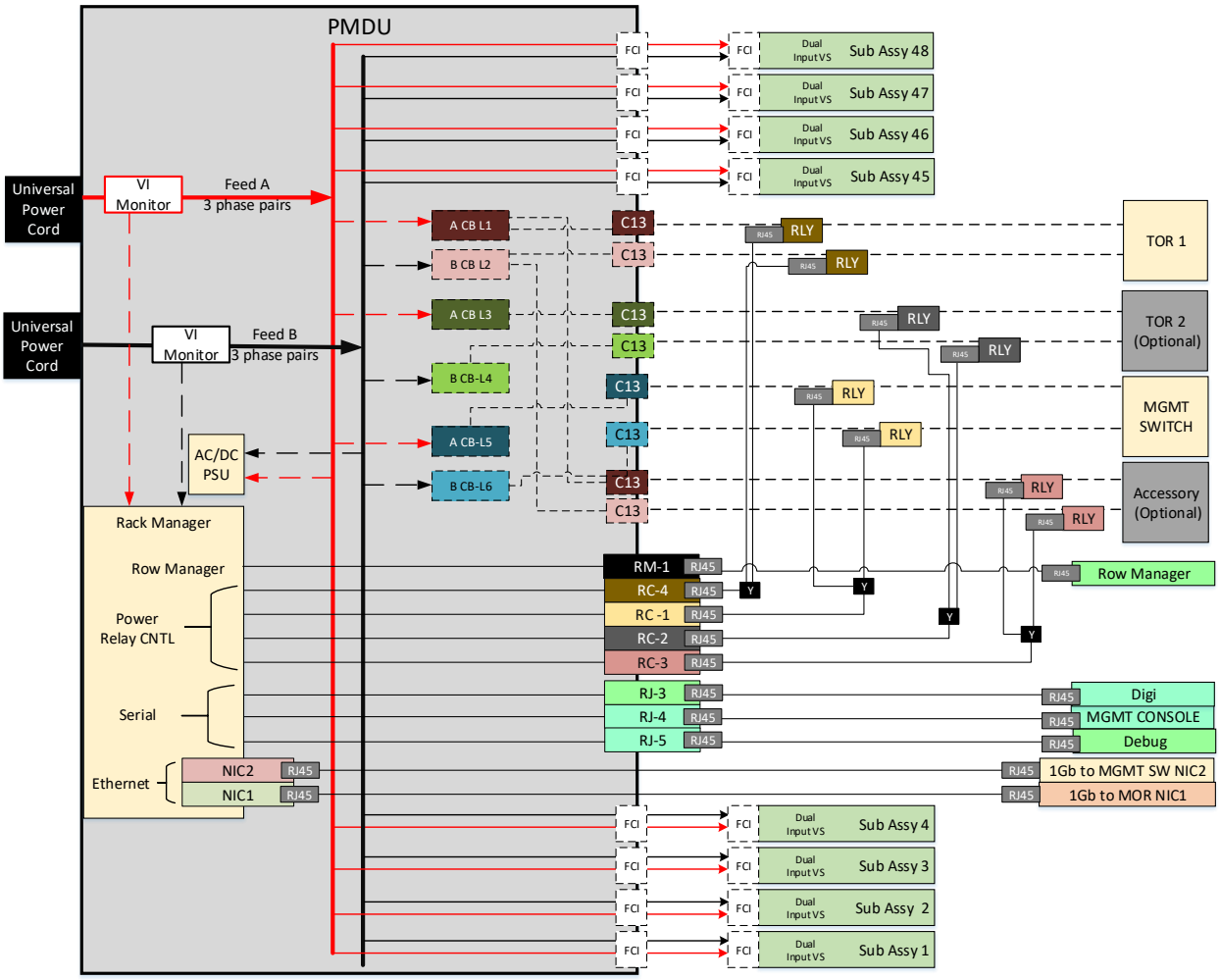


Figure 6. PMDU Power Distribution Functional Block Diagram

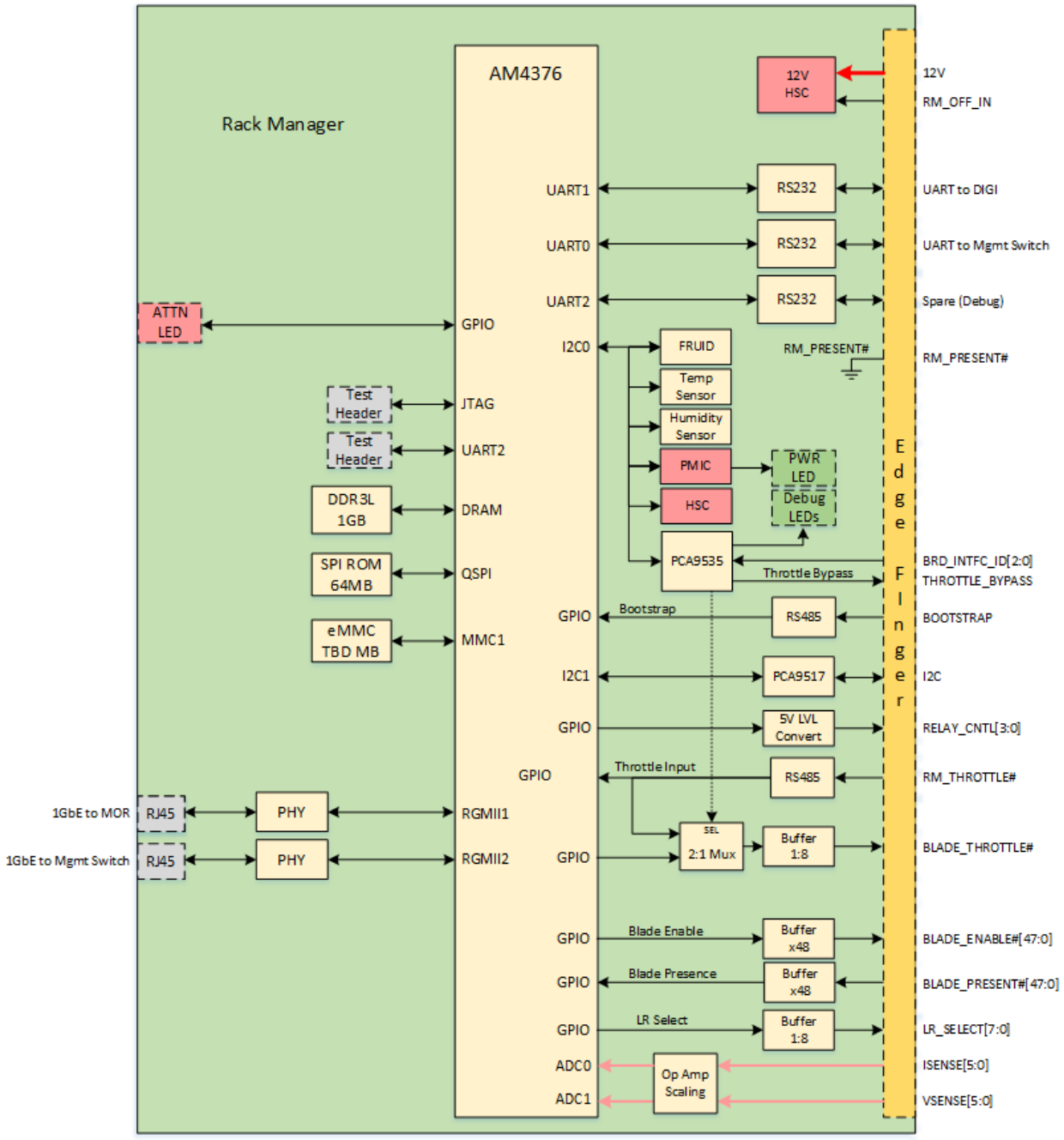


Figure 7. PMDU Rack Manager Functional Basic Block Diagram

2 PMDU Electrical

2.1 AC/DC Power Supply Module

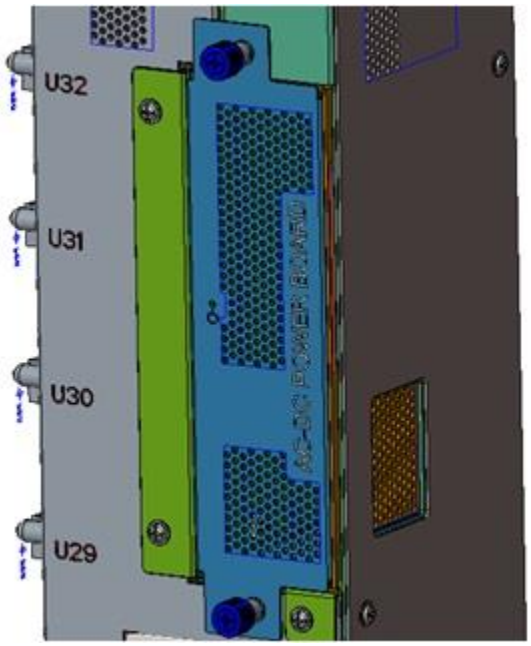
The PDMU shall have a hot swappable AC/DC module to power internal monitoring and Rack Manager. The PDMU shall be dual input from a single from VAC Feed A and B. The PSU shall not cause a secondary failure or outage as result of single fault in the unit.

The AC/DC Module shall not radiate or conduct emissions greater than applicable requirements.

2.1.1 AC/DC Module LED Indicator

This green LED is driven by internal circuitry and will illuminate GREEN whenever in an VAC input good and VDC output is good.

2.1.2 AC/DC Module Mechanical Specification



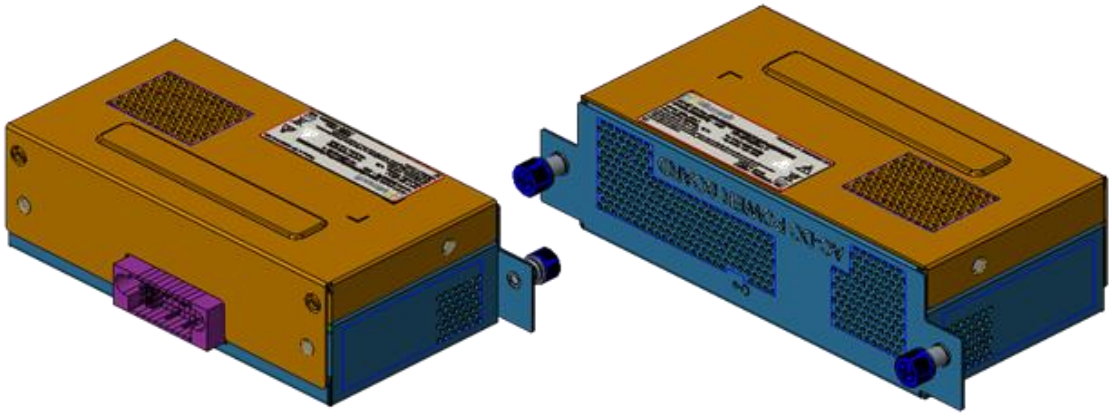


Figure 8. AC-DC Module

2.2 VAC Outlets and Overcurrent Protection

The PMDU shall provide 8 outlets with 4 outlets from feed A and feed B. The PMDU shall provide six 250VAC 10kAIC 13A breakers. Each breaker shall protect two outlets as identified in Figure 6. PMDU Power Distribution Functional Block Diagram

2.3 Power monitoring requirements.

2.3.1 PMDU

The Rack Manager in the PMDU shall be capable to report Voltage, Current, and Volt-Amps values at single and three phase units of measure at the input of the PMDU. The PMDU shall translate the threshold command to the three phases and independently calculate and report phase values as well as three phase sum.

Maximum vTHD for measurement shall be 5% or less.

Nominal vTHD for measurement shall be 1.5% or less.

2.3.2 PMDU Rack Manager Firmware Update Requirement

The PMDU Rack Manager shall be capable of receiving firmware revision updates from the management switch via Ethernet normal operation. The PMDU Rack Manager shall communicate to the management switch via RJ-4.

2.4 Universal VAC Input Plugs and Cables 4 Wire and 5 Wire Cable Assy

The PMDU is designed solely for use with the power cords described in Section 5 below.

2.4.1 Universal Cable Assembly Power and Current Rating

The PMDU uses different types of connectors for external connection to the facility.

Table 1. Power Requirements

Harting Part Number	Description	Nominal Voltage	Equipment Load Limit	
			Power	Current
73422001014	30A 5Wire 9AWG/6.63mm^2 NA	415VAC +/-10%	17.2kW	24A
	32A 5Wire 9AWG/6.63mm^2 EU	400VAC +/-10%		25A
73422001016	50A 4Wire 6AWG	208VAC +/-10%	14.4kW	40A

2.4.2 Universal Cable Assembly Breaker Protection from facility

The 30A 4 Wire L21-30 and 50A 4 Wire CS8365 cord assy shall have 30A and 50A protection respectively with UL marking and conformity to UL 489, NEMA AB1, AB3 ANSI Std. C37.16, ANSI Std. C37.17, C37.50, IEEE® Std. C37.13, UL 1066 and the National Electrical Code suitable for products certified to U.S., Canadian, European and Japanese standards.

The 32A cord shall have 32A protection with CE marking with conformity to CE RCCB, 2014/35/EU, 2014/30/EU, 2011/65/EU, EN61008-1:2012+A:2014+A11:2015, and EN 61008-2-1:1994+A11:1998

2.4.3 Universal PMDU Connector detail

The PDMU Shall provide bulkhead or panel mount connection to be mated with the Universal cable assembly described above. The cable retention clips shall reside on the 7 Wire Facility Cables not the PMDU bulkhead mount connector.

Table 2. Male Universal Connector Part Number

Connector Name/ Assy	QTY	Input Connector Part Number	Input Connector Description	Comment
7 pin male pin with plastic locking housing	2	73 42 200 0038:	Han-Eco bulkhead housing with plug modules	70A 1000V pin and safety ground pin

Standardize VAC connector, plug detail part numbers

Table 3. Male Universal Connector Part Number

73 42 200 0038: Han-Eco 10B bulkhead mounted housing, male modules, 6-16mm²

HARTING P/N	Description	QTY
19410103301	Han-Eco 10B bulkhead mounted housing, without levers	1 pc
09140022643	Han 70A axial module, male 6-16mm²	3 pcs
19410012700	Han-Eco PE module-f 16-6 AWG	1 pc

Table 4. PMDU Universal Connector Pin Assignments

Facility Cable Options		PMDU Pin Assignment		
4 Wire	5 Wire	Pin Assignment	Phase Description	
X	L1	A1	Phase A	
Y	L2	B1	Phase B	
Z	L3	C1	Phase C	
X	N	A2	Phase A	N
Y	N	B2	Phase B	N
Z	N	C2	Phase C	N
PE	PE	D1	Safety Protective Earth	



Figure 9. Functional Block Diagram of Standardized Cable plug pin number assignment orientation (note touch-proof male contacts and female ground contact)

2.5 Sub-assembly Allocated Output Power Current.

1035VA is the maximum allocated output power per sub-assembly output power connector. This assumes all six U positions are attached within a single distribution group. The maximum current per VAC pin is 2.5A in a non-faulted condition and 3.7A in single fault within a single distribution group. The net current of single distribution group shall not exceed 16A per pin in any condition.

The sub-assembly output power is limited by the rack elevation and loading under a single fault condition and device attached across the 6U single distribution group. Single distribution groups are defined at U1 through U6, U7-U12, U13-U18, U19-U24, U24-U30, U31-U36, U37-U42, and U43-U48. Within each distribution group, each VAC pin position shares a 16A per pin limitation with U positions. If all six U position pins are attached the 16A allocated evenly at 2.5A per pin.

The sub-assembly output current pins are limited to a maximum of 16A per pin if only one output connector is attached in a given distribution group.

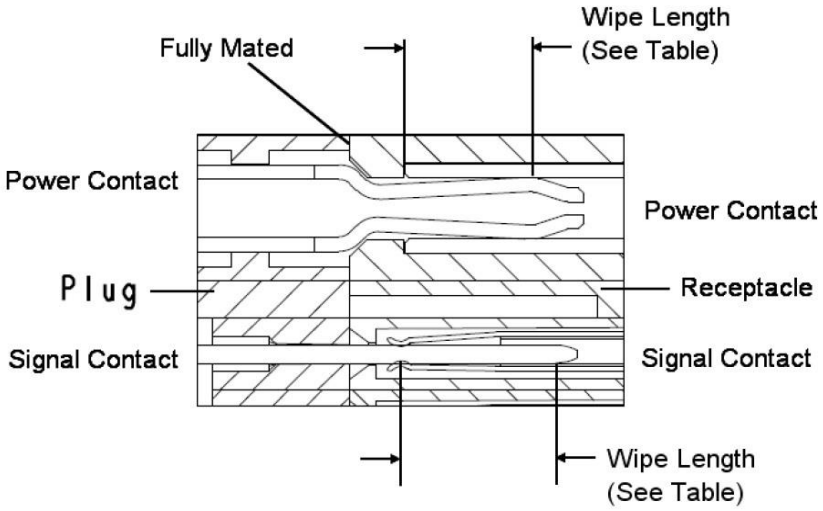
2.5.1 Sub-assembly Output Power and Signal

The sub-assembly power and signal connector shall be a FCI PwrBlade + part number 10106269-1C03001LF vertical PCB-mount receptacle. The FCI PwrBlade + series connectors have the following ratings (per EIA-364-20 unless indicated):

- High power contacts working voltage: 585Vrms, 32A
- High power contacts proof voltage: 2500Vrms
- High power contacts initial contact resistance: 10 milliohms (per IEC-364-23)

- Low power contacts working voltage: 585Vrms, 20A
- Low power contacts proof voltage: 1000Vrms
- Low power contacts initial contact resistance: 15 milliohms (per IEC-364-23)
- Signal contacts working voltage: 333Vrms
- Signal contacts proof voltage: 1000Vrms (per IEC-364-23)

The connector is configured with sequentially mating contacts, ground being the longest, power the second longest, and signal contacts the shortest. Wiping distances are as follows, with mating level 1 being safety ground, level 2 being power, and level 3 being signal. MFBL means 'make first, break last', and MLBF means 'make last, break first'. See Table 12.



CONTACT	MATING LENGTH	MATING LEVEL	WIPE LENGTH (mm)
High Power	MFBL	1	5.30
Low Power	Standard	2	3.60
Signal	MLBF	3	2.00

Table 5. Contact Wiping Distances

The connector is blind-mate and will tolerate up to 1.91mm of misalignment in the X and Y direction (viewing mating face). It is a vertical-mount PCB connector and will be mounted on vertical boards inside the PMDU.

Wiring from the Universal connectors to the sub-assembly power and signal connector shall be different.

For the 42U PMDU, U positions 1 thru 24 the sub-assembly power and signal connector shall be in accordance with the Sub Assembly A-B Pin Assignment as show below. U positions 24 thru 42 the sub-assembly power and signal connector shall be in accordance with the Sub Assembly B-A Pin Assignment as show below.

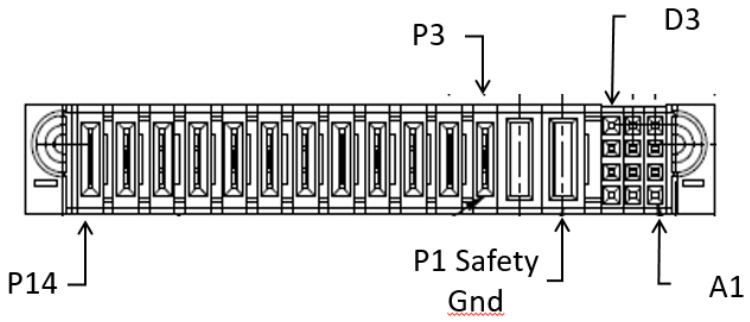


Figure 10. PMDU Subassembly Pinout Assignment Image

For the 48U PMDU, U positions 1 thru 24 the sub-assembly power and signal connector shall be in accordance with the Sub Assembly A-B Pin Assignment as show below. U positions 25 thru 42 or 48 the sub-assembly power and signal connector shall be in accordance with the Sub Assembly B-A Pin Assignment as show below.

Table 6. PMDU Sub-assembly connector pinout assignment positions C1 through C24 and C25 through 42 or 48

Universal 7 Wire Power Cable Connector to Sub Assy Definition

Universal Power Cable Connector Interface			PDMU Pin Definition	Feed A-B Sub Assy C 1-24 Interface
Feed A Universal Power Cable Connector Interface	250 VAC Pair	A1	Feed A -5 Wire and 4 Wire Phase A	P14
		B2	Feed A -5 Wire Neutral or 4 Wire Phase B	P13
	250 VAC Pair	B1	Feed A -5 Wire and 4 Wire Phase B	P10
		C2	Feed A -5 Wire Neutral or 4 Wire Phase C	P9
	250 VAC Pair	C1	Feed A -5 Wire and 4 Wire Phase C	P6
		A2	Feed A -5 Wire Neutral or 4 Wire Phase A	P5
	Safety Ground	D1	Safety Ground	P1
Feed B Universal Power Cable Connector Interface	250 VAC Pair	A1	Feed B -5 Wire and 4 Wire Phase A	P12
		B2	Feed B -5 Wire Neutral or 4 Wire Phase B	P11
	250 VAC Pair	B1	Feed B -5 Wire and 4 Wire Phase B	P8
		C2	Feed B -5 Wire Neutral or 4 Wire Phase C	P7
	250 VAC Pair	C1	Feed B -5 Wire and 4 Wire Phase C	P4
		A2	Feed B -5 Wire Neutral or 4 Wire Phase A	P3
	Safety Ground	D1	Safety Ground	P1
See the Rack manager specification for pin out destination			LR_SELECT	A1
			NODE_IDO	A2
			Analog Ground	A3
			NODE_ID1	B1
			NODE_ID2	B2

	NODE_ID3	B3
	BLADE_THROTTLE#	C1
	BLADE_ENDABLE#	C2
	BLADE_PRESENT#	C3
	PSKILL (SHORT PIN)	D1
	NODE_ID4	D2
	NODE_ID5	D3

Universal Power Cable Connector Interface			PDMU Pin Definition	Feed A-B Sub Assy C 25-C42/48 Interface
Feed A Universal Power Cable Connector Interface	250 VAC Pair	A1	Feed A -5 Wire and 4 Wire Phase A	P12
		B2	Feed A -5 Wire Neutral or 4 Wire Phase B	P11
	250 VAC Pair	B1	Feed A -5 Wire and 4 Wire Phase B	P8
		C2	Feed A -5 Wire Neutral or 4 Wire Phase C	P7
	250 VAC Pair	C1	Feed A -5 Wire and 4 Wire Phase C	P4
		A2	Feed A -5 Wire Neutral or 4 Wire Phase A	P3
	Safety Ground	D1	Safety Ground	P1
Feed B Universal Power Cable Connector Interface	250 VAC Pair	A1	Feed B -5 Wire and 4 Wire Phase A	P14
		B2	Feed B -5 Wire Neutral or 4 Wire Phase B	P13
	250 VAC Pair	B1	Feed B -5 Wire and 4 Wire Phase B	P10
		C2	Feed B -5 Wire Neutral or 4 Wire Phase C	P9
	250 VAC Pair	C1	Feed B -5 Wire and 4 Wire Phase C	P6
		A2	Feed B -5 Wire Neutral or 4 Wire Phase A	P5
	Safety Ground	D1	Safety Ground	P1
See the Rack manager specification for pin out destination			LR_SELECT	A1
			NODE_IDO	A2
			Analog Ground	A3
			NODE_ID1	B1
			NODE_ID2	B2
			NODE_ID3	B3
			BLADE_THROTTLE#	C1
			BLADE_ENDABLE#	C2
			BLADE_PRESENT#	C3
			PSKILL (SHORT PIN)	D1
			NODE_ID4	D2
			NODE_ID5	D3

2.6 Grounding and Return

The PMDU grounding shall be via power cord safety ground. The enclosure sheet metal shall not be used for signal or voltage return. Safety Ground/Safety Earth shall be attached in accordance with safety certification requirements.

2.7 RJ45 Connectors

The PMDU contains 8 RJ45 connectors for cabling to external devices with 2 additional RJ45 connectors located on the Rack Manager. Below is a summary of the RJ45 connectors and the use.

- MOR (NIC1)– Located on the Rack Manager. Supports 1GbE. Expected to connect to a Management Switch in the Middle of Row (MOR) rack.
- MGMT SW (NIC2) – Located on the Rack Manager. Supports 1GbE. Expected to connect to the Rack Manager Switch.
- RJ3 – Located on the PMDU. Supports HW flow control UART. Expected to connect to the UART DIGI in the MOR rack.
-
- RJ4 –Located on the PMDU. Supports SW flow control UART. Expected to connect to the Rack Management Switch (MGMT CONSOLE).
- RJ5 – Located on the PMDU. Supports SW flow control UART. Expected to be used as a DEBUG UART port.
- RC1 to RC4 – Located on the PMDU. Expected to connect to the AC relay cables.
- RM1 – Located on the PMDU. Expected to connect to a Stand-Alone Rack Manager Module located in the MOR rack.

2.7.1 RJ45 for UART with HW Flow Control (RJ3/DIGI)

The PMDU shall support one RJ45 connectors for interfacing with UARTs with hardware flow control. The connector pinout is shown in Table 7.

Table 7. RJ45 Pinout - UART with HW Flow Control

Pin #	Signal	I/O	Voltage	Description
1	RTS	O	RS232	Ready to Send
2	DTR	O	RS232	DSR
3	TXD	O	RS232	Transmit Data
4	GND	I	0V	GND
5	NC			No Connect
6	RXD	I	RS232	Receive Data
7	DSR	I	RS232	DTR
8	CTS	I	RS232	Clear to Send

2.7.2 RJ45 for UART without HW Flow Control (RJ4/MGMT Console, RJ5/DEBUG)

The PMDU shall support two RJ45 connectors for interfacing with UARTs without hardware flow control. The connector pinout is shown in Table 8. Hardware flow control signals are connected tied together at the connector. This enables a SW flow control port on the RM to communicate with select HW flow control end points.

Table 8. RJ45 Pinout - UART without HW Flow Control

Pin #	Signal	I/O	Voltage	Description
1	NC	I	RS232	Ready to Send. Connect to CTS (0 ohm resistor)
2	NC	I	RS232	Data Terminal Ready. Connect to DSR (0 ohm resistor)
3	RXD	I	RS232	Transmit Data
4	GND	I	0V	GND
5	NC			No Connect
6	TXD	O		No Connect
7	NC			No Connect
8	NC	O	RS232	Clear to Send. Connect to RTS (0 ohm resistor)

2.7.3 RJ45 for Rack Manager Power and Boot Control RM1

The PMDU shall support one RJ45 connectors for enabling external control of the Rack Manager power and boot state. The connector pinout is shown in Table 9.

Table 9. RJ45 Pinout – Rack Manager Power/Boot Control

Pin #	Signal	I/O	Voltage	Description
1	RM_THROTTLE+	I	RS485	Set rack to throttle mode
2	RM_THROTTLE-	I	RS485	Set rack to throttle mode
3	RM_BOOTSTRAP+	I	RS485	Sets receiving RM to boot from network
4	RM_PRESENT#	I	3.3V	Indicates Rack Manager is present
5	NC			No Connect
6	RM_BOOTSTRAP-	I	RS485	Sets receiving RM to boot from network
7	GND	I	0V	
8	RM_OFF	I	5V	Disables Rack Manager 12V HSC

2.7.4 RJ45 for AC Relay Control (RC-1, RC-2, RC-3, RC-4)

The PMDU shall support four RJ45 connectors for controlling cabled AC power to rack devices through an AC relay device. The RJ45 connectors used as a AC relay control output. The connector pinout is shown in Table 10.

Table 10. RJ45 Pinout – Rack Manager Power/Boot Control

Pin #	Signal	I/O	Voltage	Description
1	NC			No Connect
2	NC			No Connect
3	NC			No Connect
4	RELAY_CNTL	I	0V	Disables AC Power through relay
5	NC			No Connect
6	NC			No Connect
7	NC	I	0V	No Connect
8	P5V	I	5V	5V source

2.8 SLOT ID

The PMDU shall provide grounding of signal pins on the FCI connector to assign a separate slot identification code to each blade. The coding shall be as shown in Table 11.

Table 11. Slot ID

Blade	SLOT_ID[5:0]	Blade	SLOD_ID[5:0]
Blade 1	000000	Blade 25	100000
Blade 2	000001	Blade 26	100001
Blade 3	000010	Blade 27	100010
Blade 4	000011	Blade 28	100011
Blade 5	000100	Blade 29	100100
Blade 6	000101	Blade 30	100101
Blade 7	001000	Blade 31	101000
Blade 8	001001	Blade 32	101001
Blade 9	001010	Blade 33	101010
Blade 10	001011	Blade 34	101011
Blade 11	001100	Blade 35	101100
Blade 12	001101	Blade 36	101101
Blade 13	010000	Blade 37	110000
Blade 14	010001	Blade 38	110001
Blade 15	010010	Blade 39	110010
Blade 16	010011	Blade 40	110011
Blade 17	010100	Blade 41	110100
Blade 18	010101	Blade 42	110101
Blade 19	011000	Blade 43	111000
Blade 20	011001	Blade 44	111001
Blade 21	011010	Blade 45	111010
Blade 22	011011	Blade 46	111011
Blade 23	011100	Blade 47	111100
Blade 24	011101	Blade 48	111101

3 PMDU Mechanical Housing

3.1 General Construction

The PMDU housing shall be constructed of 1.2mm thick steel, having the dimensions shown in the figure below. The housing shall be coated to prevent rust and corrosion.

The PMDU shall be support 42U and 48U rack assemblies.

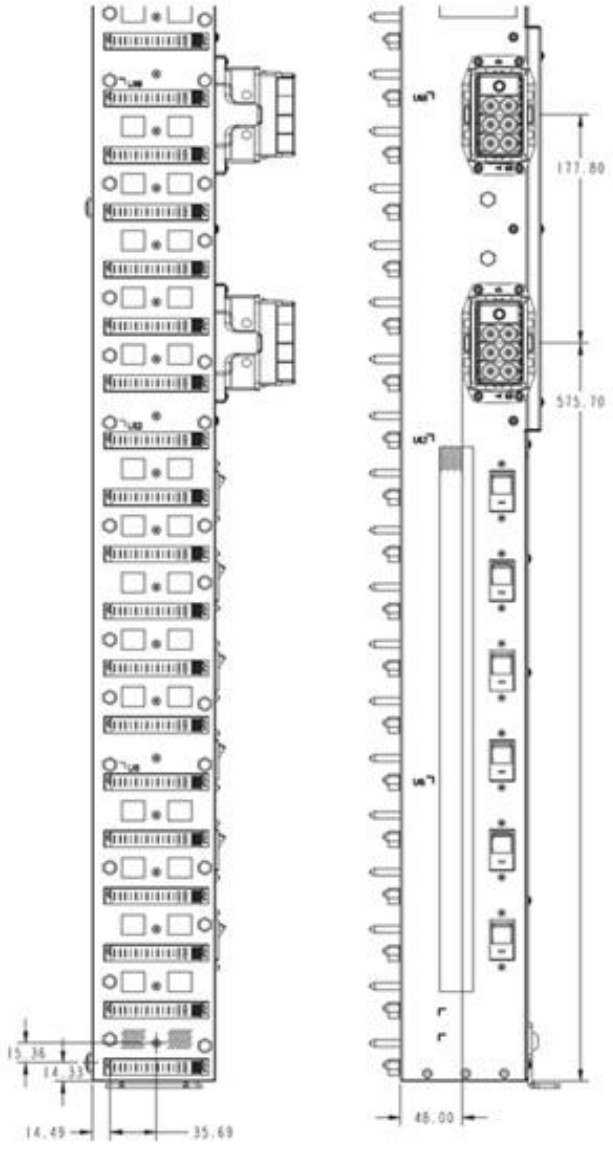
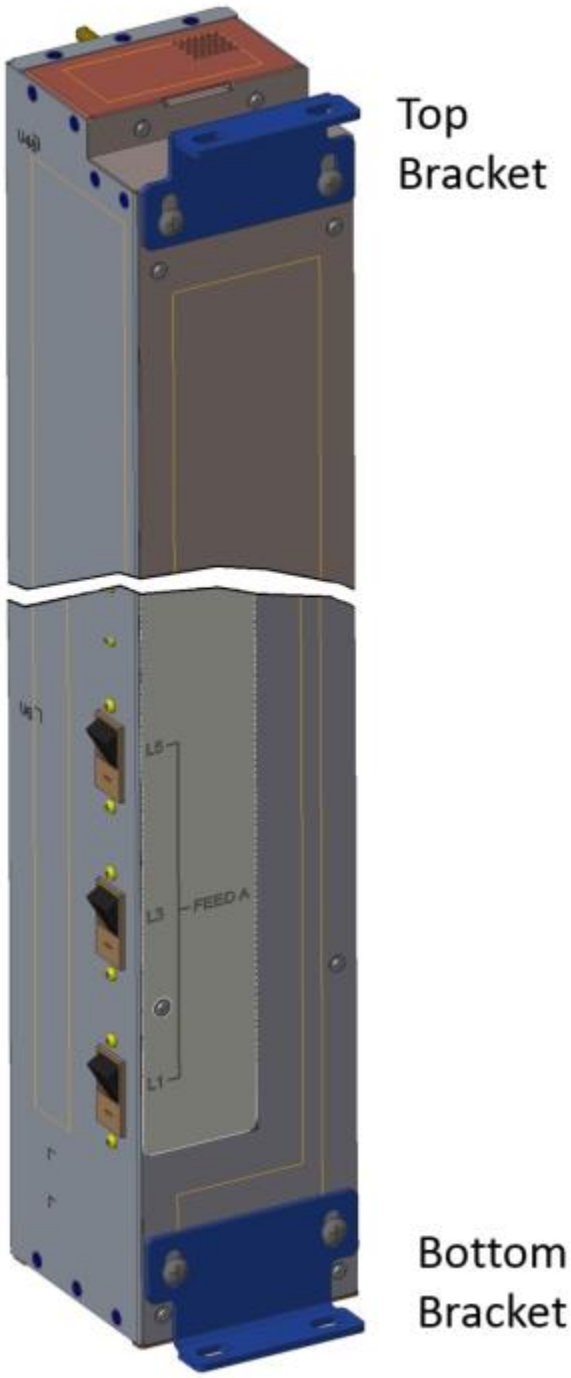


Figure 11. PMDU Housing General Dimensions

3.2 PMDU Structural Brackets

The PMDU shall include brackets at the top and bottom for to further restrict movement in the rack. Representative image is below.


Top
Bracket
L5
L3
FEED A
L1
Bottom
Bracket

3.3 PMDU Subassembly Power Connector

3.3.1 Connector and Placement

The sub-assembly power and signal connector shall be a FCI PwrBlade + part number 10106269-1C03001LF vertical PCB-mount receptacle. One connector is placed at every U (44.45mm) of the PMDU, oriented as shown in Figure 12.

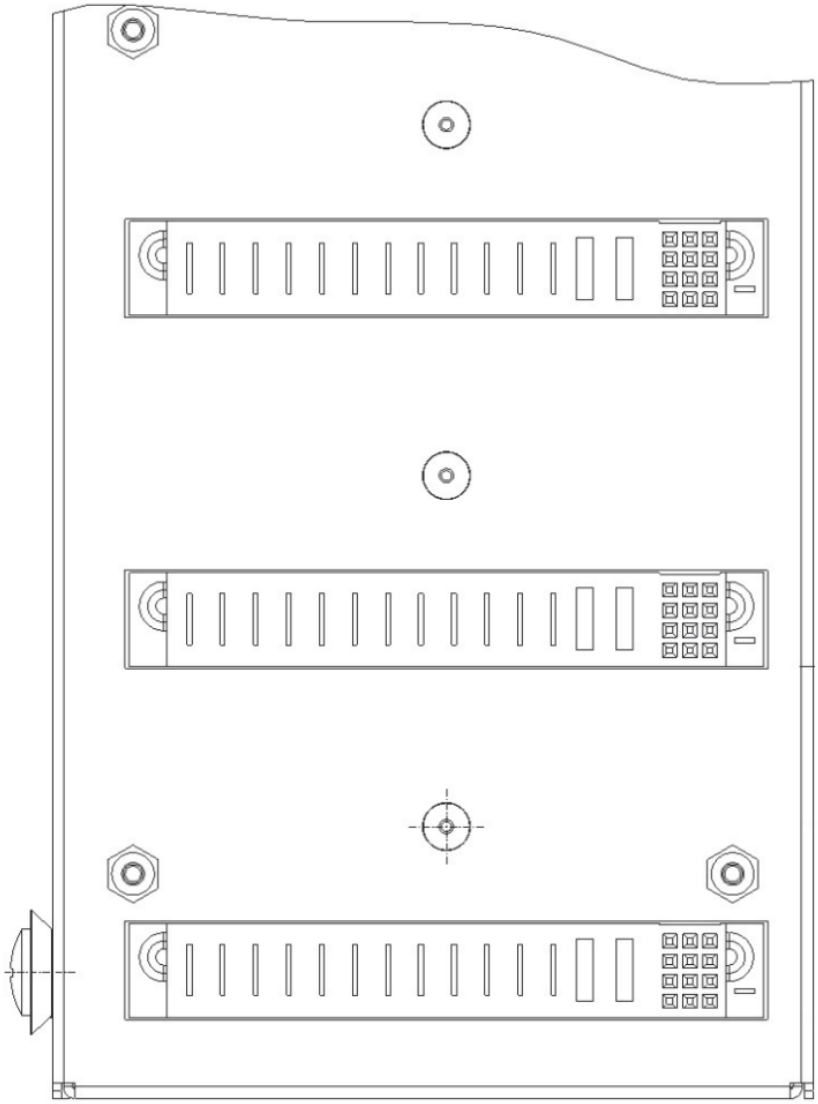


Figure 12. PMDU Housing General Location

3.4 Rail Attachment

There are threaded cone washers on the left side of the PMDU, held in place by M5 socket head screws, that allow the PMDU to mount to keyhole slots in the system rails. The inverted surfaces of the washers pull the PMDU tightly against the sides of the rails.



Figure 13. PMDU Rail Mounting: Inverted cone washers fit into keyhole slots in Project Olympus rails.

3.4.1 Subassembly Interface

The PMDU interfaces with a Project Olympus Subassembly in two ways. As a Sub assembly is inserted into the rack, a hole at the rear of the Subassembly slides onto a front-facing pin that is mounted in the PMDU sheet metal housing. As the Subassembly is further inserted, the blind mate connector on the rear of the Subassembly engages with a corresponding blind mate

connector on the PMDU. Subassembly travel is stopped by a guide pin sleeve on the rear of the subassembly.

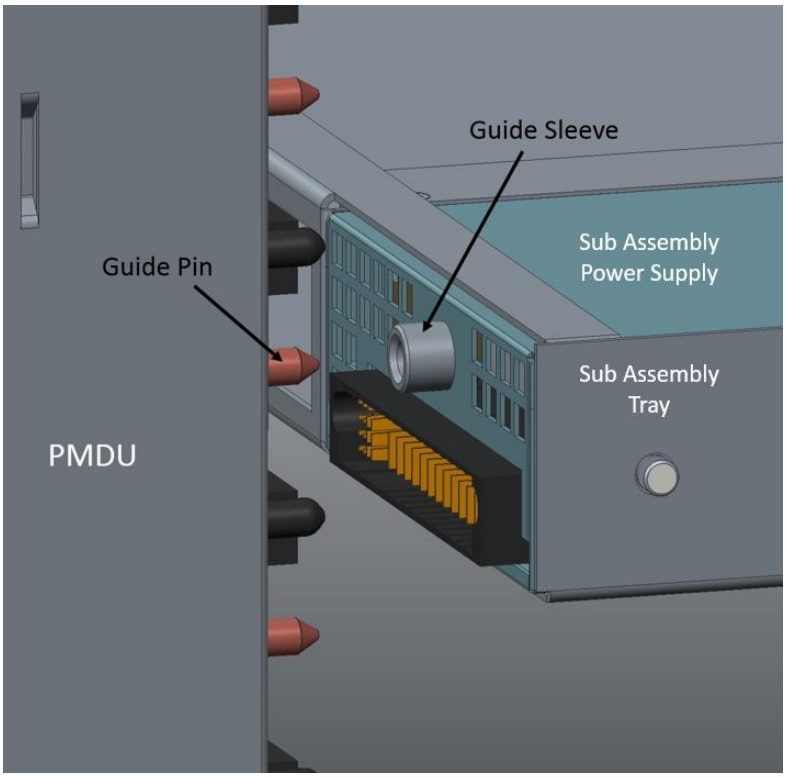


Figure 14. Guide pins interfacing with sleeves on subassemblies

3.5 Weight

The weight of the PMDU shall not exceed 35 lbs.

4 Environmental

The specifications listed in the following table must be supported for both the PMDU and the Universal Power Cords.

Table 12. Environmental Requirements

Specification		Requirement
temperature	Operating	• 50°F to 140°F (10°C to 60°C) • Maximum rate of change: 18°F (10°C)/hour • Allowable derating guideline of 1.6°F/1000ft (0.9°C/304m) above 3000 ft.
	Non-operating	• -40°F to 140°F (-40°C to 60°C) • Rate of change less than 36°F (20°C)/hour
Humidity	Operating	• Equivalent to 10% to 80% Relative Humidity (RH) non-condensing at 35C • Maximum rate of change 20% RH in an hour
	Non-operating	• 5% to 95% non-condensing • 100.4°F (38°C) maximum wet bulb temperature
Altitude	Operating	• 10000ft (3050m) maximum • Rate of change less than 1500 ft./min (457m/min)
	Non-operating	• 30000ft (9144m) maximum • Rate of change less than 1500 ft./min (457m/min)

5 Fused Universal Power Cords

The document describes this data center facility power cable assembly to be used in the Universal cable assembly rack Power Distribution Unit (PDU). The universal power cord allows any given rack to be delivered to any datacenter without modification. The datacenter's power has an appropriate input power connector with the universal output connector. This is much like a power cord for a laptop with different A/C cords customized for local standards. Each cable assembly includes an embedded fuse box to better contain any downstream component quality issues.

5.1 Universal VAC Input Plugs and Cables 4 Wire and 5 Wire Cable Assy

Below are some of the different fused power cords that have been developed for common regional power.

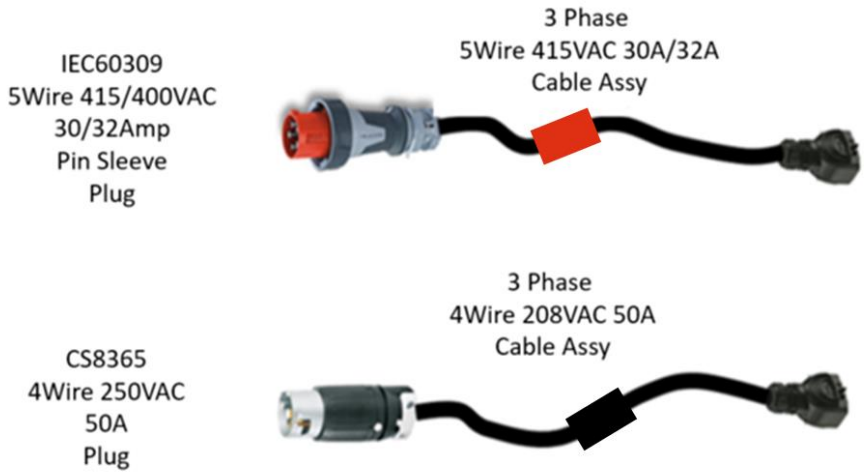


Figure 15. Universal fused cable assembly options illustration

Functional diagrams follow.

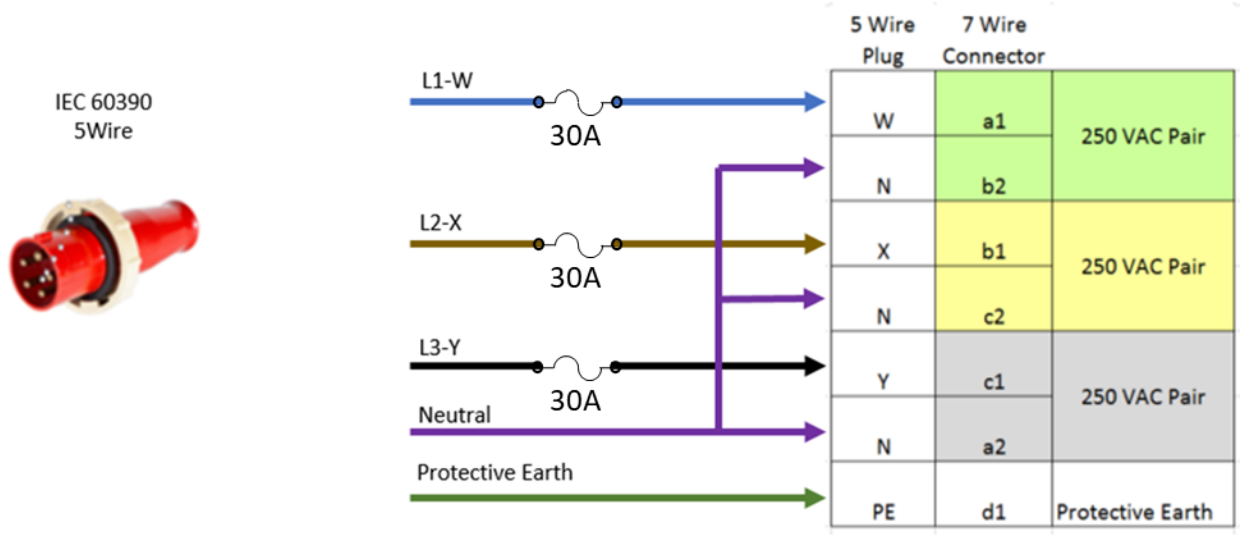


Figure 16. 5 Wire 3-Phase Universal Power Cable Assy 30A/32A

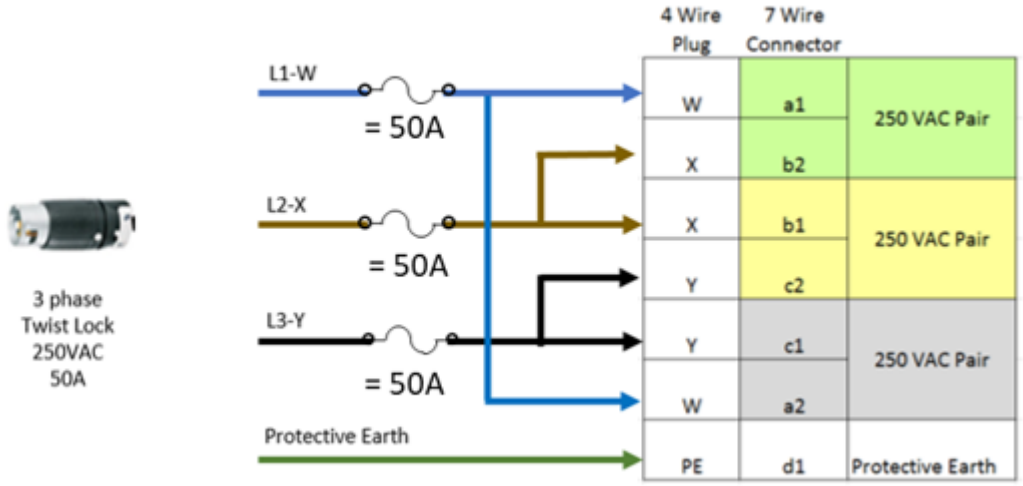


Figure 17. 4 Wire 3-Phase Universal Power Cable Assy 50A

Note: Color used in cartoons above does not reflect actual conductor insulation color. See section 4 for insulation color.

5.1 Physical Dimensions

For cables with pin and sleeve connector, Figure 18 applies as shown. For cable with twist lock connectors, overall length measurement is to be to the face of the twist lock connector.

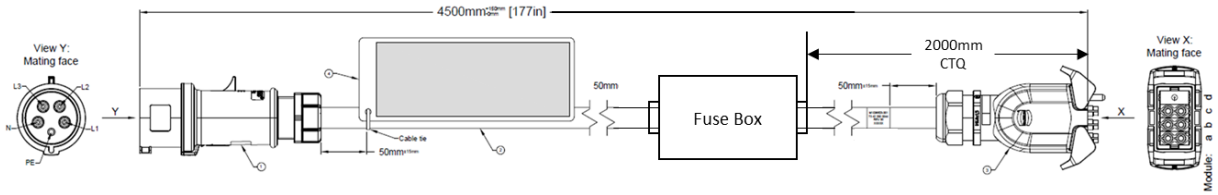


Figure 18: Physical Dimension of Fused Cable (example)

This section outlines specifics of the power cords that have been developed to date.

5.1.1 Universal Cable Cord Assembly and Power Rating

The PMDU uses different types of connectors externally.

Table 13. Power Requirements

Cable Type	Input Connector	Cable (Length of all cables is 4.5m + .1m/-0m measured from face of the Harting connector to position specified in entry below)	Output Connector Description/ Notes	Nominal Voltage	Equipment Load Limit		Country
					Power	Current	
IEC60309, 5Wire, 32A	IEC60309, 5Wire, 240/415VAC, 32A with UL/CSA, EU approvals and CCC exemption	5 x 9AWG/6mm^2 conductors, Neoprene Cordage with UL/CSA SOOW, <HAR> H07RN-F approvals and CCC exemption. Min +75°C rating. Length measured to outside end of pin and sleeve connector housing.	Connector kit, Harting P/N 73 42 200 0035	415VAC +/-10%	17.2kW	24A/25A	All countries other than Korea and India
	IEC60309, 5Wire, 240/415VAC, 32A with KCC approvals	5 x 9AWG/6mm2 conductors, Neoprene Cordage with KCC and <HAR> H07RN-F approvals. Min +75°C rating. Length measured to outside end of pin and sleeve connector housing.					Korea
	IEC60309, 5Wire, 240/415VAC, 32A with UL/CSA and EU approvals	5 x 9AWG/6mm2conductors, Neoprene Cordage with ISI and <HAR> H07RN-F approvals. Min +75°C rating. Length measured to outside end of pin and sleeve connector housing.					India
	IEC60309, 5Wire, 240/415VAC, 32A CCC approvals	5 x 9AWG/6mm^2 conductors, Neoprene Cordage with UL/CSA SOOW, <HAR> H07RN-F and CCC approvals. Min +75°C rating. Length measured to outside end of pin and sleeve connector housing.					China
CS8365, 4Wire, 50A	CS8365, 4Wire, 250VAC, 50A	4 x 6AWG conductors, Neoprene Cordage with UL/CSA SOOW approval. Min +75°C rating. Length measured to face of CS connector.	Connector kit, Harting P/N 73 42 200 0037	208VAC +/-10%	14.4kW	40A	USA, Canada

5.1.2 Equipment Cord Facility Breaker marking and conformity

The 30A and 50A cords shall have a 30A and 50A rated breaker protection with UL marking and minimum conformity to UL 489, NEMA AB1, AB3 ANSI Std. C37.16, ANSI Std. C37.17, C37.50, IEEE® Std. C37.13, UL 1066 and the National Electrical Code suitable for products certified to U.S., Canadian, European and Japanese standards.

The 32A cord shall have 32A rated breaker protection with CE marking and minimum conformity to CE RCCB, 2014/35/EU, 2014/30/EU, 2011/65/EU, EN61008-1:2012+A:2014+A11:2015, and EN 61008-2-1:1994+A11:1998

5.2 Universal Fused Facility Cable Assembly Fuse Detail

All power cords shall have high interrupt capacity fuses. Fuses shall be housed in a non-conductive housing with strain reliefs at either end, It must be necessary to use a tool to open The fuse enclosure shall require hand tool to open and access to the fuses. All fuses shall be CC time delay class.

30A fuses are Type CC time delay fuses such as:

- LittelFuse CCMR030
- Bussman LP-CC-30

50A fuses are Type CC time delay as well but at the time of this document, single sourced from Littelfuse:

- LittelFuse CCMR050

5.3 Universal Cable Assembly Output Connector detail

Standardize VAC connector, receptacle detail part numbers. The connector is not intended to be hot swapped during normal operation however the pin modules are required to survive 50 cycles at 240VAC 32Amps in accordance by UL test methods.



Figure 19. Functional Block Diagram of Universal 7 Wire Cable. Note pin housing color may different

Table 14. Universal Connector Pin Assignments for IEC 60309

IEC 60309 cable assembly pinout					
IEC 60309 Position	Wire Color			Han-Eco Position	Wire ID
L1	Brown			a1	W
L2	Black			b1	X
L3	Gray			c1	Y
N	Blue	Splice	Blue	a2	N
			Blue	b2	N
			Blue	c2	N
PE	Green / Yellow			d1	Safety Ground

Table 15. Universal Connector Pin Assignments for CS8365

CS8365 cable assembly pinout					
CS8365 Position	Wire Color			Han-Eco Position	Wire ID
X	Black	Splice	Black	a1	W
			Black	a2	
Y	White	Splice	White	b1	X
			White	b2	
Z	Red	Splice	Red	c1	Y
			Red	c2	
PE	Green			d1	Safety Ground

Table 16. Universal Connector Pin Assignments for L21-30P

L21-30P cable assembly pinout					
L21-30P Position	Wire Color			Han-Eco Position	Wire ID
W	No conductor			-	-
X	Black	Splice	Black	a1	W
			Black	a2	
Y	White	Splice	White	b1	X
			White	b2	
Z	Red	Splice	Red	c1	Y
			Red	c2	
Neutral	Not Connected				
PE	Green / Yellow			d1	Safety Ground

Note: This is a 4Wire cable using a 5 Wire plug. The neutral is not connected.

5.4 Fused Power Cord Overload Breaker Protection

The 30A/32A and 50A cords shall have a 30A/32A and 50A rated 10kAIC breaker protection, respectively. Breakers shall meet safety regulation and standards of the country where the installation takes place (i.e. all breakers in US datacenters must carry UL marking (or equivalent) and minimum conformity to UL 489, NEMA AB1, AB3 ANSI Std. C37.16, ANSI Std. C37.17, C37.50, IEEE® Std. C37.13, UL 1066 and the National Electrical Code, as applicable. Equivalent certified breakers must be available for all other countries).

5.5 Environmental Conditions

The environmental conditions listed in Section 4 must be supported

5.6 Materials

All materials used in the construction of the assembly shall support normal use for a period of 15 years.

Fuse enclosure must be rated IP40 or better.

5.7 Qualification Testing and Compliance

5.7.1 Functional Test

Facility Cables shall be tested for basic functionality before and after prescribed tests as described in this specification, unless otherwise noted. Functional testing shall be performed on a test bench using the same equipment used during production testing.

5.7.1.1 Input Pins to Output Pins Correlation

Prior to conducting the specified test plan, the facility cable shall have the input pins to outputs pins correlation verified for correct construction. See Section 1.1 for all pinout diagrams.

5.7.1.2 Insultation Resistance

Upon conclusion of each test, verify the integrity of the electrical insulation on the assembled facility cable between each electrical path including the grounding conductor:

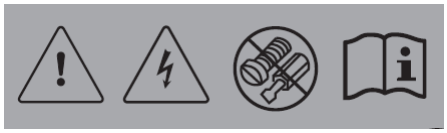
Test	Description
Insulation Resistance Test	500VDC, 1 Minute [>100MΩ]

5.7.1.3 Resistance Measurement

Verify integrity of conductive path on the assembled facility cable on each conductor including the grounding conductor through resistance measurement.

5.7.1.4 Fused facility cable markings

Fused facility cable will need to comply with all required markings from UL 817 and provide unique identification (P/N, Model Number, Manufacturer, Country of Origin).

- Use only with a CC fuse rated XX amperes, 600 volts
- Symbols: 

5.8 Warning Label

Warning label shall be attached within 25mm of the of the mechanical cable strain relief of the plug body.

5.9 Attachment method

A plastic strap (tie-wrap) must be used to secure the label. The strap shall not be removable without cutting

5.10 Label material

The label must be laminated (i.e. 14 point gloss cover stock coated both sides with 1.7 mil clear polyester laminate)

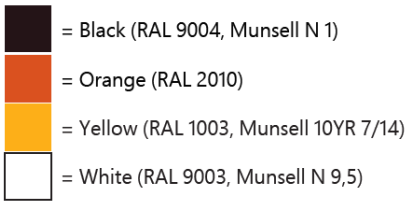
5.11 Label content, font, color and minimum dimensions

- Electric shock symbol: 
- Signal word: 

    - Font: All capitol, Sans serif letters, bold
    - Dimension: Minimum 16 point

- Label Statement: *"Electric shock hazard. Equipment may be powered by multiple sources. Disconnect connector on the rack side first."*
    - Font: Sans serif letters
    - Dimension: Minimum 10 point

- Label colors:



5.12 Localization

The signal word "**WARNING**" and the statement "**Electric shock hazard. Equipment may be powered by multiple sources. Disconnect connector on the rack side first**." shall be translated in the language of each country where the cord is going to be shipped and/or deployed (see Country List).

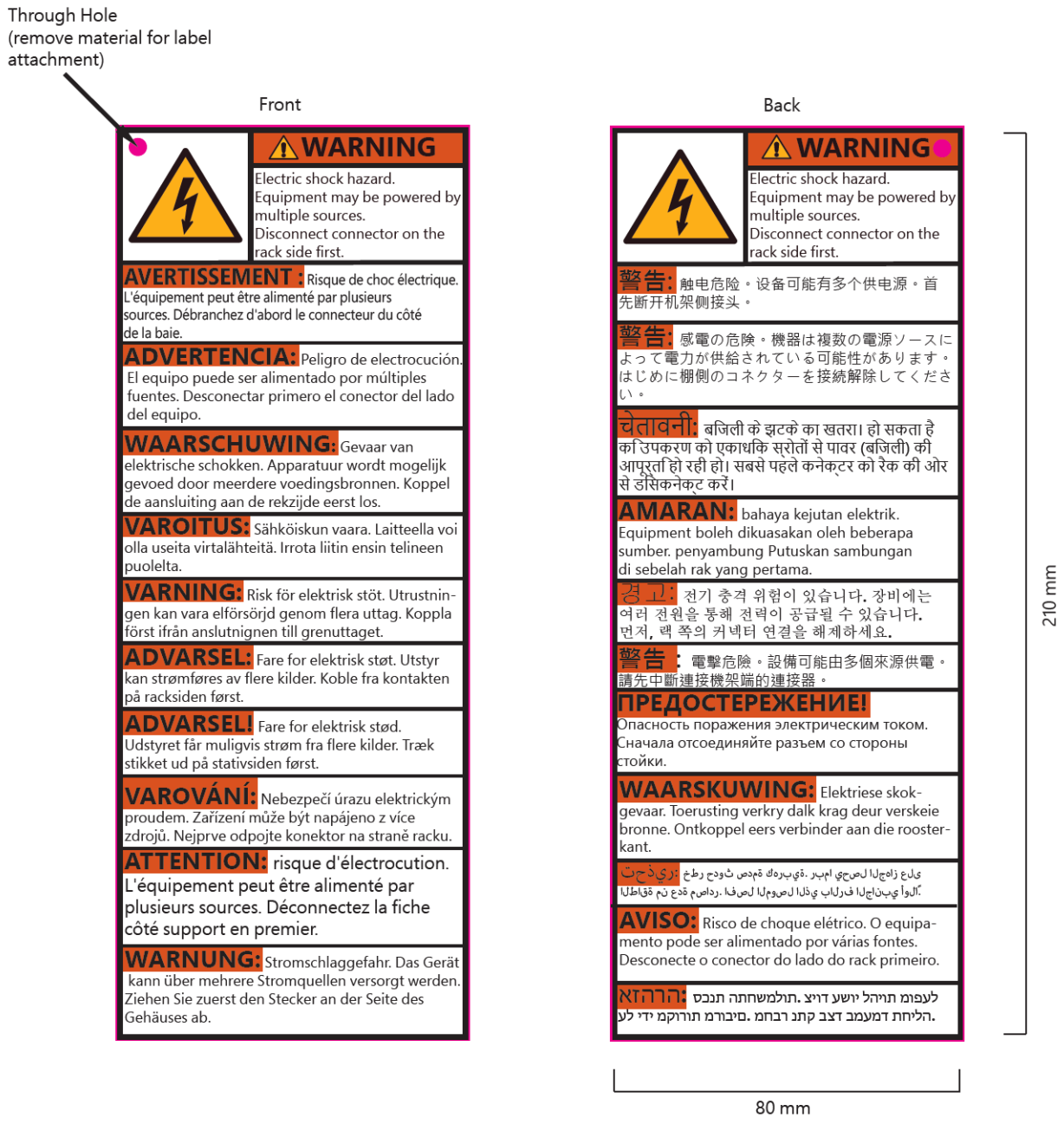


Figure 20. Example Warning Label

Table 17. Warning Label Localized Text

Language	Text
US English - source	WARNING: Electric shock hazard. Equipment may be powered by multiple sources. Disconnect connector on the rack side first.
fr-CA	AVERTISSEMENT : Risque de choc électrique. L'équipement peut être alimenté par plusieurs sources. Débranchez d'abord le connecteur du côté de la baie.

Es	ADVERTENCIA: Peligro de electrocución. El equipo puede ser alimentado por múltiples fuentes. Desconectar primero el conector del lado del equipo.
pt-BR	AVISO: Risco de choque elétrico. O equipamento pode ser alimentado por várias fontes. Desconecte o conector do lado do rack primeiro.
nl-NL	WAARSCHUWING: Gevaar van elektrische schokken. Apparatuur wordt mogelijk gevoed door meerdere voedingsbronnen. Koppel de aansluiting aan de rekzijde eerst los.
fi-FI	VAROITUS: Sähköiskun vaara. Laitteella voi olla useita virtalähteitä. Irrota liitin ensin telineen puolelta.
de-DE	WARNUNG: Stromschlaggefahr. Das Gerät kann über mehrere Stromquellen versorgt werden. Ziehen Sie zuerst den Stecker an der Seite des Gehäuses ab.
ms-MY	AMARAN: bahaya kejutan elektrik. Equipment boleh dikuasakan oleh beberapa sumber. penyambung Putuskan sambungan di sebelah rak yang pertama.
ko-KR	경고: 전기 충격 위험이 있습니다. 장비에는 여러 전원을 통해 전력이 공급될 수 있습니다. 먼저, 랙 쪽의 커넥터 연결을 해제하세요.
zh-CN	警告：触电危险。设备可能有多个供电源。首先断开机架侧接头。
ja-JP	警告: 感電の危険。機器は複数の電源ソースによって電力が供給されている可能性があります。はじめに棚側のコネクターを接続解除してください。
hi-IN	चेतावनी: बिजली के झटके का खतरा। हो सकता है कि उपकरण को एकाधिक स्रोतों से पावर (बिजली) की आपूर्ति हो रही हो। सबसे पहले कनेक्टर को रैक की ओर से डिसकनेक्ट करें।
ru-RU	ПРЕДОСТЕРЕЖЕНИЕ! Опасность поражения электрическим током. Сначала отсоедините разъем со стороны стойки.
af-ZA	WAARSKUWING: Elektriese skokgevaar. Toerusting verkry dalk krag deur verskeie bronne. Ontkoppel eers verbinder aan die roosterkant.
fr-FR	ATTENTION : risque d'électrocution. L'équipement peut être alimenté par plusieurs sources. Déconnectez la fiche côté support en premier.
sv-SE	VARNING: Risk för elektrisk stöt. Utrustningen kan vara elförsörjd genom flera uttag. Koppla först ifrån anslutnignen till grenuttaget.
nb-NO	ADVARSEL: Fare for elektrisk støt. Utstyr kan strømføres av flere kilder. Koble fra kontakten på racksiden først.
da-dk	ADVARSEL! Fare for elektrisk stød. Udstyret får muligvis strøm fra flere kilder. Træk stikket ud på stativsiden først.
cs-CZ	VAROVÁNÍ: Nebezpečí úrazu elektrickým proudem. Zařízení může být napájeno z více zdrojů. Nejprve odpojte konektor na straně racku.
ar-SA	تحذير: خطر حدوث صدمة كهربية. ربما يحصل الجهاز على الطاقة من عدة مصادر. افصل الموصل الذي بالرف الجانبي أولاً.
zh-TW	警告：電擊危險。設備可能由多個來源供電。請先中斷連接機架端的連接器。
he-IL	אזהרה: סכנת התחשמלות. ציוד עשוי להיות מופעל על ידי מקורות מרובים. מחבר נתק בצד במעמד תחילה.