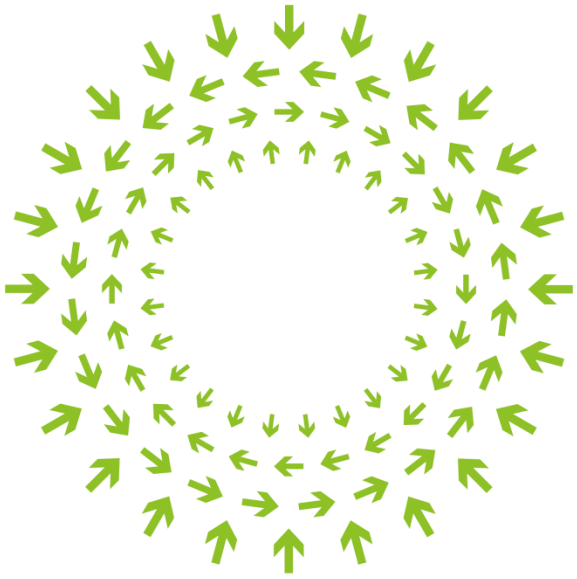

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Compute Project

# Project Olympus Power and Management Distribution Unit Specification

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# Revision History

| Date | Description |
|---|---|
| 2/15/2017 | Version 1.0 |

# Contents

## Figures

# 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 hot-plug blind-mate connectors.

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

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 via the I2C communications port. 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 two A/C power feeds utilize cords compliant with the Universal Power Cord Specification.

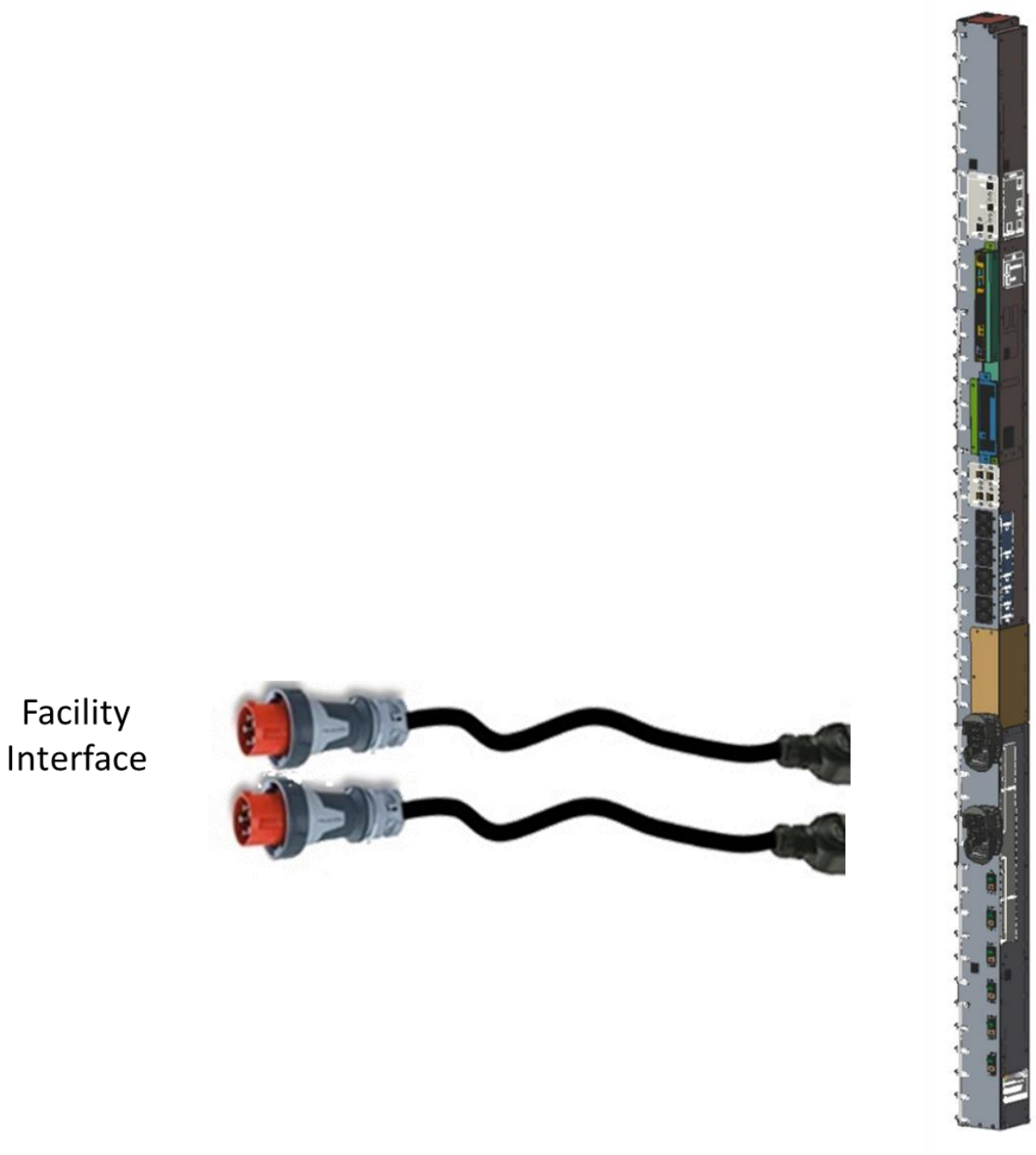



**Figure 1. PMDU General Layout**

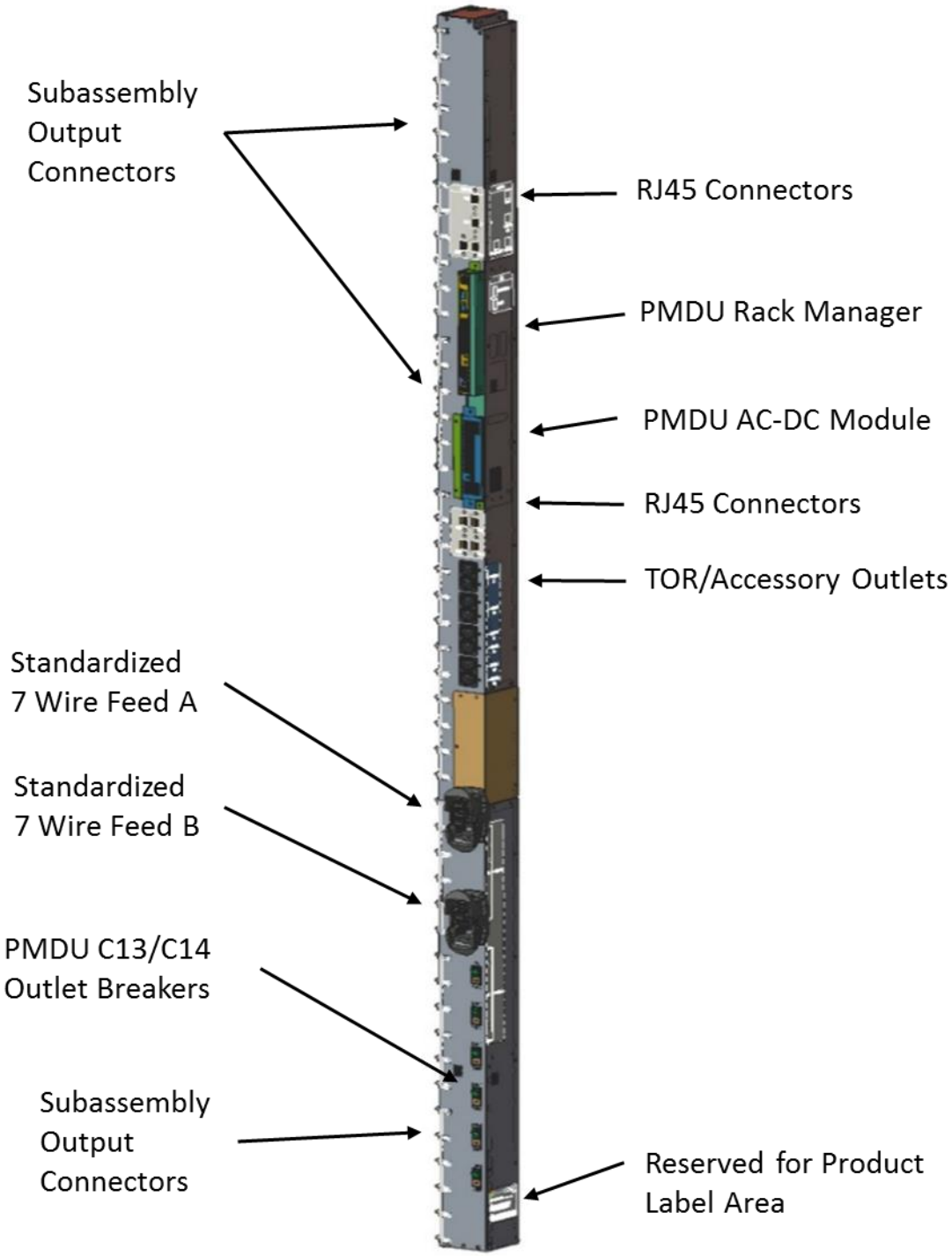



Figure 2. PMDU General Description

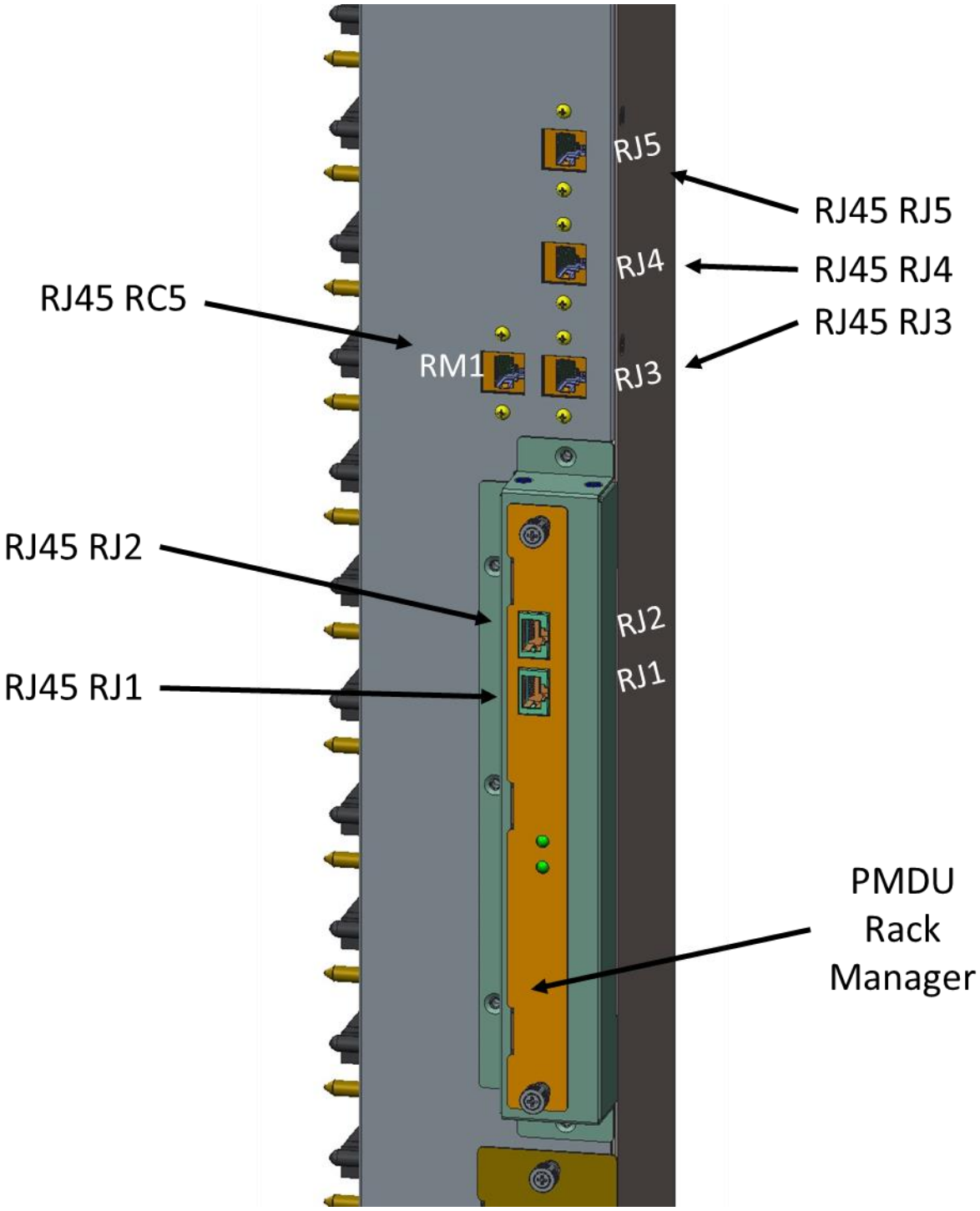



Figure 3. PMDU General Description, Rack Manager and RJ45 Network Ports

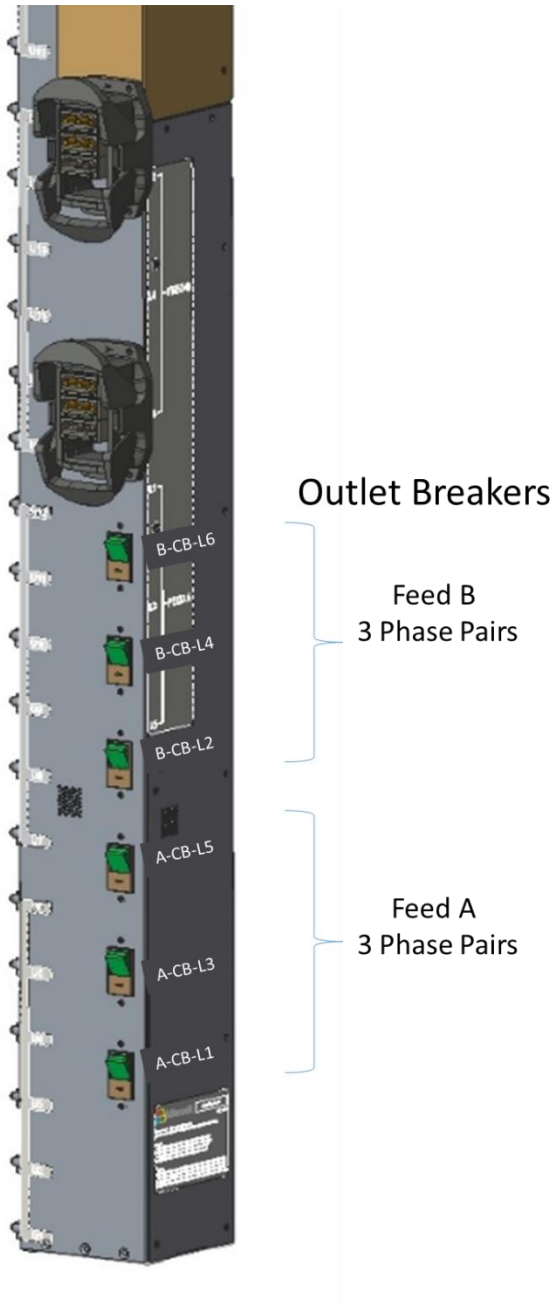



**Figure 4. PMDU Outlet Breaker Identification and Location (Note that input connectors should NOT have latches)**

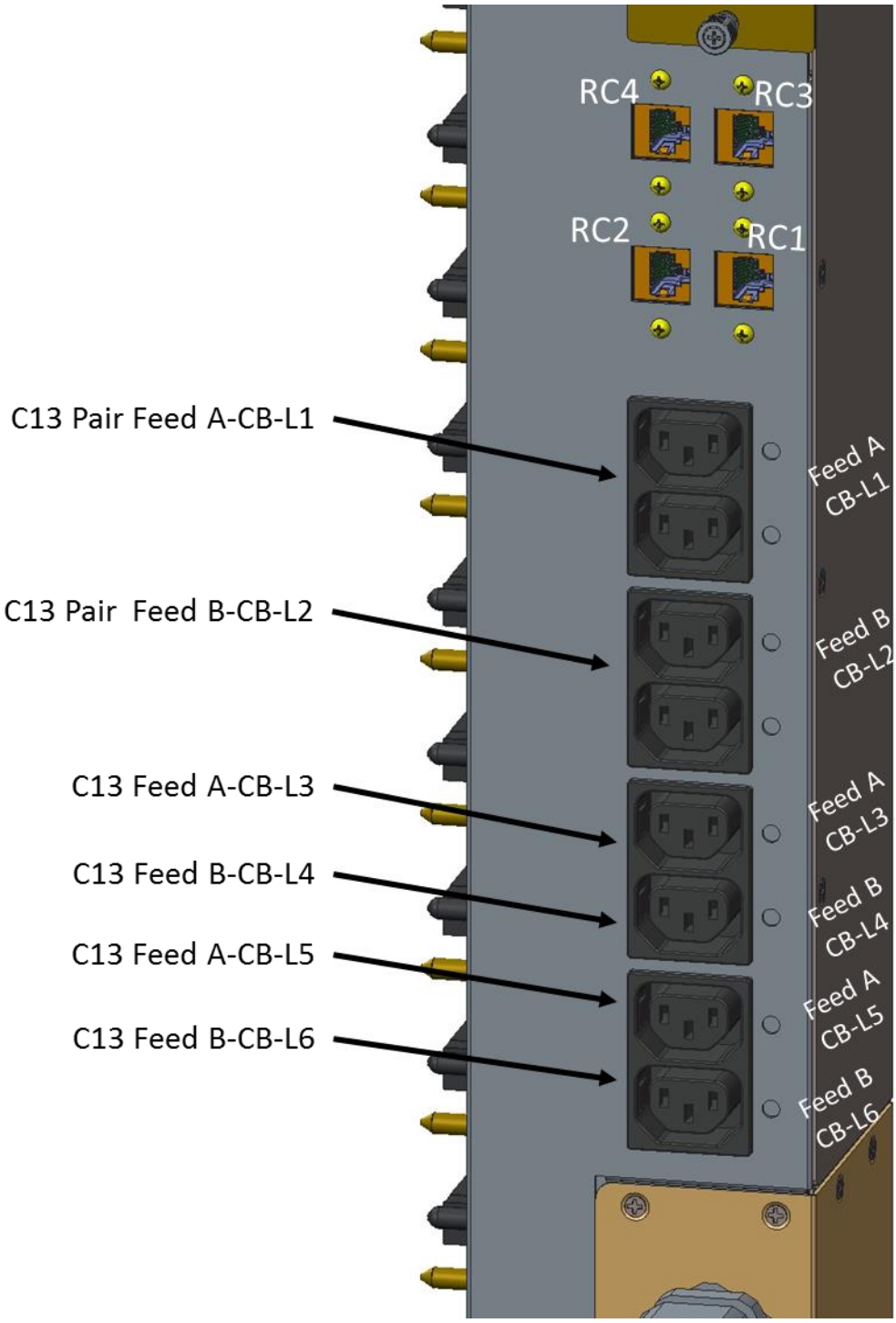



**Figure 5. PMDU Outlet and RJ45 Relay Control Location**

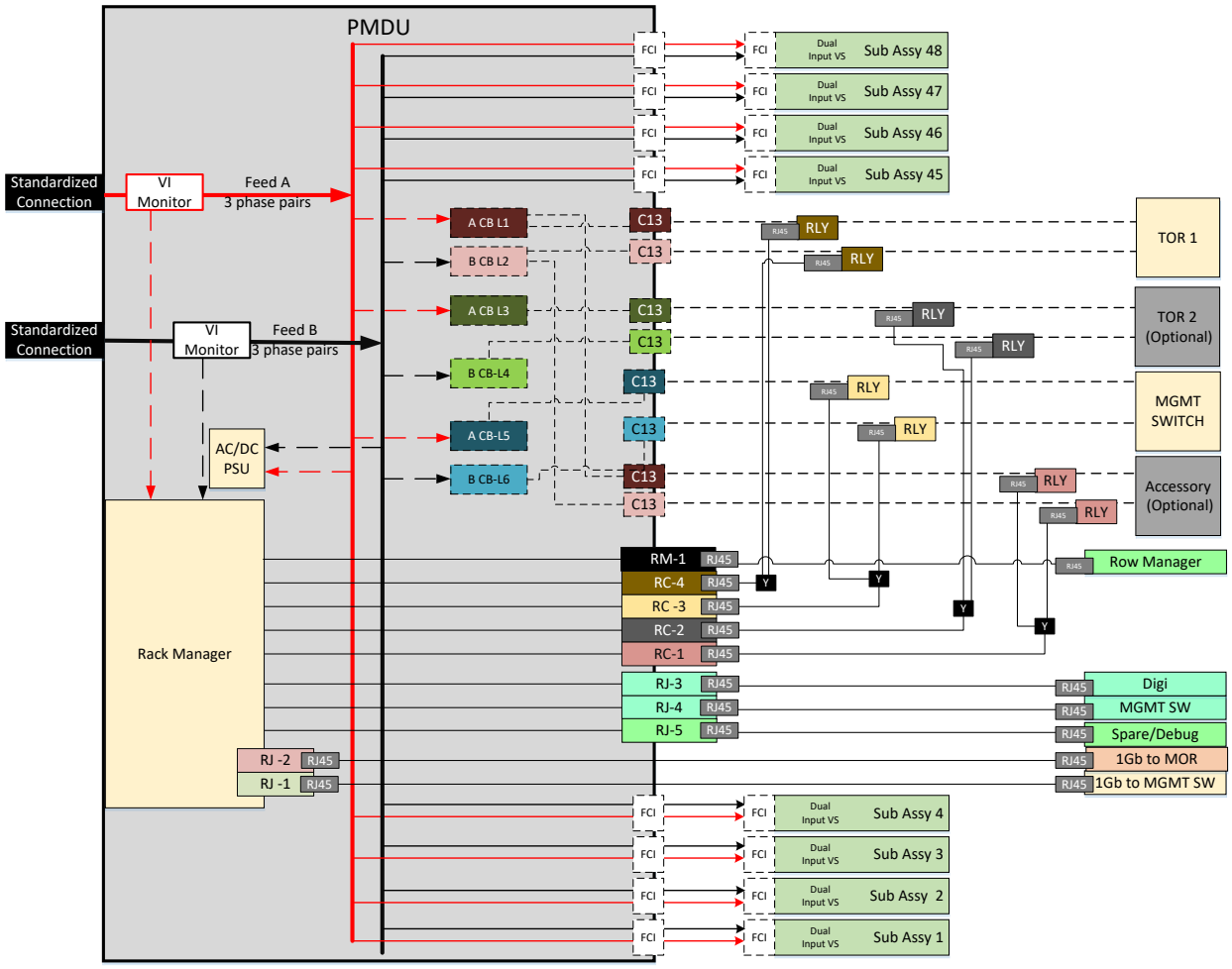



Figure 6. PMDU Power Distribution Functional Block Diagram

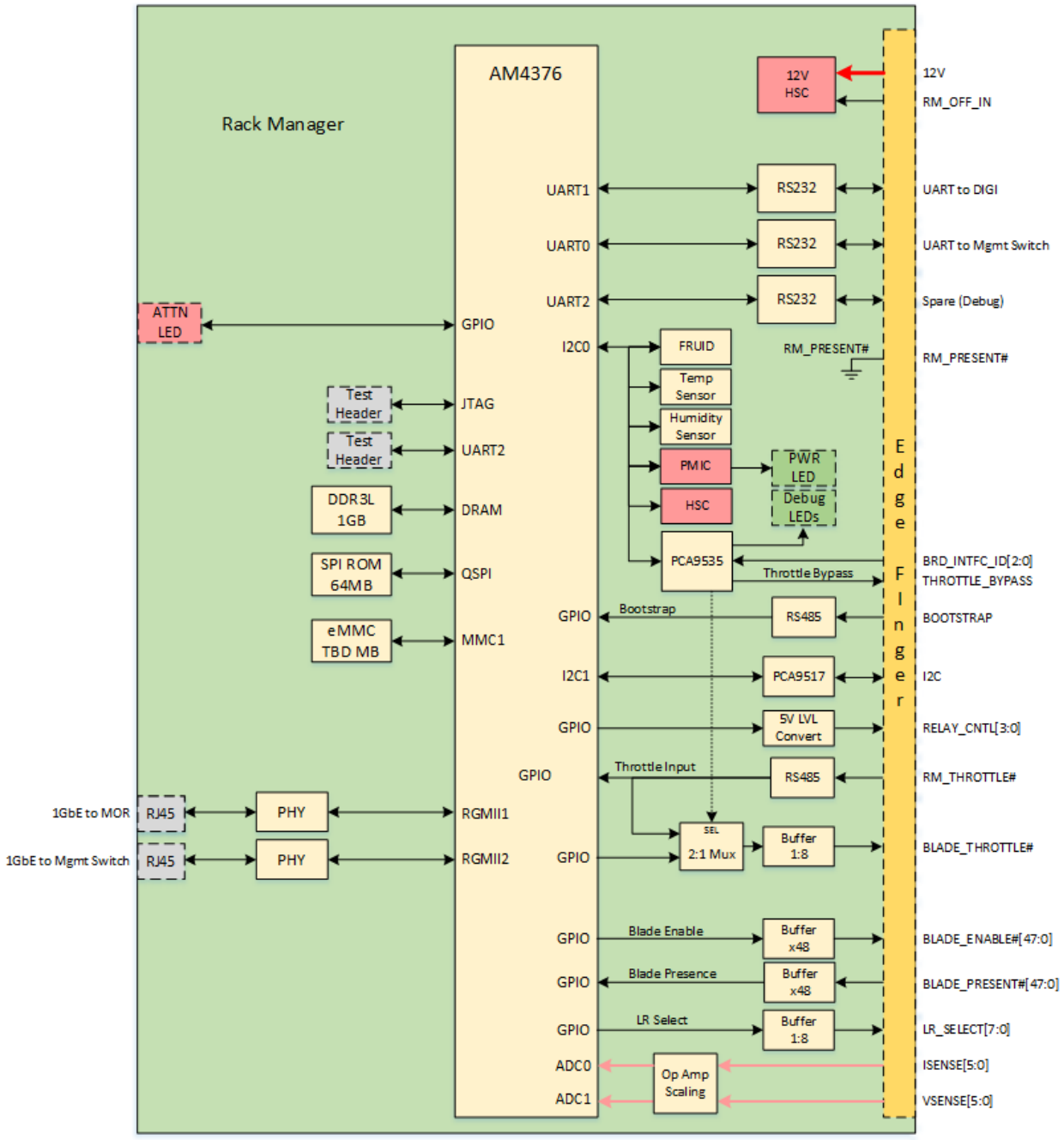



**Figure 7. PMDU Rack Manager Functional Basic Block Diagram. See Specification for detail.**

# 2 PMDU Electrical

## 2.1 AC/DC Power Supply Module

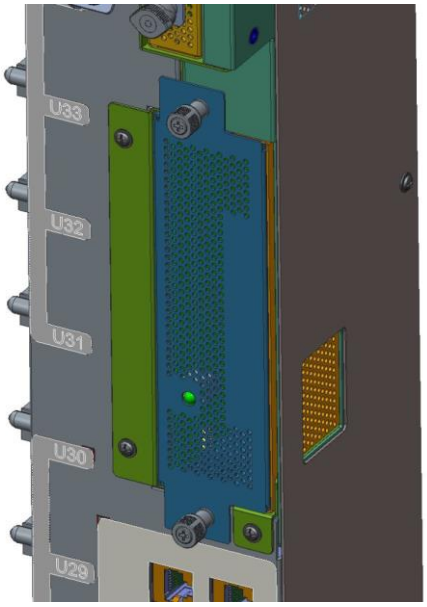
The PDMU shall have a hot swappable AC/DC module to power internal monitoring and Rack Manager. The PDMU shall be dual input from a single from VAC Feed A and B. The PSU shall not cause a secondary failure or outage as result of single fault in the unit.

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



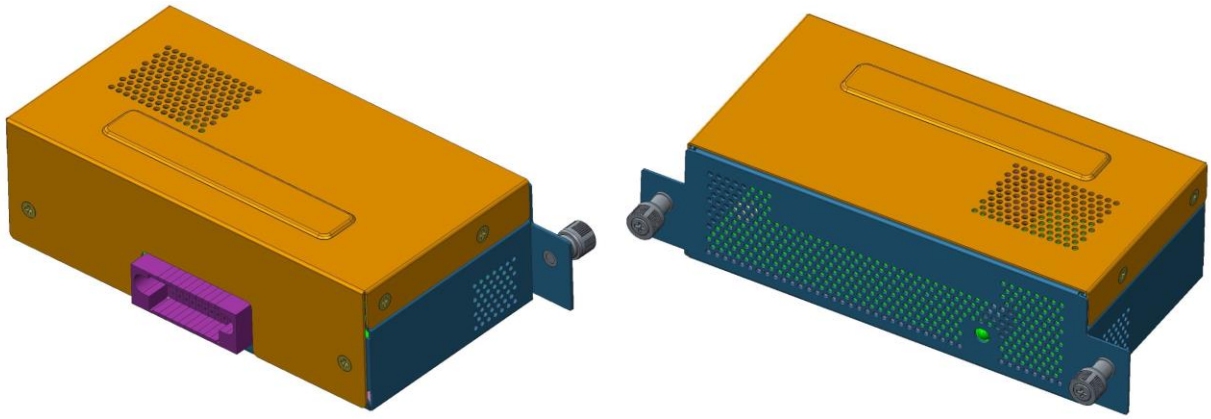


**Figure 8. AC-DC Module**

## 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 5. PMDU Outlet and RJ45 Relay Control Location 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.

See the latest revision of the Windows Cloud Server System Specification M2010 Rack Manager software spec for sample rate, measurement period, details and tolerances of voltage and current monitoring.

### 2.3.2 PMDU Rack Manager Firmware Update Requirement

The PDMU 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 Electrical Interconnect Details

## 2.5 Universal A/C Power Input

### 2.5.1 Universal Power Cable

The PMDU receives facility power that complies with the Project Olympus Universal Equipment Power Cord specification.

### 2.5.2 Power Capacity

The PMDU power capacity if limited by the equipment power cord used to connect to the facility. The maximum rated power is 17.2kW with 415VAC 30A 5 Wire/400VAC 32A 5 Wire.

### 2.5.3 Universal PMDU Connector detail

The PDMU Shall provide bulkhead or panel mount connection to be mated with the universal cord assembly described above. The cord retention clips shall reside on the universal cord assembly not the PMDU bulkhead mount connector.

**Table 1. Male Universal Connector Part Number**

| Connector Name/ Assembly | QTY | Input Connector Part Number | Input Connector Description | Comment |
|---|---|---|---|---|
| 7 pin male pin with plastic locking housing | 2 | 73 42 200 0029: | Harting Han-Eco bulkhead housing with plug modules | 70A 1000V pin and safety ground pin |

**Table 2. 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 Universal Cord plug pin number assignment orientation (note touch-proof male contacts and female ground contact)**

### 2.5.4 Input Cable Assembly Detail

## 2.6 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 single fault condition and sub assembly attached across the 6U single distribution group. Single distribution groups are defined at U1 thru 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.

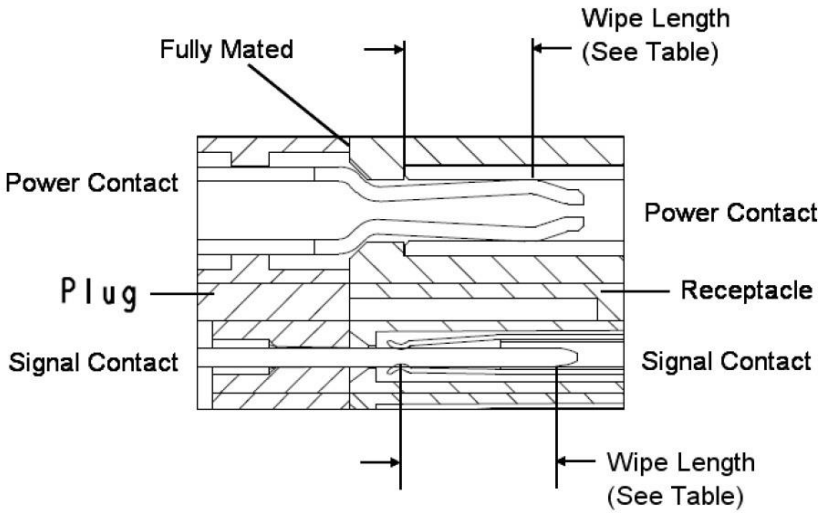
The sub-assembly output current pins are limited to a maximum of 16A per pin if only one output connector is attached in the 6U distribution group used.

### 2.6.1 Sub-assembly Output Power and Signal

The sub-assembly power and signal connector shall 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 Contact Wiping Distances table.




| 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 3. 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.

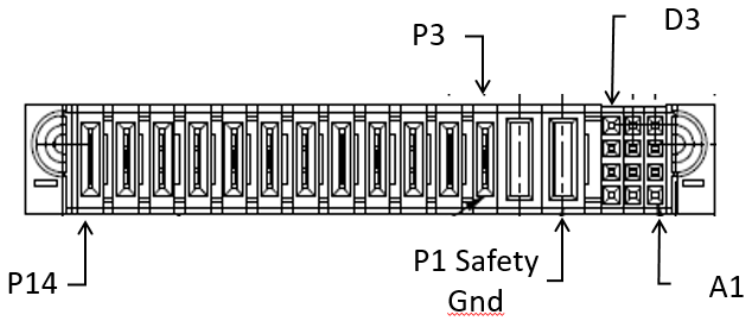



**Figure 10. PMDU Subassembly Pinout Assignment Image**

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

**Universal 7 Wire Power Cable Connector to Sub Assembly Definition**

| Universal Power Cable Connector Interface | | | PDMU Pin Definition | Feed A-B Sub Assembly 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 Assembly 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 |

## 2.7 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.

## 2.8 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.

- RJ1 – Located on the Rack Manager. Supports 1GbE. Expected to connect to the Rack Manager Switch.
- RJ2 – Located on the Rack Manager. Supports 1GbE. Expected to connect to a Management Switch in the Middle of Row (MOR) rack.
- 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 be used as a debug or spare UART port.
- RJ5 – Located on the PMDU. Supports SW flow control UART. Expected to connect to the Rack Management Switch.
- 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.

### 2.8.1 RJ45 for UART with HW Flow Control (RJ3)

The PMDU shall support one RJ45 connectors for interfacing with UARTs with hardware flow control. The connector pinout is shown in Table 5.

**Table 5. 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 |

### 2.8.2 RJ45 for UART without HW Flow Control ( RJ4, RJ5)

The PMDU shall support two RJ45 connectors for interfacing with UARTs without hardware flow control. The connector pinout is shown in Table 6. 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 6. 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 | RS232 | Receive Data |
| 7 | NC | O | RS232 | Data Set Ready. Connect to DTR (0 ohm resistor) |
| 8 | NC | O | RS232 | Clear to Send. Connect to RTS (0 ohm resistor) |

### 2.8.3 RJ45 for Rack Manager Power and Boot Control (input) (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 7.

Table 7. 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 | No Connect |
| 8 | RM_OFF | I | 5V | Disables Rack Manager 12V HSC |

### 2.8.4 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 8.

Table 8. 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 | GND | I | 0V | No Connect |
| 8 | P5V | I | 5V | 5V source |

## 2.9 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 9.

**Table 9. 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. Detailed dimensions on Microsoft drawing M1007740-001 (42U SKU) and M1007710-001 (48U SKU). The housing shall be coated to prevent rust and corrosion.

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

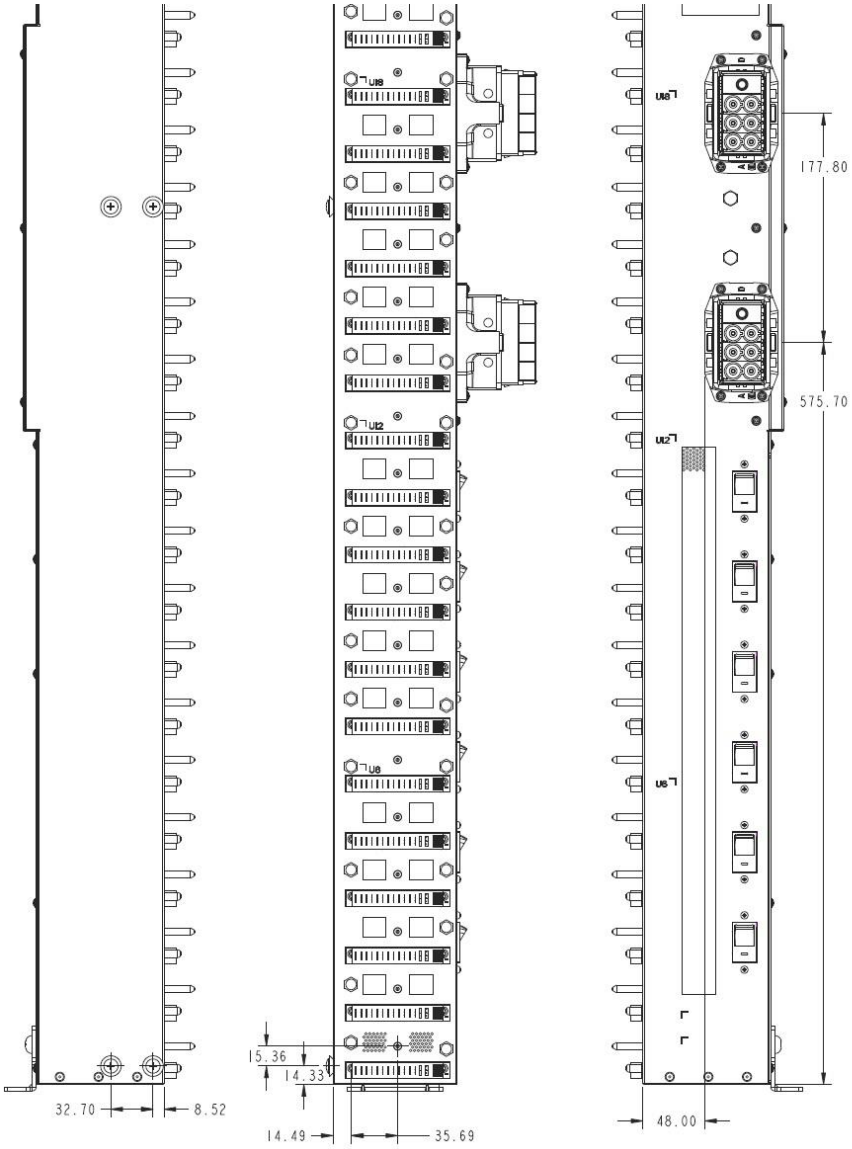
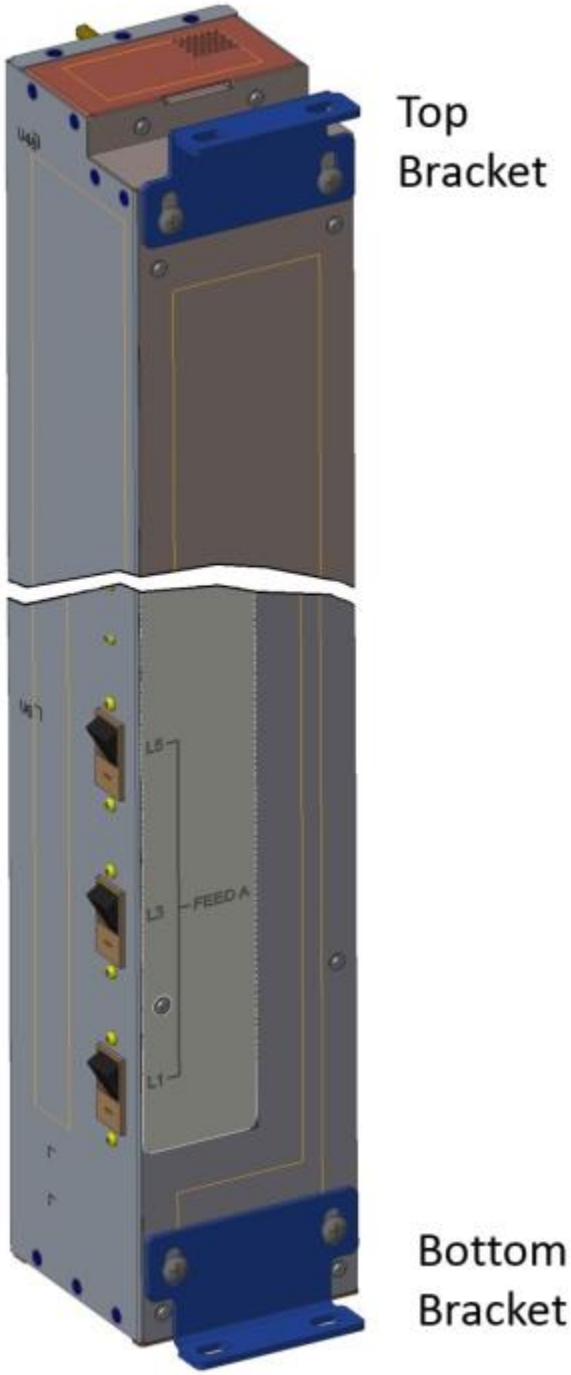



**Figure 11. PMDU Housing General Dimensions, Microsoft drawings M1007740 and M1007710 supersede this image**

## 3.2 PMDU Structural Brackets

The PMDU shall include brackets top and bottom for structural strength. Representative image is below. See Microsoft drawing M1007740-001 (42U SKU) and M1007710-001 (48U SKU) for details.



## 3.3 PMDU Subassembly Power Connector

### 3.3.1 Connector and Placement

The sub-assembly power and signal connector shall be placed at every U (44.45mm) of the PMDU, oriented as shown in PMDU Housing General Location front view.

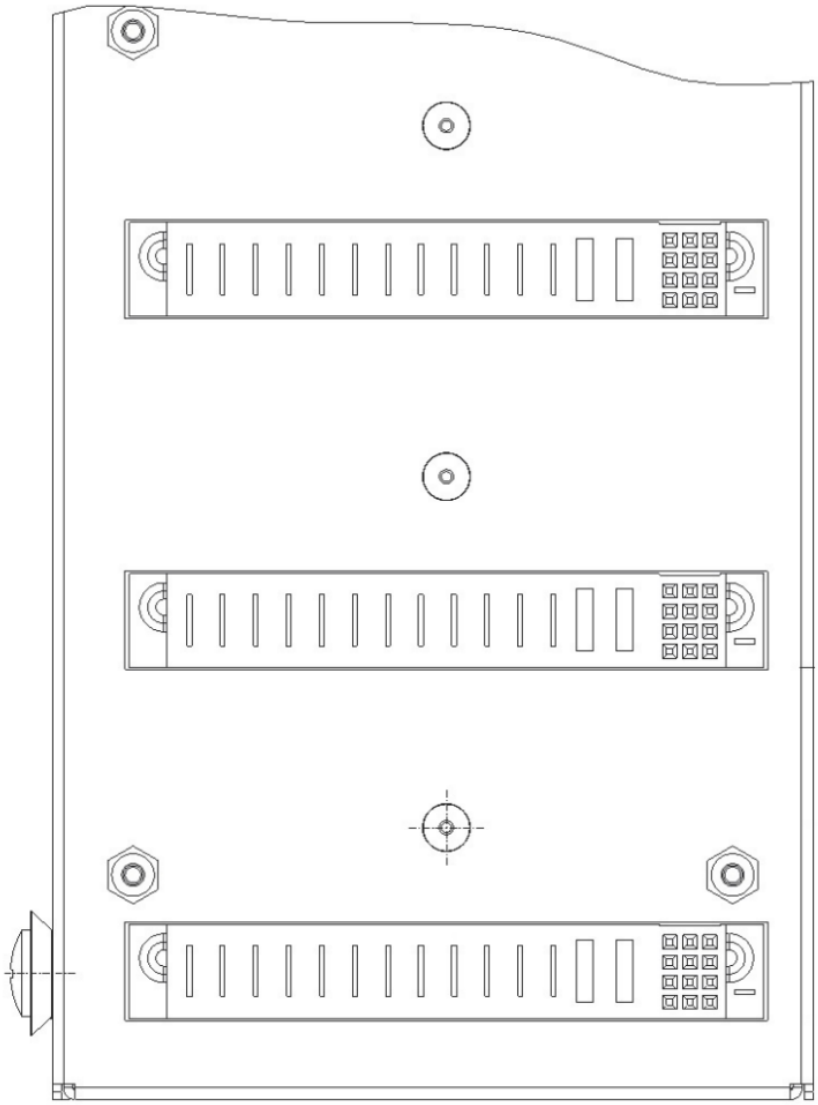


**Figure 12. PMDU Housing General Location front view, Microsoft drawings M1007740 and M1007710 supersede this image**

## 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 Project Olympus system rails. The

inverted surfaces of the washers pull the PMDU tightly against the sides of the rails. Details of cone washer design shown in Microsoft drawing M1007740-001 (42U SKU) and M1007710-001 (48U SKU).

**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 an 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.

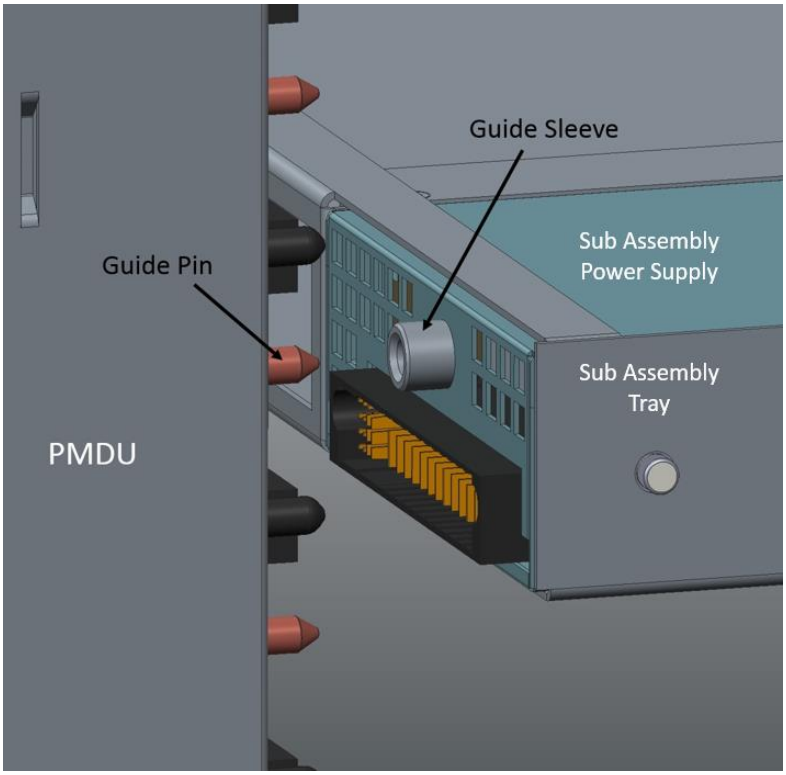



**Figure 14. Guide pins interfacing with sleeves on subassemblies**

## 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.

**Table 10. Environmental Requirements**

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

See the latest version of the IT Equipment and Data Center Power/Physical/Environmental Specification Document M1001852.