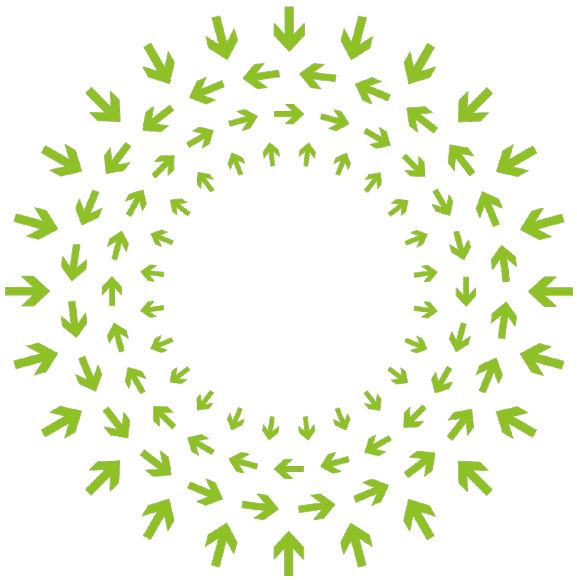


OPEN
Compute Project

Open Rack V3 HPR Power Monitoring Interface (PMI) Module

Rev: 0.2

Authors:

David Sun
Dmitriy Shapiro

Open Compute Project • Open Rack V3 HPR Power Monitoring Interface (PMI) Module
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Table of Contents

License (OCP CLA Option) 2
Table of Contents 3
Revision History 4
1. Scope 5
2. PMI Overview 5
3. Electrical requirements 5
3.1 4x RJ45 Connectors 5
3.2 Edge Connector 7
3.3 Filtering 9
4. Mechanical requirements 12
4.1 PMI Physical Dimensions 12
4.2 Construction 12
4.3 Latch and Handle Requirements 12
4.4 EMI Gaskets 13
4.5 Labeling & Markings 13
4.6 RJ45 Connector 13
4.7 Blind Mate Connector 13
4.8 Mechanical Drawings 15
5. Compliance requirements 16
5.1 Safety Standards 16
5.2 EMC Requirements 16
5.3 Environmental Compliance 16
5.4 Documentation 16
6. Serviceability 16
6.1 Required collateral 16
6.2 FRU information 16
6.3 PCB information 16
7. Thermal 17
8. Vibration and Shock (non-packaged) 18
9. Package Vibration, Drop and Compression 18

Revision History

Date	Version	Change By	Comments
07/07/2023	0.1	David Sun Dmitriy Shaparo	Initial draft based on ORV3 PMI spec Rev1.0. Added missing daisy chain cable detection signal on RJ#3 pin6 and edge connector. RJ#4 pin6 is grounded in PMI.
8/2/2023	0.2	David Sun	Section3.2: PCB edge connector A17/B17/A18 change from "RS485_Addr0/1/2" to Shelf_Position1/2/3". Add Section 3.4 DIP switches for Shelf_Position1/2/3 and RS485/CAN termination resistor selections.

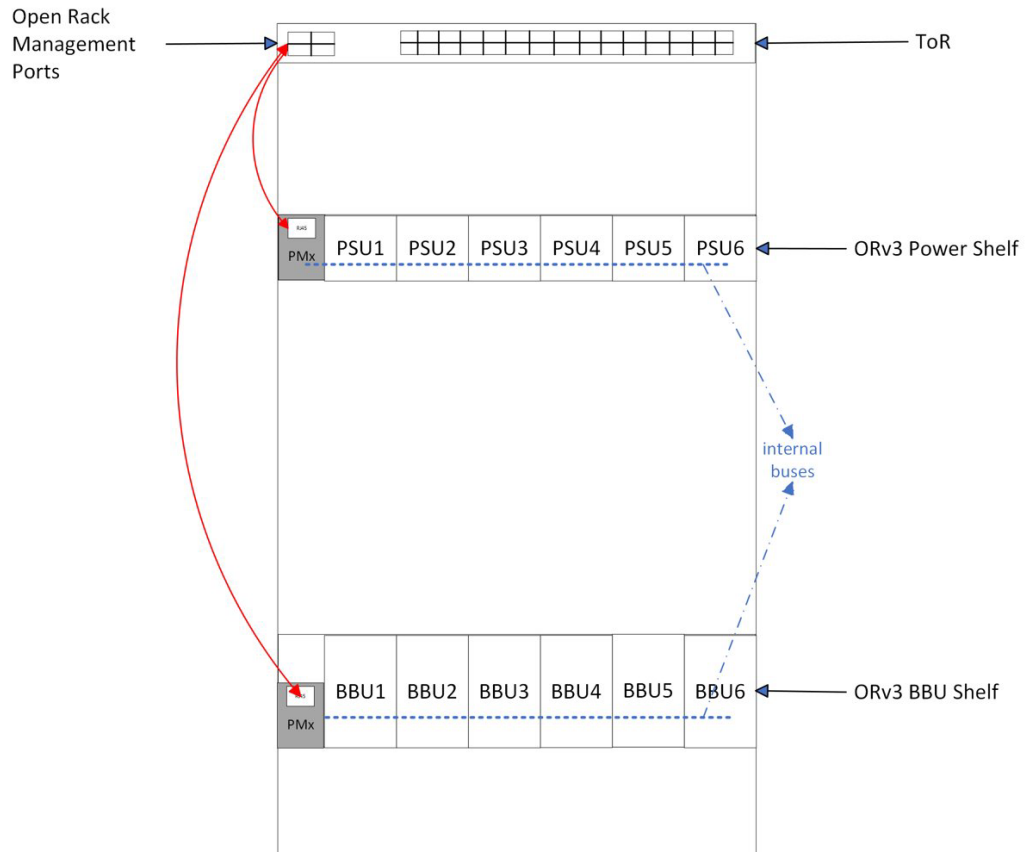
1. Scope

This document defines the technical specifications for an Open Rack V3 Power Monitoring Interface (PMI) Module used in the Open Compute Project.

2. PMI Overview

PMI is an extension module, which brings MODBUS of the PSU/BBUs directly out for upstream communication. PMI sits on Open Rack V3 Power and Battery Shelves. On one end, in has communication with the PSU or BBUs – through sliver straddle connector. On the other end, interacts with centralized system through the use of RJ45 connectors.

(PMI diagram drawing to be updated)



3. Electrical requirements

3.1 4x RJ45 Connectors

The PMI shall contain four RJ45 connectors located on the bulkhead of the assembly. The pinouts of the four connectors are shown below. The RJ45 location shall be defined in the mechanical section. Looking from the front, Top left RJ45 is #1, Top right is #2, bottom left is #3, bottom right is #4.

RJ45 #1

Pin	Wire color	Function
1	White/Orange	GND
2	Orange	PLS
3	White/Green	BKP
4	Blue	RS485A
5	White/Blue	RS485B
6	Green	RS485_Addr2
7	White/Brown	RS485_Addr1
8	Brown	RS485_Addr0

RJ45 #2

Pin	Wire color	Function
1	White/Orange	GND
2	Orange	PLS
3	White/Green	BKP
4	Blue	RS485A
5	White/Blue	RS485B
6	Green	GND
7	White/Brown	RS485_Addr1
8	Brown	RS485_Addr0

RJ45 #3

Pin	Wire color	Function
1	White/Orange	ISHARE
2	Orange	GND
3	White/Green	SYNC_START_L
4	Blue	VOUT_SEL
5	White/Blue	SYNC_STOP_L
6	Green	Missing_Daisy_Chain_Cable
7	White/Brown	CAN_H
8	Brown	CAN_L

RJ45#4

Pin	Wire color	Function
1	White/Orange	ISHARE
2	Orange	GND
3	White/Green	SYNC_START_L

4	Blue	VOUT_SEL
5	White/Blue	SYNC_STOP_L
6	Green	GND
7	White/Brown	CAN_H
8	Brown	CAN_L

3.2 Edge Connector

There are several signals on the edge connector. Yellow signals have no use-case currently, for future expansions. All other signals are routed in the power/battery shelf backplanes.

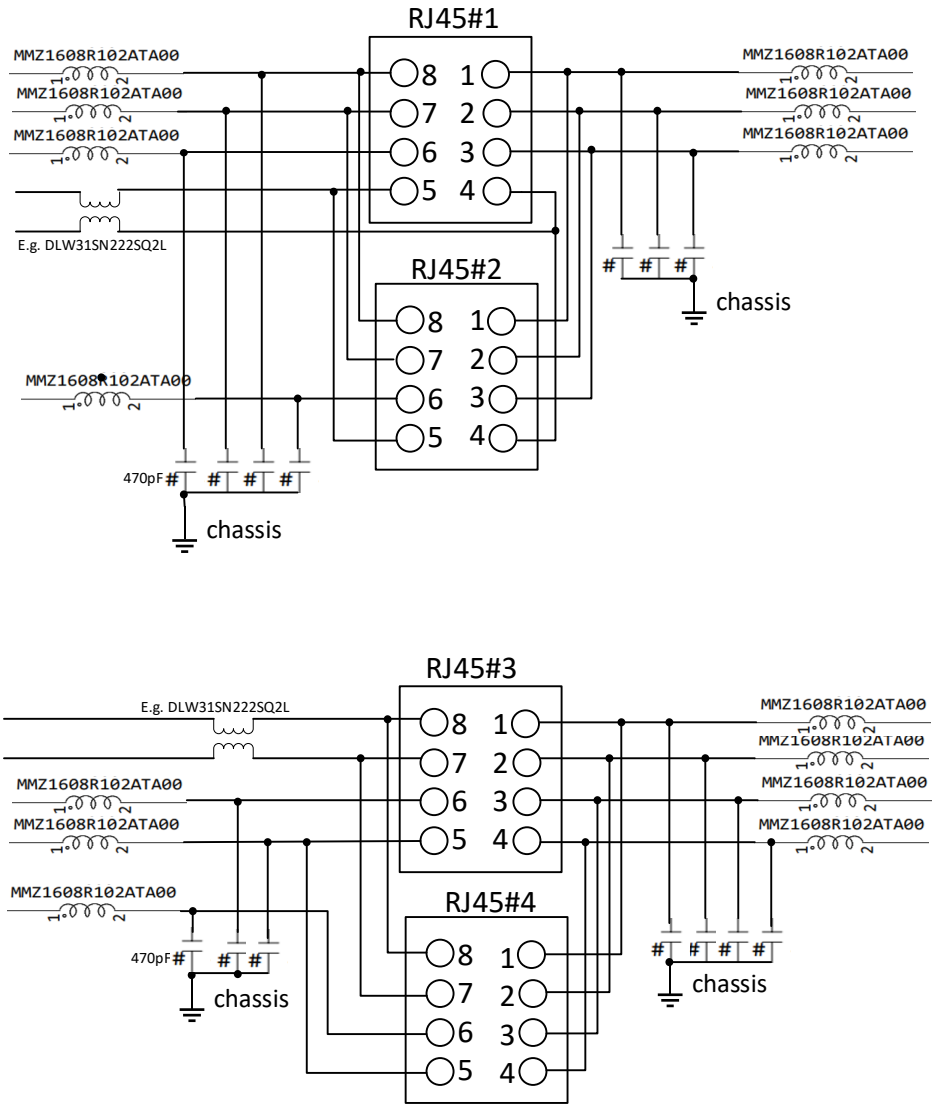
Pin #	Signal Name	I/O	Description
A1	ADDR_ID_0	I	Shelf ID 000 1U power shelf 001 Battery shelf
B1	ADDR_ID_1	I	
A2	ADDR_ID_2	I	
B2	GND	I	Ground
A3	ALERT_0_N	I	PSU/BBU Alert
B3	ALERT_1_N	I	PSU/BBU Alert
A4	ALERT_2_N	I	PSU/BBU Alert
B4	ALERT_3_N	I	PSU/BBU Alert
A5	ALERT_4_N	I	PSU/BBU Alert
B5	ALERT_5_N	I	PSU/BBU Alert
A6	ALERT_6_N	I	PSU/BBU Alert
B6	ALERT_7_N	I	PSU/BBU Alert
A7	ALERT_8_N	I	PSU/BBU Alert
B7	ALERT_9_N	I	PSU/BBU Alert
A8	ALERT_10_N	I	PSU/BBU Alert
B8	ALERT_11_N	I	PSU/BBU Alert
A9	GND	I	Ground
B9	RESET_0	O	PSU/BBU Reset
A10	RESET_1	O	PSU/BBU Reset
B10	RESET_2	O	PSU/BBU Reset
A11	RESET_3	O	PSU/BBU Reset
B11	RESET_4	O	PSU/BBU Reset
A12	RESET_5	O	PSU/BBU Reset
B12	RESET_6	O	PSU/BBU Reset
A13	RESET_7	O	PSU/BBU Reset
B13	RESET_8	O	PSU/BBU Reset
A14	RESET_9	O	PSU/BBU Reset
B14	RESET_10	O	PSU/BBU Reset
A15	RESET_11	O	PSU/BBU Reset

B15	GND	I	Ground
A16	PLS	I	PSU/BBU Power Loss Siren
B16	BKP	I	PSU/BBU BKP
A17	Shelf_Position1	O	PSU/BBU Shelf MODBUS address
B17	Shelf_Position2	O	PSU/BBU Shelf MODBUS address
A18	Shelf_Position3	O	PSU/BBU Shelf MODBUS address
B18	RS485A	I/O	Shared PSU/BBU MODBUS
A19	RS485B	I/O	Shared PSU/BBU MODBUS
B19	I2C_SDA_0	I/O	PSU/BBU #0 PMBUS
A20	I2C_CLK_0	I/O	PSU/BBU #0 PMBUS
B20	I2C_SDA_1	I/O	PSU/BBU #1 PMBUS
A21	I2C_CLK_1	I/O	PSU/BBU #1 PMBUS
B21	I2C_SDA_2	I/O	PSU/BBU #2 PMBUS
A22	I2C_CLK_2	I/O	PSU/BBU #2 PMBUS
B22	I2C_SDA_3	I/O	PSU/BBU #3 PMBUS
A23	I2C_CLK_3	I/O	PSU/BBU #3 PMBUS
B23	I2C_SDA_4	I/O	PSU/BBU #4 PMBUS
A24	I2C_CLK_4	I/O	PSU/BBU #4 PMBUS
B24	I2C_SDA_5	I/O	PSU/BBU #5 PMBUS
A25	I2C_CLK_5	I/O	PSU/BBU #5 PMBUS
B25	I2C_SDA_shelf	I/O	I2C for Shelf Temp and FRU
A26	I2C_CLK_shelf	O	I2C for Shelf Temp and FRU
B26	GPIO2	I/O	
A27	GPIO3	I/O	
B27	GPIO4	I/O	
A28	GPIO5	I/O	
B28	GPIO6	I/O	
A29	GPIO7	I/O	
B29	GPIO8	I/O	
A30	**CAN_H**	I/O	
B30	**CAN_L**	I/O	
A31	SYNC_STOP_L	I/O	
B31	GND	O	Ground
A32	ISHARE	A	PSU/BBU Current Sharing
B32	SYNC_START_L	I/O	PSU/BBU Sync Start
A33	VOUT_SEL	O	PSU/BBU Vout Select
B33	P3V3_shelf	O	3.3V for shelf I2C
A34	GND	O	Ground
B34	ADC0	A	
A35	ADC1	A	
B35	ADC2	A	
A36	ADC3	A	

B36	ADC4	A	
A37	ADC5	A	
B37	ADC6	A	
A38	ADC7	A	
B38	Power_KILL	I	Power Kill, short pin Connected to GND on the shelf.
A39	Missing_Daisy_Chain_Cable	-	Connected between RJ3/4(pin6) and PSU(Pin V1).
B39	RSVD	-	Reserved
A40	P48V_RTN (GND)	I	Ground
B40	P48V_RTN (GND)	I	Ground
A41	NC (clearance)	-	No Connect
B41	NC (clearance)	-	No Connect
A42	P48V_IN	I	48V Power In
B42	P48V_IN	I	48V Power In

3.3 Filtering

In order to meet compliance requirements, including EMC and ESD, the following filters may needed to be included:



3.4 Shelf Position and RS485/CAN termination Select Switches

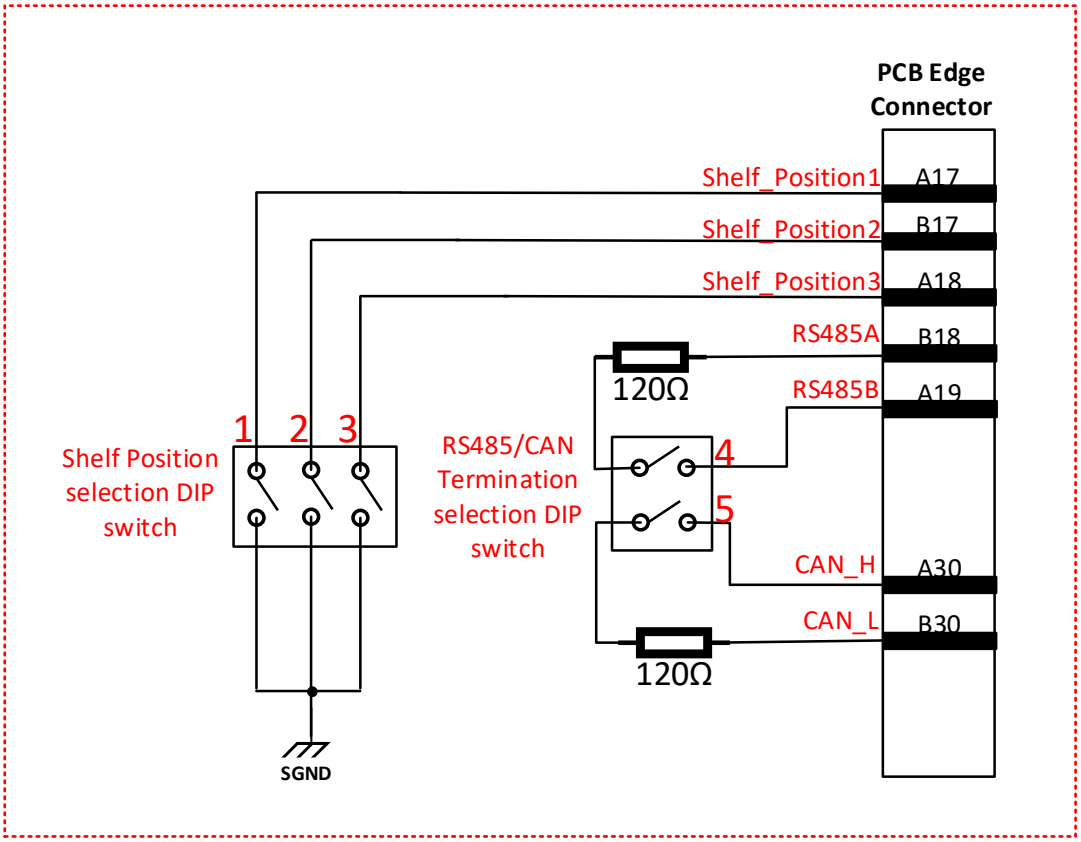
Two sets of small signal DIP switches have been added for the purposes of: 1) Selecting the Modbus address of the shelf based on its position upon installation; 2) Selecting the RS485/CAN termination resistor based on shelf position.

The shelf RS485 address is determined by the settings of SW1-3, following the table below:

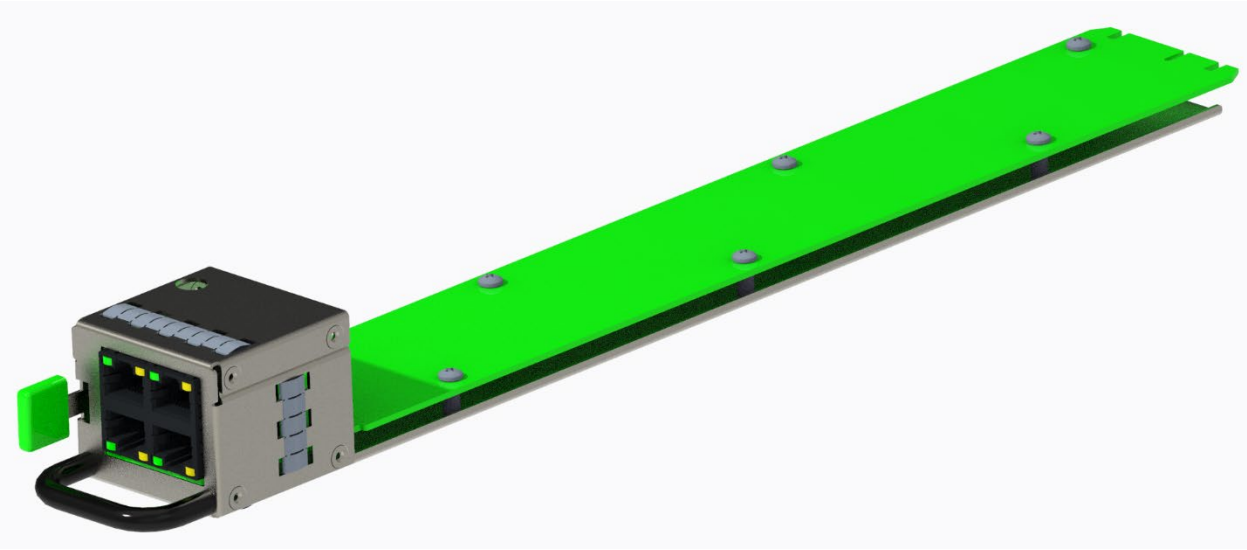
Shelf Position (from the top)	SW1	SW2	SW3
1	0	1	1
2	1	0	1
3	1	1	0

The RS485/CAN termination is determined by the settings of SW4-5, following the table below:

Shelf Position (from the top)	SW4(RS485)	SW5
First shelf (For multi-shelves only)	Open	Close
Last shelf (including single shelf)	Close	Close

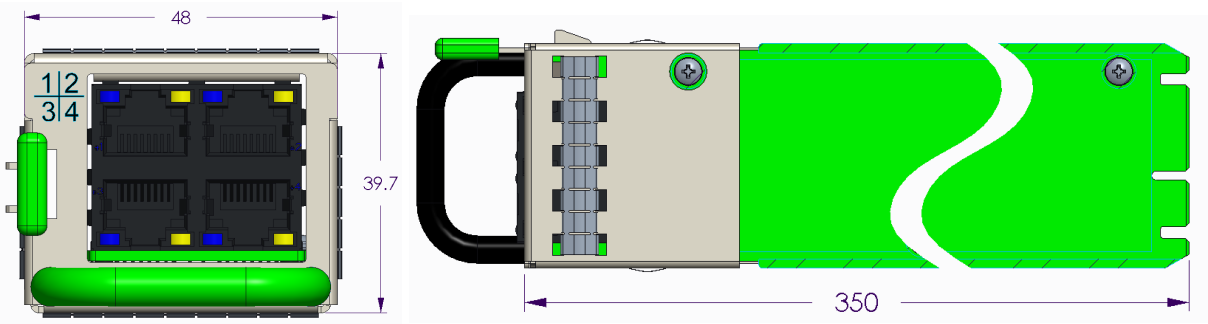


4. Mechanical requirements



4.1 PMI Physical Dimensions

The PMI is 39.7mm x 48mm x 350mm [Width x Height x Depth]



4.2 Construction

The PMI base can be welded, riveted, or screwed together, consistent with meeting shock and vibration requirements. There shall be no sharp corners or edges.

The sheet metal material shall be pre-plated hot-dip zinc coated, with 0.8-1.0mm of thickness.

4.3 Latch and Handle Requirements

A latch and handle are required for PMI removal and installation. The latch shall be attached in the location shown on the mechanical drawing, to interface with the cutout in the chassis. The latch design may vary, but the finger interface of the latch must be Pantone 375C (Green).

The handle is to be designed so it does not interfere with the removal and insertion of cables into the RJ45 connectors. Handle touch points to be Pantone 375C (Green).

4.4 EMI Gaskets

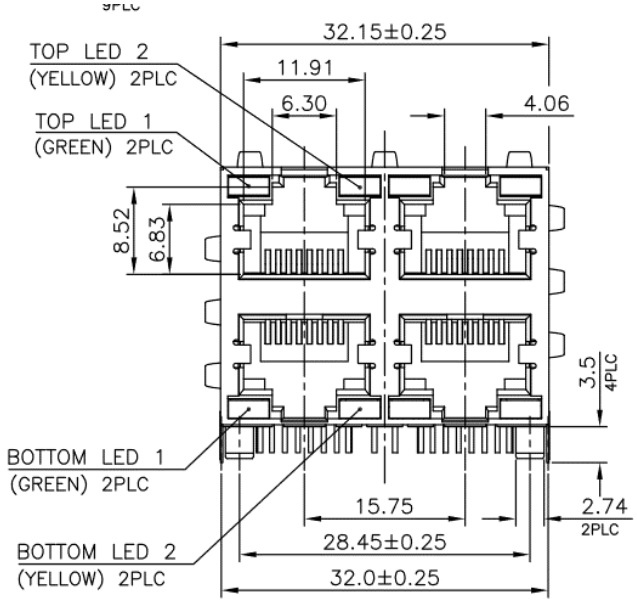
EMI gaskets are to be placed on the left & right and/or top & bottom sides of the PMI. The main purpose of the gaskets is for PMI module to shelf grounding and secondary purpose is for EMI containment. Gaskets are to be placed towards the front of the PMI so they make full contact with the walls of the shelf.

4.5 Labeling & Markings

Markings shall be placed on the front of the PMI module to indicate RJ-45 connector positions. Preferred method is silk screening / pad printing.

4.6 RJ45 Connector

In the front of the PMI, there is a single 4x RJ45 connector. This is a modular jack connector in a 2x2 configuration of RJ45s with LEDs. The MPN shall be TE 2041376-2, Amphenol RJSAE-J384-04 or equivalent. Note that this connector comes with spring fingers. These must contact the PMI chassis in order to provide sufficient EMI sealing.



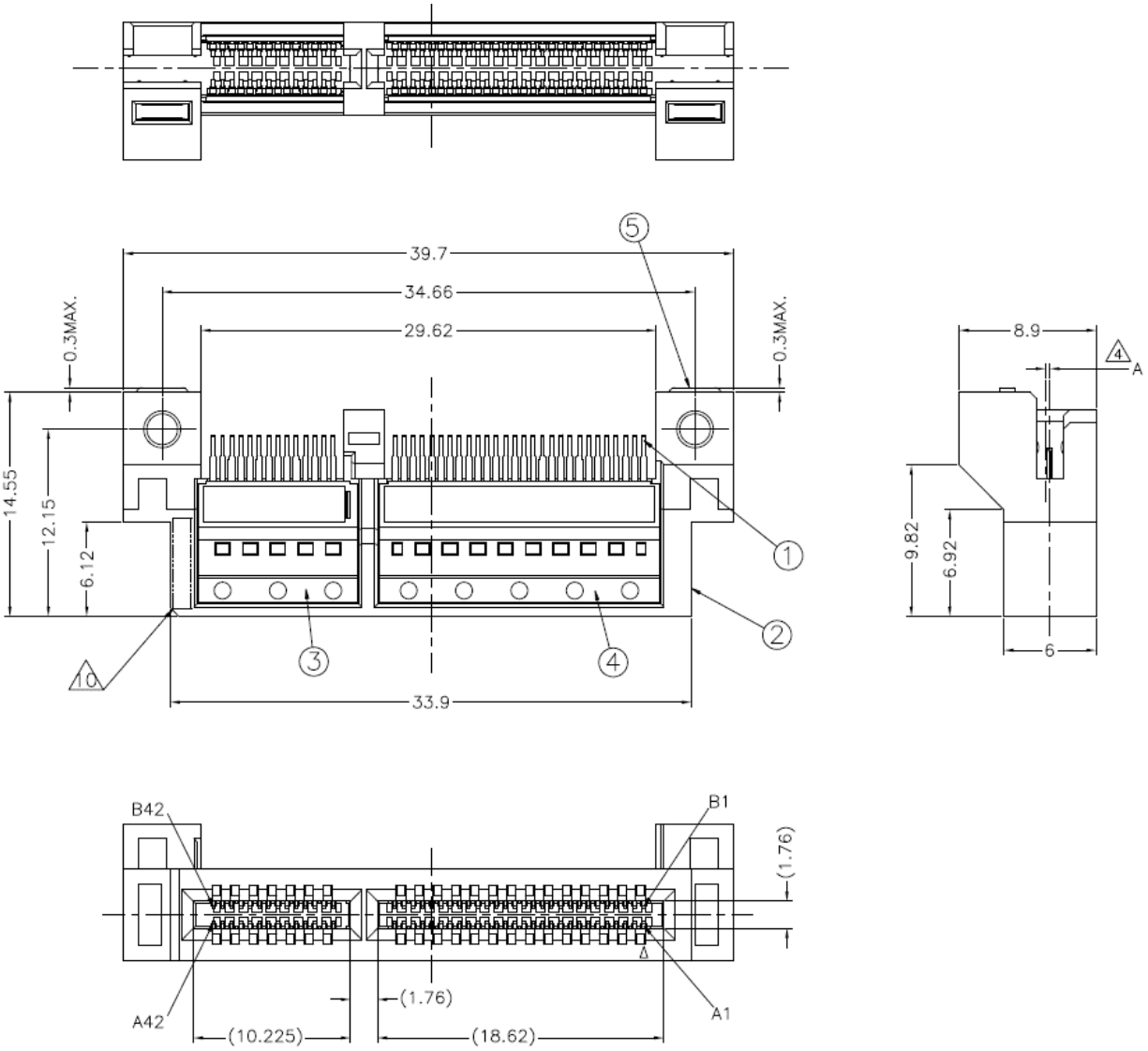


4.7 Blind Mate Connector

The PCB (card edge) of the PMI module blind mates into a 2C connector on the shelf side. The location of this connector is fixed, but the connector itself may either be mounted on a PCB or a panel-mounted cable. There are no specific requirements for the interface of this blind mate connector to the main shelf PCB. Please refer to the ORV3 Power Shelf or ORV3 BBU Shelf specification for more details on this.

Approved connectors are:

- TE Sliver 2340326-01
- Amphenol Mini Cool Edge ME1008413401101
- Molex Edgeline Sliver 2086104157

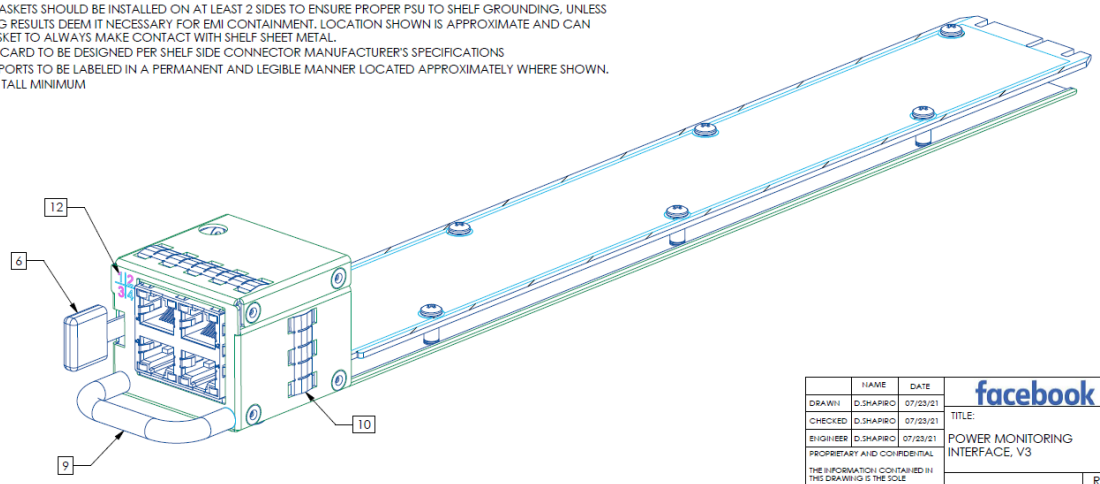

39.7
34.66
29.62
0.3MAX.
0.3MAX.
14.55
12.15
6.12
33.9
8.9
9.82
6.92
6
A
B42
B1
A42
A1
(1.76)
(1.76)
(10.225)
(18.62)

4.8 Mechanical Drawings

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	01	INITIAL RELEASE	D.SHAPIRO	07/23/2021

NOTES:

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-2009.
2. ALL DIMENSIONS ARE IN MM.
3. ALL COMPONENTS SHALL BE UL 94V-0 RECOGNIZED AND ROHS COMPLIANT.
4. CASE MATERIAL SHALL RESIST THE CREATION OF ZINC WHISKERS, SUCH AS ASTM A653 AND JISG3302 SGCC.
5. ALL DIMENSIONS ARE CONSIDERED CRITICAL TO FUNCTION DIMENSIONS AND SHALL BE INCLUDED IN PART QUALIFICATION.
6. LATCH TAB COLOR PANTONE 375C GREEN OR SIMILAR WITH WRITTEN APPROVAL FROM FACEBOOK ENGINEERING. LATCHES MUST HAVE A BACKSTOP TO PREVENT DAMAGE TO LATCH DURING ACTUATION.
7. ALL EDGES SHALL BE CONDITIONED FOR HANDLING WITH INDUSTRY STANDARD BURR NO LARGER THAN 10% OF MATERIAL THICKNESS AND SHALL CONFORM TO UL SAFETY SPECIFICATION 1349.
8. ALL COMPONENTS SHALL BE CLEAN AND FREE OF RUST AND FOREIGN MATERIAL SUCH AS DIRT, OIL, GREASE, OR OTHER CONTAMINANTS.
9. HANDLE DESIGN IS UP TO THE SUPPLIER. MAXIMUM PROTRUSION OF HANDLE PAST FRONT FACE IS 23MM. HANDLE TO BE DESIGNED SO IT DOES NOT INTERFERE WITH INSERTION AND REMOVAL OF CONNECTORS. HANDLE TO BE PANTONE 375C GREEN OR SIMILAR WITH WRITTEN APPROVAL FROM FACEBOOK ENGINEERING.
10. EMI GASKETS SHOULD BE INSTALLED ON AT LEAST 2 SIDES TO ENSURE PROPER PSU TO SHELF GROUNDING, UNLESS EMI TESTING RESULTS DEEM IT NECESSARY FOR EMI CONTAINMENT. LOCATION SHOWN IS APPROXIMATE AND CAN VARY. GASKET TO ALWAYS MAKE CONTACT WITH SHELF SHEET METAL.
11. EDGE CARD TO BE DESIGNED PER SHELF SIDE CONNECTOR MANUFACTURER'S SPECIFICATIONS
12. RJ-45 PORTS TO BE LABELED IN A PERMANENT AND LEGIBLE MANNER LOCATED APPROXIMATELY WHERE SHOWN. TEXT 3 MM TALL MINIMUM



	NAME	DATE
DRAWN	D.SHAPIRO	07/23/21
CHECKED	D.SHAPIRO	07/23/21
ENGINEER	D.SHAPIRO	07/23/21
PROPRIETARY AND CONFIDENTIAL		

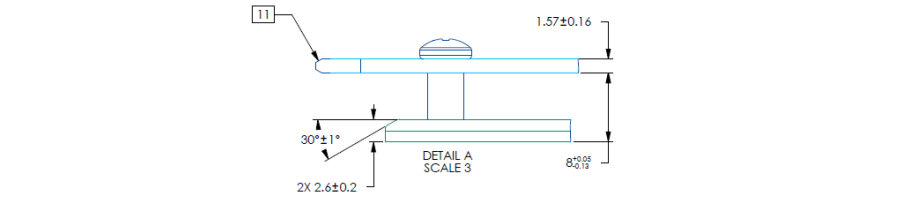
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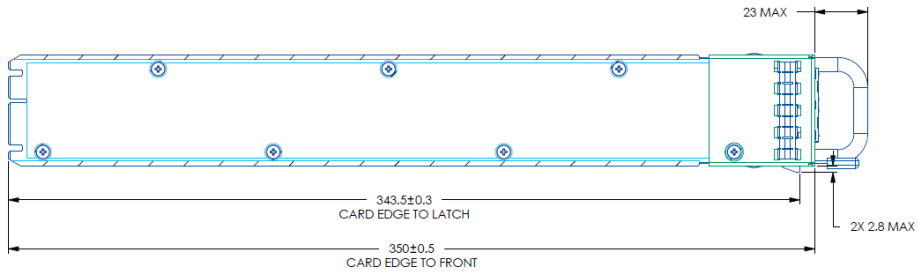
facebook

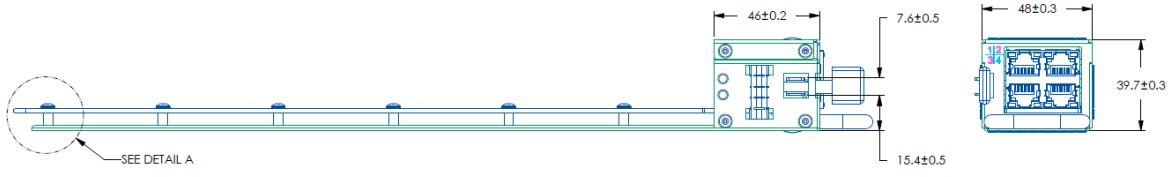
TITLE: POWER MONITORING INTERFACE, V3

TBD | REV 01

THIRD PROJECTION | 1 OF 2







TBD | 2 OF 2

5. Compliance requirements

5.1 Safety Standards

Power/Battery Shelf Management Controller (PMI) shall be tested together in the OCP power shelf and shall comply with all safety requirements specified in OCP Open Rack V3 Power shelf and Battery shelf

Any component or signal that controls charging and discharging battery shall be evaluated under single fault condition per UL62368-1 Annex M

5.2 EMC Requirements

Power/Battery Shelf Management Controller (PMI) shall be tested together in the OCP power shelf and shall comply with all EMC requirements specified in OCP Open Rack V3 Power shelf document.

5.3 Environmental Compliance

Manufacturer of PMI shall provide full material disclosure, and technical documentations to demonstrate compliance to environmental compliance requirements such as ROHS, REACH, WEEE etc, depending on the end user's goals and business need.

5.4 Documentation

Power/Battery Shelf Management Controller (PMI) shall be covered under all documents specified in OCP Open Rack V3 Power shelf document.

6. Serviceability

6.1 Required collateral

Shall include (at minimum) schematics, CAD, block diagrams, I2C diagram, Switch and jumper settings, service/repair/assembly/disassembly instructions (if applicable), LED definitions.

6.2 FRU information

FRU labels will include part number and serial number. FRU SEEPROM shall be per IPMI spec.

6.3 PCB information

PCBs shall have silkscreen markings for jumpers, LEDs, and FRUs.

6.4 Port Symbols

The Management Ethernet connectors shall have the text "MGMT" printed on or the metal stamped "MGMT" near the dedicated network port and include appropriate pictogram, and Sideband RJ45 shall have the text "SB" printed on or the metal stamped "SB" near the dedicated network port and include appropriate pictogram.

6.5 Cold Aisle Repairs

PMI shall be serviced from the Cold Aisle

6.6 Programmable updates

Non-disruptive (no reboot required) update capability is required for all programmable devices. Utilities shall be provided by the Design Partner with the capability to up and down-rev each article of firmware in the equipment.

6.7 Additional Service Requirements

Additional Service requirements may be added based on Safety and Data Center requirements. Contact specification owner for latest requirements.

7. Thermal

7.1 Environmental (operational)

- Cold aisle (inlet) temperature: -5°C to 45°C
- Relative humidity: 10% to 90%, non-condensing
- Altitude: up to 3050m (10,000ft)
- Acoustic noise: If active cooling is required, target sound pressure should not exceed 85dBA when fan modules are running at full speed and operating within the defined environmental envelope.

7.2 Thermal requirements

- Operational
    - Thermal margin: Reserving adequate margins on components is critical. These margins should be defined with respect to de-rated values, as appropriate. Following are the requirements.
        - Component thermal margin of ≥7% or ≥5°C up to 30°C inlet/ambient and 3050m (10,000ft) above sea-level. Target whichever value is larger.
        - Component thermal margin of ≥4% or ≥3°C at greater than 30°C inlet/ambient and up to 3050m (10,000ft) above sea-level. Target whichever value is larger.
        - Margin to de-rated temperatures should account for associated differences in reading and measurement location. Impact to reliability should also be considered when determining required margin.
- Thermal kit
    - Sensor accuracy: For discrete and critical sensors (such as ambient temperature), an accuracy of ≤±2°C is required (≤±1°C is preferred). If a component does not have an integrated temperature sensor, and uses a proxy, need to target an accuracy ≤±5°C (≤±2°C is preferred). If this component is temperature sensitive, thermal margin requirements defined above should account for sensor inaccuracy.
    - System fan (if required): Should be sized to support operation across environmental and loading envelopes, with an adequate operating range (speed) to achieve requirements outlined in this document. The fan should also have adequate overhead to accommodate back-pressure resulting from shelf design, rack-level accessories and data center operation. In general, head room to overcome a back-pressure of ≥ 0.3 inches of water is highly recommended. This does not take in to account impedance created at the front of the shelf to entrain airflow in the PMI (if required). In addition, to ensure thermally-efficient operation, airflow greater than 5CFM should be avoided.
    - Surface temperature: To make the PMI safe for handling in-operation, accessible surfaces should not exceed a temperature of 70°C.

8. Vibration and Shock (non-packaged)

The PMI/PMC Module shall meet vibration and shock test per EN 60068-2-6 and 60068-2-27respectively and is to be performed at system shelf level (i.e. power shelf installed with PSUs and PMI/PMC module).

Please refer to section 7.1 of ORV3 Power shelf specifications.

9. Package Vibration, Drop and Compression

PMI/PMC Modules units in their package shall meet the following requirements:

Package Vibration	1.146 G_{rms}, 2-200-2 Hz, all three axes, Random Vibe	ISTA 3E 06-06
Package Drop	8-inch drop	ISTA 3E 06-06
Package Compression	Maximum compression loading on a bulk pack	ASTM D 642-94