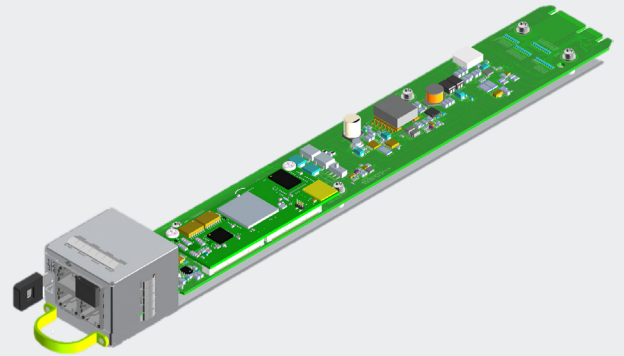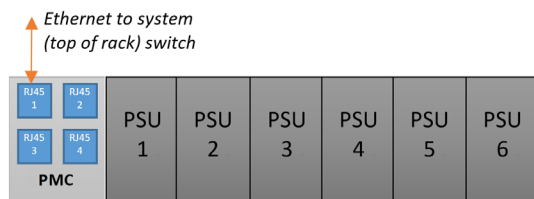# ARTESYN
ORV3 18 kW PMC Phase 2
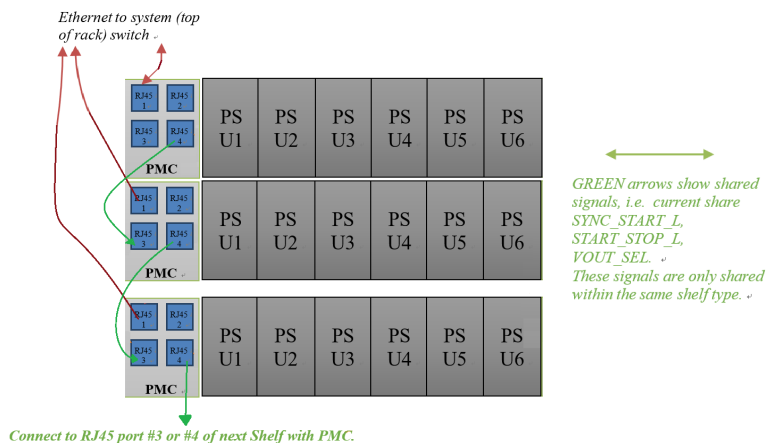
For ORv3 18 kW PMC Phase 2 Power Shelf

Advanced Energy's ORv3 18 kW PMC phase 2 Power Management Controller (PMC) is a hot-pluggable controller in the shelf that monitors and facilitates the power supply units through a 10/100/1000MB Base-T Ethernet port and can be connected directly to the rack switch. The PMC communicates with PSUs in the shelf through its backplane connector. The front connector provides one Ethernet port and one RS232 port for debugging.

The PMC is connected via Ethernet to a switch (normally the top of rack controller/switch) and up to 6 PSUs are monitored.

Multiple PSU shelves with one PMC per shelf connected:

GREEN arrows show shared signals, i.e. current share SYNC_START_L, START_STOP_L, VOUT_SEL.
These signals are only shared within the same shelf type.

Connect to RJ45 port #3 or #4 of next Shelf with PMC.

AT A GLANCE

Typical Application

Control and Monitoring of ORv3 18 kW PMC phase 2 Power Shelf

Input Voltage

Provided by 18 kW PMC phase 2 Power Shelf or PoE Connection to RJ45 Connector

Connector

4 x RJ45 Connectors

Communication Protocol

Redfish

ELECTRICAL SPECIFICATIONS

System on Module (SOM) Core

All Advanced Energy current generation shelf and PMCs utilize a shared SOM that fits onto a customer carrier. The SOM provides the core processing functionality along with storage. Communications from the SOM are routed by the carrier board which provides the mechanical form factor and connections for different shelves.

PMC Carrier

The SOM is mounted on a carrier card that provides the connection between the SOM and the rest of the system.

As per OCP Shelf Specs, the 48 V/51 V return (negative) should NOT be grounded to the power shelf/PMC frame.

PMC Carrier FRU

The PMC supports a 64 kb EEPROM for storage of manufacturing data.

3.3 VDC Output

The PMC supports a 3.3 V power output from the edge connector to support the backplane FRU device.

This output supports 3.3 V operation at up to 5 mA.

Input Voltage

The input voltage is provided by 18 kW power shelf.

The PMC can also be powered alternately through PoE (802.3at, Type 1) through RJ45 Port #1.

The PMC should draw no more than 7 W when at absolute full performance.

PMC Revision ID

The PMC supports reading of a 3-bit PCB revision using GPIOs on the AST2600 processor. Revisions are set using strapping resistors. The purpose of the ID bits is to communicate to firmware the identity of the PMC in the event that different PMC variants will require different firmware features to be enabled or disabled. The ID should be incremented with each non-interchangeable variant of the PMC.

ID	Description
000	PMC STD 18 kW / Phase 2
001	PMC STD 33 kW
010	PMC STD 72 kW
011	Reserved
100	Reserved
101	Reserved
110	Reserved
111	Reserved

Miscellaneous Peripherals

Item	Description
I^2C for Internal EEPROM	The PMC supports one I^2C bus connection to the PMC carrier FRU.
I^2C for Shelf EEPROM	The PMC supports one I^2C bus connection to the PSU shelf FRU.

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ELECTRICAL SPECIFICATIONS

Front Panel RS232 Connection

A debug RS232 connection is provided out the front panel on RJ45 port 3.

Hot Plug

The PMC is hot-pluggable. It can be removed and inserted without causing interference to the behavior of the shelf or any incorrect alerts or errors to be recorded. When inserted, the PMC will interface with the shelf and assume any defined functionality once synchronized with the PSUs.

LEDs

The design contains the following LEDs to indicate the functional status.

The power LED indicates that all of the power rails on the PMC are good. The LED is visible on the front bulkhead of the assembly.

The attention LED indicates that a fault has been detected on the PMC. The LED is controlled by GPIO on the AST2600 and is visible on the front bulkhead of the assembly.

LED Name	Color	Description
Power LED	Blue	Indicates power status of the PMC
Attention	Amber	Indicates that a fault has occurred.

LAN Reset

The PMC provides a LAN reset option. This feature allows the user to reset the IP Address to default (192.168.0.120/24).

The LAN Reset can be triggered through an RS232 debug port command.

Debug/Multi-shelf Mode Switch

The PMC provides a DPDT switch to configure RJ45 Port #3 as an RS232 debug port or as an Ishare daisy-chaining port for multi-shelf applications. The switch is set to the multi-shelf application mode by default. It can be mechanically switched to debug mode if necessary.

PMC CONNECTORS

RJ45 Connectors

The PMC contains four RJ45 connectors located on the bulkhead of the assembly. The RJ45 location is 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.

The pinouts of the four connectors are shown below.

RJ45#1 - Ethernet (10/100/1000 MB Base-T) and Power over Ethernet (PoE)

This connector is compatible with both 802.3af Mode A and Mode B.

Pin #	Wire Color	Function	I/O	Description
1	White/Orange	TRD_D1+	I/O	Bi-directional Data +/PoE DC+
2	Orange	TRD_D1-	I/O	Bi-directional Data -/PoE DC+
3	White/Green	TRD_D2+	I/O	Bi-directional Data +/PoE DC-
4	Blue	TRD_D3+	I/O	Bi-directional Data + /PoE DC +
5	White/Blue	TRD_D3-	I/O	Bi-directional Data - /PoE DC +
6	Green	TRD_D2-	I/O	Bi-directional Data -/PoE DC-
7	White/Brown	TRD_D4+	I/O	Bi-directional Data +/PoE DC -
8	Brown	TRD_D4-	I/O	Bi-directional Data -/PoE DC -

RJ45#2 - Reserved for internal only

RJ45#3 - RS232 Debug/Multi-shelf

This provides a serial debug connection to the command line of the PMC. Pin#1 and #2 are multiplexed using a DPDT switch. See details below. This provides feature to daisy-chain with Port#3 and #4 of multi-shelf PMCs.

Pin #	Wire Color	Function (Debug Mode)	Function (Multi-shelf Mode)	I/O	Description
1	White/Orange	GND	ISHARE	I/O	Dual function pin
2	Orange	DEBUG_RX	GND	I/O	Dual function pin
3	White/Green	SYNC_START_L	SYNC_START_L	I/O	Multi-shelf pin
4	Blue	VOUT_SEL	VOUT_SEL	I/O	Multi-shelf pin
5	White/Blue	SYNC_STOP_L	SYNC_STOP_L	I/O	Multi-shelf pin
6	Green	DEBUG_TX	DEBUG_TX	O	Debug signal
7	White/Brown	CAN_H	CAN_H	I/O	Multi-shelf pin
8	Brown	CAN_L	CAN_L	I/O	Multi-shelf pin

RJ45#4 - Multi-shelf

This provides feature to daisy-chain with Port#3 and #4 of multi-shelf PMCs.

Pin #	Wire Color	Function	I/O	Description
1	White/Orange	ISHARE	A	Multi-shelf pin
2	Orange	GND	-	-
3	White/Green	SYNC_START_L	I/O	Multi-shelf pin
4	Blue	VOUT_SEL	O	Multi-shelf pin
5	White/Blue	SYNC_STOP_L	I/O	Multi-shelf pin
6	Green	RSVD	-	-
7	White/Brown	CAN_H	I/O	Multi-shelf pin
8	Brown	CAN_L	I/O	Multi-shelf pin

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PMC CONNECTORS

Backplane Shelf Edge Connector

There are several signals on the edge connector. All other signals are routed in the power shelf backplanes. Below is the PMC backplant pinouts:

Pin #	Signal Name	I/O	Description	Pin #	Signal Name	I/O	Description
A1	ADDR_ID_0	I	000 = 1U power shelf	A18	RS485_Addr2	O	PSU Modbus Address
B1	ADDR_ID_1	I	001 = BBU	B18	RS485A	I/O	Shared PSU Modbus
A2	ADDR_ID_2	I	111 = RSV	A19	RS485B	I/O	Shared PSU Modbus
B2	GND	I	Ground	B19	I2C_SDA_0	I/O	PSU #0 PMBus
A3	ALERT_0_N	I	PSU Alert	A20	I2C_CLK_0	I/O	PSU #0 PMBus
B3	ALERT_1_N	I	PSU Alert	B20	I2C_SDA_1	I/O	PSU #1 PMBus
A4	ALERT_2_N	I	PSU Alert	A21	I2C_CLK_1	I/O	PSU #1 PMBus
B4	ALERT_3_N	I	PSU Alert	B21	I2C_SDA_2	I/O	PSU #2 PMBus
A5	ALERT_4_N	I	PSU Alert	A22	I2C_CLK_2	I/O	PSU #2 PMBus
B5	ALERT_5_N	I	PSU Alert	B22	I2C_SDA_3	I/O	PSU #3 PMBus
A6	ALERT_6_N	I	PSU Alert	A23	I2C_CLK_3	I/O	PSU #3 PMBus
B6	ALERT_7_N	I	PSU Alert	B23	I2C_SDA_4	I/O	PSU #4 PMBus
A7	ALERT_8_N	I	PSU Alert	A24	I2C_CLK_4	I/O	PSU #4 PMBus
B7	ALERT_9_N	I	PSU Alert	B24	I2C_SDA_5	I/O	PSU #5 PMBus
A8	ALERT_10_N	I	PSU Alert	A25	I2C_CLK_5	I/O	PSU #5 PMBus
B8	ALERT_11_N	I	PSU Alert	B25	I2C_SDA_shelf	I/O	I2C data for Shelf FRU
A9	GND	I	Ground	A26	I2C_CLK_shelf	O	I2C clock for Shelf FRU
B9	RESET_0	O	PSU Reset	B26	GPIO2	I/O	
A10	RESET_1	O	PSU Reset	A27	GPIO3	I/O	
B10	RESET_2	O	PSU Reset	B27	GPIO4	I/O	
A11	RESET_3	O	PSU Reset	A28	GPIO5	I/O	
B11	RESET_4	O	PSU Reset	B28	GPIO6	I/O	
A12	RESET_5	O	PSU Reset	A29	GPIO7	I/O	
B12	RESET_6	O	PSU Reset	B29	GPIO8	I/O	
A13	RESET_7	O	PSU Reset	A30	CAN_H	I/O	
B13	RESET_8	O	PSU Reset	B30	CAN_L	I/O	
A14	RESET_9	O	PSU Reset	A31	SYNC_STOP_L	I/O	
B14	RESET_10	O	PSU Reset	B31	GND	O	Ground
A15	RESET_11	O	PSU Reset	A32	ISHARE	A	PSU Current Sharing
B15	GND	I	Ground	B32	SYNC_START_L	I/O	PSU Sync Start
A16	PLS	I	PSU Power Loss Siren	A33	VOUT_SEL	O	PSU Vout Select
B16	BKP	I	PSU BKP	B33	P3V3_Shelf	O	3.3 V for Shelf I2C
A17	RS485_Addr0	O	PSU MODBUS address	A34	GND	O	Ground
B17	RS485_Addr1	O	PSU MODBUS address	B34	ADC0	A	

Note 1: Requires external pull-up 10 kohm resistor.

PMC CONNECTORS CON'T

Pin #	Signal Name	I/O	Description	Pin #	Signal Name	I/O	Description
A35	ADC1	A		A39	RSVD	-	Reserved
B35	ADC2	A		B39	RSVD	-	Reserved
A36	ADC3	A		A40	P48V_RTN (GND)	I	Ground
B36	ADC4	A		B40	P48V_RTN (GND)	I	Ground
A37	ADC5	A		A41	NC (Clearance)	-	No Connect
B37	ADC6	A		B41	NC (Clearance)	-	No Connect
A38	ADC7	A		A42	P48V_IN	I	48V Power In
B38	Power_Kill	I	Power Kill, Short Pin Connected to GND on the shelf	B42	P48V_IN	I	48V Power In

PMC SOFTWARE

The PMC software runs on Yocto Linux combining open source packages with customized driver and application software.

PMC Boot and Software/Firmware Update

Update via Redfish

The PMC software allows updating all images in the system via the Redfish update service. These images include:

· uBoot images

· Kernel

· PMC application software

· PSU firmware images

The new image can be downloaded (uBoot, Kernel Image, and the PMC application software) while simutaneous maintaining full functionality of the power shelf. The new image is booted and becomes active after a power cycle.

Firmware Rollback

After updating the PMC firmware, it is possible to rollback to the previous FW version. This is done automatically if the new images fail to boot.

PMC Connected Shelf Monitoring

Redundancy Status

The number of active power supplies is detected at startup. It will signal a status via Redfish if the available number drops below the detected count.

Communication Fault

The PMC will indicate through the attention LED if there is a communication error between the PMC and PSUs.

Advanced Energy

PMC SOFTWARE CON'T

PMC System Communications

RedFish

The system provides a full Redfish interface aligned with the Redfish 2021.4 version. Where functionality is not available in Redfish, OEM extensions may be used. OEM extensions appear under the OEM name Advanced Energy.

Redfish is available over HTTP or HTTPS, but HTTP is disabled by default in the configuration. HTTPS certificates are self-signed.

SSH/Command Line Interface and Tools

The system provides a Linux command line with a standard set of configurations, diagnostic and debug tools.

Other PMC Functionality

Network Configuration

The PMC can be addressed through both Static and Dynamic IP Addresses.

The Static IP Address, Subnet Mask, and Gateway IP Address can be configured either via Redfish or the command line.

The Dynamic IP Address is automatically assigned by a DHCP server of the PMC's network.

Logging

The PMC logs and stores the following logs and contents.

- PMC Logs
  - o PMC Software Update
  - o PSU Software Update
  - o PMC Reset
  - o PMC Resource Added (PMC Vesions on Power Up)
  - o Shelf Resource Added
  - o PSU Resource Added (Detected PSU Versions)
- Power Shelf Logs
  - o Redundancy Faults
- Power Supply Logs
  - o Input Under/Over Voltage
  - o Input Over Current/Short Cuircuit
  - o Input Over Power
  - o Output Under/Over Voltage
  - o Output Over Current/Short Cuircuit
  - o Output OVer Power
  - o Inlet Over Temperature
  - o Outlet Over Temperature
  - o Fan Fault
- Power Supply Blackbox Contents
  - o Refer to Power Supply Specifications for details

The logs can be read via Redfish. The last 100 logged events are stored. Older events than the required is automatically overridden with newer events.

PMC SOFTWARE CON'T

FRU Information

The PMC and shelf FRU information can be read from Redfish via Entity Collection details endpoints.

End users will not be able to modify the PMC and Shelf FRU contents, and a separate utility shall be used at the Factory to write the FRU information.

End users will be provided though with an FRU space where they can write user writeable FRU information.

The Redfish endpoint shall be available on the OEM Collection.

- Base Component
  - Asset Tag
  - Software Version
  - Product Name
  - Part Number
  - Serial Number
  - Manufacturing Date
  - Customer Part Number
  - Manufacturer
  - Manufacturing Location
  - Hardware Version
- Sub-Component 1
  - Asset Tag
  - Software Version
  - Product Name
  - Part Number
  - Serial Number
  - Manufacturing Date
  - Customer Part Number
  - Manufacturer
  - Manufacturing Location
  - Hardware Version
- Sub-Component 2
  - Asset Tag
  - Software Version
  - Product Name
  - Part Number
  - Serial Number
  - Manufacturing Date
  - Customer Part Number
  - Manufacturer
  - Manufacturing Location
  - Hardware Version

Shelf Interface ID (SW)

The PMC supports reading of a 3-bit interface ID.

ID	Description
000	1U power shelf
001	2U BBU shelf
010	Reserved
011	Reserved
100	Reserved
101	Reserved
110	Reserved
111	Reserved

SECURITY

Accounts Security

Authentication

Access via Redfish is protected by at least Basic Authentication (Username and Password).

User management endpoints are provided to allow creation, update, and deletion of authenticated users.

Authenticated users are classified into three types depending on the level of access/control they are allowed on the system

- Administrator
  - o   Can create, read, update, delete resources
  - o   Can activate actions
- Operator
  - o   Can read resources
  - o   Can activate actions
- Read Only User
  - o   Can read resources

Passwords

Password must meet the minimum password length of at least 8 characters. They are stored as salted hash values to limit the risk when accidentally leaked. A one-time process requires the administrator user to change the password upon initial powerup before they are allowed to access the rest of authenticated endpoints.

The Redfish administrator username and password can be reverted back to factory default by physically connecting to the device via the Debug Interface.

Application Security

Redfish

HTTPS is the main transport protocol of Redfish. HTTP is disabled by default but can be enabled via Redfish when the user desire.

The HTTPS is supplied with a self-signed TLS certificate, but the user may opt to supply their own TLS certificate for added security. (Option to supply own certificate for future development).
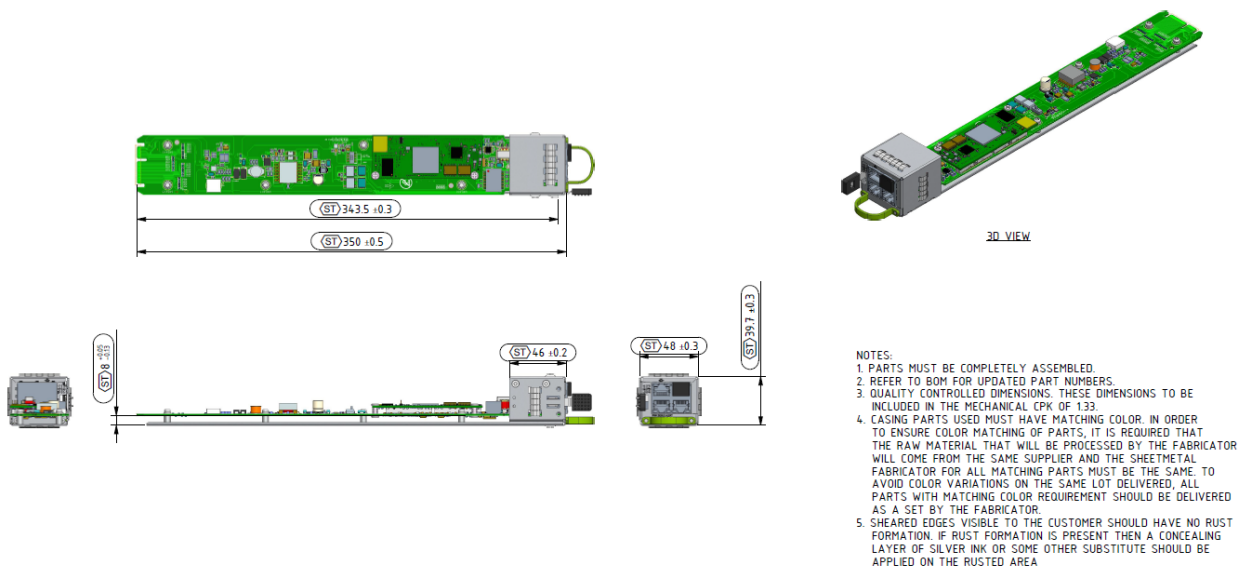
SSH

SSH is disabled by default but can be enabled via Redfish when the user desire. SSH can only be accessed by an authenticated user and will be logged as non-root user to limit access.

Debug Interface

A command line interface is provided to allow user perform basic operations. The command line interface can only be accessed by having physical access to the debug port. Only authenticated users can perform operations and will be logged as non-root users to limit access.
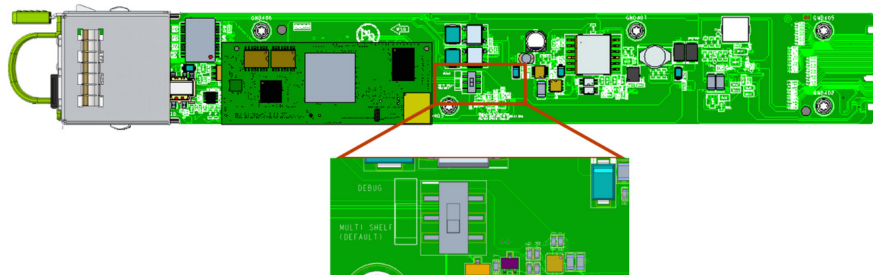
MECHANICAL DRAWING

Mechanical Drawing Unit: mm

3D VIEW

NOTES:
1. PARTS MUST BE COMPLETELY ASSEMBLED.
2. REFER TO BOM FOR UPDATED PART NUMBERS.
3. QUALITY CONTROLLED DIMENSIONS. THESE DIMENSIONS TO BE INCLUDED IN THE MECHANICAL CPK OF 1.33.
4. CASING PARTS USED MUST HAVE MATCHING COLOR. IN ORDER TO ENSURE COLOR MATCHING OF PARTS, IT IS REQUIRED THAT THE RAW MATERIAL THAT WILL BE PROCESSED BY THE FABRICATOR WILL COME FROM THE SAME SUPPLIER AND THE SHEETMETAL FABRICATOR FOR ALL MATCHING PARTS MUST BE THE SAME. TO AVOID COLOR VARIATIONS ON THE SAME LOT DELIVERED, ALL PARTS WITH MATCHING COLOR REQUIREMENT SHOULD BE DELIVERED AS A SET BY THE FABRICATOR.
5. SHEARED EDGES VISIBLE TO THE CUSTOMER SHOULD HAVE NO RUST FORMATION. IF RUST FORMATION IS PRESENT THEN A CONCEALING LAYER OF SILVER INK OR SOME OTHER SUBSTITUTE SHOULD BE APPLIED ON THE RUSTED AREA

DPDT Switch

The DPDT slide-type switch is required to change the front RJ45 Port#3 connector between multi-shelf mode and RS232 debug mode. The switch is in default position (multi-shelf mode) per silkscreen guide prior to shipment as below. Switch to opposite side for RS232 debug mode.

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MECHANICAL DRAWING

RJ45 Connector

The MPN is TE 2041376-2 or equivalent. The connectors come with spring fingers. They must contact the chassis in order to provide good EMI sealing. The reserved port 2# should be plugged with a connector cap.
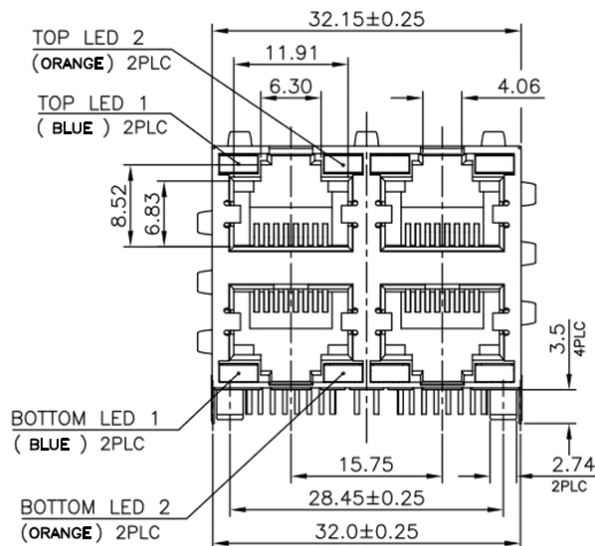
Blind Mate

The PCB (card edge) of the PMC module plugs into a 2C connector on the chassis side. This connector should be a TE Sliver 2.0 Straddle Mount cable or PCB-mounted connector, TE 2340326-1 or equivalent, and can be customized for the particular power shelf.

ORV3 18 kW PMC Phase 2
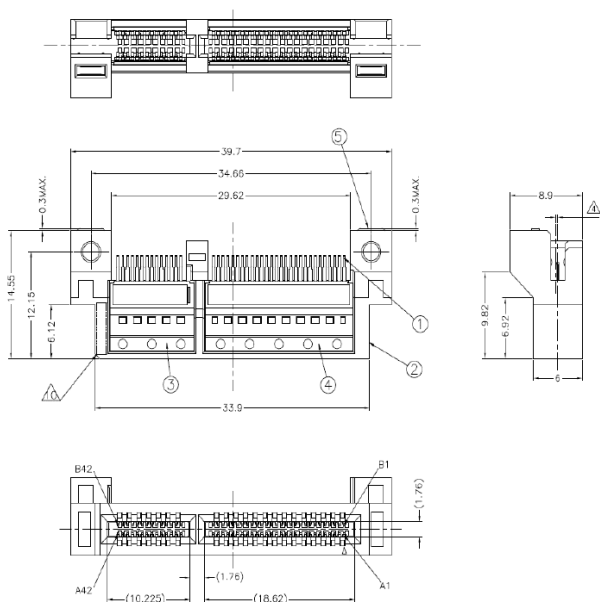
SERVICEABILITY

FRU Information

FRU labels include part number and serial number.

MAC Address Information

The MAC address labels include MAC OID D8:97:3B prefix, and are unique on every unit, and at least a QR code label is to be provided.

Default Static IP Address

The default static IP address should be included on the label. Default static IP address is "192.168.0.120/24" across all units.

LED Information

Power Status LED

One bi-color LED (blue and AMBER 602 to 610 nm) is incorporated into the front face plate of equipment indicating the power-on, power-off & standby states as follows:

RJ45#3 Blue LED	RJ45#3 Amber LED	Description
Off	Off	No power
On	Off	Normal, shelf powered
Blinking	Off	Normal, PoE powered
On/Blinking	On	Attention (Comms Fault, Redundancy Loss)
On/Blinking	Blinking	PMC SW update fault
Off	Blinking	PMC shelf detection fault

Management Ethernet Port LED

Two separate blue LEDs are incorporated into the front face plate of equipment for the management Ethernet port to indicate activity and speed as follows:

RJ45#1 Blue LED Activity	RJ45#1 Amber LED Speed	Description
Off	Off	No ethernet connection
On	Off/On	Link established
Blinking	Off/On	Transmitting
On/Blinking	Off	10/100 Mbps speed
On/Blinking	On	1000 Mbps speed

Cold Aisle Repairs

PMC should be serviced from the cold aisle.

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ENVIRONMENTAL SPECIFICATIONS

Thermals

Thermal specification should match OCP spec (PMI and PMC) - ORv3 PMI spec v1.0 section 7.

Environmental

Operational:

- Cold aisle (inlet) temperature: -5ºC to 45ºC
- Relative humidity: 10% to 90%, non-condensing
- Altitude: up to 3050m (10,000ft)

Thermal Requirements

Operational:

Reserving adequate thermal margins on components is critical. These margins should be defined with respect to de-rated values, as appropriate.

Thermal Margin Requirements
Component thermal margin of ≥7% or ≥5ºC up to 30ºC inlet/ambient and 3050m (10,000ft) above sea-level. Target whichever value is larger.
Component thermal margin of ≥4% or ≥3ºC at greater than 30ºC 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.

Themal Kit:

- To target an accuracy of ≤±5ºC (≤±2ºC is preferred), if this component is temperature sensitive, thermal margin requirements defined above should account for sensor inaccuracy for a temperature sensitive component.
- Surface temperature: To make the PMC safe for handling in-operation, accessible surfaces shoud not exceed a temperature of 70ºC.

The PMC should operate within a standard "OCPv3 21" rack with 10 to 35ºC ambient with no active cooling

Vibration and Shock

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

Safety Standards

Power Management Controller (PMC) is tested together in the OCP ORv3 18 kW PMC phase 2 power shelf and complies with all safety requirements specified in OCP Open Rack V3 18 kW PMC phase 2 power shelf.

EMC Requirements

Power Management Controller (PMC) is tested together in the OCP power shelf and complies with all EMC requirements specified in OCP Open Rack V3 Power shelf document when PMC runs in a normal operation mode.

Environmental Compliance

Full material disclosure, and technical documentation to demonstrate compliance to environmental requirements such as ROHS, REACH, WEEE etc, can be provided depending on user's goals and business need.

ORDERING INFORMATION

Model	Description
700-015798-0200	Standard ORV3 18 kW PMC Phase 2

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than four decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

PRECISION | POWER | PERFORMANCE | TRUST

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