ARTESYN FCM33K 1OU OPEN RACK POWER SHELF

33 kW (6 individual output at 5.5 kW, 49 V)

Advanced Energy's Artesyn™ introduces FCM33K, a 1OU, 33 kW power shelf that converts the incoming supply voltage into six individual 49 VDC outputs. The shelf accommodates six 5.5 kW hot-swappable single-phase PSU modules. The power shelf inputs have 2 AC feeds that only accept line-to-line connection without provision for a neutral wire (3P, 3W + PE). Each AC feed supplies power to 3 AC-DC power supply units. The power shelf includes a slot for hot-pluggable Power Management Module for single shelf and multi-shelf communications and control. This power shelf is typically used for compute and storage applications that require reliable power and optional battery backup. It can also be used for industrial applications.

KEY FEATURES

- 33 kW total power with 6 individual output at 5.5 kW, 49 VDC
- Highly accurate droop + active current sharing
- Houses 6 x 5.5 kW power modules
- Very high efficiency
- Accepts three-phase delta 4-wire input configuration

COMPLIANCE

- EN 61000-4-2 Cat-A for surges
- EN 61000-3-2 Class-A for harmonics
- EN55022, FCC Part 15, CISPR 22, Class-A for EMC

SAFETY

- EN 62368-1
- UL 62368-1
- IEC 62368-1

AT A GLANCE

Total Output Power

33 kW

Input Voltage

Nominal Ranges:
208 to 230 VAC 3ϕ 3-wire + PE
(L1 + L2 + L3 + PE)

Output Voltage

49 VDC

Mechanical Dimensions

720 x 537 x 46 mm (L x W x H)

Operating Temperature

-5°C to +45°C

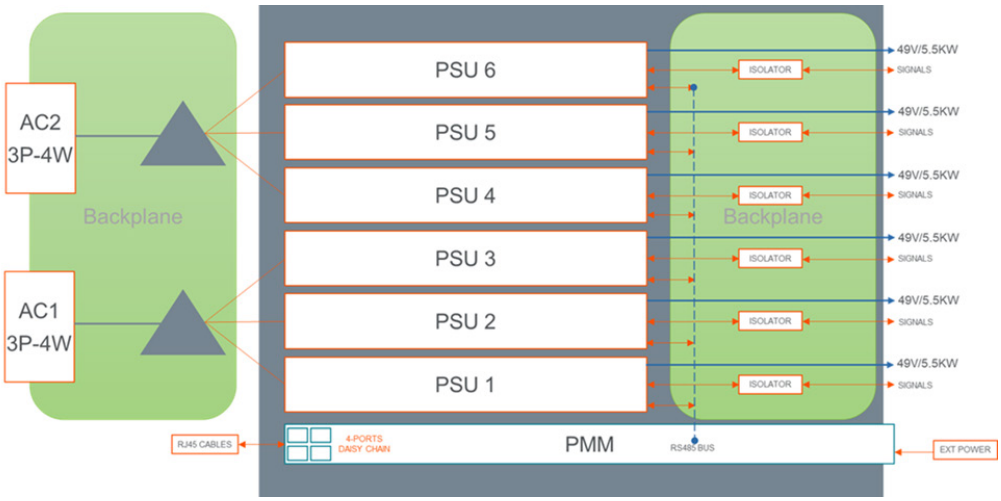
ELECTRICAL SPECIFICATIONS

INPUT				
Input Voltage (3P, 3-wire + PE), Line to Line	MIN	NOM	MAX	UNIT
Full Input Range (with output power derating at lower range)	180	208/230	264	VAC
At Rated Output Power (5.5 kW per module)	190	208/230	264	VAC
OUTPUT				
	MIN	NOM	MAX	UNIT
Set Point VDC (no Load)	49.10	49.15	49.20	VDC
Output Voltage Regulation	-	-	150	mV
Output Power	-	-	5.5	kW
Ripple & Noise (@ 20 MHz BW)[1]	-	-	500	mVpp

Note 1: Measured with a 0.1 mF capacitor connected to the probe tip

POWER SHELF INPUT CONFIGURATION

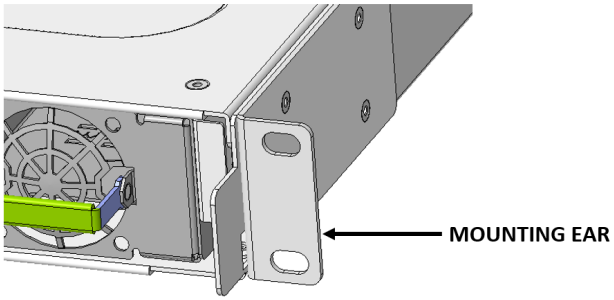
The following section explains the input configuration of the power shelf:
Power Shelf for 6 x 5.5 kW PSU with dual cord (2 x 30 A NEC or 32 A IEC breaker upstream)
1OU shelf with two AC power input
6 x 5.5 kW rectifier slots
Output power: 33 kW (6 individual output at 5.5 kW, 49 V)
Direct connect to tap-boxes/facility - no intermediate PDU



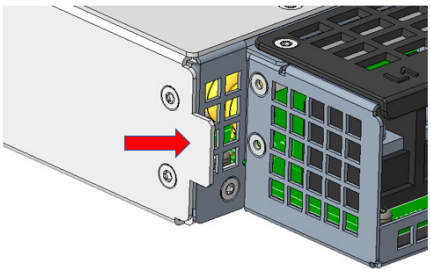
MECHANICAL

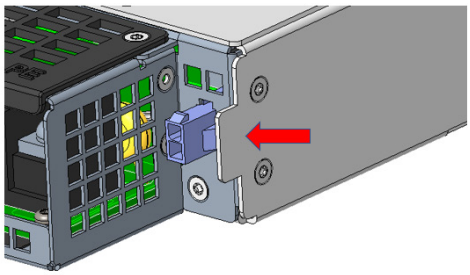
Rack Mounting Features

- Mounting Ear



- Rear Stop





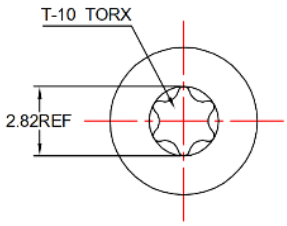
Shelf Screw Details

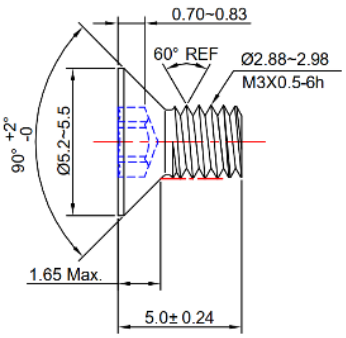
Head Type: Flat countersunk head with Torx T-10

Material: Low carbon steel SWRCH18A (Refer to JIS H 3507)

Finish: Zinc plated with blue trivalent chromate conversion coating

Minimum breaking torque: 10.5 kgf-cm



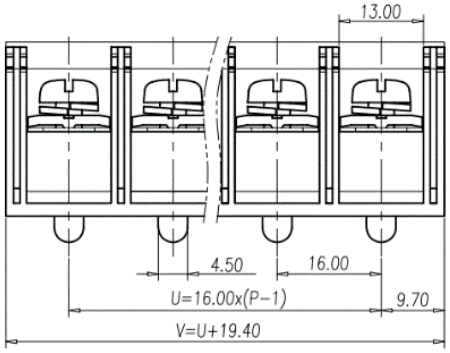


MECHANICAL

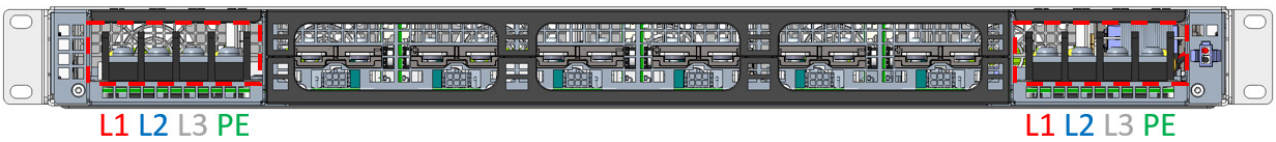
Connector Details

■ **AC Input Terminal Block**

The power shelf has two AC input terminal blocks on the left and right rear of the shelf. Terminal block VPN: 0166-8004C from Vendor: DINKLE.



Recommended terminal lug should be suitable for M5 screw with outer width/diameter of <13 mm to fit inside housing. Additionally, the lug must support a maximum screw tightening torque of 2.4 N·m

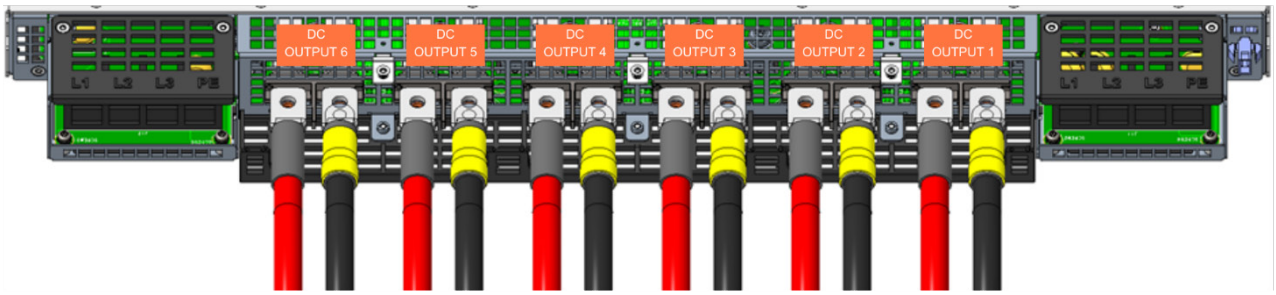


■ **AC Input Connection Wiring**

Each AC input feed accommodates 3-Phase + PE line-to-line configuration, without Neutral connection. The terminals are rated for up to 600 V/100 A.

■ **DC Output Connector**

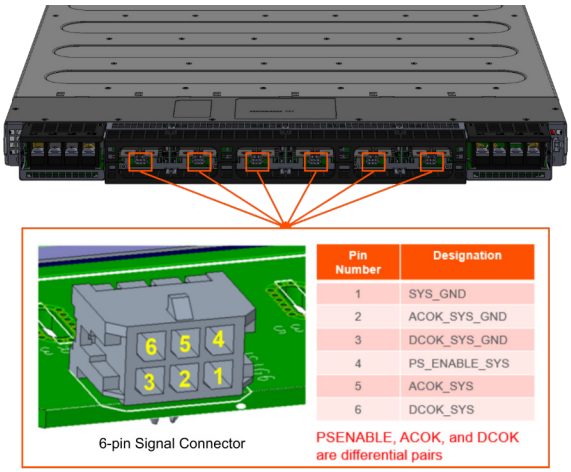
The power shelf has 6 DC output terminals, which correspond to the number of power supply modules inserted. Recommended terminal lug should be suitable for AWG #2 cables with M5 screw.



MECHANICAL

■ Isolated PSU Enable, ACOK, and DCOK Signals

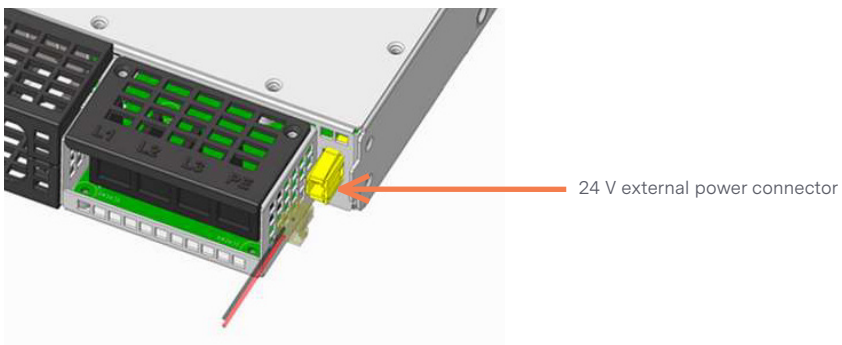
Each DC output has 6-pin signals connector.



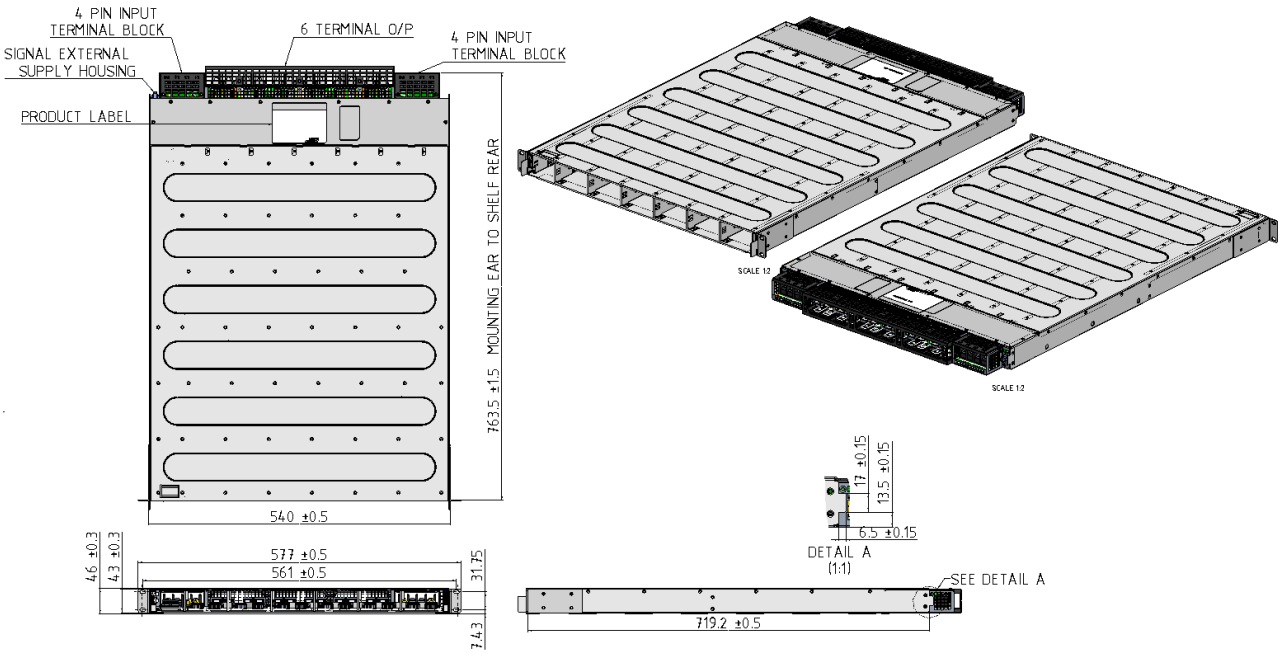
Signal	Type	Function	Note
Isolated PSU Enable Control (PS_ENABLE_SYS)	Input signal	Enables or disables the main output	Logic active low: Pulling this pin to ground enables the main output Open (floating): Disables the main output
Isolated AC Status Monitor (ACOK_SYS)	Open-collector output from opto-isolator	Open (non-conducting) when AC input is within valid range Pulled low (collector-emitter shorted) when AC input is outside valid range	Requires external pull-up resistor: Use ≥ 2 kΩ for 5 V bias Use ≥ 8.2 kΩ for 24 V bias
Isolated DC Output Status Monitor (DCOK_SYS)	Open-collector output from opto-isolator	Open (non-conducting) when DC output is within regulation range Pulled low (collector-emitter shorted) when DC output is outside regulation range	Requires external pull-up resistor: Use ≥ 2 kΩ for 5 V bias Use ≥ 8.2 kΩ for 24 V bias

■ 24 VDC External Power Connector

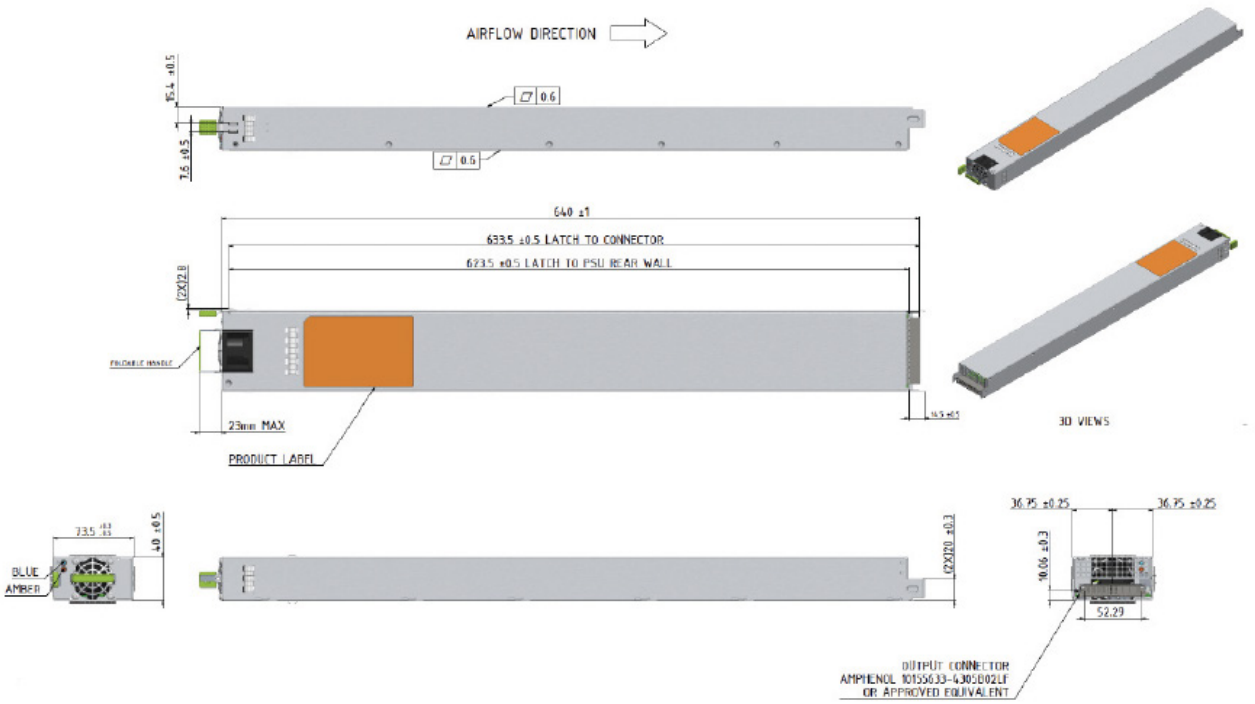
The PMM unit requires power to be provided by an external 24 V (+/-10%) source via the 2-pin jack situated on the right side of the rear panel. Each PMM board consumes less than 2 W of power.



POWER SHELF MECHANICAL OUTLINE



PSU MECHANICAL OUTLINE



Unit: mm

POWER MONITOR MODULE (PMM)

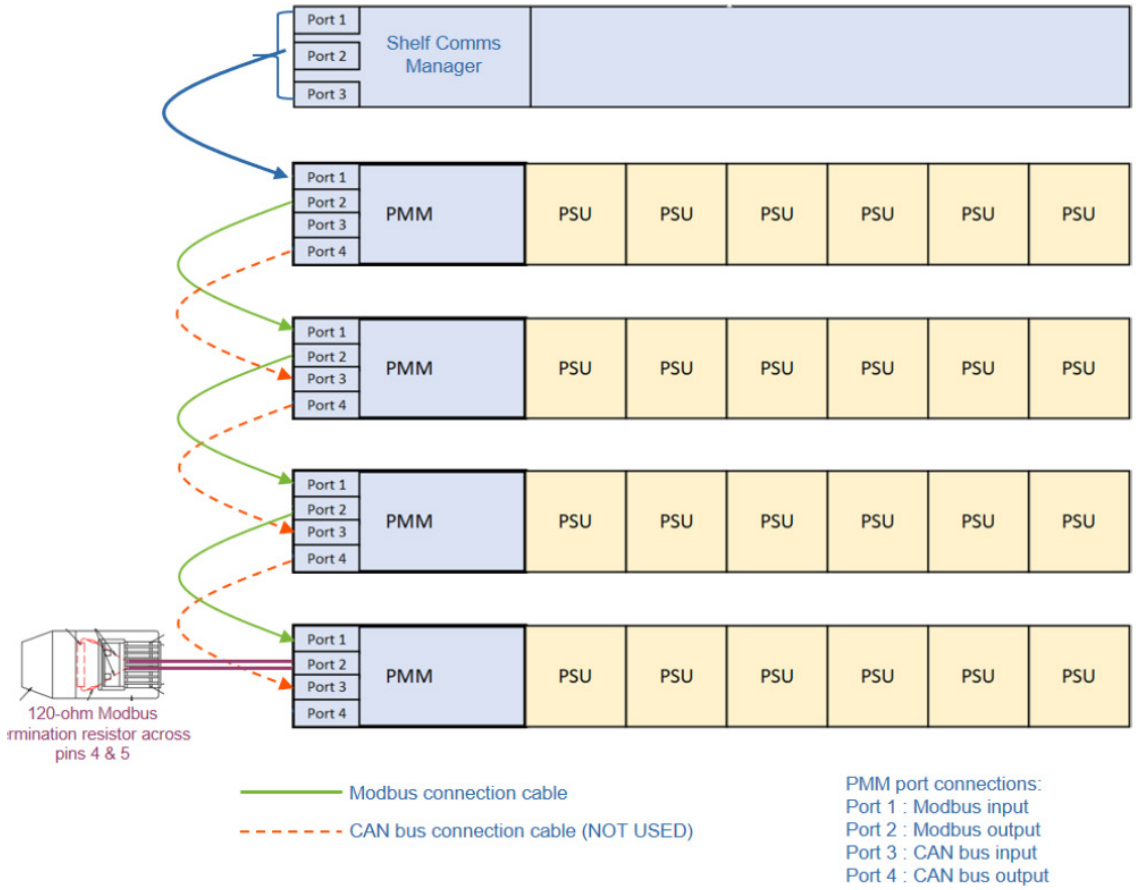
PMM Overview

The Power Monitor Module (PMM) is a shelf-level monitoring card designed to track and report the status of power modules installed in equipment shelves. Each shelf requires one PMM to enable accurate monitoring and communication with higher-level management systems.

The PMM collects operational data from power supply units and transmits aggregated information to an upstream management controller via a standard communication interface, such as Modbus over RJ45.

To support scalable deployments, the PMM enables daisy-chained communication across multiple shelves. It automatically assigns unique communication addresses to each shelf, simplifying integration and reducing configuration effort. Where applicable, it also supports inter-shelf coordination using additional control buses.

A typical setup includes multiple power shelves connected in a chain, all reporting to a centralized management device for system-wide visibility and control.



Modified from: Open Rack V3 HPR Power Monitoring Interface Module (PMM), Rev. 0.4.0, © Open Compute Project. Licensed under the OCP Hardware License – Permissive.

POWER MONITOR MODULE (PMM)

Electrical Interface on the Front Panel

Adapted content from Open Rack V3 HPR Power Monitoring Interface Module (PMM), Rev. 0.4.0, © Open Compute Project. Licensed under the OCP Hardware License – Permissive.

The PMM contains four RJ45 connectors located on the bulkhead of the assembly. The pinouts of the connectors are shown below.

RJ45 port #1 and port #2 includes the electrical connections for Modbus communication, address pins and alert signals. Two port designs allow Daisy Chain Modbus connection with multiple PSU shelves, BBU shelves and RPU on the same daisy chain.

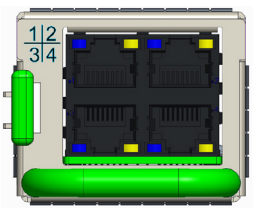
RJ45 #3 and RJ45 #4 are NOT to be USED since FCM33K uses Modbus communications only.

RJ45 #1 (MODBUS over RS485)			RJ45 #2 (MODBUS over RS485)		
Pin	**Wire Color**	**Function**	**Pin**	**Wire Color**	**Function**
1	White/Orange	GND	1	White/Orange	GND
2	Orange	PLS (power loss siren, from BBU shelf)	2	Orange	PLS (power loss siren, from BBU shelf)
3	White/Green	CLS (cooling loss siren, from the RPU cooling device)	3	White/Green	CLS (cooling loss siren, from the RPU cooling device)
4	Blue	RS485A	4	Blue	RS485A
5	White/Blue	RS485B	5	White/Blue	RS485B
6	Green	RS485_Addr2	6	Green	RS485_Addr2
7	White/Brown	RS485_Addr1	7	White/Brown	RS485_Addr1
8	Brown	RS485_Addr0	8	Brown	RS485_Addr0

LED on the Front Panel

Due to the limited size of the PMM front panel, the PMM uses LEDs on the RJ45 ports as its indicators. Blue LEDs (#1 and #2 in the drawing below) on the RJ45 ports will be controlled at the same time as a single Blue LED. Amber LEDs (#3 and #4 in the drawing below) on the RJ45 ports will be controlled at the same time as a single amber LED.

Color	Meaning	Color	Meaning
Solid blue	PMM ready	Solid Amber	Permanent fault (Replacement required)
Blinking Blue @0.5 s on/0.5 s off	PMM FW upgrade	Blinking Amber @0.5 s on/0.5 s off	Modbus cable wiring issue
Off	Default	Blinking Amber @0.25 s on/0.25 s off	Ishare Bus Daisy Chain not detected
		Off	Default



THERMAL DESIGN

- Sensor accuracy: For discrete and critical sensors (such as ambient temperature) have an accuracy of ±2°C
- Back-pressure: The shelf is designed to accommodate compliance requirements while ensuring reasonable impact to upstream components. A back-pressure of ≤0.15 inches of water is targeted.
- Bus-bar power or DC output connection assembly: Cables external to the shelf as well as the clip/connector (to the rack bus-bar) mounting at the rear panel are designed to ensure adequate cooling for compliance requirements (temperature difference as a function of current draw).
- Surface temperature: To make the shelf safe for handling in-operation, accessible surfaces should not exceed a temperature of 70°C.

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ENVIRONMENTAL COMPLIANCE

- Gaseous contamination: Severity Level G1 per ANSI/ISA 71.04-1985
- Ambient operating temperature range: -5°C to +45°C
- Operating and storage relative humidity: 10% to 90% (non-condensing)
- Storage temperature range: -40°C to +70°C
- Transportation temperature range: -55°C to +85°C (short-term storage)
- Operating altitude with no de-ratings: 3,050 m (10,000 feet)
- Acoustic noise: Target sound pressure should not exceed 85 dBA when fan modules are running at full speed and operating within the defined environmental envelope

Vibration and Shock (Non-packaged)

The “power shelf with PSUs inside” meet vibration and shock test per EN 60068-2-6 and 60068-2-27, respectively, for both non-operating and operating condition, with the specifications listed below.

During operating vibration and shock tests, the PSU will exhibit full compliance to the specification without any electrical discontinuities.

During the non-operating tests, no damages of any kinds (included physical damages) should occur and they should not corrupt the functionalities of the PSU per the specifications.

Vibration Non-Operating:

Excitation Mode	Sinusoidal
Test Frequency	5 to 500 Hz (5 to 9 Hz) 6 mm peak to peak (9 to 500 Hz) 1 g
Amplitude	1 g
Frequency Change Rate	1 octave / min
Test Directions	3 directions in space (x, y, z)
Duration	10 sweep cycles for each direction (2 hours 13 minutes)
Test Temperature	Room temperature
Electrical Work	None

ENVIRONMENTAL COMPLIANCE

Shock Non-Operating:

Shock Pulse	Half sinusoidal
Shock Duration	11 ms
Shock Amplitude	12 g
Test Directions	6 directions
Number of Shocks	60 (10 per each direction)
Test Temperature	Room temperature
Electrical Work	None

Vibration Operating:

Excitation Mode	Sinusoidal
Test Frequency	5 to 500 Hz (5 to 9 Hz) 6 mm peak to peak (9 to 500 Hz) 1 g
Amplitude	0.5 g
Frequency Change Rate	1 octave / min
Test Directions	3 directions in space (x, y, z)
Duration	10 sweep cycles for each direction (2 hours 13 minutes)
Test Temperature	Room temperature
Electrical Work	Power supply in operation

Shock Operating:

Shock Pulse	Half sinusoidal
Shock Duration	11 ms
Shock Amplitude	6 g
Test Directions	6 directions
Number of Shocks	30 (5 per each direction)
Test Temperature	Room temperature
Electrical Work	Power supply in operation

Package Vibration, Drop and Compression

The power shelves (without PSUs) in their shipping package meet the following requirements:

Package Vibration:	1.146 g, 2 to 200 to 2 Hz, all three axes, random vibe	ISTA 3E 06-06
Package Drop:	8 in drop	ISTA 3E 06-06
Package Compression:	Maximum compression loading on a bulk pack	ASTM D 642-94

EMC, SAFETY AND ENVIRONMENTAL COMPLIANCE

The power supply shelf is designed for compliance to allow worldwide deployment.

Safety Standards

The product is to be designed to comply with the latest edition, revision, and amendment of the following standards. The product is designed such that the end user could obtain the safety certifications: UL 62368-1, IEC 62368-1 and EN 62368-1; hazard-based performance standard for Audio video, IT & Communication Technology Equipment

- UL or an equivalent NRTL for the US with follow-up service (e.g. UL or CSA)
- CB certificate and test report issued by CSA, UL, VDE, TUV or DEMKO
- CE marking for EU

Component Safety Requirements

Following are the safety compliances for major components:

- All fans have the minimum certifications: UL and TUV or VDE.
- All current limiting devices have UL and TUV or VDE certifications and are suitable rated for the application where the device in its application complies with IEC/UL 62368-1.
- All printed wiring boards are rated UL94V-0 and sourced from a UL approved printed wiring board manufacturer.
- All connectors are UL recognized and have a UL flame rating of UL94V-0.
- All wiring harnesses are sourced from a UL approved wiring harness manufacturer. SELV cable to be rated minimum 80 V, 130°C.
- Product safety label will be printed on UL approved label stock and printer ribbon. Alternatively, labels can be purchased from a UL approved label manufacturer.
- The product will be marked with the correct regulatory markings to support the certifications that are specified in this document.

Product Safety Test

The product is tested for the following safety routine tests in 100% basis:

- Earth continuity test: 12 V, 25 A 100 mΩ, 1 s
- Hipot input to output & signals: 2500 VDC, 1 mA, 4 s ramp, 4 s dwell, arc detect off
- Hipot input to Earth: 2500 VDC, 1 mA, 4 s ramp, 4 s dwell, arc detect off
- Hipot output & signals to Earth: 200 VDC, 1 mA, 4 s ramp, 4 s dwell, arc detect off

EMC Requirements

The power shelf meets the following requirements in the latest edition of standards when operating under typical load conditions and with all ports fully loaded.

The Power supply integrated into the shelf is called the component power supply.

The power shelf will have minimum 6 dB margin from the Class A limit for the radiated and conducted emissions.

The following EMC Standards (the latest version) are applicable to the product:

- FCC /ICES-003
- CISPR 32/EN55032
- CISPR 35/EN55035 - Immunity
- EN61000-3-2 - Harmonics
- EN61000-3-3 - Voltage flicker
- VCCI
- KN 32 and KN35

Each individual basic standard for immunity test has the following minimum passing requirement. Higher level of passing criteria may be applied depending on the system manufacturer's design goals and business needs.

- EN61000-4-2 Electrostatic Discharge immunity
  Contact discharge: > 5.6 kV
  Air discharge: > 11.2 kV
- EN61000-4-3 Radiated immunity
  > 3 V/m

EMC, SAFETY AND ENVIRONMENTAL COMPLIANCE

- EN61000-4-4 Electrical Fast Transient immunity
  AC power line: > 1 kV
  Signal line: > 0.5 kV
- EN61000-4-5 Surge
  AC power line: > 2 kV (Line-to-line), > 4 kV (Line-to-earth)
  Signal port: > 1 kV
- EN61000-4-6 Immunity to conducted disturbances
  DC power line: > 3 Vrms
- EN61000-4-8 Power frequency magnetic field immunity, when applicable
  > 1 A/m
- EN61000-4-11 Voltage dip and sag

Environmental Compliance

The power shelf (including all components inside) complies with the following minimum environmental requirements:

- RoHS Directive (2011/65/EU and 2015/863/EU)
- REACH Regulation (EC) No 1907/2006;
- Halogen Free: IEC 61249-2-21, Definition of Halogen Free, 900 ppm for Br or Cl, or 1500 ppm combined
- US SEC conflict mineral regulation to source mineral materials from socially responsible countries, if applicable
- Waste Electrical and Electronic Equipment (“WEEE”) Directive (2012/19/EU) if applicable;
- Product does not contain any substances regulated by EPA 40 CFR751

ORDERING INFORMATION

Model	Description
FCM33K-SHF-L-W-T	6 outputs, 1U shelf, AC-DC 3-Phase input
FCM5K5W-N-P	5.5 kW, AC-DC pluggable module 49.1 V/112 A

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.

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