



PSS5033-21C1 Power Shelf System

User Manual

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/support/> for additional assistance.

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Admonishments Used in this Document



DANGER! Warns of a hazard the reader **will** be exposed to that will **likely** result in death or serious injury if not avoided. (ANSI, OSHA)



WARNING! Warns of a potential hazard the reader **may** be exposed to that **could** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)



CAUTION! Warns of a potential hazard the reader **may** be exposed to that **could** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)



ALERT! Alerts the reader to an action that **must be avoided** in order to protect equipment, software, data, or service. (ISO)



ALERT! Alerts the reader to an action that **must be performed** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)



FIRE SAFETY! Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)



SAFETY! Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

Important Safety Instructions

Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page iv.

General Safety



DANGER! YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.

Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:

- a) The tasks should be performed in the order indicated.
- b) Remove watches, rings, and other metal objects.
- c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present. Check for voltage with both AC and DC voltmeters prior to making contact.
- d) Wear eye protection.
- e) Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed.
- f) All circuits connected to this power system must comply with the ES1 requirements defined in the IEC 62368 standard.
- g) To operate within the power system, ensure that the power system is not live. The mains input and battery of the power system must be disconnected.
- h) The wiring of the power distribution cables should be arranged carefully so that the cables are kept away from the maintenance personnel.
- i) It is prohibited to directly connect aluminum cables or conductors to this system. If it is necessary to connect, please strictly use a transfer method that complies with local regulations.
- j) Before use, please confirm that the relevant operating environment of this power system is in good condition, including but not limited to ensuring that the equipment is connected to the environment that meets lightning protection and grounding requirements.

Voltages

AC Input Voltages



DANGER! This system operates from AC input voltage capable of producing fatal electrical shock. AC input power must be completely disconnected from the branch circuits wiring used to provide power to the system before any AC electrical connections are made. Follow local lockout/tagout procedures to ensure upstream branch circuit breakers remain de-energized during installation. DO NOT apply AC input power to the system until all electrical connections have been completed and checked.

DC Output and Battery Voltages



DANGER! This system produces DC power and may have a battery source connected to it. Although the DC voltage is not hazardously high, the rectifiers and/or battery can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact an output terminal or battery terminal or exposed wire connected to an output terminal or battery terminal. NEVER allow a metal object, such as a tool, to contact more than one termination or battery terminal at a time, or to simultaneously contact a termination or battery terminal and a grounded object. Even a momentary short circuit can cause sparking, explosion, and injury.



DANGER! Follow local lockout/tagout procedures to ensure DC branch circuit protection devices remain de-energized during installation at loads, as required.

Personal Protective Equipment (PPE)



DANGER! ARC FLASH AND SHOCK HAZARD.

Appropriate PPE and tools required when working on this equipment. An appropriate flash protection boundary analysis should be done to determine the “hazard/risk” category, and to select proper PPE.



Only authorized and properly trained personnel should be allowed to install, inspect, operate, or maintain the equipment.

Do not work on LIVE parts. If required to work or operate live parts, obtain appropriate Energized Work Permits as required by the local authority, per NFPA 70E “Standard for Electrical Safety in the Workplace”.

Hazardous Voltage



DANGER! HAZARD OF ELECTRICAL SHOCK.

More than one disconnect may be required to de-energize the system before servicing.

Handling Equipment Containing Static Sensitive Components



ALERT! Installation or removal of equipment containing static sensitive components requires careful handling. Before handling any equipment containing static sensitive components, read and follow the instructions contained on the Static Warning Page.

Maintenance and Replacement Procedures



CAUTION! When performing any step in procedures that requires removal or installation of hardware, use caution to ensure no hardware is dropped and left inside the unit; otherwise service interruption or equipment damage may occur.



NOTE! When performing any step in procedures that requires removal of existing hardware, retain all hardware for use in subsequent steps, unless otherwise directed.

Interference



NOTE! 1. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2. ICES complies with CAN ICES-003(A) / NMB-003(A).

Static Warning



This equipment contains static sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any equipment containing static sensitive components, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor. Some wrist straps have a built-in one megohm resistor; no external resistor is necessary. Read and follow wrist strap manufacturer's instructions outlining use of a specific wrist strap.
3. Do not touch traces or components on equipment containing static sensitive components. Handle equipment containing static sensitive components only by the edges that do not have connector pads.
4. After removing equipment containing static sensitive components, place the equipment only on static dissipative surfaces such as conductive foam or ESD bag. Do not use ordinary Styrofoam or ordinary plastic.
5. Store and ship equipment containing static sensitive components only in static shielding containers.
6. If necessary to repair equipment containing static sensitive components, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.

Instructions for Use

Before transporting, storing, installing, operating, using or maintaining the equipment, please read this manual, operate in strict accordance with the contents of the manual, and follow the equipment markings and all safety precautions in the manual.

This equipment should be used in an environment that meets the requirements of standard specifications. Otherwise, it may cause equipment failure, abnormal equipment function, or component damage. In serious cases, it may cause personal injury, property damage, etc.

Applicable laws, regulations, standards and code requirements must be followed when transporting, storing, installing, operating, using or maintaining equipment.

The above content does not represent all safety matters that should be observed. You also need to comply with relevant international, national or regional standards and industry rules.

Disclaimer

The company is not responsible for any of the following situations or their consequences:

1. Equipment damage caused by force majeure such as earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, etc.
2. Equipment damage caused by you or your commissioned third-party transportation.
3. Equipment damage caused by storage conditions not meeting the requirements of the product manual.
4. The installation and use environment does not comply with relevant international, national or regional standards.
5. The equipment is installed and used by personnel who are not qualified to operate it.
6. Not following the operating instructions and safety warnings in the product and manual to operate the equipment.
7. Not operating according to the usage conditions described in this manual.
8. Unauthorized disassembly, modification of product or modification of software code.
9. The materials and tools you prepare do not meet the requirements of local laws, regulations and relevant standards.
10. Damage caused by you or a third party due to negligence, intention, gross negligence, improper operation or reasons not caused by Vertiv.

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1 Overview

This chapter introduces the composition, configuration and key features of the PSS5033-21C1 power shelf system. The PSS5033-21C1 supports a DC output range of 48.5 V to 50 V for powering equipment, and the maximum capacity of a single power shelf within the power system is 33 kW.

The power system in this manual refers to the PSS5033-21C1 power shelf system.

1.1 Composition and Configuration

Composition

The PSS5033-21C1 power shelf system is an integrated power system comprising a power shelf, rectifiers (PSUs), and a controller (PMC). A single rack system can be configured with up to eight power shelves. The capacity of a single power shelf is 33 kW/49 Vdc.

The system structure of the PSS5033-21C1 is illustrated in Figure 1.1 through Figure 1.5.

Figure 1.1 PSS5033-21C1 System Structure (Front View)

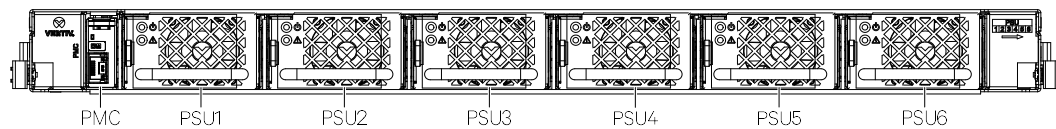


Figure 1.2 PSS5033-21C1 System Structure (Rear View)

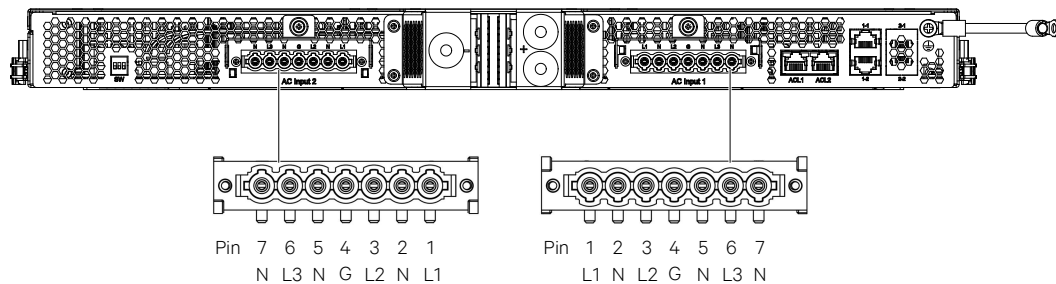


Figure 1.3 PSS5033-21C1 System Structure (Top View)

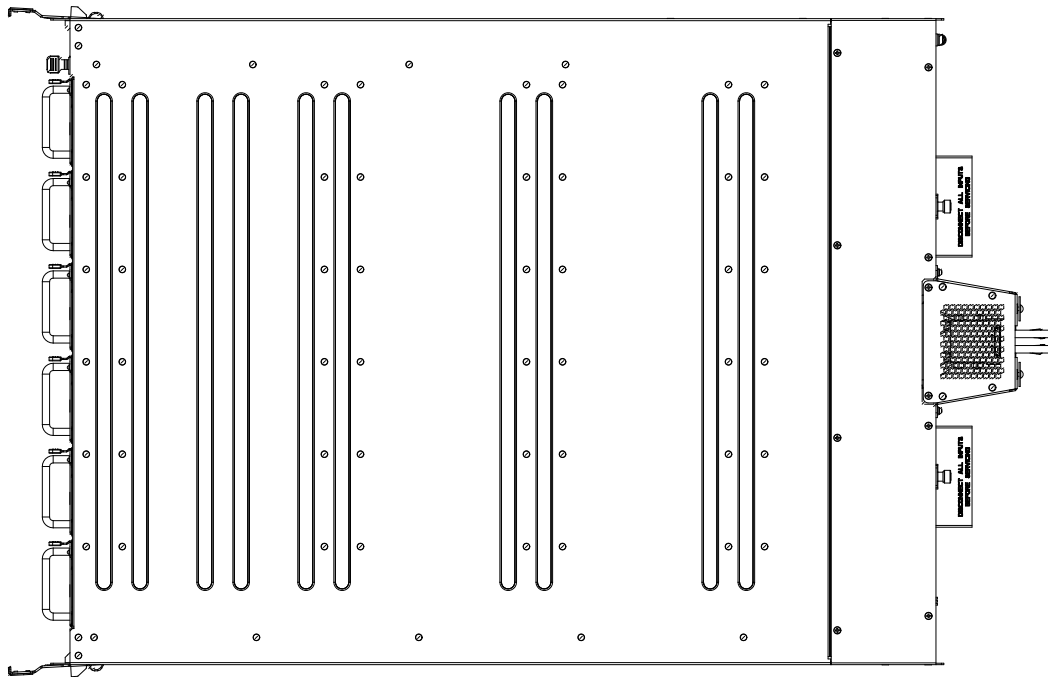


Figure 1.4 PSS5033-21C1 System Structure (Axonometric View)

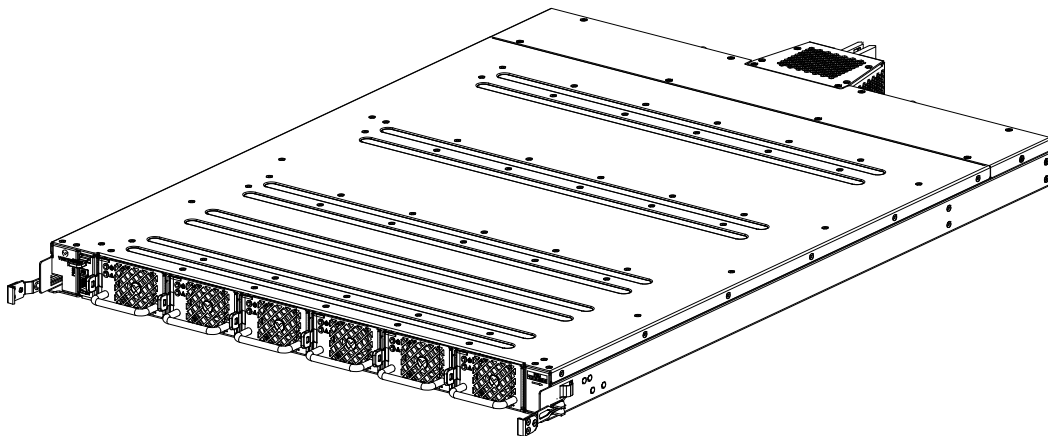
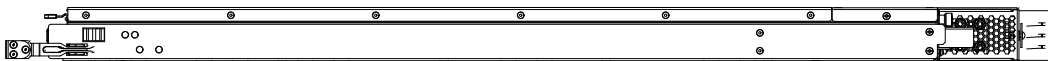
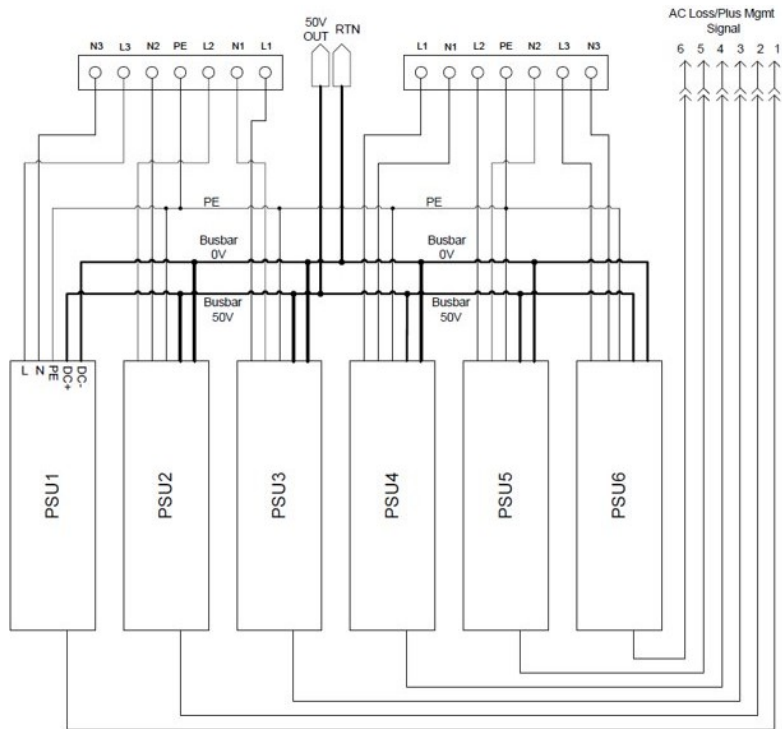


Figure 1.5 PSS5033-21C1 System Structure (Side View)



The schematic block diagram of the power system is shown in Figure 1.6.

Figure 1.6 Schematic Block Diagram



Configuration

The configuration of the power system is listed in Table 1.1.

Table 1.1 Power System Configuration

Configuration Unit	Model	Standard Value	Max. Value	Min. Value	Optional	Remark
Power shelf system (PSS)	PSS5033-21C1	1	/	/	N	
5.5kW rectifier (PSU)	R50-5500E4	6	6	1	Y	
Controller (PMC)	PMC1S0	1	1	0	Y	
AC input cable assembly (AC whip)	/	/	2	0	Y	Optional specifications are shown in Table 1.2
PSU dummy panel	/	/	3	0	Y	
21-inch rail kit	/	/	1	0	Y	Installed in a 21-inch rack

Table 1.2 Optional Specifications for AC Whip

PD Code	Model	Manufacturer	Description	Specification Sheet
10143069	10178161-C7A301	Amphenol	AC whip, ORV3 HPR, NEMA L22-30P, 30 A, 1.6 m	 C_10178161-C7A3XX_X3.pdf
10143070	10178161-C7A302		AC whip, ORV3 HPR, NEMA L22-30P, 30 A, 2.7 m	
10143071	10178161-C7A303		AC whip, ORV3 HPR, NEMA L22-30P, 30 A, 3.8 m	
10143072	10178747-C70301	Amphenol	AC whip, ORV3 HPR, IEC309 PLUG, 32 A, 2.1 m	 C_10178747-C703XX_X3.pdf
10143073	10178747-C70302		AC whip, ORV3 HPR, IEC309 PLUG, 32 A, 3.2 m	
10143074	10178747-C70303		AC whip, ORV3 HPR, IEC309 PLUG, 32 A, 4.3 m	



NOTE! Customized products may differ from the configurations listed in the table above; please refer to the actual shipped product.

1.2 Features

- Standard 21-inch shelf design, featuring network connectors at the front, AC power connections at the rear, and rear-mounted RJ45 parallel connection ports.
- Wide input voltage range: 200 Vac to 277 Vac (346 Vac to 480 Vac three-phase line voltage).
- DC 49 V / 33 kW output, comprising six 5.5 kW PSUs.
- Supports current sharing across multiple power shelves; hardware-based current sharing has currently been validated for up to 48 rectifiers (i.e., 8 power shelves).
- Both PSUs and the PMC support hot-swapping.
- Telemetry and monitoring are enabled via the Redfish protocol.
- PMC and PSU firmware can be upgraded via the Redfish protocol.
- Front-to-back airflow design with built-in variable-speed fans.
- Surge protection capability: AC input > 2 kV (line-to-line), AC input > 4 kV (line-to-ground).
- Protection rating: IP20.
- Safety design complies with UL, CB, and CE certification requirements.

2 Installation

This chapter describes the installation and wiring of the power system. Before installation, please read the safety regulations carefully, and then proceed with the installation and wiring in accordance with the contents of this chapter.

2.1 Safety Regulations

Certain components in this power system carry hazardous voltage and current, therefore, to ensure personal safety, the following regulations must be strictly observed at all times:

1. Only personnel who have received training on this power system and possess a comprehensive understanding of its operation may install it. During the installation process, the aforementioned safety regulations and local safety regulations must be strictly adhered to at all times.
2. All circuits connected to this power system must comply with the ES1 requirements defined in the IEC 62368 standard.
3. It is strictly prohibited to remove the cover panel independently for the purpose of maintaining internal components.
4. The power system must be housed within a lockable room or device, with the keys kept in the custody of the person designated as responsible for the power system.
5. Power distribution cables must be routed in a logical manner and equipped with appropriate protective measures to prevent accidental contact during the operation of the power system.
6. During safety compliance testing, the protective conductor current exceeds 10 mA.

2.2 Installation Preparation

1. Unpack the package, retrieve the packing list, and check it against the received items to confirm that all ordered components have been received. If any items are found to be missing, please notify the carrier and your local sales representative immediately.
2. Inspect the equipment and the shipping container for any signs of damage or mishandling.
3. After unpacking, inspect the system for any damage sustained during transit. If signs of damage in the system are detected, do not attempt to install the system.
4. If any damage is discovered, report and handle the damaged items in accordance with local regulations.

2.3 Mechanical Installation



NOTE! 1. Racks used for housing the power system shall provide mechanical, fire, and electrical protective enclosures, or be mounted on concrete or other non-combustible surfaces while maintaining a sufficient distance from other combustible materials.

2. To facilitate maintenance, a minimum clearance of 800 mm must be reserved in front of the power system.

3. The power shelf must not be mounted directly against a wall; sufficient clearance must be maintained to ensure proper heat dissipation.

4. This product must be situated in a supervised environment and is restricted to access by technical personnel only.

5. This product should be installed within a data center facility and connected to a rack management unit, which directly monitors the status of the PSUs via the PMC.

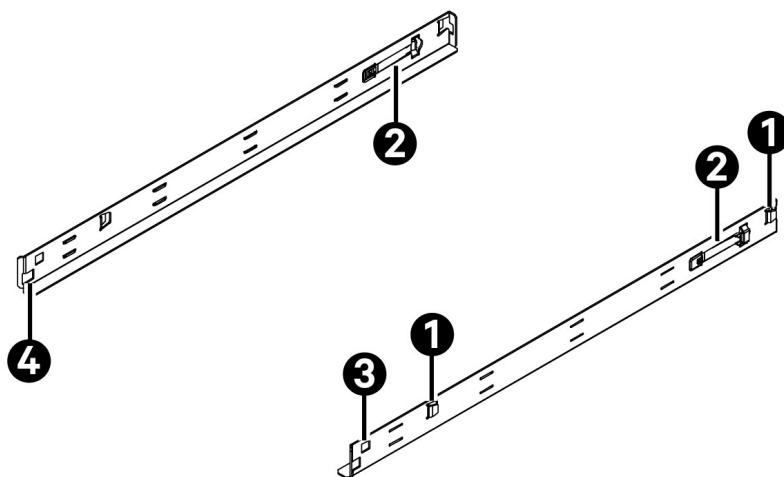
6. The ventilation openings of the PSUs and power shelf must not be obstructed, and the temperature of the air entering these openings must not exceed the specified operating ambient temperature range.

7. The power shelf is mounted on the rails of the rack.

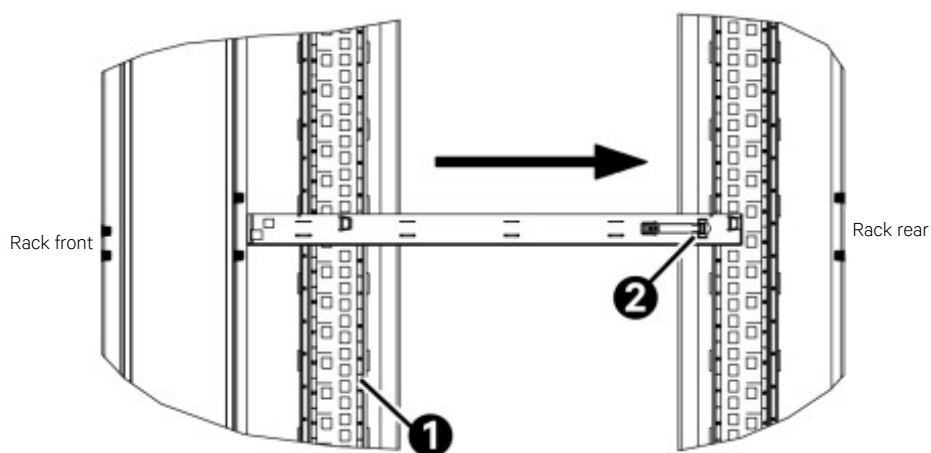
2.3.1 Installing the Rail Kit

Install the rail kit onto a 21-inch rack compliant with the version 3 HPR OCP (Open Compute Project) standard, as follows. Refer to Figure 2.1, Figure 2.2 and Figure 2.3 as this procedure is performed.

1. Find the related OpenU marking number of the desired location on the rack.
2. Install the rail on one side of the rail kit in the direction shown in Figure 2.2.
3. Align the two tabs of the rail to the corresponding cutout in the rack according to the desired OpenU number.
4. Slide the rail in until the rail tabs fit into the corresponding cutouts in the rack. Pull the rail latching clip towards the center of the rack while sliding the rail into position. Release the rail latching clip to secure the rail to the rack. See Figure 2.3.
5. Install the rail on the opposite side by following the same steps.

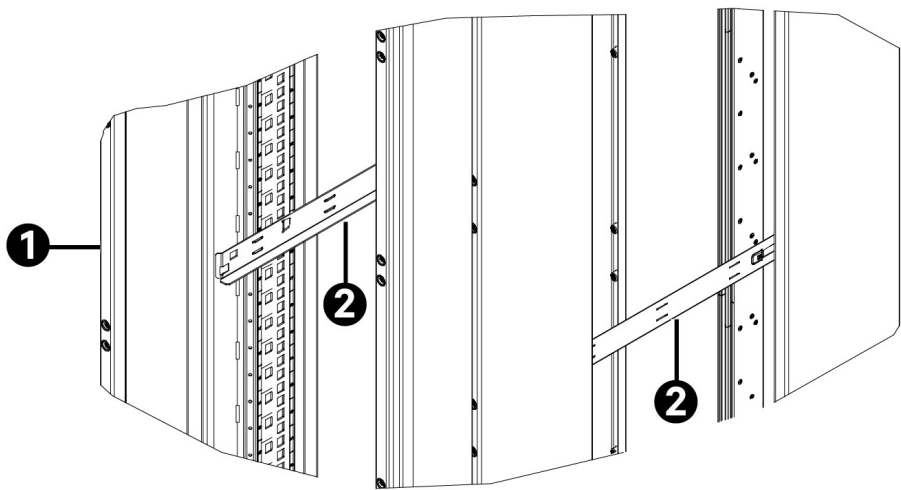
Figure 2.1 Rail Kit

Item	Description
1	Rail tab
2	Rail latching clip
3	Buffer snapper cutout
4	Power shelf latching clip cutout

Figure 2.2 Installing the Rail Kit

Item	Description
1	OpenU marking number
2	Lift the rail latching clip and push the rail into place

Figure 2.3 View of the Installed Rail Kit



Item	Description
1	Rack
2	Rail kit

2.3.2 Installing the Power Shelf

Install the power shelf onto a 21-inch rack compliant with the ORV3 HPR standard, as follows.

- 1. Slide the power shelf into the front of the rack, positioning the bottom of the power shelf onto the rack rail kit.
- 2. Push the snapper clips located on both sides of the power shelf toward the center of the power shelf.
- 3. Slide the power shelf completely into the rack.
- 4. Release the snapper clips to secure the power shelf to the rack.
- 5. Verify that the DC output connectors on the power shelf are correctly matched and connected to the vertical DC busbars located at the rear of the rack.

2.4 Electrical Installation

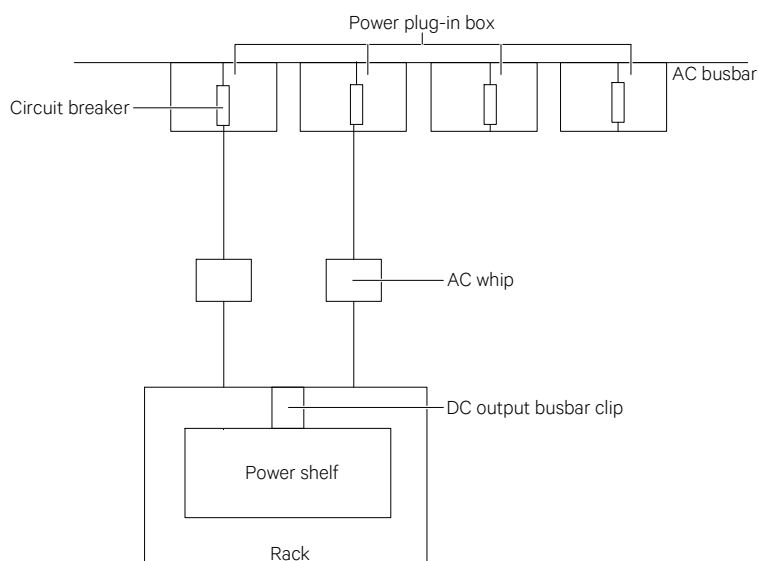
- NOTE!** 1. Please comply with the requirements specified in 2.1 Safety Regulations.
2. The power shelf must be correctly installed in the rack.
3. All wiring and branch circuit protection measures shall comply with the current edition of the American National Standards Institute (ANSI), the National Electrical Code (NEC) approved by the American National Fire Protection Association (NFPA) and applicable local regulations. For operations conducted in countries that do not recognize the NEC, applicable regulations shall be followed.

2.4.1 Installing Upstream Protection Device

The data center facility protection rating specifies that, for a 1U power shelf with dual inputs, 2 × 30 A NEC circuit breakers or 2 × 32 A IEC circuit breakers must be used. The maximum short circuit current the system can withstand is 25 kA.

The circuit breaker is installed at the front end of the AC whip of the power shelf, typically, it is installed in the power plug-in box at the front end, which is mounted on the AC busbar, as shown in Figure 2.4.

Figure 2.4 Circuit Breaker Installation Location



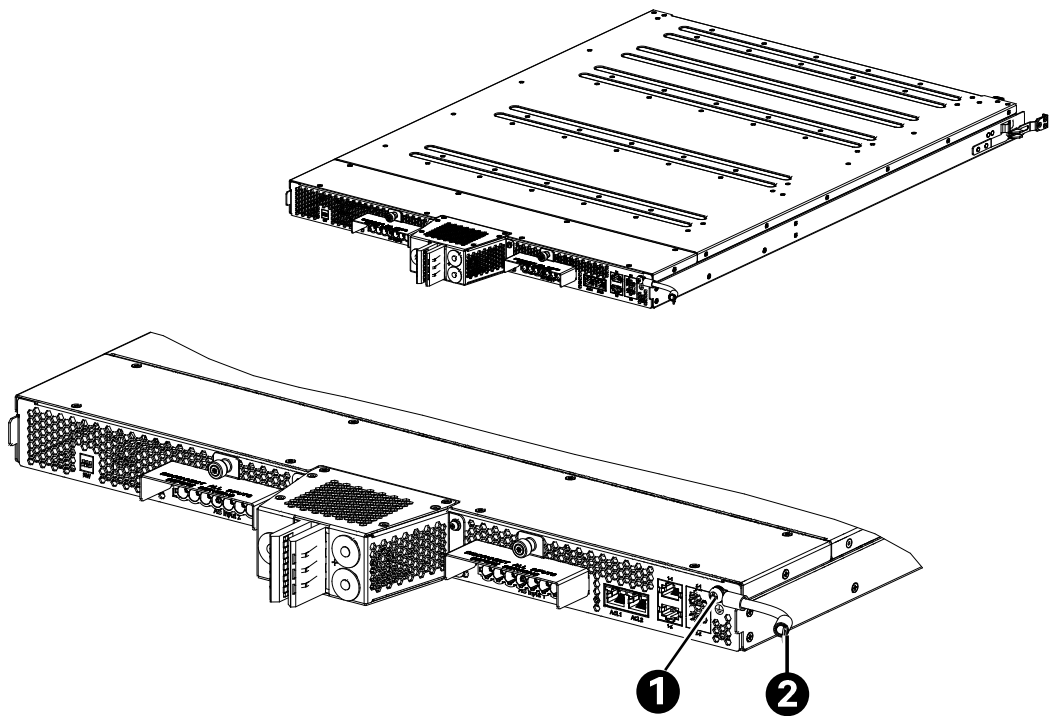
NOTE! The figure above illustrates only the positions of the circuit breakers and does not define the position of the power shelf. The power shelf position shown in the figure is for illustrative purposes only; its specific placement may be adjusted as required.

2.4.2 System Grounding Connection

For requirements regarding system frame grounding, please refer to the latest edition of the *National Electrical Code* (NEC), approved by the American National Standards Institute (ANSI) and published by the National Fire Protection Association (NFPA), applicable local codes, and your specific site requirements. For operation in countries where the NEC is not recognized, follow applicable codes.

The system grounding cable needs to be connected to the M5 grounding screws located at the rear of each power shelf, as shown in Figure 2.5. Connect one end of this cable to a suitable grounding terminal.

Figure 2.5 Power System Grounding Connection



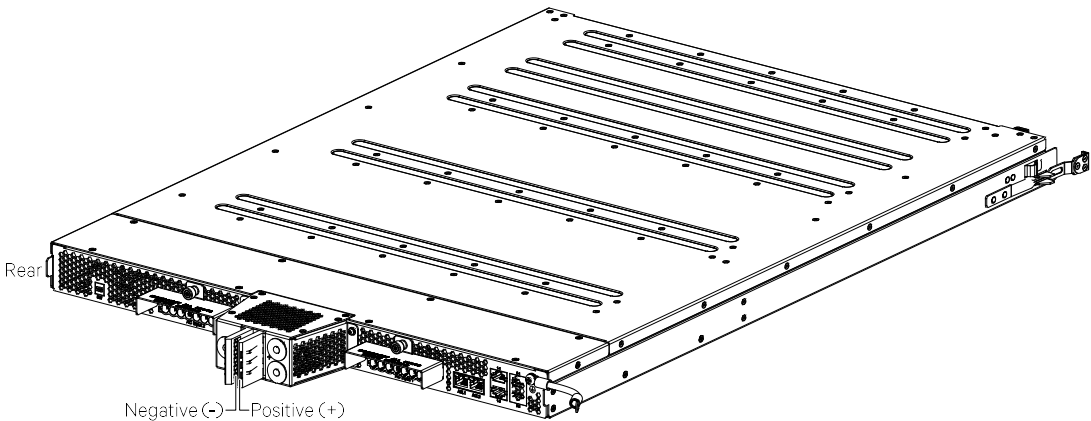
Item	Description
1	Power shelf grounding connection M5 screw. Torque: 2 N·m (17.7 in·lb)
2	The customer needs to use M5 screws to connect the grounding cable. The diameter of the grounding cable is 8 AWG (8.36 mm²)

2.4.3 DC Output Connection

- **DANGER!** 1. Please comply with the requirements specified in 2.1 *Safety Regulations*.
2. When making output connections, please pay attention to the polarity.

DC output is provided via the DC output connector located on the rear of the power shelf, as shown in Figure 2.6. This connector interfaces with the vertical DC busbar within a 21-inch rack compliant with the Version 3 HPR OCP (Open Compute Project) standard.

Figure 2.6 50 Vdc Output Connection



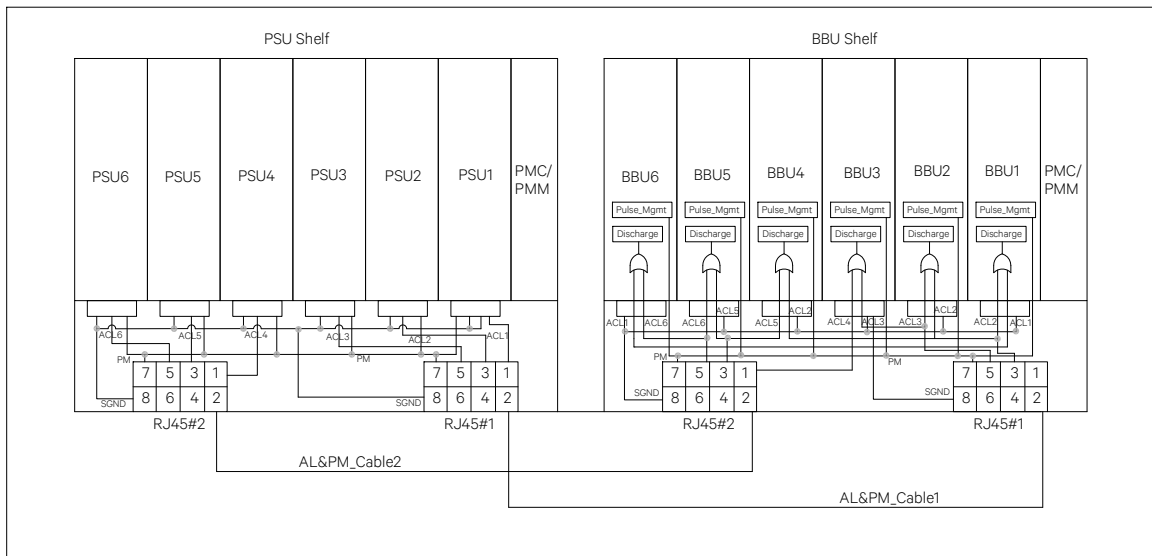
2.4.4 AC Loss Interface Connection

The AC_Loss interface is used to manage the switchover from the PSU to the BBU (Battery Backup Unit). It connects the power shelf to the BBU shelf.

The 5.5 kW PSUs, BBU, and power shelf are all equipped with AC_Loss signals to enable control in the event of an AC power interruption. Each PSU provides one outgoing AC_Loss signal, while each BBU accepts two incoming AC_Loss signals. Once an AC power interruption is detected, the PSU will send an AC_Loss signal following a verification delay of 4 ms to 5 ms.

When the BBU receives any valid AC_Loss signal, it pulls the Sync_Start_L signal low, thereby enabling the BBU shelf to immediately commence discharging. The output voltage of the BBU shelf shall rise to the normal set range within 5 ms.

Figure 2.7 AC_Loss & Pulse Management Signals



2.4.5 RJ45 Cascading Interface Connection

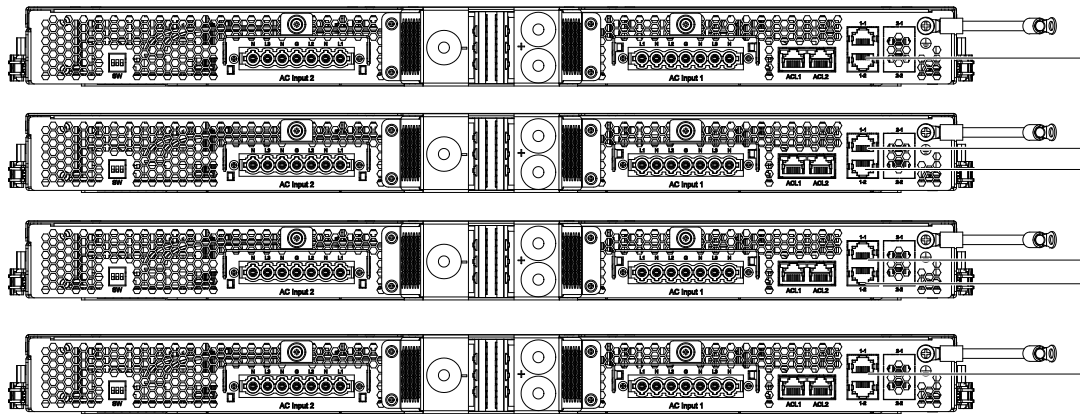
Cascading interface connection

The power system shall support parallel expansion across multiple power shelves, facilitated by two RJ45 connectors located on the rear of each power shelf. The maximum number supported in a parallel expansion is eight.

The capacity of a single power shelf is 33 kW at 49 Vdc. The figure below illustrates a scenario involving four power shelves connected in parallel.

Two types of network cables are available (P/N 0411C6FQ and P/N 0411C6G4); the default configuration for parallel operation utilizes the short network cable (P/N 0411C6FQ). If the distance between two power shelves within the rack exceeds 250 mm (9.84 inches), please order the long network cable (P/N 0411C6G4).

Figure 2.8 Power Shelf Cascading Schematic



RJ45 interface definition

Table 2.1 RJ45-1 and RJ45-2 Interface Definition

Pin	Signal	Definition
1	Ishare+	Current sharing function
2	GND	
3	SYNC_START	PSU synchronous start and stop
4	RS485-P	RS-485 communication to PSU
5	RS485-N	
6	ACF_CLR	Fault clearing
7	VOUT_SET	Output voltage setting
8	PMC_GPIO2	Reserved function

2.4.6 AC Input and Input Device Grounding Connection

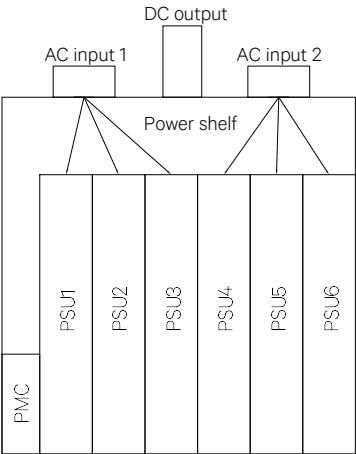
AC input schematic connection

NOTE! The AC input does not support hot-swapping; therefore, AC input cables must not be connected or disconnected while the system is in operation. If it becomes necessary to disconnect the AC input, simply switch off the AC power and the upstream protection device.

The power shelf of the power system accommodates two independent AC power inputs. Each AC power input connects to three independent PSUs. The entire power system comprises six PSUs, as shown in Figure 2.9.

The AC power inputs connect to the AC input 1 and AC input 2 interfaces. A variety of AC input cable assembly (AC whip) options are available, providing AC power cables and corresponding connectors, as shown in Figure 2.10 and Figure 2.11.

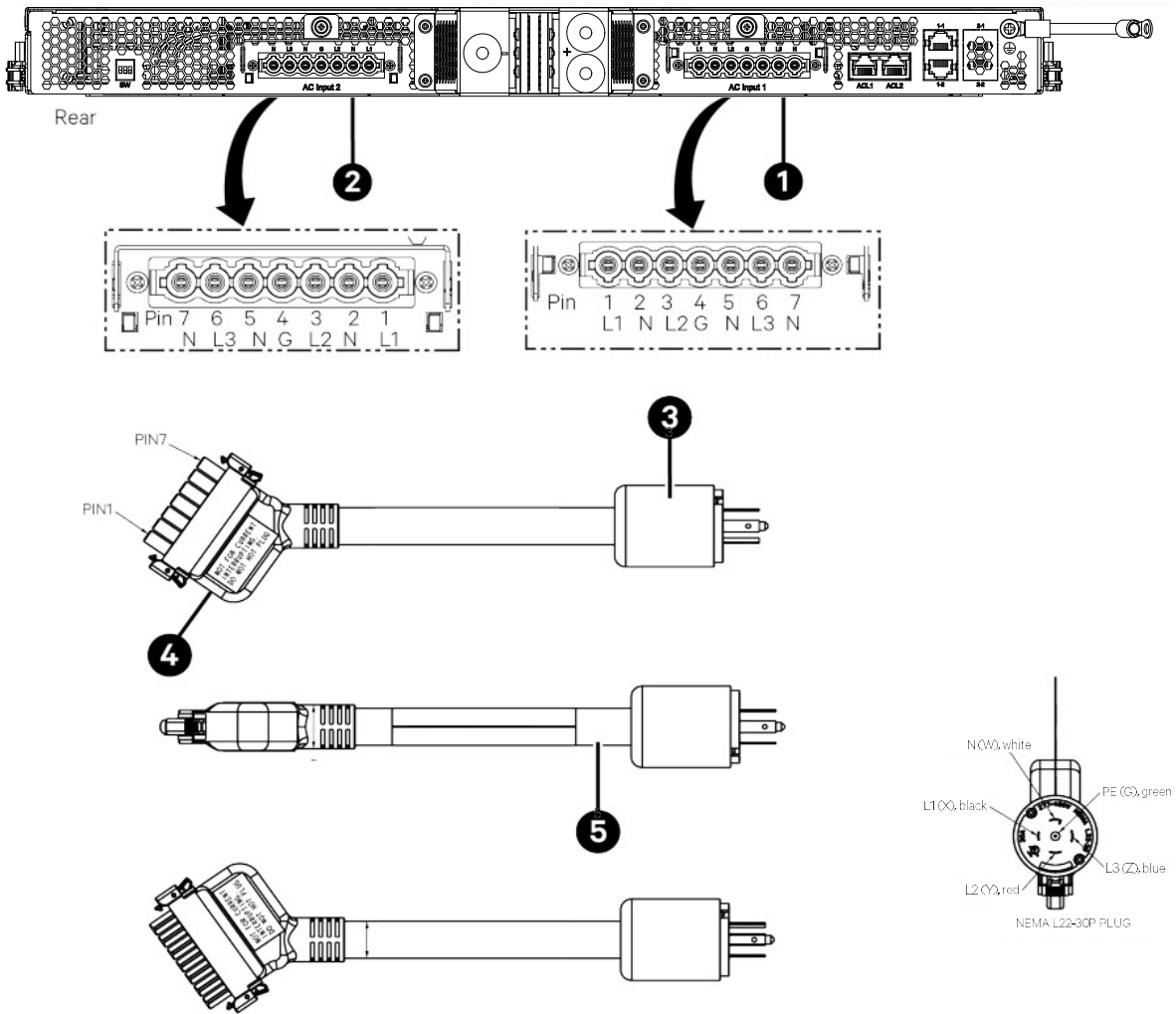
Figure 2.9 Schematic Diagram of AC Input Connections



AC whip with L22-30P plug

The AC whip with an L22-30P plug is shown in Figure 2.10.

Figure 2.10 AC Whip with L22-30P Plug



Item	Description	Item	Description
1	AC input 1	4	7 pin AC female connector

Item	Description	Item	Description
2	AC input 2	5	TYPE W5 × 10 AWG cable
3	NEMA L22-30P 30 A plug	--	--

Please refer to Table 2.2 for recommended AC input branch circuit protection. The AC input branch circuit protection device should be of the time-delay or high-inrush type.

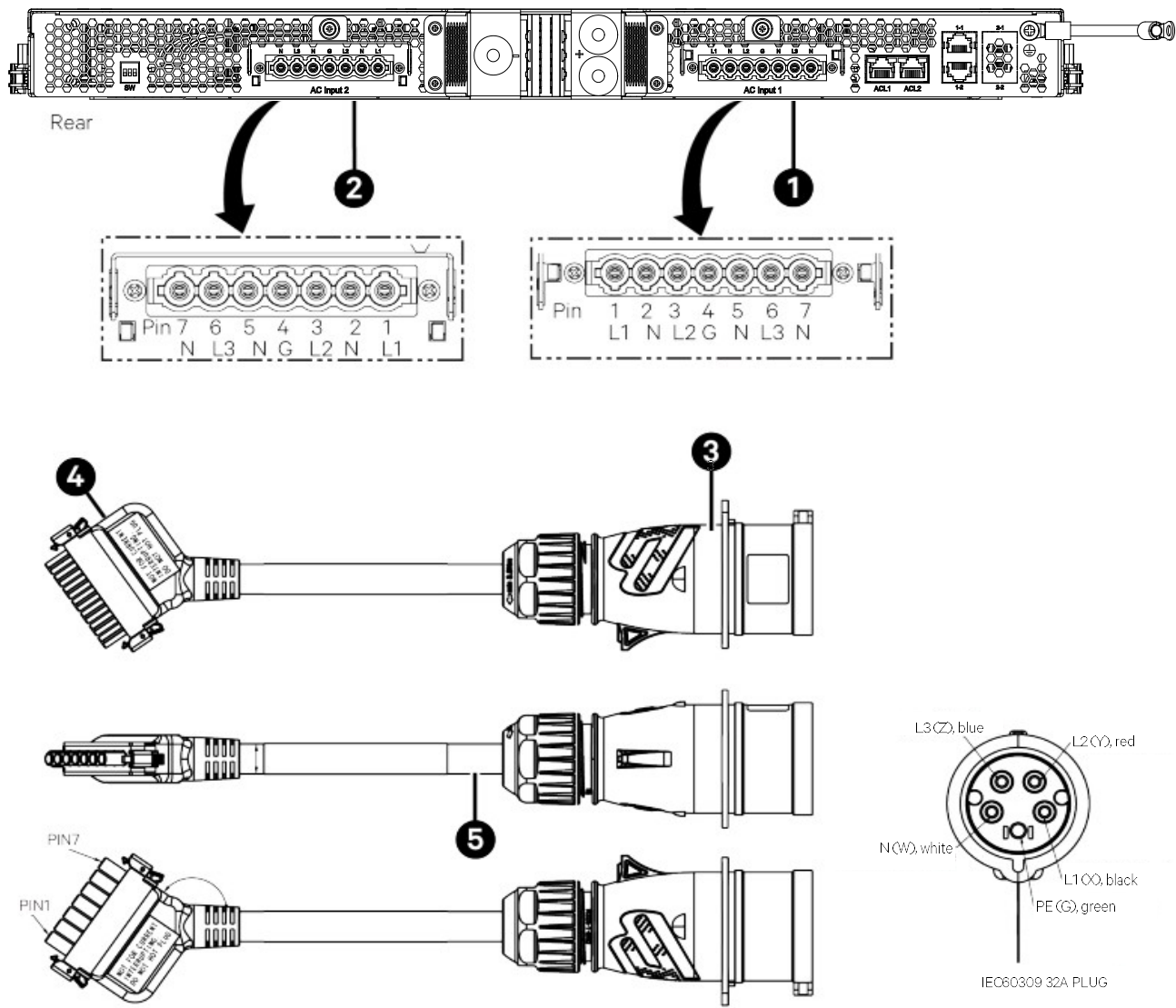
Table 2.2 AC Input Parameters

Input Voltage	Rated Input Current	Overcurrent Protection
415 Vac / 240 Vac	23.8 A	Select based on the AC power cable plug rating

AC whip with 60309 plug

The AC whip with a 60309 plug is shown in Figure 2.11.

Figure 2.11 AC Whip with 60309 Plug



Item	Description	Item	Description
1	AC input #1	4	7 pin AC female connector
2	AC input #2	5	Type W5 × 10 AWG cable
3	IEC60309, 32 A plug	--	--

Please refer to Table 2.3 for recommended AC input branch circuit protection. The AC input branch circuit protection device should be of the time-delay or high-inrush type.

Table 2.3 AC Input Parameters

Input Voltage	Rated Input Current	Overcurrent Protection
400 Vac / 230 Vac	24.9 A	Select based on the AC power cable plug rating
415 Vac / 240 Vac	23.8 A	Select based on the AC power cable plug rating

2.4.7 PMC Front Panel Interface

The RJ45 connector on the PMC front panel connects to the customer's LAN switch. The PMC monitors the PSU status of the power shelf and provides Redfish protocol data to the upstream rack management unit via the Ethernet port.

Figure 2.12 RJ45 Connector on the PMC Front Panel

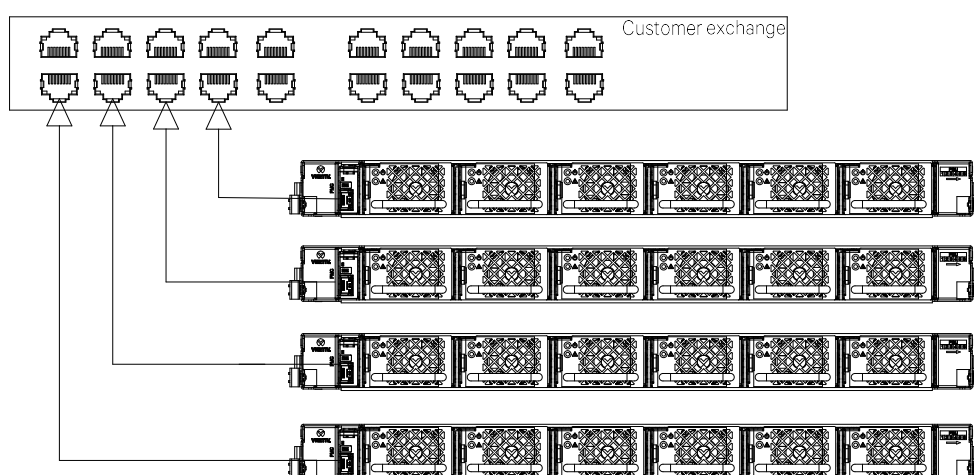


Table 2.4 RJ45 Interface Definition

Pin	Signal	Definition	Remark
1	ETH0_TD1+_S	100/1000M Ethernet data differential pair 1	
2	ETH0_TD1-_S		
3	ETH0_TD2+_S	100/1000M Ethernet data differential pair 2	
4	ETH0_TD2-_S		
5	ETH0_TD3+_S	1000M Ethernet data differential pair 3	
6	ETH0_TD3-_S		
7	ETH0_TD4+_S	1000M Ethernet data differential pair 4	
8	ETH0_TD4-_S		
9	VCC_3.3V	100/1000M Ethernet connection and data indicator	Green indicator
10	ETH0_LINK_ACT_S		
11	VCC_3.3V	100/1000M Ethernet speed indicator	Amber indicator
12	ETH0_SPEED_S		

2.5 PSU and PMC Installation

2.5.1 Installing the PSU

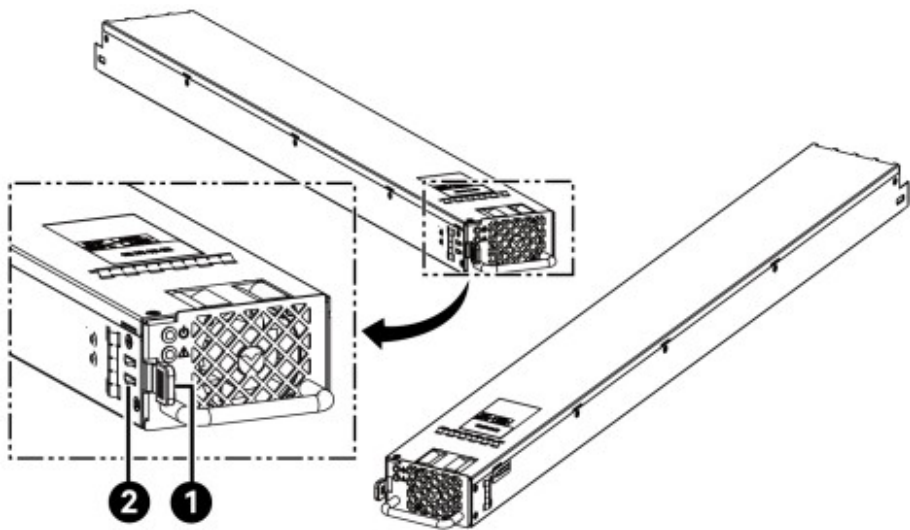
⚠ DANGER! The L / N on the PSU input side adopts a dual-fuse design. After a fuse has blown, components within the equipment that remain energized may pose a hazard during maintenance.

The PSU supports hot-swapping. It can be inserted into and removed from the system while the system is running without affecting the output bus.

Refer to Figure 2.13 when performing this procedure.

1. Unpack the PSU.
2. Slide the PSU into the power shelf.
3. Push the spring latch handle located in the front of the PSU to the right (this causes the securing latch on the side of the PSU to retract).
4. Slide the PSU completely into the power shelf, then release the spring latch handle (the securing latch on the side of the PSU will snap into the slot on the power shelf, thereby securing the PSU on the power shelf).
5. Once the physical installation of the PSU on the power shelf is complete, power on the system.
6. Verify that there are no active alarms on the system, either locally or remotely. The system is now ready for normal operation.

Figure 2.13 PSU Exterior View



Item	Description
1	Spring latch handle
2	Securing latch

2.5.2 Installing the PMC

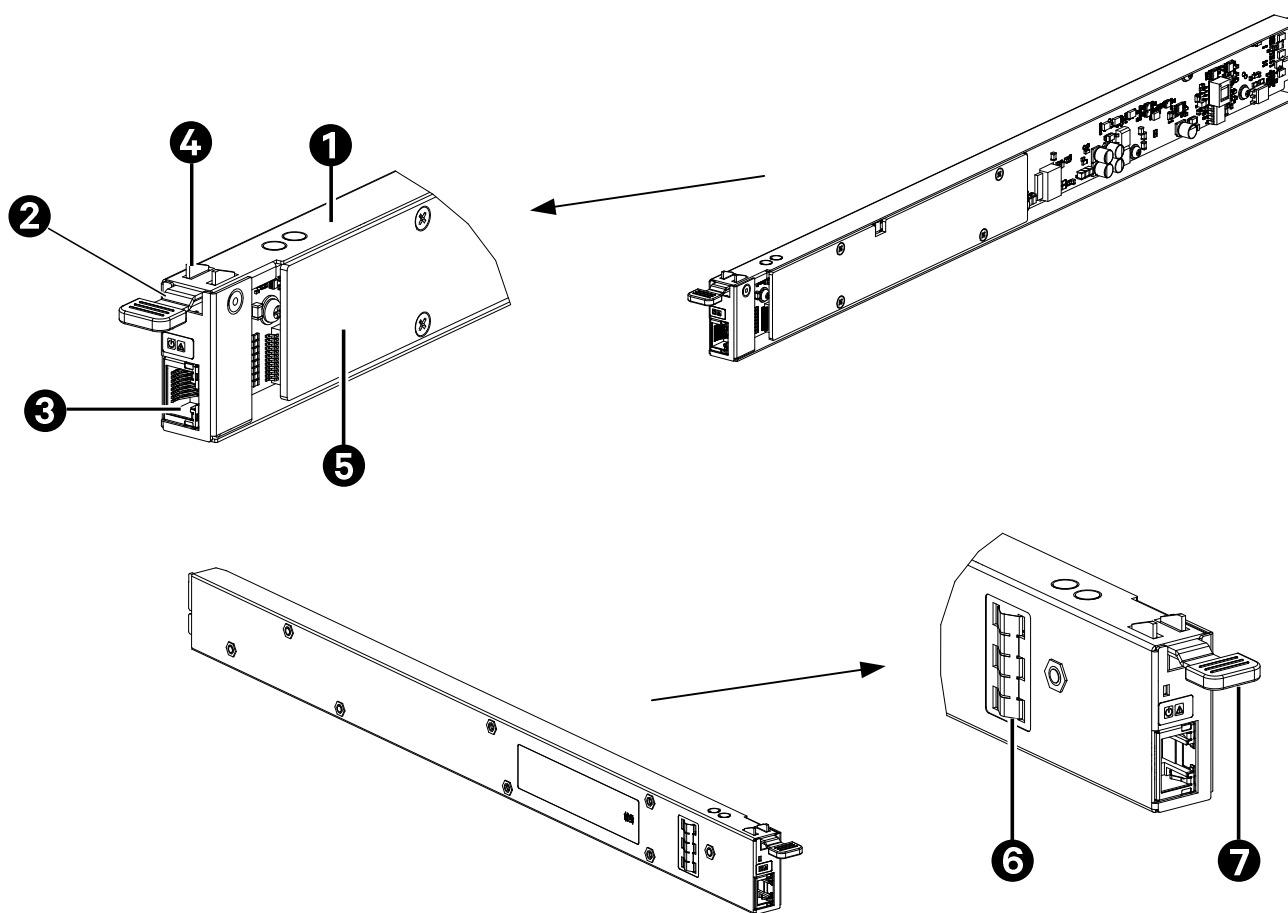
The PMC supports hot-swapping, allowing for removal and installation while the system is running without affecting the output bus.

When performing this procedure, please refer to Figure 2.14.

1. Unpack the PMC.

2. Partially slide the PMC into the power shelf.
3. Push the spring latch handle located in the front of the PMC to the right (this causes the securing latch located on the side of the PMC to retract).
4. Fully slide the PMC into the power shelf, then release the spring latch handle (the securing latch on the side of the PMC will snap into the slot on the power shelf, thereby securing the PMC on the power shelf).
5. If the system is currently running, please verify that there are no active alarms, either locally or remotely.
6. If the system displays no alarms, please wait for the PMC to finish booting and confirm that the system is running normally.

Figure 2.14 PMC Exterior View



Item	Description	Item	Description
1	Housing	5	Heat sink plate
2	Latch	6	EMI gasket
3	RJ45 connector	7	Spring latch handle
4	Securing latch	--	--

3 Testing



NOTE! 1. Please comply with the requirements specified in 2.1 Safety Regulations.

2. The power shelf must be correctly installed in the rack.

3. Executing some of the following steps may result in service interruptions or prolonged alarms. Please notify relevant personnel before commencing the operation and promptly notify them again once the operation is complete.

3.1 Installation Check and Powering on

Before the test, inform the chief manufacturer representative for the power system. System commissioning must be performed by a trained electrical engineer. Please remove any metal objects, such as rings or watches that could potentially cause a short circuit.

During operation, be aware of high voltage hazards to prevent personal injury and property damage. The system must be properly grounded before being powered on. An installation inspection must be conducted before the test; only after this inspection is complete the power system can be powered on.

Ensure that all equipment is installed in place.

Please inspect the power system item by item, referring to the checklist provided below. This checklist helps ensure the correctness of the system installation and initial operation. After completing an action listed in the checklist, please mark the corresponding box with a check mark. If a specific action is not required for your particular installation site, please still mark the corresponding box to indicate that you have reviewed that step. Once the installation is complete, be sure to verify every item on the checklist; note that some of these steps may have been pre-completed for you at the factory.

Installation check

Check Item	OK	Remark
All system cables are of the correct model and specifications	☐	
The DC output busbar clips of the power shelf are fully connected to the rack busbars, ensuring a correct connection	☐	
The power shelf is installed in the rack	☐	
The system grounding connection has been completed and is correctly connected	☐	
The 50V DC output connection has been completed and is correctly connected	☐	
The AC_LOSS interface connection has been completed (if used in conjunction with a battery backup system) and is correctly connected	☐	
The RJ45 interface connections on the power shelf have been completed and are correctly connected	☐	
The AC input connection and AC input device grounding connection have been completed and are correctly connected	☐	
The PSUs and PMC have been installed in accordance with requirements, ensuring proper installation	☐	

Startup preparation

Check Item	OK	Remark
Ensure that all inspection items have been completed	☐	
Ensure that a PSU or a blank baffle plate has been installed in every PSU slot, as required	☐	
Ensure that a PMC has been installed in every PMC slot, as required	☐	
Verify that all PSUs and PMCs are fully inserted into their slots and securely fastened to the power shelf	☐	
For complete operational information regarding the PMC, please refer to the <i>PMC User Manual</i>	☐	
Use an ohmmeter to verify that there are no short circuits between the positive and negative DC output busbars, or between the positive and negative battery poles (Note: Pull out all the modules before the check and restore them after the check)	☐	
Measure the system input voltage to ensure that the voltage value falls within the rated input range of the system	☐	

3.2 Startup



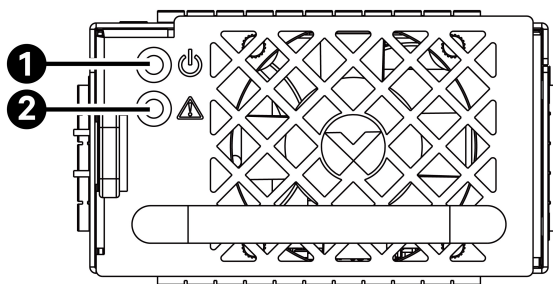
NOTE! 1. After the system is initially powered on, the PSU requires a few seconds to begin supplying power, while the PMC initialization routine takes several minutes.

2. For detailed operating instructions regarding the PMC and PSU, please refer to the *PMC User Manual (UM1PMC1S0)* and the *PSU User Manual (UM1R505500E4)*.

Check Item	OK	Remark
Close all external AC switches, DC switches and protection devices supplying power to the power shelf; then connect the AC or DC input power to the power shelf		
PSU startup		
Refer to the <i>PMC User Manual (UM1PMC1S0)</i> to configure the PMC according to your application requirements		
Observe the status of the indicators on the PSU. If the system is operating normally, the power indicator (blue) will be lit		
Verify that there are no external alarms		

PSU indicators

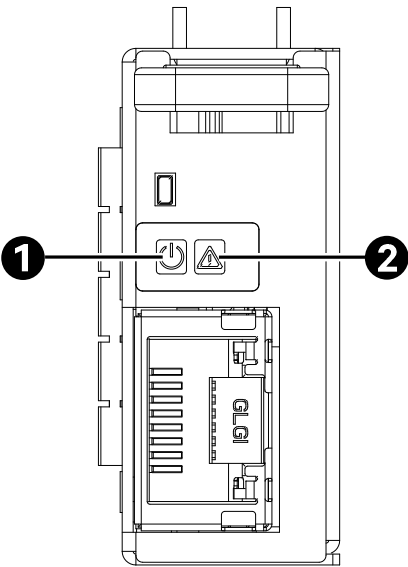
Figure 3.1 PSU Indicators



Item	Description	Color	Normal Status
1	Power indicator	Blue	On
2	Alarm and protection indicator	Amber	Off

PMC indicators

Figure 3.2 PMC Indicators



Item	Description	Color
1	Power indicator	Green
2	Alarm and protection indicator	Amber

Table 3.1 PMC Indicator Status Introduction

Green Indicator	Amber Indicator	Description
Off	Off	The PMC has no power or PMC power failure
Always on	Off	The PMC operates normally
Flashing	Flashing	The PMC firmware is being upgraded, the green and amber indicators are flashing alternately
X	Rapid flashing	The PMC is starting up. X indicates that the status of this indicator should be disregarded, as it is random
Always on	Always on	The PMC is in alarm state (priority 1)
Off	Always on	The PMC has permanent failure (priority 0)
Note: When two or more faults occur simultaneously in the PMC, the status of the PMC indicators reflects the fault with the highest priority. Priority 0 represents the highest priority		

If you have manually modified any PMC configuration parameters, please refer to the *PMC User Manual* (UM1PMC1S0) and save a copy of the configuration file; this file can be used to restore the PMC configuration if needed.

4 Maintenance

This chapter describes the routine maintenance of the power system. When performing maintenance on the power system, maintenance personnel are required to possess a comprehensive understanding of the power system.



- NOTE!** 1. *Safety regulations must be observed when performing power system maintenance.*
2. *Operations within the power shelf must be performed by trained personnel possessing sufficient knowledge of the power system.*

4.1 System Maintenance Measures

It is recommended to perform the maintenance measures listed in Table 4.1 every six months to ensure the continuous operation of the system.

Table 4.1 Common Maintenance Measures

Maintenance Measures	Reference Chapter
Check the air vents for obstructions, such as dust, paper, etc.	/
Inspect and tighten the connections of all mounting components	Please refer to 24 <i>Electrical Installation</i>
Check cables for damage or looseness	/

4.2 Adding a PSU (R505500E4)

To increase the current capacity of the system, an additional PSU may be installed in an empty PSU slot within the existing power shelf. For installation instructions, please refer to 2.5.1 *Installing the PSU*.

5 Troubleshooting and Repair

5.1 Contact Information

Please visit <https://www.vertiv.com/support/> to obtain local technical support information.

5.2 PSU and PMC Troubleshooting and Repair

The indicators on the PSUs and PMC are used to pinpoint faults to specific components of the system. For troubleshooting and maintenance instructions regarding the PSU and PMC, please refer to the following documents:

- *PSU User Manual* (UM1R505500E4)
- *PMC User Manual* (UM1PMC1S0)

5.3 System Troubleshooting and Repair

If a system fault occurs, after performing the troubleshooting and repair procedures outlined in 5.2 *PSU and PMC Troubleshooting and Repair* and replacing the PSU or PMC, the system fault persists, it can be concluded that neither the PSU nor the PMC is defective. In this scenario, you should proceed directly to replace the entire power shelf; subsequently, insert the PSU or PMC, and then power on the system to verify whether the power shelf is operating normally.

5.4 Replacing the PSU and PMC

When a system fault is identified as a failure of a specific PSU or PMC, that PSU or PMC should be replaced. Do not attempt to troubleshoot or repair individual components within the PSU or PMC. When performing a replacement, please adhere to the safety instructions outlined in this manual.

For detailed instructions on replacing a PSU, please refer to the *PSU User Manual* (UM1R505500E4).

For detailed instructions on replacing a PMC, please refer to the *PMC User Manual* (UM1PMC1S0).

After replacing a PSU, the PMC automatically assigns the lowest available ID number to the new PSU. If necessary, this ID number can be modified; for instructions on how to do so, please refer to the *PMC User Manual* (UM1PMC1S0).

Appendix 1 Technical Data

Table 1 AC Input Parameters

Parameter Name	Description	Unit	Remark
Rated input voltage range	200 ~ 277 (line voltage 346 ~ 480)	Vac	
Input voltage range	180 ~ 305 (line voltage 311 ~ 528)	Vac	
Rated frequency	50 / 60	Hz	Operating range: 47 Hz ~ 63 Hz
Input voltage configuration	Three-phase five-wire	/	
Maximum input current	29.9	A	200 Vac
Power factor	≥ 0.95 @ 10% ~ 20% load @ 208 Vac ~ 250 Vac ≥ 0.98 @ 20% ~ 100% load @ 208 Vac ~ 277 Vac ≥ 0.90 @ 10% ~ 20% load @ 250 Vac ~ 277 Vac	/	50 Hz, 60 Hz. No requirements at loads below 10%
THDi	≤ 15 @ 5% ~ 10% load @ 208 Vac ~ 277 Vac ≤ 10 @ 10% ~ 30% load @ 208 Vac ~ 277 Vac ≤ 5 @ 30% ~ 100% load @ 208 Vac ~ 277 Vac	%	50 Hz, 60 Hz. The Total Harmonic Distortion (THD) of the voltage source must be less than 1.1%
Rated power	33	kW	

Table 2 PSU Output Parameters

Parameter Name		Description	Unit	Remark
Output voltage		50 @ no load 49 @ 100% load 48.5 @ 150% load	Vdc	
Voltage regulation accuracy		±0.125	V	Or ±0.25%
Rated output current		11225	A	
Output ripple and noise		≤ 500	mVp-p	Using a 20 MHz bandwidth oscilloscope probe, the parallel capacitance of the probe is 10 μF + 0.1 μF (mVp-p)
Dynamic response	Overshoot amplitude	±0.5	V	50% step load (min. 10% load) / 1 A ~ 6 A / μs / 50 Hz to 10 kHz
	Overshoot amplitude	±1	V	90% step load (min. 10% load) / 1 A ~ 6 A / μs / 50 Hz to 10 kHz
	Overshoot amplitude	±1.5	V	140% step load (min. 10% load) / 1 A ~ 6 A / μs / 50 Hz to 10 kHz
	Recovery time	3	ms	All of the above conditions apply
Current sharing accuracy		≤ ±5 @ 50% > load ≥ 20% ≤ ±2 @ load ≥ 50%	%	
Startup output delay		3 ~ 5	s	The time from the application of the rated input voltage until the output voltage reaches 50 Vdc
Shutdown / startup overshoot		≤ 1	V	The output rise and fall must be monotonic; overshoot or oscillation is not permitted
Hold-up time		≥ 20 @ 220 Vac / 230 Vac / 277 Vac	ms	At 100% load (5500 W), the power supply shall have a hold-up time of at least 20 ms following the loss of input voltage
Maximum capacitive load		20	mF	

Table 3 PSU Efficiency

Load Range	Peak Efficiency	Minimum Efficiency
10% to 30% of full load	$\geq 97.5\%$ @ 230 Vac / 240 Vac / 277 Vac $\geq 96.5\%$ @ 208 Vac	$\geq 94\%$ @ 208 Vac ~ 277 Vac
30% to 100% of full load	/	$\geq 96.5\%$ @ 230 Vac / 240 Vac / 277 Vac

Load Range	Peak Efficiency	Minimum Efficiency
30% to 100% of full load	/	≥ 95.5% @ 208 Vac

Table 4 PSU Protection Values

Protection Point	Threshold	Unit	Remark
Input undervoltage protection	165 ~ 180	Vac	Shut down immediately. The power shelf resumes operation once AC power returns to normal. All voltages are phase voltages
Input overvoltage protection	305 ~ 315	Vac	
Output overvoltage protection	52.5 ~ 54	Vdc	Shut down and lock immediately. DC output voltage ≤ 54 V
Output overcurrent protection	> 115% load for more than 10 s > 120% load for more than 100 ms	%	Locked out after 5 trips
Output short circuit protection	Yes		Shut down and lock immediately
Employ overtemperature protection	Yes		
Ambient overtemperature protection	Yes		
Fan fault protection	Yes		

Table 5 Environmental Parameters

Application Environment	Parameter	Unit	Operating Environment	Transport Environment	Storage Environment	Remark
Temperature	Min.	°C	-5	-55	-40	
	Max.	°C	+45	+85	+70	
Humidity	Min.	%	10	10	10	
	Max.	%	90	90	90	
	Condensation	Y/N	N	/	N	
Altitude	Min.	m	0	/	0	
	Max.	m	3050	/	3050	

Table 6 Other

Specification	Parameter	Remark
Pollution degree	C2	
Overvoltage category	2	

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