NetSure™ 400V DC Power System

User Manual

Specification Number: 584001200
Model Number: 9500

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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/en-us/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.

Safety and Regulatory Statements

Refer to Section 4154 (provided with your customer documentation) for Safety and Regulatory Statements.

Déclarations de Sécurité et de Réglementation

Reportez-vous à la Section 4154 (fourni avec les documents de votre client) pour les déclarations de sécurité et de réglementation.

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1 Customer Documentation Package

This document (UM584001200) provides Operation Instructions for Vertiv™ NetSure™ 9500 400V DC Power System Model 9500, Spec. No. 584001200.

The complete Customer Documentation Package consists of…

Power System Installation Manual

- Power System Installation Instructions: IM584001200

Power System Operation Manual

- Power System Operation Instructions: UM584001200
- Rectifier Instructions: UM1R40015000e
- Power System “System Application Guide”: SAG584001200

Battery Cabinet Installation and Operation Manual

- Battery Cabinet Installation and Operation Instructions: IM58400120090

Controller User Manual

- ACU+ Controller User Instructions: UM1M820NNB 3

USB Drive with All Customer Documentation

- Power System Installation Instructions: IM584001200
- Power System Operation Instructions: UM584001200
- Battery Cabinet Installation and Operation Instructions: IM58400120090
- Rectifier Instructions: UM1R40015000e
- Power System “System Application Guide”: SAG584001200
- ACU+ Controller User Instructions: UM1M820NNB 3
- Engineering Drawings
- Also provided on the USB drive is an ACU+ configuration drawing and the ACU+ configuration files loaded into the ACU+ as shipped.

2 System Description

400V DC Output @ up to 600kW Power System

The Vertiv™ NetSure™ 9500 400V DC Power System is a complete integrated power system containing rectifiers, intelligent control, metering, monitoring, and distribution.

A system can consist of a Main Power Module/Bay, up to four (4) Expansion Power Modules/Bays, optional Distribution Modules/Bays, and Battery Cabinets.

This power system is capable of operating either with or without batteries online.

2.1 Power Module/Bay (List 01, 03)

A system can consist of a Main Power Module/Bay and up to four (4) Expansion Power Modules/Bays. These Power Modules/Bays are installed in a row next to each other. The system can be expanded either left or right of the Main Power Module/Bay (but not in both directions).

The Power Module/Bay consists of the following components. All Power Module/Bay components are factory installed in the selected rack.

Power Module/Bay "Power and Control Section"

The power and control section houses up to eight (8) rectifiers and the system control and monitoring components.

- **Rectifier**

  Each Power Module/Bay contains one (1) to eight (8) rectifiers, which provide load power, battery float current, and battery recharge current during normal operating conditions. Refer to the rectifier instructions (UM1R40015000e) for more information.

- **AC Input Distribution**

  A main AC input circuit breaker (250A) is provided. Individual AC input circuit breakers (40A) for each rectifier can also be furnished (cannot be used in a three-phase "delta" AC distribution system).

- **Controls**

  This system is specifically wired in an HRMG grounding scheme. Controls and wiring for all bays follow this manner.

  Main Power Module/Bay - ACU+ (Advanced Control Unit Plus) Controller

  The system controller provides power system control, rectifier control (including a charge control function), metering functions, monitoring functions, and local/remote alarm functions. Power system control includes battery low voltage disconnect (BLVD) functionality to remotely trip battery circuit breakers which protects batteries against over-discharge. The controller also provides data acquisition, system alarm management, and advanced battery and energy management. The controller contains an LCD display and keypad for local access. The controller provides an Ethernet port and comes with comprehensive webpages for remote access. The controller has SNMP capability for remote system management. The controller supports software upgrade via its USB port and the WEB interface. The controller also provides output bus insulation detection which provides an indication of DC ground fault (insulation fault). Refer to the ACU+ controller instructions (UM1M820NNB 3) for more information.

  Expansion Power Module/Bay - Controller Interface

  Each Expansion Power Module/Bay contains a controller interface to communicate with the Main Power Module/Bay controller.

  Temperature Probes

  The Main Power Module/Bay can be equipped with one (1) to six (6) temperature probe(s). Each Expansion Power Module/Bay can be equipped with one (1) to two (2) temperature probe(s). Any combination of the fourteen (14) temperature probes can be programmed to monitor ambient air temperature and/or battery temperature. A temperature probe set to monitor battery temperature can also be used for the rectifier battery charge temperature compensation feature and/or BTRM (battery thermal runaway management) feature. Refer to the ACU+ controller instructions (UM1M820NNB 3) for more information.

Power Module/Bay "Distribution Section"

This section can contain DC output breakers in various configurations using the following panels.

- Load Distribution Panel (List 21HA): Provides sixteen (16) circuit breaker positions (15A to 100A).
- Bulk Distribution Panel (List 23HA): Provides one (1) 400A circuit breaker for bulk load distribution.

NOTE! *Each Power Module/Bay may contain either one (1) List 21HA or up to three (3) List 23H.*

NOTE! *Refer to SAG584001200 for the ratings of List 21HA when used in a Power Module/Bay (List 01 / 03).*

NOTE! *Refer to SAG584001200 for ratings of List 23HA when used in a Power Module/Bay (List 01 / 03).*

2.2 Distribution Module/Bay (List 07)

A stand-alone Distribution Module/Bay is available.

The Distribution Module/Bay consists of the following components. All Distribution Module/Bay components are factory installed in the selected rack.

- Load Distribution Panel (List 21HA): One (1) or two (2) List 21HA load distribution panels can be installed in the Distribution Module/Bay. When the Distribution Module/Bay is populated with two (2) load distribution panels, each panel can receive a separate input feed or the panels can be interconnected for a single feed per module. Each panel provides sixteen (16) circuit breaker positions (15A to 100A).

NOTE! *Refer to SAG584001200 for ratings of List 21HA when used in a Distribution Module/Bay (List 07).*

2.3 Battery Options

The system may contain up to six (6) battery strings (depending on configuration, see SAG584001200). When a List 21HA Load Distribution Panel is deployed in the system, the total short circuit current generated by the battery option cannot exceed 25kAIC. If only List 23HA Bulk Distribution Panels are deployed in the system, the total short circuit current generated by the battery option cannot exceed 50kAIC.

- **Vertiv Provided Battery Cabinet**

  Vertiv offers a choice of battery models factory installed and connected in a cabinet (List 90, 91, 92, 93). Each Battery Cabinet houses one (1) 400V battery string consisting of twenty-eight (28) 12V battery blocks (336V nominal). Refer to the Battery Cabinet instructions (IM58400120090) for more information.

NOTE! *The maximum number of Vertiv provided Battery Cabinets is limited to a maximum of six (6) (depending on configuration, see SAG584001200).*

- **Customer Provided Batteries**

  Customer battery solutions must utilize a compatible battery breaker (see SAG584001200 for specifications). When a List 21HA Load Distribution Panel is deployed in the system, the total short circuit current generated by the customer provided battery option cannot exceed 25kAIC. If only List 23HA Bulk Distribution Panels are deployed in the system, the total short circuit current generated by the customer provided battery option cannot exceed 50kAIC. This is based upon the AIC rating of the DC breaker in the distribution panel.

2.4 HRMG (High Resistance Midpoint Ground) Configuration (+/- 200V DC)

The HRMG configuration provides system voltages to ground at half of the output system voltage, for additional personnel safety. That is, the HRMG version of 400V DC produces +/-200V DC to ground potentials. This configuration is used in applications where an internal high resistance path is required between the positive output busbar and site ground and also the negative output busbar and site ground.

The DC bus is continuously monitored for ground fault (insulation fault) conditions. If the insulation resistance between the +BUS or -BUS to ground goes below a set value, a ground fault (insulation fault) alarm is generated and an alarm LED located on the front of the Power Module/Bay's power and control section illuminates.

3 Operating Procedures

3.1 Controller and Rectifiers

For operation instructions on these units, refer to the following documents.

- ACU+ Controller User Instructions (UM1M820NNB-3)
- Rectifier Instructions (UM1R40015000e)

3.2 Battery Cabinet (if furnished)

For operation instructions on the Battery Cabinet, refer to the Battery Cabinet Installation and Operation Instructions (IM58400120090).

3.3 Local Controls and Indicators

Refer to the controller and rectifier instructions for descriptions of the local controls and indicators located on these units.

Refer to this section for descriptions of the local controls and indicators located on the Power Module/Bay's power and control section. Refer to **Figure 3.1** and **Figure 3.2** for location.

Main Power Module/Bay "Power and Control Section"

Main AC Input Circuit Breaker: A main AC input circuit breaker is provided to disconnect AC input power from the Main Power Module/Bay's power and control section.

NOTE! *The main AC input circuit breaker has a system controlled trip mechanism to trip the breaker if an EPO signal is sent.*

Optional Rectifier AC Input Circuit Breakers: Each rectifier has a separate AC input circuit breaker to disconnect AC input power from the respective rectifier.

"Output Voltage Present" Indicator: Illuminates green to indicate voltage is present on the Main Power Module/Bay's DC output bus.

"Control Voltage Present" Indicator: Illuminates green to indicate the converter power supply in the Main Power Module/Bay is functioning. (If off when system is in operation, contact Vertiv Technical Support.) (The converter power supply provides 48V DC for controls.)

"Ground/Insulation Fault Alarm" Indicator: Illuminates red to indicate a ground fault (insulation fault) related alarm condition exists. (See "HRMG Configuration Ground Fault (Insulation Fault) Detection Circuit Operation" on page 5.)

WARNING! It is important to service and remove the ground fault (insulation fault) in the system as soon as the alarm is indicated.

Expansion Power Module/Bay "Power and Control Section"

Main AC Input Circuit Breaker: A main AC input circuit breaker is provided to disconnect AC input power from the Expansion Power Module/Bay's power and control section.

NOTE! *The main AC input circuit breaker has a system controlled trip mechanism to trip the breaker if an EPO signal is sent.*

Optional Rectifier AC Input Circuit Breakers: Each rectifier has a separate AC input circuit breaker to disconnect AC input power from the respective rectifier.

"Output Voltage Present" Indicator: Illuminates green to indicate voltage is present on the Expansion Power Module/Bay's DC output bus.

"Control Voltage Present" Indicator: Illuminates green to indicate the converter power supply in the Expansion Power Module/Bay is functioning. (If off when system is in operation, contact Vertiv Technical Support.) (The converter power supply provides 48V DC for controls.)

3.4 Distribution Panel Lockout/Tagout (LOTO)

The circuit breakers located on a load distribution panel contain a bracket which allows the circuit breaker to be padlocked in the off position.

3.5 HRMG Configuration Ground Fault (Insulation Fault) Detection Circuit Operation

Overview

The ground fault (insulation fault) detection circuit in a High Resistance Mid-Point Ground (HRMG) configuration detects the insulation condition of the positive and negative DC bus to ground.

If a ground fault (insulation fault) is detected, a local indicator illuminates (located on the front of the Main Power Module/Bay's power and control section). The ground fault (insulation fault) detection circuit also sends a signal to the ACU+ controller which activates local and remote controller alarms.

High Resistance Mid-Point Ground (HRMG) Configuration Benefits

- Continuous bus operation with a single pole ground fault (insulation fault).

However; it is important to locate and isolate any ground faults (insulation faults) that occur in order to preserve these benefits. The voltages between the +Bus and –Bus will shift when a ground fault or insulation breakdown occurs and benefits above will be negated. In the extreme case, the voltage on an ungrounded pole may be elevated to 400V DC and present a safety hazard to personnel.

Ground Fault (insulation Fault) Detection Alarms

The ground fault (insulation fault) detection circuit monitors for three different types of ground faults (insulation faults).

- **Missing Ground:** The HRMG grounding lead that exits each Power Module/Bay power and control sub-rack is not connected to ground.
- **Ground Fault (Insulation Fault) Alarm:** The resistance between the +Bus to ground OR the –Bus to ground is less than the "Ground Fault (Insulation Fault) Alarm Limit" parameter set in the ACU+ controller. The default setting for this parameter is 39.2k Ohm.

NOTE! *The "Normal Operation Site" impedance to ground for both the positive and negative output to ground should be determined. Set the Ground/Insulation setpoint below your site's impedance to ground value. See UM1M820NNB-3 for instructions on how to set this parameter.*

- **Bus Voltage Imbalance:** Bus to ground voltage imbalance. The voltage difference between the +Bus to ground and the – Bus to ground is more than the "Voltage Imbalance Alarm Limit" parameter set in the ACU+ controller. The default setting for this parameter is 84V.

NOTE! *The default alarm severity setting for "Bus Voltage Imbalance" is NA (non-alarmed) and prevents the condition from being displayed. However, the User can change the "Bus Voltage Imbalance" alarm severity setting if desired to display the alarm.*

3.6 EPO (Emergency Power Off)

Each Power Module/Bay has an Emergency Power Off (EPO) function operated by a remote contact provided by the User.

Power Module/Bay EPO connectors are daisy-chained together. The Main Power Module/Bay provides terminals for connection of a customer provided external EPO switch. When the EPO switch is momentarily closed, the main AC input circuit breaker located on the power and control section of each Power Module/Bay and the battery disconnect circuit breakers (if connected to the BATT1 CTRL, BATT2 CTRL, BATT3 CTRL, and/or BATT4 CTRL connectors in the Main Power/Module Bay and the BATT1 CTRL and/or BATT2 CTRL connectors in each Expansion Power/Module Bay) are tripped open to isolate the system from all electrical sources. Manual intervention is required to restart the system. Restart the system by first turning ON the main AC input circuit breaker located on the power and control section of each Power Module/Bay then the battery circuit breaker(s).

Figure 3.1 Main Power Module/Bay Power and Control Section Controls and Indicators

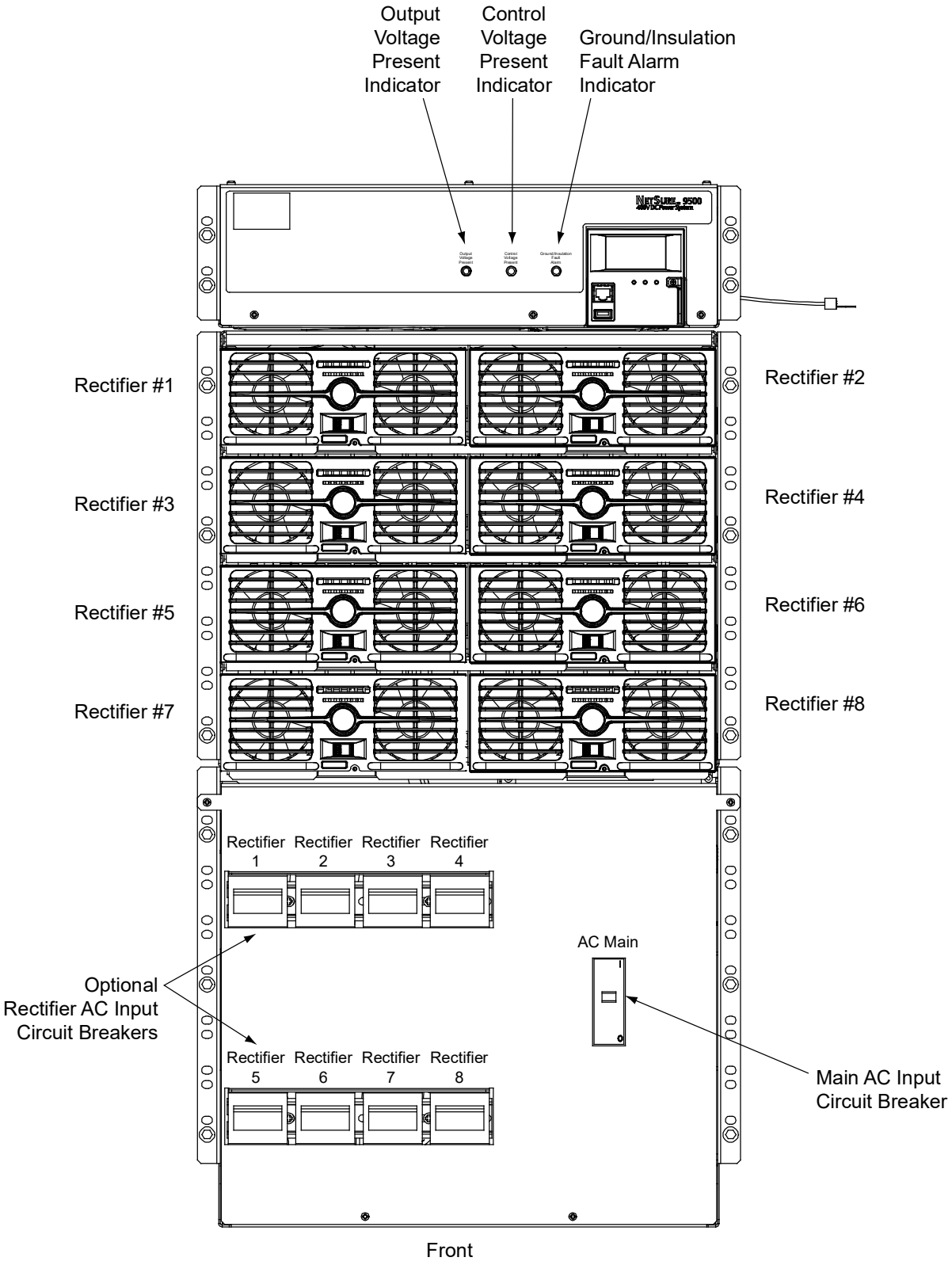
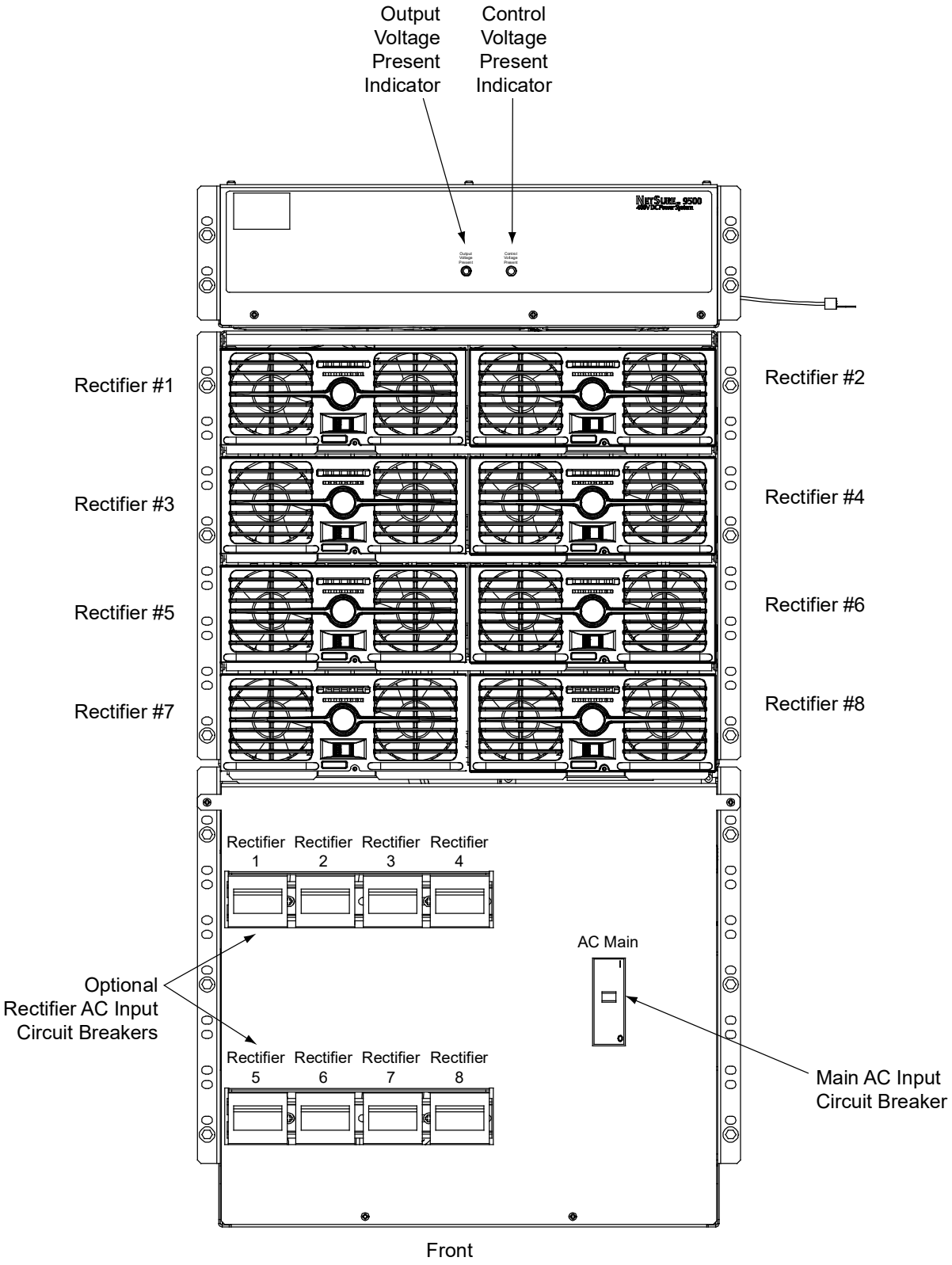


Figure 3.2 Expansion Power Module/Bay Power and Control Section Controls and Indicators



3.7 Adding a Circuit Breaker to a List 21HA Distribution Panel

DANGER! Hazardous DC voltage (400V DC) is present. The distribution panel MUST be completely isolated from all power sources.

Refer to **Figure 5.1** as this procedure is being performed.

Procedure

1. Power down and isolate the distribution panel from all power sources.
2. Refer to **Figure 5.1** and attach the leads provided with the circuit breaker to the appropriate circuit breaker terminals. The leads are to be oriented so they exit the rear of the circuit breaker. Note that the DC load distribution leads are terminated in a 2-hole lug and the DC input bus leads are terminated in a single-hole lug. Note also that the positive leads are red and the negative leads are black. Torque these connections to 62 in-lbs (7 Nm).
3. Remove the respective distribution position's blank cover from the distribution panel's top or bottom front cover.
4. Remove the distribution panel's top or bottom front cover to access the circuit breaker wiring by removing the screws securing the cover to the distribution panel.
5. Place the circuit breaker into its mounting position, feeding the attached leads to the rear of the distribution panel. Orient the ON/OFF positions as shown in **Figure 5.1**.
6. Secure the circuit breaker leads as shown in **Figure 5.1**. Torque the DC input bus leads to 66 in-lbs (7 Nm). Torque the DC load distribution leads to 66 in-lbs (7 Nm).
7. Replace the distribution panel's top or bottom front cover. Secure the cover to the distribution panel.
8. Place each circuit breaker to the OFF position.
9. Connect all power sources to the distribution panel.
10. Place each circuit breaker to the ON position.
11. Ensure that there are no local or remote alarms active on the system.

4 Maintenance

Contact Vertiv for all of your maintenance needs.

4.1 Important Safety Instructions

DANGER! Adhere to the "Important Safety Instructions" presented at the front of this document.

4.2 System Maintenance Procedures

DANGER! The system MUST be completely powered down and isolated from all power sources (AC and battery) before any maintenance procedure is performed, or use full PPE protection for arc flash.

It is recommended to perform the maintenance procedures listed in **Table 4.1** every 12 months to ensure continual system operation.

Table 4.1 Maintenance Procedures to be Performed at 12-Month Intervals

Check	Procedure
Ventilation Openings	Check ventilation openings for obstructions such as dust, papers, manuals, etc.
Grounding Connections	Inspect the HDU ground termination, tightness of all lugs on the master ground bar and equipment sub-racks, and low ohmic values to the facility ground per local practice.
AC Input Connections	Inspect the AC input mains terminations for proper temperature and/or torque values.
DC Load Connections	Inspect the DC load breaker wiring for proper temperature and/or torque values.
Battery Connections	Inspect the battery lead terminations for proper temperature and/or torque values.

4.3 Recommended Battery Maintenance

Refer also to the Battery Cabinet Installation and Operation Instructions (IM58400120090).

Lockout/Tagout (LOTO)

The “Battery Disconnect Circuit Breaker” on an Vertiv Battery Cabinet contains a bracket which allows the circuit breaker to be padlocked in the off position.

Maintenance

Inspect the batteries according to battery manufacturer’s instructions. Maintain records as required by the battery manufacturer to maintain the battery warranty.

Typical battery life is expected to be 3-5 years (depending on conditions).

Battery life is determined by a variety of factors, including the technology deployed, the charge/discharge cycle history, operating temperature, peak current draw, etc. Battery health should be checked at regular intervals per battery manufacturer’s instructions. It is recommended to verify battery string voltage (336V DC nominal) and individual battery block voltages (12V DC nominal). To verify the health of individual battery blocks, it is recommended to isolate and disconnect the battery string from the system (via the battery disconnect circuit breaker).

The ACU+ controller contains a Battery Test feature to validate batteries. Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-3).

5 Troubleshooting and Repair

5.1 Important Safety Instructions

DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

5.2 Contact Information

Refer to Section 4154 (provided with your customer documentation) for support contact information.

5.3 Controller and Rectifiers

For troubleshooting and repair instructions on these units, refer to the following documents.

- ACU+ Controller User Instructions (UM1M820NNB-3)
- Rectifier Instructions (UM1R40015000e)

5.4 ACU+ Controller Configuration

If any ACU+ controller configuration settings were changed, refer to the ACU+ User Instructions (UM1M820NNB-3) and save a copy of the configuration file. This file can be used to restore the ACU+ controller settings, if required, at a later date.

- Note that provided on a USB drive furnished with the system is an ACU+ configuration drawing (C drawing) and the ACU+ configuration files loaded into the ACU+ as shipped.

5.5 System Troubleshooting Information

This system is designed for ease in troubleshooting and repair. The various indicators as described in “Operating Procedures” on page 4 and in the controller and rectifier instructions are designed to isolate failure to a specific component. Once the faulty component has been identified, refer to “Replacement Information” on page 12 and "Replacement Procedures" on page 12.

Troubleshooting Alarm Conditions on the ACU+ Controller

The ACU+ controller displays alarm conditions as listed in the Available Alarms section of the ACU+ User Instructions (UM1M820NNB-3). Programmable external alarm relays are also available. Refer to the ACU+ Configuration Drawing (C-drawing) furnished with your system for your alarm relay configurations.

The ACU+’s ***Active Alarm*** and ***Alarm History*** submenus allow the User to view alarm details. Refer to the ACU+ User Instructions (UM1M820NNB-3) to access these menus.

Clearing a Rectifier Communications Fail Alarm after Removing a Rectifier

If a rectifier is removed from the system, a rectifier communications failure alarm is generated. If the rectifier will not be replaced, the alarm can be cleared as described in the following local LCD interface procedure.

Procedure

1. With the Main screen displayed, press **ENT** to go to the Main Menu. Navigate to and select “**Manual**” (ENT).
2. If a password screen opens, a password must be entered to allow the User to make adjustments. If a password was previously entered and has not yet timed out, skip this step and proceed to step 3). Otherwise, to enter a password, with the cursor at the User Name field (default is “Admin”), press the down arrow key to move cursor down to the password line. Press **ENT**. “0” is highlighted. Press the up arrow key once to change the “0” to”1” (default password is “1”), then press **ENT** twice. (***Note:*** *If you have been assigned a unique User Name and password, follow this procedure to enter these.*)

3. With the Manual menu screen displayed, navigate to and select "**Rectifier**" (ENT) / "**All Rect Ctrl**" (ENT).
4. Navigate to "**Clear Comm Fail**". Press **ENT**. "Yes" highlights.
5. Press **ENT** to select the operation. Press **ENT** again to confirm.
6. Return to the Main screen by repeatedly pressing **ESC** (escape).

Clearing a Rectifier Lost Alarm

If the ACU+ controller resets while a rectifier communications fail alarm is active, the rectifier communications fail alarm is replaced with a rectifier lost alarm. The alarm can be cleared as described in the following local LCD interface procedure.

Procedure

1. With the Main screen displayed, press **ENT** to go to the Main Menu. Navigate to and select "**Manual**" (ENT).
2. If a password screen opens, a password must be entered to allow the User to make adjustments. If a password was previously entered and has not yet timed out, skip this step and proceed to step 3). Otherwise, to enter a password, with the cursor at the User Name field (default is "Admin"), press the down arrow key to move cursor down to the password line. Press **ENT**. "0" is highlighted. Press the up arrow key once to change the "0" to"1" (default password is "1"), then press **ENT** twice. (***Note:*** *If you have been assigned a unique User Name and password, follow this procedure to enter these.*)
3. With the Manual menu screen displayed, navigate to and select "**Rectifier**" (ENT) / "**All Rect Ctrl**" (ENT).
4. Navigate to "**Clear Rect Lost**". Press **ENT**. "Clear" highlights.
5. Press **ENT** to select the operation. Press **ENT** again to confirm.
6. Return to the Main screen by repeatedly pressing **ESC** (escape).

5.6 Replacement Information

User Replaceable Components

Refer to SAG584001200 (System Application Guide) for part numbers of User replaceable components.

When a trouble symptom is localized to a faulty rectifier, controller, or User replaceable circuit card; that particular component should be replaced in its entirety. Other than a rectifier fan replacement, no attempt should be made to troubleshoot or repair an individual rectifier, controller, or circuit card.

5.7 Replacement Procedures

DANGER! Adhere to the "Important Safety Instructions" presented at the front of this document.

Replacing a Rectifier or Rectifier Fan

Refer to the Rectifier Instructions (UM1R40015000e) for a rectifier replacement procedure and a rectifier fan replacement procedure. Refer also to "System Troubleshooting Information" on page 8.

The rectifier being replaced is assigned by the ACU+ the lowest available identification number. If desired, you can change the identification number, see "Configuring the ACU+ Identification of Rectifiers" in the "INITIALLY STARTING THE SYSTEM" section of the separate Power System Installation Instructions (IM584001200).

Replacing the ACU+ Controller

Refer to the ACU+ User Instructions (UM1M820NNB-3) for a controller replacement procedure.

Replacing a Circuit Breaker in a List 21HA Distribution Panel

DANGER! Hazardous DC voltage (400V DC) is present. The distribution panel MUST be completely isolated from all power sources.

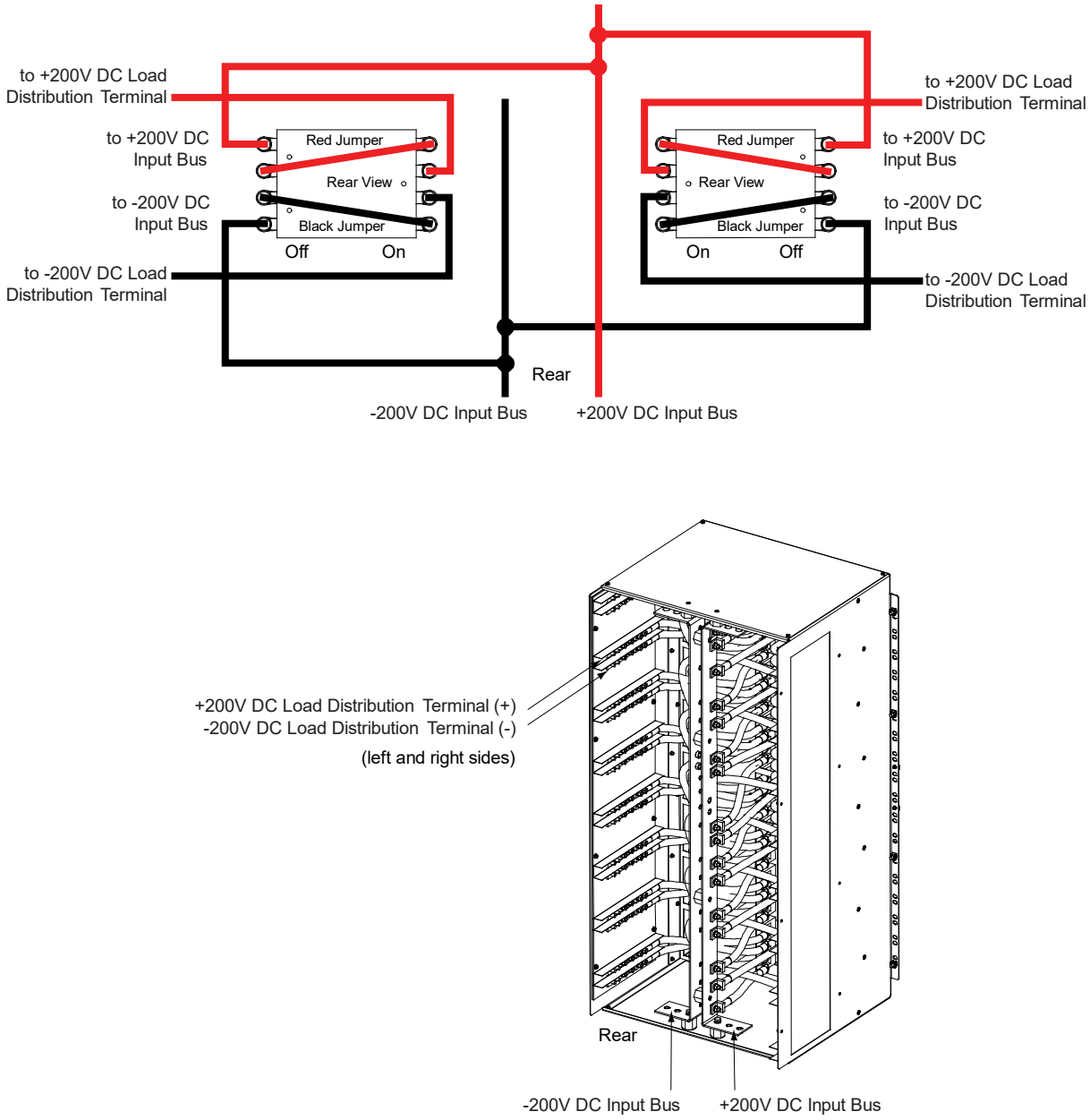
Replace distribution circuit breakers with the same type and rating. Refer to System Application Guide SAG584001200 for part numbers.

Refer to **Figure 5.1** as this procedure is being performed.

Procedure

1. Power down and isolate the distribution panel from all power sources.
2. Remove the distribution panel's top or bottom front cover to access the defective circuit breaker and wiring by removing the screws securing the cover to the distribution panel.
3. Label the wires connected to the defective circuit breaker for correct placement on the replacement circuit breaker. Remove the wires from the defective circuit breaker, leaving the ends attached to the input and output bus in place.
4. Remove the defective circuit breaker by pulling it out from the front of the distribution panel.
5. Transfer the leads that were attached to the defective circuit breaker to the replacement circuit breaker. Refer to **Figure 5.1**. The leads are to be oriented so they exit the rear of the circuit breaker. Note that the DC load distribution leads are terminated in a 2-hole lug and the DC input bus leads are terminated in a single-hole lug. Note also that the positive leads are red and the negative leads are black. Torque these connections to 62 in-lbs (7 Nm).
6. Place the replacement circuit breaker into its mounting position, feeding the attached leads to the rear of the distribution panel. Orient the ON/OFF positions as shown in **Figure 5.1**.
7. Replace the distribution panel's top or bottom front cover. Secure the cover to the distribution panel.
8. Place each circuit breaker to the OFF position.
9. Connect all power sources to the distribution panel.
10. Place each circuit breaker to the ON position.
11. Ensure that there are no local or remote alarms active on the system.

Figure 5.1 Adding or Replacing a DC Distribution Circuit Breaker in a List 21HA Distribution Panel



Replacing an AC Input Surge Protector in a Power Module/Bay

DANGER! Hazardous AC voltage (380V/400V/480V AC) is present behind the access covers being removed in this procedure. Disconnect AC input power from the Power Module/Bay. Follow local lockout/tagout procedures to ensure the external AC input circuit breaker remains in the OFF position during this procedure.

A tripped AC input surge protector is indicated by an alarm issued via the ACU+ controller.

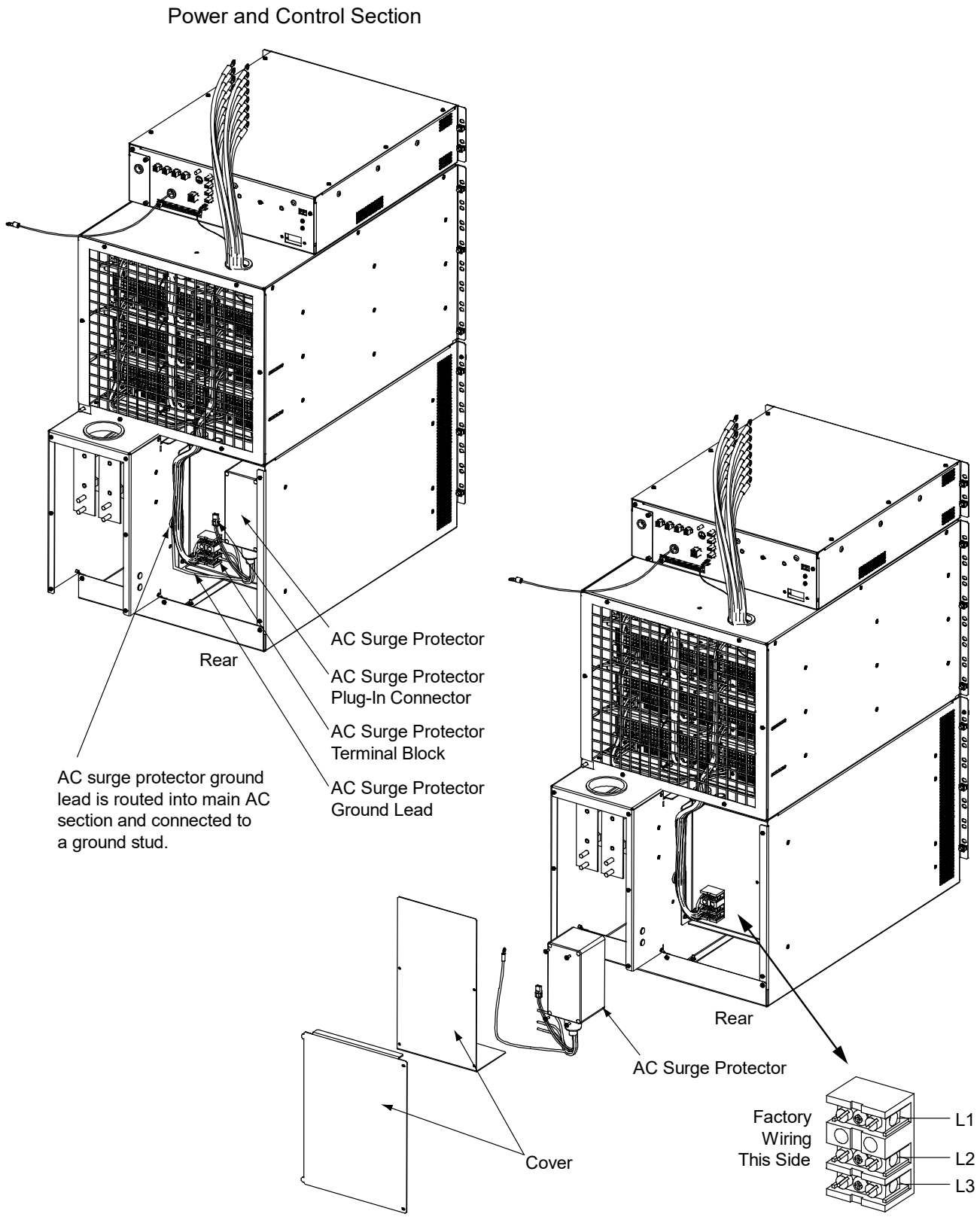
Refer to System Application Guide SAG584001200 for a replacement part number.

Refer to **Figure 5.2** as this procedure is being performed.

Procedure

1. Power down the Power Module/Bay.
2. Remove AC input power from the Power Module/Bay. Follow local lockout/tagout procedures to ensure the external AC input circuit breaker remains in the OFF position during this procedure.
3. Remove the left and right rear access covers from the Power Module/Bay's power and control section.
4. Locate the surge protector.
5. Disconnect the surge protector wiring from the surge protector wiring terminal block.
6. Unplug the surge protector plug-in connector from the connector inside the Power Module/Bay's power and control section.
7. Disconnect the surge protector ground lead.
8. Remove the defective surge protector from the Power Module/Bay's power and control section.
9. Secure the replacement surge protector to the Power Module/Bay's power and control section.
10. Reconnect the replacement surge protector ground lead.
11. Plug the replacement surge protector plug-in connector into the connector inside the Power Module/Bay's power and control section.
12. Reconnect the replacement surge protector wiring to the surge protector wiring terminal block.
13. Replace the Power Module/Bay's power and control section's left and right rear access covers.
14. Apply AC input power to the Power Module/Bay.
15. Power up the Power Module/Bay.
16. Ensure that there are no local or remote alarms active on the system.

Figure 5.2 AC Input Surge Protector Replacement in a Power Module/Bay



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