SYSTEM OVERVIEW

Description: -48V DC @ up to 16,800 amperes Power System.

This power system is designed to power a load while charging a positive grounded battery. This power system is capable of operating in a batteryless installation or off battery for maintenance purposes. This power system is designed for operation with the positive output grounded.

The Vertiv™ NetSure™ 801NLDB (208V Input Power Bay), 801NLEB (380V/480V Input Power Bay), and 801NL-B (Distribution Bay) DC Power System is a complete integrated power system containing rectifiers, intelligent control, metering, monitoring, and distribution. This power system consists of the following components.

- **Power Bays**

  The system consists of one (1) Primary Power Bay and up to six (6) Secondary Power Bays.

  Each Power Bay can be equipped with up to twenty-four (24) Rectifier Modules.

  Each Power Bay contains a Monitor and Control Panel. In the Primary Power Bay, this panel houses the Meter-Control-Alarm (MCA) assembly. This panel in the Primary Power Bay also houses the optional LMS Main CPU circuit card of the integrated LMS Monitoring System. In a Secondary Power Bay, this panel can be equipped with an optional LMS Expansion CPU circuit card. (The optional LMS Monitoring System provides a higher level of monitoring and controlling capabilities to the power system.)

  The Monitor and Control Panel in both Primary and Secondary Power Bays contain a seven-slot card cage to house MCA alarm relay circuit cards, MCA input/output (I/O) circuit cards, and optional LMS I/O circuit cards. (If a Secondary Power Bay is to be equipped with optional LMS I/O circuit cards, it must also be equipped with the LMS Expansion CPU circuit card.)

- **Distribution Bays**

  The system consists of one (1) to eight (8) Distribution Bays.

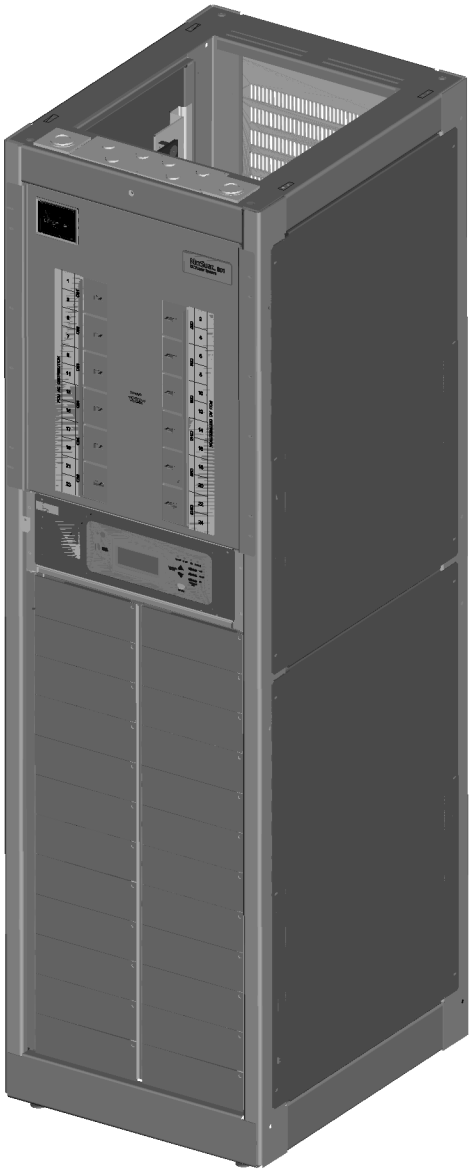
  Each Distribution Bay provides four (4) distribution buses.

  Each distribution bus accepts a choice of 218-type circuit breakers and TPL-type fuses.

  A Distribution Bay may also be equipped with an optional distribution panel which accepts a choice of TPS/TLS-type fuseholders or Bullet Nose-type circuit breakers.

- **Rectifier Modules**

  The Rectifier Modules provide load power, battery float current, and battery recharge current during normal operating conditions.



Power Bay

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- **MCA (Meter-Control-Alarm)**

  The MCA controls the operation of the Rectifier Modules and provides power system control, metering, monitoring, and alarm functions.

  MCA Local Control Panel: This panel is located on the front of the Primary Power Bay and contains a keypad, display, and indicators for local MCA user interface.

  MCA Relay Circuit Card: Each MCA relay circuit card provides six (6) sets of Form-C relay contacts for customer external alarms. These relays are user programmable for various power system alarms. Up to sixteen (16) MCA relay circuit cards can be installed in the Primary and Secondary Power Bays. The Primary Power Bay is factory equipped with two (2) MCA relay circuit cards.

  MCA I/O Circuit Cards: The MCA I/O circuit cards provide analog inputs/outputs and binary inputs. Up to sixteen (16) MCA I/O circuit cards can be installed in the Primary and Secondary Power Bays.

- **Optional Integrated LMS Monitoring System**

  The LMS Monitoring System consists of an LMS Main CPU circuit card, optional LMS Expansion CPU circuit cards, optional LMS I/O circuit cards, optional LMS Expansion Cabinet, and optional LMS Expansion Assemblies.

  The LMS Main CPU circuit card is mounted in the Primary Power Bay. Each Secondary Power Bay that is to be equipped with optional LMS I/O circuit cards must contain an LMS Expansion CPU circuit card. LMS Expansion Cabinets and LMS Expansion Assemblies are available that mount into customer racks and equipment.

  The LMS Monitoring System is factory integrated within each Power Bay, and requires no additional customer interconnections within the Power Bay. Simple cable connections between Power and Distribution Bays complete the interbay connections required. Separate analog, binary, and relay circuit cards do not have to be supplied for power system monitoring. Analog, binary, relay, and temperature circuit cards can be provided to monitor equipment external to the power system.

  The LMS input circuit cards monitor a variety of analog, binary, and temperature points external to the system. An LMS relay output circuit card is also available which provides programmable relays. These relays may be used for external alarms, or to control other equipment.

  The LMS Monitoring System can be accessed via a local port, a modem port (when optional modem is ordered), an optional TL1 port, and an Ethernet port (for Telnet access, optional Web access, optional SNMP access, optional TL1 access, and Email alarm reporting).

Distribution Bay

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The LMS Monitoring System collects data from the power system and the input circuit cards monitoring external points. The data collected is used for alarm processing and reporting, and to provide statistics.

The LMS Monitoring System is capable of reporting alarm conditions to a remote terminal, pager, Email address, via SNMP traps over Ethernet when the SNMP option is ordered, or via TL1 (over Ethernet) when the 'TL1 over Ethernet' option is ordered. TL1 is also available via a serial connection in 'direct mode'. For remote terminal or pager notification, the LMS Main CPU circuit card must be equipped with the optional modem. Two types of alarm reporting mechanisms are provided, System Alarm Reporting and Individual User Alarm Reporting.

Refer to SAG586505000 for further LMS information. The SAG can be accessed via the CD (Electronic Documentation Package) furnished with your system.

- **Applications**

  The Vertiv™ NetSure™ 801NLDB and 801NLEB is capable of interfacing with Vortex® Power Systems (VPS).

  The Vertiv™ NetSure™ 801NLDB and 801NLEB is capable of interfacing with legacy power systems.

  Refer to the wiring diagrams in the Installation Instructions (Section 6016). Refer also to Lists 64, 65, 66, and 67.

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General Specifications

See detailed specifications on page 65.

Family:	Vertiv™ NetSure™
Spec. No.:	582140001
Model:	801NLDB (208V Input Power Bay) 801NLEB (380V/480V Input Power Bay) 801NL-B (Distribution Bay)
Input Voltage	Nominal 380/480 volts AC, three phase, 50/60 Hz, with an operating range of 260 to 530 volts. Acceptable input frequency range is 45 to 65 Hz. or Nominal 208 volts AC, three phase, 50/60 Hz, with an operating range of 176 to 264 volts. Acceptable input frequency range is 45 to 65 Hz.
Output Voltage:	-48 Volts DC
Output Capacity:	
System:	16,800 Amperes, maximum (Other configurations are available. For higher amperage configurations, contact Vertiv.)
Power Bay:	2400 Amperes, maximum
Rectifier Module:	100A / -48V
Distribution Bay:	6000 Amperes, maximum
Distribution Bus: (four Distribution Buses per Distribution Bay)	1500 Amperes, maximum
Optional Distribution Panel: (Bullet Nose Circuit Breakers and/or TLS/TPS Fuses) (one optional Distribution Panel per Distribution Bay)	500 Amperes, maximum
Agency Approval:	Model 801NL-B (Distribution Bay): Listed UL 1801, NEBS Model 801NLEB (Power Bay): Listed UL 1950, NEBS Model 801NLDB (Power Bay): Lists (All): Listed UL 1950 Lists (0B, 05, 13, 21, 50, 63, 64, 65, 66, 67, 70, 71): NEBS
Framework Type:	Seismic Rated (Zone 4) Box Framework
Power Bay:	
Width:	24.375 Inches
Depth:	30 Inches
Height:	84 Inches
Access:	Front and Rear Access for Installation and Maintenance, Front for Operation.
Distribution Bay:	
Width:	31.375 Inches
Depth:	30 Inches
Height:	84 Inches
Access:	Front and Rear Access for Installation and Maintenance, Front for Operation.
Maximum Number of Power Bays per System:	7
Maximum Number of Distribution Bays per System:	8
Control:	Microprocessor
Color:	Gray

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Environment:	0°C to +40°C (+32°F to +104°F)
Configurations:	Plant is designed for centralized configuration with customer supplied Main Battery Termination Bars (MBTB's). Vertiv has standard MBTB'S in 4000, 6000, 10000, and 16000 ampere capacities. The ultimate plant capacity is determined by the capacity of the MBTB'S. Plant can be configured for distribution applications by bay-to-bay cabling up to 9600 amperes.

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MAIN COMPONENTS ILLUSTRATIONS

582140001 Power Bays

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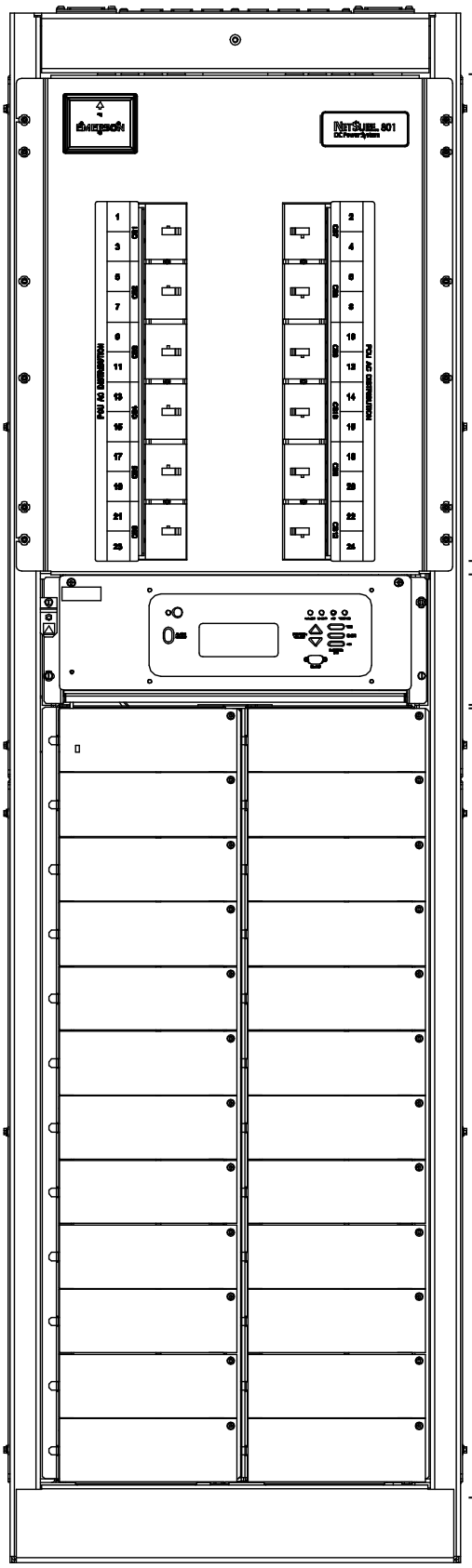
List 05: Primary Power Bay (12 or 24 AC Input Feeds)

List 06: Primary Power Bay (6 Input Feeds) 480V only.

List 12: Secondary Power Bay (2 AC Input Feeds) (Includes Circuit Breakers, One per Two Rectifier Modules)

List 13: Secondary Power Bay (12 or 24 AC Input Feeds)

List 14: Secondary Power Bay (6 Input Feeds) 480V only.



List 0A: 380/480VAC Plant Input

List 0B: 208VAC Plant Input

AC Input Termination Panel and Optional AC Input Breakers

(see Monitor and Control Diagram)

Rectifier Module Mounting Positions

List 21: Rectifier Module (208VAC Input)

List 22: Rectifier Module (380/480VAC Input)

Front View

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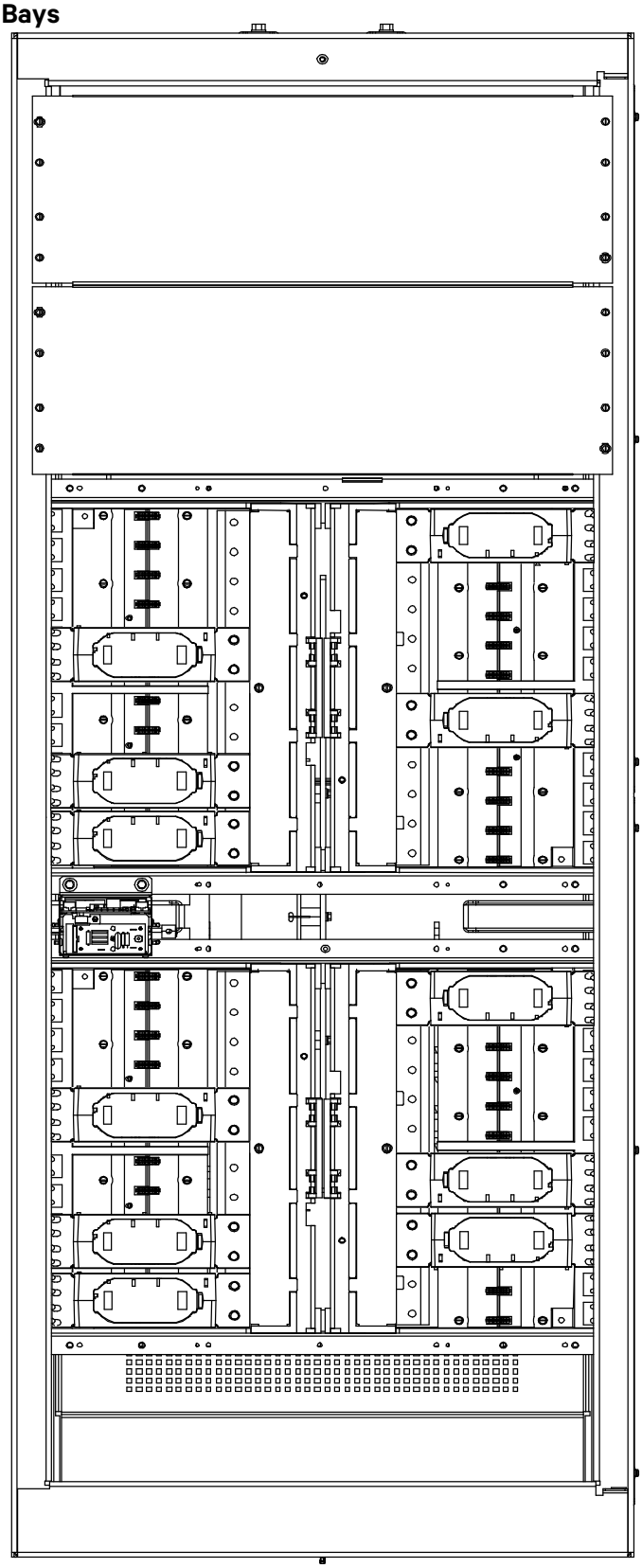
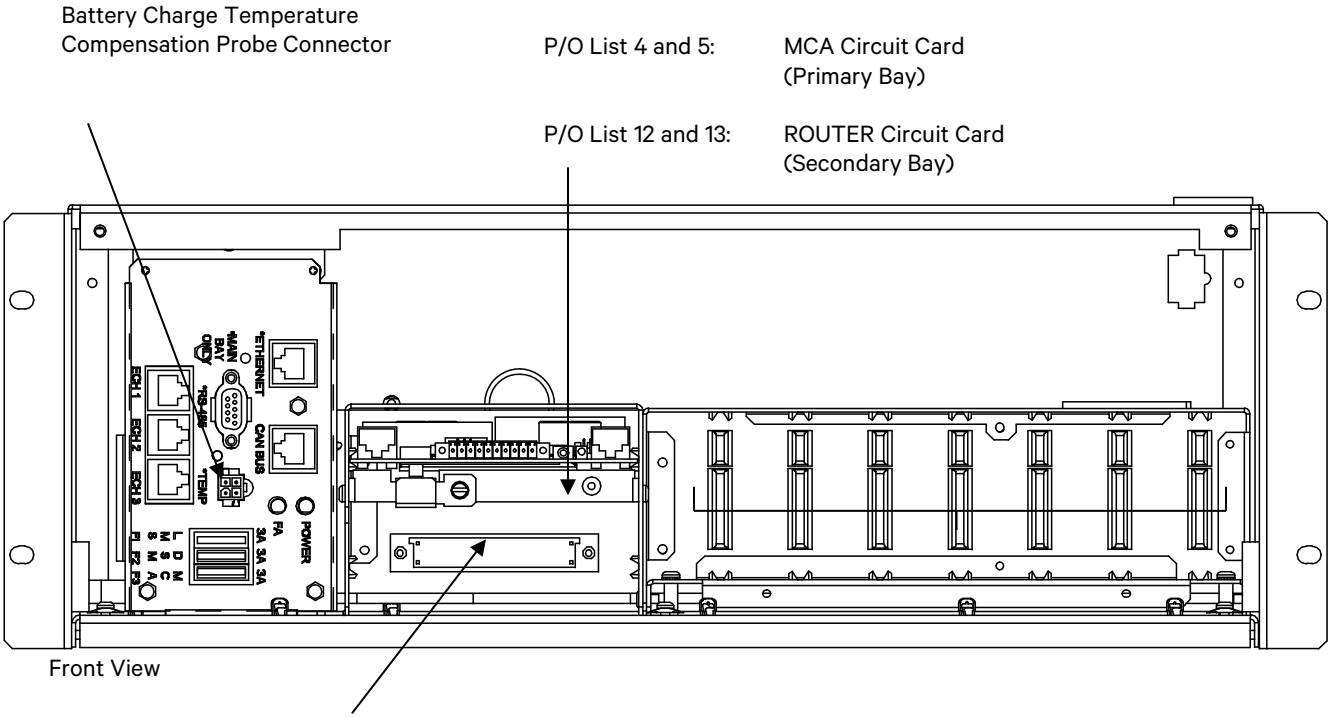
582140001 Distribution Bays



582140001 Power Bays Monitor and Control Diagram



List 50: Optional LMS Main CPU Circuit Card
or
List 63: Optional LMS Expansion CPU Circuit Card

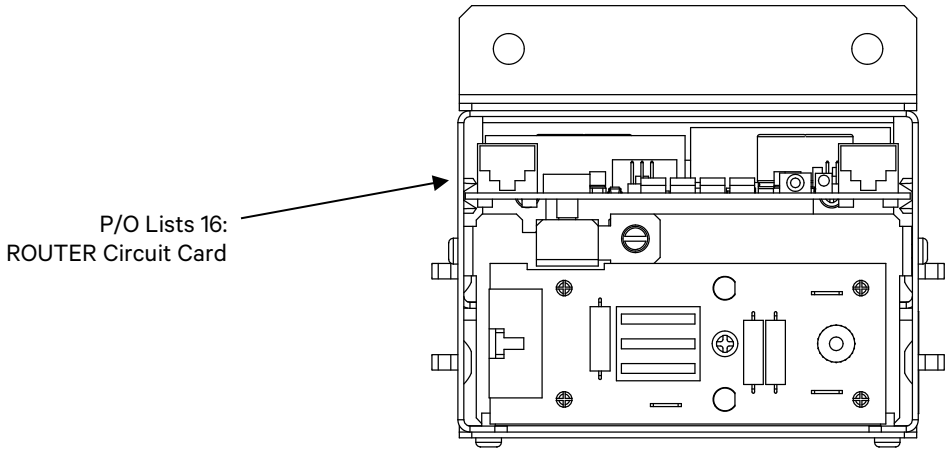
Refer to SAG586505000 for additional LMS options.

Available MCA Input/Output (I/O) Circuit Cards

List 70: MCA Customer Alarm Relay Circuit Card (Six [6] Form-C Contacts)

List 71: MCA Analog Input/Output and Binary Input Circuit Card

582140001
Distribution Bays Monitor and Control Diagram



LIST DESCRIPTIONS

List 0A: 380/480VAC Plant Input Voltage

Features

- Specifies 380/480VAC Plant Input Voltage.

List 0B: 208VAC Plant Input Voltage

Features

- Specifies 208VAC Plant Input Voltage.

List 04: Primary Power Bay (2 AC Input Feeds)

Features

- Provides common equipment for one (1) Power Bay rated for up to 2400 amperes.
- Mounted in a 7'0"H x 24.375"W x 30"D seismic rated (Zone 4) box framework.
- Provides twenty-four (24) Rectifier Module mounting positions.
- Provides an AC input termination panel that accepts two (2) AC input branch circuits, one (1) per twelve (12) Rectifier Module mounting positions. A 60A AC input circuit breaker rated for 65kA interrupting capacity is provided for each pair of rectifier positions in the List B Bay. A 30A AC input circuit breaker rated for 22kA interrupting capacity is provided for each pair of rectifier positions in the List A Bay.
- Provides the MCA Assembly and Local MCA Control Panel.
- Provides mounting for optional LMS Main CPU circuit card.
- Provides a seven-slot card cage for mounting MCA customer alarm relay circuit cards, MCA I/O circuit cards, and/or optional LMS I/O circuit cards. Two (2) MCA customer alarm relay circuit cards furnished, providing twelve (12) Form-C relay contacts
- Side cover panels are factory installed on both sides of the bay.

Restrictions

Only one (1) Primary Bay per power system required.

Ordering Notes

1) Specify List A (380/480VAC Input) or List B (208VAC Input).
2) Order up to twenty-four (24) Rectifiers Modules per bay per List 21 (208VAC Input) or List 22 (380/480VAC Input).
3) Order additional MCA customer alarm relay circuit card(s) as required per List 70, and optional MCA I/O circuit cards per List 71.
4) Order a Battery Charge Temperature Compensation Probe as required per *Optional Battery Charge Temperature Compensation Probe for Digital Compensation* in the *ACCESSORY DESCRIPTIONS* section.
5) Order optional LMS Monitor and LMS options as required per List 50, and SAG586505000.
6) Order "Power Bay DC Output" lugs as required per *Power Bay DC Output Cable Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
7) Order "AC Input" lugs as required per *AC Input (Dual AC Input Feeds) Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
8) Order "Power Bay Frame Grounding" lugs as required per *Power Bay Frame Grounding Wire Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
9) If the system is to be connected to an existing system with an MCA, refer to List 64, 65, 66, and 67.

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List 05: Primary Power Bay (12 or 24 AC Input Feeds)

Features

- Provides common equipment for one (1) Power Bay rated for up to 2400 amperes.
- Mounted in a 7'0"H x 24.375"W x 30"D seismic rated (Zone 4) box framework.
- Provides twenty-four (24) Rectifier Module mounting positions.
- Provides an AC input termination panel that accepts twenty-four (24) AC input branch circuits [one (1) per Rectifier Module mounting position] or twelve (12) AC input branch circuits [one (1) per two Rectifier Module mounting positions]. The bay ships with the 12 Feed option installed.
- Provides the MCA Assembly and Local MCA Control Panel.
- Provides mounting for optional LMS Main CPU circuit card.
- Provides a seven-slot card cage for mounting MCA customer alarm relay circuit cards, MCA I/O circuit cards, and/or optional LMS I/O circuit cards. Two (2) MCA customer alarm relay circuit cards furnished, providing twelve (12) Form-C relay contacts.
- Side cover panels are factory installed on both sides of the bay.

Restrictions

Only one (1) Primary Bay per power system required.

Ordering Notes

1) Specify List A (380/480VAC Input) or List B (208VAC Input).
2) Order up to twenty-four (24) Rectifiers Modules per bay per List 21 (208VAC Input) or List 22 (380/480VAC Input).
3) Order additional MCA customer alarm relay circuit card(s) as required per List 70, and optional MCA I/O circuit cards per List 71.
4) Order a Battery Charge Temperature Compensation Probe as required per *Optional Battery Charge Temperature Compensation Probe for Digital Compensation* in the *ACCESSORY DESCRIPTIONS* section.
5) Order optional LMS Monitor and LMS options as required per List 50, and SAG586505000.
6) Order "Power Bay DC Output" lugs as required per *Power Bay DC Output Cable Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
7) Order "AC Input Ground" lugs as required per *AC Input (Individual/Twin AC Input Feeds) Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
8) Order "Power Bay Frame Grounding" lugs as required per *Power Bay Frame Grounding Wire Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
9) If the system is to be connected to an existing system with an MCA, refer to List 64, 65, 66, and 67.

List 06: Primary Power Bay (6 AC Input Feeds)

Features

- Provides common equipment for one (1) Power Bay rated for up to 2400 amperes.
- Mounted in a 7'0"H x 24.375"W x 30"D seismic rated (Zone 4) box framework.
- Provides twenty-four (24) Rectifier Module mounting positions.
- Provides an AC input termination panel that accepts six (6) AC input branch circuits [one (1) per four Rectifier Module mounting positions].
- Provides the MCA Assembly and Local MCA Control Panel.
- Provides mounting for optional LMS Main CPU circuit card.
- Provides a seven-slot card cage for mounting MCA customer alarm relay circuit cards, MCA I/O circuit cards, and/or optional LMS I/O circuit cards. Two (2) MCA customer alarm relay circuit cards furnished, providing twelve (12) Form-C relay contacts.
- Side cover panels are factory installed on both sides of the bay.

Restrictions

Only one (1) Primary Bay per power system required. 480V only.

Ordering Notes

1) Specify List A (480VAC Input).

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2) Order up to twenty-four (24) Rectifiers Modules per bay per List 22 (380/480VAC Input).
3) Order additional MCA customer alarm relay circuit card(s) as required per List 70, and optional MCA I/O circuit cards per List 71.
4) Order a Battery Charge Temperature Compensation Probe as required per *Optional Battery Charge Temperature Compensation Probe for Digital Compensation* in the *ACCESSORY DESCRIPTIONS* section.
5) Order optional LMS Monitor and LMS options as required per List 50, and SAG586505000.
6) Order "Power Bay DC Output" lugs as required per *Power Bay DC Output Cable Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
7) Order "AC Input Ground" lugs as required per *AC Input Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
8) Order "Power Bay Frame Grounding" lugs as required per *Power Bay Frame Grounding Wire Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
9) If the system is to be connected to an existing system with an MCA, refer to List 64, 65, 66, and 67.

List 12: Secondary Power Bay (2 AC Input Feeds)

Features

- Provides common equipment for one (1) Power Bay rated for up to 2400 amperes.
- Mounted in a 7'0"H x 24.375"W x 30"D seismic rated (Zone 4) box framework.
- Provides twenty-four (24) Rectifier Module mounting positions.
- Provides an AC input termination panel that accepts two (2) AC input branch circuits, one (1) per twelve (12) Rectifier Module mounting positions. A 60A AC input circuit breaker rated for 65kA interrupting capacity is provided for each pair of rectifier positions in the List B Bay. A 30A AC input circuit breaker rated for 22kA interrupting capacity is provided for each pair of rectifier positions in the List A Bay.
- Includes a Router Assembly for bay communication to the MCA in the Primary Power Bay.
- Provides mounting for optional LMS Expansion CPU circuit card.
- Provides a seven-slot card cage for mounting MCA customer alarm relay circuit cards, MCA I/O circuit cards, and/or optional LMS I/O circuit cards.
- MCA Network bay interconnect cable provided (Qty. 1 P/N 514642).

Ordering Notes

1) Specify List A (380/480VAC Input) or List B (208VAC Input).
2) Order up to twenty-four (24) Rectifiers Modules per bay per List 21 (208VAC Input) or List 22 (380/480VAC Input).
3) Order additional MCA customer alarm relay circuit card(s) as required per List 70, and optional MCA I/O circuit cards per List 71.
4) Order optional LMS Expansion CPU circuit card and LMS options as required per List 63, and SAG586505000. Also order additional LMS Network cables as required per Replacement/Additional LMS Network Cables.
5) Order "Power Bay DC Output" lugs as required per *Power Bay DC Output Cable Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
6) Order "AC Input" lugs as required per *AC Input (Dual AC Input Feeds) Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
7) Order "Power Bay Frame Grounding" lugs as required per *Power Bay Frame Grounding Wire Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
8) If a different length LMS and/or MCA Network cable is required, order per Replacement/Additional LMS Network Cables and/or Replacement/Additional MCA Network Cables. Refer to the Installation Instructions (Section 6016) for Network cabling requirements.
9) Side cover panels are not provided. When bays are placed next to each other, the side cover panels from the 'inside' side of the Primary Power Bay are moved to the 'outside' side of the last Secondary Power Bay. In installations where a Secondary Power Bay is placed by itself, order (4) P/N 535092 side cover panels.

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List 13: Secondary Power Bay (12 or 24 AC Input Feeds)

Features

- Provides common equipment for one (1) Power Bay rated for up to 2400 amperes.
- Mounted in a 7'0"H x 24.375"W x 30"D seismic rated (Zone 4) box framework.
- Provides twenty-four (24) Rectifier Module mounting positions.
- Provides an AC input termination panel that accepts twenty-four (24) AC input branch circuits [one (1) per Rectifier Module mounting position] or twelve (12) AC input branch circuits [one (1) per two Rectifier Module mounting positions]. The bay ships with the 12 Feed option installed.
- Includes a Router Assembly for bay communication to the MCA in the Primary Power Bay.
- Provides mounting for optional LMS Expansion CPU circuit card.
- Provides a seven-slot card cage for mounting MCA customer alarm relay circuit cards, MCA I/O circuit cards, and/or optional LMS I/O circuit cards.
- MCA Network bay interconnect cable provided (Qty. 1 P/N 514642).

Ordering Notes

1) Specify List A (380/480VAC Input) or List B (208VAC Input).
2) Order up to twenty-four (24) Rectifiers Modules per bay per List 21 (208VAC Input) or List 22 (380/480VAC Input).
3) Order additional MCA customer alarm relay circuit card(s) as required per List 70, and optional MCA I/O circuit cards per List 71.
4) Order optional LMS Expansion CPU circuit card and LMS options as required per List 63, and SAG586505000. Also order additional LMS Network cables as required per Replacement/Additional LMS Network Cables.
5) Order "Power Bay DC Output" lugs as required per *Power Bay DC Output Cable Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
6) Order "AC Input Ground" lugs as required per *AC Input (Individual/Twin AC Input Feeds) Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
7) Order "Power Bay Frame Grounding" lugs as required per *Power Bay Frame Grounding Wire Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
8) If a different length LMS and/or MCA Network cable is required, order per Replacement/Additional LMS Network Cables and/or Replacement/Additional MCA Network Cables. Refer to the Installation Instructions (Section 6016) for Network cabling requirements.
9) Side cover panels are not provided. When bays are placed next to each other, the side cover panels from the 'inside' side of the Primary Power Bay are moved to the 'outside' side of the last Secondary Power Bay. In installations where a Secondary Power Bay is placed by itself, order (4) P/N 535092 side cover panels.

List 14: Secondary Power Bay (6 AC Input Feeds)

Features

- Provides common equipment for one (1) Power Bay rated for up to 2400 amperes.
- Mounted in a 7'0"H x 24.375"W x 30"D seismic rated (Zone 4) box framework.
- Provides twenty-four (24) Rectifier Module mounting positions.
- Provides an AC input termination panel that accepts six (6) AC input branch circuits [one (1) per four Rectifier Module mounting positions].
- Includes a Router Assembly for bay communication to the MCA in the Primary Power Bay.
- Provides mounting for optional LMS Expansion CPU circuit card.
- Provides a seven-slot card cage for mounting MCA customer alarm relay circuit cards, MCA I/O circuit cards, and/or optional LMS I/O circuit cards.
- MCA Network bay interconnect cable provided (Qty. 1 P/N 514642).

Restrictions

480V only.

Ordering Notes

1) Specify List A (480VAC Input).

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2) Order up to twenty-four (24) Rectifiers Modules per bay per List 22 (380/480VAC Input).
3) Order additional MCA customer alarm relay circuit card(s) as required per List 70, and optional MCA I/O circuit cards per List 71.
4) Order optional LMS Expansion CPU circuit card and LMS options as required per List 63, and SAG586505000. Also order additional LMS Network cables as required per Replacement/Additional LMS Network Cables.
5) Order "Power Bay DC Output" lugs as required per *Power Bay DC Output Cable Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
6) Order "AC Input Ground" lugs as required per *AC Input (Individual/Twin AC Input Feeds) Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
7) Order "Power Bay Frame Grounding" lugs as required per *Power Bay Frame Grounding Wire Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
8) If a different length LMS and/or MCA Network cable is required, order per Replacement/Additional LMS Network Cables and/or Replacement/Additional MCA Network Cables. Refer to the Installation Instructions (Section 6016) for Network cabling requirements.
9) Side cover panels are not provided. When bays are placed next to each other, the side cover panels from the 'inside' side of the Primary Power Bay are moved to the 'outside' side of the last Secondary Power Bay. In installations where a Secondary Power Bay is placed by itself, order (4) P/N 535092 side cover panels.

List 16: Distribution Bay

Features

- Provides common equipment for one (1) Distribution Bay rated for up to 6000 amperes.
- Mounted in a 7'0"H x 31.375"W x 30"D seismic rated (Zone 4) box framework.
- Provides forty-eight (48) distribution device mounting positions.
- Provides four (4) buses of distribution. Each bus contains an MCA monitoring circuit card; which can be set for no group designation, Group A designation, or Group B designation.
- Includes a Router Assembly for bay communication to the MCA in the Primary Power Bay.
- MCA Network bay interconnect cable provided (P/N 514644).

Ordering Notes

1) Order distribution fuse and/or circuit breaker devices as required per *Distribution Devices* in the *ACCESSORY DESCRIPTIONS* section.
2) Order load distribution lugs as required per *Load Distribution Wire Sizes and Lugs Selection (Distribution Bay)* in the *ACCESSORY DESCRIPTIONS* section.
3) Order "Distribution Bay DC Input" lugs as required per *Distribution Bay DC Input Cable Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
4) Order "Distribution Bay Frame Grounding" lugs as required per *Distribution Bay Frame Grounding Wire Sizes and Lugs Selection* in the *ACCESSORY DESCRIPTIONS* section.
5) Order one (1) "Twenty-Four (24) Position Bullet-Nose Circuit Breaker/Fuse Panel" per Distribution Bay as required per List C.
6) If a different length MCA Network cable is required, order per Replacement/Additional MCA Network Cables. Refer to the Installation Instructions (Section 6016) for Network cabling requirements.
7) Side cover panels are factory installed on one side of the bay. In installations where a Distribution Bay is placed by itself, order (2) P/N 528633 side cover panels for the other side.

List 21: Rectifier Module, 208V Input

Features

- Model R48-5800L, Spec. No. 1R485800L, 100A / 48 volt rectifier module.

Restrictions

For use in List B bays only.

Ordering Notes

1) Order List 21 Rectifier Modules as required. Each Power Bay holds up to twenty-four (24) Rectifier Modules.

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List 22: Rectifier Module, 380/480V Input

Features

- Model R48-5800, Spec. No. 1R485800, 100A / 48 volt rectifier module.

Restrictions

For use in List A bays only.

Ordering Notes

1) Order List 22 Rectifier Modules as required. Each Power Bay holds up to twenty-four (24) Rectifier Modules.

List 24: Rectifier Module, 380/480V Input

Features

- Model R48-5800e, Spec. No. 1R485800e, 100A / 48 volt rectifier module.

Restrictions

For use in List A bays only. Requires that the system Router software is version 2.5.0.0 or higher.

Ordering Notes

Order List 24 Rectifier Modules as required. Each Power Bay holds up to twenty-four (24) Rectifier Modules.

List 50: Optional LMS Main CPU Circuit Card (Primary Power Bay)

Features

- Provides the LMS Monitoring System.
- Refer to SAG586505000 for further information.

Restrictions

The LMS Monitoring System Main CPU circuit card is mounted in the Primary Power Bay only.

Ordering Notes

1) Order the optional LMS Monitor if increased monitoring capabilities are required. Order the LMS Main CPU circuit card (List 50) for the Primary Power Bay. Order the LMS Expansion CPU circuit card (List 63) for Secondary Power Bays that are to be equipped with LMS I/O circuit cards.
2) Order additional LMS Network cables as required per Replacement/Additional LMS Network Cables. Note that an LMS Network cable is factory provided with List 63.
3) This List option only provides the LMS CPU circuit card for the Primary Power Bay, additional LMS options must be ordered separately per SAG586505000.

List 63: Optional LMS Expansion CPU Circuit Card (Secondary Power Bays)

Features

- Allows LMS I/O cards to be installed in Secondary Power Bays.
- LMS Network bay interconnect cable provided (Qty. 1 P/N 514639).

Restrictions

The LMS Monitoring System Expansion CPU circuit cards are mounted in Secondary Power Bays (required only if LMS I/O circuit cards are to be installed in the same bay).

Ordering Notes

1) Order the LMS Expansion CPU circuit card for Secondary Power Bays that are to be equipped with LMS I/O circuit cards.

List 64: Interface Kit to a Spec. No. 582121900 Power System equipped with a DGU

Features

- Provides the following…

  LMS Dual MCA Interface Software Option
  LMS Gateway Software Option

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P/N 526843 50' LMS Dual MCA Option Cable
P/N 548009 50' LMS Gateway Port Cable

- LMS Dual MCA Interface Software Option enables the Spec. No. 582140001 Power System to be integrated with an existing Power System. Specifically, List 64 allows the MCA in Spec. No. 582140001 to interface with the MCA in a Spec. No. 582121900 via the LMS in Spec. No. 582140001. Refer to the LMS documentation for further information.
- LMS Gateway Software Option allows the LMS to emulate a "dumb" RS-232 asynchronous terminal interface. Specifically, List 64 enables user input through either a local or remote LMS port to be directed to a DGU connected to the LMS Gateway port. Refer to the LMS documentation for further information.

Restrictions

Operation of Energy Management is disabled with this option installed.

The Gateway port is provided via the port located on the front of the LMS CPU circuit card installed in the Spec. No. 582140001 Primary Bay.

Ordering Notes

1) Order as required.

List 65: Interface Kit to a Spec. No. 582121901 Power System equipped with an LMS1000

Features

- Provides the following…

  LMS Dual MCA Interface Software Option
  P/N 506153 LMS Expansion CPU Card
  P/N 514641 150' Echelon Cable
  P/N 526843 50' LMS Dual MCA Option Cable
- LMS Dual MCA Interface Software Option enables the Spec. No. 582140001 Power System to be integrated with an existing Power System. Specifically, List 65 allows the MCA in Spec. No. 582140001 to interface with the MCA in Spec. No. 582121901 via the LMS in Spec. No. 582140001. Refer to the LMS documentation for further information.

Restrictions

Operation of Energy Management is disabled with this option installed.

The Main LMS CPU card in 582121901 must be replaced with the Expansion LMS CPU card (P/N 506153) provided with List 65.

Ordering Notes

1) Order as required.

List 66: Interface Kit to a Vortex Power System without a DGU or LMS1000

Features

- Provides the following…

  LMS Dual MCA Interface Software Option
  P/N 526843 50' LMS Dual MCA Option Cable
- LMS Dual MCA Interface Software Option enables the Spec. No. 582140001 Power System to be integrated with an existing Power System. Specifically, List 66 allows the MCA in Spec. No. 582140001 to interface with the MCA in a Vortex Power System via the LMS in Spec. No. 582140001. Refer to the LMS documentation for further information.

Restrictions

Operation of Energy Management is disabled with this option installed.

Ordering Notes

1) Order as required.

List 67: Interface Kit to a Model 1231H Legacy Power System with 1-8 Rectifiers

Features

- Provides the following…

  LMS Gateway Software Option
  P/N 548009 50' LMS Gateway Port Cable

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Two (2) P/N 506336 LMS 4-Input Universal Analog Cards
One (1) P/N 506334 LMS 8-Input Binary Card

- LMS Gateway Software Option allows the LMS to emulate a “dumb” RS-232 asynchronous terminal interface. Specifically, List 67 enables user input through either a local or remote LMS port to be directed to a DGU (in the legacy plant) connected to the LMS Gateway port. Refer to the LMS documentation for further information.
- The analog and binary DGU I/O cards provide monitoring of the legacy system’s rectifiers

Restrictions

LMS Channels must be configured.

Ordering Notes

1) Order as required.

List 70: Additional MCA Six (6) Output Form-C Relay Circuit Card

Features

- Provides six relays each with one set of Form-C relay contacts.
- These relays are used for alarm applications and can be programmed by the user.
- Refer to the "Specifications" section of this document for further information.
- Plugs into any slot in 7-position card cage in Primary and Secondary Power Bays.
- User maps relay closure to any or multiple programmable alarm functions.

Restrictions

Relay contacts rated for 2A at 30 volts DC.

The system may contain up to 16 MCA Relay circuit cards.

Ordering Notes

1) Order one (1) List 70 relay circuit card for every six (6) **customer** relay contacts to be provided by the MCA.

List 71: MCA I/O Circuit Card P/N 524550

Features

- Provides 1 analog input, 1 analog output (for remote plant output current monitoring), and 4 binary inputs.
- Refer to the "Specifications" section of this document for further information.
- Plugs into any slot in 7-position card cage in Primary and Secondary Power Bays.

Restrictions

The system may contain up to 16 MCA I/O circuit cards.

Only one (1) P/N 524550 card can be installed per bay.

Analog input and output rating = 0-50mv DC.

Binary input rating = dry contact.

Analog inputs should be protected by a 49.9 ohm resistor.

Recommended to use current limiting resistors to protect binary input wiring.

Ordering Notes

1) Order optional MCA I/O circuit cards as required.
2) Use of the “Alternate Current Limit” feature requires that an MCA I/O circuit card be installed.

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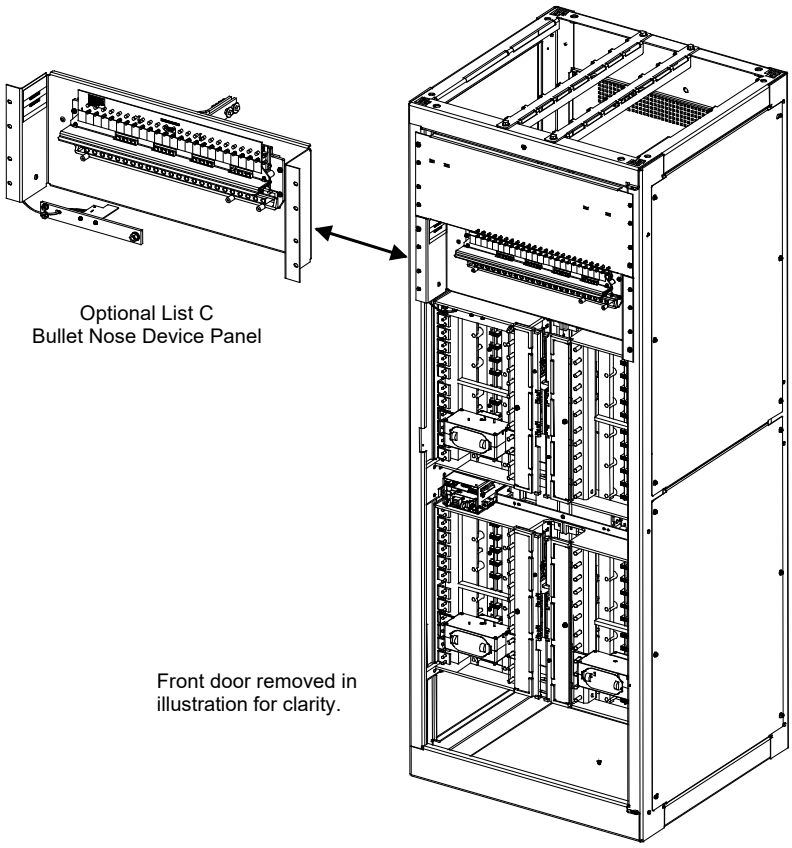
List 0C: 24 Position Bullet-Nose Circuit Breaker/Fuse Panel

Features

- Provides twenty-four (24) Bullet Nose Device positions.
- Accepts a choice of TLS/TPS-type fuseholders, Bullet Nose-Type circuit breakers, or Bullet Nose-Type GMT Fuse Modules.
- The List C Fuse/Circuit Breaker Panel is equipped with one (1) shunt for all distribution positions for MCA load current measurements.
- Refer also to Bullet Nose-Type Circuit Breakers and Bullet Nose-Type Fuseholders e/w TLS/TPS Fuses and Optional Bullet Nose-Type 10-Position GMT Fuse Module for List C.



Restrictions

Each Distribution Bay can be equipped with only one (1) List C panel.

The List C Circuit Breaker/Fuse Panel requires distribution position #12 in the Bus #1 Distribution Panel.

Current monitoring for the List C Fuse/Circuit Breaker Panel is for the complete panel. Circuit Breakers and/or fuses are not individually monitored.

When installed, the bay can be loaded with up to (47) 218 Circuit Breakers or (23) TPL Fuses and (24) Bullet Nose Circuit Breakers or TLS/TPS Fuses.

The List C Circuit Breaker/Fuse Panel is rated for a maximum continuous load of 500 amps.

The total load combination of List C and Distribution Panel #1 cannot exceed 1500A.

Ordering Notes

1) Order as required.
2) Also order distribution fuses, circuit breakers, and/or Bullet Nose-Type 10-Position GMT Fuse Modules as required per *Distribution Devices* in the *ACCESSORY DESCRIPTIONS* section.

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ACCESSORY DESCRIPTIONS

Seismic Anchor Kit, P/N 545387

Features

Provides four (4) Relay Rack Seismic Mounting Anchors, P/N 216821200.

Ordering Notes

1) Order Seismic Anchor Kit, P/N 545387, as required.

Seismic Anchor Isolation Kit, P/N 545388

Features

Provides four (4) bushings, P/N 124866 (one per seismic anchor) and one (1) insulator, P/N 112490.

Ordering Notes

1) Order Seismic Isolation Anchor Kit, P/N 545388, as required.

Main Battery Termination Bars (MBTB's)

Plant is designed for centralized configuration with customer supplied Main Battery Termination Bars (MBTB's). Vertiv has standard MBTB'S in 4000, 6000, 10000, and 16000 ampere capacities. The ultimate plant capacity is determined by the capacity of the MBTB'S. Refer to the EA3434-41xx Series MBTB's drawings.

Distribution Device and Load Lug Locations

Each Distribution Bay has four (4) distribution buses. Each distribution bus has twelve (12) fuse/circuit breaker device mounting positions. Note that the various fuse/circuit breaker devices require different number of mounting positions, as detailed in the following sections. Note also that each distribution bus is divided into half, and each half **MUST** be populated with distribution devices as shown in the following illustration, without skipping any distribution device mounting positions within each half. This allows automatic monitoring of each position and allows the controller to located all distribution positions. The load side of each fuse/circuit breaker mounting position is bused to the rear of the bay. Each fuse/circuit breaker device requires a load lug adapter plate kit that mounts to the appropriate load side busbars at the rear of the bay (except 1-pole devices). Load return leads are terminated outside the bay to customer provided return busbars. See following illustration.

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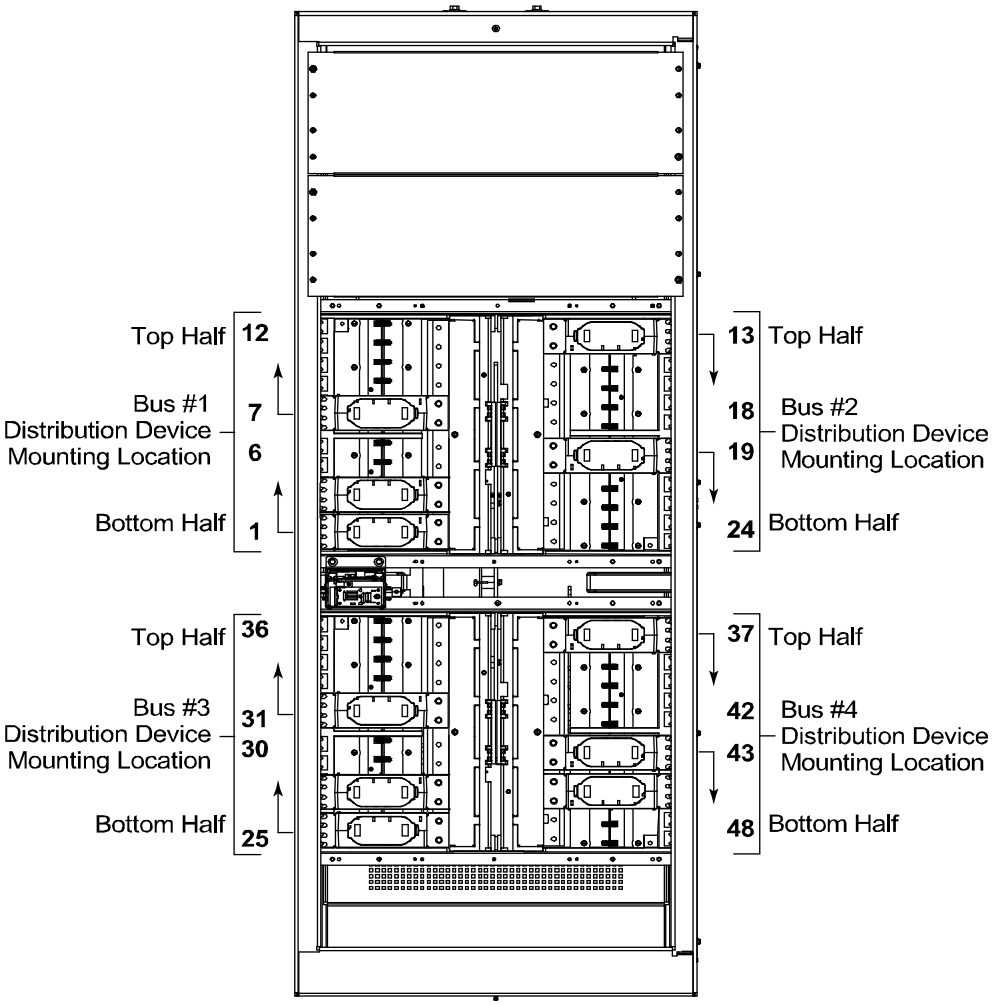

Front View

Door removed in illustration for clarity.

Note: On the left side, each half of each bus MUST be populated with distribution devices from bottom-to-top, without skipping any distribution device mounting positions within each half. (Arrows indicate starting position in each half.)

Note: On the right side, each half of each bus MUST be populated with distribution devices from top-to-bottom, without skipping any distribution device mounting positions within each half. (Arrows indicate starting position in each half.)

This allows automatic monitoring of each position and allows the controller to located all distribution positions.

Load Lug Adapter Plates are Mounted on the Rear of the Bay

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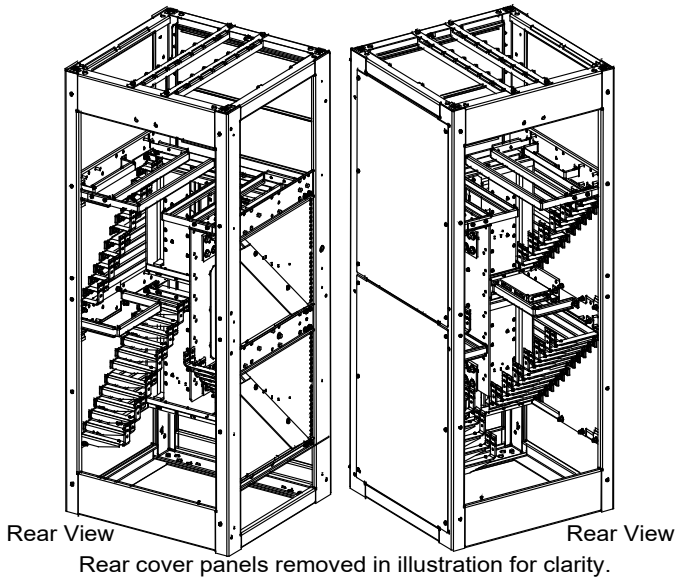
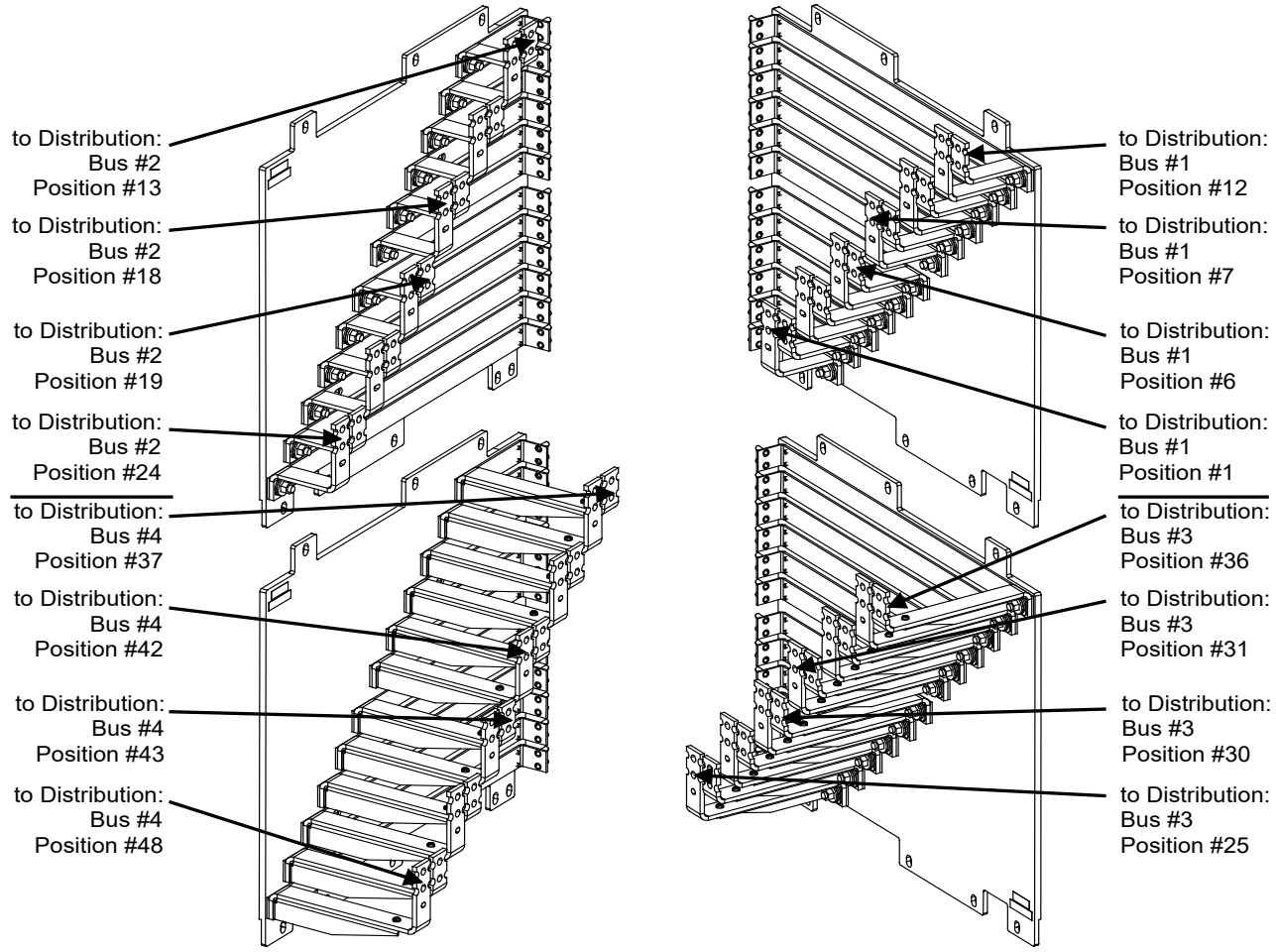


Rear cover panels removed in illustration for clarity.



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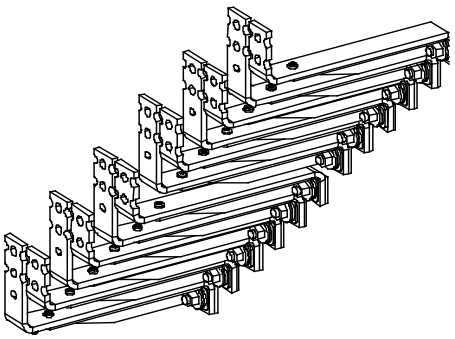
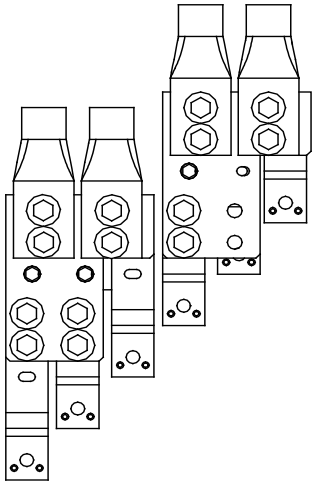
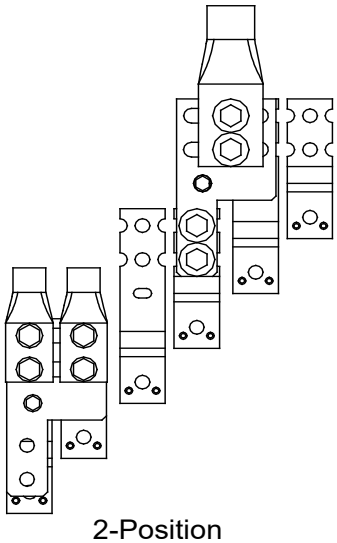


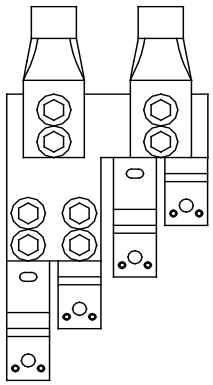
1-Position Devices
(Load Busbars with NO
Lug Adapters Installed)
(see Note 6)



3-Position
Lug Adapter Kit
P/N 529131
(see Notes 2, 3, 4, 5)



2-Position
Lug Adapter Kit
P/N 529132
(see Notes 1, 3, 4, 5)



4-Position
Lug Adapter Kit
P/N 534420
(see Notes 2, 3, 4)

Notes:

1. Lug adapter accepts a maximum of (2) 750 kcmil or (4) 350 kcmil lugs.
2. Lug adapter accepts a maximum of (4) 750 kcmil lugs.
3. Lugs are not part of the kit, shown for illustration only.
4. Bay busbars are not part of the kit, shown for illustration only.
5. Two (2) kits shown for illustration of the kit installed on busbars with tops even with each other and staggered.
6. Maximum lug width (without using an adapter plate) is 1.250 inches.

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Distribution Devices

See Distribution Device and Load Lug Locations at the beginning of this section for illustrations of distribution device and load lug mounting locations.

218 Circuit Breaker Assemblies

Features

- Each circuit breaker assembly is equipped with a shunt for MCA load current measurements.
- Bolts into bay's distribution device mounting positions.
- Load lug busbars and adapter plates provide 3/8" clearance holes on 1" centers for installation of customer provided two-hole lugs.

Restrictions

Load should not exceed 80% of device rating.

Refer to Table 1 for required distribution bus mounting positions.

Each distribution bus is divided into half. Each half **MUST** be populated with distribution devices as shown in the illustrations at the beginning of this section, without skipping any distribution device mounting positions within each half.

Four (4) position devices can only be installed in the 1st four or last four positions within each half of a distribution bus. This is because the lug adapter plate for four (4) position devices can only be installed in positions starting with the load busbar tops even with each other (not staggered).

Divide distribution equally between rows.

Refer to the illustrations in this section for lug and wire size restrictions.

Load return leads are terminated outside the bay to customer provided return busbars.

Ordering Notes

1) Order circuit breaker assemblies and load lug adapter kits per Table 1. Load lug adapter kits also contain the necessary hardware to mount the circuit breakers. For 1-pole circuit breakers, also order circuit breaker hardware kit P/N 558709. This hardware is used to mount the circuit breaker.
2) See Table 10 for recommended load distribution wire sizes and lugs.

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Ampere Rating	No. of Poles	Required Distribution Bus Mounting Positions	Circuit Breaker Part Number		Lug Adapter Kit Part Number (Qty 1)
			Electrical Trip[1] (White Handle)	Electrical/ Mechanical Trip[2] (Black Handle)	
100	1	1	513766	513767	not required
125	1	1	513768	513769	not required
150	1	1	513770	513771	not required
175	1	1	513772	513773	not required
200	1	1	513774	513775	not required
225	1	1	513776	513777	not required
250	1	1	513778	513779	not required
300	2	2	513780	513781	529132
350	2	2	513782	513783	529132
400	2	2	513784	513785	529132
450	3	3	513786	513787	529131
500	3	3	513788	513789	529131
600	3	3	513790	513791	529131
800	4	4	513792	513793	534420
See Table 10 for recommended load distribution wire sizes and lugs.					

Circuit Breaker Alarm Operation:

[1] Provides an alarm during an electrical trip condition only.

[2] Provides an alarm during an electrical or manual trip condition.

Table 1
218 Circuit Breaker Assemblies

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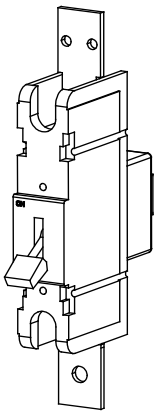
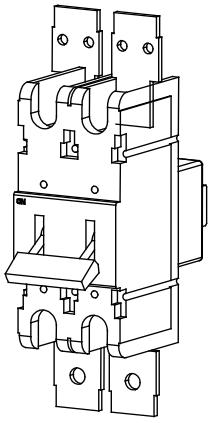


1-Pole 218 Circuit
Breakers Assemblies

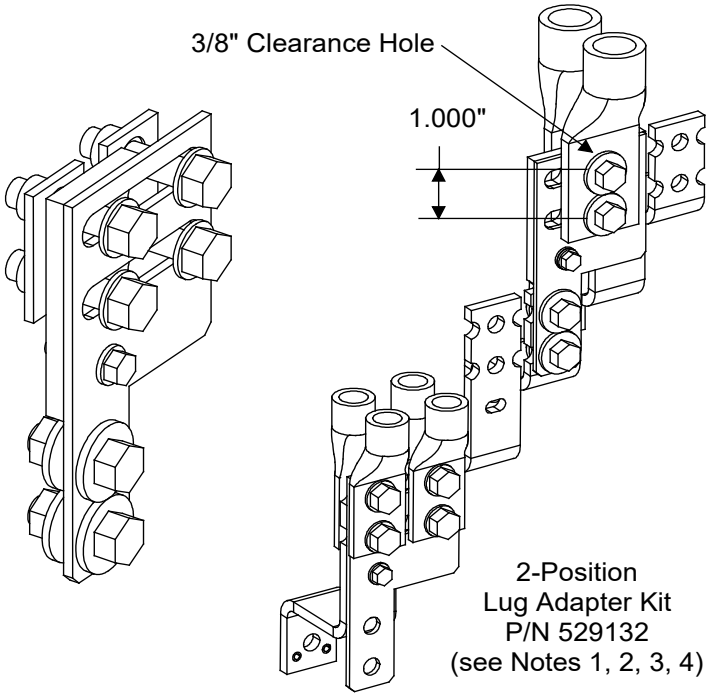
Lug Adapter Kit

NO LUG ADAPTER
KIT REQUIRED



2-Pole 218 Circuit
Breaker Assemblies

Lug Adapter Kit



2-Position
Lug Adapter Kit
P/N 529132
(see Notes 1, 2, 3, 4)

Notes:

1. Lug adapter accepts a maximum of (2) 750 kcmil or (4) 350 kcmil lugs.
2. Lugs are not part of the kit, shown for illustration only.
3. Bay busbars are not part of the kit, shown for illustration only.
4. Two (2) kits shown for illustration of the kit installed on busbars with tops even with each other and staggered.

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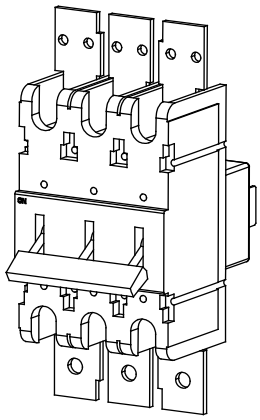
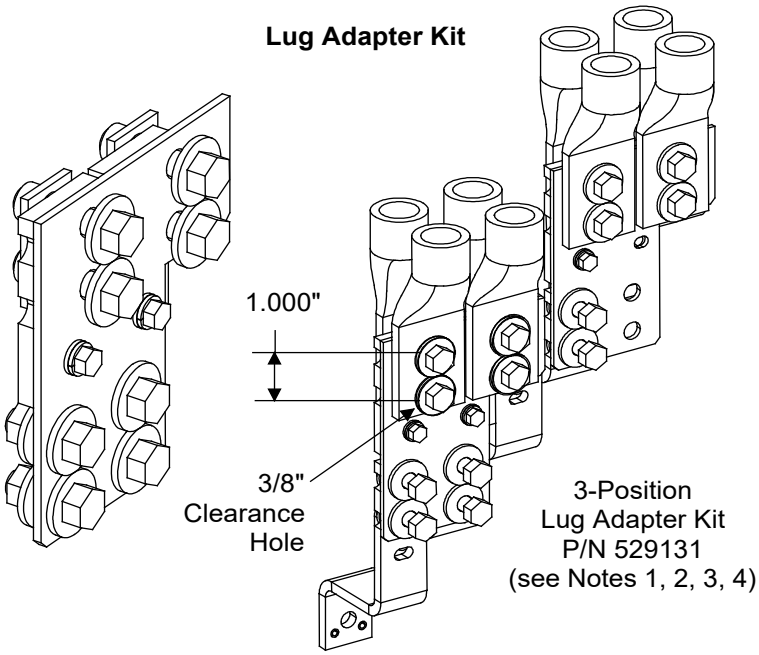
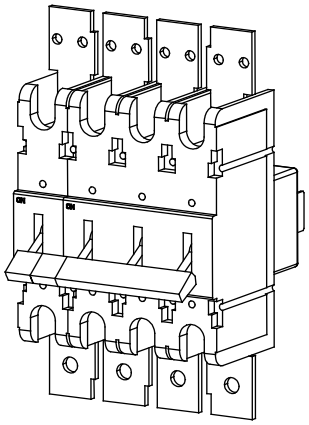


3-Pole 218 Circuit
Breaker Assemblies

Lug Adapter Kit

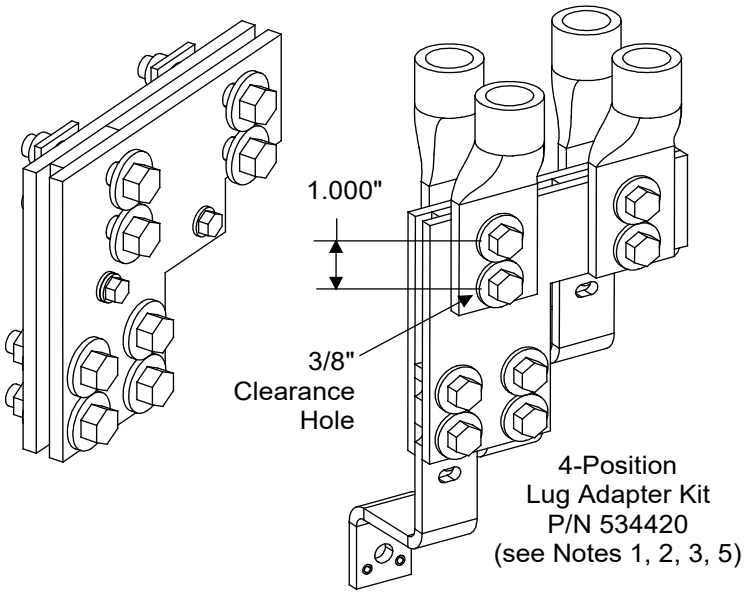


3-Position
Lug Adapter Kit
P/N 529131
(see Notes 1, 2, 3, 4)



4-Pole 218 Circuit
Breaker Assemblies

Lug Adapter Kit



4-Position
Lug Adapter Kit
P/N 534420
(see Notes 1, 2, 3, 5)

Notes:

1. Lug adapter accepts a maximum of (4) 750 kcmil lugs.
2. Lugs are not part of the kit, shown for illustration only.
3. Bay busbars are not part of the kit, shown for illustration only.
4. Two (2) kits shown for illustration of the kit installed on busbars with tops even with each other and staggered.
5. Can only be installed in positions starting with busbar tops even with each other (not staggered).

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TPL Fuses and Fuseholder Assemblies

Features

- Each fuseholder assembly is equipped with a shunt for MCA load current measurements.
- Bolts into bay's distribution device mounting positions.
- Load lug busbars and adapter plates provide 3/8" clearance holes on 1" centers for installation of customer provided two-hole lugs.

Restrictions

Load should not exceed 80% of device rating.

Refer to Table 2 for required distribution bus mounting positions.

Each distribution bus is divided into half. Each half **MUST** be populated with distribution devices as shown in the illustrations at the beginning of this section, without skipping any distribution device mounting positions within each half.

Divide distribution equally between rows.

Refer to the illustrations in this section for lug and wire size restrictions.

Load return leads are terminated outside the bay to customer provided return busbars.

Ordering Notes

1) Order fuses, the appropriate fuseholder assembly for each fuse, and load lug adapter kits per Table 2. Load lug adapter kits also contain the necessary hardware to mount the fuseholder assembly.
2) For each fuse ordered, also order one (1) P/N 248610301 alarm fuse, and one (1) P/N 248898700 safety fuse cover.
3) See Table 10 for recommended load distribution wire sizes and lugs.

Ampere Rating	Required Distribution Bus Mounting Positions	Part Number		Lug Adapter Kit Part Number (Qty. 1)
		Fuse	Fuseholder Assembly	
70	2	248251500	514403	529132
80	2	248252000	514403	529132
100	2	248252600	514403	529132
150	2	248253300	514403	529132
200	2	248254000	514403	529132
225	2	248254500	514403	529132
250	2	248255000	514403	529132
300	2	248255700	514403	529132
400	2	248257000	514403	529132
500	2	248258000	514403	529132
600	2	248259000	514403	529132
800	3	102901	514404	529131
For each fuse ordered, also order: one (1) P/N 248610301 alarm fuse (GMT-18/100A), and one (1) P/N 248898700 safety fuse cover (GMT-X).				
See Table 10 for recommended load distribution wire sizes and lugs.				

Table 2
TPL Fuses and Fuseholder Assemblies

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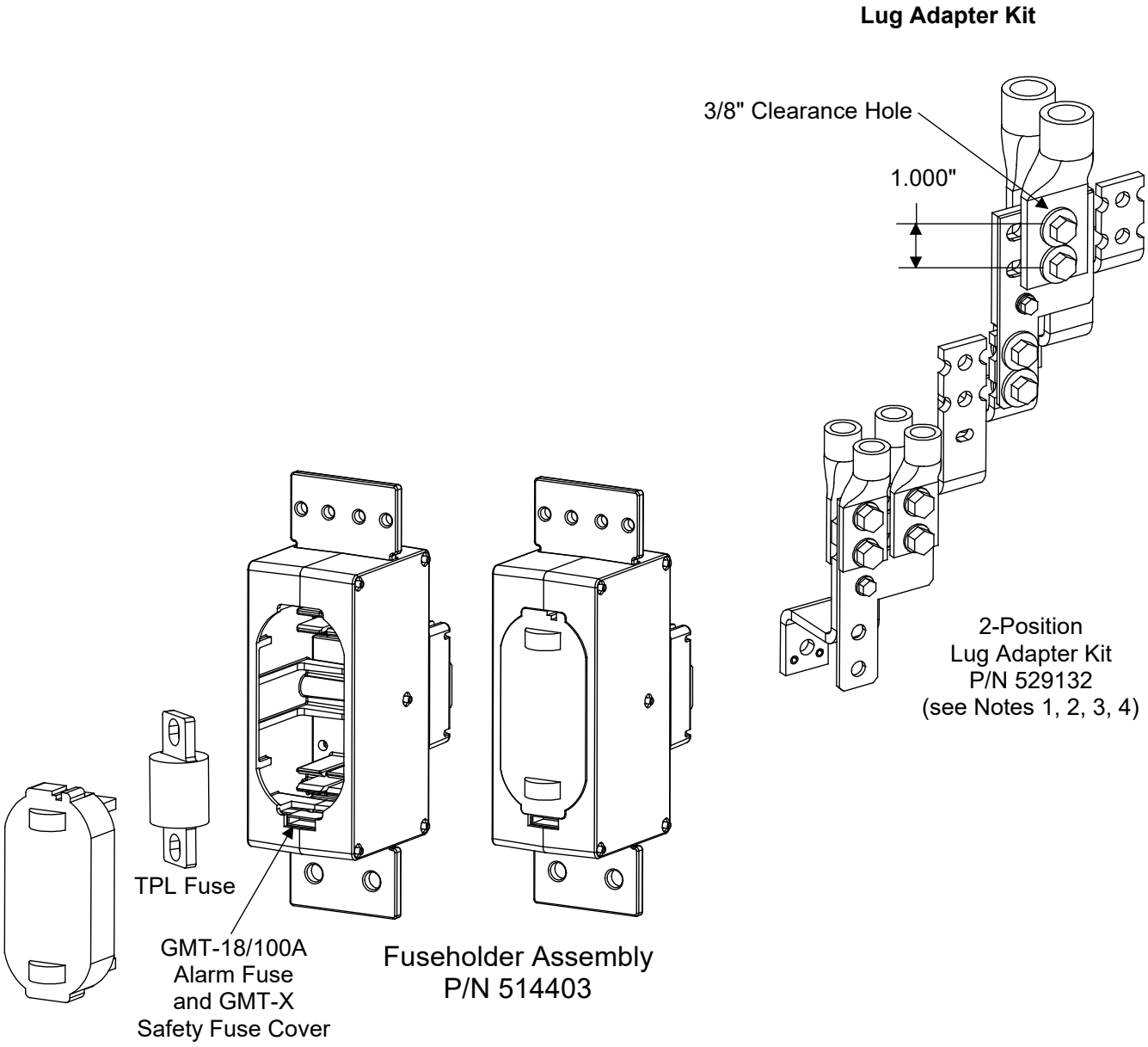

Notes:

1. Lug adapter accepts a maximum of (2) 750 kcmil or (4) 350 kcmil lugs.
2. Lugs are not part of the kit, shown for illustration only.
3. Bay busbars are not part of the kit, shown for illustration only.
4. Two (2) kits shown for illustration of the kit installed on busbars with tops even with each other and staggered.

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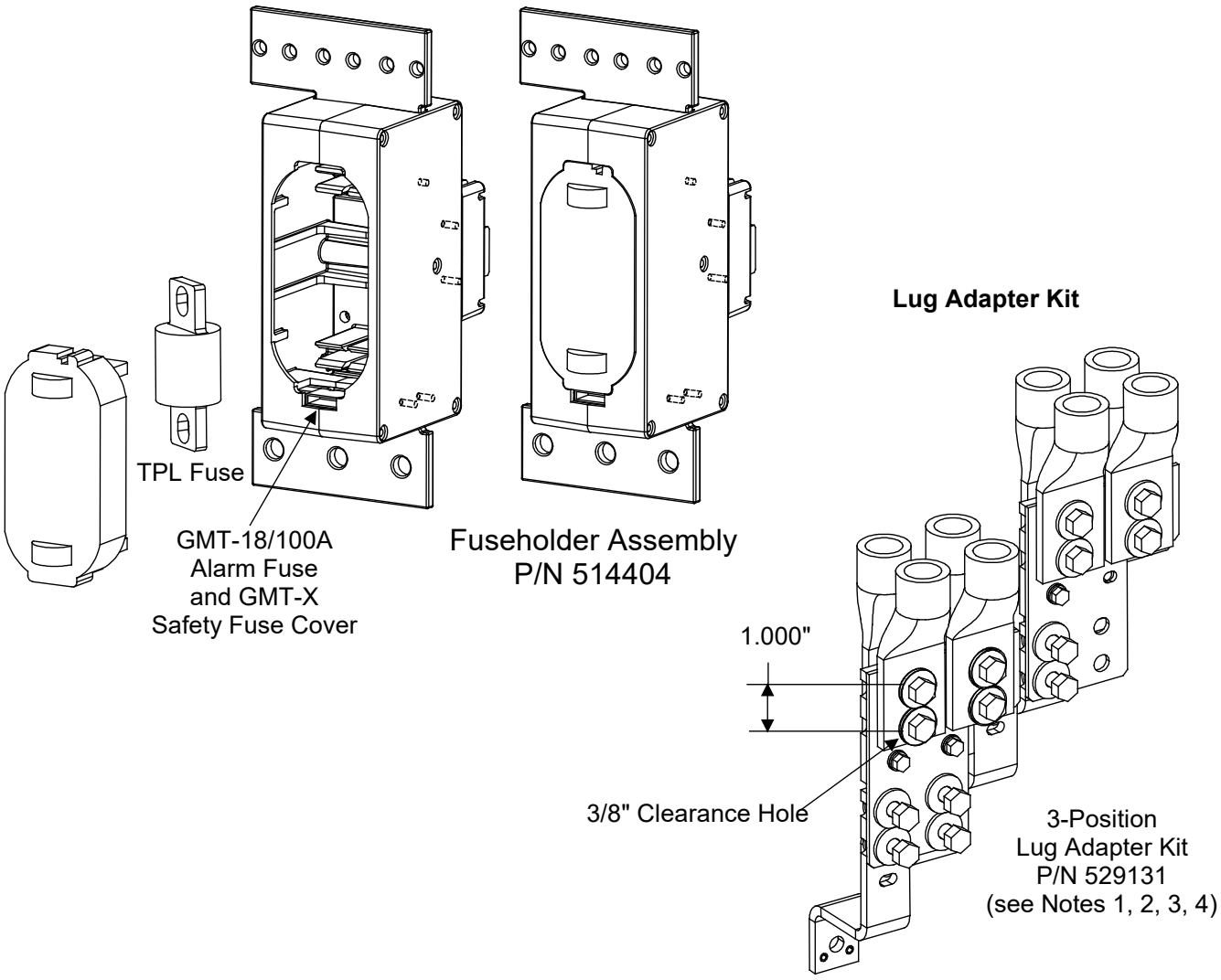

Notes:

1. Lug adapter accepts a maximum of (4) 750 kcmil lugs.
2. Lugs are not part of the kit, shown for illustration only.
3. Bay busbars are not part of the kit, shown for illustration only.
4. Two (2) kits shown for illustration of the kit installed on busbars with tops even with each other and staggered.

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Bullet Nose-Type Circuit Breakers and Bullet Nose-Type Fuseholders e/w TLS/TPS Fuses

Features

- Installs in the optional List C Fuse/Circuit Breaker Panel.
- Load lugs are connected to busbars provided on the List C Fuse/Circuit Breaker Panel. These busbars provide 1/4-20 threaded holes on 5/8" centers for installation of customer provided two-hole lugs. Load return leads are terminated outside the bay to customer provided return busbars.
- Each circuit breaker (as listed in Table 3 and Table 4) plugs into one, two, or three mounting position(s).
- A single fuseholder provides for installation of a 3 to 100 ampere Bussmann TPS-type or Littelfuse TLS-type fuse (as listed in Table 5). This fuseholder plugs into a single mounting position. This fuseholder provides a GMT-A alarm type fuse, which operates open to provide an alarm indication if the associated distribution fuse opens.

Restrictions

Load should not exceed 80% of device rating.

Caution: ***An overcurrent protective device with a rating of 150 amperes or greater SHALL HAVE an empty mounting position between it and any other overcurrent protective device within the List C Fuse/Circuit Breaker Panel.***

Maximum size of wire to be connected to a single lug position is 2 AWG.

Maximum lug width is 0.610.

Customer must provide lug mounting bolts and additional hardware.
Bolt length: 3/4”.

Load return leads are terminated outside the bay to customer provided return busbars.

Ordering Notes

1) Order circuit breakers per Table 3 and Table 4.
2) Order fuses per Table 5. For each fuse ordered, also order one (1) P/N 117201 bullet nose type fuseholder.
3) See Table 9 for recommended load distribution wire sizes and lugs.

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Ampere Rating	Number of Poles (and mounting positions required in the List C Fuse/Circuit Breaker Panel)	Part Number	
		Electrical Trip[1] (White Handle)	Electrical/ Mechanical Trip[2] (Black Handle)
1	1	102272	101596
3	1	102273	101597
5	1	102274	101598
10	1	102275	101599
15	1	102276	101600
20	1	102277	101601
25	1	102278	101602
30	1	102279	101603
35	1	102280	101604
40	1	102281	101605
45	1	121998	121997
50	1	102282	101606
60	1	102283	101607
70	1	102284	101608
75	1	102285	101609
80	1	121996	121995
90	1	138887	138888
100	1	102286	101610
125	2	516991	516838
150	2	516993	516839
175	2	144883	144884
200	2	121831	121832
225	3	144885	144886
250	3	121835	121836
See Table 9 for recommended load distribution wire sizes and lugs.			

Circuit Breaker Alarm Operation:

[1] Provides an alarm during an electrical trip condition only.

[2] Provides an alarm during an electrical or manual trip condition.

Table 3
Toggle Handle Bullet Nose-Type Circuit Breakers

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Ampere Rating	Number of Poles (and mounting positions required in the List C Fuse/Circuit Breaker Panel)	Part Number	
		Electrical Trip[1] (White Handle)	Electrical/ Mechanical Trip[2] (Black Handle)
1	1	142856	142878
3	1	142857	142879
5	1	142858	142880
10	1	142859	142881
15	1	142861	142882
20	1	142862	142883
25	1	142863	142884
30	1	142864	142885
35	1	142865	142886
40	1	142866	142887
45	1	142867	142888
50	1	142868	142889
60	1	142869	142890
70	1	142870	142891
75	1	142871	142892
80	1	142872	142901
100	1	142873	142902
125	2	142874	142903
150	2	142875	142904
200	2	142876	142905
250	3	142877	142906
See Table 9 for recommended load distribution wire sizes and lugs.			

Circuit Breaker Alarm Operation:

[1] Provides an alarm during an electrical trip condition only.

[2] Provides an alarm during an electrical or manual trip condition.

Table 4
Rocker Handle Bullet Nose-Type Circuit Breakers

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Ampere Rating	Part Number	Bussmann P/N	Littelfuse P/N
3	248230900	TPS-3	TLS003
5	248231000	TPS-5	TLS005
6	248231200	TPS-6	TLS006
10	248231500	TPS-10	TLS010
15	248231800	TPS-15	TLS015
20	248232100	TPS-20	TLS020
25	248232400	TPS-25	TLS025
30	248232700	TPS-30	TLS030
40	248233300	TPS-40	TLS040
50	248233900	TPS-50	TLS050
60	248234200	TPS-60	TLS060
70	248234500	TPS-70	TLS070
80	118413	--	TLS080
90	118414	--	TLS090
100	118415	--	TLS100
For each fuse ordered, also order a Bullet Nose-Type Fuseholder P/N 117201. Fuseholder P/N 117201 also includes... (1) P/N 248610301 alarm fuse (GMT-18/100A), and (1) P/N 248898700 safety fuse cover (GMT-X).			
See Table 9 for recommended load distribution wire sizes and lugs.			

Table 5
Bullet Nose-Type Fuseholders (TLS/TPS Fuses)

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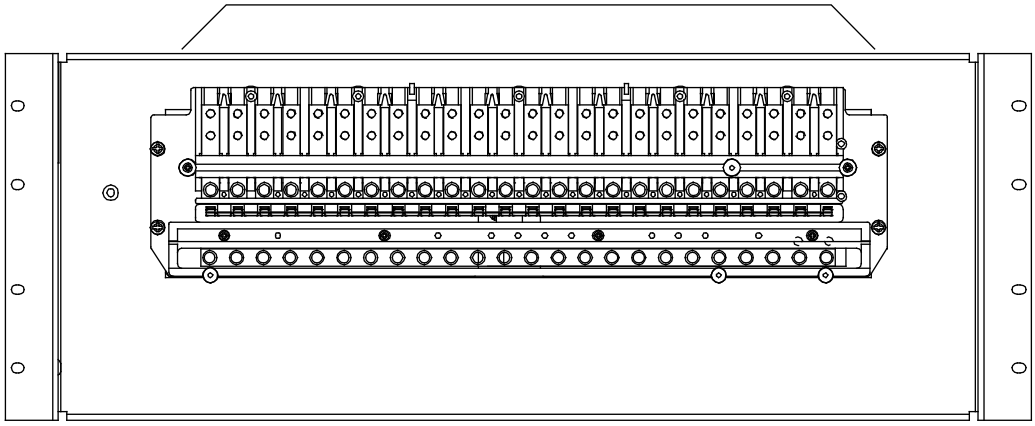
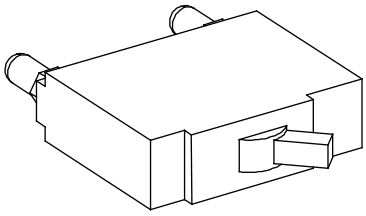
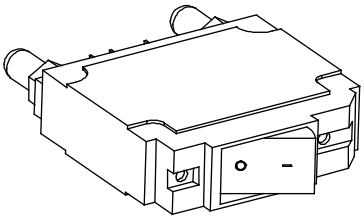
Note: Load Leads are connected to load busbars. These busbars provide 1/4-20 threaded holes on 5/8” centers for installation of customer provided two-hole lugs. Customer must provide lug mounting bolts and additional hardware. Bolt length: 3/4”.

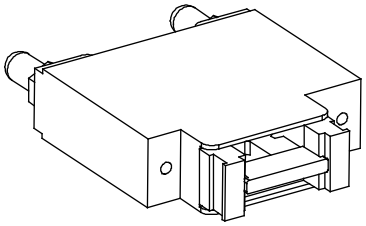




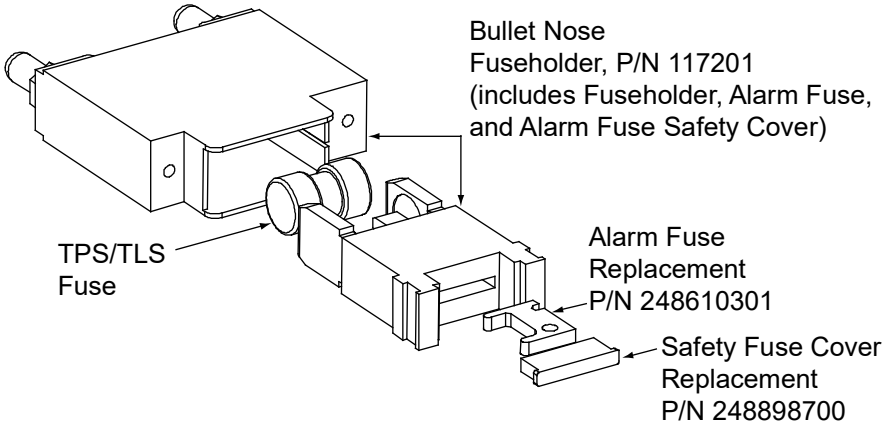
Toggle Handle Bullet Nose Circuit Breaker



Rocker Handle Bullet Nose Circuit Breaker



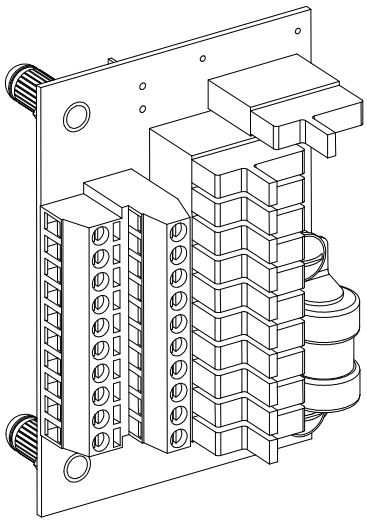
Bullet Nose Fuseholder



Optional Bullet Nose-Type 10-Position GMT Fuse Module for List C

Features

- Installs in the optional List C Fuse/Circuit Breaker Panel.
- Provides 10 GMT fuse positions.
  (1/4A to 15A GMT Alarm-Type Fuses).
- Screw clamp type load and load return terminals provided.
- Includes ten dummy fuses equipped with safety fuse covers.
- Includes 35A input fuse and associate alarm fuse.



P/N 509128
GMT Fuse Module

Restrictions

30A maximum capacity per block.

Terminal block wire size capacity: 24 to 14 AWG.

Requires five (5) bullet device mounting positions.

When used for power distribution, load should not exceed 80% of device rating, except 10 and 15 Amp fuses, for which load should not exceed 70% of device rating.

Ordering Notes

1) Order optional Bullet Nose-Type 10-Position GMT Fuse Module (P/N 509128) as required.
2) Order GMT fuses as required per Table 6.
3) See "Replacement Alarm, Reference, and Control Fuses" and Table 8 for ordering replacement input fuse and associated alarm fuse.

Ampere Rating	Part Number	Fuse Color
18/100 GMT-A	248610301	---
1/4	248610200	VIOLET
1/2	248610300	RED
3/4	248610500	BROWN
1-1/3	248610700	WHITE
2	248610800	ORANGE
3	248610900	BLUE
5	248611000	GREEN
7-1/2	248611300	BLACK-WHITE
10	248611200	RED-WHITE
15	248611500	RED-BLUE
Replacement Safety Fuse Cover	102774	---
Replacement Dummy Fuse	248872600	---

Table 6
Bussmann GMT-Type Fuses

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Replacement Alarm, Reference, and Control Fuses

Fuseblock Located in Bay's Left Center

Features

- Alarm, reference, and control fuses are located on the fuseblock mounted in the left center of the Power Bays and Distribution Bays. These fuses are not available for customer connected loads. Note also that distribution fuses also contain alarm-type fuses as detailed in the previous sections of this document.

Ordering Notes

1) Order replacement fuses as required per Table 7 (Replaceable Alarm, Reference, and Control Fuses).

ASSEMBLY	DESIG.	FUNCTION	SIZE (Amperes)	TYPE	PART NO.
Power Bays	F1	LMS CPU Circuit Card Input Power	3	SAN-O AX-1	248609200
	F2	--	--	--	--
	F3	MCA/Router Circuit Card Input Power	3	SAN-O AX-1	248609200
	--	Safety Fuse Cover	--	SAN-O SAX-1	248898600
Distribution Bays	F1	Router Circuit Card Input Power	3	SAN-O AX-1	248609200
	F2	Distribution Bus Monitoring Circuit Cards Input Power (Bus #1 and #2)	3	SAN-O AX-1	248609200
	F3	Distribution Bus Monitoring Circuit Cards Input Power (Bus #3 and #4)	3	SAN-O AX-1	248609200
	--	Safety Fuse Cover	--	SAN-O SAX-1	248898600
Distribution Fuseholder Alarm Fuse	FA	Fuse Alarm	18/100A	Bussmann GMT-18/100A	248610301
	--	Safety Fuse Cover	--	Bussmann GMT-X	248898700

Table 7
Replaceable Alarm, Reference, and Control Fuses

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Input and Alarm Fuse on Optional Bullet Nose-Type 10-Position GMT Fuse Module, P/N 509128

Features

- Located on the optional Bullet Nose-Type 10-Position GMT Fuse Module (P/N 509128) is an input fuse. If this fuse opens, an alarm type fuse also opens to activate the fuse alarm circuit. The alarm-type fuse is located in fuse position #11 on the Fuse Module.

Restrictions

These fuses are not available for customer connected loads.

Ordering Notes

1) Order replacement fuses as required per Table 8.

Ampere Rating	Part Number
35	110982
0.18	248610301
Safety Fuse Cover (Bussmann GMT-Y)	102774

Table 8
Replacement Input Fuse and Associated Alarm Fuse on
Bullet Nose-Type 10-Position GMT Fuse Module P/N 509128

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Wiring Components

Load Distribution Wire Sizes and Lugs Selection (Distribution Bay)

Features

- Load distribution leads are connected as described in the section titled *Distribution Devices* under "Accessory Descriptions".
- For lug mounting hole size and spacing dimensions, refer to the illustrations in the section titled *Distribution Devices* under "Accessory Descriptions".

Restrictions

All lugs for customer connections must be ordered separately.

Ordering Notes

1) The type of distribution device determines the load lug hole size and spacing requirements. The rating of the distribution device determines the wire size requirements. For wire size and lug selection; refer to Table 9 and Table 10 (Load Side). (Load return leads are terminated outside the bay to customer provided return busbars.)
2) Lugs should be crimped per lug manufacturer's specifications.

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Fuse/Circuit Breaker Amperage	Recm 90°C Wire Size [1]						
	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG	4 AWG	2 AWG
	Loop Length (feet) [2]						
1, 3, 5, 6, 10A	37 [3, 4]	58 [3, 4]	93 [3, 4]	--	--	--	--
15A	24 [3, 4]	39 [3, 4]	62 [3, 4]	--	--	--	--
20A	--	29 [3, 4]	46 [3, 4]	74 [3, 4]	--	--	--
25A	--	--	37 [3, 4]	59 [3, 4]	94 [3, 4]	--	--
30A	--	--	31 [3, 4]	49 [3, 4]	78 [3, 4]	--	--
35A	--	--	--	42 [3, 4]	67 [3, 4]	107 [3, 4]	--
40A	--	--	--	37 [3, 4]	59 [3, 4]	94 [3, 4]	--
45A	--	--	--	33 [3, 4]	52 [3, 4]	83 [3, 4]	--
50A	--	--	--	29 [3, 4]	47 [3, 4]	75 [3, 4]	--
60A	--	--	--	--	39 [3, 4]	62 [3, 4]	99 [3, 4]
70A	--	--	--	--	33 [3]	53 [3, 4]	85 [3, 4]
75A	--	--	--	--	31 [3]	50 [3, 4]	79 [3, 4]
80A	--	--	--	--	--	47 [3, 4]	74 [3, 4]
90A	--	--	--	--	--	41 [3]	66 [3, 4]
100A	--	--	--	--	--	--	59 [3, 4]
125A	Two Pole Devices. Use Load Lug Adapter Plate P/N 513700, Kit P/N 520891 (kit includes mtg. hardware) and select Wire Sizes and Lugs per Table 10.						
150A							
200A							
250A	Three Pole Devices. Use Load Lug Adapter Plate P/N 514676, Kit P/N 534703 (kit includes mtg. hardware) and select Wire Sizes and Lugs per Table 10.						
Recommended Crimp Lug [5]							
Lug	245342300	245342300	245342300	245390200	245346700	245346800	245346900

1 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire at **90°C** conductor temperature operating in ambients of **30°C** and **40°C** was used. For other operating ambient temperatures, refer to the NEC. For operation in countries where the NEC is not recognized, follow applicable codes.

2 Recommended wire sizes are sufficient to restrict voltage drop to 1.0 volt or less at listed branch current for the loop lengths shown. Loop length is the sum of the lengths of the positive and negative leads.

3 Wire Size / Loop Length Combination Calculated using 30°C Ambient Operating Temperature.

4 Wire Size / Loop Length Combination Calculated using 40°C Ambient Operating Temperature.

5 Two-hole lug, 1/4" bolt clearance hole, 5/8" centers. Lugs should be crimped per lug manufacturer's specifications.

Table 9
Recommended Load Distribution Wire Size and Lug Selection for
TLS/TPS Fuse and **Bullet Nose-Type Circuit Breaker** (Load Side)

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Fuse/ Circuit Breaker Amperage	Recm 90°C Wire Size [1]									
	6 AWG	4 AWG	2 AWG	1/0 AWG	2/0 AWG	3/0 AWG	4/0 AWG	250 kcmil	300 kcmil	350 kcmil
	Loop Length (feet) [2]									
70A	33 [3]	53 [3, 4]	85 [3, 4]	135 [3, 4]	--	--	--	--	--	--
80A	--	47 [3, 4]	74 [3, 4]	118 [3, 4]	--	--	--	--	--	--
100A	--	--	59 [3, 4]	95 [3, 4]	119 [3, 4]	--	--	--	--	--
125A	--	--	47 [3]	76 [3, 4]	95 [3, 4]	120 [3, 4]	--	--	--	--
150A	--	--	--	63 [3, 4]	79 [3, 4]	100 [3, 4]	--	--	--	--
175A	--	--	--	--	68 [3, 4]	86 [3, 4]	108 [3, 4]	--	--	--
200A	--	--	--	--	--	75 [3, 4]	95 [3, 4]	112 [3, 4]	--	--
225A	--	--	--	--	--	67 [3]	84 [3, 4]	100 [3, 4]	120 [3, 4]	--
250A	--	--	--	--	--	--	76 [3]	90 [3, 4]	108 [3, 4]	126 [3, 4]
Recommended Crimp Lug [5]										
Lug	2453-49900	2453-50000	2453-48200	2453-47100	2453-47200	2453-47300	2453-47400	2453-47500	2453-47600	2453-47700

1 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire at **90°C** conductor temperature operating in ambients of **30°C** and **40°C** was used. For other operating ambient temperatures, refer to the National Electrical Code. For operation in countries where the NEC is not recognized, follow applicable codes.

2 Recommended wire sizes are sufficient to restrict voltage drop to 1.0 volt or less at listed branch current for the loop lengths shown. Loop length is the sum of the lengths of the positive and negative leads.

3 Wire Size / Loop Length Combination Calculated using 30°C Ambient Operating Temperature.

4 Wire Size / Loop Length Combination Calculated using 40°C Ambient Operating Temperature.

5 Two-hole lug, 3/8" bolt clearance hole, 1" centers. Lugs should be crimped per lug manufacturer's specifications.

Table 10 (cont'd on next page)
Recommended Load Distribution Wire Size and Lug Selection for
TPL Fuse and **218 Circuit Breaker** (Load Side)

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Fuse/ Circuit Breaker Amperage	Recm 90°C Wire Size [1]						
	2/0 AWG	3/0 AWG	4/0 AWG	250 kcmil	300 kcmil	350 kcmil	400 kcmil
	Loop Length (feet) [2]						
300A	--	--	--	150 [3, 4] (2) Wires	90 [3]	105 [3, 4]	120 [3, 4]
350A	68 [3, 4] (2) Wires	86 [3, 4] (2) Wires	108 [3, 4] (2) Wires	128 [3, 4] (2) Wires	--	90 [3]	103 [3]
400A		75 [3, 4] (2) Wires	95 [3, 4] (2) Wires	112 [3, 4] (2) Wires	--	--	--
450A	--	67 [3] (2) Wires	84 [3, 4] (2) Wires	100 [3, 4] (2) Wires	120 [3, 4] (2) Wires	--	--
500A		--	76 [3] (2) Wires	90 [3, 4] (2) Wires	108 [3, 4] (2) Wires	126 [3, 4] (2) Wires	--
600A		--	--	--	90 [3] (2) Wires 135 [3, 4] (3) Wires	105 [3, 4] (2) Wires	120 [3, 4] (2) Wires
800A	--	--	--	84 [3] (3) Wires	101 [3, 4] (3) Wires	118 [3, 4] (3) Wires	135 [3, 4] (3) Wires
Recommended Crimp Lug [5]							
Lug	245347200 (per cable)	245347300 (per cable)	245347400 (per cable)	245347500 (per cable)	245347600 (per cable)	245347700 (per cable)	245347800 (per cable)

1 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire at **90°C** conductor temperature operating in ambients of **30°C** and **40°C** was used. For other operating ambient temperatures, refer to the National Electrical Code. For operation in countries where the NEC is not recognized, follow applicable codes.

2 Recommended wire sizes are sufficient to restrict voltage drop to 1.0 volt or less at listed branch current for the loop lengths shown. Loop length is the sum of the lengths of the positive and negative leads.

3 Wire Size / Loop Length Combination Calculated using 30°C Ambient Operating Temperature.

4 Wire Size / Loop Length Combination Calculated using 40°C Ambient Operating Temperature.

5 Two-hole lug, 3/8" bolt clearance hole, 1" centers. Lugs should be crimped per lug manufacturer's specifications.

Table 10 (cont'd from previous page)
Recommended Load Distribution Wire Size and Lug Selection for
TPL Fuse and **218 Circuit Breaker** (Load Side)

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Power Bay DC Output Cable Sizes and Lugs Selection

Features

- 3/8” clearance holes on 1" centers are provided for installation of customer provided DC output cables terminated in two-hole lugs. These are accessed from the rear of each Power Bay.
- For lug mounting hole size and spacing dimensions, refer to the illustration provided in this section.

Restrictions

All lugs for customer connections must be ordered separately.

Customer needs to supply lug mounting hardware.

Maximum size of wire to be connected to a single lug position is 750 kcmil (2 per lug position).

Maximum lug width, 1.937 inches.

Ordering Notes

1) DC output cable size varies depending on power requirements, therefore no specific information is provided for cable size. Refer to Table 11 for recommended cable sizes and lugs at rated maximum bay output (2400 amperes). When making connections, observe correct polarity.
2) Lugs should be crimped per lug manufacturer’s specifications.

Ambient Operating Temperature [1]	Loop Length [2] (Ft)	Recm 90°C Wire Size [1, 2]	Recommended Crimp Lug [3]
30°C	140	(5) 750 kcmil	245392000
40°C	140	(5) 750 kcmil	
	168	(6) 750 kcmil	

[1] Cable sizes are based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire rated at **90°C** conductor temperature operating in ambients of **30°C** and **40°C** was used. For other operating ambient temperatures, refer to the NEC. For operation in countries where the NEC is not recognized, follow applicable codes.

[2] Recommended cable sizes are sufficient to restrict voltage drop to 1.0 volt or less at rated full output current of the bay for the loop lengths shown. Loop length is the sum of the lengths of the positive and negative leads.

[3] Two-hole lug, 3/8" bolt clearance hole, 1" centers. Lugs should be crimped per lug manufacturer’s specifications.

Table 11
Recommended Power Bay DC Output Cable Size and Lug Selection

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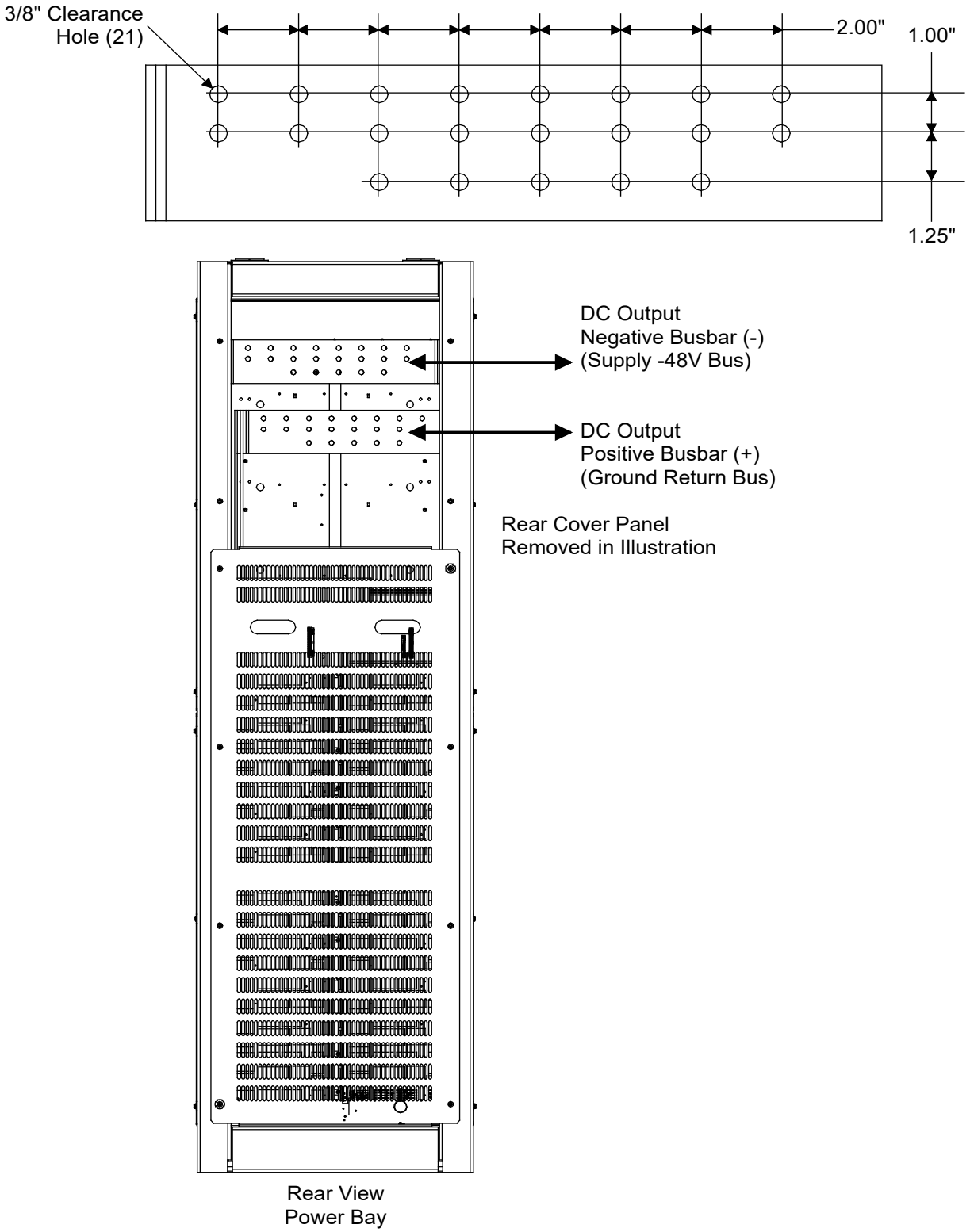
3/8" Clearance
Hole (21)
2.00"
1.00"
1.25"
DC Output
Negative Busbar (-)
(Supply -48V Bus)
DC Output
Positive Busbar (+)
(Ground Return Bus)
Rear Cover Panel
Removed in Illustration
Rear View
Power Bay

Distribution Bay DC Input Cable Sizes and Lugs Selection

Features

- 3/8” clearance holes on 1" centers are provided for installation of customer provided DC input cables terminated in two-hole lugs. These are accessed from the rear of each Distribution Bay.
- For lug mounting hole size and spacing dimensions, refer to the illustration provided in this section.

Restrictions

All lugs for customer connections must be ordered separately.

Customer needs to supply lug mounting hardware.

Maximum size of wire to be connected to a single lug position is 750 kcmil (2 per lug position).

Maximum lug width, 2.000 inches.

Ordering Notes

1) DC input cable size varies depending on power requirements, therefore no specific information is provided for cable size. Refer to Table 12 for recommended cable sizes and lugs at rated maximum bay load (6000 amperes). When making connections, observe correct polarity.
2) Lugs should be crimped per lug manufacturer’s specifications.

Ambient Operating Temperature [1]	Loop Length [2] (Ft)	Recm 90°C Wire Size [1, 2]	Recommended Crimp Lug [3]
30°C	112	(10) 750 kcmil	245392000
40°C	112	(10) 750 kcmil	
	157	(14) 750 kcmil	

[1] Wire sizes are based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire rated at **90°C** conductor temperature operating in ambients of **30°C** and **40°C** was used. For other operating ambient temperatures, refer to the NEC. For operation in countries where the NEC is not recognized, follow applicable codes.

[2] Recommended wire sizes are sufficient to restrict voltage drop to 1.0 volt or less at rated full load output current of the bay for the loop lengths shown. Loop length is the sum of the lengths of the positive and negative leads.

[3] Two-hole lug, 3/8" bolt clearance hole, 1" centers. Lugs should be crimped per lug manufacturer’s specifications.

Table 12
Recommended Distribution Bay DC Input Cable Size and Lug Selection

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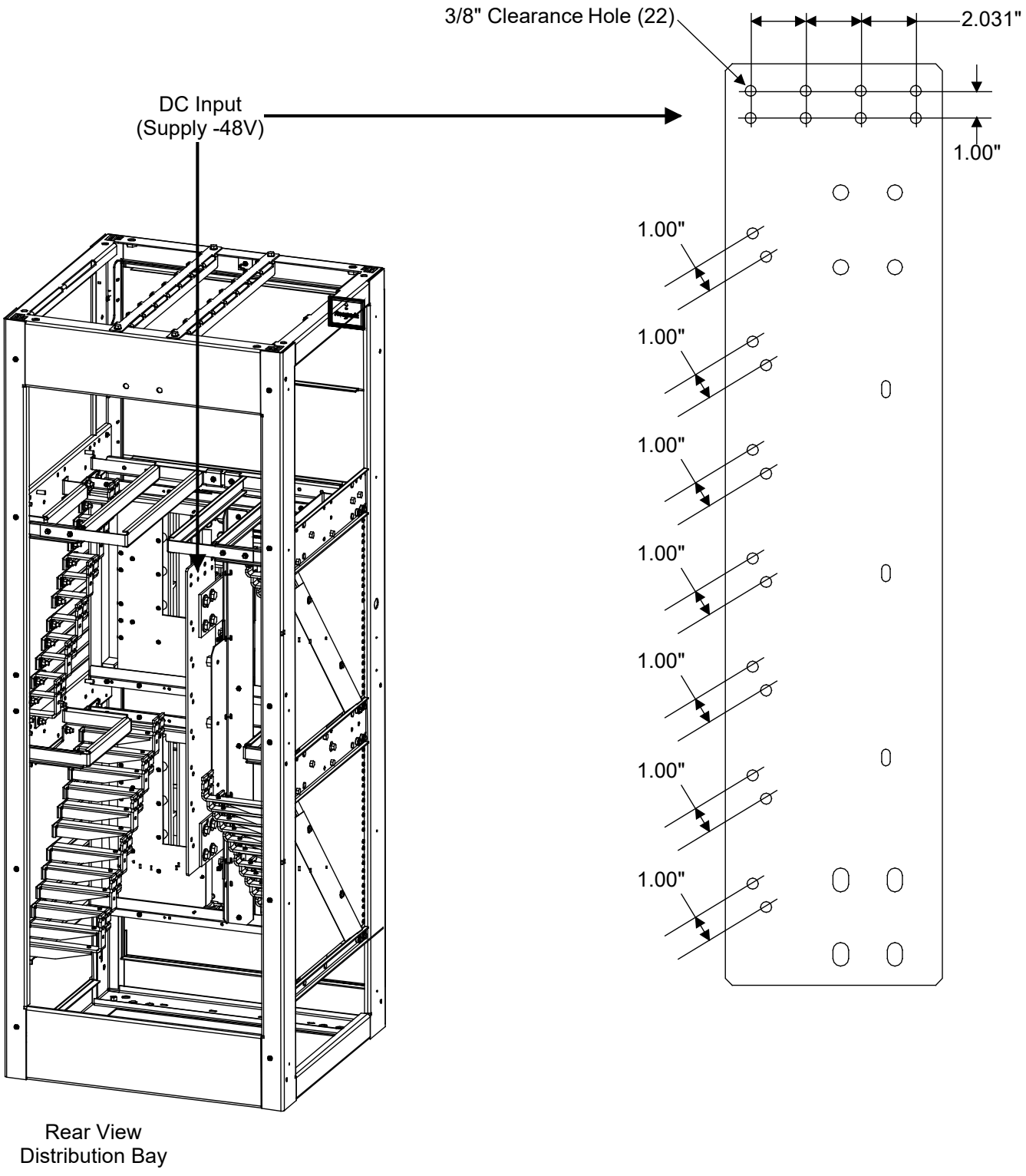

3/8" Clearance Hole (22)
2.031"
1.00"
DC Input
(Supply -48V)
1.00"
1.00"
1.00"
1.00"
1.00"
1.00"
1.00"
Rear View
Distribution Bay

Power Bay Frame Grounding Wire Sizes and Lugs Selection

Features

- 1/4” clearance holes on 5/8" centers are provided for installation of customer provided two-hole lugs, as shown in the following illustration.

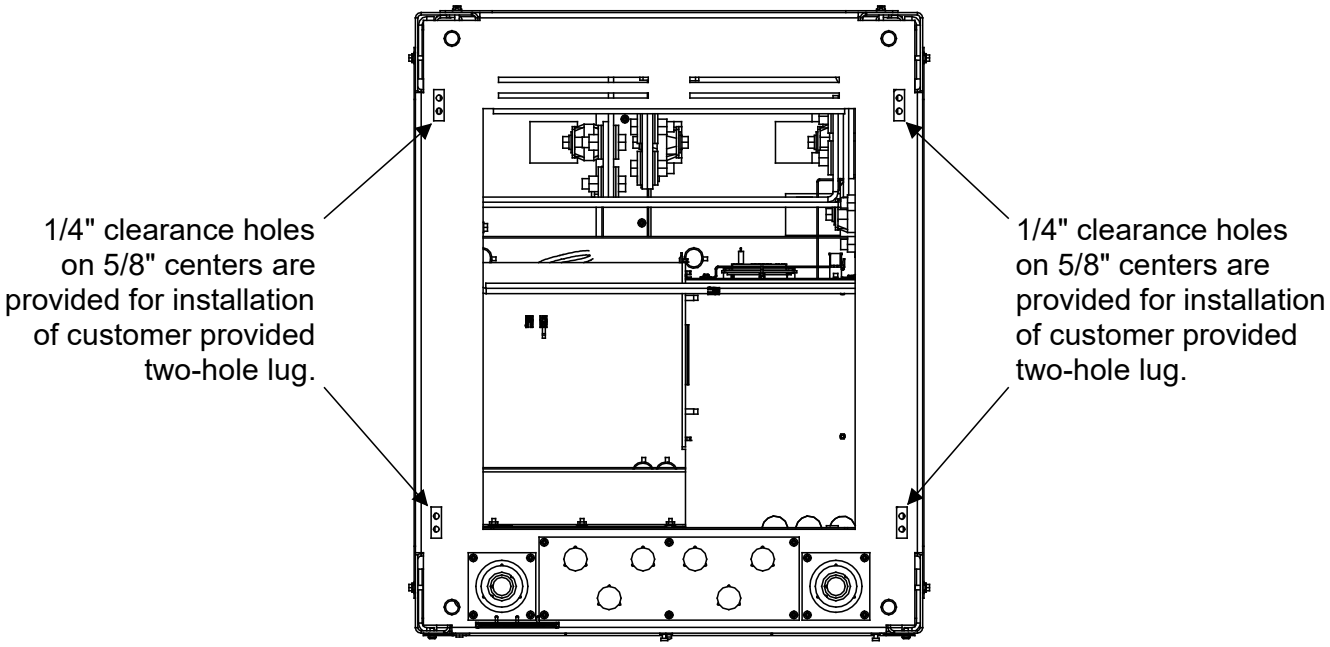
Restrictions

All lugs for customer connections must be ordered separately.

Customer needs to supply lug mounting bolts and hardware.

The recommended frame grounding wire size is 6 AWG.

Recommended lug P/N 245346700.



Top View
Power Bay

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Distribution Bay Frame Grounding Wire Sizes and Lugs Selection

Features

- 1/4” clearance holes on 5/8" centers are provided for installation of customer provided two-hole lugs, as shown in the following illustration.

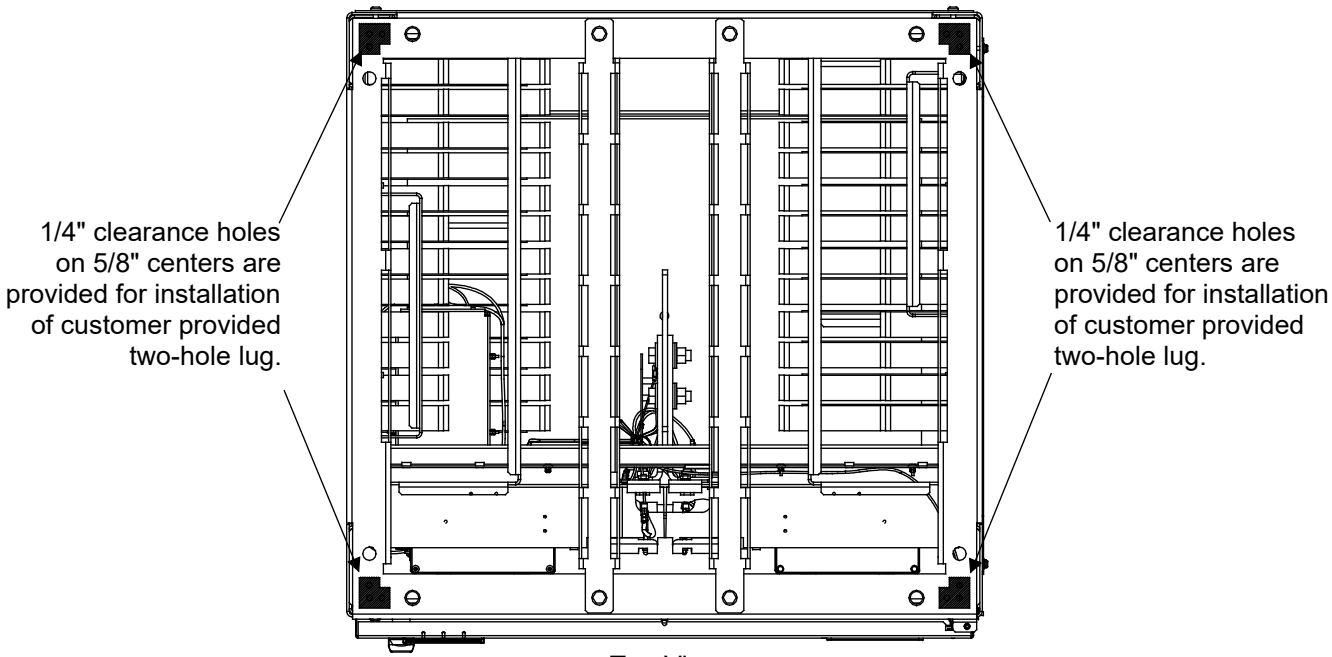
Restrictions

All lugs for customer connections must be ordered separately.

Customer needs to supply lug mounting bolts and hardware.

The recommended frame grounding wire size is 6 AWG.

Recommended lug P/N 245346700.



Top View
Distribution Bay

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AC Input (12 or 24 AC Input Feeds)
Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection
Lists 5 and 13

Features

- 10-32 studs on 5/8" centers are provided for installation of customer provided two-hole AC Input lugs.
- 1/4-20 studs are provided for installation of customer provided two-hole AC equipment grounding lugs.
- For AC input wiring, refer to the illustration provided in this section.

Restrictions

Twelve (12) or twenty-four (24) AC input feeds are required in Lists 5 and 13 only.

24 Feeds, 208VAC, List B w/ List 5 or 13: Three feeds per conduit and one ground per conduit. Customer must provide a high inrush circuit breaker overcurrent protection device in each AC input feed as shown in Table 13.

24 Feeds, 380/480VAC, List A w/ List 5 or 13: Three feeds per conduit and one ground per conduit. Customer must provide a high inrush circuit breaker overcurrent protection device in each AC input feed as shown in Table 13.

12 Feeds, 208VAC, List B w/ List 5 or 13: Two feeds per conduit and one ground per conduit. Customer must provide a high inrush circuit breaker overcurrent protection device in each AC input feed as shown in Table 14.

12 Feeds, 380/480VAC, List A w/ List 5 or 13: Two feeds per conduit and one ground per conduit. Customer must provide a high inrush circuit breaker overcurrent protection device in each AC input feed as shown in Table 14.

All lugs for equipment grounding connections must be ordered separately. Customer needs to supply lug mounting hardware.

Ordering Notes

1) Refer to Tables 13 (24 Feeds) and 14 (12 Feeds) for recommended AC input wire and conduit sizes, branch circuit protection, and equipment grounding lugs.

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24 Feeds				
Input Voltage	**Input Current**	**Overcurrent Protection (1)**	**40°C Ambient Temperature (2)**	
			Wire AWG (2) (3)	**Conduit Size (in.)**
THWN - 75°C Wire - Individual Feed Three Rectifiers (9 Current and 1 Ground Wire) per Conduit				
480V	7.8A	15A	14	1/2
380V	10A	15A	14	1/2
208V	18A	25A	10	3/4
THHN - 90°C Wire - Individual Feed Three Rectifiers (9 Current and 1 Ground Wire) per Conduit				
480V	7.8A	15A	14	1/2
380V	10A	15A	14	1/2
208V	18A	25A	10	3/4
Recommended Equipment Grounding Wire Crimp Lugs				
Wire AWG		**Crimp Lug P/N (4)**		
14		245359650		
10		245342300		
8		245346600		

1 The AC input branch circuit protective device should be of the time-delay or high inrush type.

2 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire at **75°C** and **90°C** conductor temperature; operating in an ambient of **40°C** was used. For other operating ambient temperatures, refer to the National Electrical Code. For operation in countries where the NEC is not recognized, follow applicable codes.

3 Equipment grounding conductors **must** be provided with the AC input conductors supplied to the Bay. Frame ground terminals must be connected to earth ground, not power system neutral. Equipment grounding conductor size based on recommendations of the NEC Table 250-122 for copper wire. When aluminum or copper clad aluminum grounding conductor is used, refer to Table 250-122 for increased conductor size. For operation in countries where the NEC is not recognized, follow applicable codes.

4 Single-hole lug, 1/4" bolt clearance hole.

Table 13
Recommended AC Input Wire and Conduit Size, and Lug Selection
(24 AC Input Feeds, 1 per Rectifier Module)

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12 Feeds				
Input Voltage	**Input Current**	**Overcurrent Protection (1)**	**40°C Ambient Temperature (2)**	
			Wire AWG (2) (3)	**Conduit Size (in.)**
THWN - 75°C Wire - Individual Feed Four Rectifiers (6 Current and 1 Ground Wire) per Conduit				
480V	15.6A	20A	12	1/2
380V	20A	25A	10	3/4
208V	35.8A	50A	6	1
THHN - 90°C Wire - Individual Feed Four Rectifiers (6 Current and 1 Ground Wire) per Conduit				
480V	15.6A	20A	12	1/2
380V	20A	25A	10	3/4
208V	35.8A	50A	6	1
Recommended Equipment Grounding Wire Crimp Lugs				
Wire AWG		**Crimp Lug P/N (4)**		
8		245346600		
6		245346500		

1 The AC input branch circuit protective device should be of the time-delay or high inrush type.

2 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire at **75°C** and **90°C** conductor temperature; operating in an ambient of **40°C** was used. For other operating ambient temperatures, refer to the National Electrical Code. For operation in countries where the NEC is not recognized, follow applicable codes.

3 Equipment grounding conductors **must** be provided with the AC input conductors supplied to the Bay. Frame ground terminals must be connected to earth ground, not power system neutral. Equipment grounding conductor size based on recommendations of the NEC Table 250-122 for copper wire. When aluminum or copper clad aluminum grounding conductor is used, refer to Table 250-122 for increased conductor size. For operation in countries where the NEC is not recognized, follow applicable codes.

4 Single-hole lug, 1/4" bolt clearance hole.

Table 14
Recommended AC Input Wire and Conduit Size, and Lug Selection
(12 AC Input Feeds, 1 per 2 Rectifier Modules)

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AC Input (6 AC Input Feeds)
Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection
Lists 6 and 14

Features

- 10-32 studs on 5/8" centers are provided for installation of customer provided two-hole AC Input lugs.
- 1/4-20 studs are provided for installation of customer provided two-hole AC equipment grounding lugs.
- For AC input wiring, refer to the illustration provided in this section.

Restrictions

Six (6) AC input feeds are required in Lists 6 and 14 only.

6 Feeds, 480V, List A w/ List 6 or 14: One feed per conduit and one ground per conduit. Customer must provide a 40-50A high inrush circuit breaker overcurrent protection device in each AC input feed.

All lugs for equipment grounding connections must be ordered separately. Customer needs to supply lug mounting hardware.

Ordering Notes

1) Refer to Table 15 for recommended AC input wire and conduit sizes, branch circuit protection, and equipment grounding lugs.

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6 Feeds				
Input Voltage	**Input Current**	**Overcurrent Protection (1)**	**40°C Ambient Temperature (2)**	
			Wire AWG (2) (3)	**Conduit Size (in.)**
THWN - 75°C Wire - Individual Feed Four Rectifiers (6 Current and 1 Ground Wire) per Conduit				
480V	31A	40A	8	3/4
480V	31A	50A	6	3/4
THHN - 90°C Wire - Individual Feed Four Rectifiers (6 Current and 1 Ground Wire) per Conduit				
480V	31A	40A	8	3/4
480V	31A	50A	6	3/4
Recommended Equipment Grounding Wire Crimp Lugs				
Wire AWG		**Crimp Lug P/N (4)**		
8		245346600		
6		245346500		

1 The AC input branch circuit protective device should be of the time-delay or high inrush type.

2 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire at **75°C** and **90°C** conductor temperature; operating in an ambient of **40°C** was used. For other operating ambient temperatures, refer to the National Electrical Code. For operation in countries where the NEC is not recognized, follow applicable codes.

3 Equipment grounding conductors **must** be provided with the AC input conductors supplied to the Bay. Frame ground terminals must be connected to earth ground, not power system neutral. Equipment grounding conductor size based on recommendations of the NEC Table 250-122 for copper wire. When aluminum or copper clad aluminum grounding conductor is used, refer to Table 250-122 for increased conductor size. For operation in countries where the NEC is not recognized, follow applicable codes.

4 Single-hole lug, 1/4" bolt clearance hole.

Table 15
Recommended AC Input Wire and Conduit Size, and Lug Selection
(6 AC Input Feeds, 1 per 4 Rectifier Modules)

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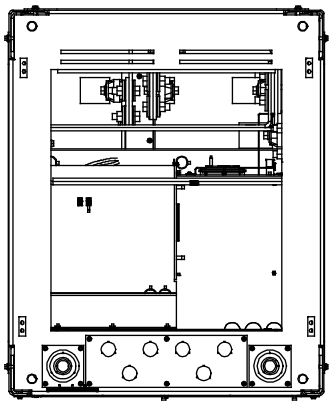
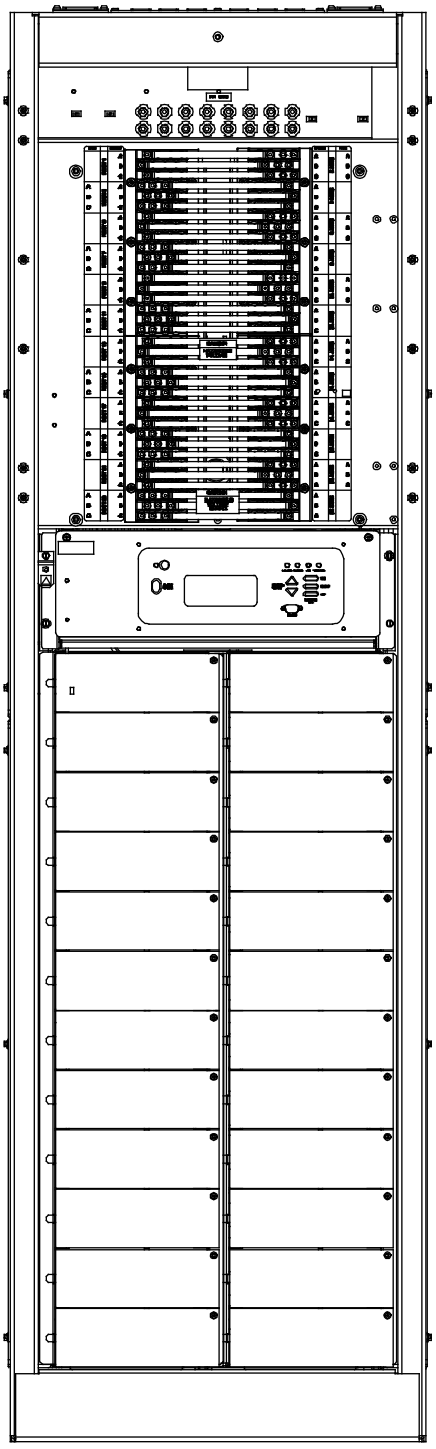


Six (6) 1.125" openings for 3/4" conduit.
Two (2) conduit plates with
2.5", 1.75", and 1.125" knock-outs
for 2", 1.5", and 3/4" conduit.
Six (6) 1.75" openings for 1.5" conduit
(under plate).

Top View
Power Bay

Note: Rectifier numbering is for wiring identification only. The MCA identifies rectifiers differently.



See Detail A
(12 Feeds)

See Detail B
(24 Feeds)

See Detail C
(6 Feeds)

Front cover panel
omitted

Rectifier #1 Mounting Slot
Rectifier #2 Mounting Slot
Rectifier #3 Mounting Slot
Rectifier #4 Mounting Slot
Rectifier #5 Mounting Slot
Rectifier #6 Mounting Slot
Rectifier #7 Mounting Slot
Rectifier #8 Mounting Slot
Rectifier #9 Mounting Slot
Rectifier #10 Mounting Slot
Rectifier #11 Mounting Slot
Rectifier #12 Mounting Slot
Rectifier #13 Mounting Slot
Rectifier #14 Mounting Slot
Rectifier #15 Mounting Slot
Rectifier #16 Mounting Slot
Rectifier #17 Mounting Slot
Rectifier #18 Mounting Slot
Rectifier #19 Mounting Slot
Rectifier #20 Mounting Slot
Rectifier #21 Mounting Slot
Rectifier #22 Mounting Slot
Rectifier #23 Mounting Slot
Rectifier #24 Mounting Slot

Front View
Power Bay

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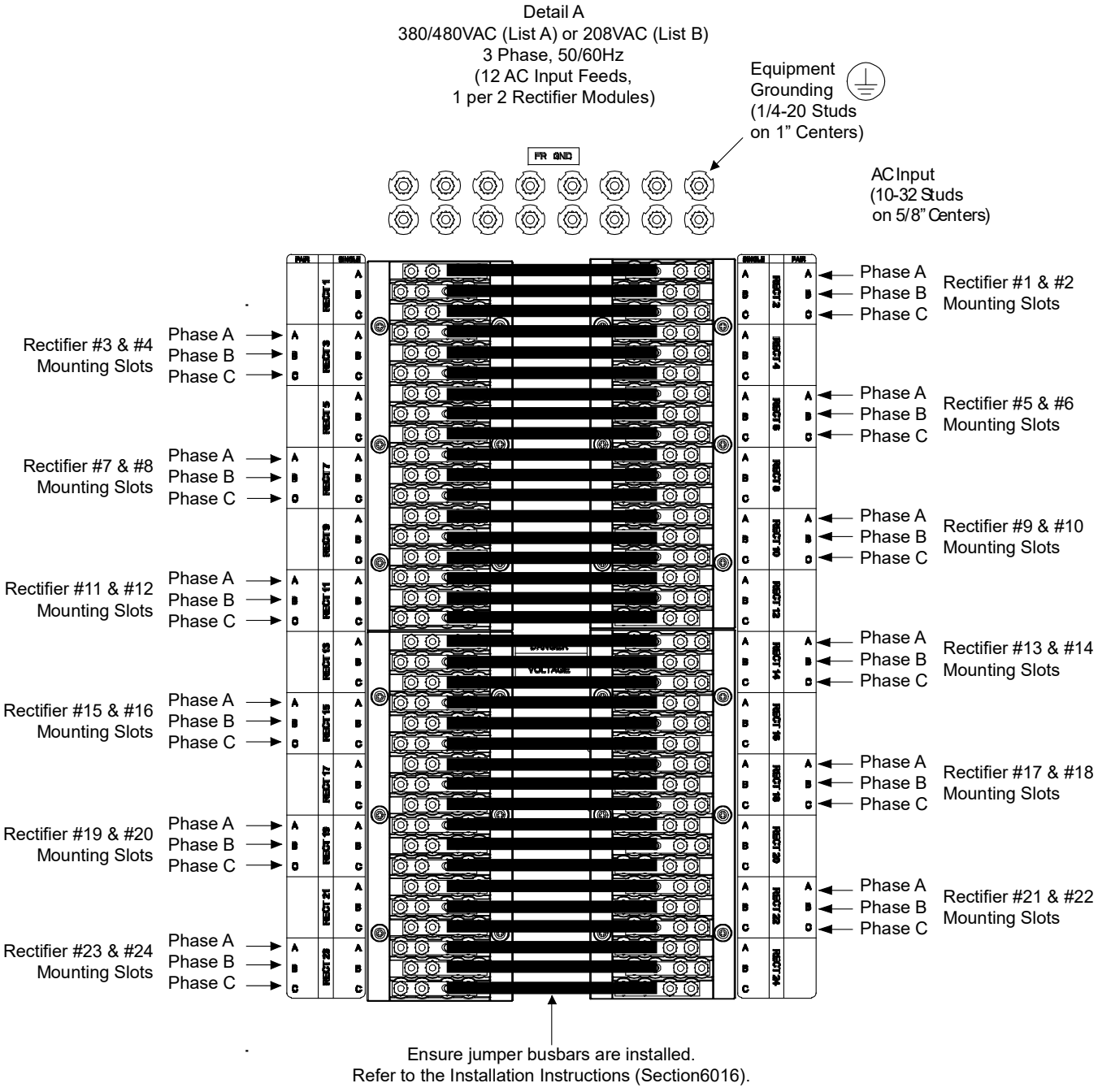

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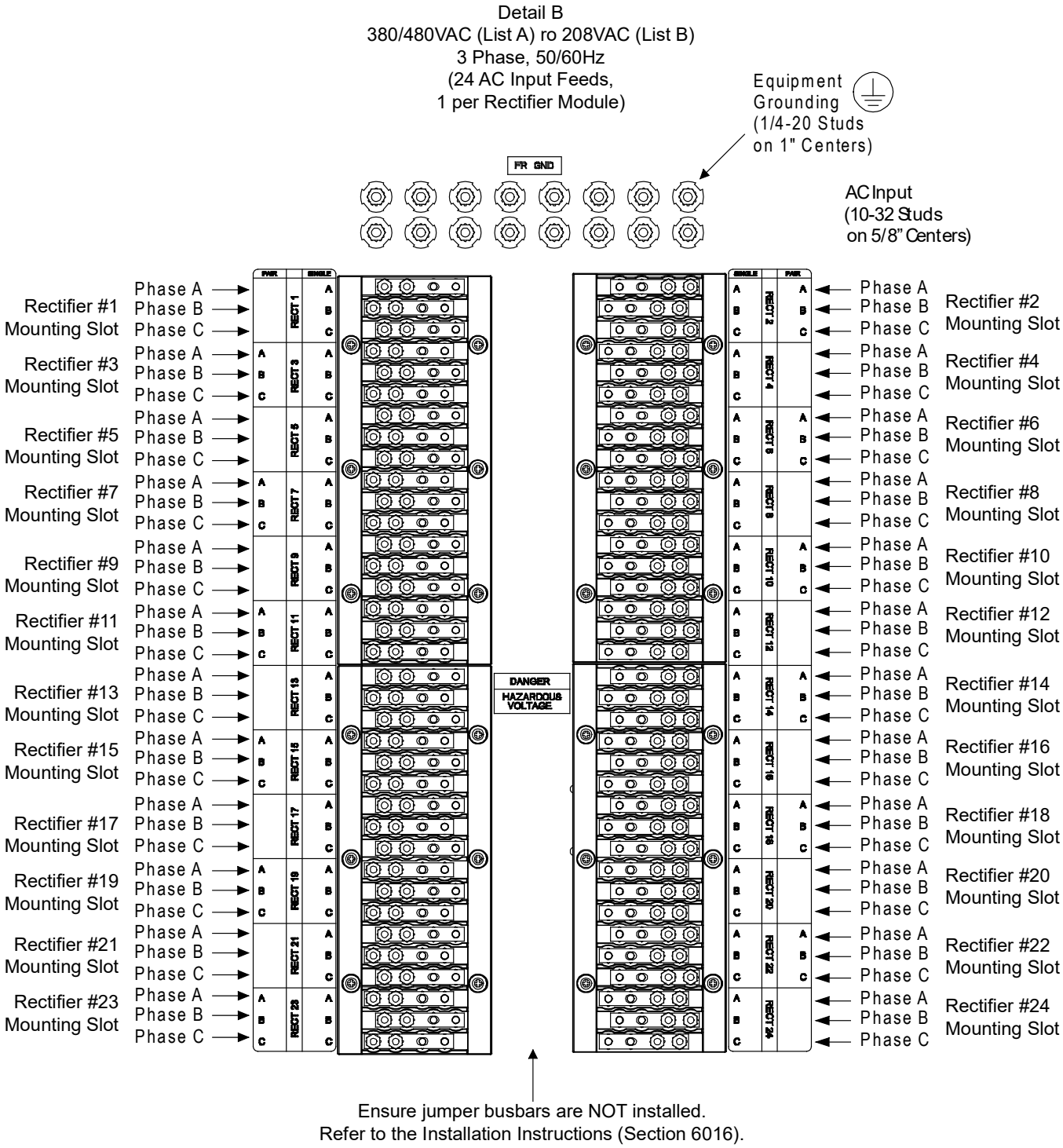
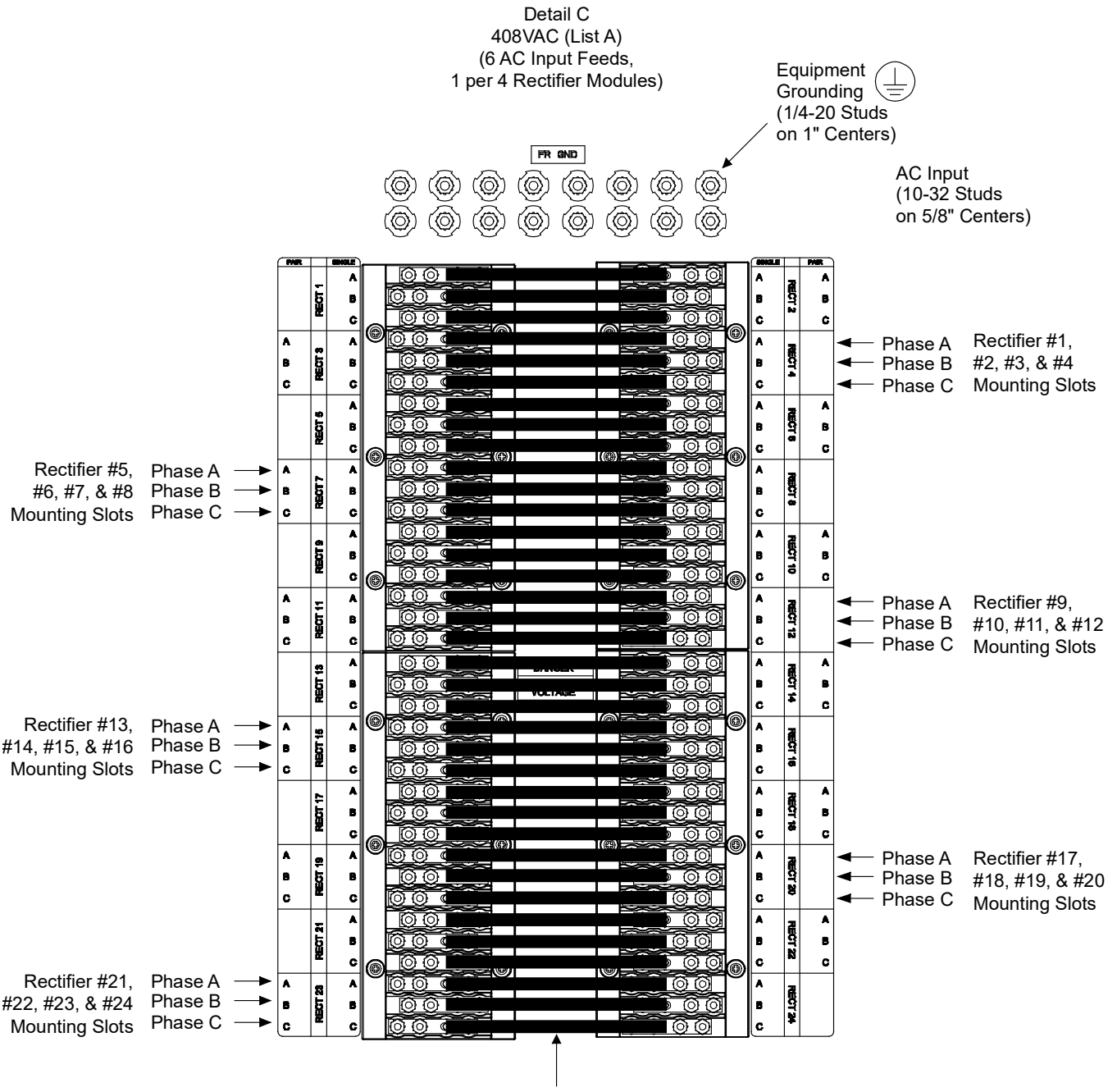

Detail B
380/480VAC (List A) ro 208VAC (List B)
3 Phase, 50/60Hz
(24 AC Input Feeds,
1 per Rectifier Module)
Equipment
Grounding
(1/4-20 Studs
on 1" Centers)
FR GND
AC Input
(10-32 Studs
on 5/8" Centers)
Rectifier #1
Mounting Slot
Rectifier #2
Mounting Slot
Rectifier #3
Mounting Slot
Rectifier #4
Mounting Slot
Rectifier #5
Mounting Slot
Rectifier #6
Mounting Slot
Rectifier #7
Mounting Slot
Rectifier #8
Mounting Slot
Rectifier #9
Mounting Slot
Rectifier #10
Mounting Slot
Rectifier #11
Mounting Slot
Rectifier #12
Mounting Slot
Rectifier #13
Mounting Slot
Rectifier #14
Mounting Slot
Rectifier #15
Mounting Slot
Rectifier #16
Mounting Slot
Rectifier #17
Mounting Slot
Rectifier #18
Mounting Slot
Rectifier #19
Mounting Slot
Rectifier #20
Mounting Slot
Rectifier #21
Mounting Slot
Rectifier #22
Mounting Slot
Rectifier #23
Mounting Slot
Rectifier #24
Mounting Slot
Phase A
Phase B
Phase C
DANGER
HAZARDOUS
VOLTAGE
Ensure jumper busbars are NOT installed.
Refer to the Installation Instructions (Section 6016).


Detail C
408VAC (List A)
(6 AC Input Feeds,
1 per 4 Rectifier Modules)
Equipment
Grounding
(1/4-20 Studs
on 1" Centers)
FR GND
AC Input
(10-32 Studs
on 5/8" Centers)
Phase A
Phase B
Phase C
Rectifier #1,
#2, #3, & #4
Mounting Slots
Rectifier #5,
#6, #7, & #8
Mounting Slots
Phase A
Phase B
Phase C
Phase A
Phase B
Phase C
Rectifier #9,
#10, #11, & #12
Mounting Slots
Rectifier #13,
#14, #15, & #16
Mounting Slots
Phase A
Phase B
Phase C
Phase A
Phase B
Phase C
Rectifier #17,
#18, #19, & #20
Mounting Slots
Rectifier #21,
#22, #23, & #24
Mounting Slots
Phase A
Phase B
Phase C
Ensure jumper busbars and jumper wires are installed.
(Jumpers wires not shown.)
Refer to the Installation Instructions (Section 6016).

AC Input (2 AC Input Feeds)
Wire and Conduit Sizes, Branch Circuit Protection, and Lugs Selection
Lists 4 and 12

Features

- 3/8-16 studs on 1" centers are provided for installation of customer provided two-hole AC Input lugs.
- 1/4-20 studs are provided for installation of customer provided two-hole AC equipment grounding lugs.
- For AC input wiring, refer to the illustration provided in this section.

Restrictions

Two (2) AC input feeds are required in Lists 4 and 12 only. One feed per conduit and one ground per conduit.

2 Feeds, 208VAC, List B w/ List 4 or 12: Customer must provide a 300A high inrush circuit breaker overcurrent protection device in each AC input feed.

2 Feeds, 380VAC, List A w/ List 4 or 12: Customer must provide a 150A high inrush circuit breaker overcurrent protection device in each AC input feed.

2 Feeds, 480VAC, List A w/ List 4 or 12: Customer must provide a 125A high inrush circuit breaker overcurrent protection device in each AC input feed.

All lugs for customer connections must be ordered separately.

Customer needs to supply lug mounting hardware.

Ordering Notes

1) Refer to Table 16 for recommended AC input wire and conduit sizes, branch circuit protection, and lugs.

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Input Voltage	Input Current	Overcurrent Protection (1)	40°C Ambient Temperature (2)	
			Wire AWG (2) (3)	Conduit Size (in.)
THWN - 75°C Wire - Dual Feed Twelve Rectifiers (3 Current and 1 Ground Wire) per Conduit				
480V	91A	125A	1/0	1-1/2
380V	115A	150A	1/0	1-1/2
208V	212A	300A	300 kcmil	2-1/2
THHN - 90°C Wire - Dual Feed Twelve Rectifiers (3 Current and 1 Ground Wire) per Conduit				
480V	91A	125A	2	1-1/2
380V	115A	150A	1/0	1-1/2
208V	212A	300A	300 kcmil	2-1/2
Recommended Crimp Lugs				
Wire AWG		**Crimp Lug P/N (4)**		
1/0		245347100		
350 kcmil		245347700		

1 The AC input branch circuit protective device should be of the time-delay or high inrush type.

2 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for copper wire at **75°C** and **90°C** conductor temperature; operating in an ambient of **40°C**, was used. For other operating ambient temperatures, refer to the National Electrical Code. For operation in countries where the NEC is not recognized, follow applicable codes.

3 Equipment grounding conductors **must** be provided with the AC input conductors supplied to the Bay. Frame ground terminals must be connected to earth ground, not power system neutral. Equipment grounding conductor size based on recommendations of the NEC Table 250-122 for copper wire. When aluminum or copper clad aluminum grounding conductor is used, refer to Table 250-122 for increased conductor size. For operation in countries where the NEC is not recognized, follow applicable codes.

4 Two-hole lug, 3/8" bolt clearance hole, 1" centers. Lugs should be crimped per lug manufacturer's specifications.

Table 16
Recommended AC Input Wire and Conduit Size, and Lug Selection
(2 AC Input Feeds, 1 per 12 Rectifier Modules)

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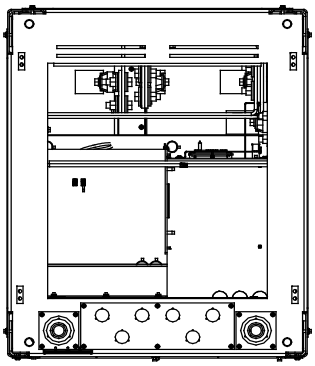


Six (6) 1.125" openings for 3/4" conduit.
Two (2) conduit plates with
2.5", 1.75", and 1.125" knock-outs
for 2", 1.5", and 3/4" conduit.
Six (6) 1.75" openings for 1.5" conduit
(under plate).

Top View
Power Bay

Note: Rectifier numbering is for wiring identification only. The MCA identifies rectifiers differently.

380/480VAC (List A) or 208VAC (List B)
3 Phase, 50/60Hz
(2 AC Input Feeds,
1 per 12 Rectifier Modules)

Odd Numbered Rectifier Mounting Slots

Even Numbered Rectifier Mounting Slots

C B A A B C

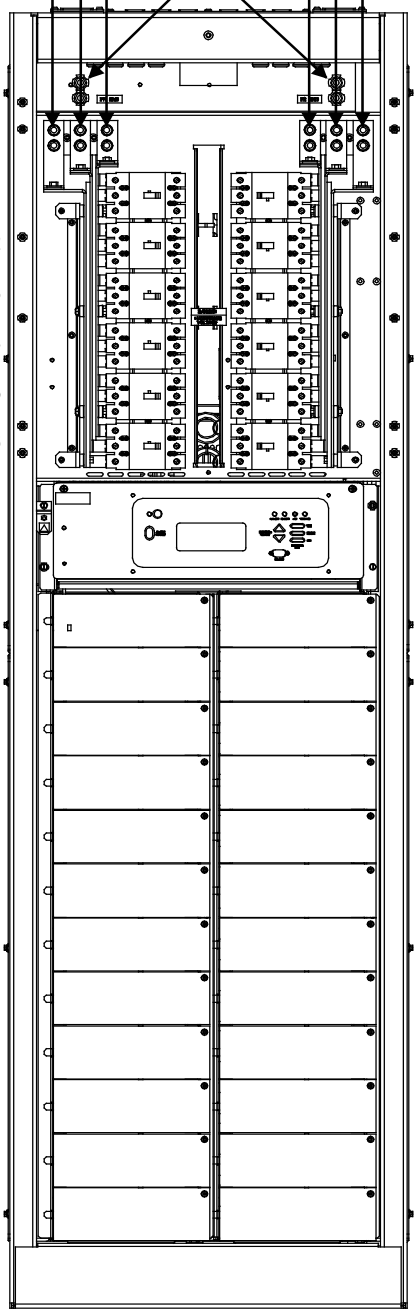
Equipment Grounding (1/4-20 Studs on 1" Centers)

AC Input (3/8-16 Studs on 1" Centers)

Front cover panel removed in illustration

CB1 CB2 CB3 CB4 CB5 CB6

CB7 CB8 CB9 CB10 CB11 CB12



Rectifier #1 Mounting Slot
Rectifier #2 Mounting Slot
Rectifier #3 Mounting Slot
Rectifier #4 Mounting Slot
Rectifier #5 Mounting Slot
Rectifier #6 Mounting Slot
Rectifier #7 Mounting Slot
Rectifier #8 Mounting Slot
Rectifier #9 Mounting Slot
Rectifier #10 Mounting Slot
Rectifier #11 Mounting Slot
Rectifier #12 Mounting Slot
Rectifier #13 Mounting Slot
Rectifier #14 Mounting Slot
Rectifier #15 Mounting Slot
Rectifier #16 Mounting Slot
Rectifier #17 Mounting Slot
Rectifier #18 Mounting Slot
Rectifier #19 Mounting Slot
Rectifier #20 Mounting Slot
Rectifier #21 Mounting Slot
Rectifier #22 Mounting Slot
Rectifier #23 Mounting Slot
Rectifier #24 Mounting Slot

Front View
Power Bay

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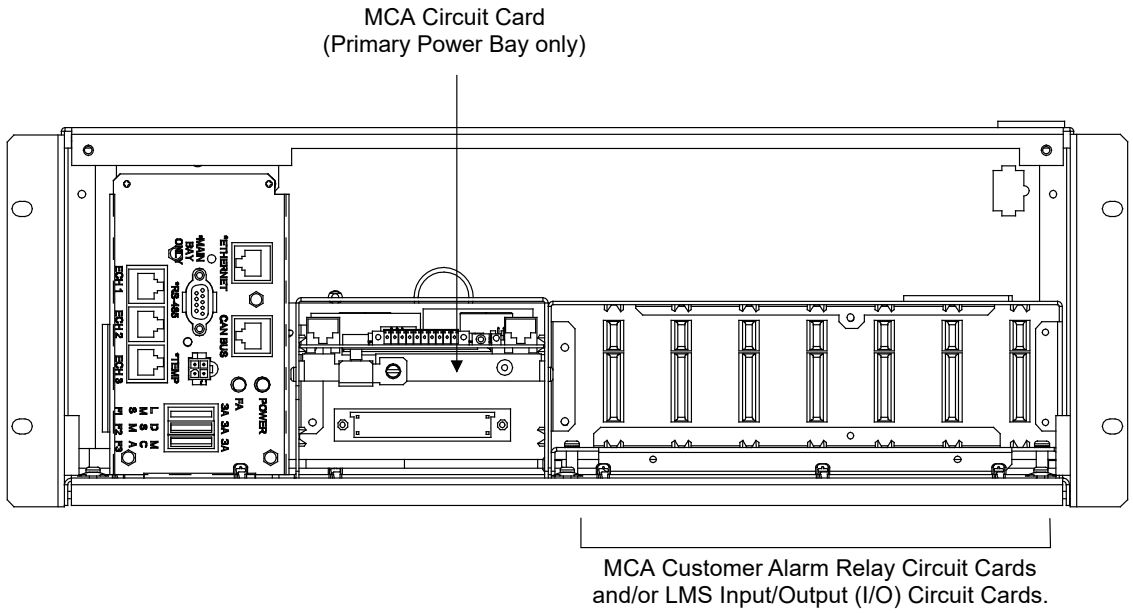
External Alarm, Reference, and Control Wire Sizes - Power Bays

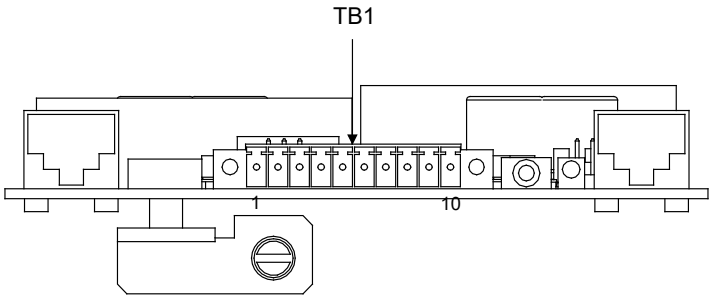
Features

- External Alarm, Reference, and Control connections are made to TB1 on the MCA circuit card and TB1 on the MCA Customer Alarm Relay Circuit Cards.

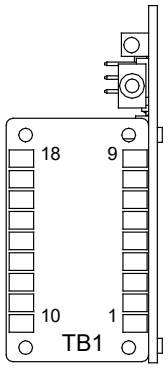
Terminals		Recm Wire Size
Capacity	Type	
28 to 16 AWG	Screw Clamp	22 AWG for Loop Lengths Up to 200 ft. 18-20 AWG for Loop Lengths Over 200 ft.

Table 17
Recommended Alarm, Reference, and Control Wire Size
(TB1 on MCA Circuit Card)
(TB1 on MCA Customer Alarm Relay Circuit Card)





MCA Circuit Card P/N 509478
(Primary Bay)



MCA Customer Alarm
Relay Circuit Card P/N 514348
(Primary and/or Secondary Bays)

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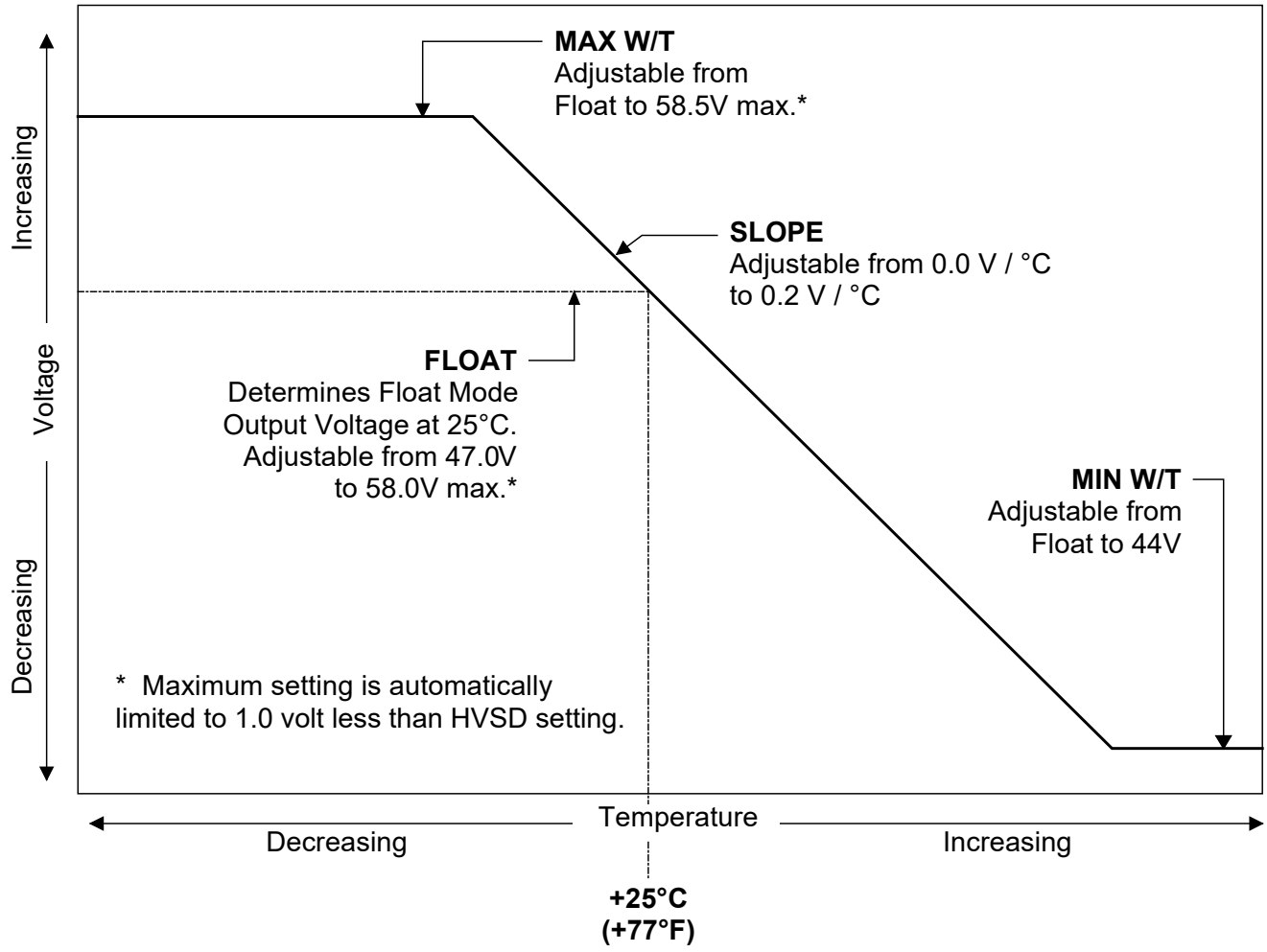
Optional Battery Charge Temperature Compensation Probe for Digital Compensation

Features

- This system can be used with a Battery Charge Temperature Compensation Probe. This probe must be mounted near the battery to sense battery ambient temperature. The probe connects to and allows the MCA to automatically increase or decrease the output voltage of the system to maintain battery float current as battery ambient temperature decreases or increases, respectively. Battery life can be extended when an optimum charge voltage to the battery with respect to temperature is maintained.
- Refer to the "Specifications" section of this document for further information.
- **Temperature Curve:** The following figure details a user defined, via the MCA, Temperature Compensation Probe Curve.

Ordering Notes

1) Order one Battery Charge Temperature Compensation Probe per power system. Part No. 107021 has a 25-foot long cord. Part No. 106824 has a 100 foot-long cord.



Typical Float Charge Thermal Characteristics
Using Optional Battery Charge Digital Temperature Compensation Probe

Replacement/Additional MCA Network Cable

Features

- MCA bay-to-bay interconnect cable. Connects between bay expansion ports located on the bay's MCA (Primary Power Bay) and Router (Secondary Power Bays and Distribution Bays) circuit cards.
- Cable identification color is **yellow**.

Restrictions

Maximum combined cable length must not exceed 125 feet.

Ordering Notes

1) For a replacement or additional cable, order the proper length cable from those listed below.

   P/N 514642 (3 feet) (factory provided with List 9 and 10)
   P/N 514643 (4 feet)
   P/N 514644 (6 feet) (factory provided with List 16)
   P/N 524726 (15 feet)
   P/N 514645 (25 feet)
   P/N 514646 (50 feet)
   P/N 514647 (100 feet)

Replacement/Additional LMS Network Cable

Features

- LMS bay-to-bay interconnect cable. Connects between the bay's LMS Echelon expansion ports. Also connects the LMS System to LMS Expansion Cabinets and Assemblies, if furnished.
- Cable identification color is **blue**.

Restrictions

Refer to SAG586505000 (LMS System Application Guide) for maximum LMS network cabling length.

Ordering Notes

1) For a replacement or additional cable, order the proper length cable from those listed below.

   P/N 524409 (5 inches)
   P/N 509070 (6 inches)
   P/N 528520 (10 inches)
   P/N 509071 (15 inches)
   P/N 524410 (2 feet)
   P/N 514639 (3 feet) (factory provided with List 63)
   P/N 509900 (4 feet)
   P/N 514640 (25 feet)
   P/N 514641(150 feet)

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Replacement Modules and Circuit Cards

Ordering Notes

1) Refer to the following table.

Item	Part Number
Rectifier Module, 208VAC Input	Order via List 21
Rectifier Module, 380/480VAC Input	Order via List 22
Rectifier Module Fan	32010109
MCA Circuit Card (Primary Power Bay)	509478
Router Circuit Card (Secondary Power Bay and Distribution Bays)	509509
Distribution Monitoring Circuit Card (Distribution Bays)	524982
LMS Primary CPU Circuit Card (Primary Power Bay)	Order via List 50
LMS Expansion CPU Circuit Card (Secondary Power Bay)	Order via List 63
MCA Customer Alarm Relay Circuit Card	Order via List 70
MCA I/O Circuit Card	Order via List 71

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SPECIFICATIONS

1. SYSTEM
   - 1.1 DC Operating Voltage
     - 1.1.1 Nominal: -48Vdc.
     - 1.1.2 Range: -42Vdc to -60Vdc.
   - 1.2 Environmental Ratings

     Note: *See also 'Environmental Ratings' in the Rectifier Module section.*

     1.2.1 Operating Ambient Temperature Range: 0°C to +40°C (+32°F to +104°F).

     1.2.2 Storage Ambient Temperature Range: -40°C to +65°C (-40°F to +149°F).

     1.2.3 Humidity: This system is capable of operating in an ambient relative humidity range of 0% to 95%, noncondensing.

     1.2.4 Altitude: The maximum operating ambient temperature should be derated by 10°C at an elevation of 10,000 feet above sea level. For elevations between 3,000 feet and 10,000 feet, derate the maximum operating ambient temperature linearly.

     1.2.5 Heat Dissipation: With Rectifier Module output adjusted to 54.48 volt DC at rated full load and nominal input voltage.

No. of Rectifier Modules	Power Bay Output Current (Amperes)	BTU/Hr (Typical)	
		1R485800 Rectifier	1R485800L Rectifier
1	100	1472	1739
24	2400	35328	41726

     1.2.6 Ventilation Requirements: The Rectifier Modules are fan cooled and utilize front to back forced ventilation. The Power Bays must be mounted so ventilating openings are not blocked and temperature of the air entering the Rectifier Module shelf does not exceed the Operating Ambient Temperature Range stated above.

     1.2.7 Audible Noise: The audible noise does not exceed the following when measured at any point two feet from any vertical surface of a Power Bay and five feet from the floor using a Sound Level Meter conforming to ANSI S1.4.

No. of Rectifier Modules	Audible Noise
1	50 dBA
24	60 dBA

     1.2.8 EMI/RFI Suppression: Rectifier Modules operating in a Power Bay conform to the requirements of FCC rules Part 15, Subpart B, Class A for Radiated and Conducted emissions limits.

     1.2.9 Surge Protection: Compliance with EN61000-4-5 Installation Class 4, and capable of withstanding surges per ANSI/IEEE C 62.41-1991 Category B across the input terminals.

     Note: *This level of protection is a widely used standard for telecommunications power equipment. As with all such equipment, it is the end user's responsibility to provide an adequately sized Surge Suppression Device at the commercial power service entrance of the building that reduces all incoming surges to levels below the classes/categories stated for the equipment.*

     1.2.10 ESD Protection: Complies with EN61000-4-2 Level 4 (8kV contact).

     1.2.11 Electrical Fast Transient / Burst Immunity: Complies with EN61000-4-4 Level 4.

     1.2.12 Mounting: This Power System is intended only for installation in a Restricted Access Location on or above a non-combustible surface. Typical industry standards recommend minimum aisle space clearance of 2'6" for the front of the relay rack and 2' for the rear of the relay rack.

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1.3 Compliance Information

1.3.1 Safety Compliance

(A) Model 801NLEB and 801NLDB (Power Bay): This unit meets the requirements of UL 60950, Standard for Information Technology Equipment, and is UL Listed as a power supply for use in Telephone, Electronic Data Processing or Information Processing Equipment.

(B) Model 801NL-B (Distribution Bay): This power board is UL Listed as a DC Power Distribution Center for Communications Equipment.

1.3.2 NEBS Compliance

(A) Model 801NLEB (Power Bay) and Model 801NL-B (Distribution Bay): Compliance verified by a Nationally Recognized Testing Laboratory (NRTL) per GR-1089-CORE and GR-63-CORE. Contact Vertiv for NEBS compliance reports.

(B) Model 801NLDB (Power Bay) (Lists 0B, 05, 13, 21, 50, 63, 64, 65, 66, 67, 70, 71): Compliance verified by a Nationally Recognized Testing Laboratory (NRTL) per GR-1089-CORE and GR-63-CORE. Contact Vertiv for NEBS compliance reports.

In order to remain compliant during a fan failure condition, the backup battery connection must be utilized to provide sufficient power to the loads for up to eight (8) hours when the system is operated at greater than 50% output power. If no backup battery connection is used, the system must operate with a redundant module installed.

1.4 Local Controls and Indicators

1.4.1 "Bay Alarm" Indicator: Located at the top center of each bay.

Green = OK
Red = Bay Failure
Yellow (flashing) = Identified by the MCA

1.4.2 MCA Component Identification Indicator: Each MCA component (i.e. Rectifier Module, Bus Monitoring Circuit Card, Bay Router Circuit Card, MCA Relay Circuit Card) contains an ID LED Indicator. The ID indicator illuminates Green when the component is OK, Red when the component has failed, and flashing yellow when the component is identified by the MCA.

1.4.3 "Distribution Bus" Indicators: Each distribution bus contains and indicator located on a hinged door panel covering the bus's MCA Monitoring circuit card.

Green = OK
Red = Card Failure
Yellow (flashing) = Identified by the MCA

1.4.4 See also 'Local Controls and Indicators' in the Rectifier Module, MCA, and LMS sections.

2. DISTRIBUTION BAY

2.1 DC Ratings

2.1.1 Bay: 6000 amperes, maximum, per bay.
16,800 amperes, maximum, per system.

2.1.2 Bus: 1500 amperes, maximum.
Each bay has four (4) Distribution Buses.
Optional Distribution Panel: 500 amperes, maximum.
One optional Distribution Panel per Distribution Bay.

2.1.3 Fuse/Circuit Breaker Mounting Positions: Each Distribution Bus contains 12 fuse/circuit breaker mounting positions which provides 48 fuse/circuit breaker mounting positions per bay. Note that some fuse/circuit breaker combinations require more than one fuse/circuit breaker mounting position. Refer to *Distribution Devices* under *ACCESSORY DESCRIPTIONS* for details.

The optional Distribution Panel provides twenty-four (24) Bullet Nose Device positions. The panel accepts a choice of TLS/TPS-type fuseholders or Bullet Nose-type circuit breakers. When installed, bay can be loaded with up to (46) 218 Circuit Breakers or TPL Fuses, and (24) Bullet Nose Circuit Breakers or TLS/TPS Fuses.

Note: *The List C Circuit Breaker/Fuse Panel requires distribution position #12 in the Bus #1 Distribution Panel. Also, distribution position #36 in the Bus #3 Distribution Panel must remain empty.*

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3. RECTIFIER MODULE (MODEL R48-5800, SPEC. NO. 1R485800)

3.1 DC Output Ratings

3.1.1 Voltage: Nominal -48 volts DC, Positive Ground.

(A) Without Battery Charge Temperature Compensation: Float voltage is adjustable from 47.00 to 58.00 volts DC. Test/equalize voltage is adjustable from 45.00 to 58.00 volts DC. Adjustment is made via the MCA. Both float and test/equalize voltages are factory set at 52.00 volts, unless otherwise specified. The output voltage temperature coefficient (1/°C) does not exceed 0.01% per degree centigrade from 0°C to +40°C.

(B) With Battery Charge Digital Temperature Compensation Probe: With an optional battery charge digital temperature compensation probe installed, the MCA automatically increases or decreases the output voltage as battery ambient temperature decreases or increases, respectively. Float voltage is factory set at approximately 54.48 volts at 25°C battery ambient. The float and test/equalize voltage range is the same as without battery charge temperature compensation. Using battery and equipment manufacturers' recommendations, the user selects the following temperature compensation curve parameters via the MCA. Refer to "Typical Float Charge Thermal Characteristics Using Optional Battery Charge Digital Temperature Compensation Probe" in *Battery Charge Temperature Compensation Probe for Digital Compensation* under *ACCESSORY DESCRIPTIONS*.

(1) The temperature compensation slope in volts/°C. Adjustable from zero to 200 millivolts/°C. Adjustment is made via the MCA. Factory set at 0V/°C (DIGITAL TC OFF).

(2) The maximum voltage limit in volts DC. Adjustable from float up to 58.5 volts DC, but automatically limited to one volt below the High Voltage Shutdown setting. Adjustment is made via the MCA. Factory set at 56.5 volts DC.

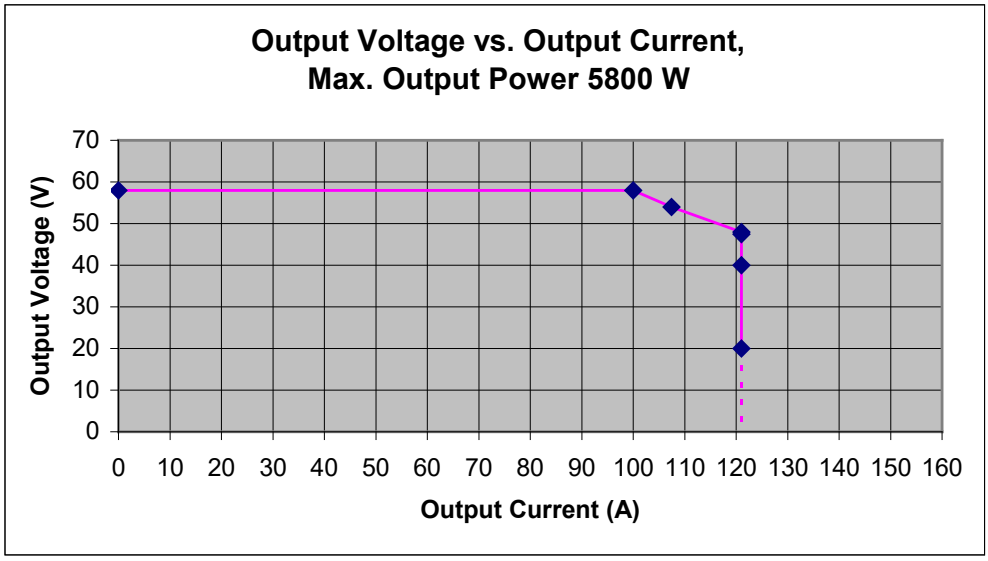
(3) The minimum voltage limit in volts DC. Adjustable from float down to 44 volts DC. Adjustment is made via the MCA. Factory set at 50.0 volts DC.

3.1.2 Current: One hundred amperes (100A) per Rectifier Module.

3.1.3 Output Power: 5800W @ Vout > 48VDC.

3.1.4 Output Characteristics: The relationship between output voltage and current is summarized in the following table and depicted graphically in the following illustration.

Output Power	Output Current	Output Voltage
5800 W	100.0 A	58 VDC
5800 W	121.0 A	48 VDC



3.1.5 Power Derating Based on Input Voltage: The Rectifier Module power varies with changes in input voltage and output voltage. It uses an advanced power limitation method. The Rectifier Module can provide its maximum rated power (5800W) as long as the input voltage is within the range of 304 to 530 VAC (hysteresis is less

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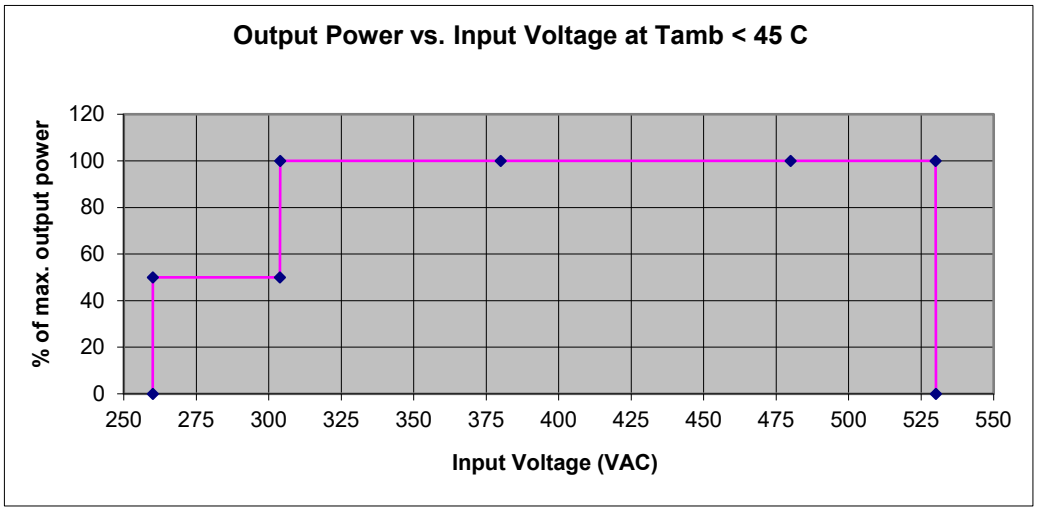
than 3V). Below 304 VAC (and down to 260 VAC), the Rectifier Module will continue to operate normally but will be in a power derating mode. The relationship between the output power and input voltage is illustrated in the following illustration.

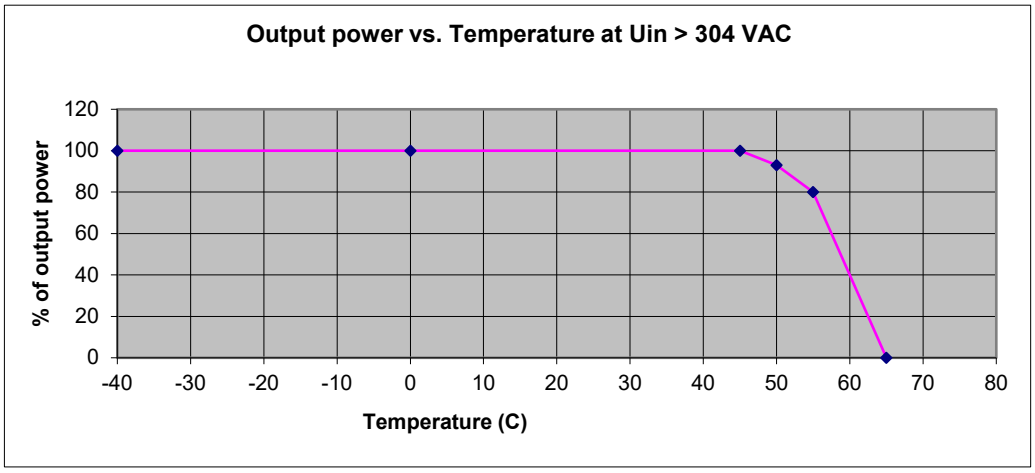
Note: *As depicted in the following illustration, the output power will derate from 100% of the rated capacity as the input voltage drops below 304 VAC, and to 50% of the rated capacity as the input voltage falls to 260 VAC.*



3.1.6 Power Derating Based on Temperature: The Rectifier Module delivers full power when operating at an ambient temperature of +45°C (+113°F) or below. Refer to the following illustration to view the relationship between the output power and the ambient temperature.

Other power rating values are as follows:

- At an ambient temperature of +50°C (+122°F), the power delivered by the Rectifier Module is greater than 5400W.
- At an ambient temperature of +55°C (+131°F), the power delivered by the Rectifier Module is greater than 4640W.



3.1.7 Regulation (Rectifier Module)

(A) Voltage Regulation: ≤±1%

(B) Load Regulation: ≤±0.5%

(C) Line Regulation: ≤±0.1%

(D) Overshoot at Startup: ≤±1%

(E) Dynamic Response (at rated input and output voltage values):

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- Response time is ≤200 μs, and the overshoot is ≤5% for load changes at 50%-25%-50% and 50%-75%-50%.
- Overshoot or undershoot is ≤5% and within ±1% of the regulation band, ≤4 ms at 50 μs for load changes at 10%-90% and 90%-10%.

3.1.8 Regulation (via MCA)

(A) Static: The MCA controls the steady state output voltage to within ±0.5% of any voltage setting within the range of 44.0 to 58.0 volts DC for any and all combinations of load from no load to full load, input voltage, and input frequency at a constant ambient temperature. If the MCA's regulation feature is disabled for any reason, steady state regulation is ±1.0% as controlled within the Rectifier Modules.

(B) Dynamic Response: For any step load change from 10% to 90% or from 90% to 10% of full rated load within 250 microseconds, shall not cause the voltage measured at the output to overshoot or undershoot more than 5% of the regulated output level within 1 millisecond. The output voltage must return and stay within the ±1% regulation band within 4 milliseconds and within the ±0.5% regulation band within 3 seconds.

Any step change of the line voltage within the limits specified in Paragraph 3.2.1 shall not cause the output voltage to deviate outside the ±0.5% regulation band.

3.1.9 Filtering (with or without battery): Typical readings were taken at nominal input voltage, nominal output voltage, 50% load, and 25 degrees C ambient.

(A) Voice Band Noise: Complies with Telcordia GR-947_CORE.

(1) Typically 20.4 dBrn C-message weighting. Does not exceed 32 dBrn C.

(2) Typically 0.28 millivolts psophometric. Does not exceed 1 millivolt psophometric.

(B) Wide Band Noise: Complies with Telcordia GR-947_CORE.

(1) Typically 55 millivolts peak-to-peak. Does not exceed 200 millivolts peak-to-peak

(2) Typically 15.9 millivolts rms. Does not exceed 100 millivolts rms.

3.1.10 Hold Up Time: 10 ms (The DC voltage is allowed to decrease to 42V from 54V during the test.)

3.2 AC Input Ratings

3.2.1 Voltage: Nominal 380/480 volts AC, three phase, 50/60 Hz, with an operating range of 260 to 530 volts. Acceptable input frequency range is 45 to 65 Hz.

Maximum non-destructive input voltage when rectifier is not operating: 600 VAC

3.2.2 Current: <13A @ 5800 W, and at an input voltage of 260 VAC.

3.2.3 THD (Total Harmonic Distortion): ≤5% when loaded at 50 to 100% of the rated output power.

3.2.4 Inrush Current: <150% of the rated input steady-state peak value.

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3.2.5 Typical Input Data: 60 Hz input.

(A) System output is initially adjusted to 54.48 volts DC as measured at the system sense points at 50% of full load and nominal input.

Number of Rectifier Modules Installed	Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Power Factor %	Efficiency %	Power Loss Watts
1	408	0	0.50	356	101	28.4	--	101.2
		25	2.23	1576	1494	94.8	89.6	155.5
		50	4.15	2930	2883	98.3	92.8	208.0
		75	6.14	4337	4317	99.5	92.9	307.4
		100	8.18	5783	5771	99.8	92.7	423.5
		110	9.01	6368	6359	99.8	92.4	483.0
	480	0	0.56	481	98	20.3	--	97.8
		25	1.95	1619	1487	91.8	90.0	148.0
		50	3.54	2944	2876	97.8	93.0	201.0
		75	5.22	4338	4313	99.4	93.0	299.8
		100	6.95	5776	5757	99.6	92.9	409.7
		110	7.64	6354	6341	99.8	92.7	465.5

(B) Typical Power Factor: Greater than or equal to 98% for any load greater than or equal to 50% of rated full load at nominal line. Meets IEC 1000-3-2.

(C) Typical Operating Efficiency: 93% at best point, 91% at full load and nominal input voltage.

(D) Maximum Input Current: 9.1A at 100% of full load with output adjusted to 58 volts DC as measured at the shelf output terminals, and input voltage as shown.

3.3 Environmental Ratings

3.3.1 Operating Ambient Temperature Range: -40°C to +65°C (-40°F to +149°F)

(A) Full rated output power of 5800 W for temperatures -40°C to +45°C (-40°F to +113°F).

(B) Power limitation for temperatures higher than +45°C (+113°F).

3.3.2 Storage Ambient Temperature Range: -40°C to +80°C (-40°F to +176°F).

3.3.3 Humidity: This system is capable of operating in an ambient relative humidity range of 0% to 95%, noncondensing.

3.3.4 Altitude: 2000 m (6560 ft) at full power (power limited for heights above 2000 m).

3.3.5 Acoustic Noise: ≤50dB(A), measured at a distance of 0.6 m from the rectifier.

3.3.6 Insulation Resistance and Dielectric Strength

(A) Insulation Resistance

- Between the AC input and the enclosure: $\geq 20 \times 10^6\ \Omega$
- Between the AC input and the DC output: $\geq 20 \times 10^6\ \Omega$
- Between the DC output and the enclosure: $\geq 20 \times 10^6\ \Omega$

(B) Dielectric Strength

- Between the AC input and the enclosure: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 2120 V.
- Between the AC input and the DC output: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 4242 V.
- Between the DC output and the enclosure: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 707 V.

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- Between the DC output and the ground: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 1500 V (with the varistor and filter capacitors removed before doing the test).

3.3.7 Surge Protection: Complies with IEEE C62 41-1991 Class B3, 6kV/3kA (1.2/50 μs surge voltage and 8/20 μs surge current).

3.3.8 Compliance Information

(A) Safety and EMC: The rectifier has been recognized to meet the UL/EN/IEC 60950-2000 safety standard and is CE marked. The rectifier also meets the latest EMC requirements, as listed in the following table.

Item	Standard	Class
Surge Immunity	EN61000-4-5	AC Port: 4kV/2Ω 6kV/12Ω for com. DC Port: 800V/2Ω CAN Bus: 1kV diff. / 2kV com.
	GR-1089-CORE	R4-8, R4-9, R4-24, R-25
EFT	EN 61000-4-4	AC and DC Port: 4kV CAN Bus: 1kV
	GR-1089-CORE	O2-8
ESD	EN 61000-4-2 and	8kV/15kV
	GR-1089-CORE	R2-1, R2-2, R2-3, O2-4
Conducted immunity	EN 61000-4-6	3Vrms 0.15-80MHz
	GR-1089-CORE	R3-15, CO3-16, R3-17
Radiated immunity	EN 61000-4-6	10V 80-2GHz
	GR-1089-CORE	R3-11, CR3-12
Mains frequency Magnetic fields immunity	EN 61000-4-8	30A/m
Conducted emissions	EN 55022	Class B
	CFR 47 Part 15	
	GR-1089-CORE	R3-5 (Class B)
Conducted current emissions	GR-1089-CORE	R3-6
Radiated emissions	EN 55022	Class B
	CFR 47 Part 15	
	GR-1089-CORE	R3-1, R3-4 (Class B)

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3.4 Standard Features

3.4.1 Type of Power Conversion Circuit: High frequency.

3.4.2 Float Charging Output Mode: In this mode of operation, system output voltage is constant and output current does not exceed the current limit setting. During normal operation, the battery is not required to furnish load current and remains in a fully charged condition.

The float voltage setting can be checked and/or adjusted without removing a Rectifier Module or affecting the load. One adjustment changes the output of all Rectifier Modules.

Note: *If the current demanded by the load exceeds the current limit setting of the system, the battery is required to furnish the difference in load current and begins discharging.*

Note: *If the system is used with a digital battery charge temperature compensation probe, the MCA automatically adjusts system output. This ensures proper voltage to the battery as battery ambient temperature fluctuates.*

3.4.3 Test/Equalize Charging Output Mode: This mode of operation is used if higher output voltage is required for equalizing the charge on all battery cells of a conventional flooded cell battery, or for recharging the battery following a commercial power failure.

If the installation site does not require system equalize mode of operation, the equalize feature can be used as a test feature. System equalize voltage can be adjusted to a test voltage value. Placing the system into the test/equalize mode causes system output voltage to increase or decrease to this test voltage value.

The test/equalize voltage setting can be checked and/or adjusted without removing a Rectifier Module or affecting the load. One adjustment changes the output of all Rectifier Modules.

Note: *If the system is used with a battery charge temperature compensation probe, typical equalize mode of operation is not used.*

3.4.4 Output Mode of Operation Selection: There are four methods of placing the system from the float mode to the test/equalize mode.

(A) Method 1 (Manual Test/Equalize): A user manually places the system into the test/equalize mode via the MCA interface. A user must manually return the system to the float mode via the MCA interface.

(B) Method 2 (Manually Initiated Timed Test/Equalize): A user manually places the system into the test/equalize mode via the MCA interface. The system automatically returns to the float mode after a preset programmable time period (1-99 hours, in increments of one hour).

(C) Method 3 (Automatic Test/Equalize):

THE AUTOMATIC EQUALIZE FEATURE IS INTENDED FOR USE ONLY WITH WET CELL BATTERIES. USING THIS FEATURE WITH VALVE REGULATED BATTERIES IS NOT RECOMMENDED.

This feature can be enabled or disabled by a user via the MCA. The default state is disabled.

The Automatic Equalize feature is a time based function that is controlled by a customer selectable multiplier and by the Battery on Discharge (BOD) alarm setpoint. The MCA's default setting is for a multiplier of zero, which disables the Automatic Equalize feature.

When the Automatic Equalize feature is enabled, if system voltage drops to less than the BOD alarm setpoint, the MCA initiates a timing cycle to measure the discharge time period. The MCA requires at least 15 minutes of continuous BOD alarm in order to prevent nuisance equalization cycles. When system voltage rises to above the BOD alarm setpoint, the MCA ends the discharge timing cycle and (assuming a minimum of 15 minutes has elapsed) places the Rectifier Modules into the equalize mode for a customer selectable multiple of the discharge time period (the discharge time period includes the initial 15 minutes).

The equalize time period can be set for 0 to 15 times the discharge time period, up to a maximum of 300 hours. A zero (0) setting disables the feature.

(D) Method 4 (External Test/Equalize): A user (or external equipment) places the system into the test/equalize mode by applying an external signal to the system. The system returns to the float mode when the external signal is removed. This method overrides the other three methods.

3.4.5 Input Protection: Lists 1 and 9 provide connections for twenty-four (24) AC input branch circuits (one per Rectifier Module mounting position). Lists 2 and 10 provide connections for two (2) AC input branch circuits (two per Power Bay). Customer to provide AC input branch circuit protection.

(A) Input Over/Under Voltage Protection: The Rectifier Module shuts down and its protection indicator (yellow) illuminates when the input voltage is lower than 260VAC or higher than 530VAC. This condition is reported to the power system controller and the power system controller processes the alarms accordingly.

(B) Input Fusing: Input fusing is provided in each Rectifier Module. This fusing is not customer replaceable.

3.4.6 Output Protection

(A) Current Limiting: The maximum current delivered by the system can be programmed from 10% to 110% of total system capacity. The MCA automatically adjusts the current limit circuit on each Rectifier Module so that this value is not exceeded. If a Rectifier Module fails, the MCA automatically resets each remaining Rectifier Module's current limit point to maintain this value. The MCA also insures that the current limit circuit on any Rectifier Module is not set above 110% of its capacity. The default current limit setting is the sum of each installed Rectifier Module's output rating. If an additional Rectifier Module is added to the system, the system current limit is automatically increased by the rating of the new Rectifier Module and the new current limit value is displayed.

The current limiting point can be adjusted without removing a Rectifier Module. One adjustment changes the setting of all Rectifier Modules.

The current limit is factory set at 100% of rated full load, unless otherwise specified.

(B) Output Fusing: Output fusing is provided in each Rectifier Module. If a fuse opens, local and remote Rectifier Module Fail Alarms activate. This fusing is not customer replaceable.

(C) High Voltage Shutdown

(1) Internal: If Rectifier Module output voltage exceeds an adjustable preset value, the Rectifier Module shuts down.

After approximately 5 seconds, the Rectifier Module automatically restarts. If Rectifier Module output voltage again exceeds the high voltage shutdown value within 5 minutes, the Rectifier Module shuts down and locks out. Manual restart is then required. If the Rectifier Module does not experience a high voltage condition within the 5 minute time period, the restart circuit is reset.

If two or more Rectifier Modules are installed in the Power Bay, or if the Power Bay is paralleled with other Power Bays, only the Rectifier Module causing the high voltage condition shuts down.

The high voltage shutdown point can be checked and/or adjusted without removing a Rectifier Module. One adjustment changes the setting of all Rectifier Modules.

Adjustable from 56.0 to 59.0 volts DC. Factory set at 57.50 volts, unless otherwise specified.

(2) Remote: See Paragraph 4.1.14 (B).

(3) Backup: If Rectifier Module output voltage exceeds a second (non-adjustable) value, the Rectifier Module shuts down and locks out regardless of load. Manual restart is then required. The fixed hardware HVSD is 59.5V (within the range of 58.5 to 60V).

3.4.7 High Temperature Protection:

(A) When the PFC board temperature is higher than 85°C, the rectifier turns off. When the PFC board temperature is lower than 75°C, the rectifier resumes to normal operation, and the hysteresis is at least 10°C.

(B) When the “ambient temperature – PFC board temperature” is higher than 5°C, the rectifier turns off. When the “ambient temperature – PFC board temperature” is lower than 2°C, the rectifier resumes to normal operation, and the hysteresis is at least 3°C.

(C) When the DC board temperature is higher than 105°C, the rectifier turns off. When the DC board temperature is lower than 95°C, the rectifier resumes to normal operation, and the hysteresis is at least 10°C.

3.4.8 Fan Fault Protection: An alarm will be generated upon a fan fault. In such cases, the fault indicator (red) on the Rectifier Module front panel will flash and the Rectifier Module will also inhibit its output. Auto-recovery is enabled upon the clearing of the corresponding fault.

3.4.9 PFC Over/Under Voltage: The rectifier will shut down when its bus voltage is higher than the over voltage set point or is lower than the under voltage set point. During such conditions, the rectifier does not output any power and its protection indicator (yellow) will light up.

3.4.10 Load Sharing (via MCA): The MCA load sharing feature automatically balances the load. If the MCA's load sharing feature is disabled for any reason, pre-programmed slope control in each Rectifier Module balances the load. The MCA's load sharing feature is disabled whenever the system is in current limit, the system is delivering more than 97% capacity, or the system is delivering less than 3% capacity.

Active Load Sharing (Rectifier Module): The Rectifier Module uses advanced digital active load sharing technology that maintains balancing to within ±3A. The difference in the average current between rectifiers is <±3A for loads in the 10 to 100% range.

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3.4.11 Startup Time: The Rectifier Module has two startup modes:

(A) Normal Soft Start Time: The duration from the time when the rectifier is powered on to the time when the rectifier provides output voltage is <8s.

(B) Current Walk-In: The rise time of the rectifier output voltage is >8s at 90% of the rated load, and the maximum time is 90s at 100% of the rated load.

3.4.12 Hot Swappable: The Rectifier Module is designed to be plug-and-play. The Rectifier Module can be inserted or removed from a live DC power system with no damage. When the Rectifier Module is plugged into the system, the system output voltage will not be affected.

3.4.13 Cooling: Each Rectifier Module contains a fan for forced convection cooling.

3.4.14 Fan Control: When the PFC bus voltage is within a normal range, the built-in processor adjusts the fan's speed according to the Rectifier Module's internal temperature and output current. For example, a higher temperature or output current will increase the fan speed. Above 45°C at full load, the fan operates at full speed. When the PFC bus voltage is abnormal, such as very low bus voltage, the fan turns off.

3.4.15 Communication Failure: The Rectifier Module's protection indicator (yellow) will flash should it experience a communication failure. The failure information will be reported to the Controller and the Controller will process the failure accordingly. During a communication failure, in order to protect the battery, the Rectifier Module output voltage will automatically adjust to 53.5 V (this is a default value which can be modified using the Controller). The Rectifier Module will revert to normal operation once normal communication is restored.

3.4.16 Unbalance of Rectifier Module Output Current: When the output current of the Rectifier Modules in a DC power system is unbalanced, the Rectifier Module having the unbalanced output current will be identified automatically and its protection indicator (yellow) will turn on.

The failure information will be reported to the Controller and the Controller will process the failure accordingly.

3.4.17 Paralleling: This system may be connected in parallel with any rectifier of the same polarity and adjusted to the same output voltage.

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3.4.18 Monitoring Function: The Rectifier Module has a built-in advanced DSP that monitors and controls the operation of the Rectifier Module. The DSP also communicates with the Controller in real time through the CAN bus. The following table lists the different commands and information exchanged between the Rectifier Module and the Controller.

Commands / signals that can be received by the Rectifier Module from the Controller.	**Information gathered by the Controller from the Rectifier Module.**
• Turn on/off • Current walk-in on/off • HVSD reset • Current limit adjustment • Voltage regulation	• Input voltage • Output voltage • Output current • Current limit setting • Temperature • Over voltage setting • On/off status • Fault alarms, such as: HVSD Fan fail • Protection alarms, such as: Input voltage protection Inner DC bus voltage protection High temperature protection • Thermal derating • AC derating • AC fail • Unbalanced output current • Address • Code • Date • SW version • HW version

3.4.19 Dimensions:

Millimeters: 87.5 (Height) X 243.5 (Width) X 371.5 (Depth).
Inches: 3.44 (Height) X 9.59 (Width) X 14.63 (Depth).

3.4.20 Weight: < 8 kg (17.6 lbs).

3.4.21 Local Status and Alarm Indicators: Refer to the "Operating Procedures" chapter in the Power System User Instructions (Section 6017) for a complete description.

(A) Power (Green)

(B) Protection (Yellow)

(C) Alarm (Red)

(D) A 10-segment Green LED is located on the front panel to represent output current, each segment represents 10A.

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4. RECTIFIER MODULE (MODEL R48-5800L, SPEC. NO. 1R485800L)

4.1 DC Output Ratings

4.1.1 Voltage: Nominal -48 volts DC, Positive Ground.

(A) Without Battery Charge Temperature Compensation: Float voltage is adjustable from 47.00 to 58.00 volts DC. Test/equalize voltage is adjustable from 45.00 to 58.00 volts DC. Adjustment is made via the MCA. Both float and test/equalize voltages are factory set at 52.00 volts, unless otherwise specified. The output voltage temperature coefficient (1/°C) does not exceed 0.01% per degree centigrade from 0°C to +40°C.

(B) With Battery Charge Digital Temperature Compensation Probe: With an optional battery charge digital temperature compensation probe installed, the MCA automatically increases or decreases the output voltage as battery ambient temperature decreases or increases, respectively. Float voltage is factory set at approximately 54.48 volts at 25°C battery ambient. The float and test/equalize voltage range is the same as without battery charge temperature compensation. Using battery and equipment manufacturers' recommendations, the user selects the following temperature compensation curve parameters via the MCA. Refer to "Typical Float Charge Thermal Characteristics Using Optional Battery Charge Digital Temperature Compensation Probe" in *Battery Charge Temperature Compensation Probe for Digital Compensation* under *ACCESSORY DESCRIPTIONS*.

(1) The temperature compensation slope in volts/°C. Adjustable from zero to 200 millivolts/°C. Adjustment is made via the MCA. Factory set at 0V/°C (DIGITAL TC OFF).

(2) The maximum voltage limit in volts DC. Adjustable from float up to 58.5 volts DC, but automatically limited to one volt below the High Voltage Shutdown setting. Adjustment is made via the MCA. Factory set at 56.5 volts DC.

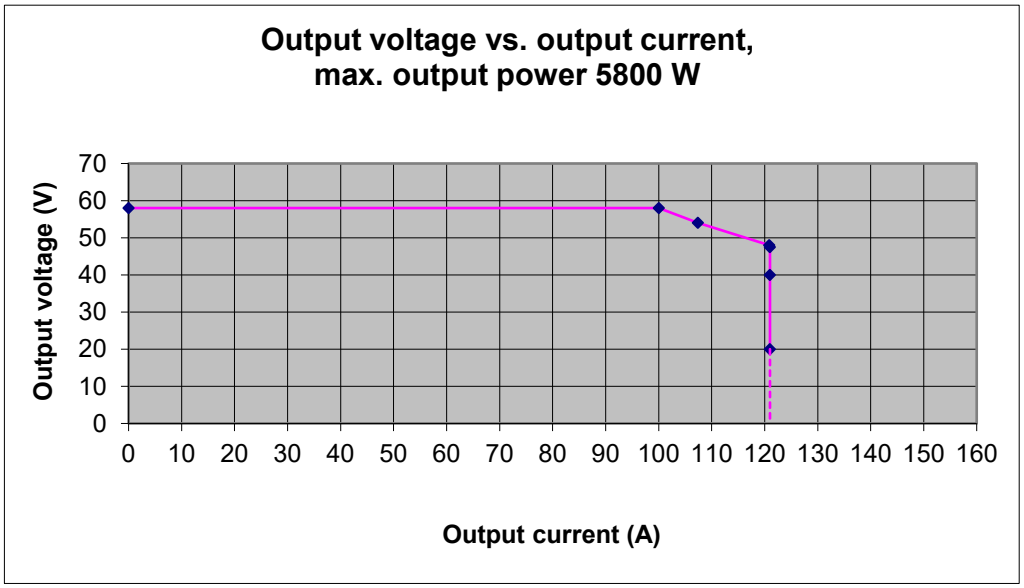
(3) The minimum voltage limit in volts DC. Adjustable from float down to 44 volts DC. Adjustment is made via the MCA. Factory set at 50.0 volts DC.

4.1.2 Current: One hundred amperes (100A) per Rectifier Module.

4.1.3 Output Power: 5800W @ Vout > 48VDC.

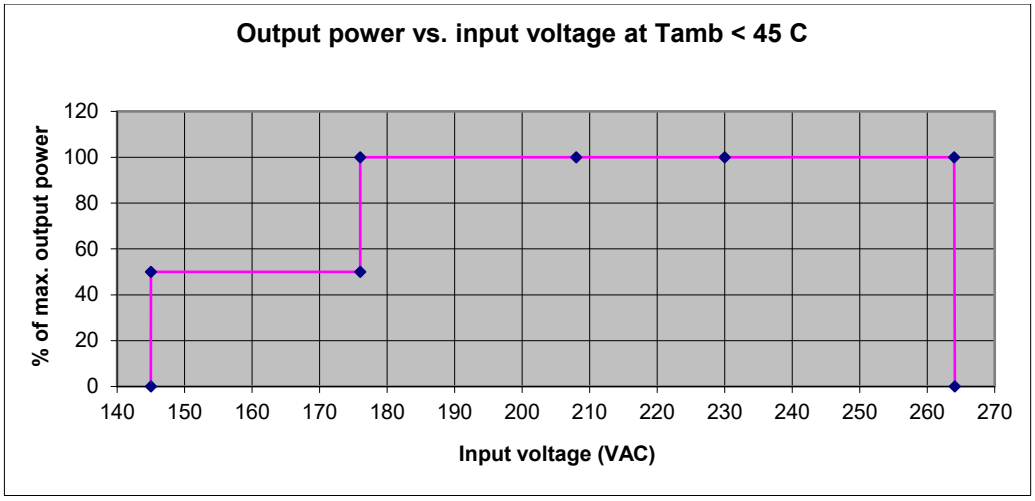
4.1.4 Output Characteristics: The relationship between output voltage and current is summarized in the following table and depicted graphically in the following illustration.

Output Power	Output Current	Output Voltage
5800 W	100.0 A	58 VDC
5800 W	121.0 A	48 VDC



4.1.5 Power Derating Based on Input Voltage: The Rectifier Module power varies with changes in input voltage and output voltage. It uses an advanced power limitation method. The Rectifier Module can provide its maximum rated power (5800W) as long as the input voltage is within the range of 176 to 264 VAC (hysteresis is less than 3V). Below 176 VAC (and down to 145 VAC), the Rectifier Module will continue to operate normally but will be in a power derating mode. The relationship between the output power and input voltage is illustrated in the following illustration.

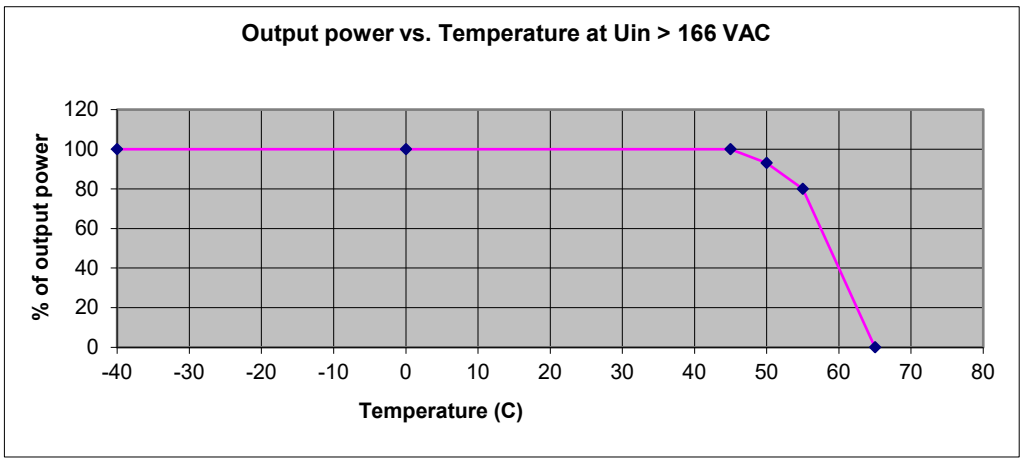
Note: *As depicted in the following illustration, the output power will derate from 100% of the rated capacity as the input voltage drops below 176 VAC, and to 50% of the rated capacity as the input voltage falls to 145 VAC.*



4.1.6 Power Derating Based on Temperature: The Rectifier Module delivers full power when operating at an ambient temperature of +45°C (+113°F) or below. Refer to the following illustration to view the relationship between the output power and the ambient temperature.

Other power rating values are as follows:

- At an ambient temperature of +50°C (+122°F), the power delivered by the Rectifier Module is greater than 5400W.
- At an ambient temperature of +55°C (+131°F), the power delivered by the Rectifier Module is greater than 4640W.



4.1.7 Regulation (Rectifier Module)

(A) Voltage Regulation: ≤±1%

(B) Load Regulation: ≤±0.5%

(C) Line Regulation: ≤±0.1%

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(D) Overshoot at Startup: ≤±1%

(E) Dynamic Response (at rated input and output voltage values):

- Response time is ≤200 μs, and the overshoot is ≤5% for load changes at 50%-25%-50% and 50%-75%-50%.
- Overshoot or undershoot is ≤5% and within ±1% of the regulation band, ≤4 ms at 50 μs for load changes at 10%-90% and 90%-10%.

4.1.8 Regulation (via MCA)

(A) Static: The MCA controls the steady state output voltage to within ±0.5% of any voltage setting within the range of 44.0 to 58.0 volts DC for any and all combinations of load from no load to full load, input voltage, and input frequency at a constant ambient temperature. If the MCA's regulation feature is disabled for any reason, steady state regulation is ±1.0% as controlled within the Rectifier Modules.

(B) Dynamic Response: For any step load change from 10% to 90% or from 90% to 10% of full rated load within 250 microseconds, shall not cause the voltage measured at the output to overshoot or undershoot more than 5% of the regulated output level within 1 millisecond. The output voltage must return and stay within the ±1% regulation band within 4 milliseconds and within the ±0.5% regulation band within 3 seconds.

Any step change of the line voltage within the limits specified in Paragraph 3.2.1 shall not cause the output voltage to deviate outside the ±0.5% regulation band.

4.1.9 Filtering (with or without battery): Typical readings were taken at nominal input voltage, nominal output voltage, 50% load, and 25 degrees C ambient.

(A) Voice Band Noise: Complies with Telcordia GR-947_CORE.

(1) Typically 23 dBrn C-message weighting. Does not exceed 32 dBrn C.

(2) Typically 0.335 millivolts psophometric. Does not exceed 1 millivolt psophometric.

(B) Wide Band Noise: Complies with Telcordia GR-947_CORE.

(1) Typically 45.4 millivolts peak-to-peak. Does not exceed 200 millivolts peak-to-peak

(2) Typically 15.9 millivolts rms. Does not exceed 100 millivolts rms.

4.1.10 Hold Up Time: 10 ms (The DC voltage is allowed to decrease to 42V from 54V during the test.)

4.2 AC Input Ratings

4.2.1 Voltage: Nominal 208 volts AC, three phase, 50/60 Hz, with an operating range of 176 to 264 volts. Acceptable input frequency range is 45 to 65 Hz.

Maximum non-destructive input voltage when rectifier is not operating: 600 VAC

4.2.2 Current: <18A @ 5800 W, and at an input voltage of 176 VAC.

4.2.3 THD (Total Harmonic Distortion): ≤5% when loaded at 50 to 100% of the rated output power.

4.2.4 Inrush Current: <150% of the rated input steady-state peak value.

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4.2.5 Typical Input Data: 60 Hz input.

(A) System output is initially adjusted to 54.48 volts DC as measured at the system sense points at 50% of full load and nominal input.

Number of Rectifier Modules Installed	Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Power Factor %	Efficiency %	Power Loss Watts
1	176	0	0.4135	128.32	111.48	76.9	0.78	110.6
		25	5.139	1579.5	1522.7	96.9	89.12	165.62
		50	9.571	2929	2922	99.7	92.03	232.82
		75	14.476	4408	4405	99.9	91.43	377.6
		100	19.651	5957	5950	99.8	91.04	509.4
		110	21.68	6562	6552	99.8	90.09	578.4
		120	21.89	6620	6608	99.8	89.17	638.1
	208	0	0.3972	142.76	110.25	78.4	0.79	109.4
		25	4.333	1570	1526	97.2	88.93	168.97
		50	8.114	2930	2903	99.2	92.62	214.34
		75	12.142	4371	4365	99.8	91.80	357.7
		100	16.38	5873	5870	99.9	91.32	509.4
		110	18.127	6489	6487	99.9	91.08	578.4
		120	18.283	6545	6542	99.9	90.02	638.1

(B) Typical Power Factor: Greater than or equal to 99.2% for any load greater than or equal to 50% of rated full load at nominal line. Meets IEC 1000-3-2.

(C) Typical Operating Efficiency: 92.62% at best point, 90.25% at full load and nominal input voltage.

(D) Maximum Input Current: 21.92A at 100% of full load with output adjusted to 58 volts DC as measured at the shelf output terminals, and input voltage as shown.

4.3 Environmental Ratings

4.3.1 Operating Ambient Temperature Range: -40°C to +65°C (-40°F to +149°F)

(A) Full rated output power of 5800 W for temperatures -40°C to +45°C (-40°F to +113°F).

(B) Power limitation for temperatures higher than +45°C (+113°F).

4.3.2 Storage Ambient Temperature Range: -40°C to +80°C (-40°F to +176°F).

4.3.3 Humidity: This system is capable of operating in an ambient relative humidity range of 0% to 95%, noncondensing.

4.3.4 Altitude: 2000 m (6560 ft) at full power (power limited for heights above 2000 m).

4.3.5 Acoustic Noise: ≤50dB(A), measured at a distance of 0.6 m from the rectifier.

4.3.6 Insulation Resistance and Dielectric Strength

(A) Insulation Resistance

- Between the AC input and the enclosure: $\geq 20 \times 10^6\ \Omega$
- Between the AC input and the DC output: $\geq 20 \times 10^6\ \Omega$
- Between the DC output and the enclosure: $\geq 20 \times 10^6\ \Omega$

(B) Dielectric Strength

- Between the AC input and the enclosure: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 2120 V.
- Between the AC input and the DC output: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 4242 V.

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- Between the DC output and the enclosure: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 707 V.
- Between the DC output and the ground: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 1500 V (with the varistor and filter capacitors removed before doing the test).

4.3.7 Surge Protection: Complies with IEEE C62 41-1991 Class B3, 6kV/3kA (1.2/50 μs surge voltage and 8/20 μs surge current).

4.3.8 Compliance Information

(A) Safety and EMC: The rectifier has been recognized to meet the UL/EN/IEC 60950-2000 safety standard and is CE marked. The rectifier also meets the latest EMC requirements, as listed in the following table.

Item	Standard	Class
Surge Immunity	EN61000-4-5	AC Port: 4kV/2Ω 6kV/12Ω for com. DC Port: 800V/2Ω CAN Bus: 1kV diff. / 2kV com.
	GR-1089-CORE	R4-8, R4-9, R4-24, R-25
EFT	EN 61000-4-4	AC and DC Port: 4kV CAN Bus: 1kV
	GR-1089-CORE	O2-8
ESD	EN 61000-4-2 and	8kV/15kV
	GR-1089-CORE	R2-1, R2-2, R2-3, O2-4
Conducted immunity	EN 61000-4-6	3Vrms 0.15-80MHz
	GR-1089-CORE	R3-15, CO3-16, R3-17
Radiated immunity	EN 61000-4-6	10V 80-2GHz
	GR-1089-CORE	R3-11, CR3-12
Mains frequency Magnetic fields immunity	EN 61000-4-8	30A/m
Conducted emissions	EN 55022	Class B
	CFR 47 Part 15	
	GR-1089-CORE	R3-5 (Class B)
Conducted current emissions	GR-1089-CORE	R3-6
Radiated emissions	EN 55022	Class B
	CFR 47 Part 15	
	GR-1089-CORE	R3-1, R3-4 (Class B)

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4.4 Standard Features

4.4.1 Type of Power Conversion Circuit: High frequency.

4.4.2 Float Charging Output Mode: In this mode of operation, system output voltage is constant and output current does not exceed the current limit setting. During normal operation, the battery is not required to furnish load current and remains in a fully charged condition.

The float voltage setting can be checked and/or adjusted without removing a Rectifier Module or affecting the load. One adjustment changes the output of all Rectifier Modules.

Note: *If the current demanded by the load exceeds the current limit setting of the system, the battery is required to furnish the difference in load current and begins discharging.*

Note: *If the system is used with a digital battery charge temperature compensation probe, the MCA automatically adjusts system output. This ensures proper voltage to the battery as battery ambient temperature fluctuates.*

4.4.3 Test/Equalize Charging Output Mode: This mode of operation is used if higher output voltage is required for equalizing the charge on all battery cells of a conventional flooded cell battery, or for recharging the battery following a commercial power failure.

If the installation site does not require system equalize mode of operation, the equalize feature can be used as a test feature. System equalize voltage can be adjusted to a test voltage value. Placing the system into the test/equalize mode causes system output voltage to increase or decrease to this test voltage value.

The test/equalize voltage setting can be checked and/or adjusted without removing a Rectifier Module or affecting the load. One adjustment changes the output of all Rectifier Modules.

Note: *If the system is used with a battery charge temperature compensation probe, typical equalize mode of operation is not used.*

4.4.4 Output Mode of Operation Selection: There are four methods of placing the system from the float mode to the test/equalize mode.

(A) Method 1 (Manual Test/Equalize): A user manually places the system into the test/equalize mode via the MCA interface. A user must manually return the system to the float mode via the MCA interface.

(B) Method 2 (Manually Initiated Timed Test/Equalize): A user manually places the system into the test/equalize mode via the MCA interface. The system automatically returns to the float mode after a preset programmable time period (1-99 hours, in increments of one hour).

(C) Method 3 (Automatic Test/Equalize):

THE AUTOMATIC EQUALIZE FEATURE IS INTENDED FOR USE ONLY WITH WET CELL BATTERIES. USING THIS FEATURE WITH VALVE REGULATED BATTERIES IS NOT RECOMMENDED.

This feature can be enabled or disabled by a user via the MCA. The default state is disabled.

The Automatic Equalize feature is a time based function that is controlled by a customer selectable multiplier and by the Battery on Discharge (BOD) alarm setpoint. The MCA's default setting is for a multiplier of zero, which disables the Automatic Equalize feature.

When the Automatic Equalize feature is enabled, if system voltage drops to less than the BOD alarm setpoint, the MCA initiates a timing cycle to measure the discharge time period. The MCA requires at least 15 minutes of continuous BOD alarm in order to prevent nuisance equalization cycles. When system voltage rises to above the BOD alarm setpoint, the MCA ends the discharge timing cycle and (assuming a minimum of 15 minutes has elapsed) places the Rectifier Modules into the equalize mode for a customer selectable multiple of the discharge time period (the discharge time period includes the initial 15 minutes).

The equalize time period can be set for 0 to 15 times the discharge time period, up to a maximum of 300 hours. A zero (0) setting disables the feature.

(D) Method 4 (External Test/Equalize): A user (or external equipment) places the system into the test/equalize mode by applying an external signal to the system. The system returns to the float mode when the external signal is removed. This method overrides the other three methods.

4.4.5 Input Protection: Lists 1 and 9 provide connections for twenty-four (24) AC input branch circuits (one per Rectifier Module mounting position). Lists 2 and 10 provide connections for two (2) AC input branch circuits (two per Power Bay). Customer to provide AC input branch circuit protection.

(A) Input Over/Under Voltage Protection: The Rectifier Module shuts down and its protection indicator (yellow) illuminates when the input voltage is lower than 260VAC or higher than 530VAC. This condition is reported to the power system controller and the power system controller processes the alarms accordingly.

(B) Input Fusing: Input fusing is provided in each Rectifier Module. This fusing is not customer replaceable.

4.4.6 Output Protection

(A) Current Limiting: The maximum current delivered by the system can be programmed from 10% to 110% of total system capacity. The MCA automatically adjusts the current limit circuit on each Rectifier Module so that this value is not exceeded. If a Rectifier Module fails, the MCA automatically resets each remaining Rectifier Module's current limit point to maintain this value. The MCA also insures that the current limit circuit on any Rectifier Module is not set above 110% of its capacity. The default current limit setting is the sum of each installed Rectifier Module's output rating. If an additional Rectifier Module is added to the system, the system current limit is automatically increased by the rating of the new Rectifier Module and the new current limit value is displayed.

The current limiting point can be adjusted without removing a Rectifier Module. One adjustment changes the setting of all Rectifier Modules.

The current limit is factory set at 100% of rated full load, unless otherwise specified.

(B) Output Fusing: Output fusing is provided in each Rectifier Module. If a fuse opens, local and remote Rectifier Module Fail Alarms activate. This fusing is not customer replaceable.

(C) High Voltage Shutdown

(1) Internal: If Rectifier Module output voltage exceeds an adjustable preset value, the Rectifier Module shuts down.

After approximately 5 seconds, the Rectifier Module automatically restarts. If Rectifier Module output voltage again exceeds the high voltage shutdown value within 5 minutes, the Rectifier Module shuts down and locks out. Manual restart is then required. If the Rectifier Module does not experience a high voltage condition within the 5 minute time period, the restart circuit is reset.

If two or more Rectifier Modules are installed in the Power Bay, or if the Power Bay is paralleled with other Power Bays, only the Rectifier Module causing the high voltage condition shuts down.

The high voltage shutdown point can be checked and/or adjusted without removing a Rectifier Module. One adjustment changes the setting of all Rectifier Modules.

Adjustable from 56.0 to 59.0 volts DC. Factory set at 57.50 volts, unless otherwise specified.

(2) Remote: See Paragraph 4.1.14 (B).

(3) Backup: If Rectifier Module output voltage exceeds a second (non-adjustable) value, the Rectifier Module shuts down and locks out regardless of load. Manual restart is then required. The fixed hardware HVSD is 59.5V (within the range of 58.5 to 60V).

4.4.7 High Temperature Protection:

(A) When the PFC board temperature is higher than 85°C, the rectifier turns off. When the PFC board temperature is lower than 75°C, the rectifier resumes to normal operation, and the hysteresis is at least 10°C.

(B) When the “ambient temperature – PFC board temperature” is higher than 5°C, the rectifier turns off. When the “ambient temperature – PFC board temperature” is lower than 2°C, the rectifier resumes to normal operation, and the hysteresis is at least 3°C.

(C) When the DC board temperature is higher than 105°C, the rectifier turns off. When the DC board temperature is lower than 95°C, the rectifier resumes to normal operation, and the hysteresis is at least 10°C.

4.4.8 Fan Fault Protection: An alarm will be generated upon a fan fault. In such cases, the fault indicator (red) on the Rectifier Module front panel will flash and the Rectifier Module will also inhibit its output. Auto-recovery is enabled upon the clearing of the corresponding fault.

4.4.9 PFC Over/Under Voltage: The rectifier will shut down when its bus voltage is higher than the over voltage set point or is lower than the under voltage set point. During such conditions, the rectifier does not output any power and its protection indicator (yellow) will light up.

4.4.10 Load Sharing (via MCA): The MCA load sharing feature automatically balances the load. If the MCA's load sharing feature is disabled for any reason, pre-programmed slope control in each Rectifier Module balances the load. The MCA's load sharing feature is disabled whenever the system is in current limit, the system is delivering more than 97% capacity, or the system is delivering less than 3% capacity.

Active Load Sharing (Rectifier Module): The Rectifier Module uses advanced digital active load sharing technology that maintains balancing to within ±3A. The difference in the average current between rectifiers is <±3A for loads in the 10 to 100% range.

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4.4.11 Startup Time: The Rectifier Module has two startup modes:

(A) Normal Soft Start Time: The duration from the time when the rectifier is powered on to the time when the rectifier provides output voltage is <8s.

(B) Current Walk-In: The rise time of the rectifier output voltage is >8s at 90% of the rated load, and the maximum time is 90s at 100% of the rated load.

4.4.12 Hot Swappable: The Rectifier Module is designed to be plug-and-play. The Rectifier Module can be inserted or removed from a live DC power system with no damage. When the Rectifier Module is plugged into the system, the system output voltage will not be affected.

4.4.13 Cooling: Each Rectifier Module contains a fan for forced convection cooling.

4.4.14 Fan Control: When the PFC bus voltage is within a normal range, the built-in processor adjusts the fan's speed according to the Rectifier Module's internal temperature and output current. For example, a higher temperature or output current will increase the fan speed. Above 45°C at full load, the fan operates at full speed. When the PFC bus voltage is abnormal, such as very low bus voltage, the fan turns off.

4.4.15 Communication Failure: The Rectifier Module's protection indicator (yellow) will flash should it experience a communication failure. The failure information will be reported to the Controller and the Controller will process the failure accordingly. During a communication failure, in order to protect the battery, the Rectifier Module output voltage will automatically adjust to 53.5 V (this is a default value which can be modified using the Controller). The Rectifier Module will revert to normal operation once normal communication is restored.

4.4.16 Unbalance of Rectifier Module Output Current: When the output current of the Rectifier Modules in a DC power system is unbalanced, the Rectifier Module having the unbalanced output current will be identified automatically and its protection indicator (yellow) will turn on.

The failure information will be reported to the Controller and the Controller will process the failure accordingly.

4.4.17 Paralleling: This system may be connected in parallel with any rectifier of the same polarity and adjusted to the same output voltage.

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4.4.18 Monitoring Function: The Rectifier Module has a built-in advanced DSP that monitors and controls the operation of the Rectifier Module. The DSP also communicates with the Controller in real time through the CAN bus. The following table lists the different commands and information exchanged between the Rectifier Module and the Controller.

Commands / signals that can be received by the Rectifier Module from the Controller.	**Information gathered by the Controller from the Rectifier Module.**
• Turn on/off • Current walk-in on/off • HVSD reset • Current limit adjustment • Voltage regulation	• Input voltage • Output voltage • Output current • Current limit setting • Temperature • Over voltage setting • On/off status • Fault alarms, such as: HVSD Fan fail • Protection alarms, such as: Input voltage protection Inner DC bus voltage protection High temperature protection • Thermal derating • AC derating • AC fail • Unbalanced output current • Address • Code • Date • SW version • HW version

4.4.19 Dimensions:

Millimeters: 87.5 (Height) X 243.5 (Width) X 371.5 (Depth).
Inches: 3.44 (Height) X 9.59 (Width) X 14.63 (Depth).

4.4.20 Weight: < 8 kg (17.6 lbs).

4.4.21 Local Status and Alarm Indicators: Refer to the "Operating Procedures" chapter in the Power System User Instructions (Section 6017) for a complete description.

(A) Power (Green)

(B) Protection (Yellow)

(C) Alarm (Red)

(D) A 10-segment Green LED is located on the front panel to represent output current, each segment represents 10A.

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5. RECTIFIER MODULE (MODEL R48-5800E SPEC. NO. 1R485800E)

5.1 DC Output Ratings

5.1.1 Voltage: Nominal -48 volts DC, Positive Ground.

(A) Without Battery Charge Temperature Compensation: Float voltage is adjustable from 47.00 to 58.00 volts DC. Test/equalize voltage is adjustable from 45.00 to 58.00 volts DC. Adjustment is made via the MCA. Both float and test/equalize voltages are factory set at 52.00 volts, unless otherwise specified. The output voltage temperature coefficient (1/°C) does not exceed 0.01% per degree centigrade from 0°C to +40°C.

(B) With Battery Charge Digital Temperature Compensation Probe: With an optional battery charge digital temperature compensation probe installed, the MCA automatically increases or decreases the output voltage as battery ambient temperature decreases or increases, respectively. Float voltage is factory set at approximately 54.48 volts at 25°C battery ambient. The float and test/equalize voltage range is the same as without battery charge temperature compensation. Using battery and equipment manufacturers' recommendations, the user selects the following temperature compensation curve parameters via the MCA. Refer to "Typical Float Charge Thermal Characteristics Using Optional Battery Charge Digital Temperature Compensation Probe" in *Battery Charge Temperature Compensation Probe for Digital Compensation* under *ACCESSORY DESCRIPTIONS*.

(1) The temperature compensation slope in volts/°C. Adjustable from zero to 200 millivolts/°C. Adjustment is made via the MCA. Factory set at 0V/°C (DIGITAL TC OFF).

(2) The maximum voltage limit in volts DC. Adjustable from float up to 58.5 volts DC, but automatically limited to one volt below the High Voltage Shutdown setting. Adjustment is made via the MCA. Factory set at 56.5 volts DC.

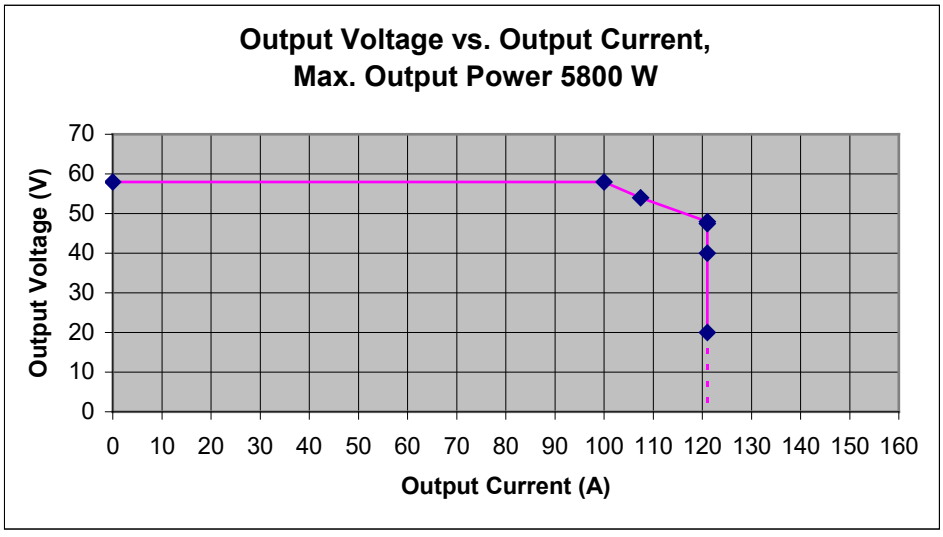
(3) The minimum voltage limit in volts DC. Adjustable from float down to 44 volts DC. Adjustment is made via the MCA. Factory set at 50.0 volts DC.

5.1.2 Current: One hundred amperes (100A) per Rectifier Module.

5.1.3 Output Power: 5800W @ Vout > 48VDC.

5.1.4 Output Characteristics: The relationship between output voltage and current is summarized in the following table and depicted graphically in the following illustration.

Output Power	Output Current	Output Voltage
5800 W	100.0 A	58 VDC
5800 W	121.0 A	48 VDC



5.1.5 Power Derating Based on Input Voltage: The Rectifier Module power varies with changes in input voltage and output voltage. It uses an advanced power limitation method. The Rectifier Module can provide its maximum rated power (5800W) as long as the input voltage is within the range of 304 to 530 VAC (hysteresis is less than 3V). Below 304 VAC (and down to 260 VAC), the Rectifier Module will continue to operate normally but

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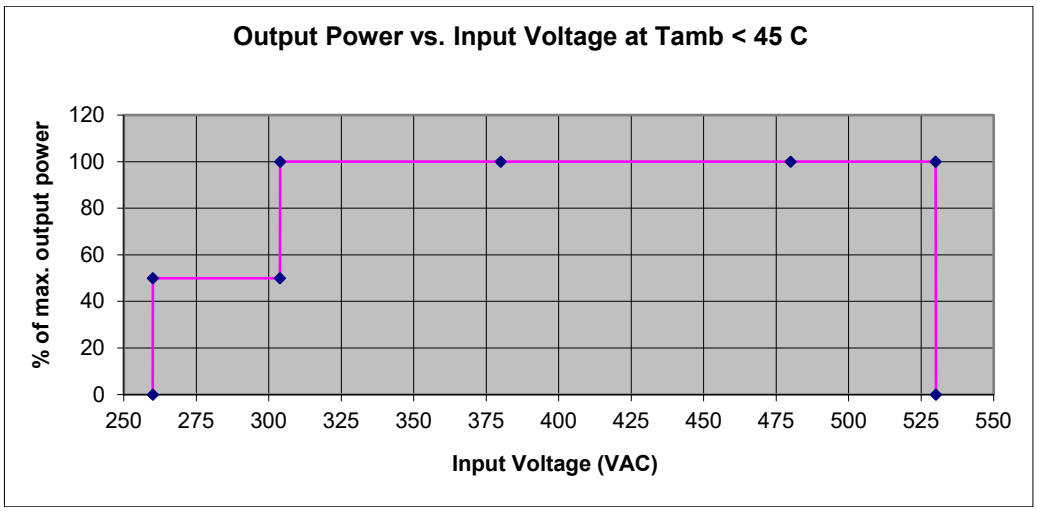
will be in a power derating mode. The relationship between the output power and input voltage is illustrated in the following illustration.

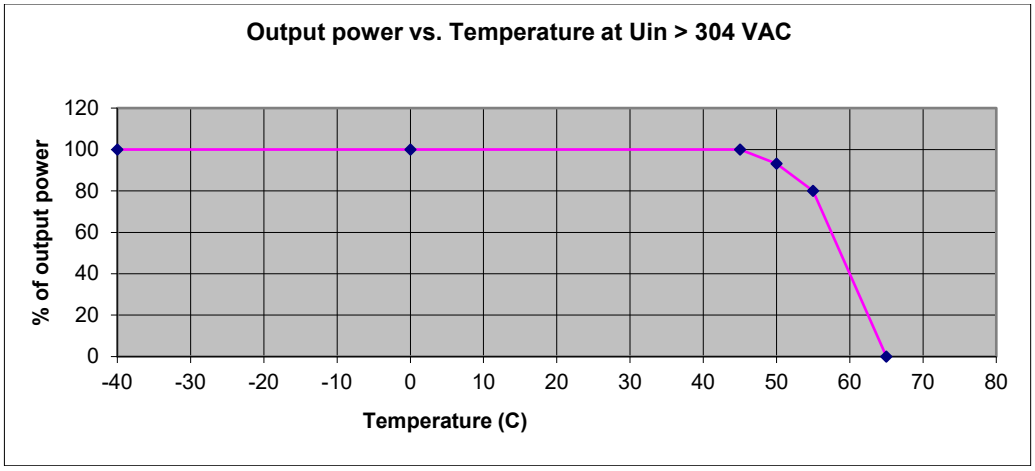
Note: *As depicted in the following illustration, the output power will derate from 100% of the rated capacity as the input voltage drops below 304 VAC, and to 50% of the rated capacity as the input voltage falls to 260 VAC.*



5.1.6 Power Derating Based on Temperature: The Rectifier Module delivers full power when operating at an ambient temperature of +45°C (+113°F) or below. Refer to the following illustration to view the relationship between the output power and the ambient temperature.

Other power rating values are as follows:

- At an ambient temperature of +50°C (+122°F), the power delivered by the Rectifier Module is greater than 5400W.
- At an ambient temperature of +55°C (+131°F), the power delivered by the Rectifier Module is greater than 4640W.



5.1.7 Regulation (Rectifier Module)

(A) Voltage Regulation: ≤±1%

(B) Load Regulation: ≤±0.5%

(C) Line Regulation: ≤±0.1%

(D) Overshoot at Startup: ≤±1%

(E) Dynamic Response (at rated input and output voltage values):

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- Response time is ≤200 µs, and the overshoot is ≤5% for load changes at 50%-25%-50% and 50%-75%-50%.
- Overshoot or undershoot is ≤5% and within ±1% of the regulation band, ≤4 ms at 50 µs for load changes at 10%-90% and 90%-10%.

5.1.8 Regulation (via MCA)

(A) Static: The MCA controls the steady state output voltage to within ±0.5% of any voltage setting within the range of 44.0 to 58.0 volts DC for any and all combinations of load from no load to full load, input voltage, and input frequency at a constant ambient temperature. If the MCA's regulation feature is disabled for any reason, steady state regulation is ±1.0% as controlled within the Rectifier Modules.

(B) Dynamic Response: For any step load change from 10% to 90% or from 90% to 10% of full rated load within 250 microseconds, shall not cause the voltage measured at the output to overshoot or undershoot more than 5% of the regulated output level within 1 millisecond. The output voltage must return and stay within the ±1% regulation band within 4 milliseconds and within the ±0.5% regulation band within 3 seconds.

Any step change of the line voltage within the limits specified in Paragraph 3.2.1 shall not cause the output voltage to deviate outside the ±0.5% regulation band.

5.1.9 Filtering (with or without battery): Typical readings were taken at nominal input voltage, nominal output voltage, 50% load, and 25 degrees C ambient.

(A) Voice Band Noise: Complies with Telcordia GR-947_CORE.

(1) Typically 20.4 dBrn C-message weighting. Does not exceed 32 dBrn C.

(2) Typically 0.28 millivolts psophometric. Does not exceed 1 millivolt psophometric.

(B) Wide Band Noise: Complies with Telcordia GR-947_CORE.

(1) Typically 55 millivolts peak-to-peak. Does not exceed 200 millivolts peak-to-peak

(2) Typically 15.9 millivolts rms. Does not exceed 100 millivolts rms.

5.1.10 Hold Up Time: 10 ms (The DC voltage is allowed to decrease to 42V from 54V during the test.)

5.2 AC Input Ratings

5.2.1 Voltage: Nominal 380/480 volts AC, three phase, 50/60 Hz, with an operating range of 260 to 530 volts. Acceptable input frequency range is 45 to 65 Hz.

Maximum non-destructive input voltage when rectifier is not operating: 600 VAC

5.2.2 Current: <13A @ 5800 W, and at an input voltage of 260 VAC.

5.2.3 THD (Total Harmonic Distortion): ≤5% when loaded at 50 to 100% of the rated output power.

5.2.4 Inrush Current: <150% of the rated input steady-state peak value.

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5.2.5 Typical Input Data: 60 Hz input.

(A) System output is initially adjusted to 54.48 volts DC as measured at the system sense points at 50% of full load and nominal input.

Number of Rectifier Modules Installed	Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Power Factor	Efficiency %	Heat Dissipation BTU/Hr
1	408	0	0.488	343.8	52.54	0.156	-	179
		25	2.4017	1693.46	1595.19	0.942	94.62	293
		50	4.0168	2832.47	2795.47	0.986	96.18	365
		75	6.1416	4328.16	4302.15	0.934	96.24	552
		100	8.1106	5711.54	5693.69	0.996	95.89	798
		110	8.4813	5972.18	5950.27	0.996	95.59	894
			8.5230	6000.76	5979.37	0.996	95.37	944
	480	0	0.568	471.83	52.34	0.111	-	179
		25	2.0902	1735.52	1599.11	0.921	94.59	295
		50	3.4514	2865.13	2789.56	0.974	96.21	361
		75	5.2315	4342.83	4292.57	0.988	96.39	529
		100	6.9714	5780.32	5742.72	0.993	96.15	754
		110	7.2089	5974.45	5932.20	0.993	95.99	812
			7.2456	6005.29	5961.03	0.992	95.70	874

(B) Typical Power Factor: Greater than or equal to 0.973 for any load greater than or equal to 50% of rated full load at nominal line. Meets IEC 1000-3-2.

(C) Typical Operating Efficiency: 96.39% at best point, 75% at full load and nominal input voltage.

(D) Maximum Input Current: 8.597A at 100% of full load with output adjusted to 58 volts DC as measured at the shelf output terminals, and input voltage as shown.

5.3 Environmental Ratings

5.3.1 Operating Ambient Temperature Range: -40°C to +65°C (-40°F to +149°F)

(A) Full rated output power of 5800 W for temperatures -40°C to +45°C (-40°F to +113°F).

(B) Power limitation for temperatures higher than +45°C (+113°F).

5.3.2 Storage Ambient Temperature Range: -40°C to +80°C (-40°F to +176°F).

5.3.3 Humidity: This system is capable of operating in an ambient relative humidity range of 0% to 95%, noncondensing.

5.3.4 Altitude: 2000 m (6560 ft) at full power (power limited for heights above 2000 m).

5.3.5 Acoustic Noise: ≤50dB(A), measured at a distance of 0.6 m from the rectifier.

5.3.6 Insulation Resistance and Dielectric Strength

(A) Insulation Resistance

- Between the AC input and the enclosure: $\geq 20 \times 10^6\ \Omega$
- Between the AC input and the DC output: $\geq 20 \times 10^6\ \Omega$
- Between the DC output and the enclosure: $\geq 20 \times 10^6\ \Omega$

(B) Dielectric Strength

- Between the AC input and the enclosure: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 2120 V.
- Between the AC input and the DC output: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 4242 V.

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- Between the DC output and the enclosure: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 707 V.
- Between the DC output and the ground: the leakage current is <1 mA, with no breakdown within 1 minute using an applied voltage of 1500 V (with the varistor and filter capacitors removed before doing the test).

5.3.7 Surge Protection: Complies with IEEE C62 41-1991 Class B3, 6kV/3kA (1.2/50 µs surge voltage and 8/20 µs surge current).

5.3.8 Compliance Information

(A) Safety and EMC: The rectifier has been recognized to meet the UL/EN/IEC 60950-2000 safety standard and is CE marked. The rectifier also meets the latest EMC requirements, as listed in the following table.

Item	Standard	Class
Surge Immunity	EN61000-4-5	AC Port: 4kV/2Ω 6kV/12Ω for com. DC Port: 800V/2Ω CAN Bus: 1kV diff. / 2kV com.
	GR-1089-CORE	R4-8, R4-9, R4-24, R-25
EFT	EN 61000-4-4	AC and DC Port: 4kV CAN Bus: 1kV
	GR-1089-CORE	O2-8
ESD	EN 61000-4-2 and	8kV/15kV
	GR-1089-CORE	R2-1, R2-2, R2-3, O2-4
Conducted immunity	EN 61000-4-6	3Vrms 0.15-80MHz
	GR-1089-CORE	R3-15, CO3-16, R3-17
Radiated immunity	EN 61000-4-6	10V 80-2GHz
	GR-1089-CORE	R3-11, CR3-12
Mains frequency Magnetic fields immunity	EN 61000-4-8	30A/m
Conducted emissions	EN 55022	Class B
	CFR 47 Part 15	
	GR-1089-CORE	R3-5 (Class B)
Conducted current emissions	GR-1089-CORE	R3-6
Radiated emissions	EN 55022	Class B
	CFR 47 Part 15	
	GR-1089-CORE	R3-1, R3-4 (Class B)

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5.4 Standard Features

5.4.1 Type of Power Conversion Circuit: High frequency.

5.4.2 Float Charging Output Mode: In this mode of operation, system output voltage is constant and output current does not exceed the current limit setting. During normal operation, the battery is not required to furnish load current and remains in a fully charged condition.

The float voltage setting can be checked and/or adjusted without removing a Rectifier Module or affecting the load. One adjustment changes the output of all Rectifier Modules.

Note: *If the current demanded by the load exceeds the current limit setting of the system, the battery is required to furnish the difference in load current and begins discharging.*

Note: *If the system is used with a digital battery charge temperature compensation probe, the MCA automatically adjusts system output. This ensures proper voltage to the battery as battery ambient temperature fluctuates.*

5.4.3 Test/Equalize Charging Output Mode: This mode of operation is used if higher output voltage is required for equalizing the charge on all battery cells of a conventional flooded cell battery, or for recharging the battery following a commercial power failure.

If the installation site does not require system equalize mode of operation, the equalize feature can be used as a test feature. System equalize voltage can be adjusted to a test voltage value. Placing the system into the test/equalize mode causes system output voltage to increase or decrease to this test voltage value.

The test/equalize voltage setting can be checked and/or adjusted without removing a Rectifier Module or affecting the load. One adjustment changes the output of all Rectifier Modules.

Note: *If the system is used with a battery charge temperature compensation probe, typical equalize mode of operation is not used.*

5.4.4 Output Mode of Operation Selection: There are four methods of placing the system from the float mode to the test/equalize mode.

(A) Method 1 (Manual Test/Equalize): A user manually places the system into the test/equalize mode via the MCA interface. A user must manually return the system to the float mode via the MCA interface.

(B) Method 2 (Manually Initiated Timed Test/Equalize): A user manually places the system into the test/equalize mode via the MCA interface. The system automatically returns to the float mode after a preset programmable time period (1-99 hours, in increments of one hour).

(C) Method 3 (Automatic Test/Equalize):

THE AUTOMATIC EQUALIZE FEATURE IS INTENDED FOR USE ONLY WITH WET CELL BATTERIES. USING THIS FEATURE WITH VALVE REGULATED BATTERIES IS NOT RECOMMENDED.

This feature can be enabled or disabled by a user via the MCA. The default state is disabled.

The Automatic Equalize feature is a time based function that is controlled by a customer selectable multiplier and by the Battery on Discharge (BOD) alarm setpoint. The MCA's default setting is for a multiplier of zero, which disables the Automatic Equalize feature.

When the Automatic Equalize feature is enabled, if system voltage drops to less than the BOD alarm setpoint, the MCA initiates a timing cycle to measure the discharge time period. The MCA requires at least 15 minutes of continuous BOD alarm in order to prevent nuisance equalization cycles. When system voltage rises to above the BOD alarm setpoint, the MCA ends the discharge timing cycle and (assuming a minimum of 15 minutes has elapsed) places the Rectifier Modules into the equalize mode for a customer selectable multiple of the discharge time period (the discharge time period includes the initial 15 minutes).

The equalize time period can be set for 0 to 15 times the discharge time period, up to a maximum of 300 hours. A zero (0) setting disables the feature.

(D) Method 4 (External Test/Equalize): A user (or external equipment) places the system into the test/equalize mode by applying an external signal to the system. The system returns to the float mode when the external signal is removed. This method overrides the other three methods.

5.4.5 Input Protection: Lists 1 and 9 provide connections for twenty-four (24) AC input branch circuits (one per Rectifier Module mounting position). Lists 2 and 10 provide connections for two (2) AC input branch circuits (two per Power Bay). Customer to provide AC input branch circuit protection.

(A) Input Over/Under Voltage Protection: The Rectifier Module shuts down and its protection indicator (yellow) illuminates when the input voltage is lower than 260VAC or higher than 530VAC. This condition is reported to the power system controller and the power system controller processes the alarms accordingly.

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(B) Input Fusing: Input fusing is provided in each Rectifier Module. This fusing is not customer replaceable.

5.4.6 Output Protection

(A) Current Limiting: The maximum current delivered by the system can be programmed from 10% to 110% of total system capacity. The MCA automatically adjusts the current limit circuit on each Rectifier Module so that this value is not exceeded. If a Rectifier Module fails, the MCA automatically resets each remaining Rectifier Module's current limit point to maintain this value. The MCA also insures that the current limit circuit on any Rectifier Module is not set above 110% of its capacity. The default current limit setting is the sum of each installed Rectifier Module's output rating. If an additional Rectifier Module is added to the system, the system current limit is automatically increased by the rating of the new Rectifier Module and the new current limit value is displayed.

The current limiting point can be adjusted without removing a Rectifier Module. One adjustment changes the setting of all Rectifier Modules.

The current limit is factory set at 100% of rated full load, unless otherwise specified.

(B) Output Fusing: Output fusing is provided in each Rectifier Module. If a fuse opens, local and remote Rectifier Module Fail Alarms activate. This fusing is not customer replaceable.

(C) High Voltage Shutdown

(1) Internal: If Rectifier Module output voltage exceeds an adjustable preset value, the Rectifier Module shuts down.

After approximately 5 seconds, the Rectifier Module automatically restarts. If Rectifier Module output voltage again exceeds the high voltage shutdown value within 5 minutes, the Rectifier Module shuts down and locks out. Manual restart is then required. If the Rectifier Module does not experience a high voltage condition within the 5 minute time period, the restart circuit is reset.

If two or more Rectifier Modules are installed in the Power Bay, or if the Power Bay is paralleled with other Power Bays, only the Rectifier Module causing the high voltage condition shuts down.

The high voltage shutdown point can be checked and/or adjusted without removing a Rectifier Module. One adjustment changes the setting of all Rectifier Modules.

Adjustable from 56.0 to 59.0 volts DC. Factory set at 57.50 volts, unless otherwise specified.

(2) Remote: See Paragraph 4.1.14 (B).

(3) Backup: If Rectifier Module output voltage exceeds a second (non-adjustable) value, the Rectifier Module shuts down and locks out regardless of load. Manual restart is then required. The fixed hardware HVSD is 59.5V (within the range of 58.5 to 60V).

5.4.7 High Temperature Protection:

(A) When the PFC board temperature is higher than 85°C, the rectifier turns off. When the PFC board temperature is lower than 75°C, the rectifier resumes to normal operation, and the hysteresis is at least 10°C.

(B) When the “ambient temperature – PFC board temperature” is higher than 5°C, the rectifier turns off. When the “ambient temperature – PFC board temperature” is lower than 2°C, the rectifier resumes to normal operation, and the hysteresis is at least 3°C.

(C) When the DC board temperature is higher than 105°C, the rectifier turns off. When the DC board temperature is lower than 95°C, the rectifier resumes to normal operation, and the hysteresis is at least 10°C.

5.4.8 Fan Fault Protection: An alarm will be generated upon a fan fault. In such cases, the fault indicator (red) on the Rectifier Module front panel will flash and the Rectifier Module will also inhibit its output. Auto-recovery is enabled upon the clearing of the corresponding fault.

5.4.9 PFC Over/Under Voltage: The rectifier will shut down when its bus voltage is higher than the over voltage set point or is lower than the under voltage set point. During such conditions, the rectifier does not output any power and its protection indicator (yellow) will light up.

5.4.10 Load Sharing (via MCA): The MCA load sharing feature automatically balances the load. If the MCA's load sharing feature is disabled for any reason, pre-programmed slope control in each Rectifier Module balances the load. The MCA's load sharing feature is disabled whenever the system is in current limit, the system is delivering more than 97% capacity, or the system is delivering less than 3% capacity.

Active Load Sharing (Rectifier Module): The Rectifier Module uses advanced digital active load sharing technology that maintains balancing to within ±3A. The difference in the average current between rectifiers is <±3A for loads in the 10 to 100% range.

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5.4.11 Startup Time: The Rectifier Module has two startup modes:

(A) Normal Soft Start Time: The duration from the time when the rectifier is powered on to the time when the rectifier provides output voltage is <8s.

(B) Current Walk-In: The rise time of the rectifier output voltage is >8s at 90% of the rated load, and the maximum time is 90s at 100% of the rated load.

5.4.12 Hot Swappable: The Rectifier Module is designed to be plug-and-play. The Rectifier Module can be inserted or removed from a live DC power system with no damage. When the Rectifier Module is plugged into the system, the system output voltage will not be affected.

5.4.13 Cooling: Each Rectifier Module contains a fan for forced convection cooling.

5.4.14 Fan Control: When the PFC bus voltage is within a normal range, the built-in processor adjusts the fan's speed according to the Rectifier Module's internal temperature and output current. For example, a higher temperature or output current will increase the fan speed. Above 45°C at full load, the fan operates at full speed. When the PFC bus voltage is abnormal, such as very low bus voltage, the fan turns off.

5.4.15 Communication Failure: The Rectifier Module's protection indicator (yellow) will flash should it experience a communication failure. The failure information will be reported to the Controller and the Controller will process the failure accordingly. During a communication failure, in order to protect the battery, the Rectifier Module output voltage will automatically adjust to 53.5 V (this is a default value which can be modified using the Controller). The Rectifier Module will revert to normal operation once normal communication is restored.

5.4.16 Unbalance of Rectifier Module Output Current: When the output current of the Rectifier Modules in a DC power system is unbalanced, the Rectifier Module having the unbalanced output current will be identified automatically and its protection indicator (yellow) will turn on.

The failure information will be reported to the Controller and the Controller will process the failure accordingly.

5.4.17 Paralleling: This system may be connected in parallel with any rectifier of the same polarity and adjusted to the same output voltage.

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5.4.18 Monitoring Function: The Rectifier Module has a built-in advanced DSP that monitors and controls the operation of the Rectifier Module. The DSP also communicates with the Controller in real time through the CAN bus. The following table lists the different commands and information exchanged between the Rectifier Module and the Controller.

Commands / signals that can be received by the Rectifier Module from the Controller.	**Information gathered by the Controller from the Rectifier Module.**
• Turn on/off • Current walk-in on/off • HVSD reset • Current limit adjustment • Voltage regulation	• Input voltage • Output voltage • Output current • Current limit setting • Temperature • Over voltage setting • On/off status • Fault alarms, such as: HVSD Fan fail • Protection alarms, such as: Input voltage protection Inner DC bus voltage protection High temperature protection • Thermal derating • AC derating • AC fail • Unbalanced output current • Address • Code • Date • SW version • HW version

5.4.19 Dimensions:

Millimeters: 87.5 (Height) X 243.5 (Width) X 371.5 (Depth).
Inches: 3.44 (Height) X 9.59 (Width) X 14.63 (Depth).

5.4.20 Weight: < 8 kg (17.6 lbs).

5.4.21 Local Status and Alarm Indicators: Refer to the "Operating Procedures" chapter in the Power System User Instructions (Section 6017) for a complete description.

(A) Power (Green)

(B) Protection (Yellow)

(C) Alarm (Red)

(D) A 10-segment Green LED is located on the front panel to represent output current, each segment represents 10A.

6. MCA

6.1 Standard Features

6.1.1 MCA Interface: You interface with the MCA locally via the MCA Control Panel located on the outside of the primary Power Bay's front door.

You can also interface with the MCA via the LMS, if furnished.

Note: *Option switches are provided to lockout changing adjustment/configuration/calibration settings via the MCA control panel and/or via the LMS.*

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6.1.2 MCA Local Display: Provides digital metering of system load voltage and current, individual Rectifier Module output, and individual load shunts. Also displays system alarm messages and adjustment information, as detailed in Paragraph 4.1.13 (*MCA Display*).

6.1.3 MCA Meter Accuracy: ±0.01 V, ±0.005% / °C

6.1.4 MCA Remote Sense Maximum Voltage Drop Compensation: The maximum voltage drop that the Remote Sense can compensate is 400mV for 48V systems and 200mV for 24V systems.

6.1.5 MCA Universal Adjustment Circuit: Provides single point control of float output voltage, test/equalize output voltage, high voltage shutdown, and current limit adjustments.

Note: *If the MCA should fail, the Rectifier Modules remember the float and high voltage shutdown settings last delivered by the MCA. The current limit setting of each Rectifier Module goes to 100% of rated full load.*

Provides adjustments for all MCA alarm and control circuits. Adjustment ranges and factory settings as follows.

All adjustments can be performed locally via the MCA Control Panel, and most can be performed remotely via the LMS (if furnished).

(A) Rectifier Module Output Voltage: See Paragraph 3.1.1.

(B) Rectifier Module Current Limit: See Paragraph 3.4.6 (A).

(C) Rectifier Module High Voltage Shutdown: See Paragraph 3.4.6 (C).

(D) System High Voltage #1 Alarm: Adjustable from 48.00 to 59.00 volts DC. Factory set at 55.5 volts, unless otherwise specified.

(E) System High Voltage #2 Alarm: Adjustable from 48.00 to 59.00 volts DC. Factory set at 56.5 volts, unless otherwise specified.

(F) Battery On Discharge Alarm: Adjustable from 40.00 to 56.00 volts DC. Factory set at 51.0 volts, unless otherwise specified.

(G) Very Low Voltage Alarm: Adjustable from 40.00 to 56.00 volts DC. Factory set at 47.0 volts, unless otherwise specified.

(H) Total Distribution Load Alarm: Adjustable from 0 to 60000 amperes. Factory set at 2000 amperes, unless otherwise specified.

(I) Distribution Group A Load Alarm: Adjustable from 0 to 60000 amperes. Factory set at 2000 amperes, unless otherwise specified.

(J) Distribution Group B Load Alarm: Adjustable from 0 to 60000 amperes. Factory set at 2000 amperes, unless otherwise specified.

(K) High Battery Ambient Temperature #1 Alarm (if battery charge digital temperature compensation probe installed): Adjustable from -50°C to +99°C. You disable the feature by selecting the setting above +99°C. Factory set to off, unless otherwise specified.

(L) High Battery Ambient Temperature #2 Alarm (if battery charge digital temperature compensation probe installed): Adjustable from -50°C to +99°C. You disable the feature by selecting the setting above +99°C. Factory set to off, unless otherwise specified.

(M) Low Battery Ambient Temperature #1 Alarm (if battery charge digital temperature compensation probe installed): Adjustable from -49°C to +100°C. You disable the feature by selecting the setting below -49°C. Factory set to off, unless otherwise specified.

(N) Low Battery Ambient Temperature #2 Alarm (if battery charge digital temperature compensation probe installed): Adjustable from -49°C to +100°C. You disable the feature by selecting the setting below -49°C. Factory set to off, unless otherwise specified.

(O) Audible Alarm Cutoff Reset Feature: Adjustable from 0 to 15 minutes, in one minute intervals. A zero setting disables the feature. Factory set at 15 minutes, unless otherwise specified.

(P) Rectifier Module Sequencing: The time delay between turning individual Rectifier Modules on is adjustable from 1 to 20 seconds, or feature disabled. The Rectifier Module Sequencing feature is factory set to 'disabled'.

(Q) Timed Test/Equalize Period (also enables/disables the manually initiated timed test/equalize feature): Adjustable from 1 to 99 hours, in one hour intervals. When a value is set, the feature is enabled. You disable the feature by selecting the setting above 99. Factory set at 1 (one) hour, unless otherwise specified.

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(R) Automatic Test/Equalize Period (also enables/disables the automatic test/equalize feature): Adjustable from 0 to 15 times the discharge time period, up to a maximum of 300 hours. A zero (0) setting disables the feature. Factory set at zero (0), unless otherwise specified.

(S) Relay Test Seconds: Adjustable from 5 to 120 seconds, in one second intervals. Factory set at 45 seconds, unless otherwise specified.

6.1.6 MCA Audible Alarm and Audible Alarm Cutoff: The MCA contains an Audible Alarm, which is located on the MCA Control Panel. The audible alarm sounds when any alarm condition monitored by the MCA occurs. The alarm can be manually silenced (cutoff) by pressing a local pushbutton. A local indicator illuminates when the audible alarm has been cutoff. The alarm remains silenced for the current alarm condition only. If another alarm condition occurs, the audible alarm again sounds.

A programmable audible alarm cutoff reset feature is provided. Once an audible alarm has been cutoff, it automatically resets (and sounds if the alarm condition is still present) after the time period programmed expires. If another alarm condition occurs, the audible alarm again sounds.

6.1.7 Remote On/Off (TR): The operation of any or all Rectifier Modules can be inhibited (TR) via the MCA Control Panel or from the LMS (if furnished). A Rectifier Module fail alarm is NOT issued.

6.1.8 MCA Alarm Logging: The MCA logs (with a date/time stamp) up to 500 recordable events.

6.1.9 Rectifier Module Sequencing: The MCA can be set to provide Rectifier Module Sequencing. When the MCA senses an “AC Power is OFF to All Rectifier Modules” alarm, it turns off all Rectifier Modules. When the “AC Power is OFF to All Rectifier Modules” alarm clears, the MCA turns on Rectifier Module #1, then turns on the other Rectifier Modules starting with Rectifier Module #2 every *n* seconds (*n* is user programmable from 1 to 20 seconds). If the MCA fails or the communication link is broken during a Rectifier Module Sequencing routine, all Rectifier Modules turn on immediately.

6.1.10 MCA Power Share Feature: The MCA Power Share feature allows you to connect the Spec. No. 582140001 Power System to an existing DC power system instead of extending or completely replacing the existing power system. The MCA Power Share feature provides for the sharing of the total load in a controlled manner. When Power Share is programmed, the MCA in the 582140001 Power System adjusts PCU output voltage per load demands to ensure proper sharing between the two systems. For further information, request Application Note AN38.

6.1.11 MCA Alternate Current Limit Feature: The MCA Alternate Current Limit feature provides a means to limit the output current of all rectifiers based on the state of an external signal. The rectifiers output current is limited to a percentage of rectifier output capacity as configured by the user. A binary input on an installed MCA I/O circuit card is used to monitor the external signal that triggers the current limiting action.

6.1.12 Local Controls: Refer to the "Operating Procedures" chapter in the Power System User Instructions (Section 6017) for a complete description.

Location	NAME / Description	Type
MCA Control Panel	Function Select Up	Pushbutton Switch
	Function Select Down	Pushbutton Switch
	Function Set Enter / Move Left / Move Right	Pushbutton Switch
	Function Set Yes / + / i	Pushbutton Switch
	Function Set No / -	Pushbutton Switch
	Alarm Cutoff	Pushbutton Switch

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6.1.13 Local Status and Alarm Indicators: Refer to the "Operating Procedures" chapter in the Power System User Instructions (Section 6017) for a complete description.

Location	NAME / Description	Type
MCA Control Panel	Message Display, Shows... • Active Alarms or "SYSTEM OK" • Various Measurement Items and Values • Various Inventory Items • Various Adjustment Items and Values • Various Operation Items • Various Configuration Items and Settings See Paragraph 4.1.13 "*MCA Display*"	---
	Alarm Cutoff	LED - yellow
	Major	LED - flashing red
	Minor	LED - red
	AC	LED - green/red
	Test/EQ	LED - yellow

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6.1.14 MCA Numbering Scheme: The MCA identifies (numbers) the components of the system as follows.

COMPONENT	MCA IDENTIFICATION NUMBER		
	MCA NUMBERING SCHEME (note that each line shown below is separated with a dash in the MCA display)	**NOTES**	**EXAMPLE**
MCA/Router	Bay #	Primary Power Bay is #1, other bays are numbered consecutively, following the bay-to-bay cabling scheme.	Primary Power Bay **1** Second Bay **2** Fifth Bay **5**
Rectifier (PCU)	Bay # MCA Rectifier ID# within the Bay / # of Rectifiers Installed in System	Main Power Bay is #1, other bays are numbered consecutively, following the bay-to-bay cabling scheme. Rectifiers are identified from 1 to 24, as they are powered-up and recognized by the MCA.	Primary Power Bay, First Recognized Rectifier (w/ 36 rectifiers installed) **1-01/36** Second Bay, Third Recognized Rectifier (w/ 24 rectifiers installed) **2-03/24** Fifth Bay, Tenth Recognized Rectifier (w/ 12 rectifiers installed) **5-10/12**
MCA Relay Circuit Card	Bay # Card Position # w/in Bay Relay # w/in Card	Primary Bay is #1, other bays are numbered consecutively, following the bay-to-bay cabling scheme. Card #1 = left slot, Card #7 = right slot. Relay # (see illustration in *System Overview* Chapter of the USER INSTRUCTIONS).	Primary Bay, Relay Card in First Slot, Relay One on Card **1-1-1** Second Bay, Relay Card in Third Slot, Relay Four on Card **2-3-4** Fifth Bay, Relay Card in Seventh Slot, Relay Six on Card **5-7-6**
MCA I/O Circuit Card	Bay # Card Position # w/in Bay	Primary Bay is #1, other bays are numbered consecutively, following the bay-to-bay cabling scheme. Card #1 = left slot, Card #7 = right slot.	Primary Bay, I/O Card in First Slot **1-1** Second Bay, I/O Card in Third Slot **2-3** Fifth Bay, I/O Card in Seventh Slot **5-7**

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COMPONENT	MCA IDENTIFICATION NUMBER		
	MCA NUMBERING SCHEME (note that each line shown below is separated with a dash in the MCA display)	**NOTES**	**EXAMPLE**
Distribution Bay's Distribution Bus	Bay # Distribution Bus # w/in Bay (A or B Designation)	Primary Power Bay is #1, other bays are numbered consecutively, following the bay-to-bay cabling scheme. Distribution Bus #1 = Top Left, Distribution Bus #2 = Top Right, Distribution Bus #3 = Bottom Left, Distribution Bus #4 = Bottom Right, A or B as set by jumper on MCA Distribution Bus Monitoring Circuit Card.	Fifth Bay, Top Left Bus, Set for B Designation **5-1B** Sixth Bay, Top Right Bus, Set for B Designation **6-2B** Seventh Bay, Bottom Left Bus, Set for B Designation **7-3B** Seventh Bay, Bottom Right Bus, Designation Not Set **7-4**
Distribution Bay's Distribution Device	Type Bay # Distribution Point # w/in Bay	Type = Breaker or Fuse or MISC 50-73. Primary Bay is #1, other bays are numbered consecutively, following the bay-to-bay cabling scheme. Distribution Point = 1-12 (bottom - top, Top Left Bus, Bus #1). 13-24 (top - bottom, Top Right Bus, Bus #2). 25-36 (bottom - top, Bottom Left Bus, Bus #3). 37-48 (top - bottom, Bottom Right Bus, Bus #4). Note that distribution components may take more than one mounting position, designation number is the left most mounting position. ***Note:*** *The optional bullet-device fuse panel is displayed as MISC 50-73.*	Fifth Bay, Circuit Breaker Mounted in Position One, Bus 1 Set for A Designation **Breaker 5-01A** Sixth Bay, Fuse Mounted in Position Thirteen, Bus 2 Designation Not Set **Fuse 6-13**

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6.1.15 MCA Display: Presented next are illustrations from the MCA Menu Tree (Section 5886). Refer to the latest version of Section 5886 for the most recent MCA Menu Tree. Refer to the Power System User Instructions (Section 6017) for a complete description of menu items (the MCA is used in multiple platforms, some menu items may not be available as detailed in Section 6017).

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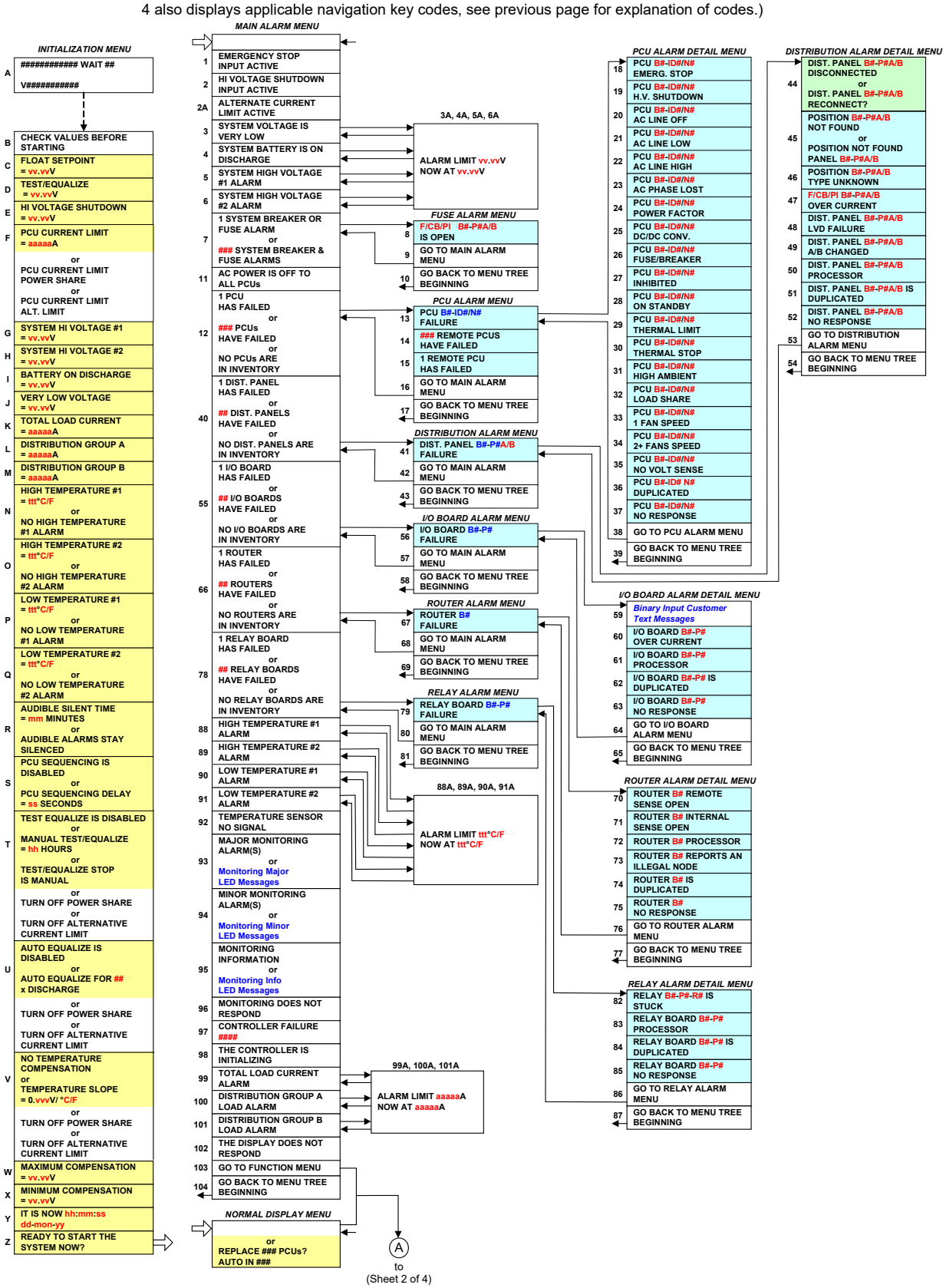
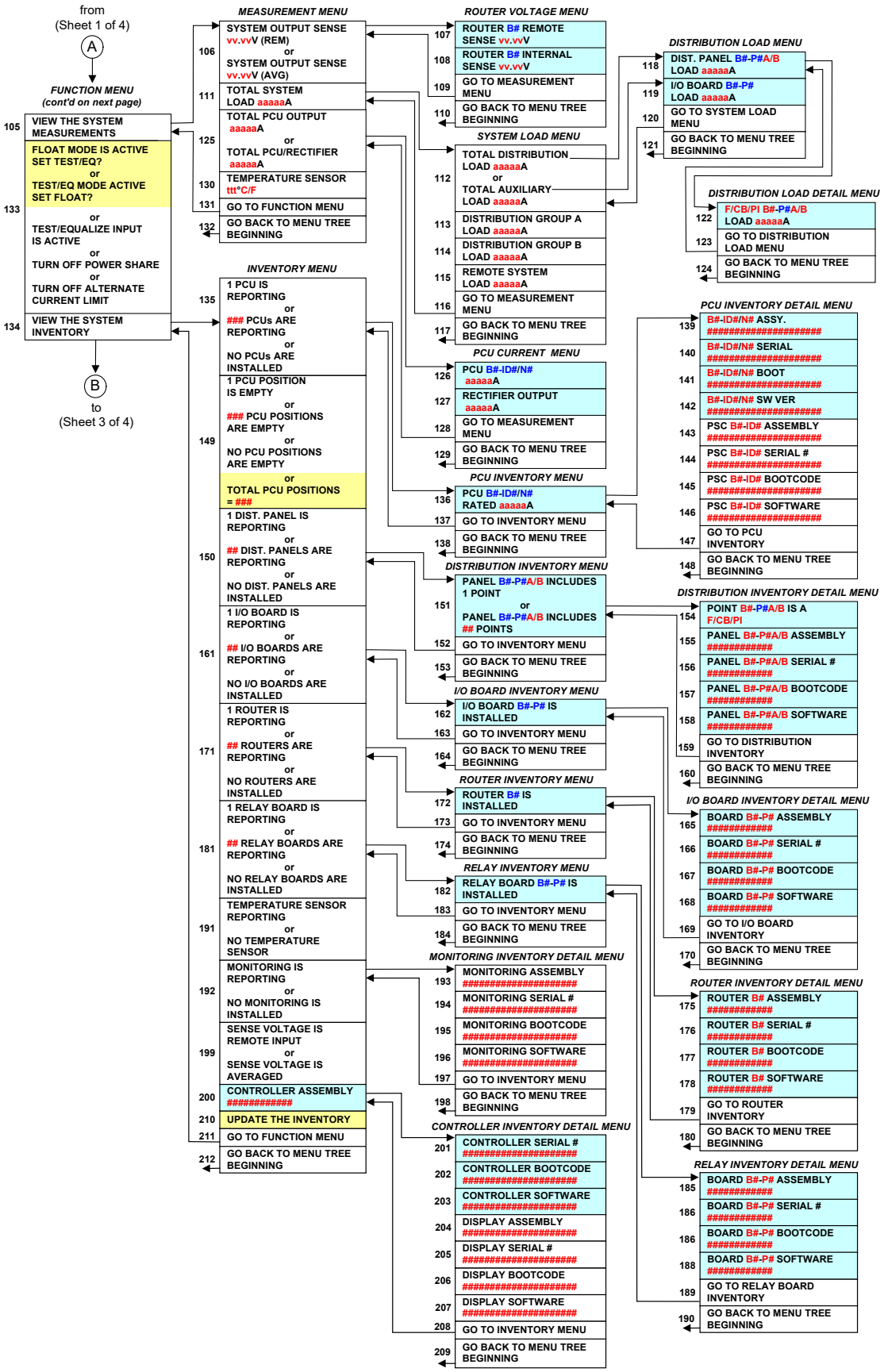
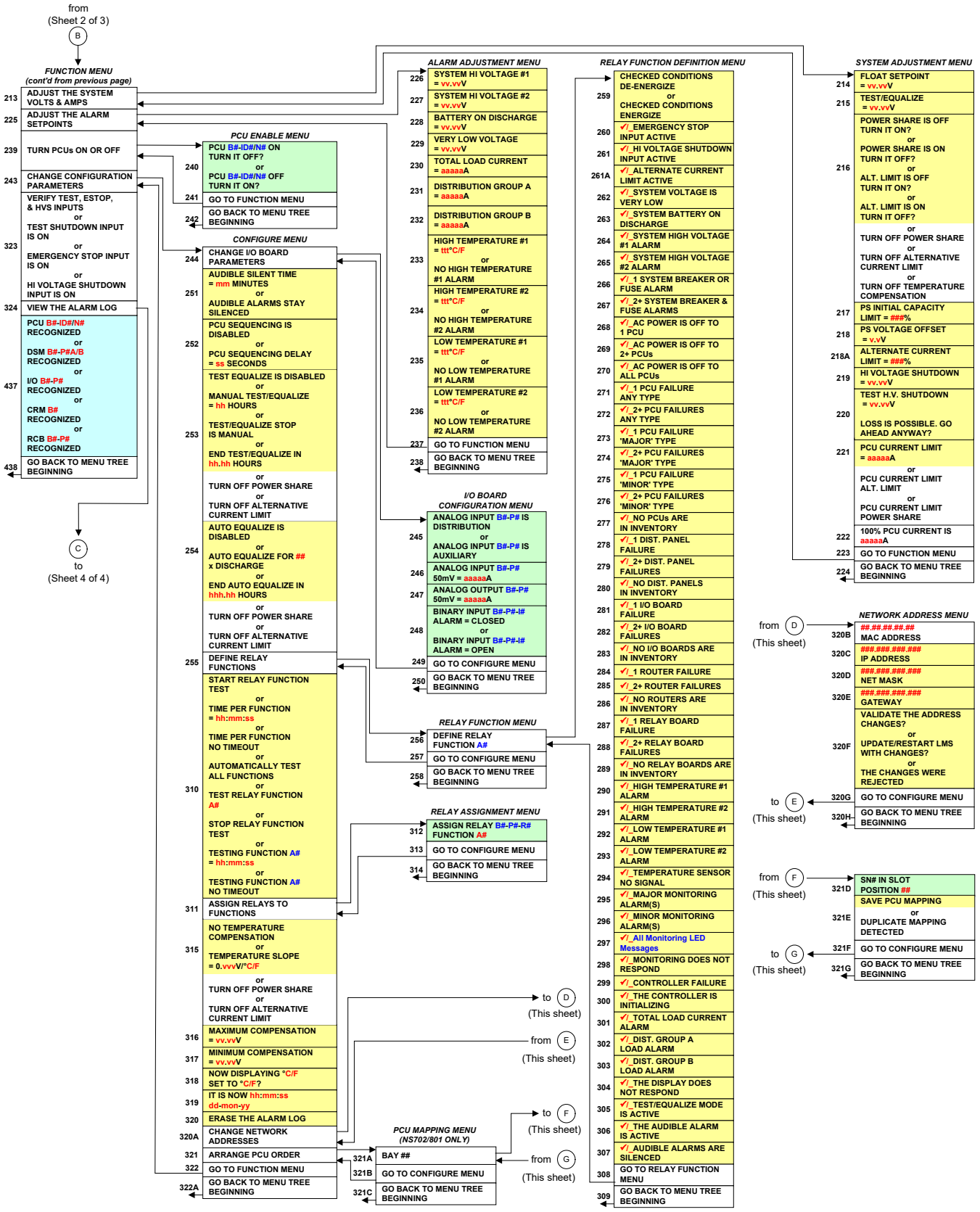
The User navigates **Lines 3 and 4** of the MCA Display using the Keypad on the MCA Control Panel. (The following indicates the actual text shown on each line of Lines 3 and 4 of the MCA Display, Line 4 also displays applicable navigation key codes, see previous page for explanation of codes.)




from
(Sheet 1 of 4)
A
FUNCTION MENU
(cont'd on next page)
105 VIEW THE SYSTEM MEASUREMENTS
FLOAT MODE IS ACTIVE
SET TEST/EQ?
or
TEST/EQ MODE ACTIVE
SET FLOAT?
133 or
TEST/EQUALIZE INPUT IS ACTIVE
or
TURN OFF POWER SHARE
or
TURN OFF ALTERNATE CURRENT LIMIT
134 VIEW THE SYSTEM INVENTORY
B
to
(Sheet 3 of 4)
MEASUREMENT MENU
106 SYSTEM OUTPUT SENSE vv.vvV (REM)
or
SYSTEM OUTPUT SENSE vv.vvV (AVG)
111 TOTAL SYSTEM LOAD aaaaaA
125 TOTAL PCU OUTPUT aaaaaA
or
TOTAL PCU/RECTIFIER aaaaaA
130 TEMPERATURE SENSOR ttt°C/F
131 GO TO FUNCTION MENU
132 GO BACK TO MENU TREE BEGINNING
INVENTORY MENU
135 1 PCU IS REPORTING
or
PCUs ARE REPORTING
or
NO PCUs ARE INSTALLED
149 1 PCU POSITION IS EMPTY
or
PCU POSITIONS ARE EMPTY
or
NO PCU POSITIONS ARE EMPTY
or
TOTAL PCU POSITIONS = ###
150 1 DIST. PANEL IS REPORTING
or
DIST. PANELS ARE REPORTING
or
NO DIST. PANELS ARE INSTALLED
161 1 I/O BOARD IS REPORTING
or
I/O BOARDS ARE REPORTING
or
NO I/O BOARDS ARE INSTALLED
171 1 ROUTER IS REPORTING
or
ROUTERS ARE REPORTING
or
NO ROUTERS ARE INSTALLED
181 1 RELAY BOARD IS REPORTING
or
RELAY BOARDS ARE REPORTING
or
NO RELAY BOARDS ARE INSTALLED
191 TEMPERATURE SENSOR REPORTING
or
NO TEMPERATURE SENSOR
192 MONITORING IS REPORTING
or
NO MONITORING IS INSTALLED
199 SENSE VOLTAGE IS REMOTE INPUT
or
SENSE VOLTAGE IS AVERAGED
200 CONTROLLER ASSEMBLY ############
210 UPDATE THE INVENTORY
211 GO TO FUNCTION MENU
212 GO BACK TO MENU TREE BEGINNING
ROUTER VOLTAGE MENU
107 ROUTER B# REMOTE SENSE vv.vvV
108 ROUTER B# INTERNAL SENSE vv.vvV
109 GO TO MEASUREMENT MENU
110 GO BACK TO MENU TREE BEGINNING
SYSTEM LOAD MENU
112 TOTAL DISTRIBUTION LOAD aaaaaA
or
TOTAL AUXILIARY LOAD aaaaaA
113 DISTRIBUTION GROUP A LOAD aaaaaA
114 DISTRIBUTION GROUP B LOAD aaaaaA
115 REMOTE SYSTEM LOAD aaaaaA
116 GO TO MEASUREMENT MENU
117 GO BACK TO MENU TREE BEGINNING
PCU CURRENT MENU
126 PCU B#-ID#/N# aaaaaA
127 RECTIFIER OUTPUT aaaaaA
128 GO TO MEASUREMENT MENU
129 GO BACK TO MENU TREE BEGINNING
PCU INVENTORY MENU
136 PCU B#-ID#/N# RATED aaaaaA
137 GO TO INVENTORY MENU
138 GO BACK TO MENU TREE BEGINNING
DISTRIBUTION INVENTORY MENU
151 PANEL B#-P#A/B INCLUDES 1 POINT
or
PANEL B#-P#A/B INCLUDES ## POINTS
152 GO TO INVENTORY MENU
153 GO BACK TO MENU TREE BEGINNING
I/O BOARD INVENTORY MENU
162 I/O BOARD B#-P# IS INSTALLED
163 GO TO INVENTORY MENU
164 GO BACK TO MENU TREE BEGINNING
ROUTER INVENTORY MENU
172 ROUTER B# IS INSTALLED
173 GO TO INVENTORY MENU
174 GO BACK TO MENU TREE BEGINNING
RELAY INVENTORY MENU
182 RELAY BOARD B#-P# IS INSTALLED
183 GO TO INVENTORY MENU
184 GO BACK TO MENU TREE BEGINNING
MONITORING INVENTORY DETAIL MENU
193 MONITORING ASSEMBLY ####################
194 MONITORING SERIAL # ####################
195 MONITORING BOOTCODE ####################
196 MONITORING SOFTWARE ####################
197 GO TO INVENTORY MENU
198 GO BACK TO MENU TREE BEGINNING
CONTROLLER INVENTORY DETAIL MENU
201 CONTROLLER SERIAL # ####################
202 CONTROLLER BOOTCODE ####################
203 CONTROLLER SOFTWARE ####################
204 DISPLAY ASSEMBLY ####################
205 DISPLAY SERIAL # ####################
206 DISPLAY BOOTCODE ####################
207 DISPLAY SOFTWARE ####################
208 GO TO INVENTORY MENU
209 GO BACK TO MENU TREE BEGINNING
DISTRIBUTION LOAD MENU
118 DIST. PANEL B#-P#A/B LOAD aaaaaA
119 I/O BOARD B#-P# LOAD aaaaaA
120 GO TO SYSTEM LOAD MENU
121 GO BACK TO MENU TREE BEGINNING
DISTRIBUTION LOAD DETAIL MENU
122 F/CB/PI B#-P#A/B LOAD aaaaaA
123 GO TO DISTRIBUTION LOAD MENU
124 GO BACK TO MENU TREE BEGINNING
PCU INVENTORY DETAIL MENU
139 B#-ID#/N# ASSY. ####################
140 B#-ID#/N# SERIAL ####################
141 B#-ID#/N# BOOT ####################
142 B#-ID#/N# SW VER ####################
143 PSC B#-ID# ASSEMBLY ####################
144 PSC B#-ID# SERIAL # ####################
145 PSC B#-ID# BOOTCODE ####################
146 PSC B#-ID# SOFTWARE ####################
147 GO TO PCU INVENTORY
148 GO BACK TO MENU TREE BEGINNING
DISTRIBUTION INVENTORY DETAIL MENU
154 POINT B#-P#A/B IS A F/CB/PI
155 PANEL B#-P#A/B ASSEMBLY ############
156 PANEL B#-P#A/B SERIAL # ############
157 PANEL B#-P#A/B BOOTCODE ############
158 PANEL B#-P#A/B SOFTWARE ############
159 GO TO DISTRIBUTION INVENTORY
160 GO BACK TO MENU TREE BEGINNING
I/O BOARD INVENTORY DETAIL MENU
165 BOARD B#-P# ASSEMBLY ############
166 BOARD B#-P# SERIAL # ############
167 BOARD B#-P# BOOTCODE ############
168 BOARD B#-P# SOFTWARE ############
169 GO TO I/O BOARD INVENTORY
170 GO BACK TO MENU TREE BEGINNING
ROUTER INVENTORY DETAIL MENU
175 ROUTER B# ASSEMBLY ############
176 ROUTER B# SERIAL # ############
177 ROUTER B# BOOTCODE ############
178 ROUTER B# SOFTWARE ############
179 GO TO ROUTER INVENTORY
180 GO BACK TO MENU TREE BEGINNING
RELAY INVENTORY DETAIL MENU
185 BOARD B#-P# ASSEMBLY ############
186 BOARD B#-P# SERIAL # ############
186 BOARD B#-P# BOOTCODE ############
188 BOARD B#-P# SOFTWARE ############
189 GO TO RELAY BOARD INVENTORY
190 GO BACK TO MENU TREE BEGINNING



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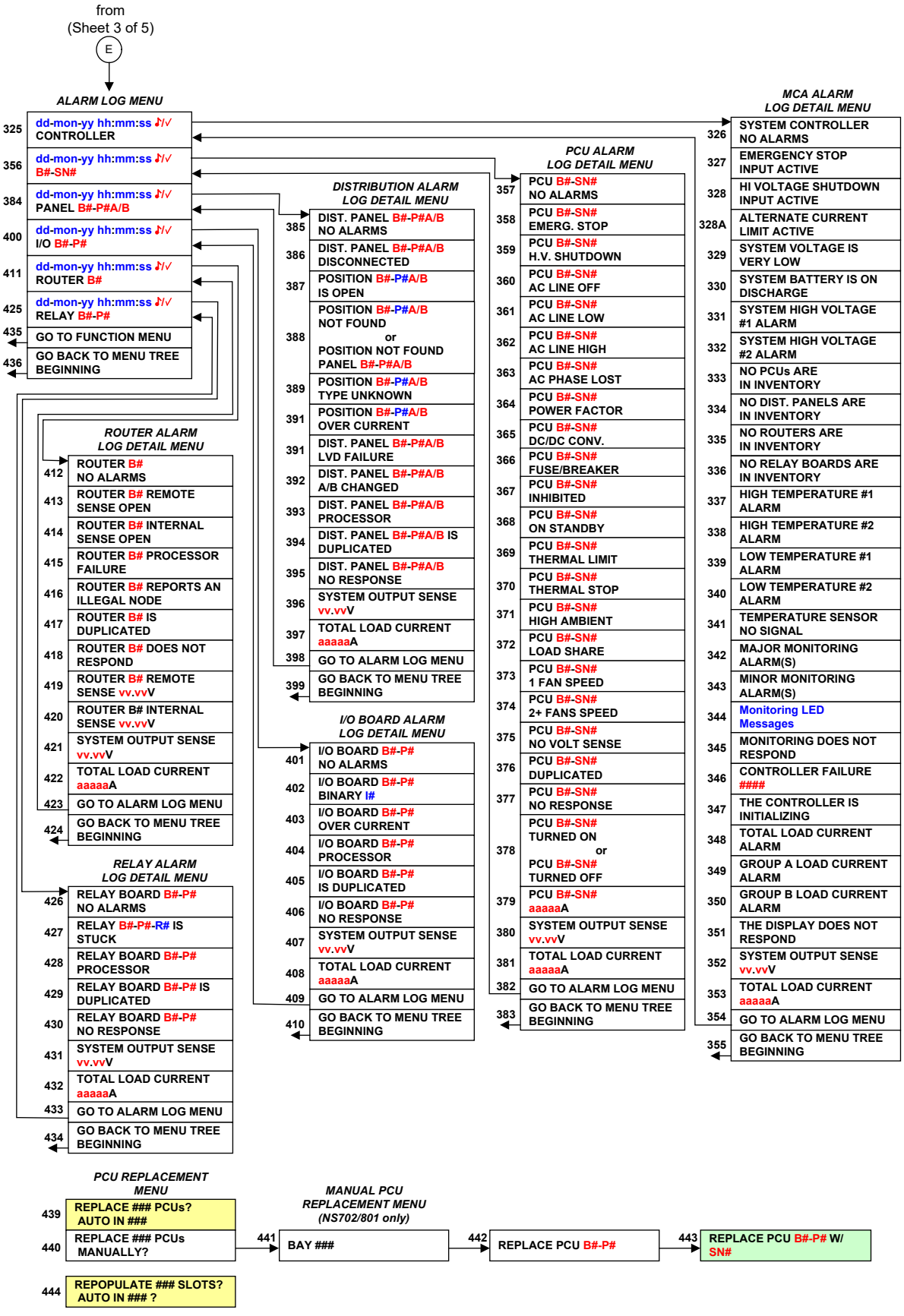
from
(Sheet 3 of 5)
E
ALARM LOG MENU
325 dd-mon-yy hh:mm:ss ♪/✓ CONTROLLER
356 dd-mon-yy hh:mm:ss ♪/✓ B#-SN#
384 dd-mon-yy hh:mm:ss ♪/✓ PANEL B#-P#A/B
400 dd-mon-yy hh:mm:ss ♪/✓ I/O B#-P#
411 dd-mon-yy hh:mm:ss ♪/✓ ROUTER B#
425 dd-mon-yy hh:mm:ss ♪/✓ RELAY B#-P#
435 GO TO FUNCTION MENU
436 GO BACK TO MENU TREE BEGINNING
ROUTER ALARM LOG DETAIL MENU
412 ROUTER B# NO ALARMS
413 ROUTER B# REMOTE SENSE OPEN
414 ROUTER B# INTERNAL SENSE OPEN
415 ROUTER B# PROCESSOR FAILURE
416 ROUTER B# REPORTS AN ILLEGAL NODE
417 ROUTER B# IS DUPLICATED
418 ROUTER B# DOES NOT RESPOND
419 ROUTER B# REMOTE SENSE vv.vvV
420 ROUTER B# INTERNAL SENSE vv.vvV
421 SYSTEM OUTPUT SENSE vv.vvV
422 TOTAL LOAD CURRENT aaaaaA
423 GO TO ALARM LOG MENU
424 GO BACK TO MENU TREE BEGINNING
RELAY ALARM LOG DETAIL MENU
426 RELAY BOARD B#-P# NO ALARMS
427 RELAY B#-P#-R# IS STUCK
428 RELAY BOARD B#-P# PROCESSOR
429 RELAY BOARD B#-P# IS DUPLICATED
430 RELAY BOARD B#-P# NO RESPONSE
431 SYSTEM OUTPUT SENSE vv.vvV
432 TOTAL LOAD CURRENT aaaaaA
433 GO TO ALARM LOG MENU
434 GO BACK TO MENU TREE BEGINNING
DISTRIBUTION ALARM LOG DETAIL MENU
385 DIST. PANEL B#-P#A/B NO ALARMS
386 DIST. PANEL B#-P#A/B DISCONNECTED
387 POSITION B#-P#A/B IS OPEN
388 POSITION B#-P#A/B NOT FOUND or POSITION NOT FOUND PANEL B#-P#A/B
389 POSITION B#-P#A/B TYPE UNKNOWN
391 POSITION B#-P#A/B OVER CURRENT
391 DIST. PANEL B#-P#A/B LVD FAILURE
392 DIST. PANEL B#-P#A/B A/B CHANGED
393 DIST. PANEL B#-P#A/B PROCESSOR
394 DIST. PANEL B#-P#A/B IS DUPLICATED
395 DIST. PANEL B#-P#A/B NO RESPONSE
396 SYSTEM OUTPUT SENSE vv.vvV
397 TOTAL LOAD CURRENT aaaaaA
398 GO TO ALARM LOG MENU
399 GO BACK TO MENU TREE BEGINNING
I/O BOARD ALARM LOG DETAIL MENU
401 I/O BOARD B#-P# NO ALARMS
402 I/O BOARD B#-P# BINARY I#
403 I/O BOARD B#-P# OVER CURRENT
404 I/O BOARD B#-P# PROCESSOR
405 I/O BOARD B#-P# IS DUPLICATED
406 I/O BOARD B#-P# NO RESPONSE
407 SYSTEM OUTPUT SENSE vv.vvV
408 TOTAL LOAD CURRENT aaaaaA
409 GO TO ALARM LOG MENU
410 GO BACK TO MENU TREE BEGINNING
PCU ALARM LOG DETAIL MENU
357 PCU B#-SN# NO ALARMS
358 PCU B#-SN# EMERG. STOP
359 PCU B#-SN# H.V. SHUTDOWN
360 PCU B#-SN# AC LINE OFF
361 PCU B#-SN# AC LINE LOW
362 PCU B#-SN# AC LINE HIGH
363 PCU B#-SN# AC PHASE LOST
364 PCU B#-SN# POWER FACTOR
365 PCU B#-SN# DC/DC CONV.
366 PCU B#-SN# FUSE/BREAKER
367 PCU B#-SN# INHIBITED
368 PCU B#-SN# ON STANDBY
369 PCU B#-SN# THERMAL LIMIT
370 PCU B#-SN# THERMAL STOP
371 PCU B#-SN# HIGH AMBIENT
372 PCU B#-SN# LOAD SHARE
373 PCU B#-SN# 1 FAN SPEED
374 PCU B#-SN# 2+ FANS SPEED
375 PCU B#-SN# NO VOLT SENSE
376 PCU B#-SN# DUPLICATED
377 PCU B#-SN# NO RESPONSE
378 PCU B#-SN# TURNED ON or PCU B#-SN# TURNED OFF
379 PCU B#-SN# aaaaaA
380 SYSTEM OUTPUT SENSE vv.vvV
381 TOTAL LOAD CURRENT aaaaaA
382 GO TO ALARM LOG MENU
383 GO BACK TO MENU TREE BEGINNING
MCA ALARM LOG DETAIL MENU
326 SYSTEM CONTROLLER NO ALARMS
327 EMERGENCY STOP INPUT ACTIVE
328 HI VOLTAGE SHUTDOWN INPUT ACTIVE
328A ALTERNATE CURRENT LIMIT ACTIVE
329 SYSTEM VOLTAGE IS VERY LOW
330 SYSTEM BATTERY IS ON DISCHARGE
331 SYSTEM HIGH VOLTAGE #1 ALARM
332 SYSTEM HIGH VOLTAGE #2 ALARM
333 NO PCUs ARE IN INVENTORY
334 NO DIST. PANELS ARE IN INVENTORY
335 NO ROUTERS ARE IN INVENTORY
336 NO RELAY BOARDS ARE IN INVENTORY
337 HIGH TEMPERATURE #1 ALARM
338 HIGH TEMPERATURE #2 ALARM
339 LOW TEMPERATURE #1 ALARM
340 LOW TEMPERATURE #2 ALARM
341 TEMPERATURE SENSOR NO SIGNAL
342 MAJOR MONITORING ALARM(S)
343 MINOR MONITORING ALARM(S)
344 Monitoring LED Messages
345 MONITORING DOES NOT RESPOND
346 CONTROLLER FAILURE ####
347 THE CONTROLLER IS INITIALIZING
348 TOTAL LOAD CURRENT ALARM
349 GROUP A LOAD CURRENT ALARM
350 GROUP B LOAD CURRENT ALARM
351 THE DISPLAY DOES NOT RESPOND
352 SYSTEM OUTPUT SENSE vv.vvV
353 TOTAL LOAD CURRENT aaaaaA
354 GO TO ALARM LOG MENU
355 GO BACK TO MENU TREE BEGINNING
PCU REPLACEMENT MENU
439 REPLACE ### PCUs? AUTO IN ###
440 REPLACE ### PCUs MANUALLY?
444 REPOPULATE ### SLOTS? AUTO IN ### ?
MANUAL PCU REPLACEMENT MENU (NS702/801 only)
441 BAY ###
442 REPLACE PCU B#-P#
443 REPLACE PCU B#-P# W/ SN#

6.1.16 External Control Circuits

(A) Remote Test/Equalize: All Rectifier Modules can be placed into the test/equalize mode by applying a loop closure signal. The Rectifier Modules operate in the float mode when the loop closure signal is absent.

(B) Remote High Voltage Shutdown: The high voltage shutdown circuit on all Rectifier Modules, as described in Paragraph 3.4.6 (C), can be activated by applying a loop closure signal. This feature is to be used only when the system is connected to battery. See Section 6016 (Installation Instructions) for details.

(C) Rectifier Module Emergency Shutdown and Fire Alarm Disconnect: The Rectifier Modules can be inhibited by applying a loop closure signal. Manual restart is required. This feature is to be used only when the system is connected to battery. See Section 6016 (Installation Instructions) for details.

(D) External "System Voltage" Meter Reading: Leads can be extended from the MCA to an external voltage source. This is the voltage source the MCA monitors for system alarms and displays as "System Output Voltage".

(E) Test Input: The High Voltage Shutdown and/or Rectifier Module Emergency Stop circuits can be tested without affecting the system by applying a test loop closure signal before applying the Remote High Voltage Shutdown or Rectifier Module Emergency Shutdown loop closure signal.

6.1.17 Optional MCA Relay Circuit Card, P/N 514348: Each circuit card adds six (6) Form-C external alarm relay contacts to the system. Plugs into seven-slot card cage provided in each bay for optional MCA and LMS I/O cards.

(A) Contact Rating: 2A at 30 VDC.

(B) Description of Operation: The MCA provides 25 programmable function channels. Program each function channel to alarm for selected conditions, then program each external alarm relay to activate if a specific function channel alarms.

MCA relays can also be programmed to activate if an LMS LED channel activates.

6.1.18 Optional MCA Input/Output (I/O) Circuit Card, P/N 524550: This I/O card provides capability for monitoring of external shunts and binary signals. Plugs into seven-slot card cage provided in each bay for optional MCA and LMS I/O cards. Provides 1 analog input, 1 analog output (for remote plant output current monitoring), and 4 binary inputs.

(A) One analog input with a range of 0-50mV can be used to provide monitoring of additional load shunt or a plant load shunt.

(B) Four binary inputs can be used to monitor dry contact closures. When the “Alternate Current Limit” feature is used, binary input #4 is assigned to monitor the signal used to trigger the MCA to place the rectifiers in the Alternate Current Limit mode.

(C) One analog output with a 50mV full scale output provides a value to indicate the “Total Load Current” parameter of the NPS system.

The reading displayed for the NPS system parameter “Total Load Current” is derived from one of two algorithms using multiple data sources. The algorithm and its data sources used are determined by the presence and configuration of CAN I/O card(s) in the system.

1) Algorithm #1: This source is used when there are no CAN I/O cards installed OR when the configuration of all installed CAN I/O cards is set to “Distribution” mode.

“Distribution” Mode Operation:

“Total Load Current” =
NPS bay distribution node current readings,
+ CAN I/O card analog input readings,
+ LMS function channel 63 reading.

The VPS ‘*Total System Current*’ reading (LMS channel A9002) will be passed to the NPS through LMS function channel sixty-three. The function channel configuration will default to provide the reading of the associated LMS channel for the VPS Total System Current. The NPS controller will include the value of LMS function channel sixty-four when summing the distribution load currents to determine its Total Load Current reading to display. (associated LMS channel A9903).

Channel F63 program line is ‘F63 = A9002’ (Vortex Total Load Current).

2) Algorithm #2: This source is used when the configuration of at least one installed CAN I/O card is set to “Auxiliary” mode.

“Auxiliary” Mode Operation:

“Total Load Current” =

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Sum of CAN I/O card analog input readings (only input readings of cards configured for “Auxiliary” operation are summed),
+ LMS function channel 63 reading.

The reading displayed for the NPS system parameter “Total Auxiliary Load” is derived from the sum of all analog input readings of CAN I/O cards configured for “Auxiliary” mode operation.

7. OPTIONAL LMS MONITORING SYSTEM

   Refer to SAG586505000

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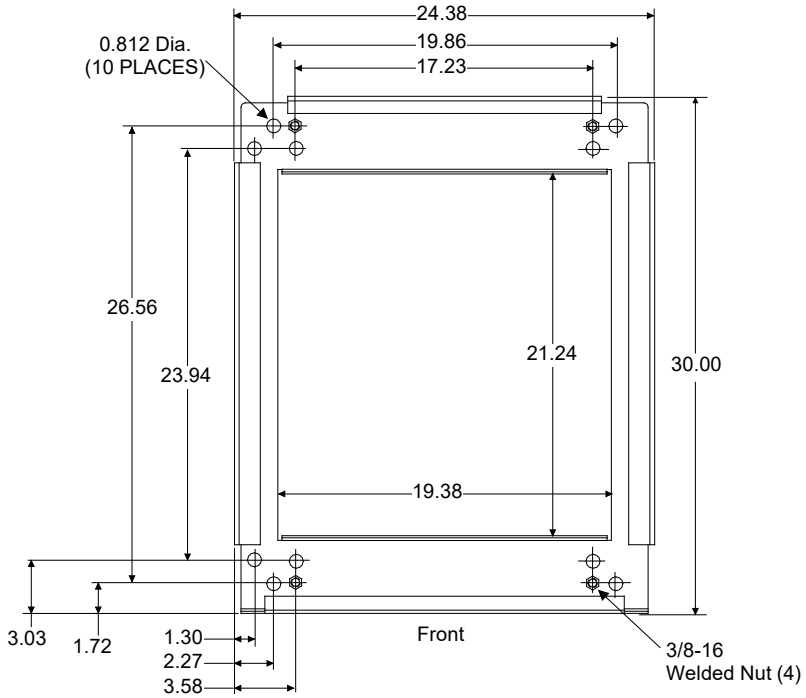
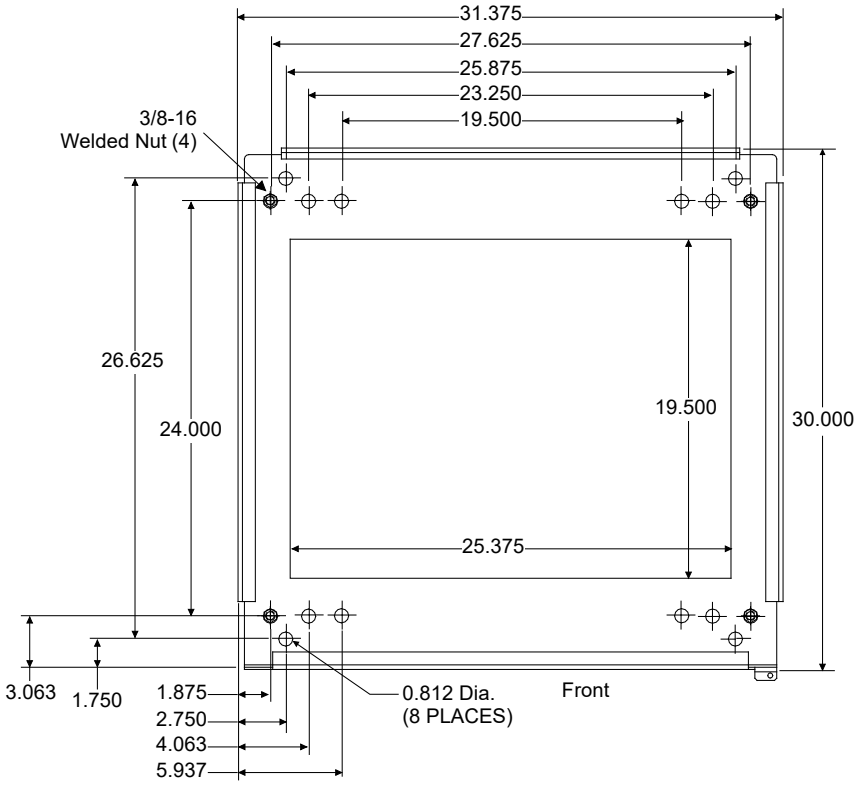
MECHANICAL SPECIFICATIONS

Floor Hole Drilling Pattern Dimensions - Power Bays



Floor Hole Drilling Pattern Dimensions - Distribution Bays



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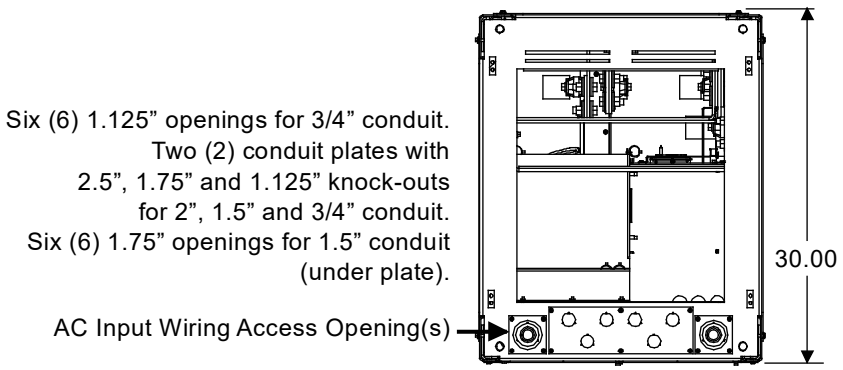
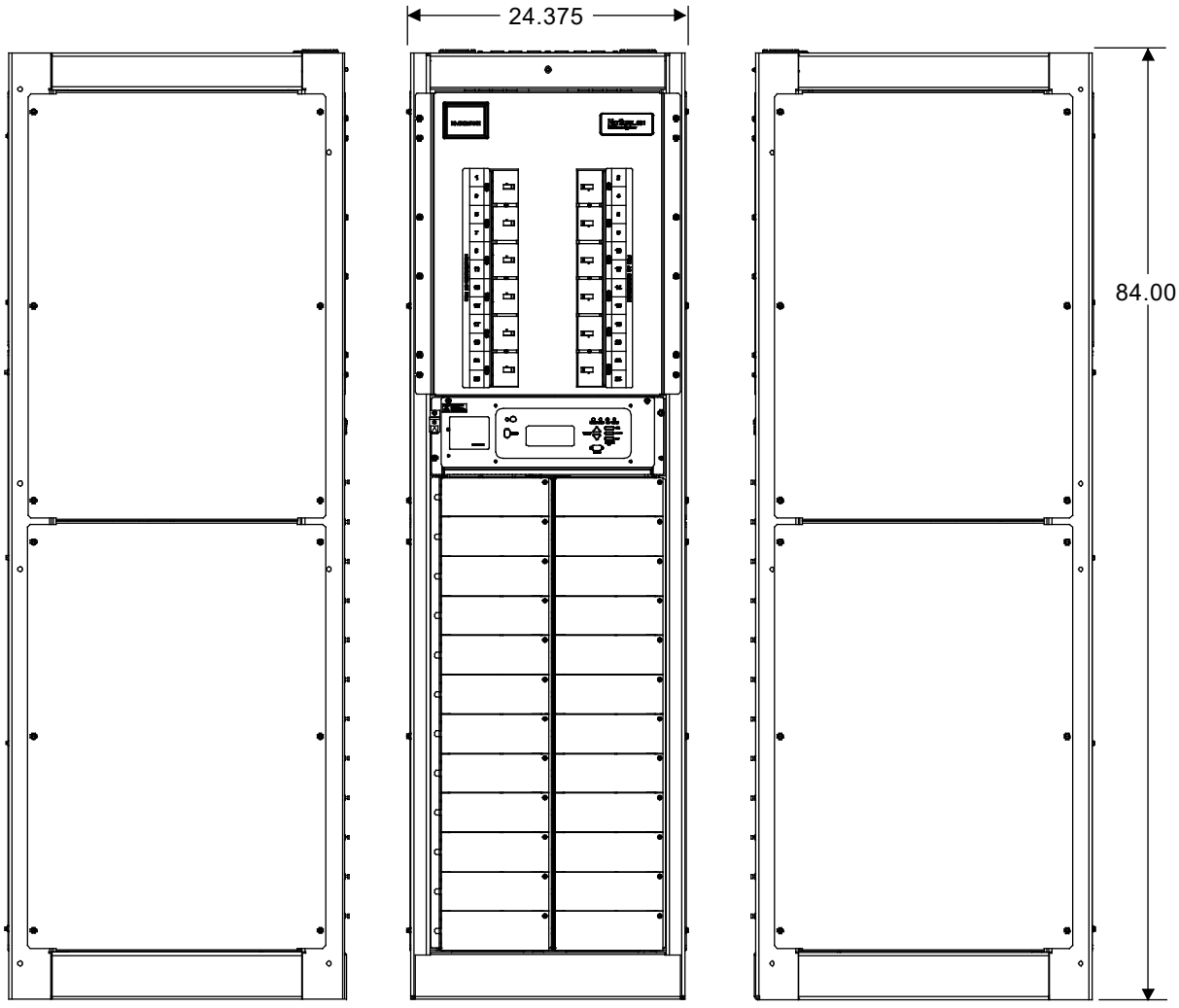
Overall Dimensions - Primary and Secondary Power Bays



Top View

Notes:
1. All dimensions are in inches unless otherwise specified.
2. Weight in Lbs:
   Bay
      Net: 548
      Shipping: 603
   Rectifier
      Net: 17.8
      Shipping: 20
3. Finish: Gray



Left Side View | Front View | Right Side View

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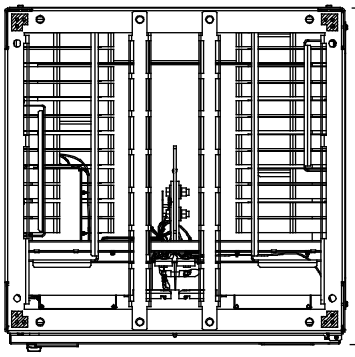
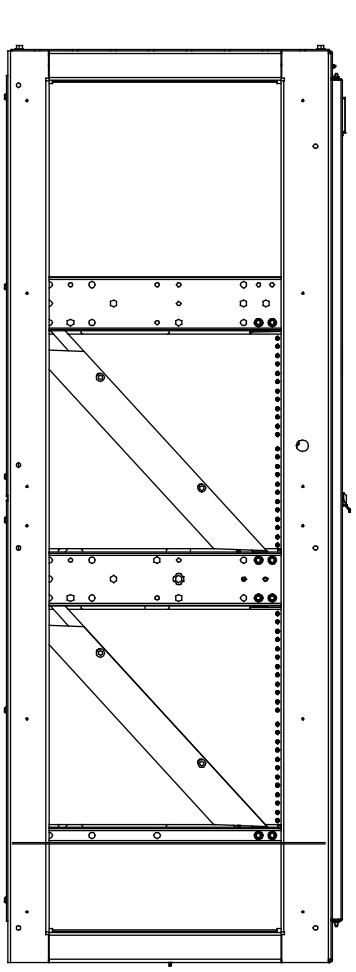
Overall Dimensions - Distribution Bays

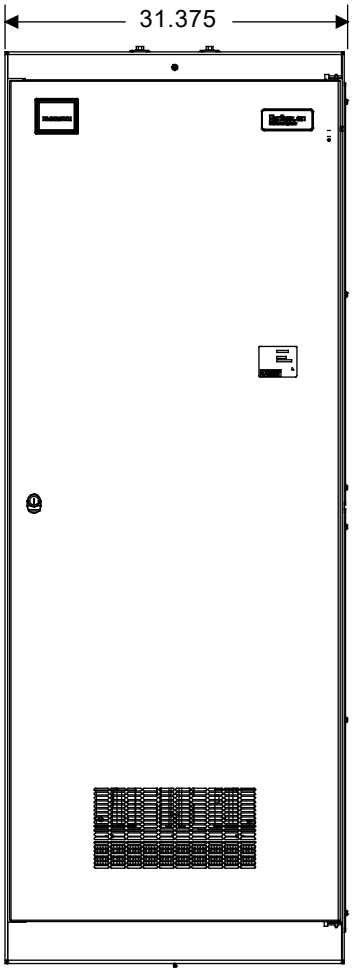


Top View

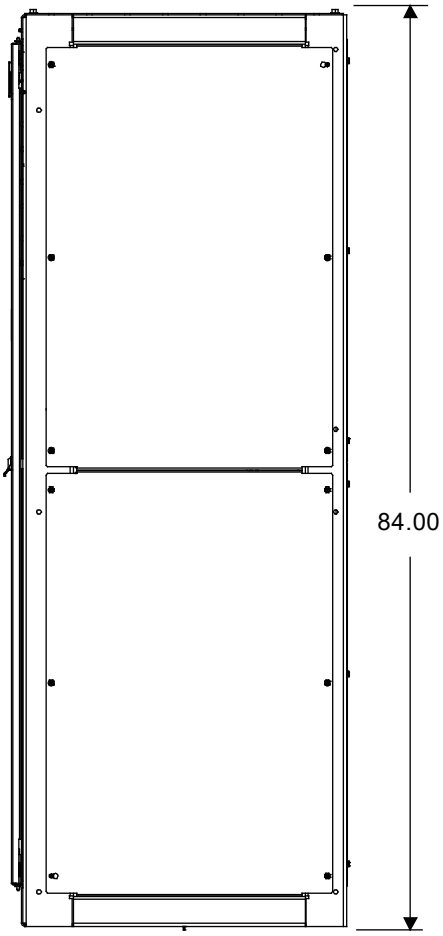
Notes:
1. All dimensions are in inches unless otherwise specified.
2. Weight in Lbs:
   Net: 916
   Shipping: 972
3. Finish: Gray



Left Side View



Front View



Right Side View

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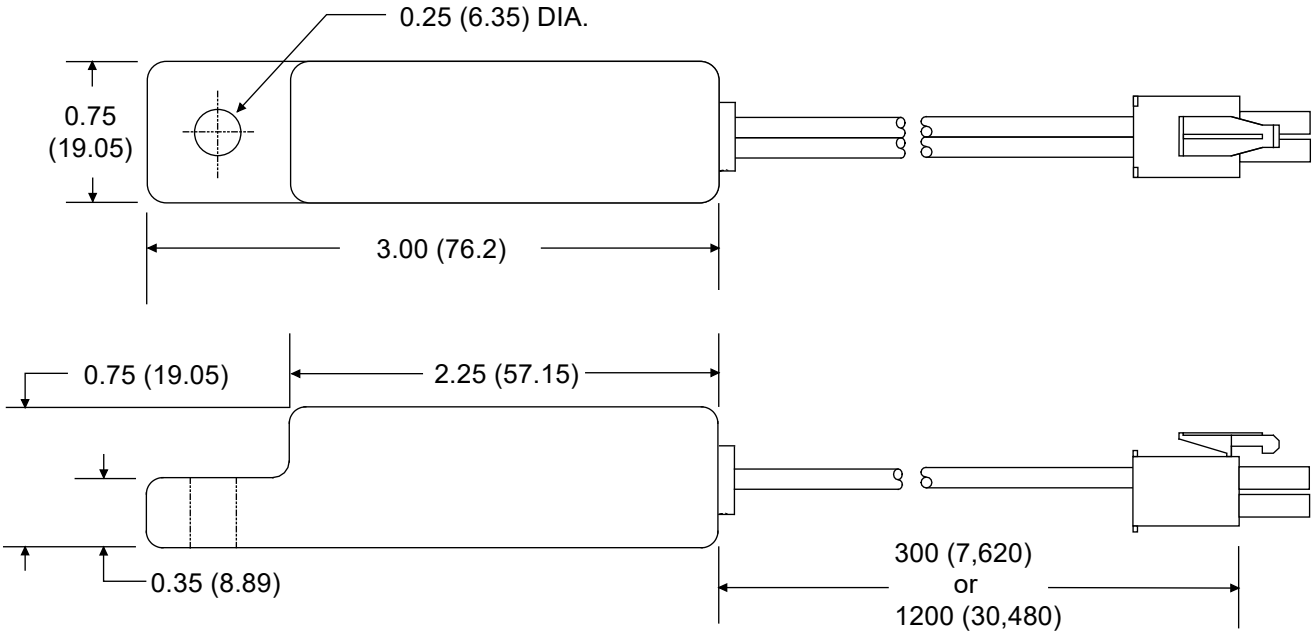
Overall Dimensions – Optional Battery Charge Digital Temperature Compensation Probes P/N 107021 (25 feet) and P/N 106824 (100 feet)



NOTE: All dimensions are in inches and (millimeters).

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RELATED DOCUMENTATION

System Installation Instructions:	Section 6016
System User Instructions:	Section 6017
Color MCA Menu Tree:	Section 5886
System Equipment and Assembly Drawing:	J582140001
System Schematic Diagram:	SD582140001
System Wiring Diagram:	T582140001
LMS Installation Instructions:	Section 5879
LMS User Instructions:	Section 5847
LMS System Application Guide:	SAG586505000
LMS I/O Circuit Card Label Sheet:	520538
LMS Expansion Assembly Schematic Diagram:	SD507606

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