



NetSure™ 710NPBA +24 VDC Power System

Installation Manual

Specification Number: 581127000

Model Number: 710NPBA

The information contained in this document is subject to change without notice and may not be suitable for all applications. While every precaution has been taken to ensure the accuracy and completeness of this document, Vertiv assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions. Refer to other local practices or building codes as applicable for the correct methods, tools, and materials to be used in performing procedures not specifically described in this document.

The products covered by this instruction manual are manufactured and/or sold by Vertiv. This document is the property of Vertiv and contains confidential and proprietary information owned by Vertiv. Any copying, use or disclosure of it without the written permission of Vertiv is strictly prohibited.

Names of companies and products are trademarks or registered trademarks of the respective companies. Any questions regarding usage of trademark names should be directed to the original manufacturer.

Technical Support Site

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

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

TABLE OF CONTENTS

Admonishments Used in this Document	v
Important Safety Instructions	vi
Safety Admonishments Definitions.....	vi
Safety and Regulatory Statements.....	vi
Déclarations de Sécurité et de Réglementation.....	vi
1 Customer Documentation Package	1
2 Installation Acceptance Checklist	1
3 Installing the System	3
3.1 General Requirements.....	3
3.2 Physical Security.....	4
3.3 Securing the Relay Rack to the Floor.....	4
3.4 Mounting System Components in an Equipment Rack.....	8
3.4.1 Mounting the Distribution Cabinet with Module Mounting Assembly.....	8
3.4.2 Installing a 581127000 List 93 Battery Tray.....	11
3.5 Installing Optional Battery Busbar Extension Kit, Part No. 562364.....	15
3.6 Installing Optional Lug Adapter Busbar Kits, Part Nos. 534449 and 514714.....	17
3.7 Installing Optional Lug Adapter Busbar Kit, Part No. 562888.....	19
3.8 Installing Optional Second IB2 (Controller Interface Board) or Optional Second EIB (Controller Extended Interface Board).....	21
3.9 Installing Circuit Breakers and Fuses.....	23
4 Setting Jumpers and Switch Options	36
4.1 Circuit Card Locations.....	36
4.2 Jumpers on System Interface Circuit Card.....	37
4.3 Switch Settings on IB2 Interface Board.....	39
4.4 Switch Setting on Optional EIB Interface Board.....	39
4.5 Switch Setting on SM-DU+.....	42
5 Making Electrical Connections	44
5.1 Important Safety Instructions.....	44
5.2 Wiring Considerations.....	44
5.3 Relay Rack Grounding Connection (Frame Ground).....	45
5.4 Central Office Ground Connection.....	45
5.5 AC Input and AC Input Equipment Grounding Connections (if List A1 not furnished).....	47
5.6 AC Input, AC Output, and Frame Ground Connections to List A1 (if furnished).....	59
5.6.1 General.....	59
5.6.2 Removing and Installing the AC Termination Panel Access Cover.....	59
5.6.3 Connections for the PCU Mounting Shelf.....	59
5.6.4 Connections for the Inverter(s).....	60
5.7 External Alarm, Reference, Monitoring, and Control Connections.....	63
5.7.1 Circuit Card Locations.....	63
5.7.2 System Interface Circuit Card.....	64
5.7.3 IB2 (Controller Interface Board) Connections (if required).....	66
5.7.4 Optional EIB (Controller Extended Interface Board) Connections (if required).....	71

- 5.7.5 Optional SM-DU+ and Shunt Interface Board76
- 5.7.6 Connecting a Device or System to the Controller’s CAN Bus78
- 5.8 Controller Ethernet Connection (if required)79
- 5.9 Control Bus Connections between Controller and Module Mounting Shelves83
- 5.10 Connecting Converter Output Cables 581127000 List 6085
- 5.11 Load Connections88
 - 5.11.1 Recommended Torques88
 - 5.11.2 Load Connections to Single Voltage Distribution Panels89
 - 5.11.3 Load Connections to Dual Voltage Distribution Panels94
 - 5.11.4 Load Connections to Return Bar99
 - 5.11.5 Load Connections to Bulk Output Panel99
 - 5.11.6 Load Connections to GMT Distribution Fuse Block100
- 5.12 DC Output Connections to List D2 and/or D3 DC-DC Converters101
- 5.13 Battery Connections102
 - 5.13.1 Important Safety Instructions102
 - 5.13.2 Recommended Torques102
 - 5.13.3 Battery Connections to Optional Battery Disconnect Distribution Panels102
 - 5.13.4 Battery Connections to Distribution Cabinet Battery Busbars106
 - 5.13.5 Battery Connections to Optional Battery Busbar Extension Kit P/N 562364108
 - 5.13.6 Battery Connections to Optional Battery Landing Busbar Kit P/N 553584109
 - 5.13.7 Battery Connections to Optional Battery Landing Busbar Kit P/N 555478110
- 5.14 Installing and Connecting Batteries in List 93 Battery Tray (if furnished)111
- 6 Installing the Rectifier and DC-DC Converter Modules 119**
- 7 Initially Starting, Configuring, and Checking System Operation 121**
- 7.1 Initial Startup Preparation 121
- 7.2 Initially Starting the System 121
- 7.3 ACU+ Controller Procedure 121
- 7.4 NCU Controller Procedure 128
- 7.5 Checking System Status 133
- 7.6 Final Steps 134

Admonishments Used in this Document



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



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



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



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



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



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



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

Important Safety Instructions

Safety Admonishments Definitions

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

Safety and Regulatory Statements

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

Déclarations de Sécurité et de Réglementation

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

1 Customer Documentation Package

This document (IM581127000) provides *Installation Instructions* for Vertiv™ NetSure™ +24 VDC Power System Model 710NPBA, Spec. No. 581127000.

The complete Customer Documentation Package consists of...

Power System Installation Manual

- Power System Installation Instructions: IM581127000

ACU+ Controller User Manual

- ACU+ Controller User Instructions: UM1M820BNA

NCU Controller User Manual

- NCU Controller User Instructions: UM1M830BNA

USB Drive with All Customer Documentation

- Power System Quick Start Guide: QS581127000
- Power System Installation Instructions: IM581127000
- Power System User Instructions: UM581127000
- ACU+ Controller User Instructions: UM1M820BNA
- NCU Controller User Instructions: UM1M830BNA
- Power System “System Application Guide”: SAG581127000
- Module Mounting Shelf Power Data Sheet: PD588705200 (PD588705201, PD588705202, PD588705203, PD588705204)
- Rectifier Instructions: UM1R243000
- Converter Instructions: UM1C24481500
- NCU Controller 2nd Ethernet Port Add-On Kit Instructions: IM559252
- NCU Controller 2nd Ethernet Port Retrofit Kit Instructions: IM559251
- Engineering Drawings
- Also provided on the USB drive is a controller configuration drawing and the controller configuration files loaded into the controller as shipped.

2 Installation Acceptance Checklist

Provided in this section is an Installation Acceptance Checklist. This checklist helps ensure proper installation and initial operation of the system. As the procedures presented in this document are completed, check the appropriate box on this list. If the procedure is not required to be performed for your installation site, also check the box in this list to indicate that the procedure was read. When installation is done, ensure that each block in this list has been checked. Some of these procedures may have been factory performed for you.



NOTE! The system is not powered up until the end of this checklist.



NOTE! Some of these procedures may have been performed at the factory for you.

Installing the System

- Relay Rack Secured to Floor
- System Components Mounted in Relay Rack (if required)
- Optional Lug Adapter Busbar Kits Installed
- Circuit Breakers Installed
- Fuses Installed

Setting Jumper and Switch Options

- Jumpers on System Interface Circuit Card Set
- Factory Switch Setting on IB2 Interface Board Verified
- Factory Switch Setting on Optional EIB Interface Board Verified
- Factory Switch Setting on Optional SM-DU+ Verified

Making Electrical Connections

- Relay Rack Grounding Connection (Frame Ground) Made
- Central Office Ground Connection Made
- AC Input and AC Input Equipment Grounding Connections Made
- External Alarm, Reference, Monitoring, and Control Connections Made
- Ethernet Connection Made (if required)
- Load Connections Made
- Battery Connections Made
 - a) Batteries Installed and Connected in an optional Battery Tray (if furnished)
 - b) Optional Battery Tray Front Battery Covers Installed (if furnished)
 - c) Optional Battery Tray Circuit Breaker Guards Installed (if furnished)

Installing the Modules

- Rectifier and Converter Modules Installed

Initially Starting the System

- System Started, Configured, and Checked

3 Installing the System

3.1 General Requirements

- This product is intended only for installation in a restricted access location on or above a non-combustible surface.
- This product must be located in a controlled environment with access to Crafts persons only.
- This product is intended for installation in network telecommunication facilities (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).
- This product is intended for connection to the common bonding network in a network telecommunication facility (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).
- The DC return connection to this system can remain isolated from system frame and chassis (DC-I).
- This system is suitable for installation as part of the Common Bonding Network (CBN).
- The installer should be familiar with the installation requirements and techniques to be used in securing the relay rack to the floor.
- Rectifier, converter, and mounting shelf ventilating openings must not be blocked, and temperature of air entering rectifiers and converters must not exceed rated operating ambient temperature range found in SAG581127000.
- Clearance requirements are:
 - a) Recommended minimum aisle space clearance for the front of each bay is 2' 6".
 - b) Recommended minimum aisle space clearance for the rear of each bay is 2' 0" for any of the following conditions:
 - Addition of a module mounting assembly in the field.
 - Adding battery tray(s) in the field.
 - Any bay equipped with List A1 or A2 Inverters, or List D2 or D3 DC-DC Converters.
 - c) For all other conditions, required minimum spacing from the rear of the bay to a wall or other solid surface is that which is specified for proper module mounting shelf ventilation. Refer to the specific module mounting shelf Power Data Sheet or System Application Guide for ventilation spacing requirements.



NOTE! *Minimum spacing specified for ventilation may not permit replacement of certain components such as busbars or module mounting shelves.*

3.2 Physical Security

This product is designed and intended to be deployed and operated in a physically secure and network firewall-protected location. Vertiv recommends a review of the physical security and operating environment of the unit. Since an attacker or disgruntled user can cause serious disruption, below are some recommended best practices that include, but are not limited to:

- Restrict access to areas, racks, and units with encrypted card RFID/badges, unique multi-factor passcode authentication for access, man traps, and biometric scanners for physical access to the equipment.
- Have trusted and background-checked security guards with 24x7x365 physical presence and written logs to help document and note physical access to a data center, building, rack, and so on.
- Restrict physical access to telecommunications equipment and network cabling. Physical access to the telecommunications lines and network cabling should be restricted to protect against attempts to intercept or sabotage communications. Best practices include use of metal conduits for the network cabling running between equipment cabinets.
- All USB, RJ45, and/or any other physical ports should be restricted on the units.
- Do not connect removable media (such as USB devices, SD cards, and so on) for any operation (such as firmware upgrade, configuration change, or boot application change) unless the origin of media is known and trusted. Before connecting any portable device through a USB port or SD card slot, scan the device for malware and viruses.

3.3 Securing the Relay Rack to the Floor

All equipment cabinets are factory mounted to the relay rack(s) or shipping brackets specified when ordered.

Secure the relay rack to the floor per site requirements. Refer to “General Requirements” on page 3.

Ventilation Requirements

Refer to the “General Requirements” on page 3.

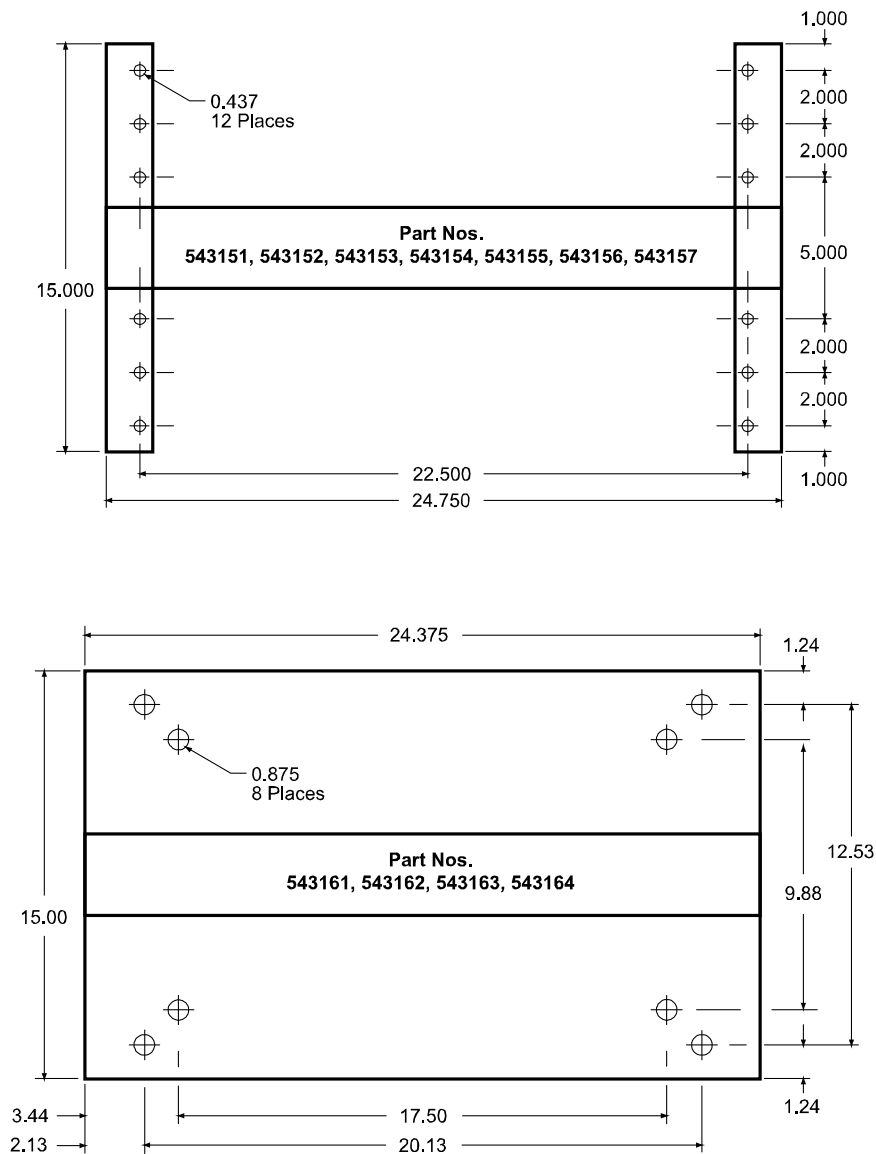
Relay Rack Floor Mounting Dimensions

Refer to Figure 3.1 for relay rack floor mounting dimensions.

Optional Relay Rack Isolation Kit

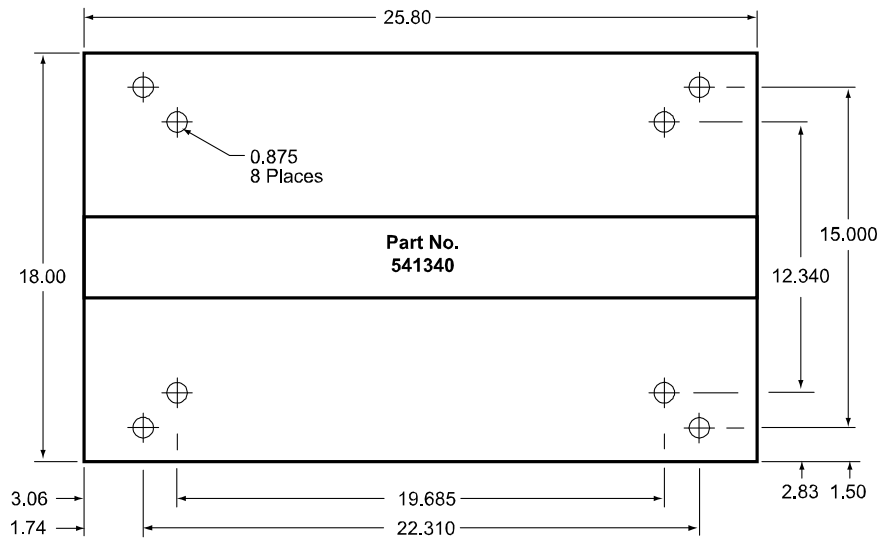
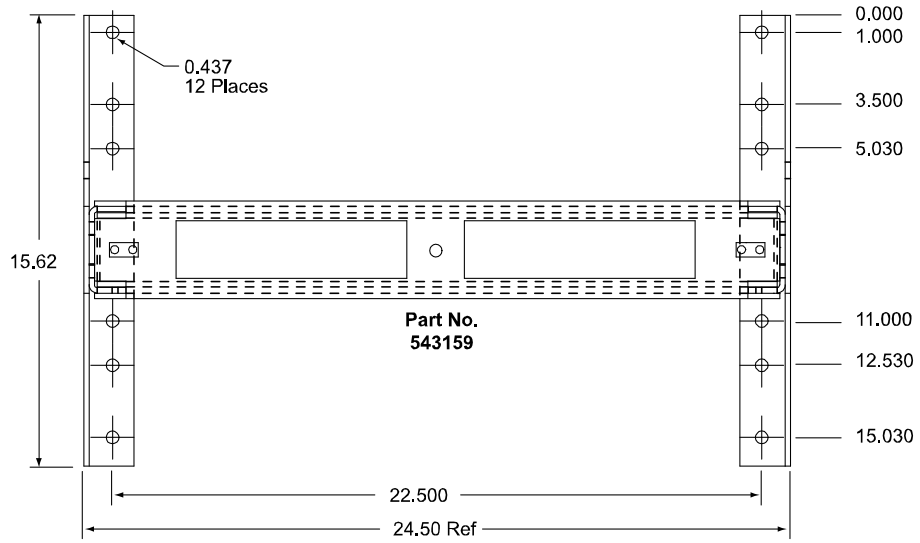
Refer to Figure 3.2 when using the optional Relay Rack Isolation Kit.

Figure 3.1: Relay Rack Floor Mounting Dimensions (cont'd on next page)



Notes:
 1. All dimensions are in inches.

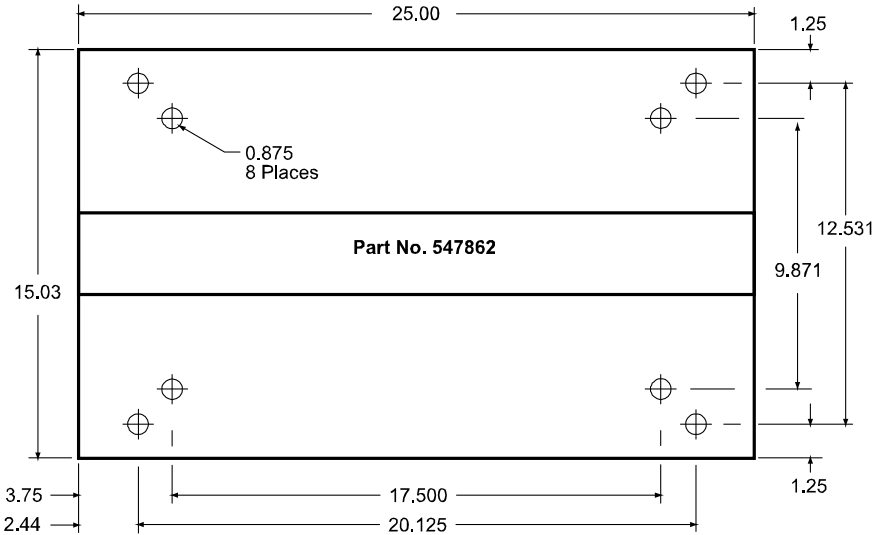
Figure 3.1: Relay Rack Floor Mounting Dimensions (cont'd from previous page, cont'd on next page)



Notes:

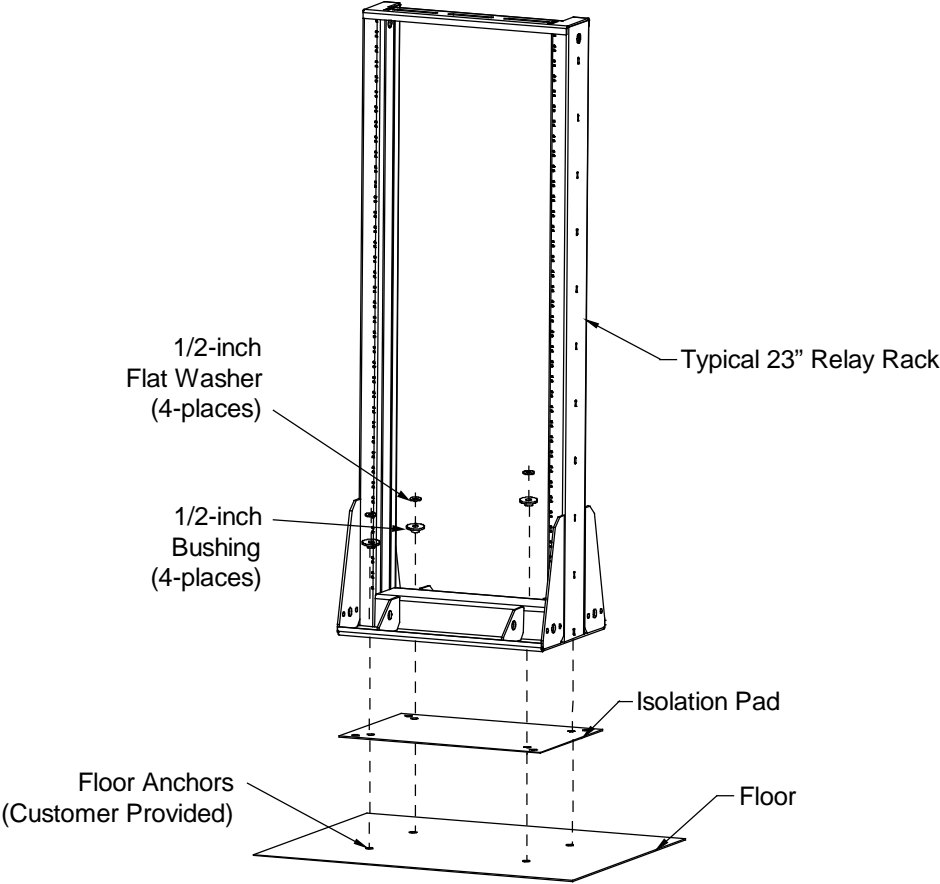
1. All dimensions are in inches.

Figure 3.1: Relay Rack Floor Mounting Dimensions (cont'd from previous page)



Notes:
1. All dimensions are in inches.

Figure 3.2: Optional Relay Rack Isolation Kit Mounting



3.4 Mounting System Components in an Equipment Rack



NOTE! If the power system was ordered in a relay rack, these procedures have been performed at the factory.

This power system is designed to mount in a standard 23" relay rack having 1" or 1-3/4" multiple drillings. Refer to System Application Guide SAG581127000 for overall dimensions and a list of available relay racks.

3.4.1 Mounting the Distribution Cabinet with Module Mounting Assembly



NOTE! The distribution cabinet is factory connected to the module mounting assembly. The distribution cabinet with module mounting assembly is mounted as a complete assembly.

The distribution cabinet with module mounting assembly must be the top-most component in the rack. Perform the following steps to mount the distribution cabinet with module mounting assembly.



DANGER! The relay rack must be securely anchored to the floor before the distribution cabinet with module mounting assembly is installed.



DANGER! The distribution cabinet with module mounting assembly is heavy. Use a hoist, battery lift, or other appropriate lifting device to raise and support the assembly during the installation. Take appropriate precautions to avoid injury.

Procedure

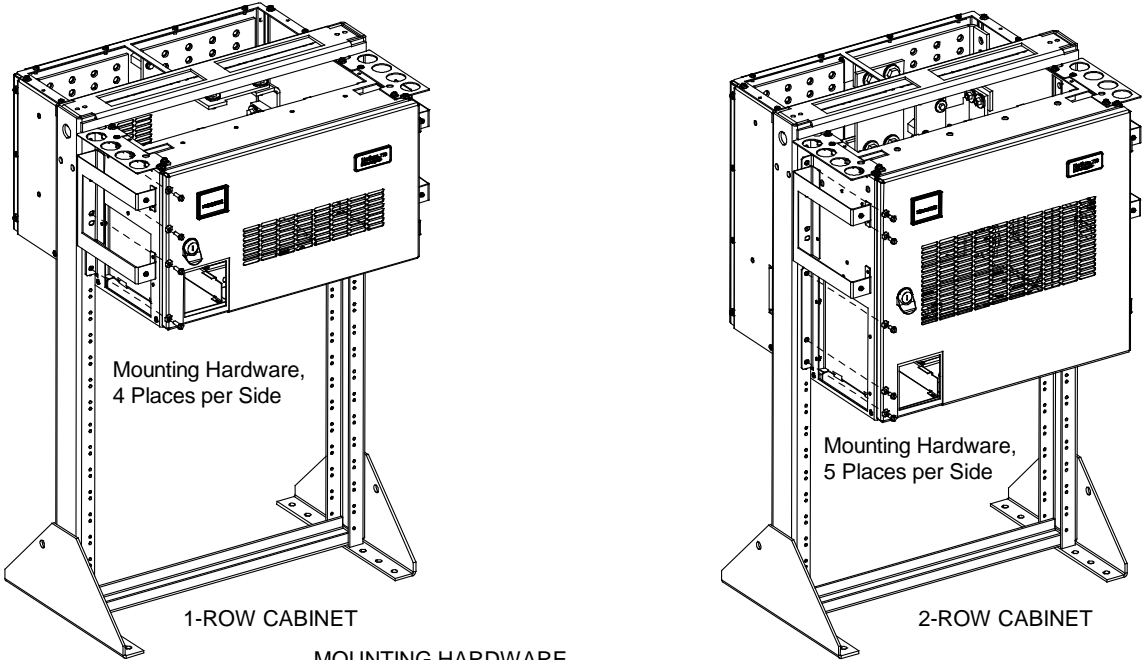
1. Remove the distribution cabinet with module mounting assembly from its shipping brackets. Position the assembly in the equipment rack. Note that part of the AC wireways will have to be temporarily removed from the distribution cabinet to access the mounting hardware.



NOTE! Install the ground washers so the teeth dig into the paint on the mounting angles. Torque all screws to 65 in-lbs.

2. Mount the distribution cabinet to the relay rack using the following hardware. Refer to Figure 3.3.
 - a) **1-Row Cabinet:** Install (8) 12-24 x 3/4" hex head thread-forming screws (P/N 218710600) and (8) No. 12 ground washers (P/N 215640600).
 - b) **2-Row Cabinet:** Install (10) 12-24 x 3/4" hex head thread-forming screws (P/N 218710600) and (10) No. 12 ground washers (P/N 215640600).
 - c) **3-Row Cabinet:** Install (12) 12-24 x 3/4" hex head thread-forming screws (P/N 218710600) and (12) No. 12 ground washers (P/N 215640600).
 - d) **4-Row Cabinet:** Install (16) 12-24 x 3/4" hex head thread-forming screws (P/N 218710600) and (16) No. 12 ground washers (P/N 215640600).
3. Mount the module mounting assembly to the relay rack using hardware as shown Figure 3.4.

Figure 3.3: Distribution Cabinet Mounting Hardware View



MOUNTING HARDWARE
12-24 X 1/2" THREAD FORMING HEX HEAD SCREW
NO. 12 GROUND WASHER

Module Mounting Shelf Assembly not shown for clarity only.

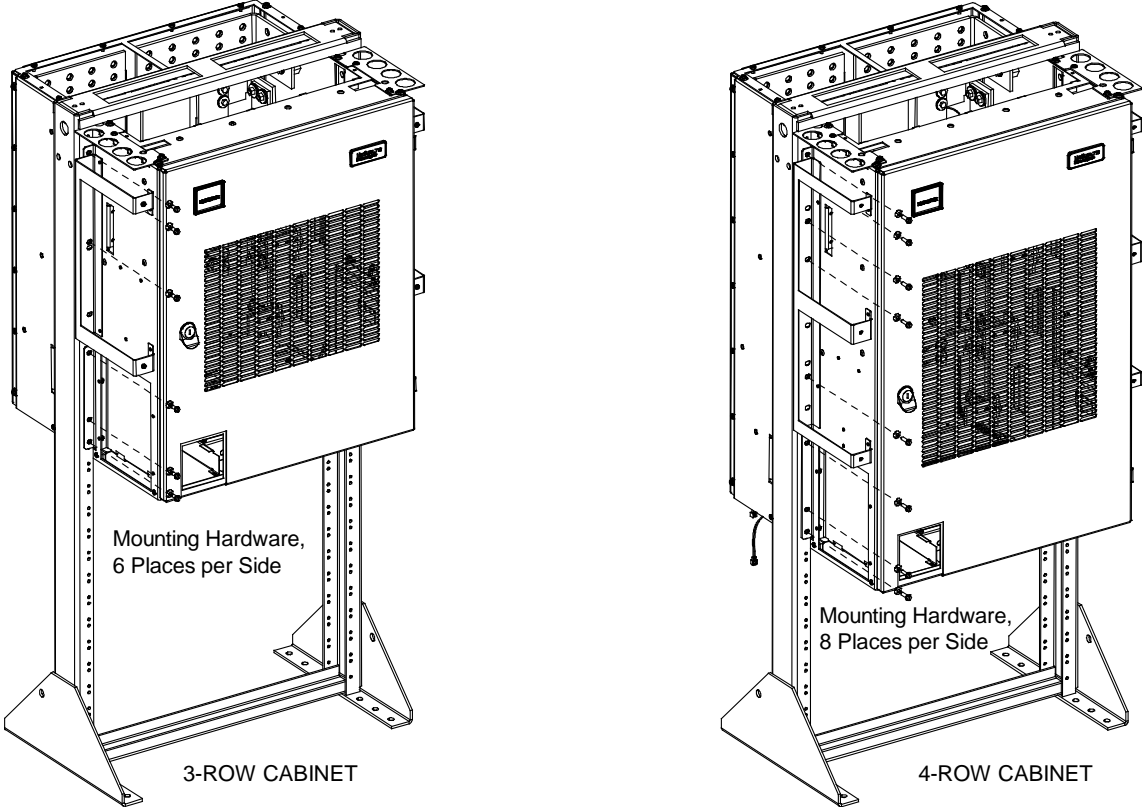
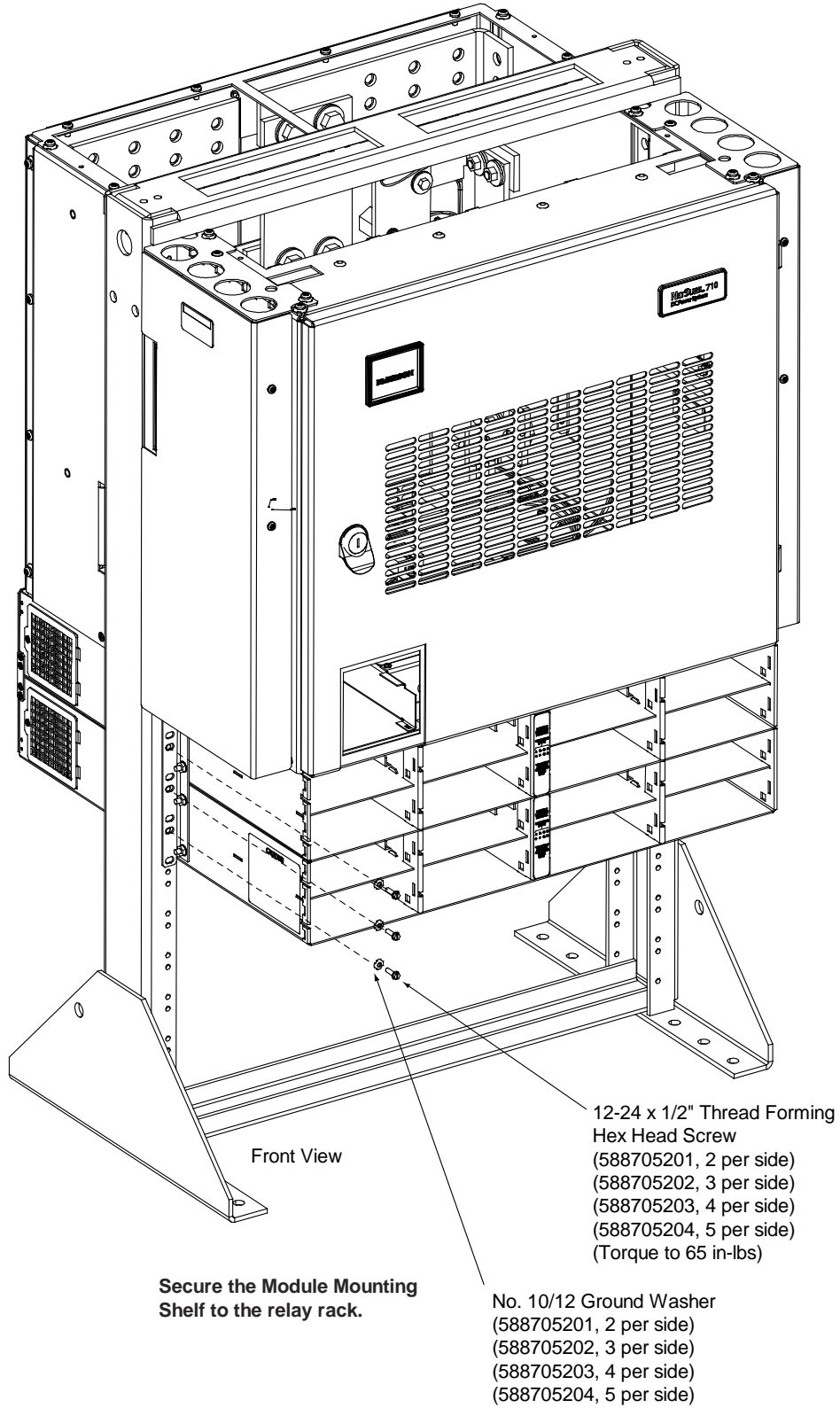


Figure 3.4: Module Mounting Assembly Mounting Hardware View



3.4.2 Installing a 581127000 List 93 Battery Tray

Perform the following procedures to install a 581127000 List 93 Battery Tray.



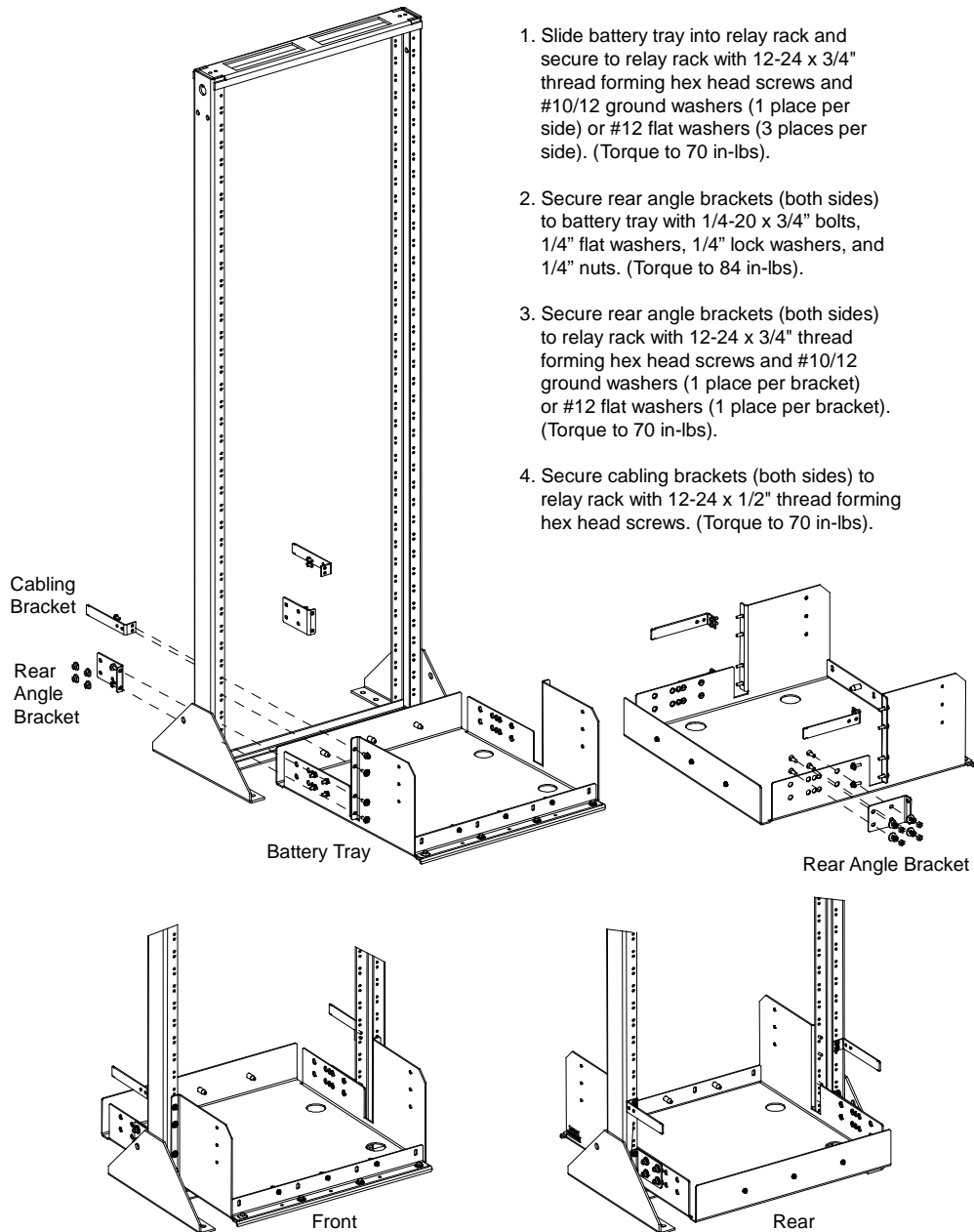
DANGER! The relay rack must be securely anchored to the floor before a battery tray is installed.

Installing a Battery Tray

Procedure

- To install a 581127000 List 93 Battery Tray, perform the procedure in Figure 3.5.

Figure 3.5: Installing a 581127000 List 93 Battery Tray

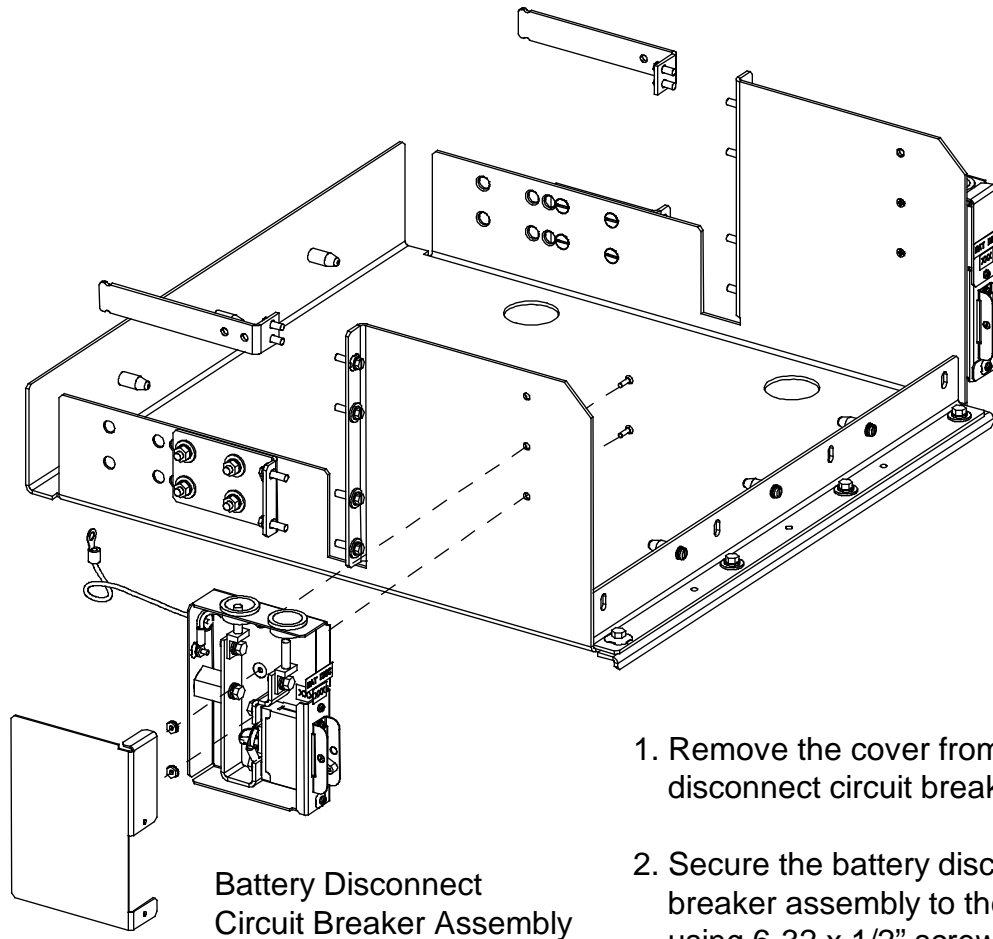


Installing Optional Battery Disconnect Circuit Breakers

Procedure

1. To install an optional battery disconnect circuit breaker onto the List 93 Battery Tray, perform the procedure in Figure 3.6.
2. Battery tray wiring is shown in “Installing and Connecting Batteries in List 93 Battery Tray (if furnished)” on page 111.

Figure 3.6: Installing Optional Battery Disconnect Circuit Breakers onto a List 93 Battery Tray



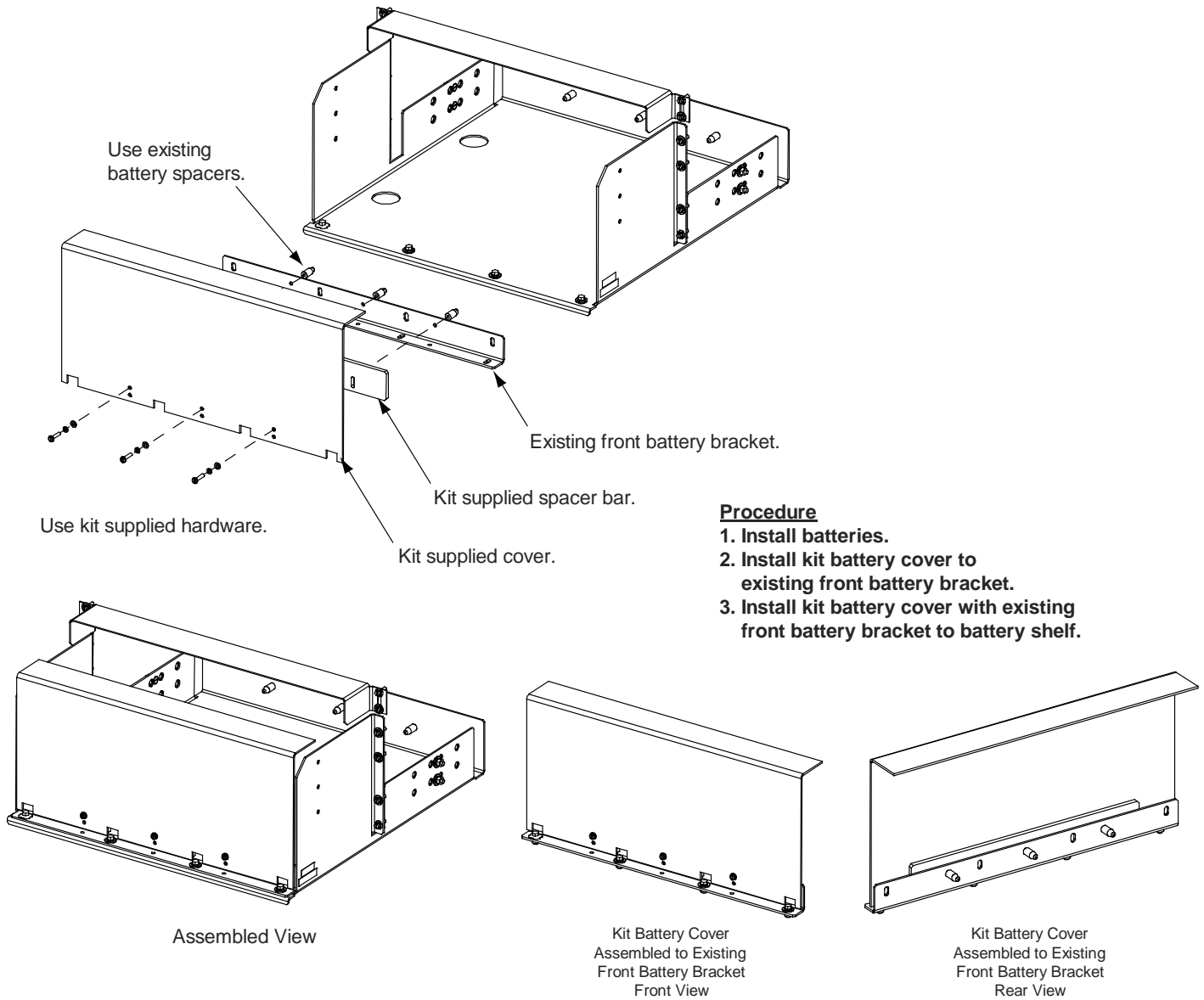
1. Remove the cover from the battery disconnect circuit breaker assembly.
2. Secure the battery disconnect circuit breaker assembly to the battery tray using 6-32 x 1/2" screws and 6-32 KEPS nuts (2-places).
3. Secure the ground lead under a battery tray relay rack mounting bolt.
4. After wiring to the battery disconnect circuit breaker, replace the cover.
5. Repeat for the other side of the battery tray.

Installing Optional Front Battery Cover

Procedure

- To install an optional front battery cover onto a List 93 Battery Tray, perform the procedure in Figure 3.7. Note that batteries must be installed first, as described in “Installing and Connecting Batteries in List 93 Battery Tray (if furnished)” on page 111.

Figure 3.7: Installing Optional Front Battery Cover onto a List 93 Battery Tray

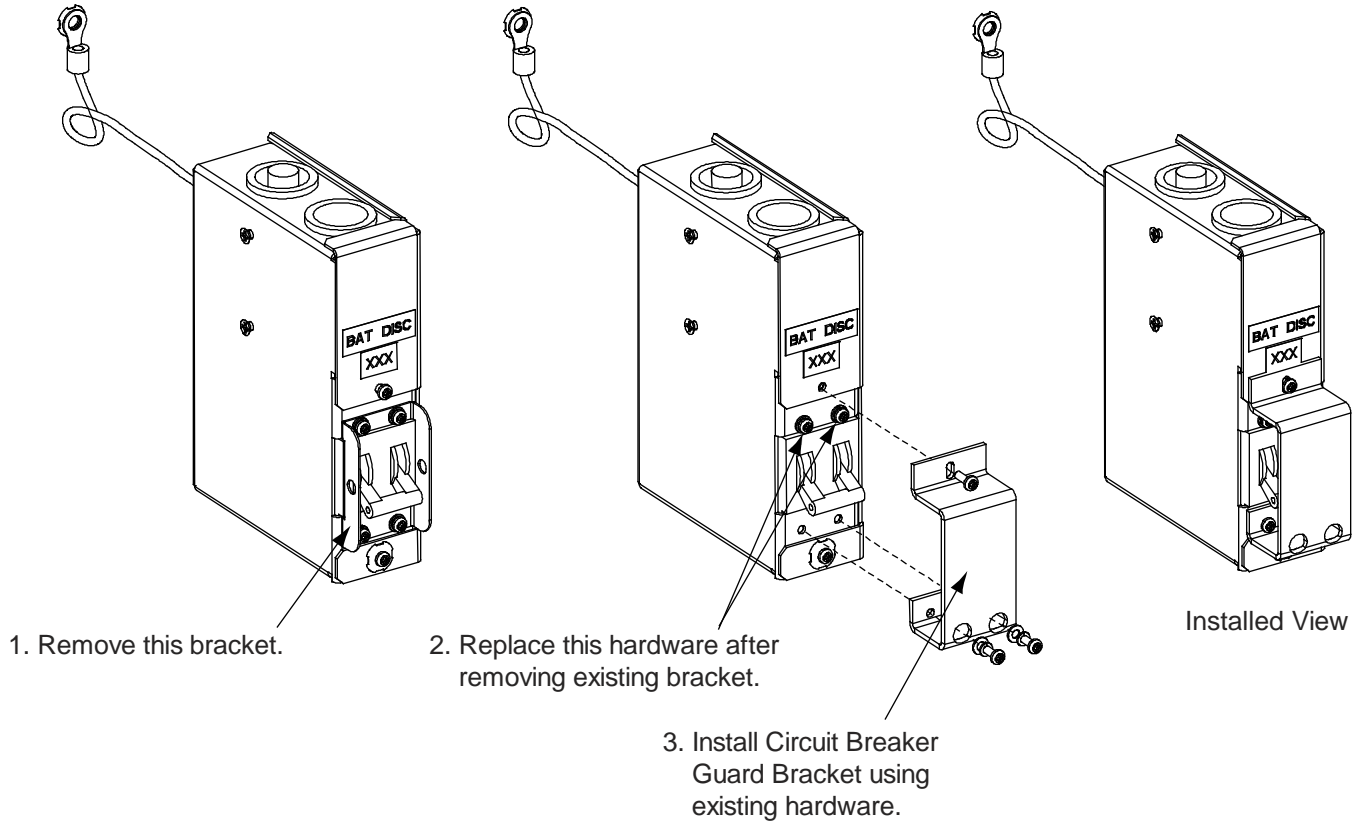


Installing Optional Circuit Breaker Guard

Procedure

1. To install an optional circuit breaker guard onto a battery disconnect circuit breaker, perform the procedure in Figure 3.8.

Figure 3.8: Installing Optional Circuit Breaker Guard



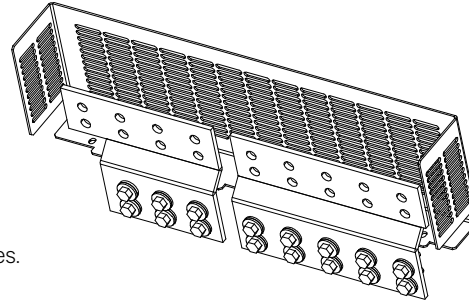
3.5 Installing Optional Battery Busbar Extension Kit, Part No. 562364

This kit provides plates that extend the system busbars above the top of a List 23 and List 24 distribution cabinet and increases the number of lug landings available for battery cables. This kit provides back-to-back landings for up to ten lugs for the hot side and eight lugs for the return side.

Installing Part No. 562364 Busbar Extension Kit

This kit consists of the following:

Qty.	Part No.	Description
1	562362	Return Side Extension Busbar
1	562363	Power Side Extension Busbar
1	562354	Cover Kit
16	214204100	3/8" Flat Washer
16	214825000	3/8" Belleville Washer
16	227646800	3/8-16 x 1-1/4" Bolt



Perform the following steps to install the battery busbar extension plates.

Procedure

Refer to Figure 3.9 as the procedure is performed.

1. Open the distribution cabinet front door.
2. Install busbar extension plates as shown in Figure 3.9. Apply anti-oxidizing compound to busbar mating surfaces before assembling. Tighten bolts to the recommended torque value shown in Figure 3.9.



NOTE! Install the Belleville lock washers so the concave side is towards the busbar.

3. Close the distribution cabinet access door.

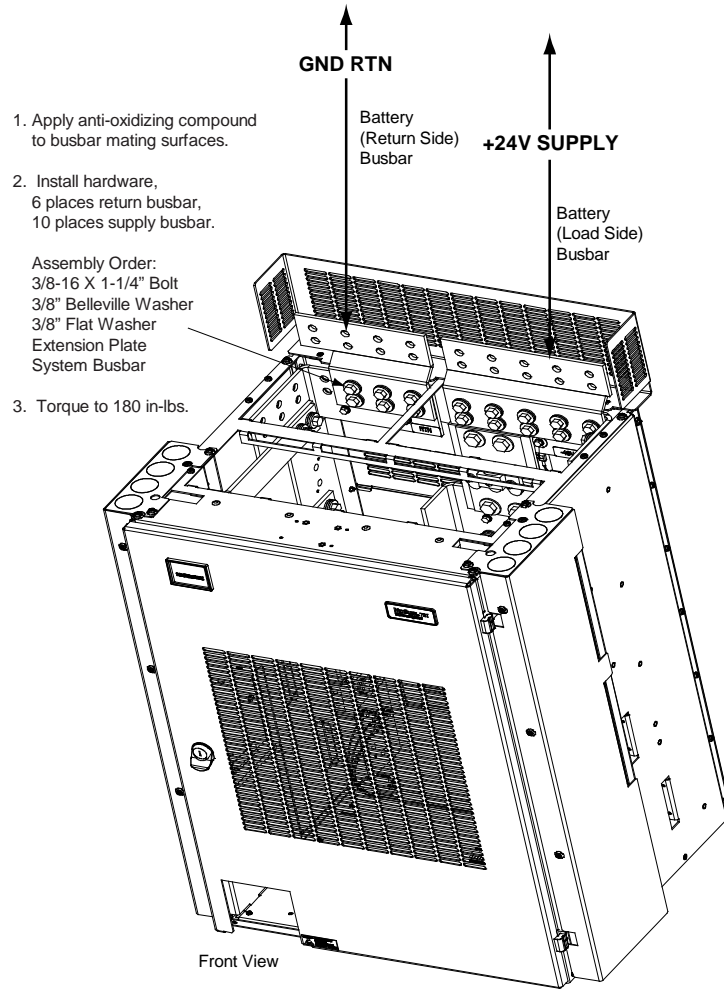
Perform the following steps to mount the Lexan cover.

Procedure

Refer to Figure 3.10 as the procedure is performed.

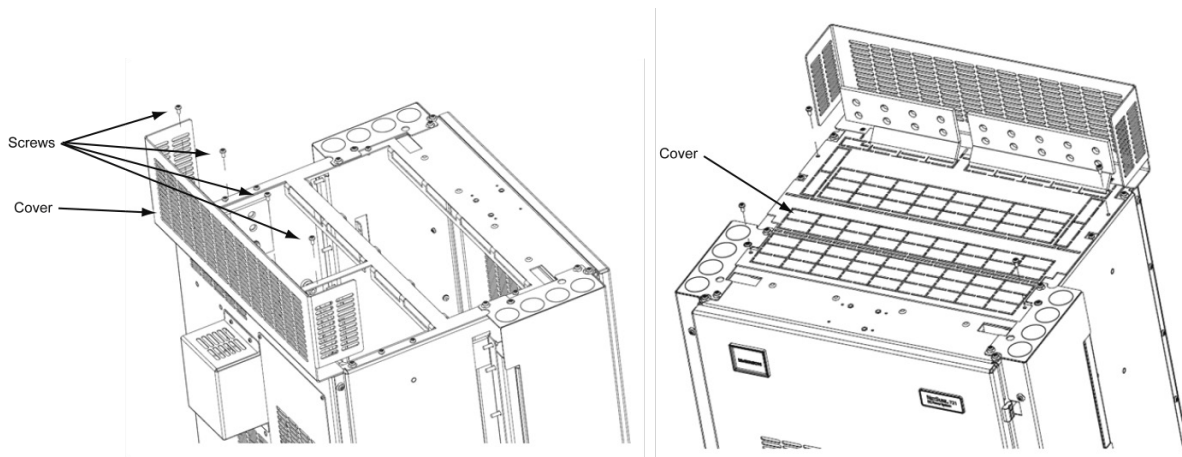
1. Loosen the four (4) screws at the back of the busbars.
2. Place the Lexan cover at the back of the busbars and use the four (4) screws to secure it.
3. Remove the four (4) screws at the top of the cabinet and place the cover.
4. Re-use the screws to secure the top cover.

Figure 3.9: Installing Battery Busbar Extension Kit, Part No. 562364



List 24 Distribution Cabinet
(List 23 similar)

Figure 3.10: Mounting the Lexan Cover



3.6 Installing Optional Lug Adapter Busbar Kits, Part Nos. 534449 and 514714

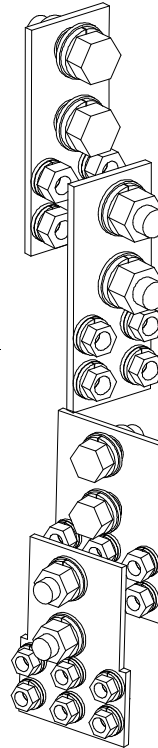
These kits provide lug adapter busbars plus hardware for use with 2-pole and 3-pole bullet circuit breakers.

Contents of Kit P/N 534449 (for 2-pole circuit breakers)

Qty.	Part No.	Description
1	534447	Busbar
1	534448	Busbar
8	214110100	Flat Washer, 1/4"
4	214112100	Flat Washer, 3/8"
8	215111100	Lock Washer, 1/4"
4	215111300	Lock Washer, 3/8"
4	227640400	Hex Head Bolt, 1/4-20 x 3/4" (not used)
2	227646600	Hex Head Bolt, 3/8-16 x 1"
8	228557100	Nut, 1/4-20
2	228567100	Nut, 3/8-16

Contents of Kit P/N 514714 (for 3-pole circuit breakers)

Qty.	Part No.	Description
1	514676	Busbar
1	514678	Busbar
12	214110100	Flat Washer, 1/4"
4	214112100	Flat Washer, 3/8"
12	215111100	Lock Washer, 1/4"
4	215111300	Lock Washer, 3/8"
6	227640400	Hex Head Bolt, 1/4-20 x 3/4" (not used)
2	227646600	Hex Head Bolt, 3/8-16 x 1"
12	228557100	Nut, 1/4-20
2	228567100	Nut, 3/8-16



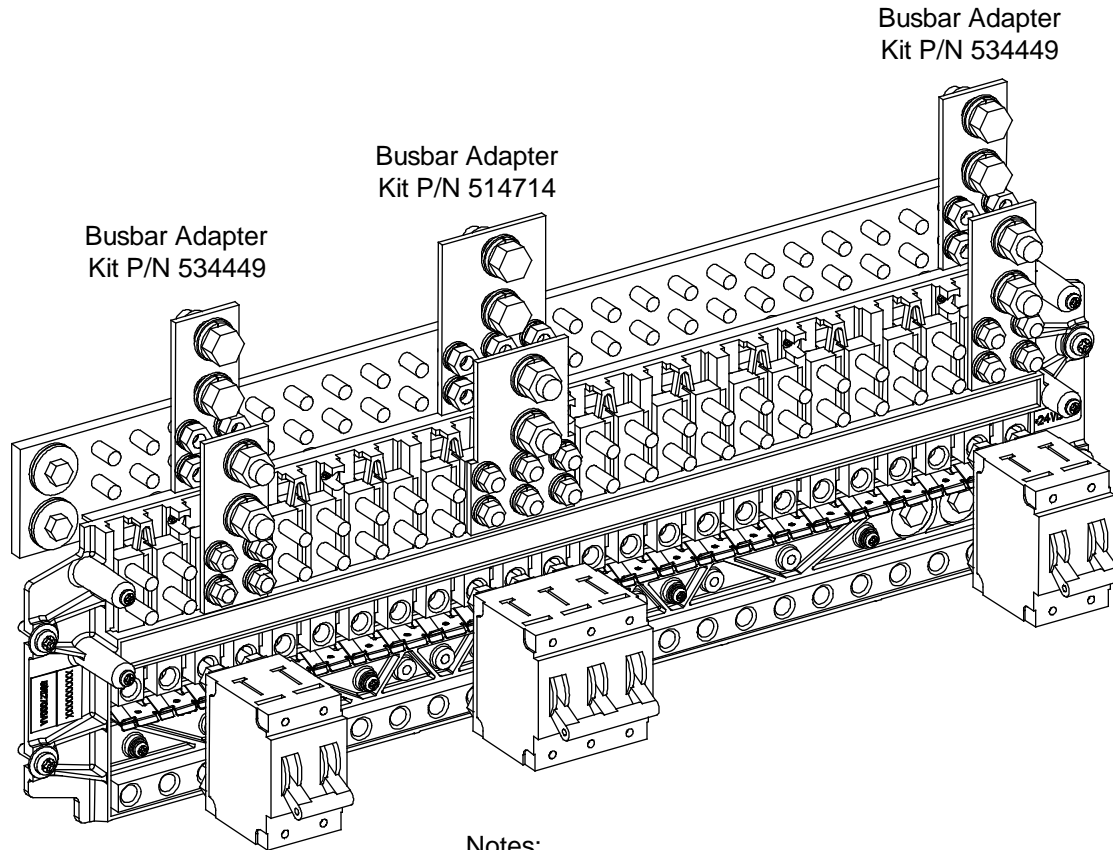
Perform the following steps to install the lug adapter busbars.

Procedure

Refer to Figure 3.11 as the procedure is performed. Note also the restrictions on location in Figure 3.11.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Install the lug adapter busbars as shown in Figure 3.11. Apply anti-oxidizing compound to busbar mating surfaces before assembling. Recommended torque is 72 in-lbs using the supplied 1/4" bolts and hardware.
3. Orient the load lug hardware as shown in Figure 3.11. Recommended torque is 300 in-lbs using the supplied 3/8" bolts and hardware.
4. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.11: Installing Lug Adapter Busbar Kits



Notes:

Orient busbars as shown.

Shield not shown. Remove breakaway areas from shield as required. Breakaways are only provided for positions 1-8, 9-12, and 23-24. This restricts 2 and 3-pole breaker adapter kits to be located in these positions only.

Circuit breaker locations for reference only.

3.7 Installing Optional Lug Adapter Busbar Kit, Part No. 562888

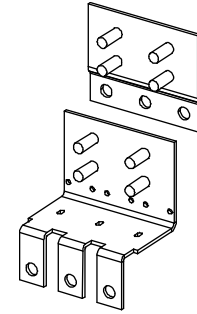
For use with List AM and List AP.

This kit provides lug adapter busbars for use with 3-pole GJ/218 circuit breakers.

Contents of Kit P/N 562888 (for 3-pole circuit breakers)

Qty.	Part No.	Description
1	562392	Busbar
1	562393	Busbar

Perform the following steps to install the lug adapter busbars.



Procedure

Refer to Figure 3.12 as the procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Install the lug adapter busbars as shown in Figure 3.12. Apply anti-oxidizing compound to busbar mating surfaces before assembling. Refer to Figure 3.12 for recommended torque.
3. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

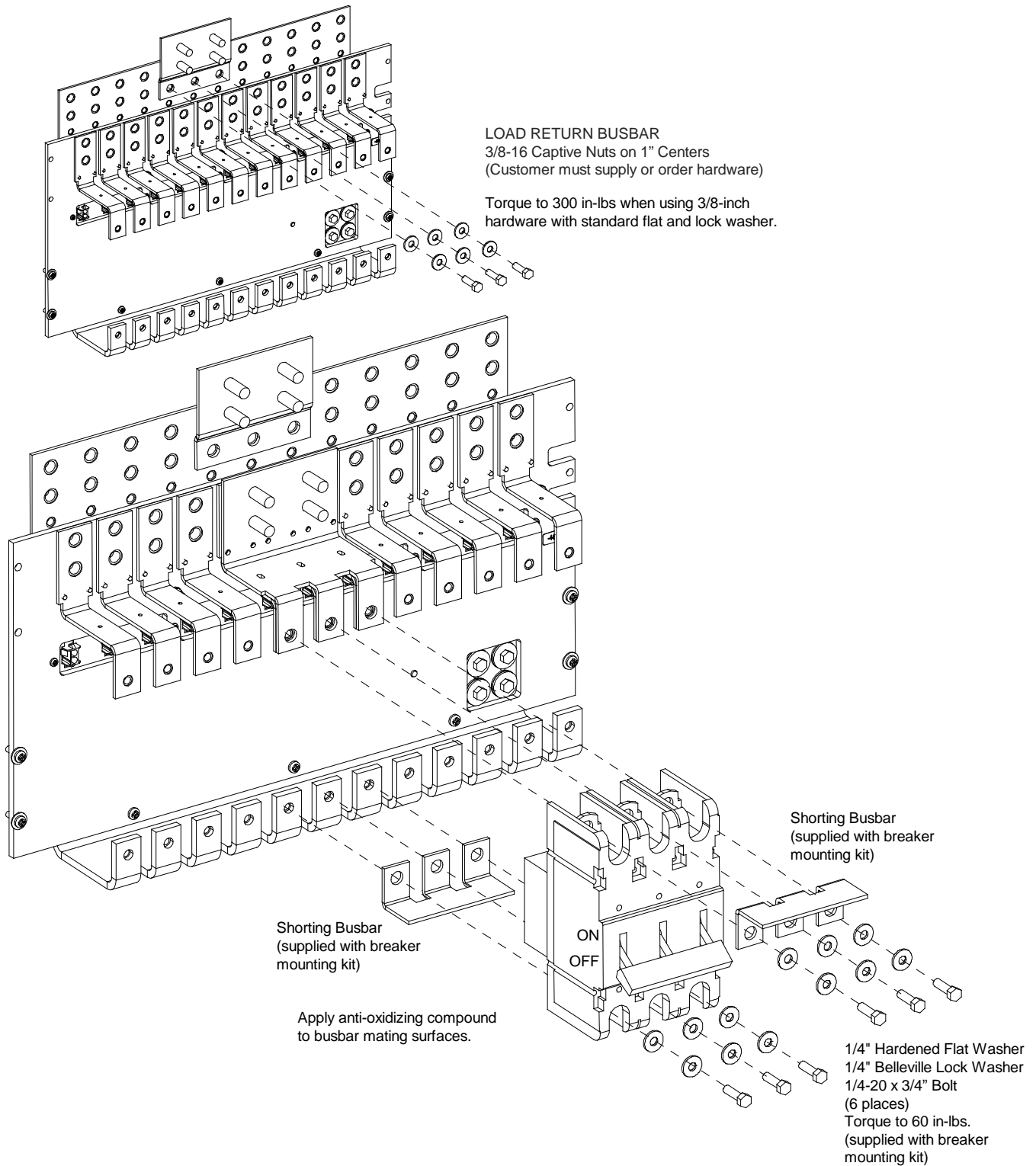
Figure 3.12: Installing Lug Adapter Busbar Kits

Busbar Adapter
Kit P/N 562888

Apply anti-oxidizing compound
to busbar mating surfaces.

LOAD RETURN BUSBAR
3/8-16 Captive Nuts on 1" Centers
(Customer must supply or order hardware)

Torque to 300 in-lbs when using 3/8-inch
hardware with standard flat and lock washer.



3.8 Installing Optional Second IB2 (Controller Interface Board) or Optional Second EIB (Controller Extended Interface Board)

A second IB2 (Controller Interface Board) or EIB (Controller Extended Interface Board) can be installed on the inside of the main bay's distribution cabinet's top panel.

This option is factory installed if ordered with the system. Refer to the following procedure to field install this option.

This board is referred to as IB2-2 or EIB-2.

Procedure

Refer to Figure 3.13 as the procedure is performed.

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system while the procedure is being performed.



DANGER! Performing the next steps exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

2. Open the main bay distribution cabinet's front door by turning the latch in the counterclockwise position.



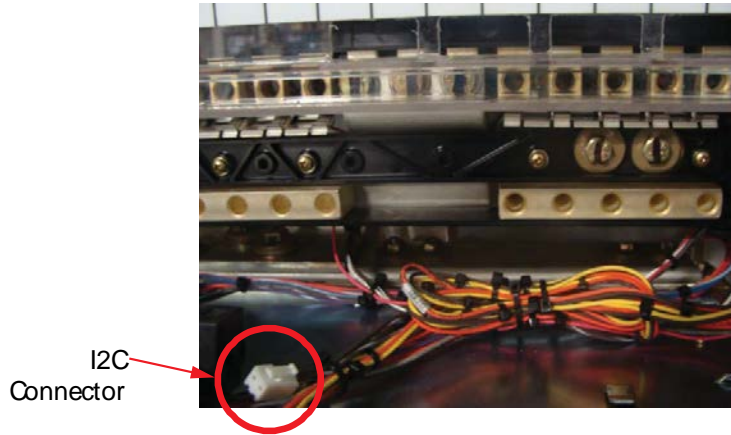
WARNING! Damage to the circuit card may result if the next step is not followed.

3. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
4. Set the switch on the new IB2 or EIB board as outlined in "Switch Settings on IB2 Interface Board" on page 39 or "Switch Setting on Optional EIB Interface Board" on page 39.
5. Refer to Figure 3.13 and install the IB2 or EIB board onto the inside top panel of the distribution cabinet.
6. Locate the I2C connector bundled at the bottom of the distribution cabinet. Route this cable up to the newly installed IB2 or EIB board. Cut cable ties as required. Refer to Figure 3.13. Plug this connector into the mating I2C connector located on the IB2 or EIB board. Refer to Figure 5.7 on page 68 or Figure 5.9 on page 74. Dress and secure the cable as required.
7. Make external connections to the IB2-2 or EIB-2 board as required. See "IB2 (Controller Interface Board) Connections (if required)" on page 66 or "Optional EIB (Controller Extended Interface Board) Connections (if required)" on page 71.
8. Remove the grounding wrist strap.
9. Reboot the Controller

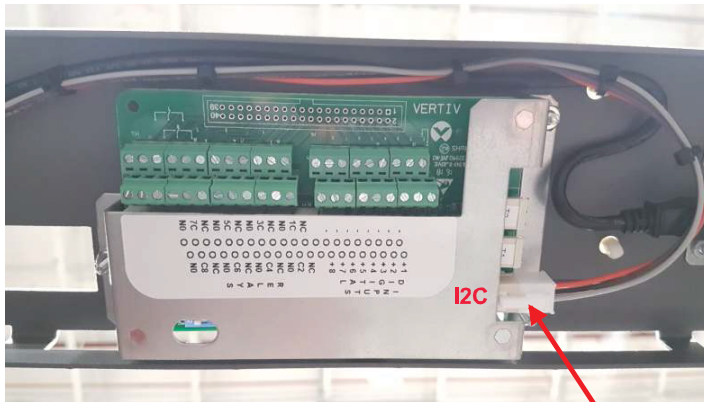
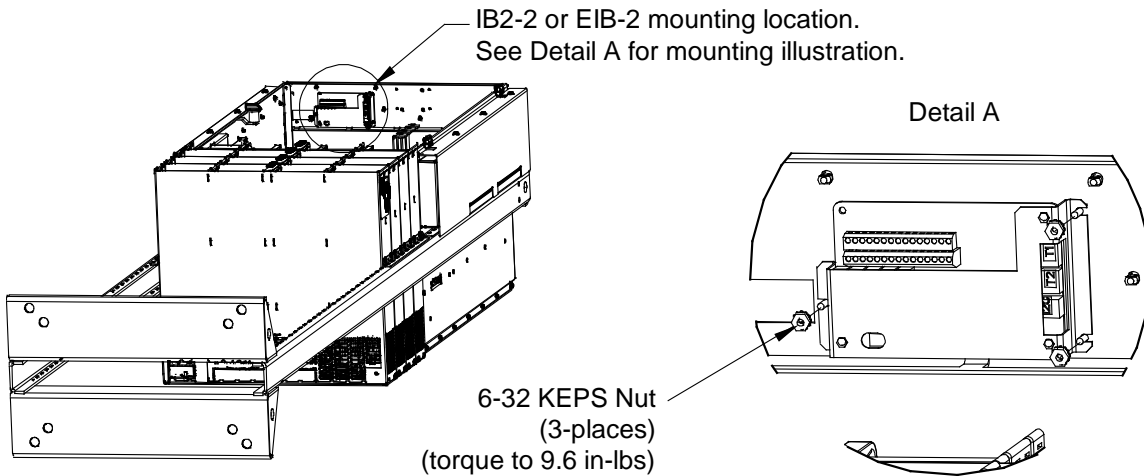
Local Menu Navigation: At the Main Screen, press ENT and ESC at the same time to reset the NCU Controller.

Web Menu Navigation: Go to Advance Settings Menu / SW Maintenance Tab / Reboot Controller button.
10. Close the distribution cabinet's front door and turn the latch clockwise to secure the door.
11. Enable the external alarms or notify appropriate personnel that this procedure is finished.
12. Ensure that there are no local or remote alarms active on the system.

Figure 3.13 Installing Optional Second IB2 (Controller Interface Board) or Optional Second EIB (Controller Extended Interface Board)



All wires from distribution and main harness are routed to the lower front of the distribution cabinet and secured with cable ties. Locate the I2C connector and separate it from the wire harness to allow it to be routed up to the IB2-2 or EIB-2 board.



Route terminal J4 from the harness (562505) to I2C on the IB2-2 or EIB-2 board.

3.9 Installing Circuit Breakers and Fuses

Circuit breakers and/or fuses may have been factory installed for you. If so, verify their positions and sizes.

Installing Bullet Nose Type Fuseholders and TPS/TLS Fuses



CAUTION! A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Refer to SAG581127000 for any other restrictions.

Refer to the following procedure and install bullet nose type fuseholders and appropriately sized TPS/TLS fuses into the proper mounting positions in the distribution cabinet.

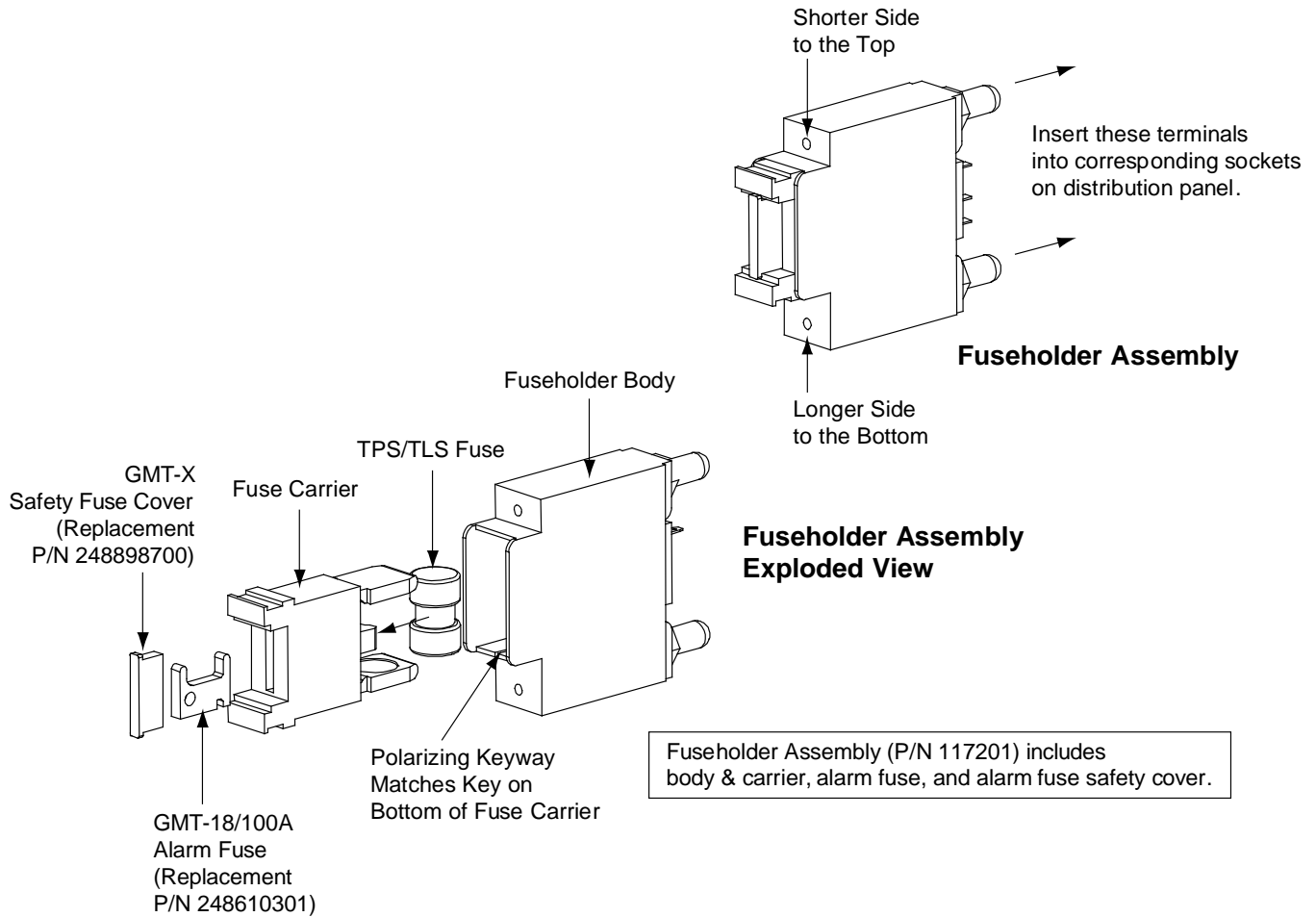
Procedure



NOTE! Refer to Figure 3.14 as this procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Orient the fuseholder as shown in Figure 3.14. Insert the terminals on the rear of the fuseholder into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the fuseholder makes contact with the alarm terminal on the spring strip. Push fuseholder in firmly until fully seated in the distribution panel.
3. When all fuseholders are installed, install an appropriately sized TPS/TLS fuse in each. To do this, remove the fuse carrier from the mounted fuseholder body. Hold the fuseholder body while you pull the fuse carrier from the body. Slide the fuse in place between the contacts of the fuse carrier. When done, push the fuse carrier back into the fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
4. Verify that an 18/100 ampere alarm fuse is present in each fuseholder and that a plastic safety cover is installed on this fuse.
5. Record all fuse sizes on the label provided on the shield.
6. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.14: Installing a Bullet Nose Type Fuseholder and TPS/TLS Fuse



Installing Bullet Nose Type Circuit Breakers



CAUTION! A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Refer to SAG581127000 for any other restrictions.

Refer to the following procedure and install appropriately sized bullet nose type circuit breakers into the proper mounting positions in the distribution cabinet.

Procedure



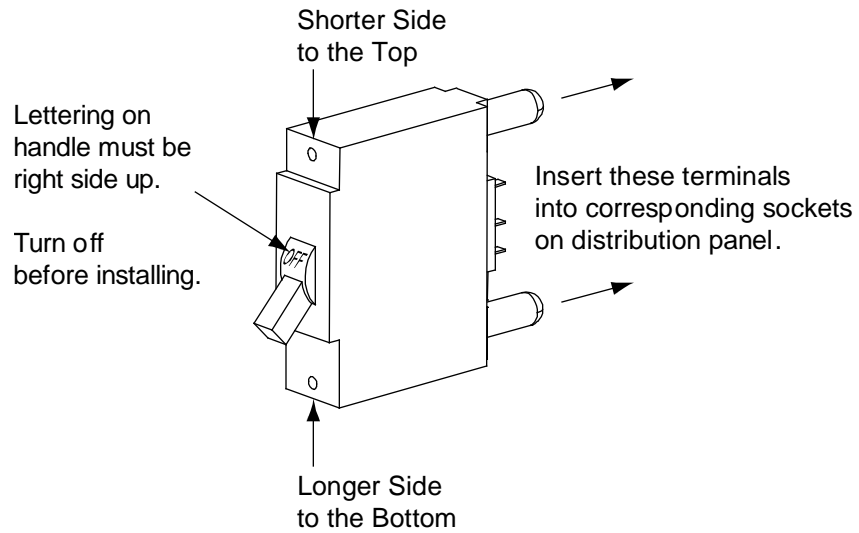
NOTE! Refer to Figure 3.15 as this procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Ensure that the circuit breaker is in the OFF position and is of the correct rating. Orient the circuit breaker as shown in Figure 3.15. Insert the terminals on the rear of the circuit breaker into their corresponding sockets on the distribution panel. Ensure

the alarm contact on the back of the circuit breaker makes contact with the alarm terminal on the spring strip. Push distribution device in firmly until fully seated in the distribution panel.

3. Record all circuit breaker sizes on the label provided on the shield.
4. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.15: Installing a Bullet Nose Type Circuit Breaker



Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 550224)



NOTE! Refer to Figure 3.16 as this procedure is performed.



NOTE! Can be used in a List AA, AB, DA, DB, DC, and DD distribution panel only.

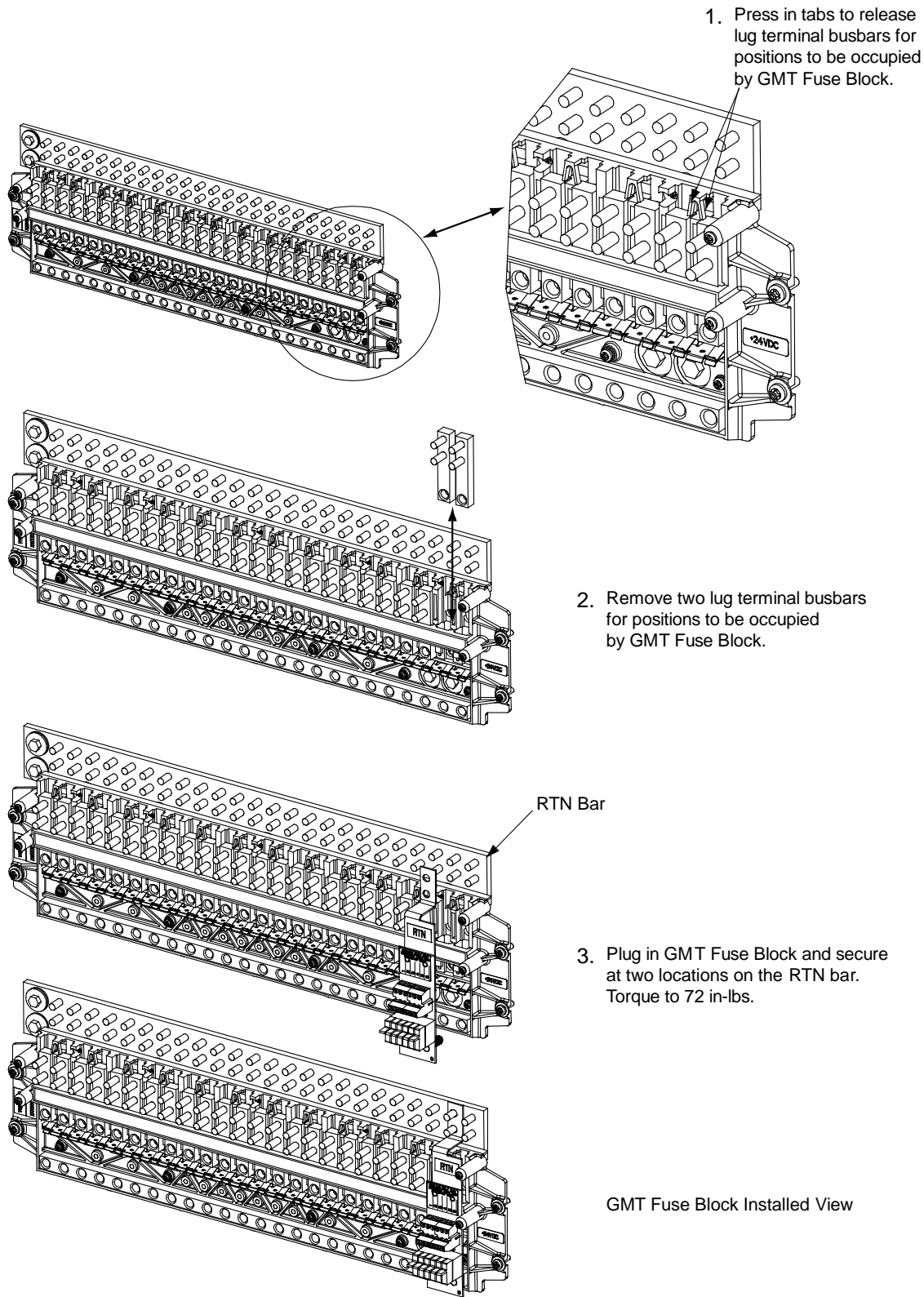


NOTE! Can only be installed in the 1-2, 3-4, 17-18, 19-20, 21-22, and 23-24 positions of the distribution panel.

Procedure

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Follow the steps in Figure 3.16.
3. Install an appropriately sized GMT fuse in each fuse mounting position on the GMT Distribution Fuse Block as required. If dummy fuses are installed, first remove the dummy fuse.
 - a) Verify that dummy fuses are installed in all unused fuse positions on the GMT distribution fuse block.
 - b) Verify that a plastic safety cover is installed on all GMT fuses on the GMT distribution fuse block.
4. Record all fuse sizes (installed on the GMT distribution fuse block) on the label provided on the shield.
5. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.16: Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 550224)



Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017)



NOTE! Refer to Figure 3.17 as this procedure is performed.

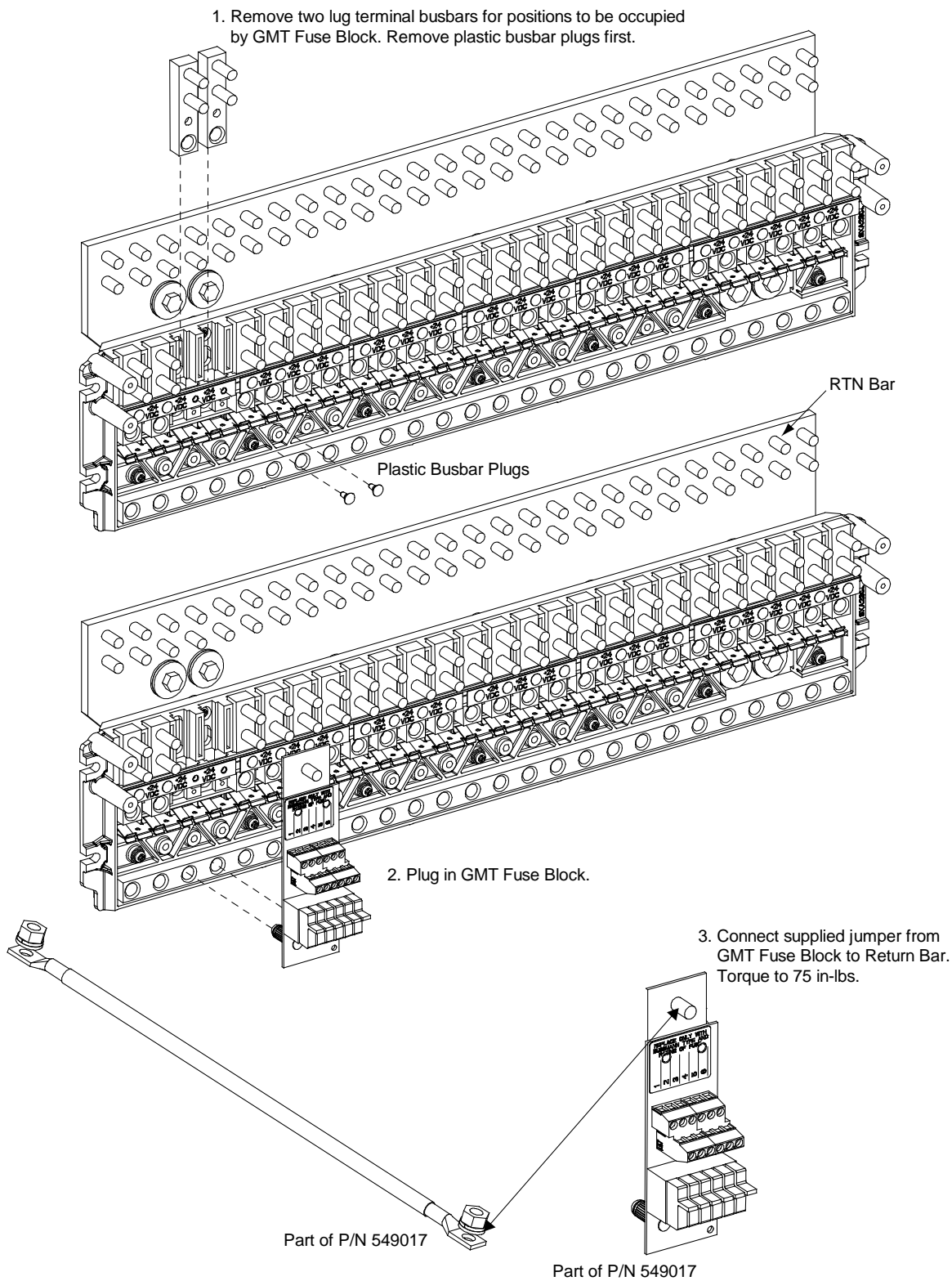


NOTE! Can be used in a List AL, AN, DE, DF, DG, DH, DJ, and DK distribution panel only.

Procedure

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Follow the steps in Figure 3.17.
3. Install an appropriately sized GMT fuse in each fuse mounting position on the GMT Distribution Fuse Block as required. If dummy fuses are installed, first remove the dummy fuse.
 - a) Verify that dummy fuses are installed in all unused fuse positions on the GMT distribution fuse block.
 - b) Verify that a plastic safety cover is installed on all GMT fuses on the GMT distribution fuse block.
4. Record all fuse sizes (installed on the GMT distribution fuse block) on the label provided on the shield.
5. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.17: Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017)



Installing TPH Fuses

Refer to the following procedure and install appropriately sized TPH fuses into the proper fuseholders in the distribution cabinet.

Refer to SAG581127000 for any restrictions.

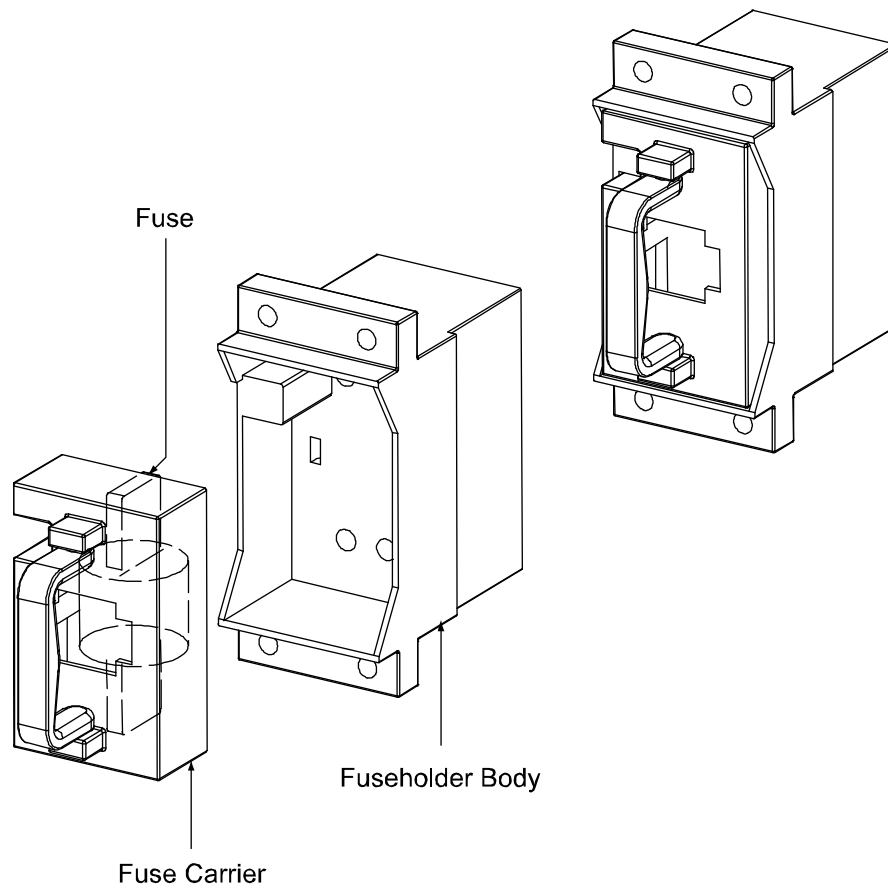
Procedure



NOTE! Refer to Figure 3.18 as this procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Remove the TPH fuse carrier from the mounted fuseholder body by grasping its handle and firmly pulling it straight out. Install the TPH fuse into the fuse carrier. When done, push the fuse carrier securely back into the mounted fuseholder body.
3. Verify that a 1/4 ampere alarm fuse is installed in the GMT-type fuseholder located adjacent to the TPH fuseholder and that a plastic safety cover is install on this fuse.
4. Record all fuse sizes on the cards provided within the fuseholders.
5. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.18: Installing a TPH Fuse



Installing TPL-B Fuses

Refer to the following procedure and install appropriately sized TPL-B fuses into the proper fuseholders in the distribution cabinet.

Refer to SAG581127000 for any restrictions.

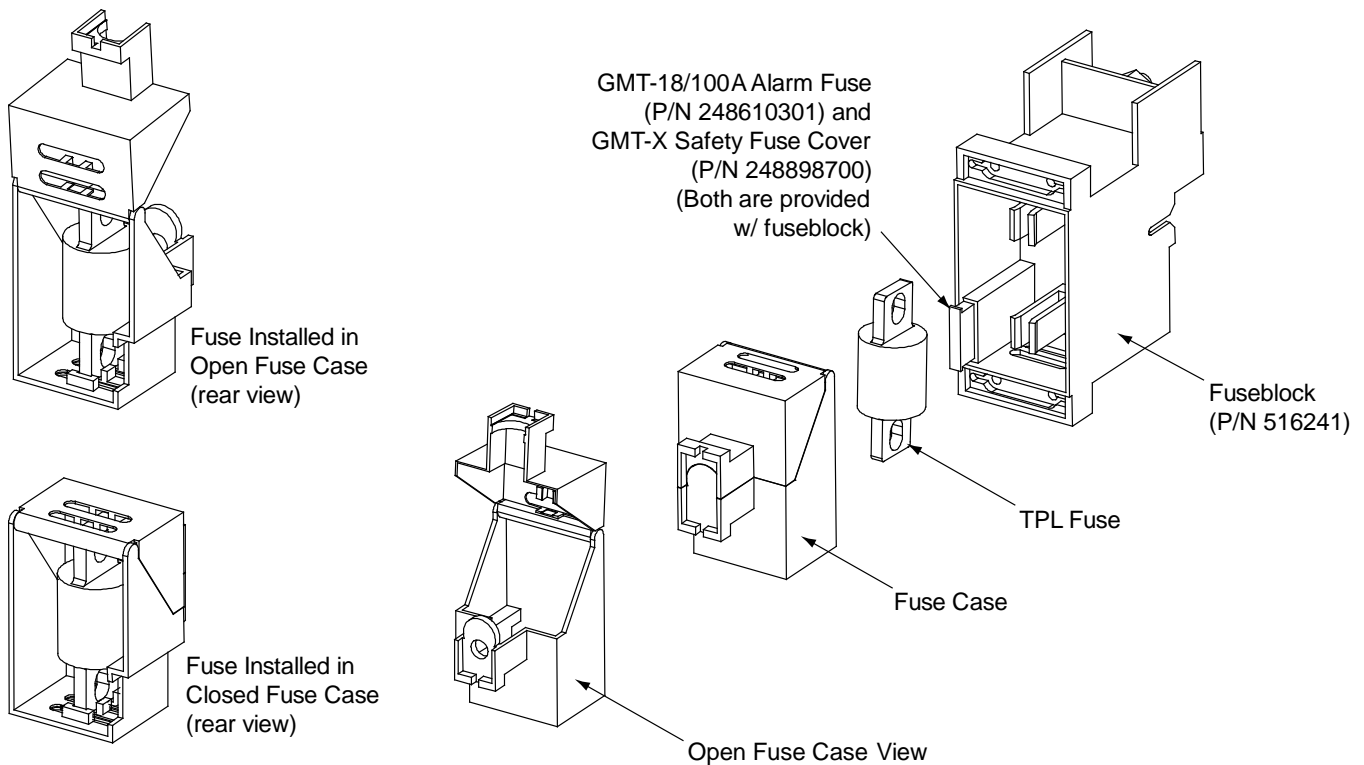
Procedure



NOTE! Refer to Figure 3.19 as this procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Remove the fuse case from the mounted fuse block by grasping its handle and pulling it straight out.
3. Verify that an 18/100 ampere alarm fuse is present in the GMT-type fuseholder located on the fuse block and that a plastic safety cover is installed on this fuse.
4. Open the fuse case.
5. Install the TPL fuse into the fuse case.
6. Close the fuse case.
7. Firmly plug the fuse and fuse case into the fuse block.
8. Record all fuse sizes on the cards provided within the fuseholders.
9. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.19: Installing TPL-B Fuses



Installing GJ/218 Circuit Breakers

Refer to the following procedure and install appropriately sized GJ/218 circuit breakers into the proper mounting positions in the distribution cabinet.

Refer to SAG581127000 for any restrictions.

Procedure



NOTE! Refer to Figure 3.20 as this procedure is performed.

1. Locate the appropriate circuit breaker mounting kit ordered with the circuit breaker. The circuit breaker mounting kit contains installation hardware, an alarm jumper, a shunt jumper (if applicable), a busbar (for 2-pole, 3-pole, and 4-pole circuit breakers), and a circuit breaker guard. Refer to SAG581127000 for part numbers of the circuit breaker mounting kits.
2. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
3. Ensure that the circuit breaker is in the OFF position, and is of the correct rating and type (electrical trip/mechanical trip or electrical trip only). Apply anti-oxidizing compound to busbar mating surfaces on the distribution panel and the circuit breaker. Orient the circuit breaker over its mounting location.
 - a) Attach the alarm jumper connectors to the back of the circuit breaker, then plug the other end of the alarm jumper into its corresponding connector. See Figure 3.20.
 - b) **Shunted Breakers Only:** Attach the shunt jumper connectors to the back of the circuit breaker, then route the jumper through the hole in the distribution panel. See Figure 3.20.



DANGER! The bolts being installed in the following step may be at system potential. Use insulated tools.

4. Install the circuit breaker into its mounting position and secure with the provided hardware. Torque to 60 in-lbs.

2-Pole, 3-Pole, and 4- Pole Circuit Breakers Only: Also install the mounting kit supplied shorting busbar as shown in Figure 3.20.
5. Install the circuit breaker guard and label (refer to Figure 3.20).
6. **Shunted Breakers Only:** Route and connect shunt leads to the SM-DU+ and Shunt Interface Assembly.

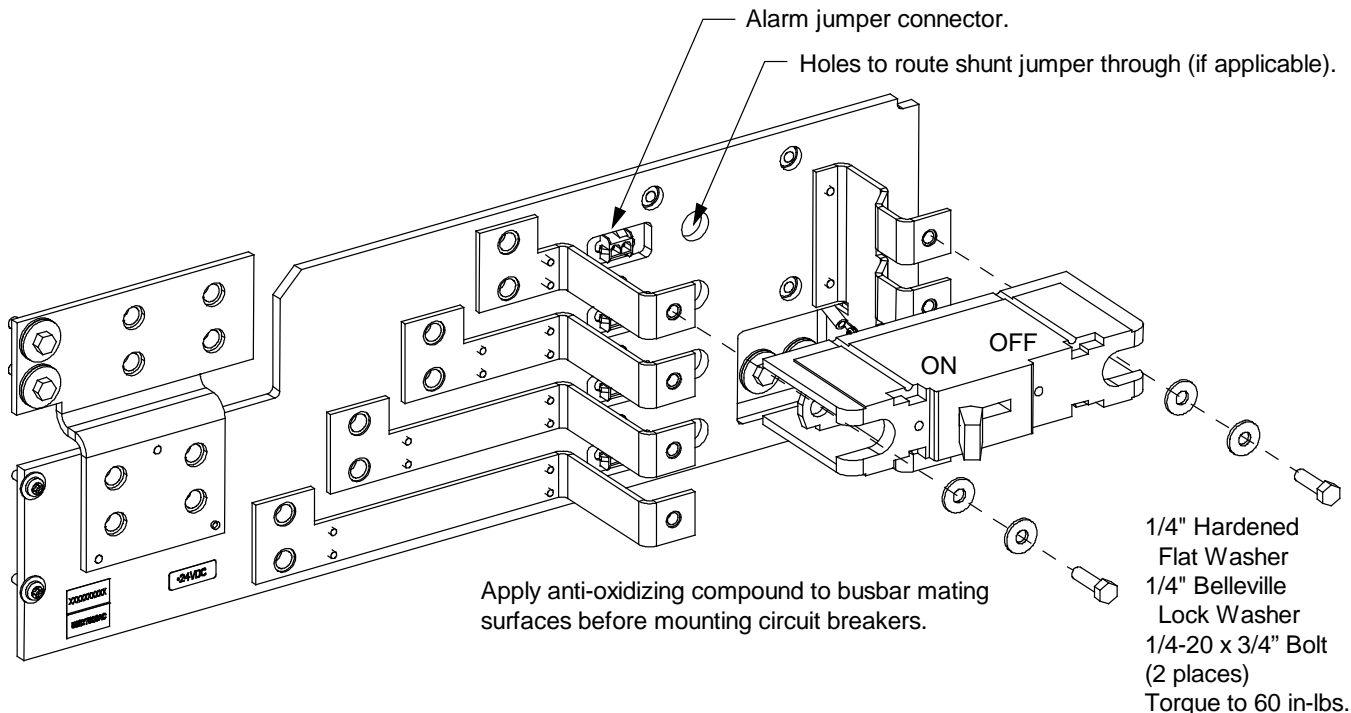


NOTE! Refer to "Optional SM-DU+ and Shunt Interface Board" on page 76 for proper wiring procedure. Leads must be terminated before switching breaker ON to avoid circuit fault.

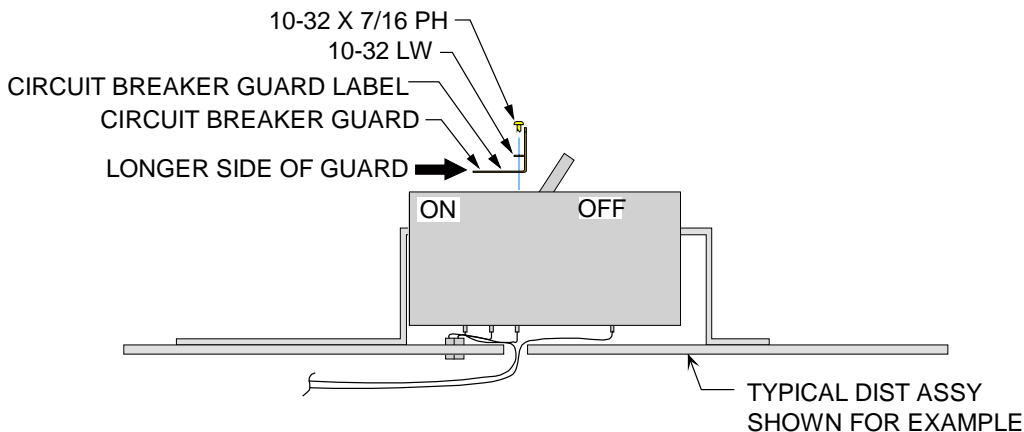
7. Record all circuit breaker sizes on the label provided on the shield.
8. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.20: Installing a GJ/218 Circuit Breaker (1-Pole) (Lists AC, AD, BC, BD) (cont'd on next page)

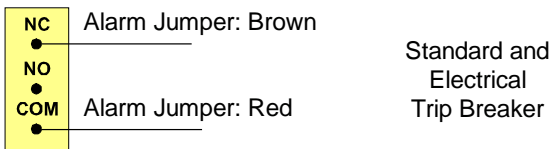
INSTALLING CIRCUIT BREAKER



INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS W/OUT SHUNTS)



ALARM WIRING (BREAKERS WITH SHUNTS)

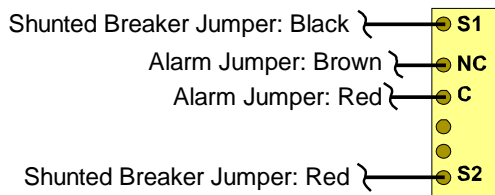
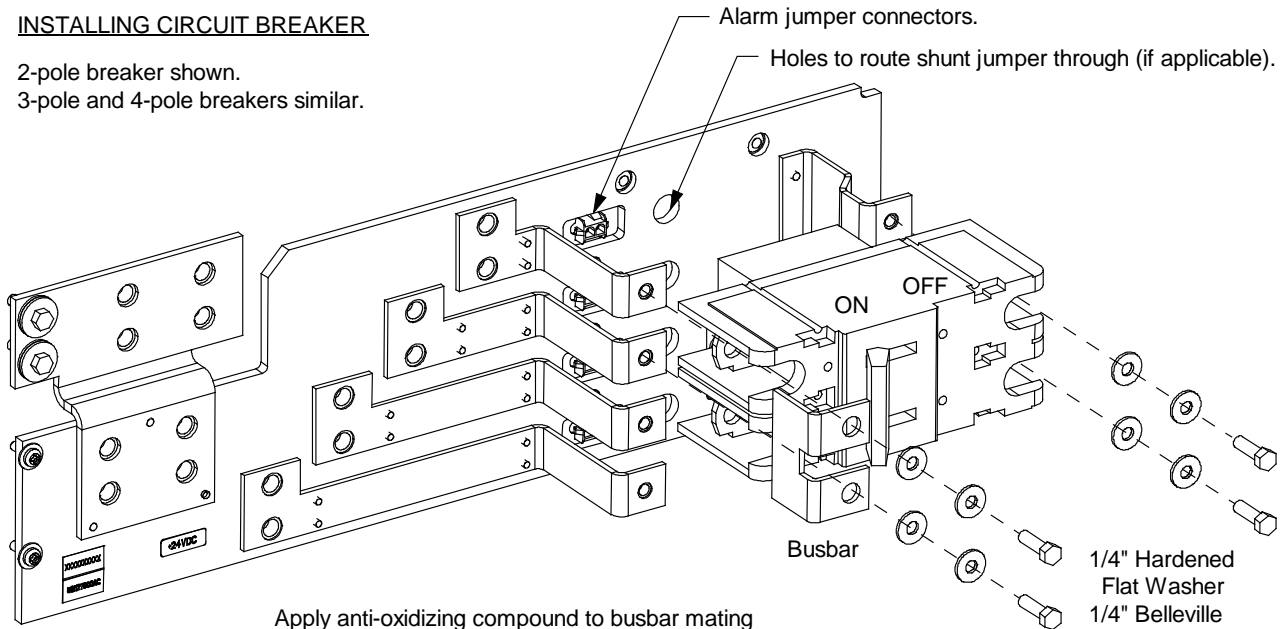


Figure 3.20: Installing a GJ/218 Circuit Breaker (2-Pole, 3-Pole, 4-Pole) (Lists AC, AD, BC, BD) (cont'd from previous page, cont'd on next page)

INSTALLING CIRCUIT BREAKER

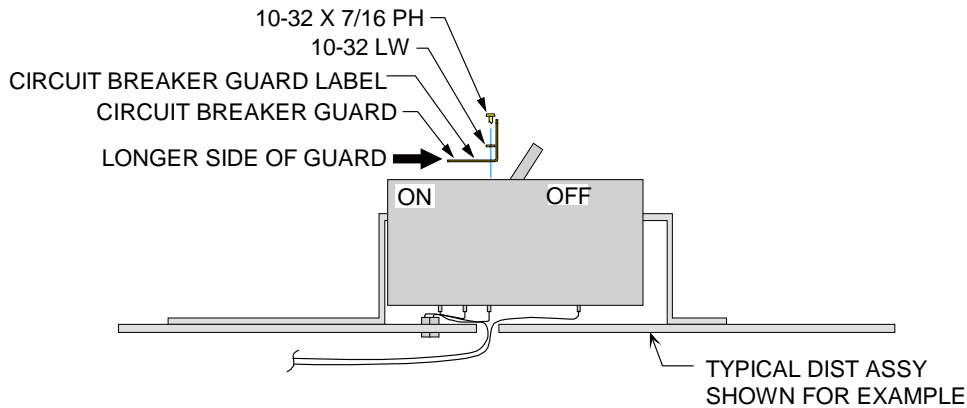
2-pole breaker shown.
3-pole and 4-pole breakers similar.



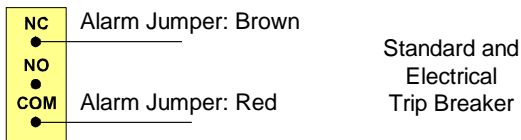
Apply anti-oxidizing compound to busbar mating surfaces before mounting circuit breakers.

- 1/4" Hardened Flat Washer
- 1/4" Belleville Lock Washer
- 1/4-20 x 3/4" Bolt
- (4 places / 2-pole brk, 6 places / 3-pole brk, 8 places / 4-pole brk)
- Torque to 60 in-lbs.

INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS W/OUT SHUNTS)



ALARM WIRING (BREAKERS WITH SHUNTS)

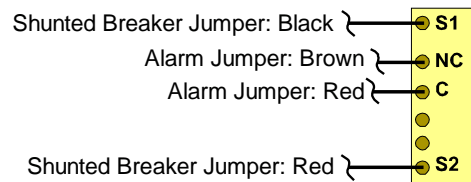
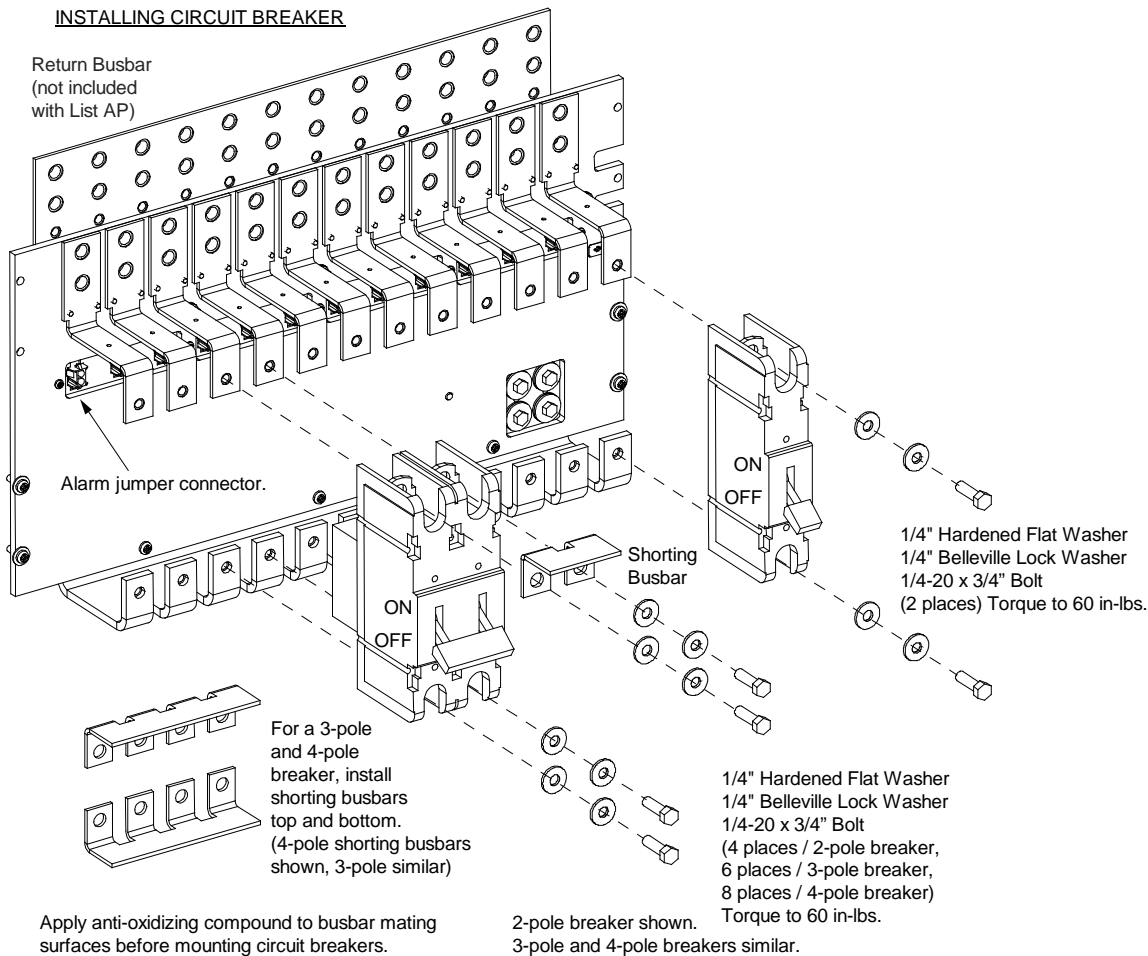
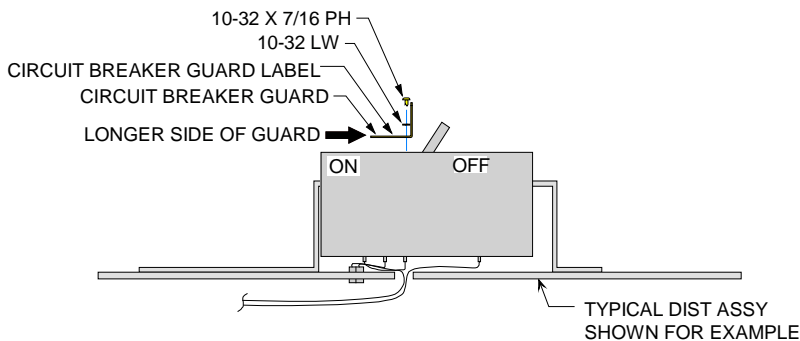


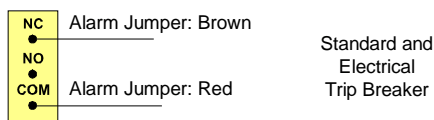
Figure 3.20: Installing a GJ/218 Circuit Breaker (1-Pole, 2-Pole, 3-Pole, 4-Pole) (List AM and List AP) (cont'd from previous page)



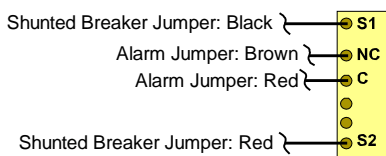
INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS W/OUT SHUNTS)



ALARM WIRING (BREAKERS WITH SHUNTS)

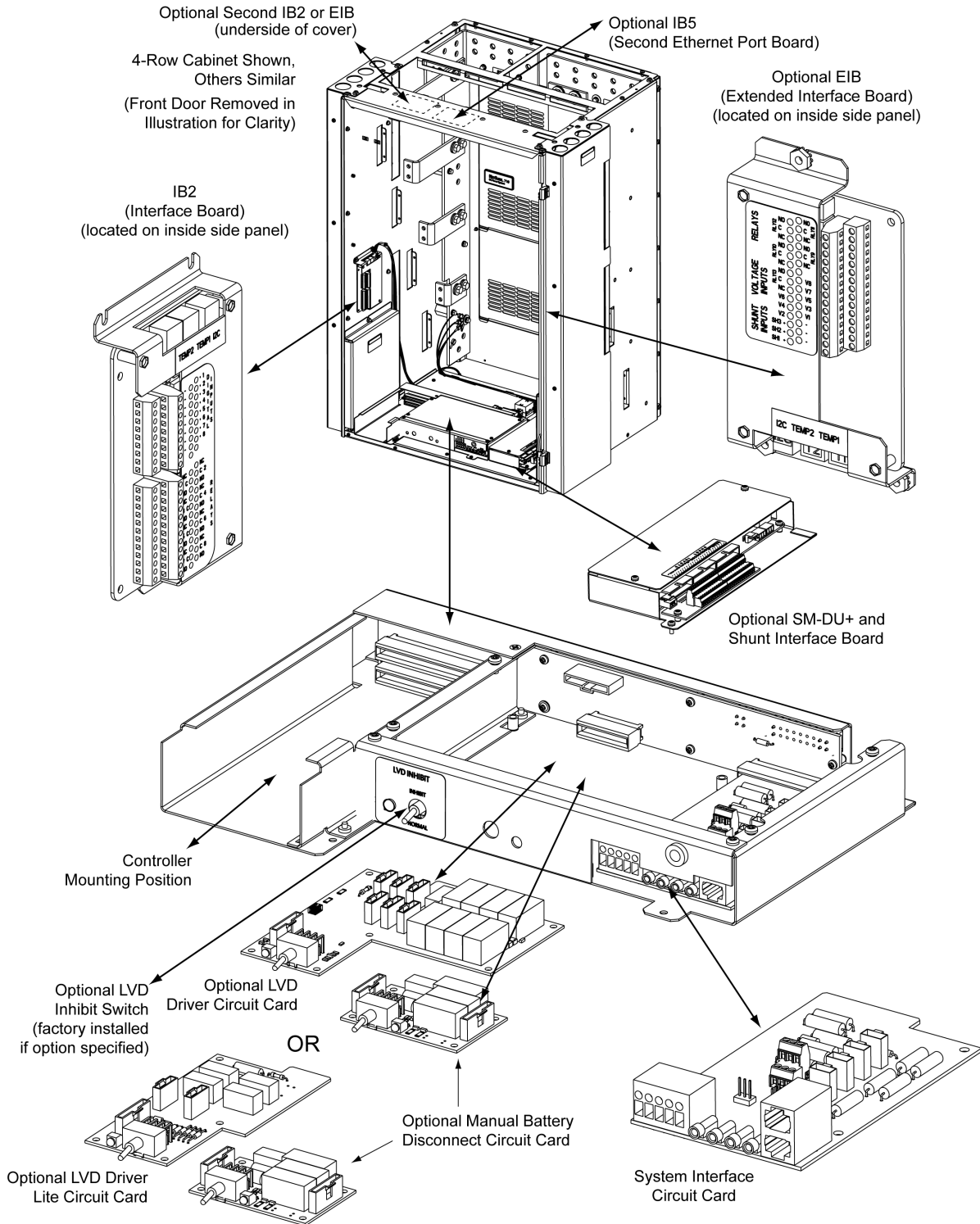


4 Setting Jumpers and Switch Options

4.1 Circuit Card Locations

Refer to Figure 4.1.

Figure 4.1: Circuit Card Locations



4.2 Jumpers on System Interface Circuit Card

Perform the following procedures to verify the factory settings and/or make the required settings per your site requirements. These procedures can also be used to make adjustments on a replacement circuit card.

Controller Power Option

The controller is always powered from the internal “system” bus. A jumper option allows the controller to be also powered by battery. Battery power allows the controller to stay running in the event rectifiers are off or battery LVD opens (if installed). Note that if powering the controller from battery, the battery will drain if rectifiers are off or battery LVD opens (if installed). The controller’s power consumption is 5W.

Procedure

1. Refer to Figure 4.2 and place the jumper on J8 in the “Battery Pwr” or “No Battery Pwr” position.

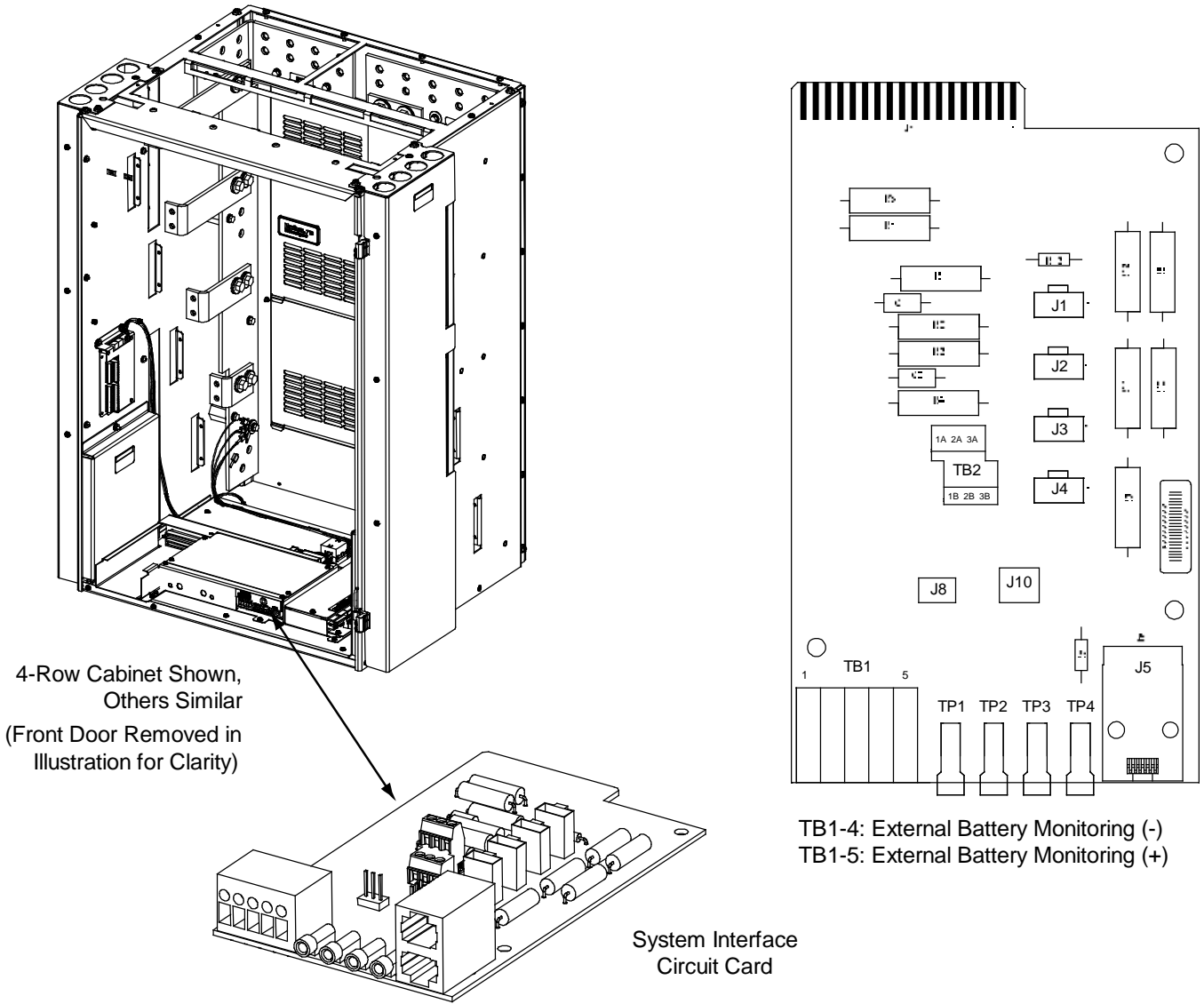
Internal/External Battery Monitoring

Selects to monitor (and display via the controller) battery voltage from either an “internal” or “external” source.

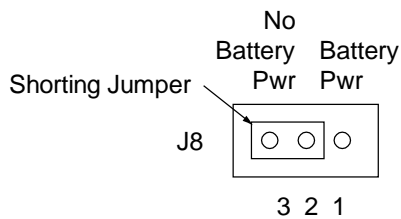
Procedure

1. Refer to Figure 4.2 and place the jumper on J10 in the “Internal” or “External” position. If “External” is selected, connect sense leads to TB1-4 and TB1-5 (see Figure 4.2).

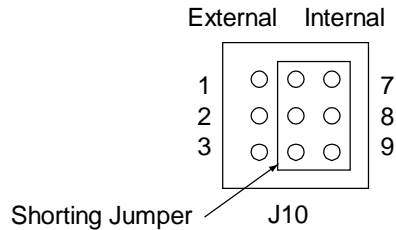
Figure 4.2: System Interface Circuit Card Jumper Locations



J8
Selects to power Controller from "Battery Power" or not.



J10
Battery Monitoring External / Internal (see TB1-4 and TB1-5 for external monitoring points)



4.3 Switch Settings on IB2 Interface Board

Dip Switch SW1 on the IB2 board is used to set the communications address for this board. Refer to Table 4.1 for SW1 settings. Refer to Figure 4.3 for SW1 location.

Perform the following procedure to verify the factory settings. This procedure can also be used to make adjustments on a replacement circuit card.

Procedure

1. Ensure SW1 is set per Table 4.1. Refer to Figure 4.3 for location.

Table 4.1: IB2 Interface Board Switch Settings

Setting	DIP Switch SW1	
	1	2
IB2-1	OFF	OFF
Optional IB2-2	ON	OFF

4.4 Switch Setting on Optional EIB Interface Board

Dip Switch SW1 on the EIB board is used to set the communications address for this board. Refer to Table 4.2 for SW1 settings. Refer to Figure 4.4 for SW1 location.

Perform the following procedure to verify the factory settings. This procedure can also be used to make adjustments on a replacement circuit card.

Procedure

1. Ensure SW1 is set per Table 4.2. Refer to Figure 4.4 for location.

Table 4.2: Optional EIB Interface Board Switch Settings

Setting	DIP Switch SW1	
	1	2
EIB-1	OFF	OFF
Optional EIB-2	ON	OFF

Figure 4.3: IB2 Interface Board Switch Location and Settings

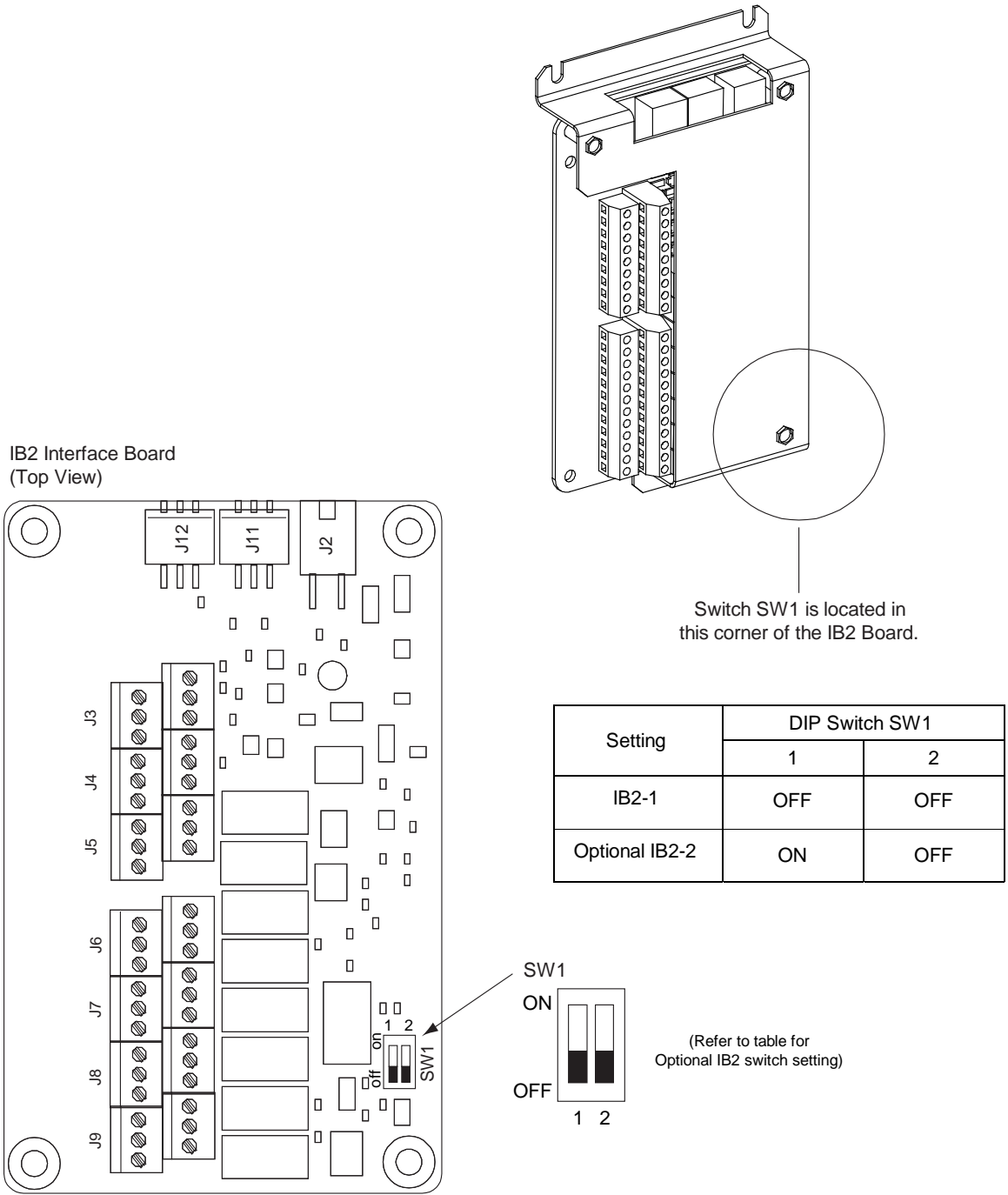
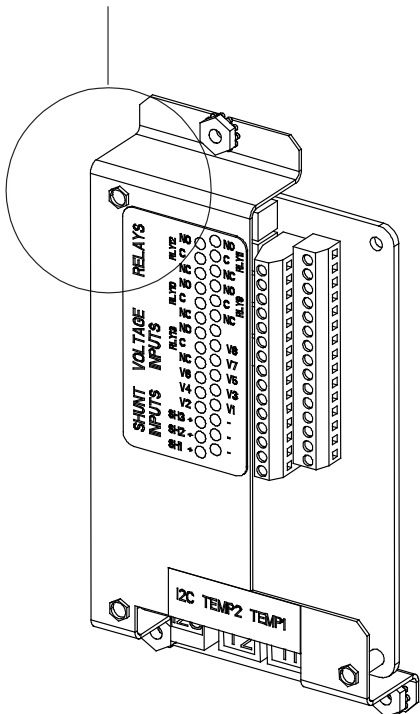


Figure 4.4: Optional EIB Interface Board Switch Location and Settings

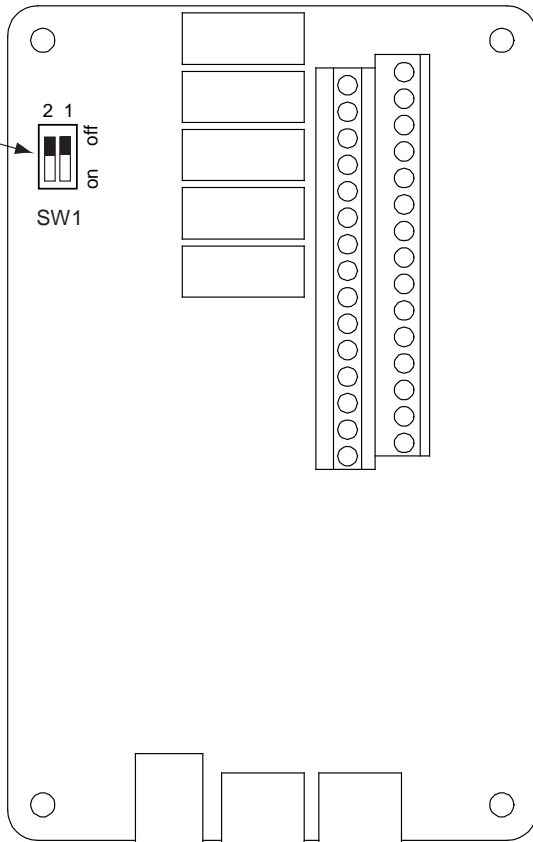
Switch SW1 is located in this corner of the EIB Board.



EIB Interface Board (Top View)

In this system, switch settings must be in positions shown.

(Refer to table for Optional EIB switch setting)



Setting	DIP Switch SW1	
	1	2
EIB-1	OFF	OFF
Optional EIB-2	ON	OFF

4.5 Switch Setting on SM-DU+

SM-DU+ uses two (2) 8-bit switches for parameter setting (SW1 and SW2). Refer to Table 4.3 for SW1 and SW2 settings. Refer to Figure 4.5 for SW1 and SW2 locations.

Perform the following procedure to verify the factory settings. This procedure can also be used to make adjustments on a replacement circuit card.

Procedure

1. Ensure SW1 and SW2 are set per Table 4.3. Refer to Figure 4.5 for location.

Figure 4.5: Optional SM-DU+ Switch Location and Settings

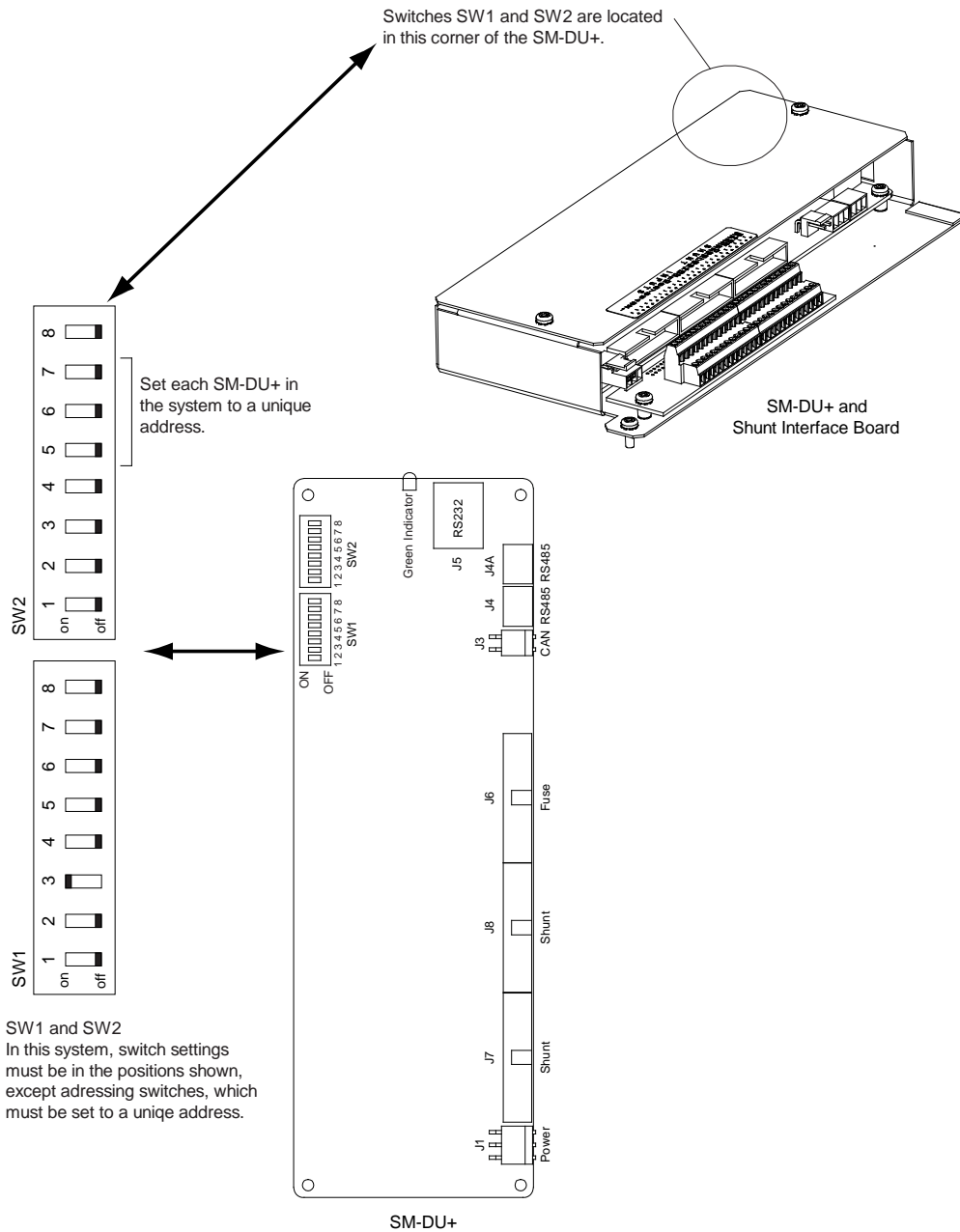


Table 4.3: Optional SM-DU+ Switch Settings

DIP Switch SW1								Description of Status
Reserved		HW/S W	Shunt Voltage		Shunt Current			
1	2	3	4	5	6	7	8	
NA	OFF	NA					Shunt parameter is set through DIP switch.	
	ON	NA					Shunt parameter is set through software (note 1) .	
NA	OFF	OFF	NA				Shunt Voltage: 25mV (note 1)	
	OFF	ON	NA				Shunt Voltage: 50mV	
	ON	OFF	NA				Shunt Voltage: 60mV	
	ON	ON	NA				Shunt Voltage: 75mV	
NA	OFF	OFF	OFF	NA			Shunt Current: 500A (note 1)	
	OFF	OFF	ON	NA			Shunt Current: 100A	
	OFF	ON	OFF	NA			Shunt Current: 200A	
	OFF	ON	ON	NA			Shunt Current: 300A	
	ON	OFF	OFF	NA			Shunt Current: 400A	
	ON	OFF	ON	NA			Shunt Current: 1000A	
	ON	ON	OFF	NA			Shunt Current: 1500A	
	ON	ON	ON	NA			Shunt Current: 2000A	
DIP Switch SW2								Description of Status
Reserved		Communications Address			Baud Rate			
1	2	3	4	5	6	7	8	
NA	OFF	OFF	OFF	NA			Address 1# (Setting for SM-DU+ in Main Bay)	
	OFF	OFF	ON	NA			Address 2# (Setting for SM-DU+ in 1st Supp. Bay)	
	OFF	ON	OFF	NA			Address 3# (Setting for SM-DU+ in 2nd Supp. Bay)	
	OFF	ON	ON	NA			Address 4# (Setting for SM-DU+ in 3rd Supp. Bay)	
	ON	OFF	OFF	NA			Address 5# (Setting for SM-DU+ in 4th Supp. Bay)	
	ON	OFF	ON	NA			Address 6# (Setting for SM-DU+ in 5th Supp. Bay)	
	ON	ON	OFF	NA			Address 7#	
	ON	ON	ON	NA			Address 8#	
NA							OFF	19200 (note 1)
NA							ON	9600

Note 1: Setting for this system.

5 Making Electrical Connections

5.1 Important Safety Instructions



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

5.2 Wiring Considerations

All wiring and branch circuit protection should follow the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association’s (NFPA) National Electrical Code (NEC), and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.

For wire size, branch circuit protection, crimp lug, and general wiring recommendations; refer to System Application Guide SAG581127000 and Power Data Sheet PD588705200 (PD588705201, PD58870520102, PD58870520103, PD58870520104).

Lugs should be crimped per lug manufacturer’s specifications.

Refer to Table 5.1 for supplemental lug crimping information when using the special application crimp lug / strap combination.

Table 5.1: Supplemental Lug Crimping Information when using the Special Application Crimp Lug / Strap Combination

Crimp Lug Part No.		Crimp Tool Required ¹ , T&B Model TBM12 or TBM15 Hydraulic Heads		
		Color Key	Die Index/ Code No.	Die Cat. Number
245393500	Burndy: YA25L-4TCG1	Pink	42H	15508
245393600	Burndy: YA26L-4TCG1	Black	45	15526
245393700	Burndy: YA27L-4TCG1	Orange	50	15530
245393800	Burndy: YA28L-4TCG1	Purple	54H	15511
514872	T & B: 256-30695-1879	Yellow	62	15510
	Burndy: YA29L-4TCG1			
514873	T & B: 256-30695-1880	Red	71	15514
	Burndy: YA31L-4TCG1			

¹ The lugs should be crimped to the specifications given in the manufacturer’s instructions furnished with the crimp tool or lug.

5.3 Relay Rack Grounding Connection (Frame Ground)

For relay rack grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

A customer's grounding network lead can be attached to the top of the relay rack. Provision is made for installing a lead with a two-hole lug that has 1/4" bolt clearance holes on 5/8" centers. When using 1/4-inch hardware, recommended torque is 84 in-lbs when a standard flat washer and lock washer are used. Refer to Figure 5.1 for locations.



NOTE! REMOVE TAPE FROM HOLE LOCATIONS BEFORE INSTALLING LUG.



NOTE! The DC return connection to this system can remain isolated from system frame and chassis (DC-I).

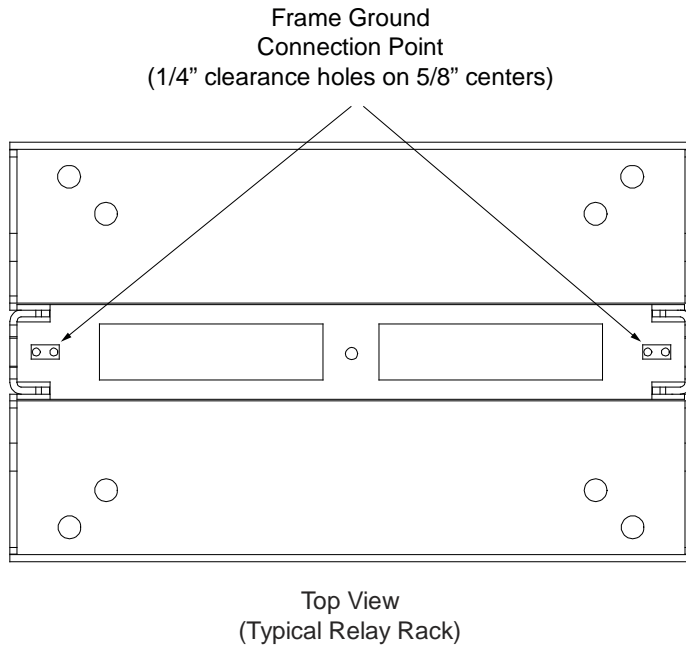
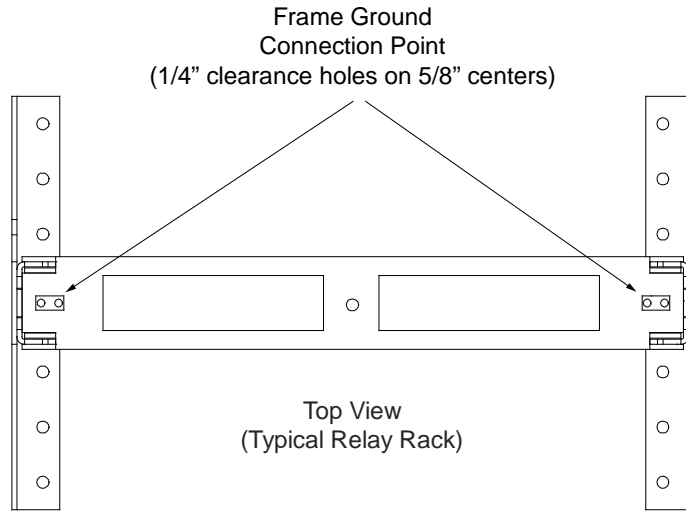


NOTE! This system is suitable for installation as part of the Common Bonding Network (CBN).

5.4 Central Office Ground Connection

Landing points are provided on the battery return bus for a central office ground lead (see Figure 5.46 and Figure 5.48). For central office grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

Figure 5.1: Relay Rack Frame Grounding Connection Points



5.5 AC Input and AC Input Equipment Grounding Connections (if List A1 not furnished)



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

Connections to Factory Installed Module Mounting Shelves

The system provides either a separate AC input connection for each rectifier position or a separate AC input connection for every two (2) rectifier positions in the factory installed module mounting shelves. Circular openings are provided in the top of the AC input wireway panels for AC input and AC input grounding conductors. The openings accept 3/4 inch conduit fittings. It is recommended that AC input wiring be provided to all rectifier mounting positions, including currently unused positions. This wiring will ease future installation of rectifiers to meet increased load requirements.



NOTE! A grounding conductor must be provided with each conduit.

Procedure

Refer to Figure 5.2 as these procedures are performed.

Accessing Connections and Routing Wire

1. Remove the two AC input connector covers and the AC input wireway covers by first loosening the fasteners that secure each of them.
2. Install conduit fittings as required in the top of the AC input wireways. Plug buttons are provided, and must be installed in the openings not being used.
3. Route wiring into the AC input wireways through the previously installed conduit fittings.

Making AC Input Connections



NOTE! Module mounting positions are lettered left to right as viewed from the front of the shelf, A-D in the top row and E-H in the bottom row of each shelf sub-assembly.



NOTE! If module mounting positions B, C, F, and G are intended solely for DC-DC Converter installation (Converter Option must be installed), AC input connections to these positions are not required.

1. Make AC input connections as shown in Figure 5.2. Connect each wire by inserting the stripped end into the wire opening, and then tightening the screw. Recommended torque is 10 in-lbs for the individual PCU feed terminal blocks and 18 in-lbs for the dual PCU feed terminal blocks.

208/240 VAC Service Type:

- Line to Line:
Connect Line 1 to Terminal 1.
Connect Line 2 to Terminal 2.
- Line to Neutral:
Connect Line to Terminal 1.
Connect Neutral to Terminal 2.

Making Equipment Grounding Connections



NOTE! Make equipment grounding connections to earth ground, **not** to the branch circuit neutral conductor.

1. Connect AC input equipment grounding leads to the frame ground studs using installer-provided ring lugs and factory-supplied mounting hardware. Recommended torque is 23 in-lbs.

Reinstalling Covers

1. After all AC input and equipment grounding connections have been made and checked, reinstall the two AC input connector covers and the AC input wireway covers. Secure each by tightening the fasteners.

Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd on next page)

AC INPUT CONNECTIONS,
INDIVIDUAL PCU FEED (581127000 LIST 40),
WHEN EQUIPPED WITH 588705201

NOTE:
WIRING TO AN EXPANSION
SHELF IS DONE AT THE
REAR OF THE EXPANSION
SHELF.

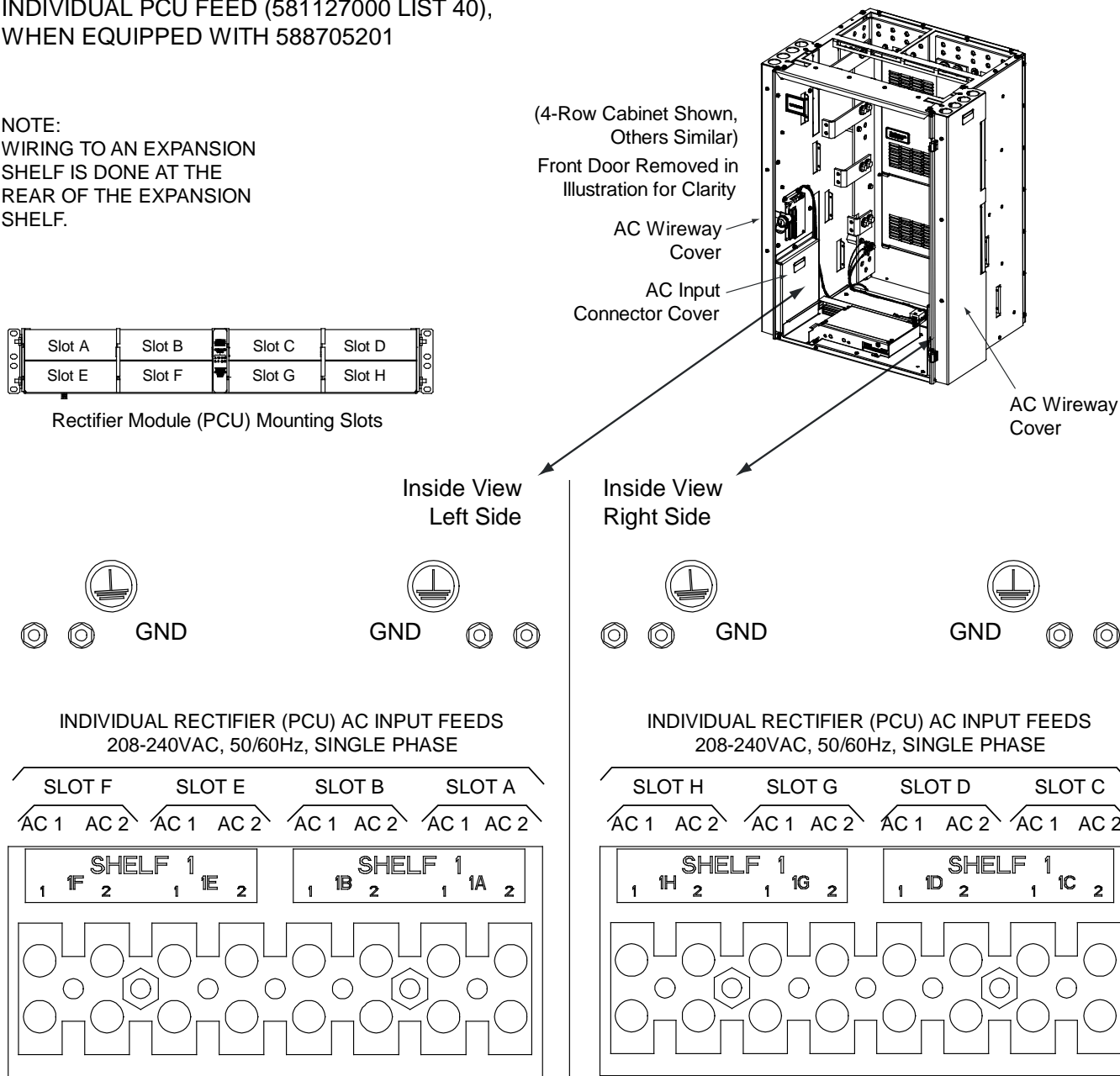


Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

**AC INPUT CONNECTIONS,
INDIVIDUAL PCU FEED (581127000 LIST 40),
WHEN EQUIPPED WITH 588705202**

NOTE:
WIRING TO AN EXPANSION SHELF IS DONE AT THE REAR OF THE EXPANSION SHELF.

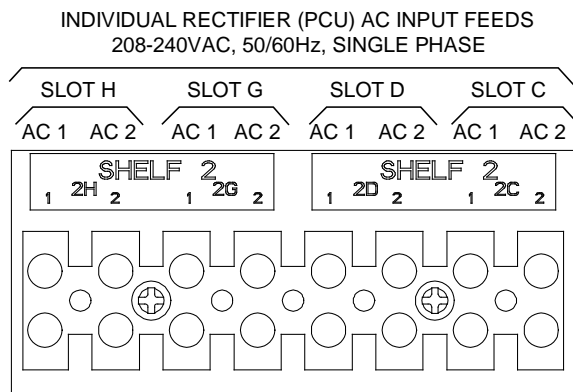
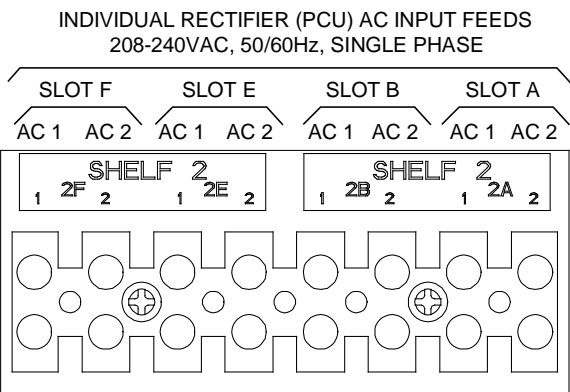
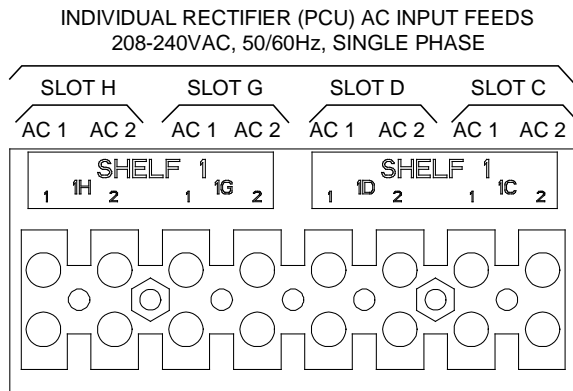
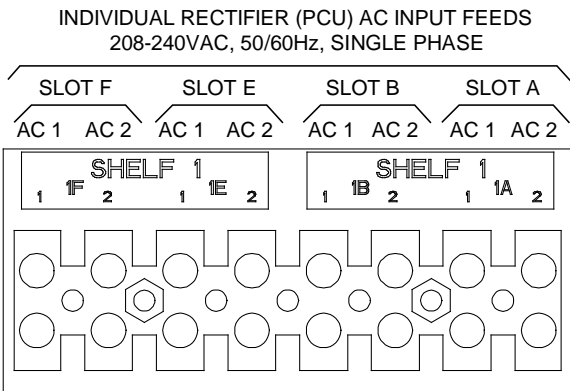
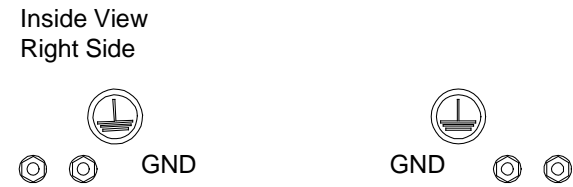
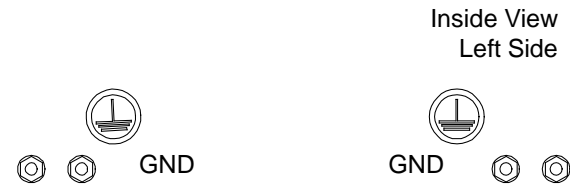
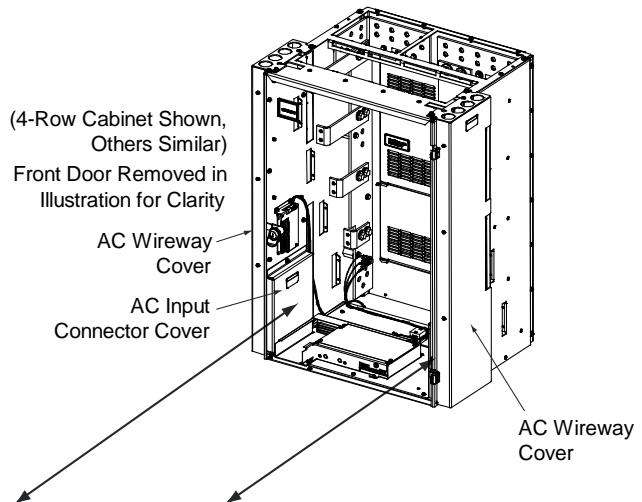
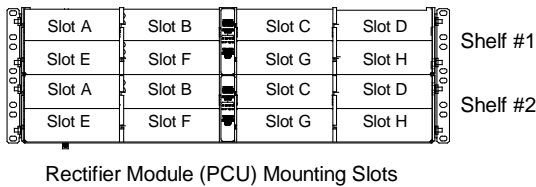
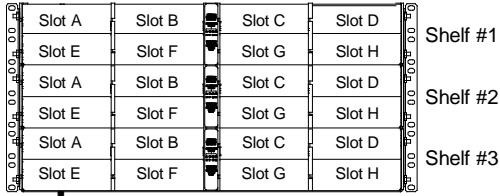


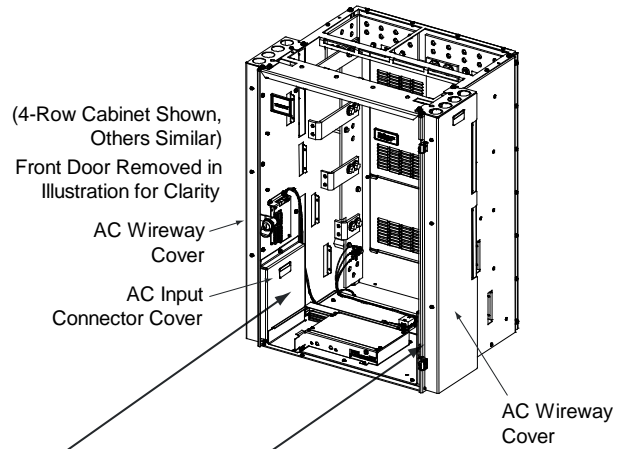
Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

**AC INPUT CONNECTIONS,
INDIVIDUAL PCU FEED (581127000 LIST 40),
WHEN EQUIPPED WITH 588705203**

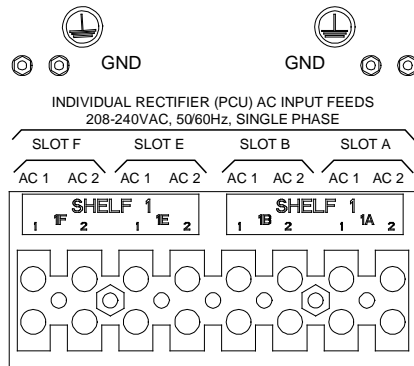
NOTE:
WIRING TO AN EXPANSION SHELF IS DONE AT THE REAR OF THE EXPANSION SHELF.



Rectifier Module (PCU) Mounting Slots



Inside View Left Side



Inside View Right Side

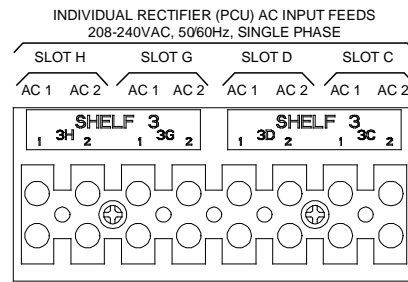
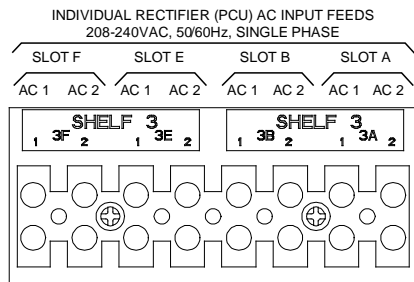
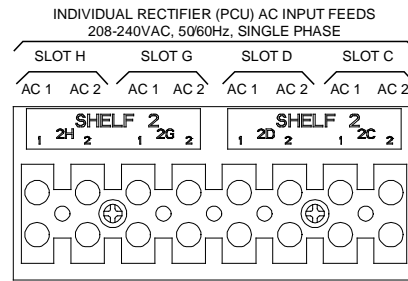
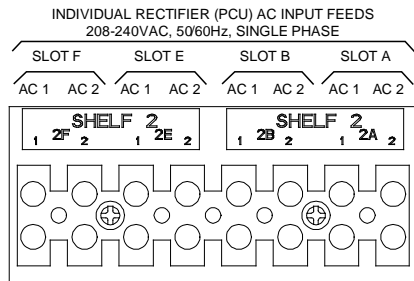
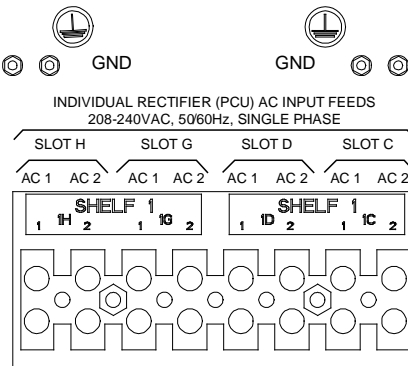


Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

AC INPUT CONNECTIONS,
INDIVIDUAL PCU FEED (581127000 LIST 40),
WHEN EQUIPPED WITH 588705204

NOTE:
WIRING TO AN EXPANSION
SHELF IS DONE AT THE
REAR OF THE EXPANSION
SHELF.

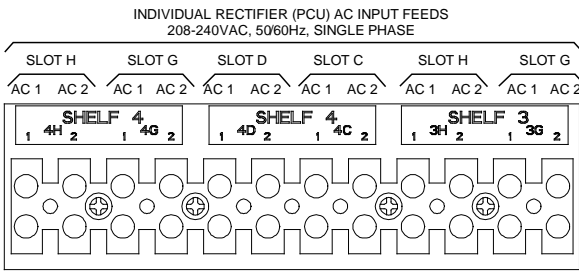
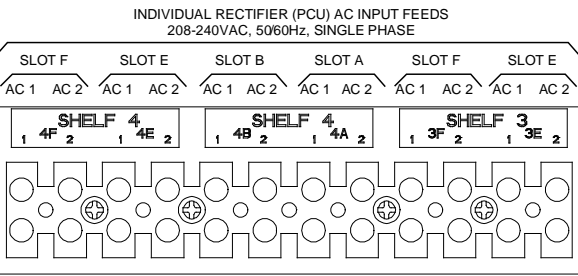
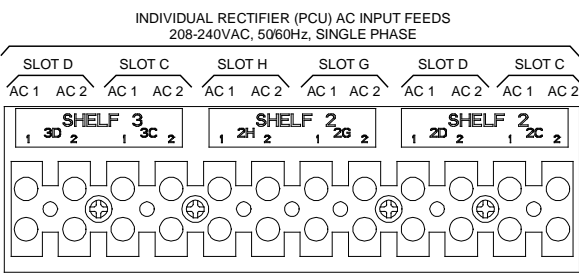
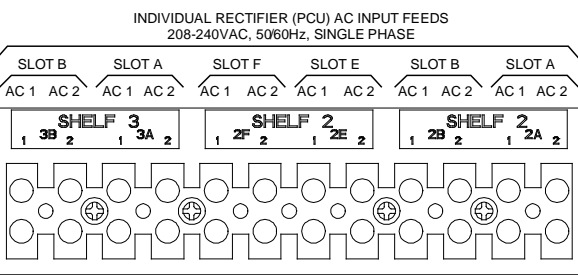
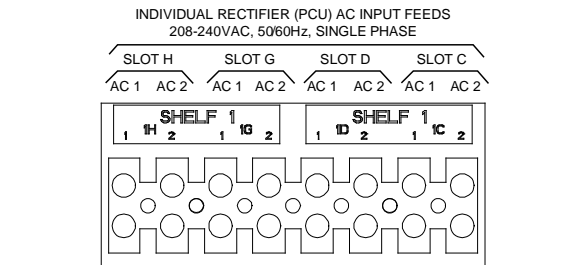
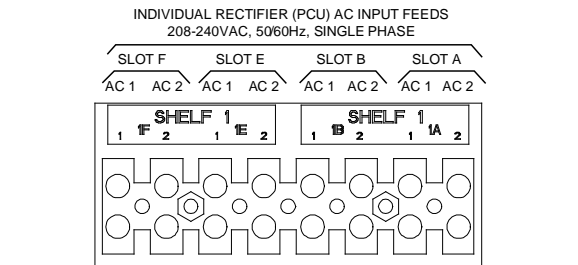
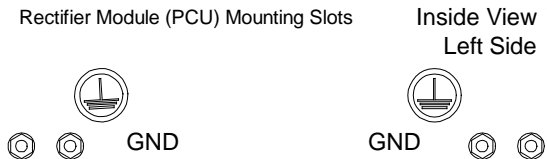
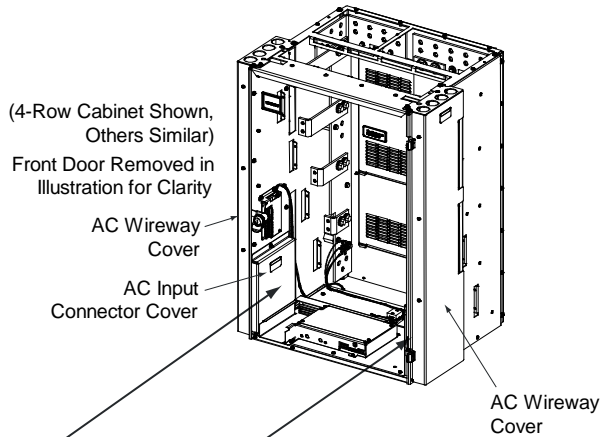
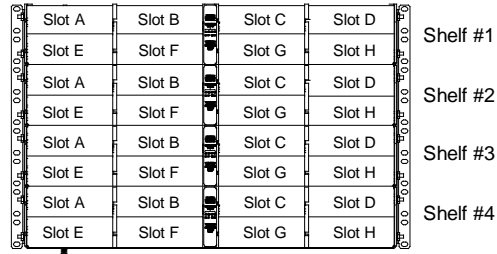
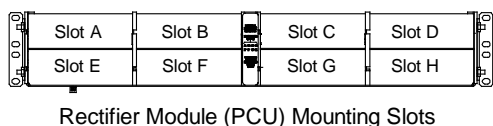


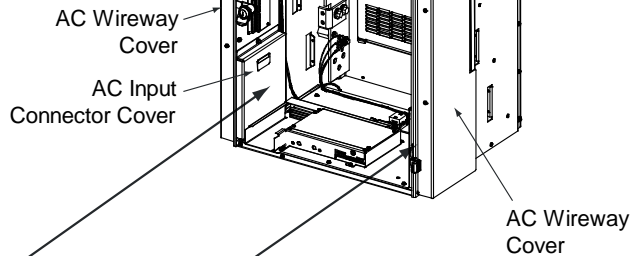
Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

AC INPUT CONNECTIONS,
DUAL PCU FEED (581127000 LIST 41),
WHEN EQUIPPED WITH 588705201

NOTE:
WIRING TO AN EXPANSION
SHELF IS DONE AT THE
REAR OF THE EXPANSION
SHELF.



(4-Row Cabinet Shown,
Others Similar)
Front Door Removed in
Illustration for Clarity



Inside View
Left Side

Inside View
Right Side



DUAL RECTIFIER (PCU) AC INPUT FEEDS
208-240VAC, 50/60Hz, SINGLE PHASE

DUAL RECTIFIER (PCU) AC INPUT FEEDS
208-240VAC, 50/60Hz, SINGLE PHASE

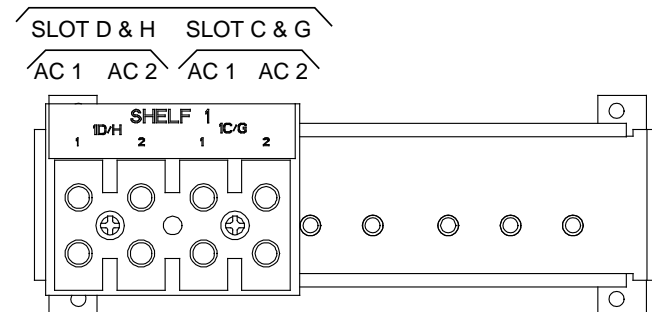
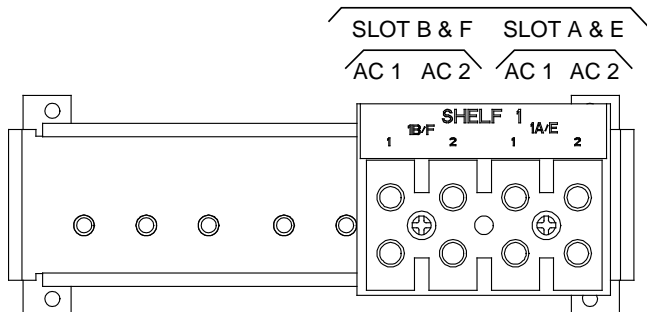
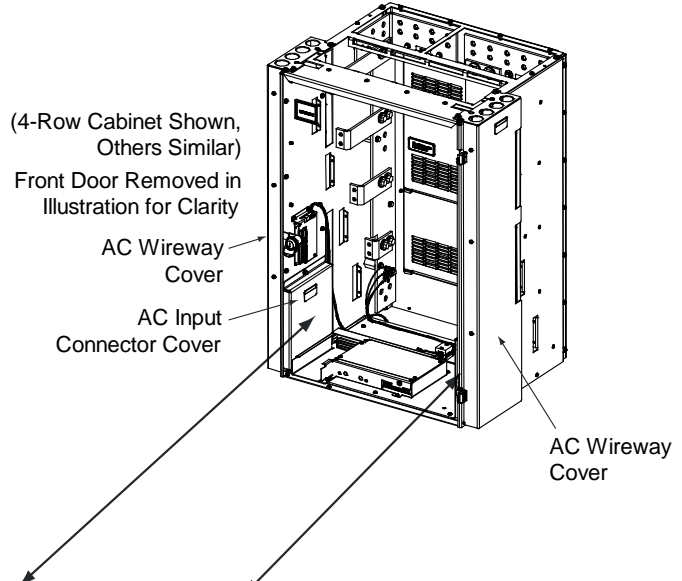
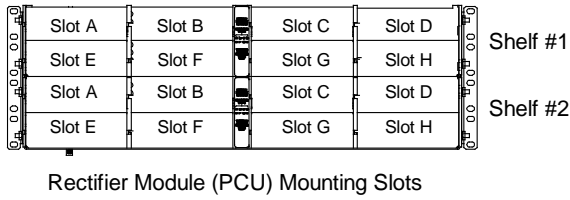


Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

**AC INPUT CONNECTIONS,
DUAL PCU FEED (581127000 LIST 41),
WHEN EQUIPPED WITH 588705202**

NOTE:
WIRING TO AN EXPANSION
SHELF IS DONE AT THE
REAR OF THE EXPANSION
SHELF.



Inside View
Left Side

Inside View
Right Side

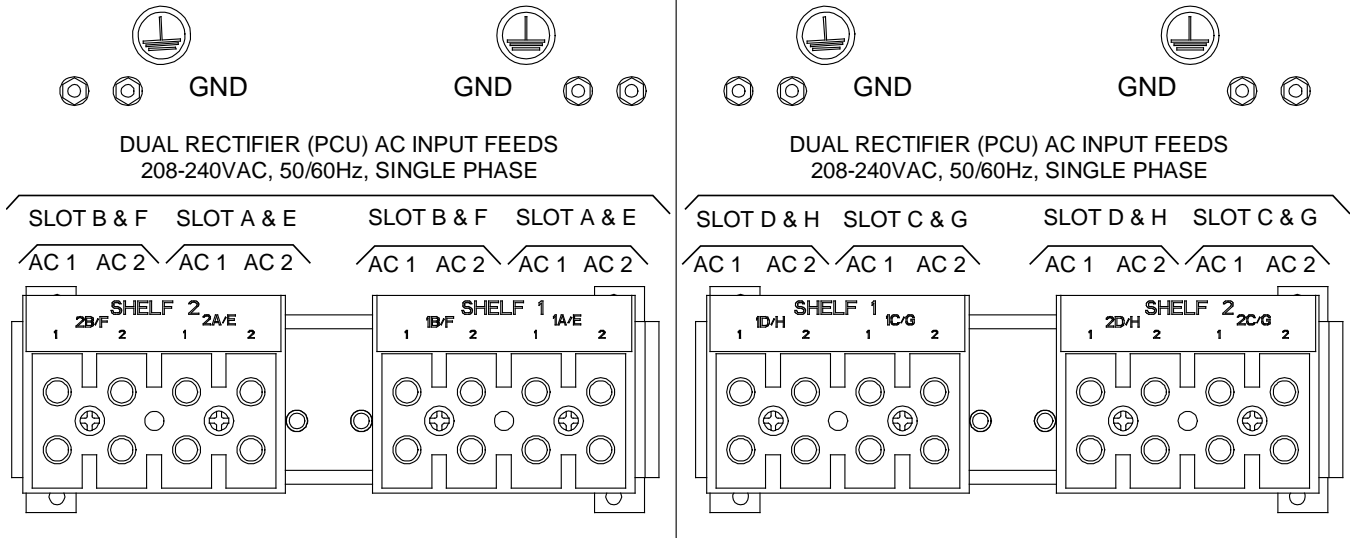
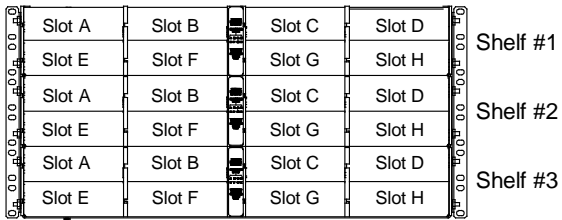


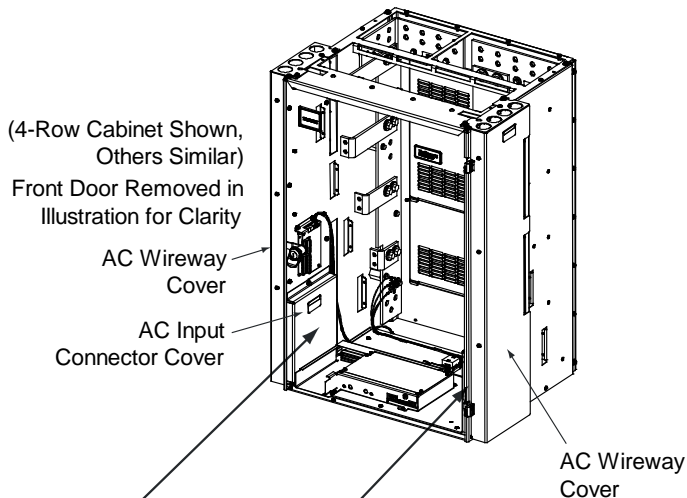
Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

AC INPUT CONNECTIONS,
DUAL PCU FEED (581127000 LIST 41),
WHEN EQUIPPED WITH 588705203

NOTE:
WIRING TO AN EXPANSION
SHELF IS DONE AT THE
REAR OF THE EXPANSION
SHELF.



Rectifier Module (PCU) Mounting Slots



Inside View
Left Side

Inside View
Right Side

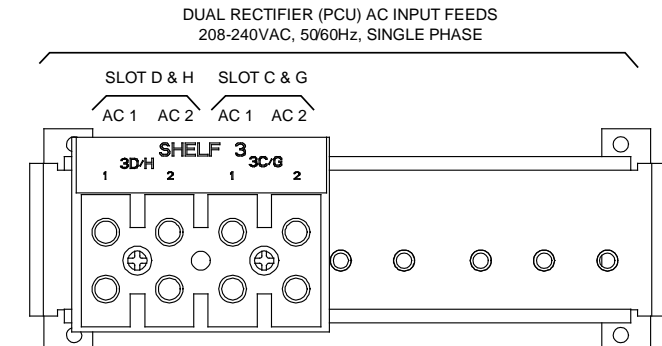
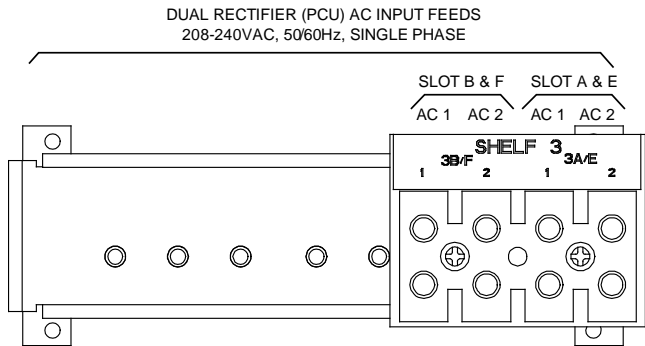
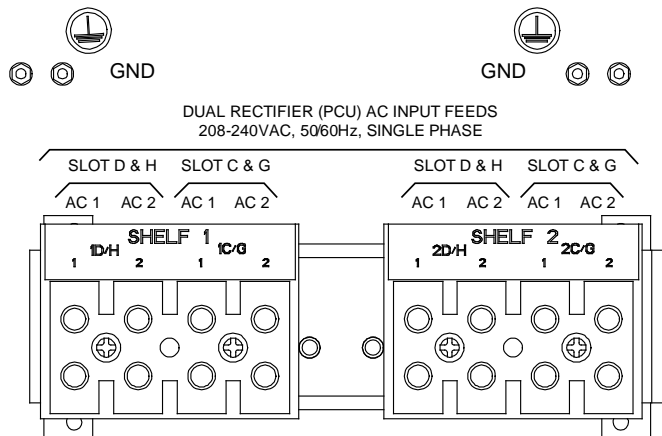
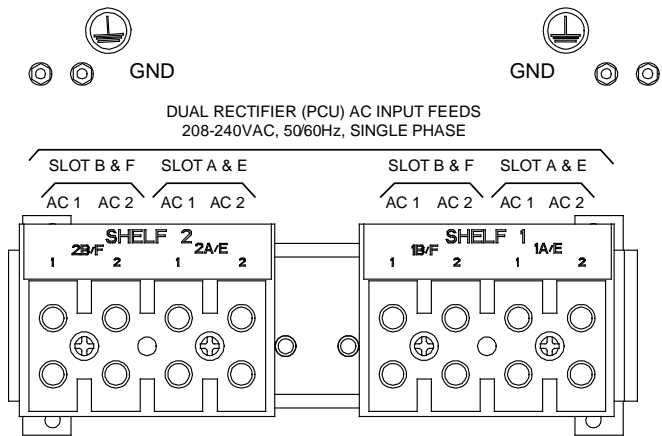
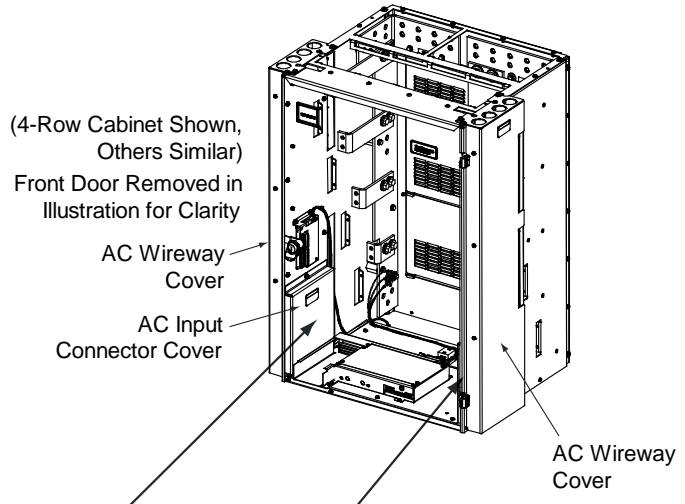


Figure 5.2: AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page)

**AC INPUT CONNECTIONS,
DUAL PCU FEED (581127000 LIST 41),
WHEN EQUIPPED WITH 588705204**

NOTE:
WIRING TO AN EXPANSION
SHELF IS DONE AT THE
REAR OF THE EXPANSION
SHELF.



Slot A	Slot B	Slot C	Slot D	Shelf #1
Slot E	Slot F	Slot G	Slot H	
Slot A	Slot B	Slot C	Slot D	
Slot E	Slot F	Slot G	Slot H	
Slot A	Slot B	Slot C	Slot D	Shelf #2
Slot E	Slot F	Slot G	Slot H	
Slot A	Slot B	Slot C	Slot D	
Slot E	Slot F	Slot G	Slot H	
Slot A	Slot B	Slot C	Slot D	Shelf #3
Slot E	Slot F	Slot G	Slot H	
Slot A	Slot B	Slot C	Slot D	
Slot E	Slot F	Slot G	Slot H	
Slot A	Slot B	Slot C	Slot D	Shelf #4
Slot E	Slot F	Slot G	Slot H	
Slot A	Slot B	Slot C	Slot D	
Slot E	Slot F	Slot G	Slot H	

Rectifier Module (PCU) Mounting Slots

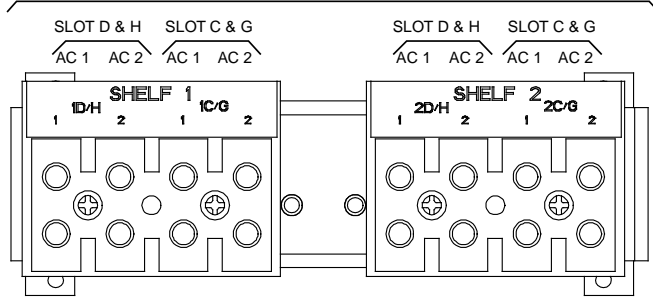
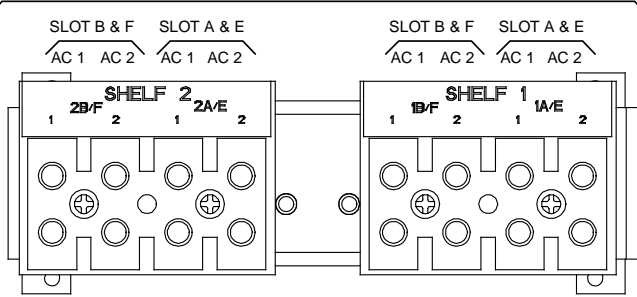
Inside View Left Side

Inside View Right Side



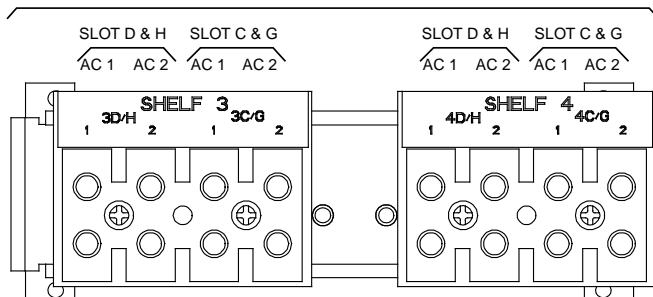
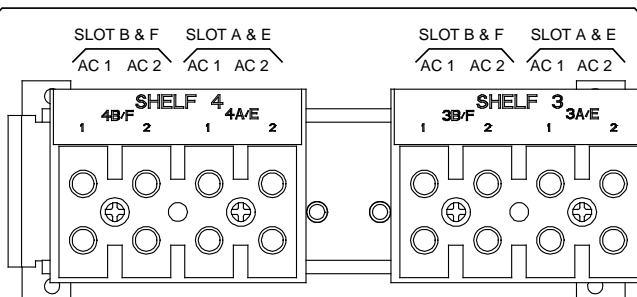
DUAL RECTIFIER (PCU) AC INPUT FEEDS
208-240VAC, 50/60Hz, SINGLE PHASE

DUAL RECTIFIER (PCU) AC INPUT FEEDS
208-240VAC, 50/60Hz, SINGLE PHASE



DUAL RECTIFIER (PCU) AC INPUT FEEDS
208-240VAC, 50/60Hz, SINGLE PHASE

DUAL RECTIFIER (PCU) AC INPUT FEEDS
208-240VAC, 50/60Hz, SINGLE PHASE



Connections to Field Expansion Module Mounting Assembly

The field expansion module mounting assembly provides separate AC input connections for each rectifier. Circular openings are provided in the side panels (side feed) and rear covers (rear feed) of the module mounting assembly for AC input and AC input equipment-grounding conductors. The openings accept 3/4" inch conduit fittings. AC input wiring should be provided to all mounting positions intended for rectifiers, including currently unused positions. This wiring will ease future installation of rectifiers to meet increased load requirements.



NOTE! A grounding conductor must be provided with each conduit.

Procedure

Refer to Figure 5.3 as these procedures are performed.

Accessing Connections and Routing Wire

1. Remove the two AC input access covers from the rear of the module mounting assembly by first removing the screws that secure them.
2. Install conduit fittings in the side or rear openings as required. Plug buttons are provided, and must be installed in the openings not being used.
3. Route wiring into the shelf through the previously installed conduit fittings.

Making AC Input Connections



NOTE! Module mounting positions are lettered left to right as viewed from the front of the shelf, A-D in the top row and E-H in the bottom row.



NOTE! If module mounting positions B, C, F, and G are intended solely for DC-DC Converter installation (Converter Option must be installed), AC input connections to these positions are not required.

1. Make AC input connections as shown in Figure 5.3. Connect each wire by inserting the stripped end into the wire opening, and then tightening the screw. Recommended torque is 10 in-lbs.

208/240 VAC Service Type:

- Line to Line:
Connect Line 1 to Terminal 1.
Connect Line 2 to Terminal 2.
- Line to Neutral:
Connect Line to Terminal 1.
Connect Neutral to Terminal 2.

Making Equipment Grounding Connections



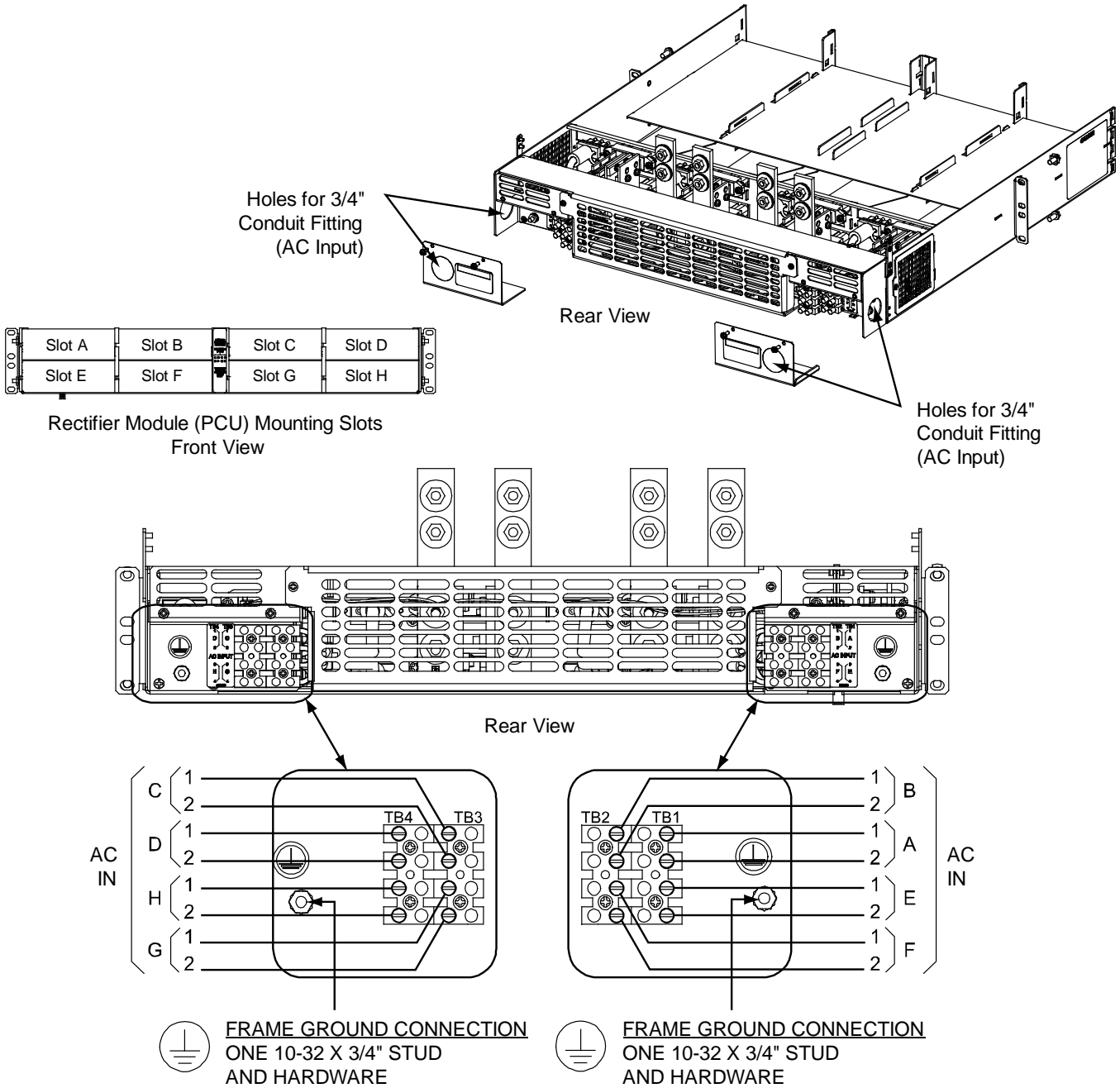
NOTE! Make equipment grounding connections to earth ground, **not** to the branch circuit neutral conductor.

1. Connect AC input equipment grounding leads to the frame ground studs using installer-provided ring lugs and factory-supplied mounting hardware. Recommended torque is 23 in-lbs.

Reinstalling Covers

1. After all AC input and equipment grounding connections have been made and checked, reinstall the two AC input access covers on the back of the shelf. Secure with the previously removed screws.

Figure 5.3: AC Input and Equipment Grounding Connections to Field Expansion Module Mounting Assembly



Note: Module mounting positions are lettered left to right as viewed from front of shelf, A-D in top row and E-H in bottom row.

Note: If mounting positions B, C, F, and G are intended solely for DC-DC Converter installation (Converter Option must be installed), AC input connections to these positions are not required.

5.6 AC Input, AC Output, and Frame Ground Connections to List A1 (if furnished)

5.6.1 General

List A1 includes a wireway with an AC Termination Panel located at the top of the bay. The AC Termination Panel provides AC input and equipment ground terminals for one (1) PCU Mounting Shelf (individual feed), AC input terminals for the List A1 and A2 Inverters, and AC output terminals for the List A1 Inverter. Wiring from the equipment to the AC Termination Panel has been installed and connected at the factory.

5.6.2 Removing and Installing the AC Termination Panel Access Cover

All wiring connections to the List A1 AC Termination Panel are accessed by removing a front cover panel. The cover must be re-installed after connections are made.

Procedure

1. To access the terminations inside the AC Termination Panel, remove the eight (8) screws that secure it.
2. After all wiring connections are made and verified, replace the access cover and secure with the eight (8) previously removed screws.

5.6.3 Connections for the PCU Mounting Shelf

Equipment Grounding Conductors

Equipment grounding conductor(s) must be provided with the AC input conductors supplied to power the PCU Mounting Shelf. Connect all equipment grounding conductors to terminal block TB3 located inside the AC Termination Panel. Connect to earth ground, not power system neutral. Refer to Figure 5.4 for terminal block location and identification, wire size range, and recommended torque. Refer to SAG581127000 for recommended wire size.

AC Input

AC input conductors are to be provided for each individual PCU mounting position in the PCU Mounting Shelf, including currently unused positions. This wiring will ease future installation of PCUs to meet increased load requirements. These conductors are connected to terminal block TB1 located inside the AC Termination Panel, as described below. Refer to Figure 5.4 for terminal block location and identification, wire size range, and recommended torque. Refer to SAG581127000 for recommended wire size.

Procedure

1. Connect AC input conductors for PCU mounting position #1 to terminals 1 and 2 of TB1. For 208-240 Volt AC Input Voltage Derived from a Line-to-Line System: Connect Line 1 to the terminal designated 1 and Line 2 to the terminal designated 2. For 208-240 Volt AC Input Voltage Derived from a Line-to-Neutral System: Connect Line to the terminal designated 1 and Neutral to the terminal designated 2.
2. Connect AC input conductors for PCU mounting position #2 to terminals 3 and 4 of TB1. For 208-240 Volt AC Input Voltage Derived from a Line-to-Line System: Connect Line 1 to the terminal designated 3 and Line 2 to the terminal designated 4. For 208-240 Volt AC Input Voltage Derived from a Line-to-Neutral System: Connect Line to the terminal designated 3 and Neutral to the terminal designated 4.
3. Connect AC input conductors for PCU mounting position #3 to terminals 5 and 6 of TB1. For 208-240 Volt AC Input Voltage Derived from a Line-to-Line System: Connect Line 1 to the terminal designated 5 and Line 2 to the terminal designated 6. For 208-240 Volt AC Input Voltage Derived from a Line-to-Neutral System: Connect Line to the terminal designated 5 and Neutral to the terminal designated 6.

4. Connect AC input conductors for PCU mounting position #4 to terminals 7 and 8 of TB1. For 208-240 Volt AC Input Voltage Derived from a Line-to-Line System: Connect Line 1 to the terminal designated 7 and Line 2 to the terminal designated 8. For 208-240 Volt AC Input Voltage Derived from a Line-to-Neutral System: Connect Line to the terminal designated 7 and Neutral to the terminal designated 8.

5.6.4 Connections for the Inverter(s)

Equipment Grounding Conductors

Equipment grounding conductors must be provided with the AC input conductors supplied to power each Inverter furnished. An equipment grounding conductor must also be provided with the AC output (load) conductors supplied to the List A1 Inverter. Connect all equipment grounding conductors to terminal block TB3 located inside the AC Termination Panel. Connect to earth ground, not power system neutral. Refer to Figure 5.4 for terminal block location and identification, wire size range, and recommended torque. Refer to the separate Inverter instruction manuals for recommended wire size.

AC Input

AC input conductors are to be provided for the List A1 Inverter and for the List A2 Inverter if furnished. These conductors are connected to terminal block TB2 located inside the AC Termination Panel, as described below. Refer to Figure 5.4 for terminal block location and identification, wire size range, and recommended torque. Refer to the separate Inverter instruction manuals for recommended wire size and branch circuit protection.

Procedure



WARNING! Use care not to connect AC input conductors to the AC output terminals of TB2. Applying AC power to the inverter output terminals will damage the inverter.

1. **Bonding Jumper Removal:** Before connecting AC input wiring, remove the green-yellow “neutral to ground” bonding jumper that is connected between the terminal of TB2 labeled **120 AC IN INV 1 N** and frame ground terminal block TB3.

If the List A2 Inverter is furnished, remove the green-yellow “neutral to ground” bonding jumper that is connected between the terminal of TB2 labeled **120 AC IN INV 2 N** and frame ground terminal block TB3.

The purpose of each bonding jumper is to connect neutral to ground in case no AC input cable is connected to the system. (When an inverter is used as the power source for a separately derived premises wiring system, the wiring should be grounded per recommendations set forth in the NEC.)

2. Connect AC input conductors for the List A1 Inverter to the terminals of TB2 labeled **120 AC IN INV 1**. Connect Line to terminal **L** and Neutral to terminal **N**.
3. If the List A2 Inverter is furnished, connect AC input conductors for the List A2 Inverter to the terminals of TB2 labeled **120 AC IN INV 2**. Connect Line to terminal **L** and Neutral to terminal **N**.

AC Output

Connect AC output (load) conductors for the List A1 Inverter to terminal block TB2 located inside the AC Termination Panel, as described below. Refer to Figure 5.4 for terminal block location and identification, wire size range, and recommended torque. Refer to the separate Inverter instruction manuals for recommended wire size.

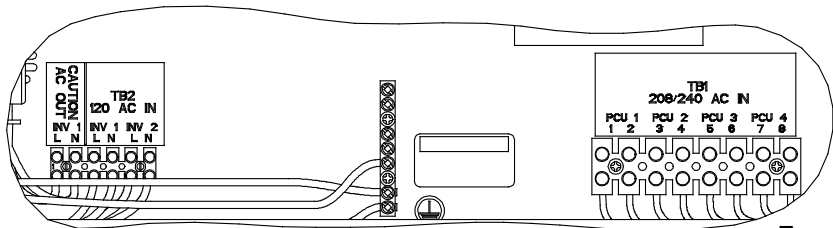
Procedure

1. Connect AC output (load) conductors for the List A1 Inverter to the terminals of TB2 labeled **AC OUT INV 1**. Connect Line to terminal **L** and Neutral to terminal **N**.

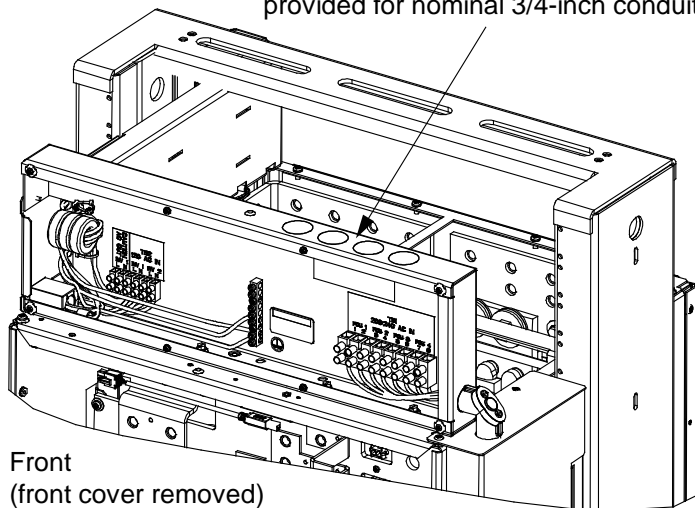


NOTE! If the List A2 Inverter is furnished, load connections are made to a standard 3-prong socket receptacle on the rear panel of the inverter.

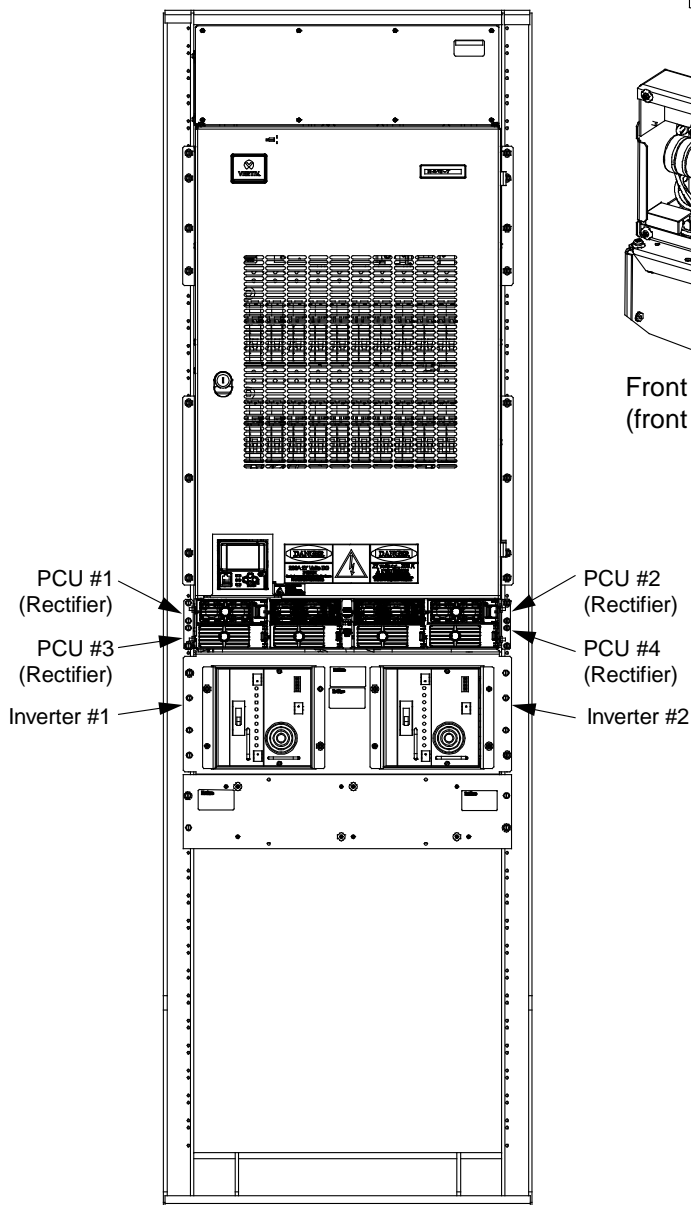
Figure 5.4: List A1 AC Termination Panel (cont'd on next page)



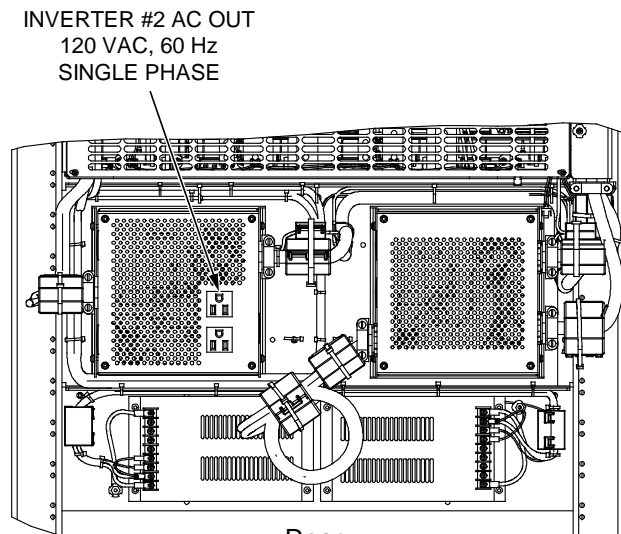
Four (4) 1.10-inch conduit knockouts provided for nominal 3/4-inch conduit.



Front (front cover removed)



Front



Rear

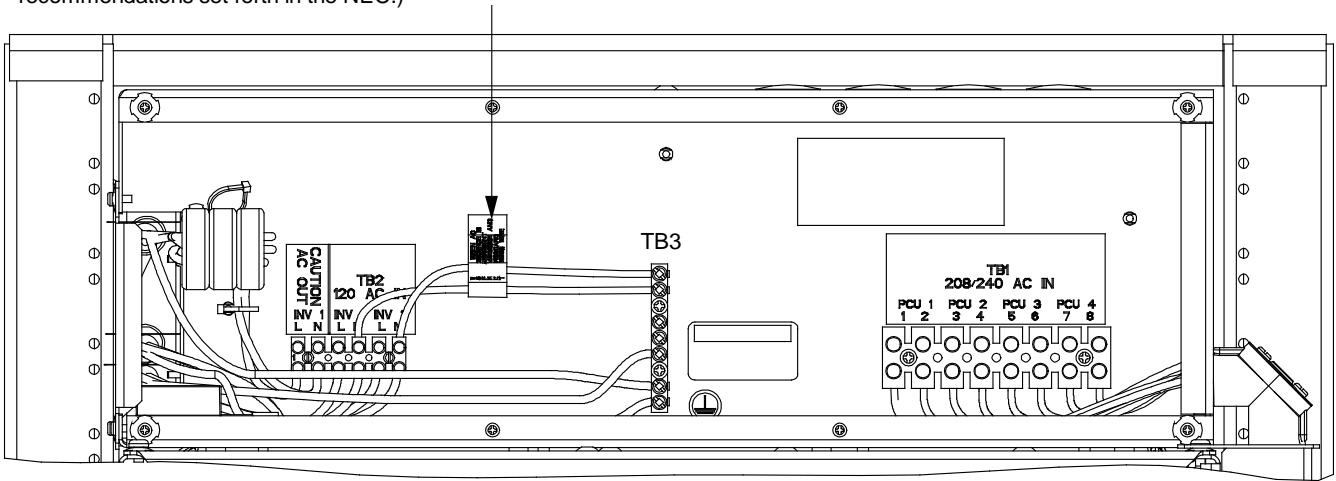
Figure 5.4: List A1 AC Termination Panel (cont'd from previous page)

Bonding Jumpers Removal:

List A1: Before connecting AC input wiring to the inverter #1 AC input terminals, remove the green-yellow "neutral to ground" bonding jumper that is connected between the terminal of TB2 labeled "120 AC IN INV 1 N" and frame ground terminal block TB3.

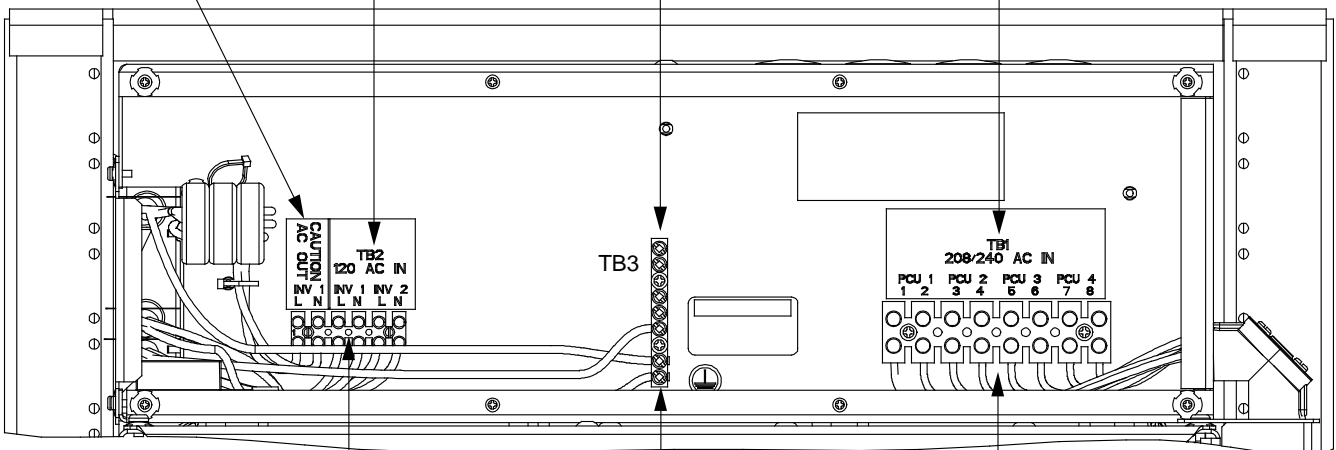
List A2: Before connecting AC input wiring to the inverter #2 AC input terminals, remove the green-yellow "neutral to ground" bonding jumper that is connected between the terminal of TB2 labeled "120 AC IN INV 2 N" and frame ground terminal block TB3.

The purpose of each bonding jumper is to connect neutral to ground in case no AC input cable is connected to the system. (When an inverter is used as the power source for a separately derived premises wiring system, the wiring should be grounded per recommendations set forth in the NEC.)



Front
(front cover removed)

<p>INVERTER #1 AC OUT 120 VAC, 60 Hz SINGLE PHASE</p>	<p>INVERTER AC INPUT FEEDS 120 VAC, 50 Hz / 60 Hz SINGLE PHASE</p>	<p>FRAME GROUND CONNECTION</p>	<p>RECTIFIER AC INPUT FEEDS 208 VAC / 240 VAC 50 Hz / 60 Hz SINGLE PHASE (1 FEED PER 1 RECTIFIER)</p>
---	--	--	---



Front
(front cover removed)

Wire Size Capacity:
12 AWG to 24 AWG.
Recommended Torque:
5 in-lbs.

Wire Size Capacity:
4 AWG to 14 AWG.
Recommended Torque:
20 in-lbs.

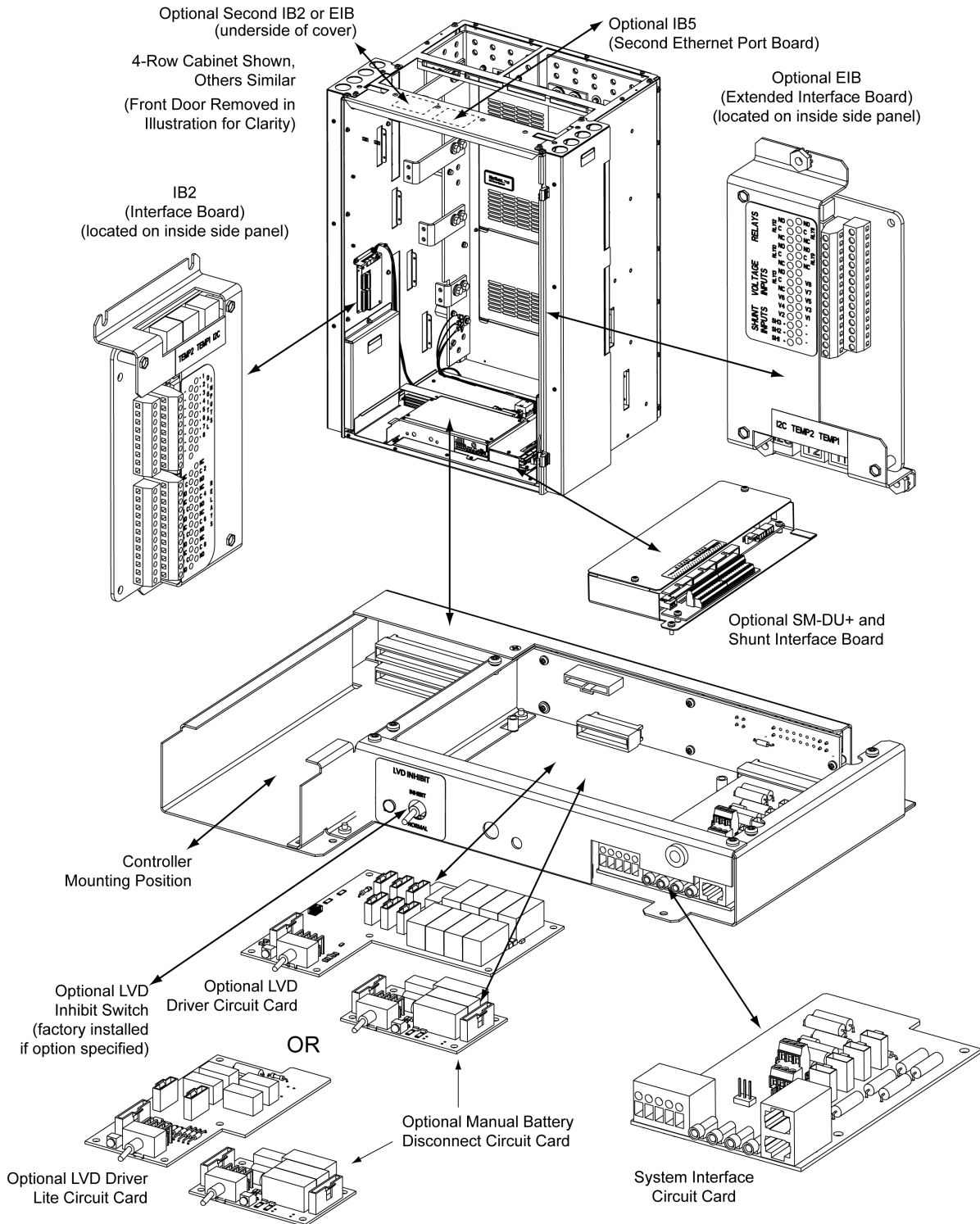
Wire Size Capacity:
6 AWG to 14 AWG.
Recommended Torque:
11 in-lbs.

5.7 External Alarm, Reference, Monitoring, and Control Connections

5.7.1 Circuit Card Locations

Refer to Figure 5.5.

Figure 5.5: Circuit Card Locations



5.7.2 System Interface Circuit Card

The System Interface Circuit Card provides connections for the following. Refer to Figure 5.6.

- **Battery Tray FA Signal:** This input is used to provide a battery tray fuse alarm (FA) on the controller due to a tripped battery disconnect breaker on a battery tray in the power system rack. Application of system voltage to pin TB1-1 activates this alarm. The lead should be protected at the source with an in-line fusible resistor. The source should be originated from the system side of the disconnect device, not the battery side. If used with List 93 battery tray option this connection is applied in the factory.
- **External Battery FA Signal:** This input is used to provide an external battery fuse alarm (FA) on the controller due to a tripped battery disconnect device (fuse, breaker or contactor) external to the power system rack. Application of system voltage to pin TB1-2 activates this alarm. The lead should be protected at the source with an in-line fusible resistor. The source should be originated from the system side of the disconnect device, not the battery side.
- **External System FA Signal:** This input is used to provide an external system fuse alarm (FA) on the controller due to a tripped distribution device (fuse or breaker) on the system output external to the power system distribution cabinet. Application of system voltage to pin TB1-3 activates this alarm. The lead should be protected at the source with an in-line fusible resistor. This input is not to be used for any voltage bus (such as converter output) other than the system bus.
- **External Battery Monitoring:** If the jumper J10 is set to External (see Figure 4.2), connect TB1-4 and TB1-5 to the desired battery voltage sensing point. Observe proper polarity per the Figure 4.2. The hot sense lead should be protected at the source with an in-line fuse or fusible resistor.
- **RS-485 (used for communication with SM modules)**

(Also used when an NCU configuration is furnished that enables NCU capability to receive status information sent from Fiamm SoNick [Sodium Nickel] batteries. Connect leads from the Fiamm SoNick batteries to the RS-485 terminals. See Figure 5.6. Refer to the battery manufacturer documentation and the NCU controller manual UM1M830BNA for details.)

- **RS-232 (used for communication with a DPU)**
- **Bay Voltage Monitoring Test Points:** Provide system bus voltage measurement for an external meter. The leads are protected against fault with 10kohm series resistors in each lead.
- **Bay Load Shunt Monitoring Test Points:** Provide for measurement of the system load shunt in the bay. See below for shunt ratings. The leads are protected against fault with 10kohm series resistors in each lead.

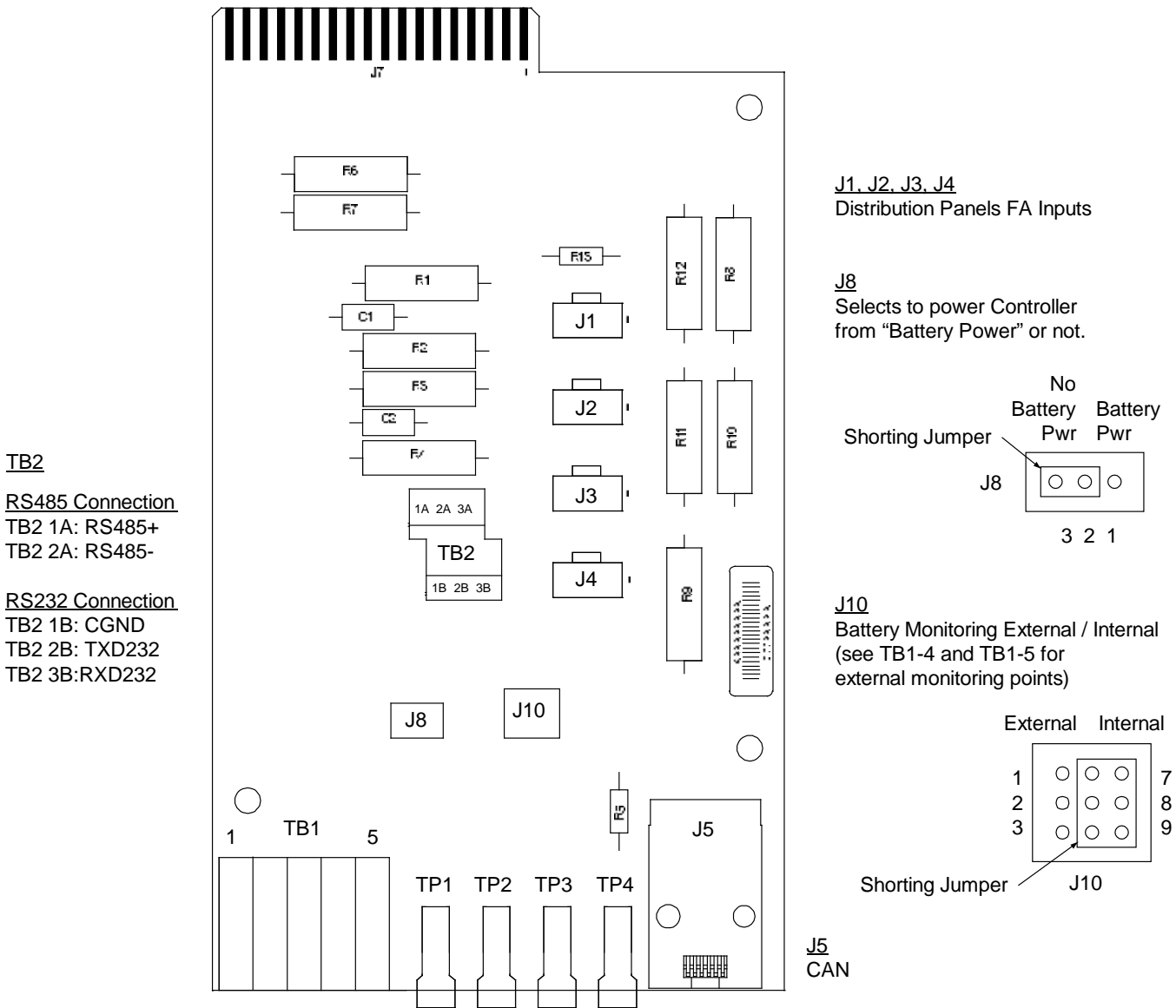
List 21, 1-Row Distribution Cabinet: 800A / 25mV (32A per mV)

List 22, 2-Row Distribution Cabinet: 2000A / 25mV (80A per mV)

List 23, 3-Row Distribution Cabinet: 2500A / 25mV (100A per mV)

List 24, 4-Row Distribution Cabinet: 2500A / 25mV (100A per mV)

Figure 5.6: System Interface Circuit Card Connections

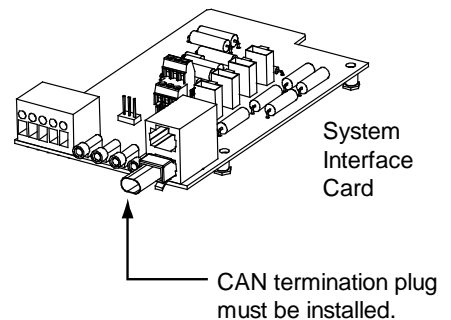


TB1-1: Battery Tray FA
 TB1-2: External Battery FA
 TB1-3: External System FA
 TB1-4: External Battery Monitoring (-)
 TB1-5: External Battery Monitoring (+)

TP1 (+) and TP2 (-)
 System Voltage Monitoring

TP3 (+) and TP4 (-)
 System Load Shunt Monitoring

TB1
 Wire Size Capacity: 22-12 AWG.
 Recommended Torque: 3.0 in-lbs.
 FA Signals: Battery applied to the terminal turns in an alarm.



5.7.3 IB2 (Controller Interface Board) Connections (if required)



NOTE! The system may have one (1) or two (2) IB2 boards installed. The first IB2 is standard while the second IB2 is optional.

The IB2 (Controller Interface Board) provides connection points for digital inputs, programmable relay outputs, and temperature probes. The IB2 interface board is mounted inside the distribution cabinet. Refer to Figure 5.5.

Digital Inputs and Programmable Relay Outputs

Digital input and relay output leads are connected to screw-type terminal blocks located on the IB2. Recommended torque for these connections is 2.2 in-lbs. Refer to Figure 5.7 for terminal locations. Refer to Table 5.2 and Table 5.3 for pin-out information.

Digital Inputs

Connect up to eight (8) digital inputs to the IB2. Note that you must supply both paths for the digital input (either a positive or negative signal and the opposite polarity return path). Observe proper polarity. Refer to Figure 5.7 for terminal locations and Table 5.2 for pin-out information.



NOTE! First IB2 Board only: +24V is factory wired to the Digital Input #8 (+) terminal for your convenience and function predefined for ESTOP. Customer-furnished system ground applied to terminal Digital Input #8 (-) activates the ESTOP function. See "ESTOP Function" on page 66.

The digital inputs can be programmed to provide an alarm when the signal is applied (HIGH) or removed (LOW). Refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) for programming information.

Digital Input Ratings: Refer to the following.

- a) Maximum Voltage Rating: 60V DC.
- b) Active High: > 19V DC.
- c) Active Low: < 1V DC.

The digital inputs may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.

ESTOP Function

If an ESTOP switch is wired to the IB2-1 Controller Interface Board, customer-furnished system ground applied to terminal DI8- activates the ESTOP function. The ESTOP function shuts down and locks out the rectifiers, shuts down and locks out the optional +24 VDC to -48 VDC converters, and opens the optional low voltage disconnect (LVD) contactors (battery and load type). If the system has battery connected and does not contain a battery LVD or the controller power option is set to Battery Pwr (jumper J8 on the system interface board is set to Battery Pwr), the controller will remain operational. If the system does not contain battery or load LVD(s) and has battery connected, the loads will be sustained by the battery voltage.

For Systems NOT Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will close after the "LVD Reconnect Delay" has elapsed (customer configurable via the controller) if battery voltage is present on the bus. Rectifiers and +24 VDC to -48 VDC converters will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). To restart the +24 VDC to -48 VDC converters: remove the converter, wait 30 seconds or more (until the LEDs on the converter extinguish), then re-insert the converter.

For Systems Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will remain open. Rectifiers and +24 VDC to -48 VDC converters will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). When the rectifiers restart, LVD contactors (battery and load type) will close after the "LVD Reconnect Delay" has elapsed (customer configurable via the controller) and the +24 VDC to -48 VDC converters will restart.



NOTE! If a customer-furnished method to disconnect the input power to the system is not provided, the rectifiers will stay locked OFF until the input power is recycled. If the ESTOP signal is removed without recycling the input power, the rectifiers will remain off and have a local alarm visible on the module. The ESTOP alarm from the controller will extinguish. The controller will not issue an alarm for this condition.

Programmable Relay Outputs

The IB2 provides eight (8) programmable alarm relays with dry Form-C contacts. Connect up to eight (8) relay outputs to the IB2. Refer to Figure 5.7 for terminal locations and Table 5.3 for pin-out information.



NOTE! The relay assigned to “Critical Summary” alarm (Relay 1 on first IB2 by default) will operate in the “Fail Safe Mode”. “Fail Safe Mode” means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals. The remaining 7 relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) for programming information.

Relay Ratings: Refer to the following.

- a) Steady State: 0.5 A @ 60V DC; 1.0 A @ 30V DC.
- b) Peak: 3 A @ 30V DC.

The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.

Temperature Probes



NOTE! Each temperature probe consists of two or three pieces that plug together to make a complete probe. See SAG581127000 for part numbers and descriptions.

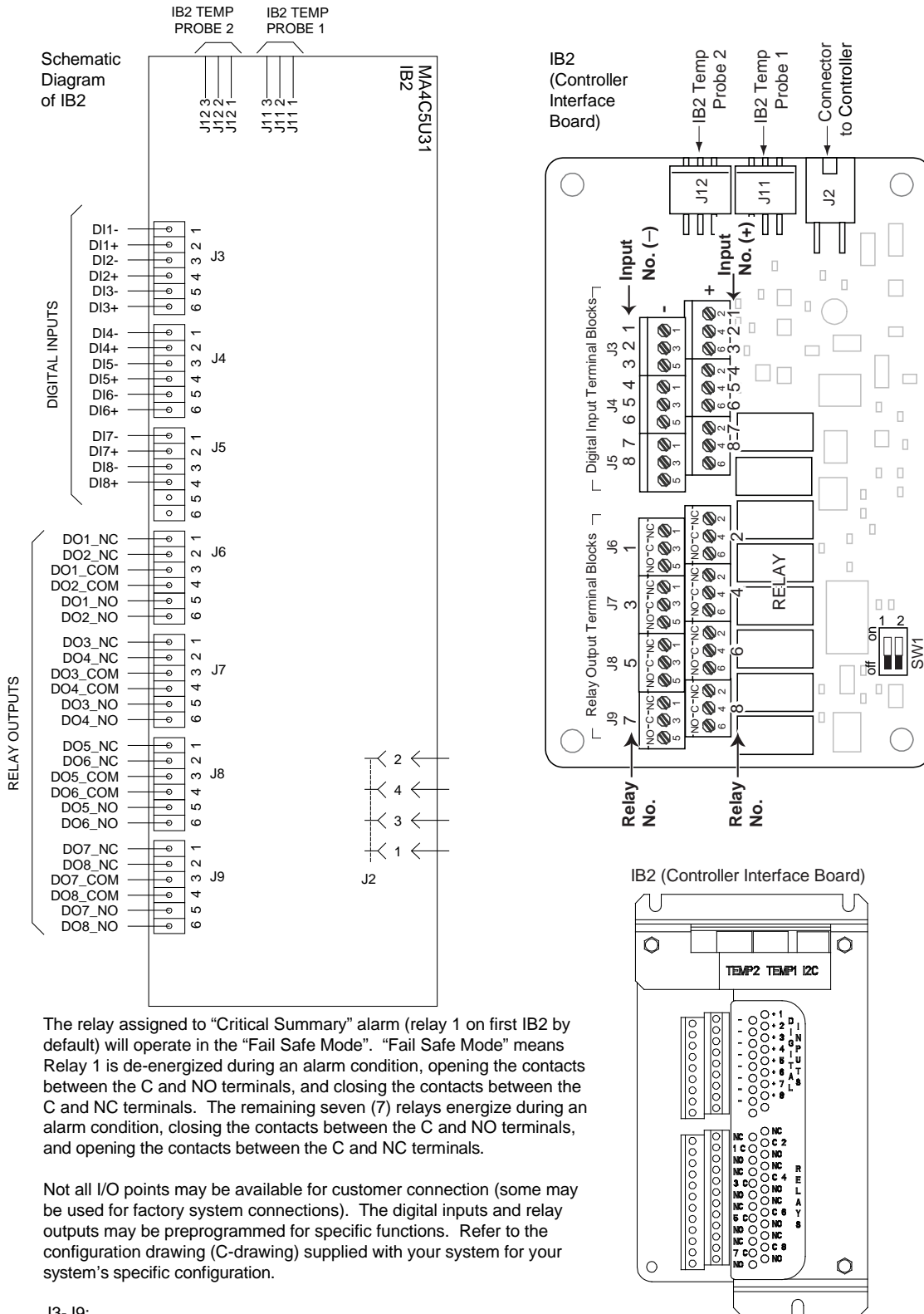
Temperature probes can be connected to the IB2 (Controller Interface Board) and/or EIB (Controller Extended Interface Board) mounted inside the distribution cabinet. See Figure 5.7 and Figure 5.9.

Each IB2 and EIB board allows for the connection of two (2) temperature probes. Any combination of temperature probes can be programmed to monitor ambient temperature and/or battery temperature. A temperature probe set to monitor battery temperature can also be used for the rectifier battery charge temperature compensation feature, or the battery charge temperature compensation feature can be programmed to use the average or highest value of all battery temperature probes. The battery charge temperature compensation feature allows the controller to automatically increase or decrease the output voltage of the system to maintain battery float current as battery temperature decreases or increases, respectively. Battery life can be extended when an optimum charge voltage to the battery with respect to temperature is maintained. A temperature probe set to monitor battery temperature can also be used for the BTRM (Battery Thermal Runaway Management) feature. The BTRM feature lowers output voltage when a high temperature condition exists to control against battery thermal runaway.

The temperature sensor end of the probe contains a tab with a 5/16" clearance hole for mounting.

A temperature probe programmed to monitor battery temperature should be mounted on the negative post of a battery cell to sense battery temperature. A temperature probe used for battery charge temperature compensation and/or BTRM (Battery Thermal Runaway Management) should also be mounted on the negative post of a battery cell. A temperature probe programmed to monitor ambient temperature should be mounted in a convenient location, away from direct sources of heat or cold.

Figure 5.7: IB2-1 and IB2-2 (Interface Board) Connections



The relay assigned to “Critical Summary” alarm (relay 1 on first IB2 by default) will operate in the “Fail Safe Mode”. “Fail Safe Mode” means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals. The remaining seven (7) relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Not all I/O points may be available for customer connection (some may be used for factory system connections). The digital inputs and relay outputs may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system’s specific configuration.

J3-J9:

Wire Size Capacity: 16 AWG to 26 AWG.

Wire Strip Length: 0.20 inch.

Recommended Torque: 2.2 in-lbs.

Table 5.2: Programmable Digital Inputs – IB2 Board

Programmable Digital Input	IB2 Pin No.		Factory Wiring	Default Digital Input Function
IB2-1 or IB2-2 DI1	J3-2	+	The digital inputs may be preprogrammed for specific functions and have factory wiring connected. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.	The digital inputs may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.
	J3-1	-		
IB2-1 or IB2-2 DI2	J3-4	+		
	J3-3	-		
IB2-1 or IB2-2 DI3	J3-6	+		
	J3-5	-		
IB2-1 or IB2-2 DI4	J4-2	+		
	J4-1	-		
IB2-1 or IB2-2 DI5	J4-4	+		
	J4-3	-		
IB2-1 or IB2-2 DI6	J4-6	+		
	J4-5	-		
IB2-1 or IB2-2 DI7	J5-2	+		
	J5-1	-		
IB2-1 or IB2-2 DI8	J5-4	+	+24 VDC	ESTOP
	J5-3	-	(to customer ESTOP switch)	
--	J5-5		not used	not used
--	J5-6			



NOTE! First IB2 Board only: +24V is factory wired to the Digital Input #8 (+) terminal for your convenience and function predefined for ESTOP. Customer-furnished system ground applied to terminal Digital Input #8 (-) activates the ESTOP function. See “ESTOP Function” on page 66.

Table 5.3: Programmable Relay Outputs – IB2 Board

Programmable Relay Output		IB2 Pin No.	Alarms Assigned to this Relay (Default)
IB2-1 or IB2-2 D01	NO	J6-5	The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.
	COM	J6-3	
	NC	J6-1	
IB2-1 or IB2-2 D02	NO	J6-6	
	COM	J6-4	
	NC	J6-2	
IB2-1 or IB2-2 D03	NO	J7-5	
	COM	J7-3	
	NC	J7-1	
IB2-1 or IB2-2 D04	NO	J7-6	
	COM	J7-4	
	NC	J7-2	
IB2-1 or IB2-2 D05	NO	J8-5	
	COM	J8-3	
	NC	J8-1	
IB2-1 or IB2-2 D06	NO	J8-6	
	COM	J8-4	
	NC	J8-2	
IB2-1 or IB2-2 D07	NO	J9-5	
	COM	J9-3	
	NC	J9-1	
IB2-1 or IB2-2 D08	NO	J9-6	
	COM	J9-4	
	NC	J9-2	



NOTE! The relay assigned to “Critical Summary” alarm (relay 1 on first IB2 by default) will operate in the “Fail Safe Mode”. “Fail Safe Mode” means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals.

The remaining 7 relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Refer to the configuration drawing (C-drawing) supplied with your system for your system’s specific relay labeling.

5.7.4 Optional EIB (Controller Extended Interface Board) Connections (if required)



NOTE! The system may have one (1) or two (2) EIB boards installed.

Each optional EIB (Controller Extended Interface Board) provides additional connection points for voltage and current inputs, programmable relay outputs, and temperature probes. The EIB extended interface board is mounted inside the distribution cabinet. Refer to Figure 5.5.

Current Inputs, Voltage Inputs, and Programmable Relay Outputs

Current input, voltage input, and relay output leads are connected to screw-type terminal blocks located on the optional EIB. Recommended torque for these connections is 2.2 in-lbs. Refer to Figure 5.9 for terminal locations. Refer to Table 5.4, Table 5.5, and Table 5.6 for pin-out information.

Current Inputs

Connect up to three (3) shunt inputs to the EIB. Observe proper polarity. Refer to Figure 5.9 for terminal locations and Table 5.4 for pin-out information.

Refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) and program the shunt input parameters.



NOTE! The shunt needs to be installed in the hot (+24V) bus. Connect the plus side of the shunt to the positive shunt input on the EIB. Connect the negative side of the shunt to the negative shunt input on the EIB.

Voltage Inputs for Battery Block and Battery Midpoint Monitoring

The controller can monitor battery blocks (12V blocks) or midpoint battery voltage of battery strings connected to the EIB. Each EIB provides a total of eight (8) DC voltage inputs for these connections. An alarm is issued when either battery block voltage or battery midpoint voltage is abnormal. Refer to Figure 5.9 for terminal locations and Table 5.5 for pin-out information.

Refer to Figure 5.8 for connection details. Refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) and program the following parameters.

- **Battery Block Monitoring**

Voltage Type: Set to "24 (Block 2)". This selects the EIB to monitor up to four (4) 24V battery strings with two (2) 12V blocks per string.

BlockVDiff(12V): This menu item appears if "24 (Block 2)" is selected above. Set to the alarm threshold for battery block monitoring per site requirements. The controller issues an alarm when any block voltage of any battery string has an abnormal value. The alarm is issued when the difference between any block voltage and a reference voltage is greater than the value of the block voltage difference setting.

Block In-Use: Set to the number of 12V battery blocks being used.

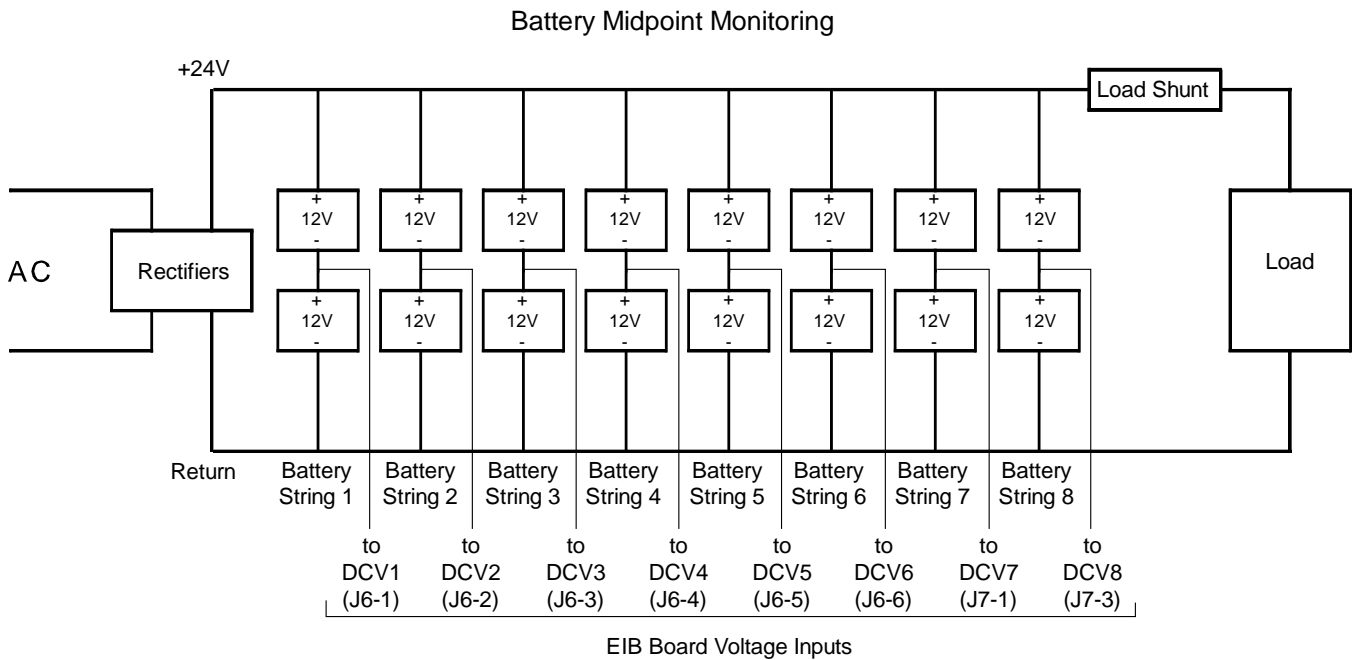
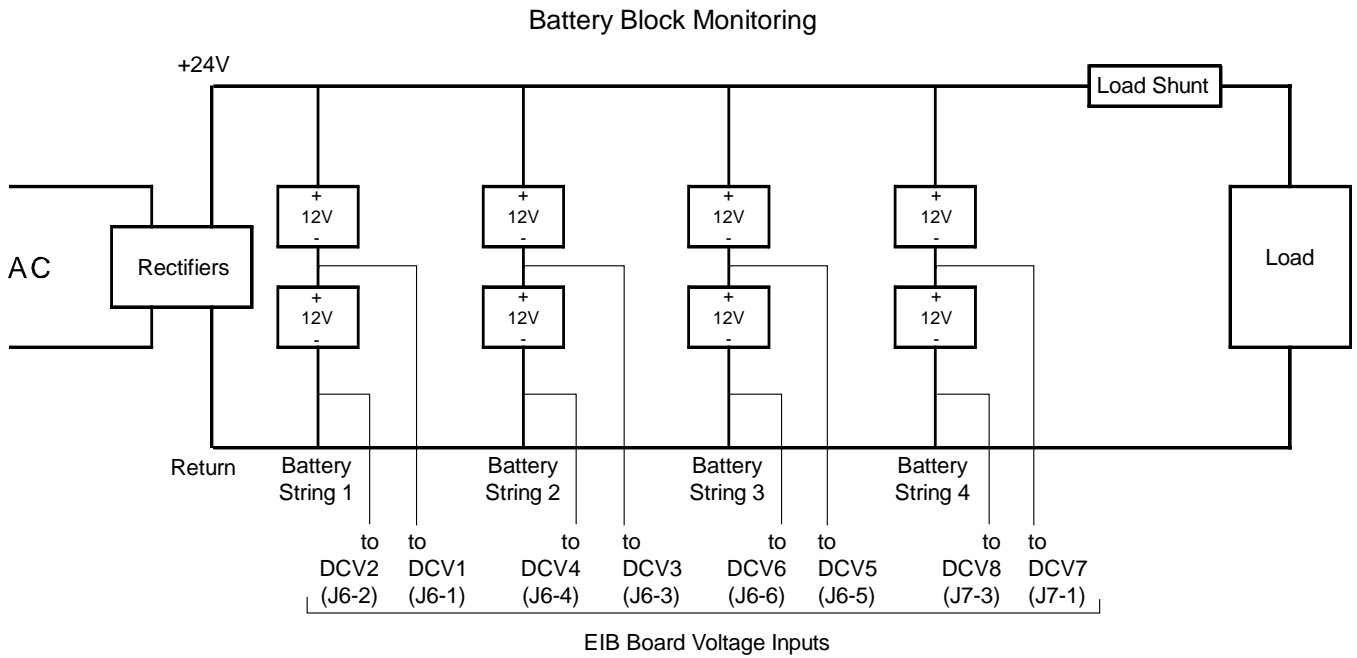
- **Midpoint Monitoring**

Voltage Type: Set to "Midpoint". This selects the EIB to monitor the midpoint voltage of up to eight (8) battery strings.

BlockVDiff(Mid): This menu item appears if "Midpoint" is selected above. Set to the alarm threshold for battery midpoint monitoring per site requirements. The controller issues an alarm when any battery midpoint voltage of any battery string has an abnormal value. The alarm is issued when the difference between any battery midpoint voltage and a reference voltage is greater than the value of the block voltage difference setting.

Block In-Use: Set to number of 12V battery blocks being used.

Figure 5.8: Sample Battery Block or Battery Midpoint Monitoring Connections



Programmable Relay Outputs

Each EIB provides five (5) programmable alarm relays with dry Form-C contacts. Connect up to five (5) relay outputs to the EIB. Refer to Figure 5.9 for terminal locations and Table 5.5 for pin-out information.

Refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) for programming information.

Relay Ratings: Refer to the following.

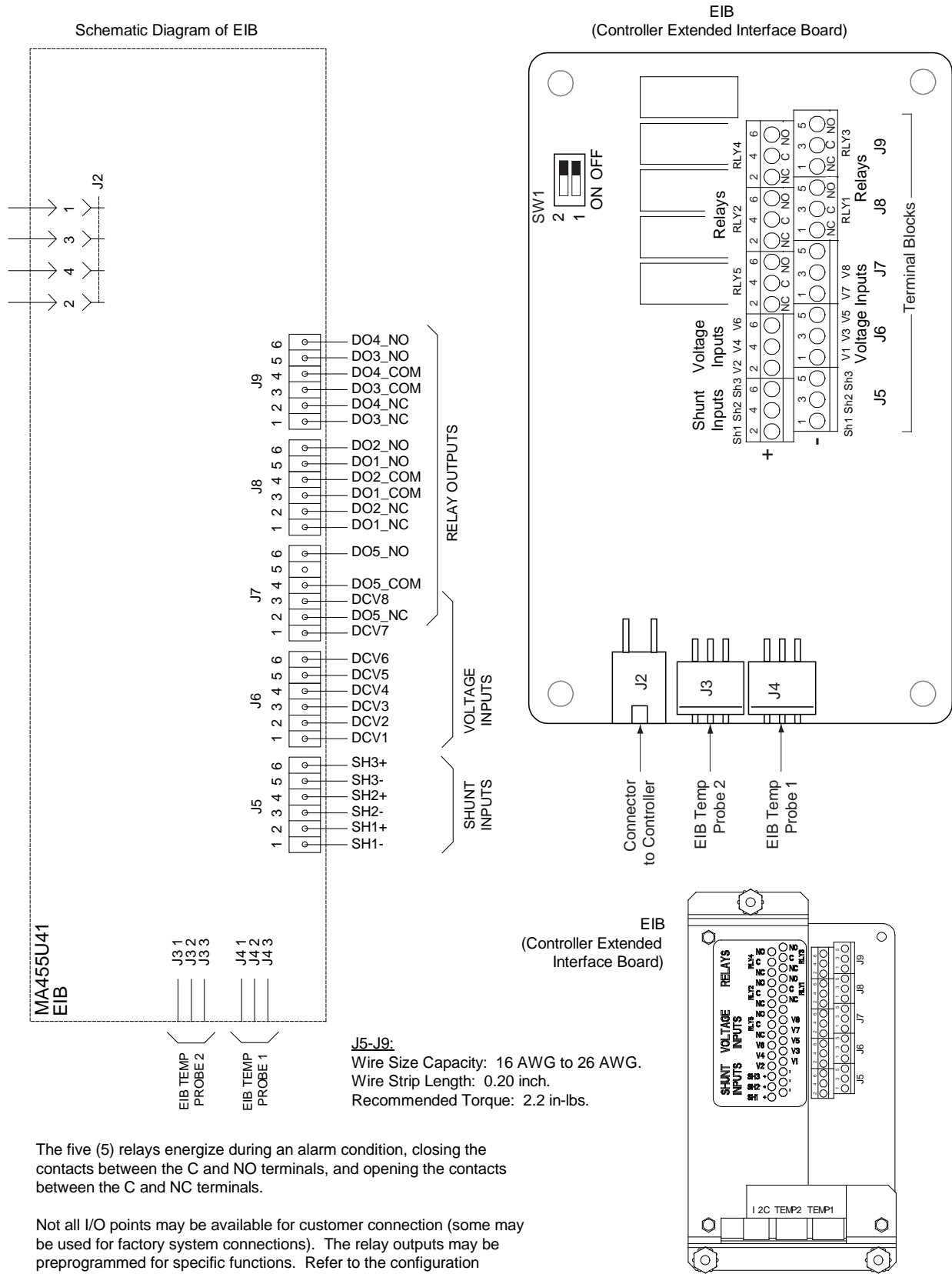
- a) Steady State: 0.5 A @ 60V DC; 1.0 A @ 30V DC.
- b) Peak: 3 A @ 30V DC.

The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.

Temperature Probes

Temperature probes can be connected to the optional EIB (Controller Extended Interface Board) mounted inside the distribution cabinet. Refer to "Temperature Probes" on page 67.

Figure 5.9: EIB-1 and EIB-2 (Extended Interface Board) Connections



J5-J9:
 Wire Size Capacity: 16 AWG to 26 AWG.
 Wire Strip Length: 0.20 inch.
 Recommended Torque: 2.2 in-lbs.

The five (5) relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Not all I/O points may be available for customer connection (some may be used for factory system connections). The relay outputs may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.

Table 5.4: Shunt Inputs – EIB

Shunt Input	EIB Pin No.		Factory Wiring	Default Function
Sh1	J5-2	+	--	none
	J5-1	-	--	
Sh2	J5-4	+	--	none
	J5-3	-	--	
Sh3	J5-6	+	--	none
	J5-5	-	--	

Table 5.5: Voltage Inputs – EIB

Voltage Input	EIB Pin No.	Default Function
1	J6-1	Battery Block Monitoring
2	J6-2	
3	J6-3	
4	J6-4	
5	J6-5	
6	J6-6	
7	J7-1	
8	J7-3	

Table 5.6: Programmable Relay Outputs – EIB

Programmable Relay Output		EIB Pin No.	Alarms Assigned to this Relay (Default)
EIB-1 or EIB-2 D01	NO	J8-5	The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.
	COM	J8-3	
	NC	J8-1	
EIB-1 or EIB-2 D02	NO	J8-6	
	COM	J8-4	
	NC	J8-2	
EIB-1 or EIB-2 D03	NO	J9-5	
	COM	J9-3	
	NC	J9-1	
EIB-1 or EIB-2 D04	NO	J9-6	
	COM	J9-4	
	NC	J9-2	
EIB-1 or EIB-2 D05	NO	J7-6	
	COM	J7-4	
	NC	J7-2	



NOTE! The relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific relay labeling.

5.7.5 Optional SM-DU+ and Shunt Interface Board

The optional SM-DU+ and Shunt Interface Board provides connections for up to twenty-five (25) shunt inputs. Inputs are factory connected to any distribution positions/devices containing shunts. Refer to Figure 5.10.

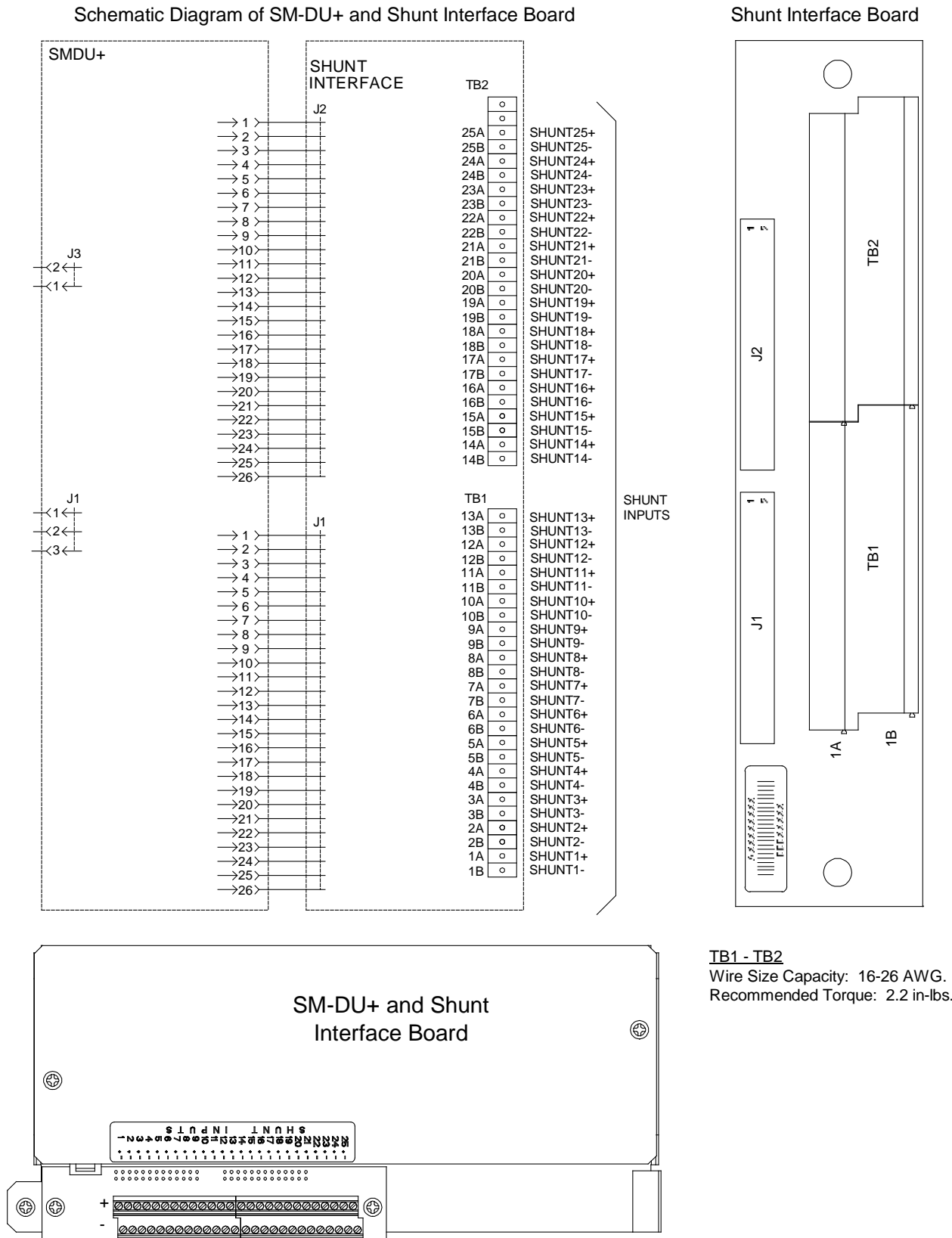
Procedure

Current Inputs: Connect up to twenty-five (25) shunt inputs to the Shunt Interface Board. Observe proper polarity. Note that some inputs may be factory connected, depending on distribution devices installed. Refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) for programming information for the unused inputs.



NOTE! The shunt needs to be installed in the hot (+24V) bus. Connect the plus side of the shunt to the positive shunt input on the SM-DU+. Connect the negative side of the shunt to the negative shunt input on the SM-DU+.

Figure 5.10: SM-DU+ and Shunt Interface Board Connections



5.7.6 Connecting a Device or System to the Controller's CAN Bus

A supporting device or system may be connected to the Controller's CAN Port. Refer to Figure 5.6 for location. Refer to Table 5.7 for pin-outs. Refer also to the external device's or system's instruction manual.

General Procedure

1. Remove the CAN termination plug from the bottom CAN connector on the System Interface circuit card (see Figure 5.6 for location). Connect the device or system to the bottom CAN connector on the System Interface circuit card. Refer to Table 5.7 for pin-outs. Ensure that the last device on the controller's CAN bus has a CAN termination plug. Refer also to the external device's or system's instruction manual.
2. Reboot the controller.

Local Menu Navigation: At the Main Screen, press ENT and ESC at the same time to reset the NCU Controller.

Web Menu Navigation: Go to Advance Settings Menu / SW Maintenance Tab / Reboot Controller button.

Optional SM-Temp Module Procedure

The analog output of the SM-Temp Module may be connected to a controller's temperature port input. In lieu of connecting the analog output of the SM-TEMP module to a temperature port input, the SM-TEMP module can simply be connected at the end of the Controller's CAN Bus (for system's equipped with an ACU+, requires ACU+ version 3.02 or later). Refer to the SM-Temp Module Instructions (UM547490) for details.

Connecting the SM-Temp Module to the Controller's CAN Bus

1. Remove the CAN termination plug from the bottom CAN connector on the System Interface circuit card. Connect the SM-Temp Module CAN bus to the bottom CAN connector on the System Interface circuit card. Refer to Table 5.7 for pin-outs. Ensure the last SM-Temp Module (or if only one) has a CAN termination strap as shown in the SM-Temp Module Instructions (UM547490).

Table 5.7: CAN Connections

Controller CAN Port (RJ-45)		SM-Temp Module CAN Port Pin Number
Pin Number	Function	
1	CAN L	TB1-5 (CAN L)
2	CAN H	TB1-3 (CAN H)
3	--	--
4	--	--
5	--	--
6	--	--
7	--	--
8	--	--

5.8 Controller Ethernet Connection (if required)

The controller provides a Web Interface via an Ethernet connection to a TCP/IP network. This interface can be accessed locally on a computer or remotely through a network. An RJ-45 10Base-T jack is provided on the front of the controller for connection into a customer's network. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 5.11 for location and Table 5.8 for pin outs. Use shielded Ethernet cable (grounded at both ends). Note that the controller's RJ-45 jack is connected to chassis ground. Refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) for operational details.



NOTE! You can access the Web pages of the power system locally by using a "crossover" or "straight" cable connected directly between your PC and the controller.



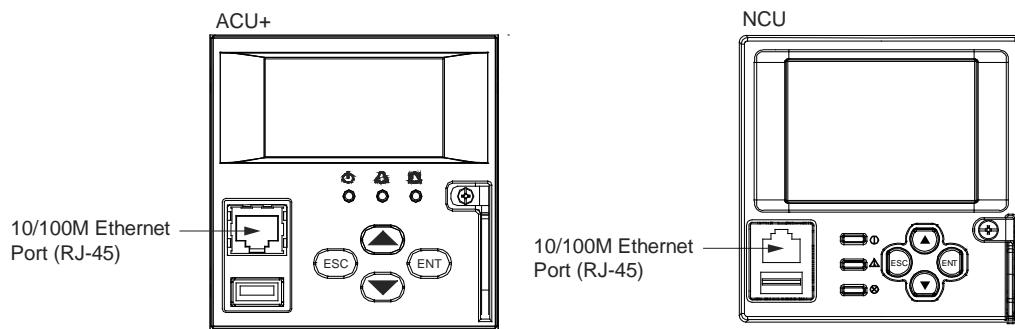
WARNING! The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly **MUST NOT** be metallically connected to the interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

The intra-building port (RJ-45) of the equipment or subassembly must use shielded intra-building cabling/wiring that is grounded at both ends.

Table 5.8: Controller RJ-45 Ethernet Port Pin Configuration

Port Pin Number	Name	Definition
1	Tx+	Write Signal +
2	Tx-	Write Signal -
3	Rx+	Read Signal +
4	--	no connection
5	--	no connection
6	Rx-	Read Signal -
7	--	no connection
8	--	no connection

Figure 5.11: Controller Ethernet Port



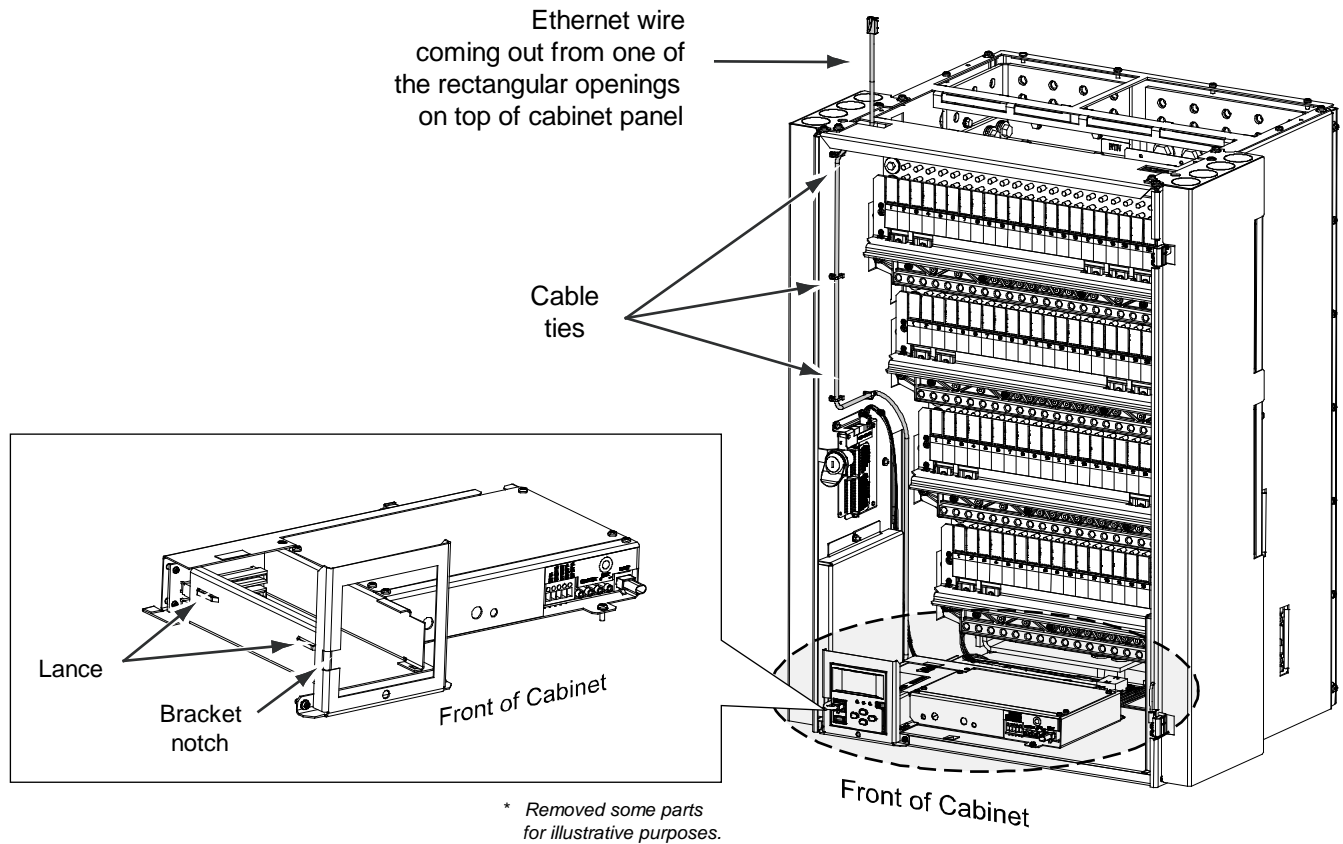
NOTE! NCU ONLY: If your system has an IB5 board, **DO NOT** connect your Local Area Network (LAN) to the NCU front Ethernet port. See "NCU Controller Second Ethernet Port Connection (if IB5 board furnished)" on page 81.

Ethernet Connection through the Power System

The Ethernet cable can be routed from the notch on the left side of the bracket. It goes through the lances on the chassis, then goes up to be bundled with the harness and all other customer alarm and signal cables.

The existing cable ties can also be used to secure the Ethernet cable as it goes up to the top panel.

Figure 5.12: Network Connection through Power System



NCU Controller Second Ethernet Port Connection (if IB5 board furnished)

Your system may be furnished with an IB5 board connected to the NCU backplane via a factory furnished and connected cable. The IB5 board provides a second Ethernet port. The Ethernet port located on the NCU Controller's front panel can ONLY be used to connect a computer directly to the NCU. The Ethernet port located on the IB5 board can be used to connect the NCU to your Local Area Network (LAN).



NOTE! If your system has an IB5 board, DO NOT connect your Local Area Network (LAN) to the NCU front Ethernet port.



NOTE! IB5 boards with a 10M/100M/1G Ethernet port replaced IB4 boards with a 10M/100M Ethernet port. This transition enables the support of connected devices that communicate up to 1G. While both boards are physically interchangeable, the IB5 board does require the NCU to have V1.2.80 or higher software loaded.

An RJ-45 10/100/1000Base-T jack is provided on the IB5 board for connection into a customer's network. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 5.13 for location and Table 5.8 for pin outs. Use shielded Ethernet cable (grounded at both ends). Note that the IB5 board's RJ-45 jack is connected to chassis ground. Refer to the NCU Instructions (UM1M830BNA) for operational details.



WARNING! The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to the interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

The intra-building port (RJ-45) of the equipment or subassembly must use shielded intra-building cabling/wiring that is grounded at both ends.

Default IB5 Ethernet Port Parameters

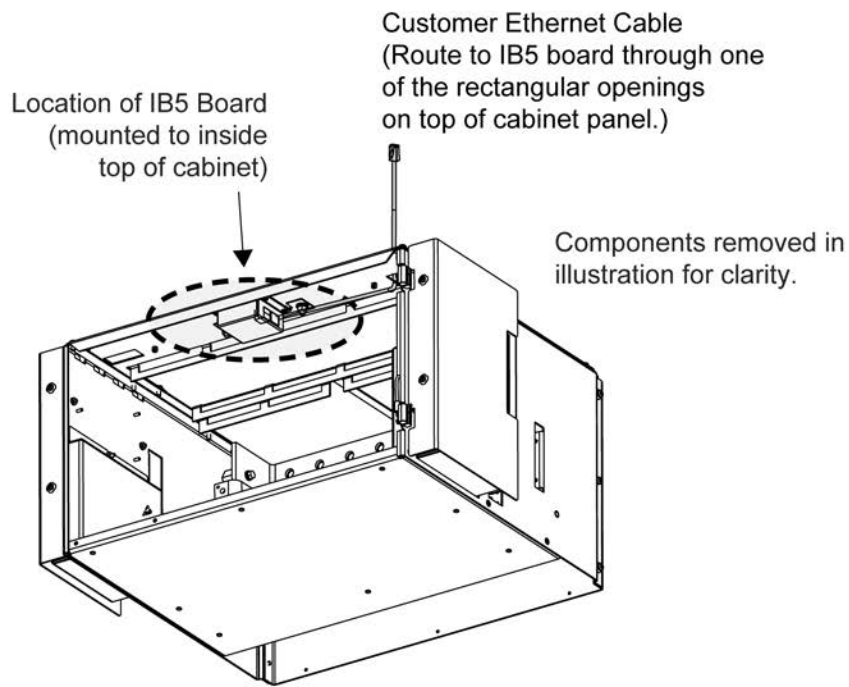
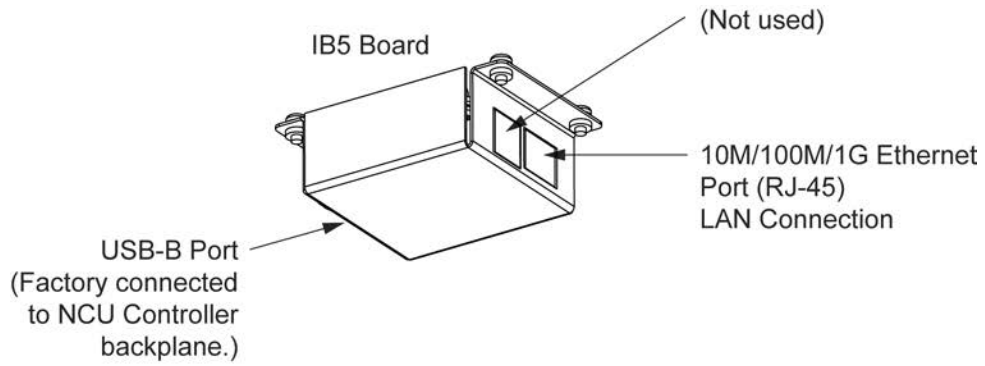
IPv4

IP Address: 192.168.1.2
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.1.1

IPv6

IPv6 Address: 20fa:ffff:ffc:ffb:ffa:fff9:fff8:fff7
IPv6 Prefix: 0
IPv6 Gateway: 20fa:1:fff:fff:fff:ffd:ffff:fffe

Figure 5.13: IB5 Board NCU Controller Second Ethernet Port



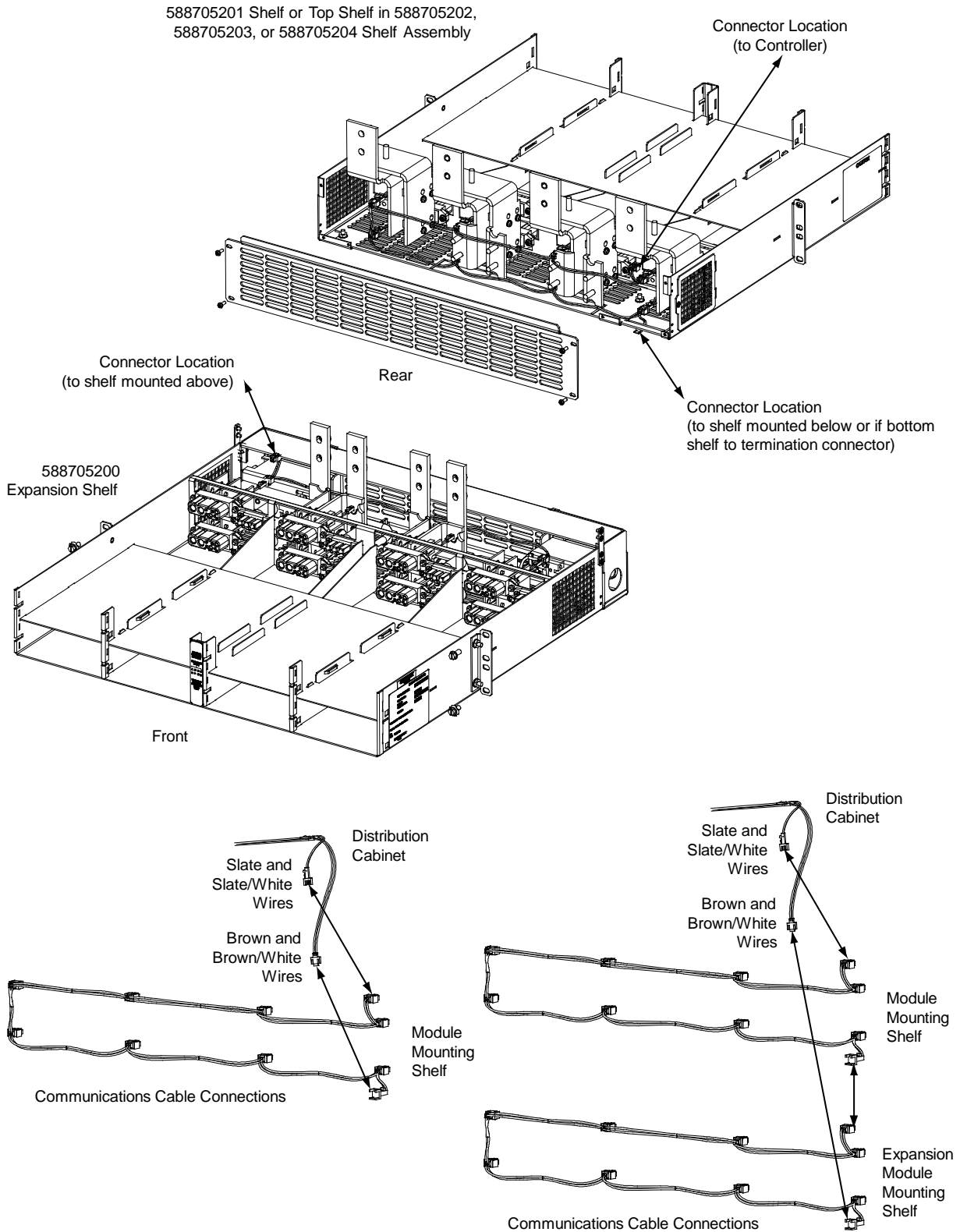
List 21 Distribution Cabinet
(others similar)

5.9 Control Bus Connections between Controller and Module Mounting Shelves

Each module mounting shelf in the system is daisy-chained to the controller. A connector is located at the top of each shelf and another at the bottom of each shelf. These connectors are used to interconnect the shelves to the controller. Refer to Figure 5.14 for connector locations. These connections are factory made for shelves factory installed. The connection must be made if a field expansion shelf is installed as shown in Figure 5.14.

- The top connector of the top most module mounting shelf connects to the controller.
- The bottom connector of a shelf plugs into the top connector on the shelf below it.
- The bottom connector on the bottom most shelf must terminate back into the distribution cabinet.

Figure 5.14: Control Bus Connections between Controller and Module Mounting Shelves



5.10 Connecting Converter Output Cables 581127000 List 60



NOTE! These connections are factory made for shelves factory installed. The connection must be made if a field expansion shelf is installed.

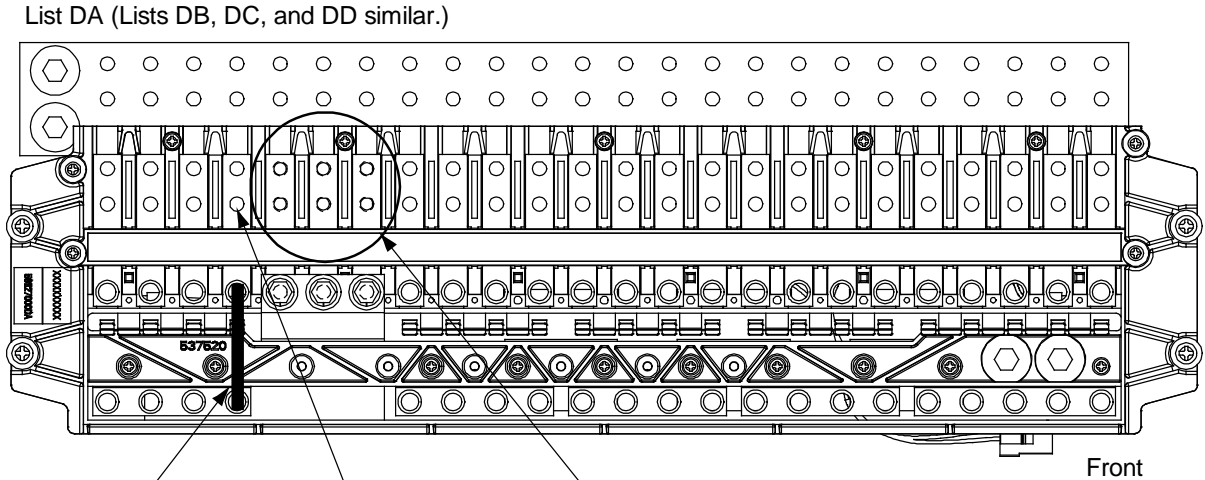
Connecting List 60 Converter Output Cables to List DA, DB, DC, DD, DE, DF, DG, DH, DJ, and DK Distribution Panel

Procedure

1. Locate the output jumpers (labeled -48V) supplied with List 60 (P/O kit P/N 540860). There are two (2) cables per List 60.
2. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
3. Loosen the screws holding the plastic shield over the circuit breakers or fuseholders on the dual voltage distribution panel. Slide the shield upwards and remove.
4. Connect the output jumpers to the distribution bus panel subsystem (-48V) input terminals as shown in Figure 5.15. Apply electrical anti-oxidizing compound to lug mating surfaces before connecting. Mount two lugs back-to-back per mounting position if required. Torque as shown in the figure.
5. Route the output jumpers installed in the previous step over the top of the distribution bus panel ground bar, toward the back of the cabinet, and down through the opening in the bottom of the distribution cabinet (between the cabinet main busbars).
6. Route the output jumpers to the converter output terminals as shown in Figure 5.15.
7. Connect the output jumpers to the converter output terminals as shown in Figure 5.15. Apply electrical anti-oxidizing compound to lug mating surfaces before connecting. Torque as shown in the figure.
8. Install the plastic shield that was removed in a previous step, over the circuit breakers or fuseholders. To do so, position the shield and slide downwards on screws. Tighten screws.

Figure 5.15: Installing Converter Output Cables

Dual Voltage Distribution Panel



Shorting Block if 4th shelf has Converter Option.

If more than three shelves with the Converter Option installed, connect /-48 / jumpers for the 4th shelf here. Assembly order is: lug, 1/4" flat washer, 1/4" lock washer, 1/4-20 nut. Torque to 84 in-lbs. Note that a shorting block will be factory installed in this distribution device position.

Connect /-48 / jumpers to an available landing here. Assembly order is: lug, 1/4" flat washer, 1/4" lock washer, 1/4-20 bolt. Torque to 84 in-lbs.

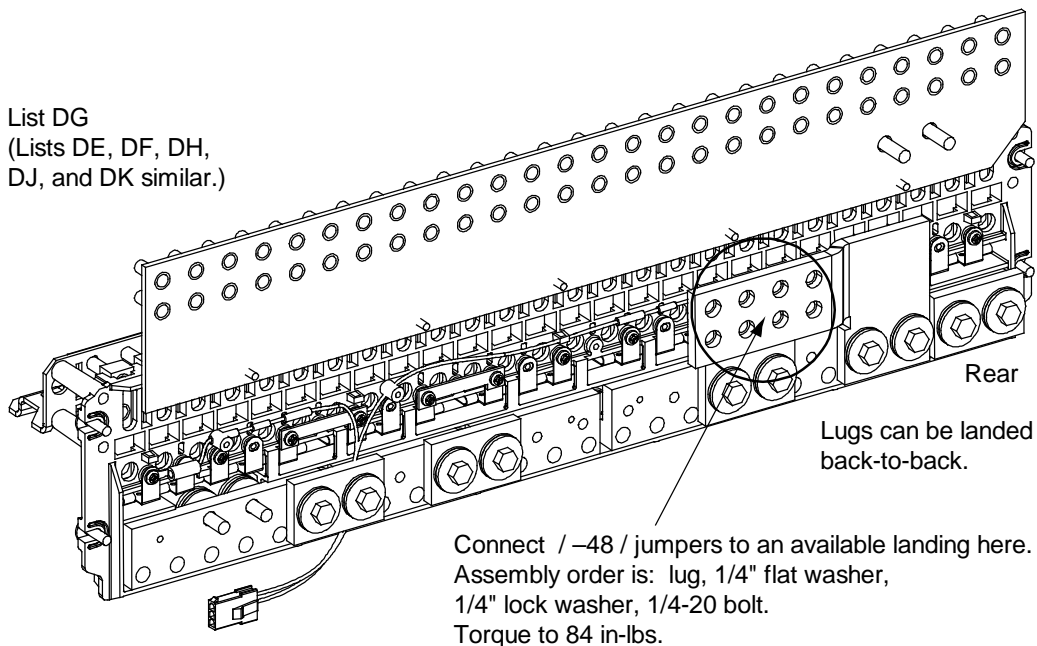
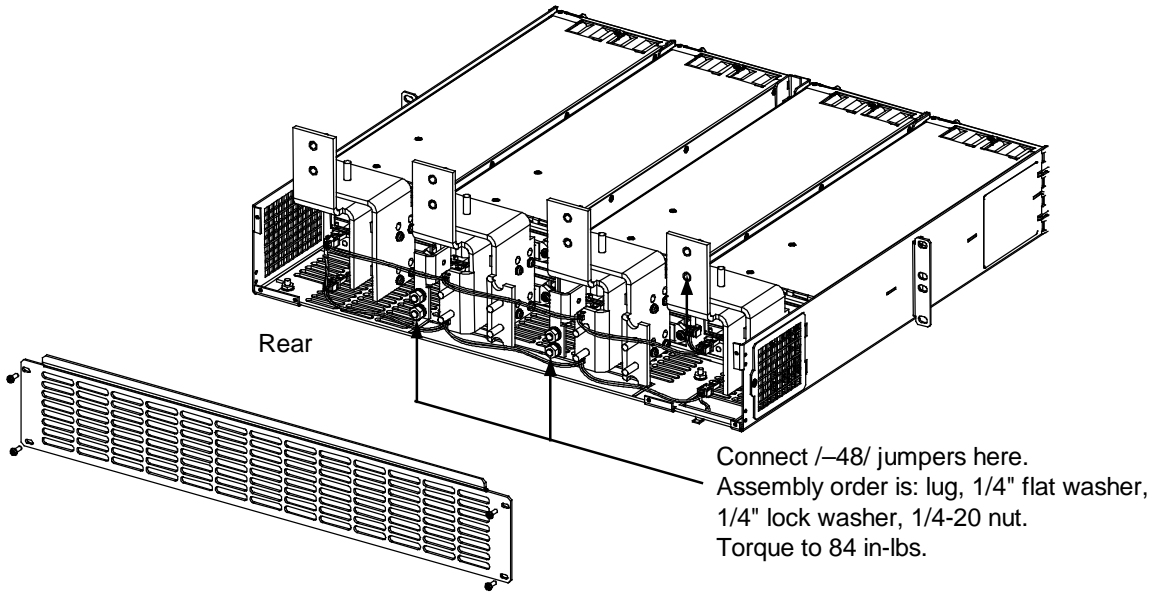
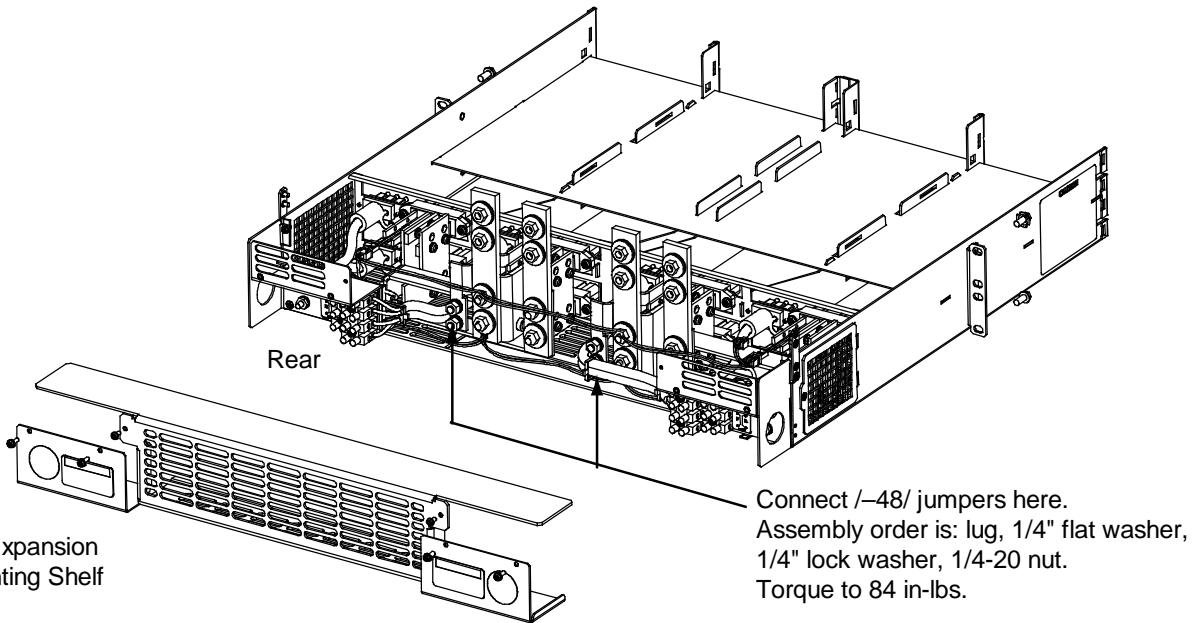


Figure 5.15: Installing Converter Output Cables



588705201 Module Mounting Shelf
or Top Shelf in 588705202, 588705203,
or 588705204 Shelf Assembly



588705200 Expansion
Module Mounting Shelf

5.11 Load Connections

Loads are connected to the various distribution panels located inside the distribution cabinet(s), as detailed in this section.

5.11.1 Recommended Torques

- 72 in-lbs for 1/4-inch hardware (when using standard flat and lock washer).
- 300 in-lbs for 3/8-inch hardware (when using standard flat and lock washer).

5.11.2 Load Connections to Single Voltage Distribution Panels

Figure 5.16: List AA: +24V Distribution Panel (with Return Busbar) and List AB: +24V Distribution Panel (without Return Busbar), (24) Bullet/TPS/TLS Circuit Breaker/Fuse Positions

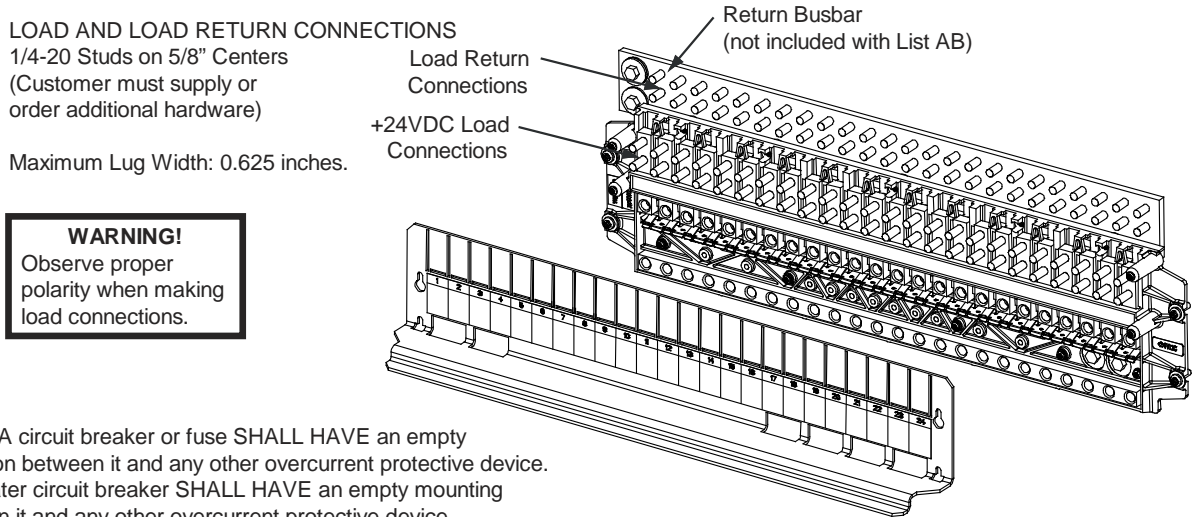


Figure 5.17: List AC: +24V Distribution Panel (with Return Busbar) and List AD: +24V Distribution Panel (without Return Busbar), (4) GJ/218 Circuit Breaker Positions

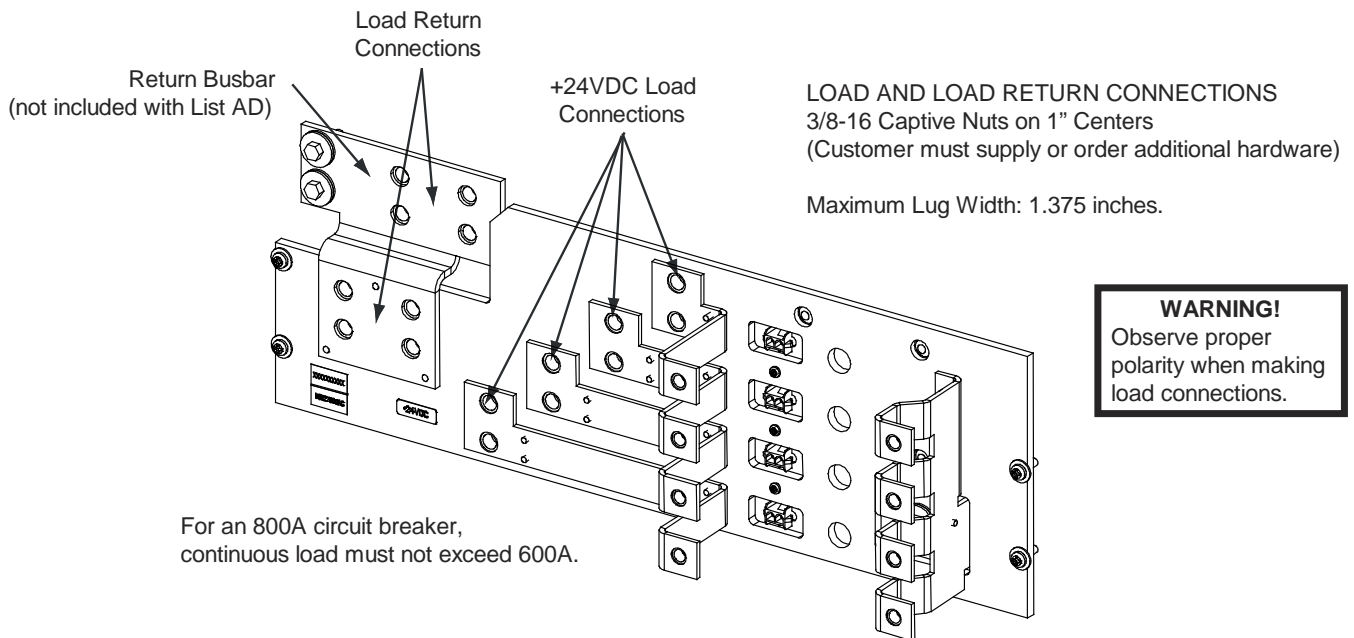


Figure 5.18: List AE: +24V Distribution Panel, (2) TPH Fuse Positions (without Shunts) (without Return Busbar)

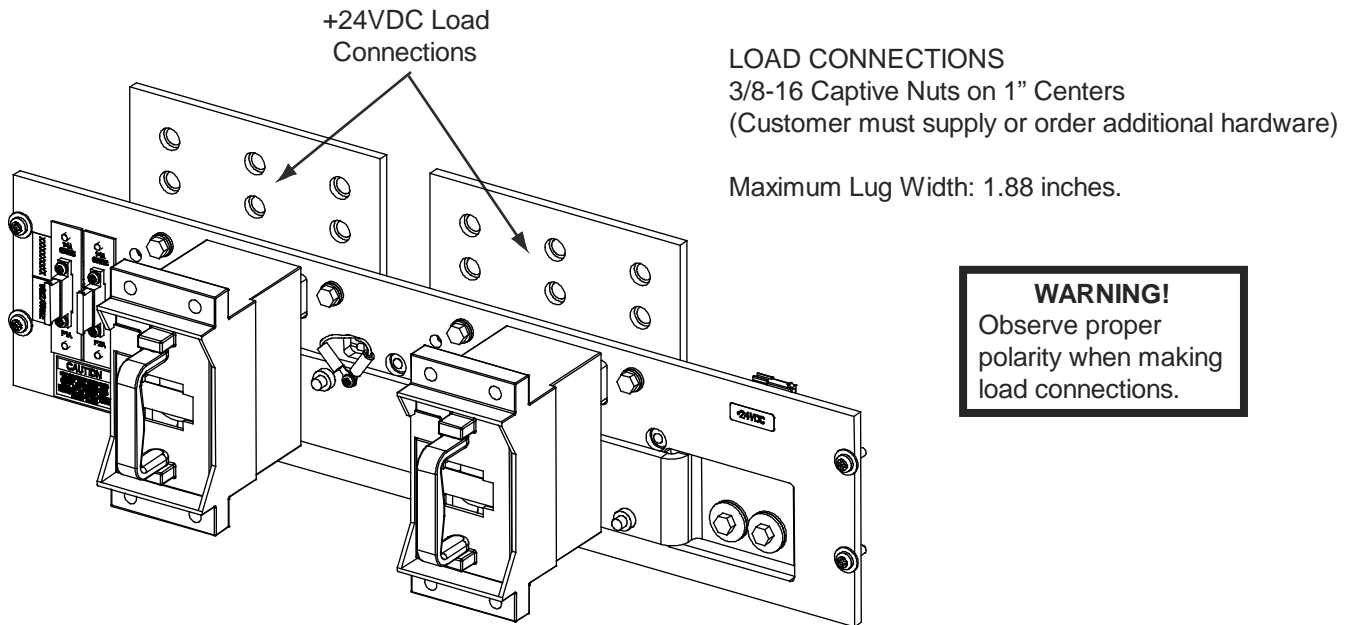


Figure 5.19: List AF: +24V Distribution Panel, (2) TPH Fuse Positions (with Shunts) (without Return Busbar)

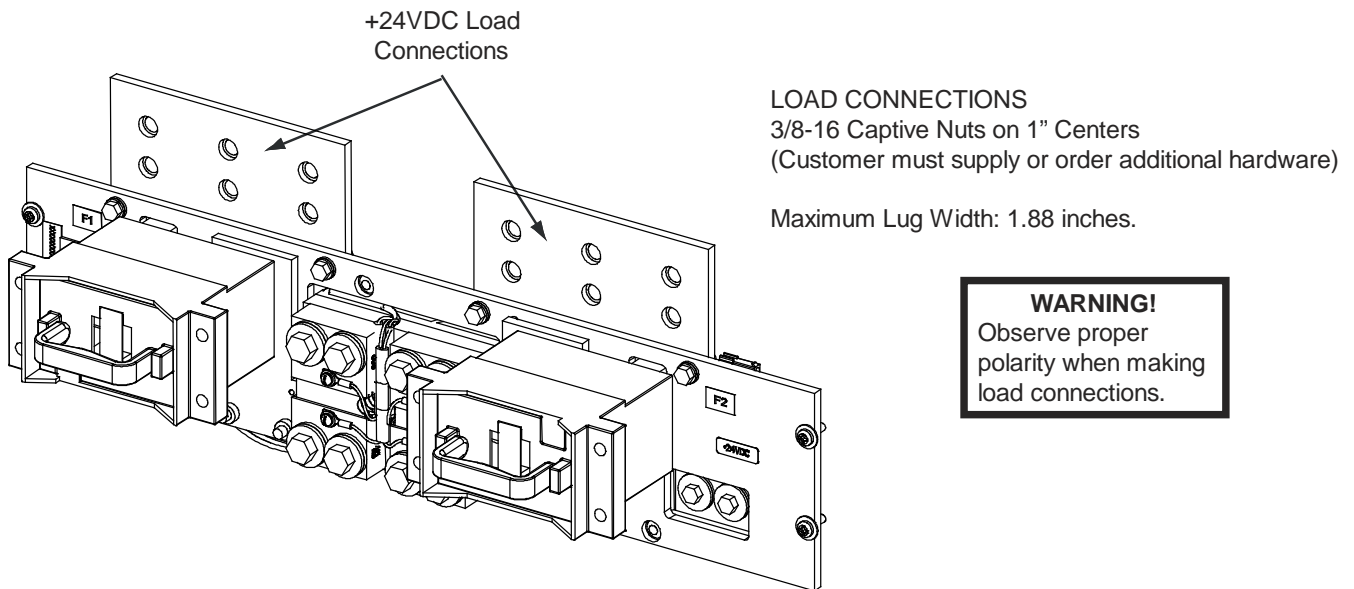


Figure 5.20: List AG: +24V Distribution Panel, (4) TPH Fuse Positions (without Shunts) (without Return Busbar)

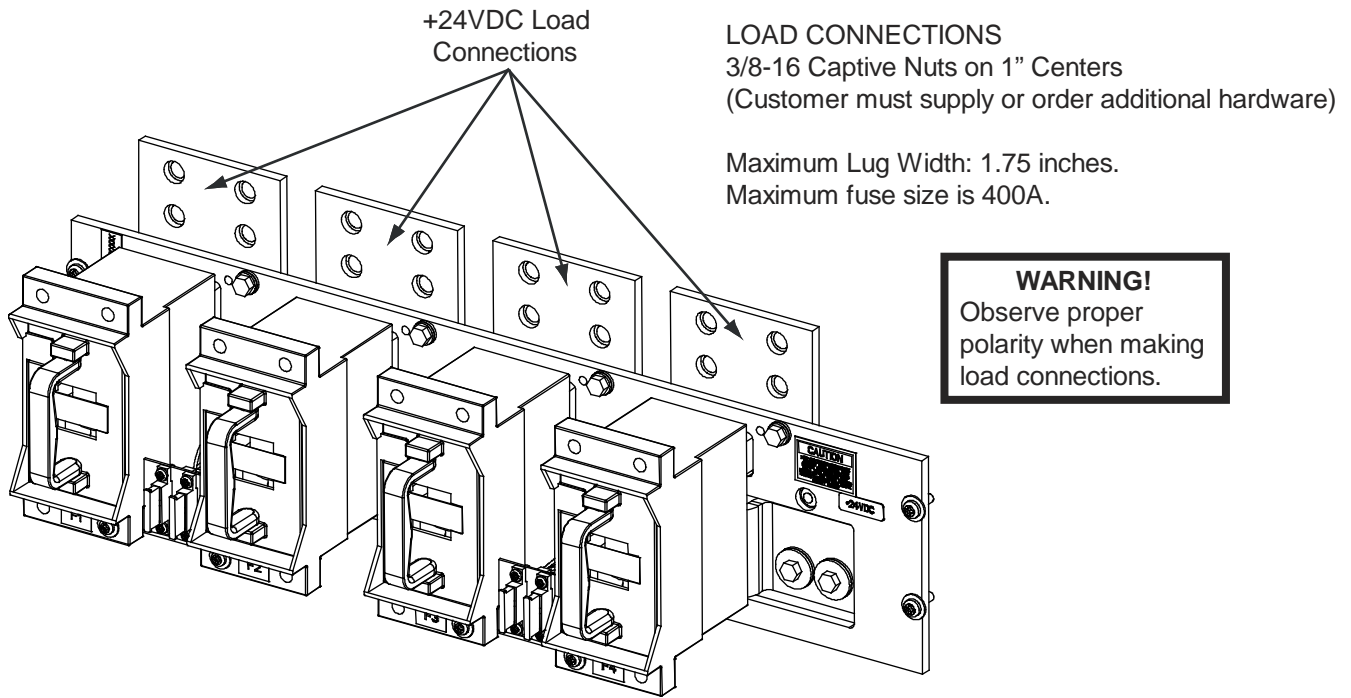


Figure 5.21: List AH: +24V Distribution Panel, (4) TPH Fuse Positions (with Shunts) (without Return Busbar)

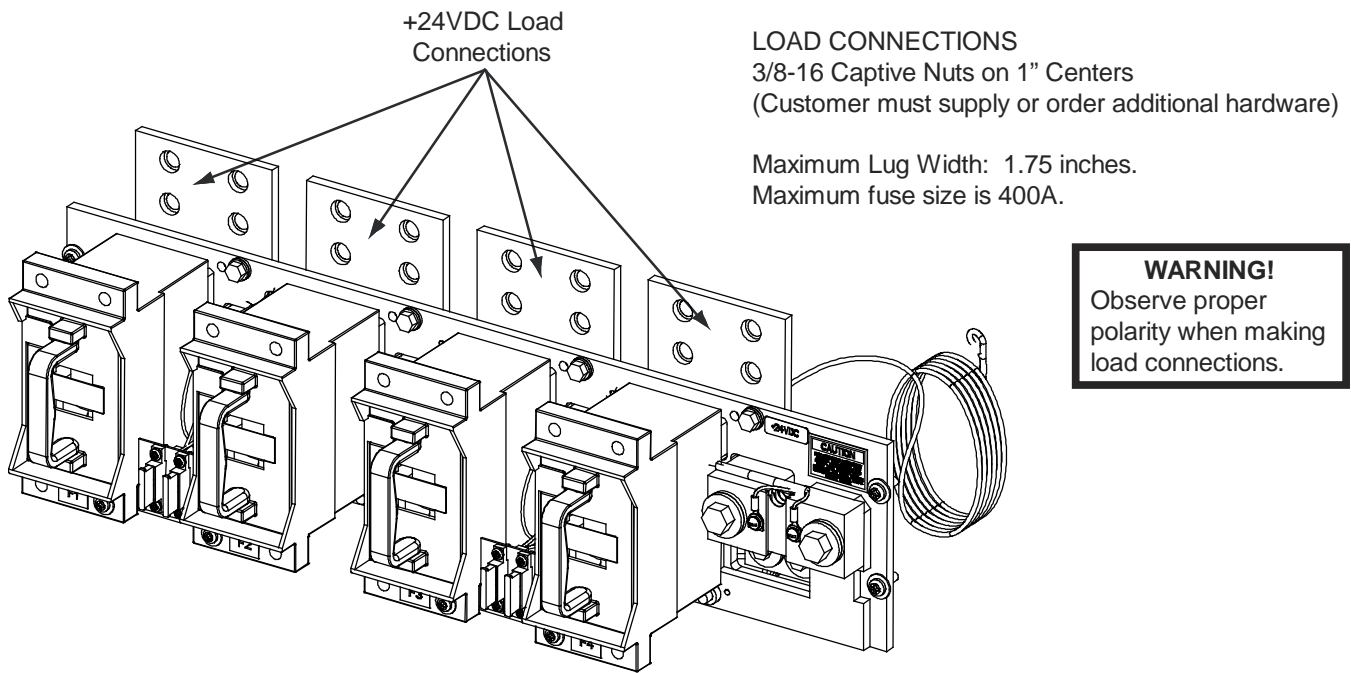


Figure 5.22: List AJ: +24V Distribution Panel, (4) TPL-B Fuse Positions (without Shunts) (without Return Busbar)

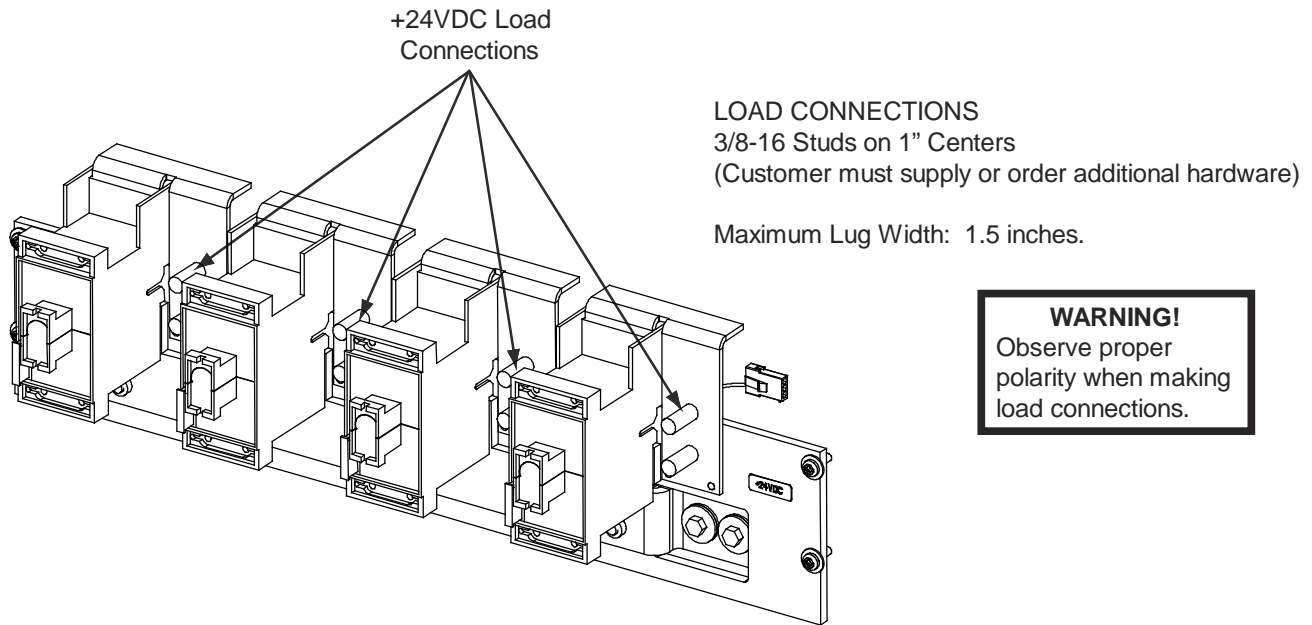


Figure 5.23: List AK: +24V Distribution Panel, (4) TPL-B Fuse Positions (with Shunts) (without Return Busbar)

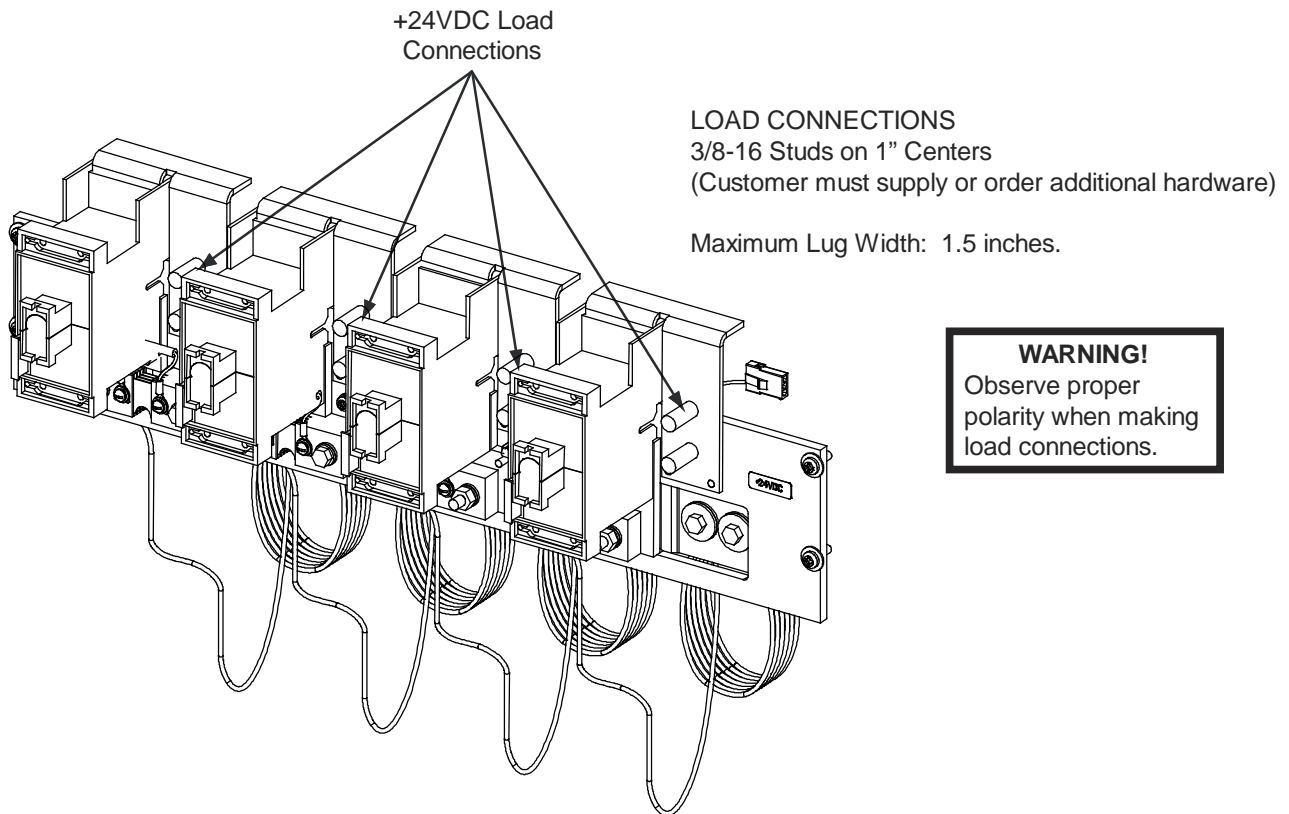
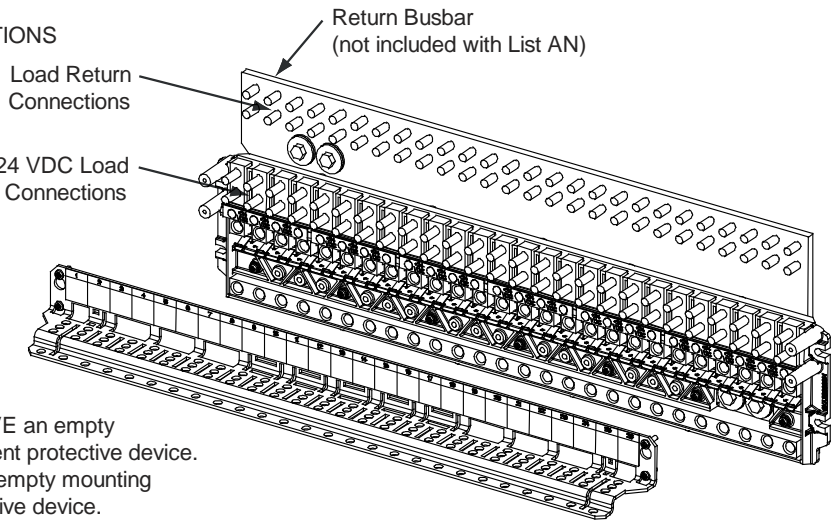


Figure 5.24: List AL and List AN: +24V Distribution Panel, (26) Bullet/TPS/TLS Circuit Breaker/Fuse Positions

LOAD AND LOAD RETURN CONNECTIONS
 1/4-20 Studs on 5/8" Centers
 (Customer must supply or order additional hardware)

Maximum Lug Width: 0.625 inches.

WARNING!
 Observe proper polarity when making load connections.



Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
 A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.25: List AM and List AP: +24V Distribution Panel, (12) GJ/218 Circuit Breaker Positions

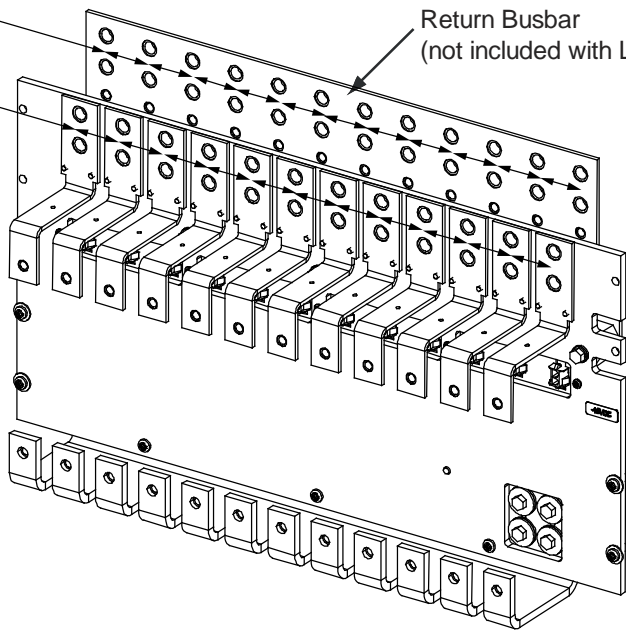
Load Return Connections
 +24 VDC Load Connections

Return Busbar
 (not included with List AP)

LOAD AND LOAD RETURN CONNECTIONS
 3/8-16 Captive Nuts on 1" Centers
 (Customer must supply or order additional hardware)

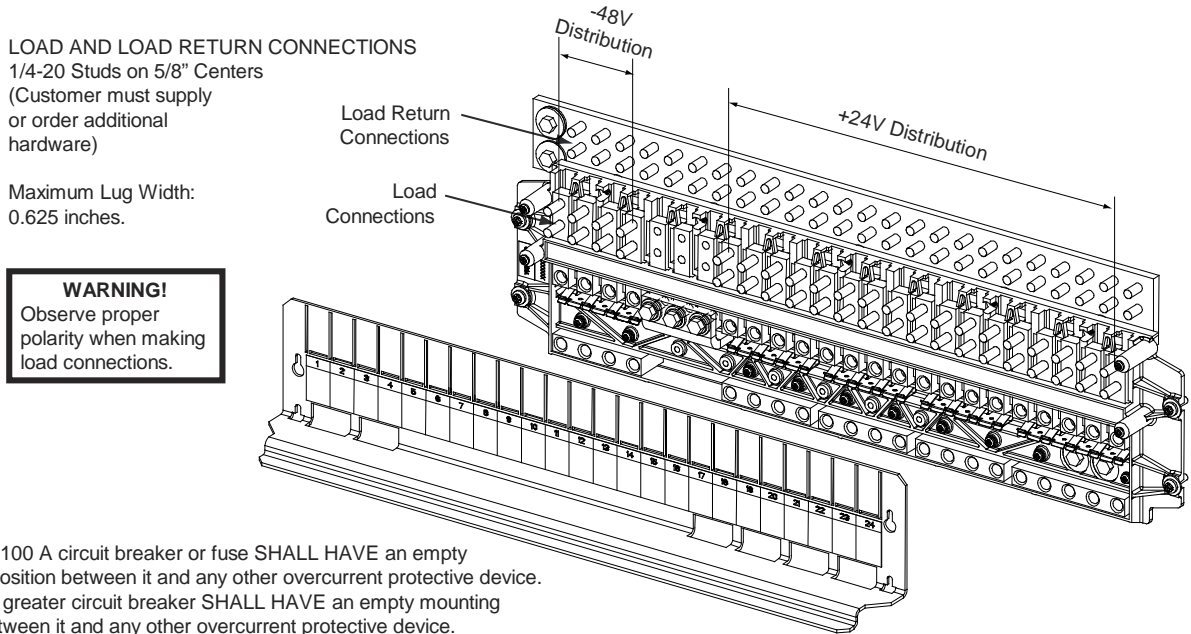
Maximum Lug Width: 1.375 inches.

WARNING!
 Observe proper polarity when making load connections.

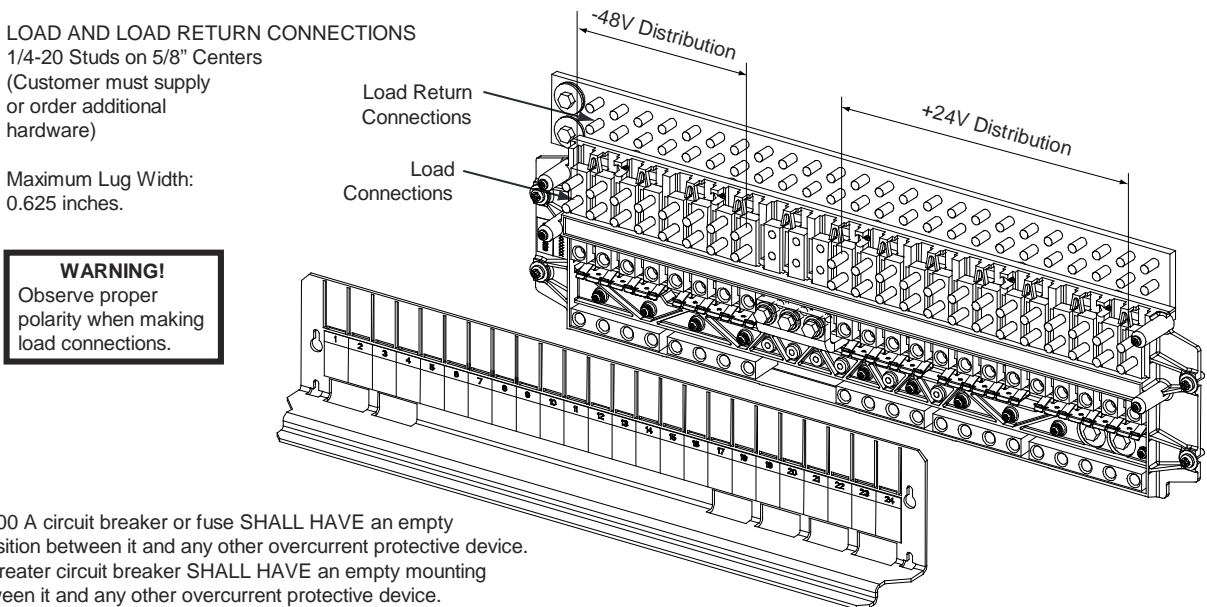


5.1.1.3 Load Connections to Dual Voltage Distribution Panels

**Figure 5.26: List DA: +24V/-48V Distribution Panel,
(17) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
(4) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**



**Figure 5.27: List DB: +24V/-48V Distribution Panel,
(13) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
(8) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

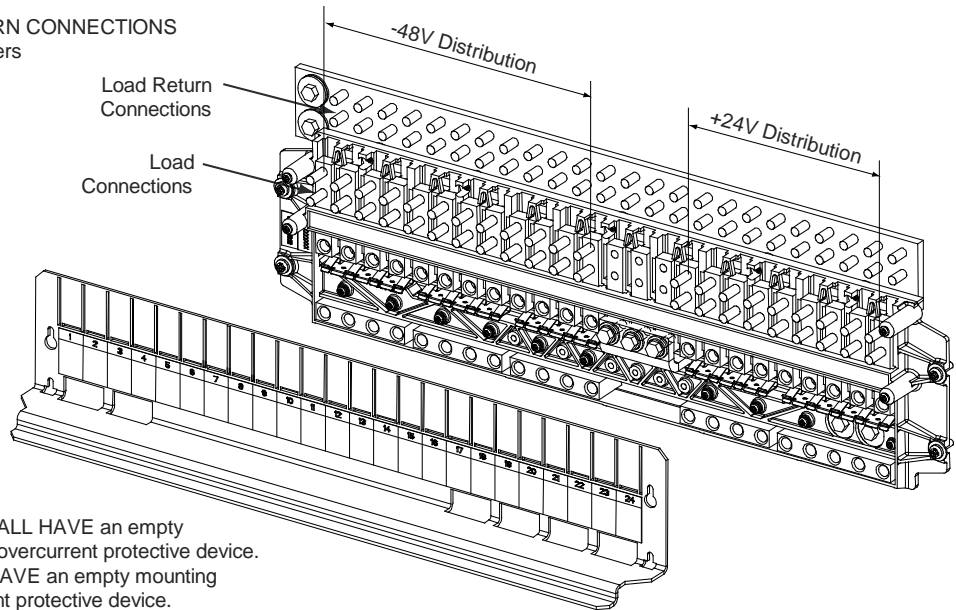


**Figure 5.28: List DC: +24V/-48V Distribution Panel,
(9) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
(12) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
1/4-20 Studs on 5/8" Centers
(Customer must supply
or order additional
hardware)

Maximum Lug Width:
0.625 inches.

WARNING!
Observe proper
polarity when making
load connections.



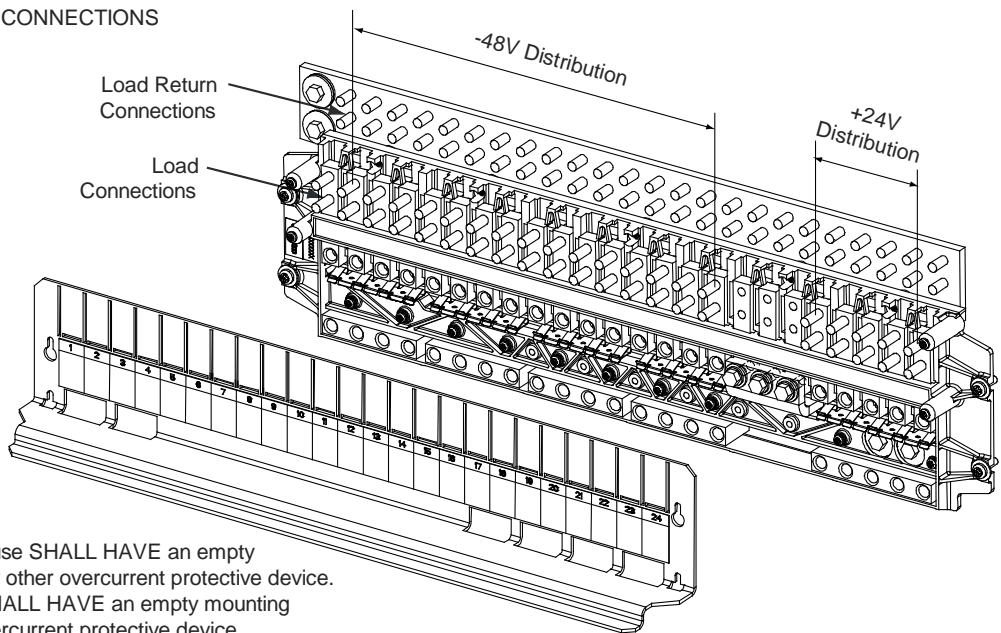
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

**Figure 5.29: List DD: +24V/-48V Distribution Panel,
(5) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
(16) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
1/4-20 Studs on 5/8" Centers
(Customer must supply
or order additional
hardware)

Maximum Lug Width:
0.625 inches.

WARNING!
Observe proper
polarity when making
load connections.



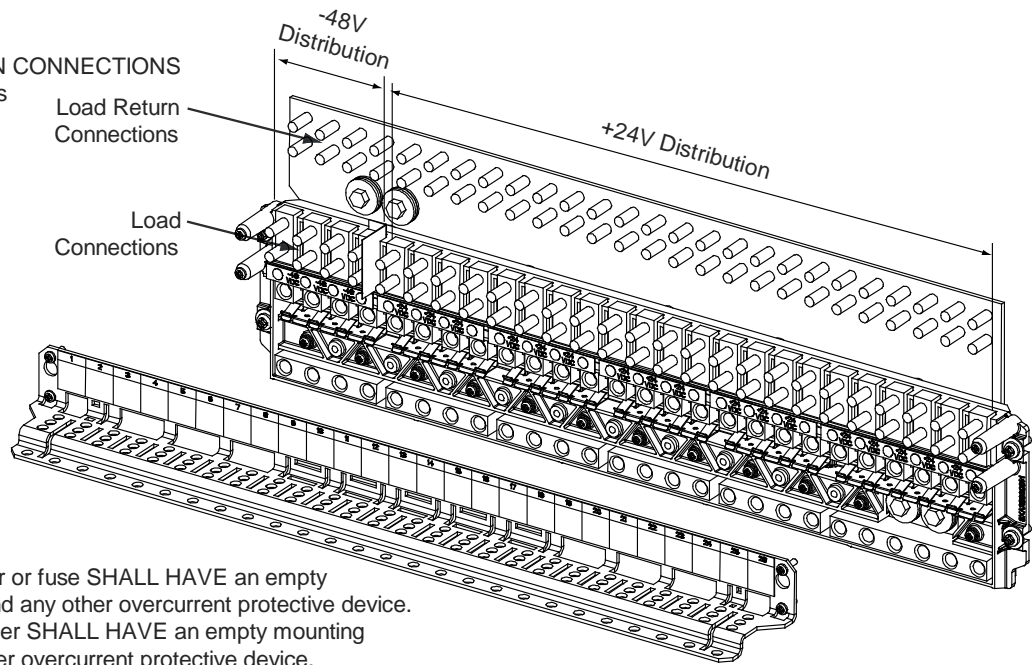
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

**Figure 5.30: List DE: +24V/-48V Distribution Panel,
(22) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
(4) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
1/4-20 Studs on 5/8" Centers
(Customer must supply
or order additional
hardware)

Maximum Lug Width:
0.625 inches.

WARNING!
Observe proper
polarity when making
load connections.



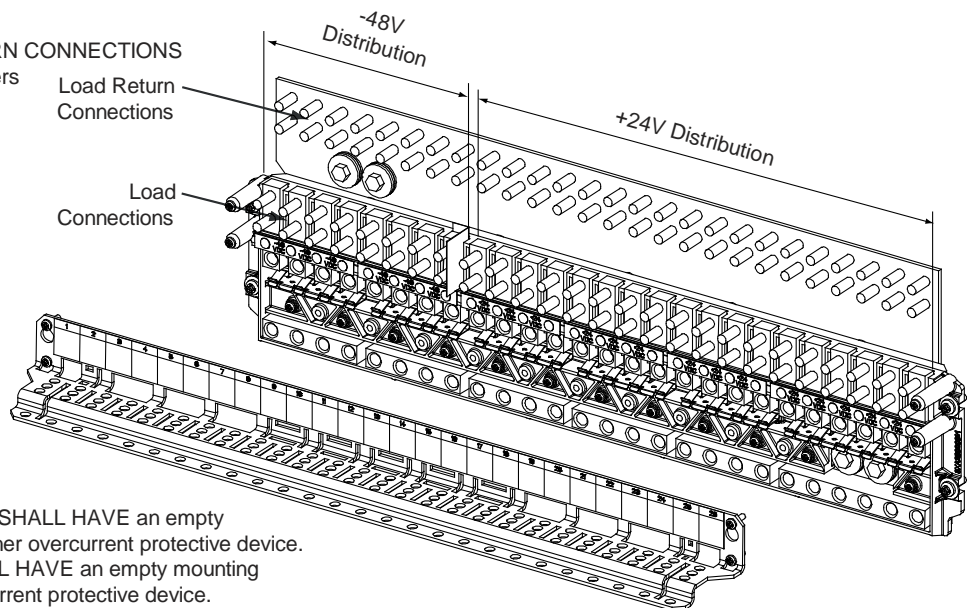
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

**Figure 5.31: List DF: +24V/-48V Distribution Panel,
(18) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
(8) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
1/4-20 Studs on 5/8" Centers
(Customer must supply
or order additional
hardware)

Maximum Lug Width:
0.625 inches.

WARNING!
Observe proper
polarity when making
load connections.



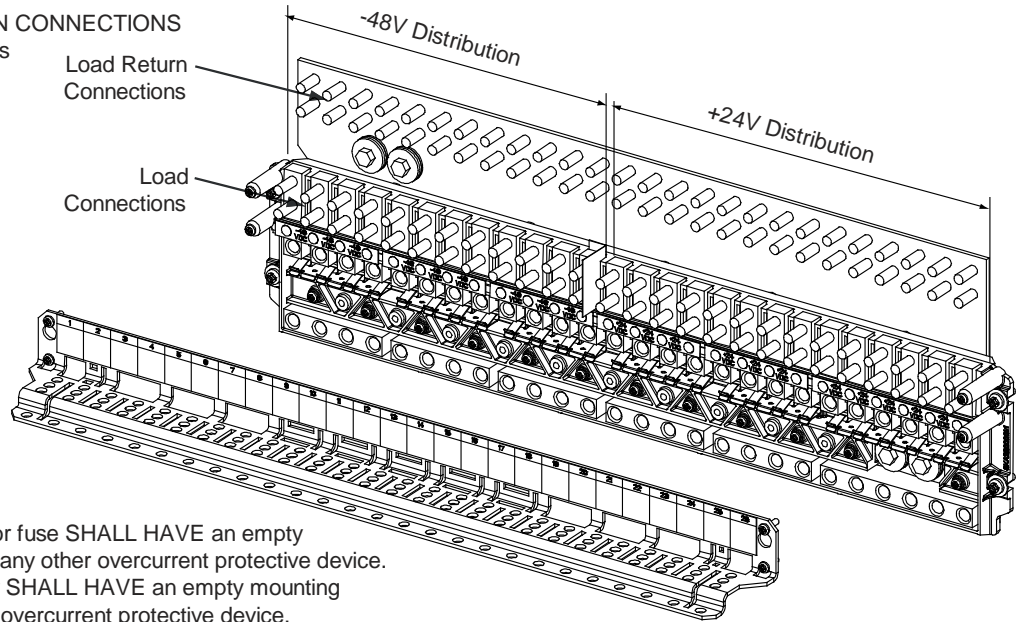
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

**Figure 5.32: List DG: +24V/-48V Distribution Panel,
 (14) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
 (12) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
 1/4-20 Studs on 5/8" Centers
 (Customer must supply
 or order additional
 hardware)

Maximum Lug Width:
 0.625 inches.

WARNING!
 Observe proper
 polarity when making
 load connections.



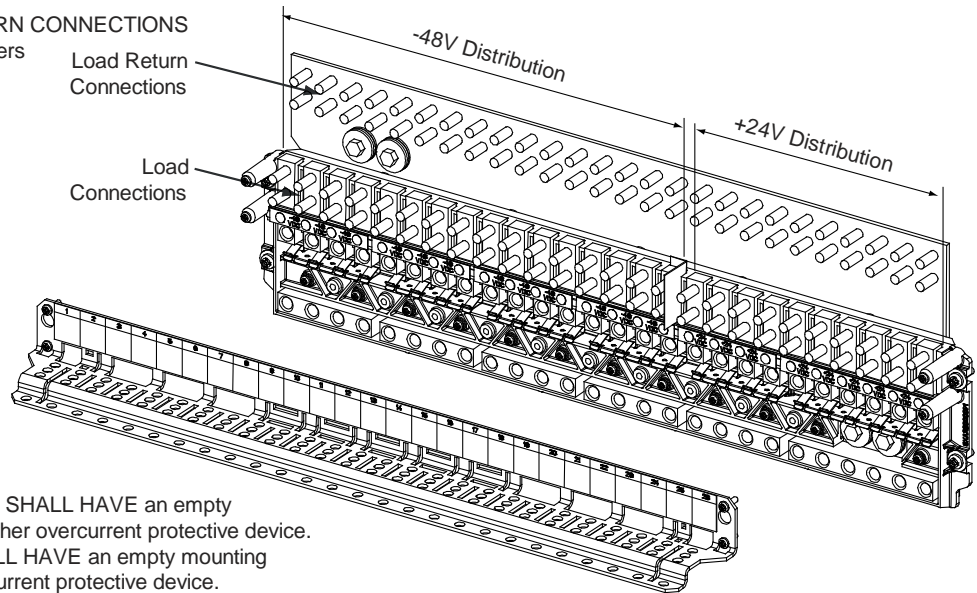
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
 A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

**Figure 5.33: List DH: +24V/-48V Distribution Panel,
 (10) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
 (16) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
 1/4-20 Studs on 5/8" Centers
 (Customer must supply
 or order additional
 hardware)

Maximum Lug Width:
 0.625 inches.

WARNING!
 Observe proper
 polarity when making
 load connections.



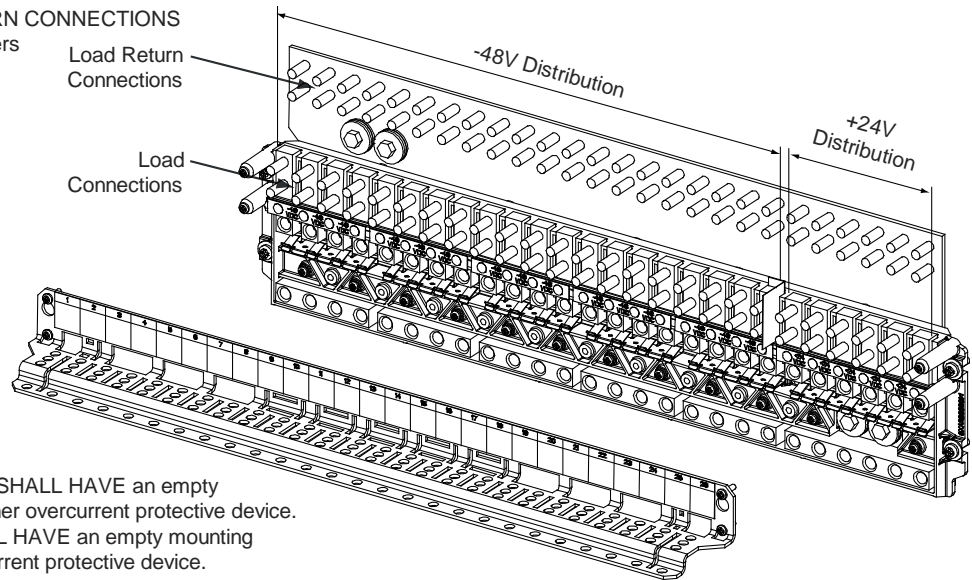
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
 A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

**Figure 5.34: List DJ: +24V/-48V Distribution Panel,
 (6) +24V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and
 (20) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
 1/4-20 Studs on 5/8" Centers
 (Customer must supply
 or order additional
 hardware)

Maximum Lug Width:
 0.625 inches.

WARNING!
 Observe proper
 polarity when making
 load connections.



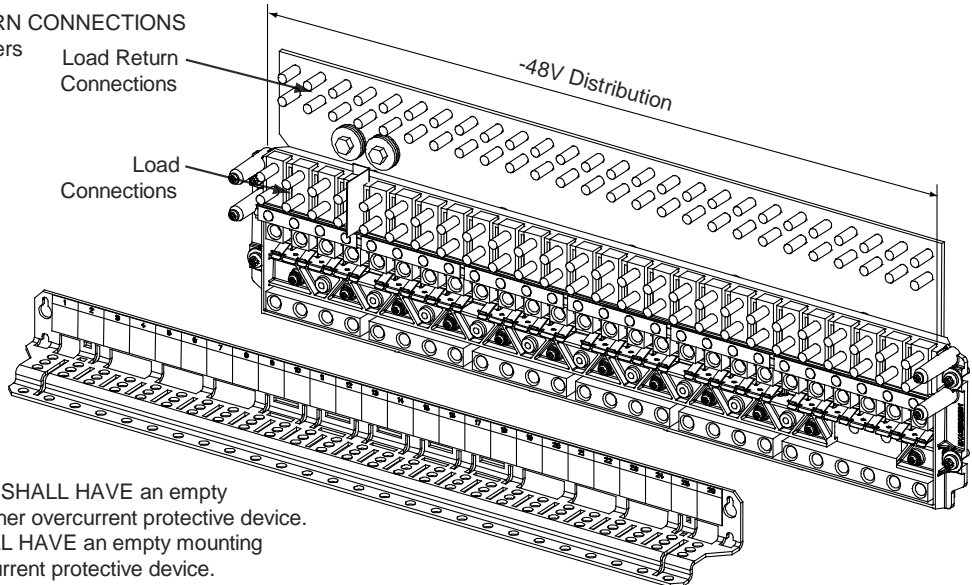
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
 A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

**Figure 5.35: List DK: +24V/-48V Distribution Panel,
 (26) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)**

LOAD AND LOAD RETURN CONNECTIONS
 1/4-20 Studs on 5/8" Centers
 (Customer must supply
 or order additional
 hardware)

Maximum Lug Width:
 0.625 inches.

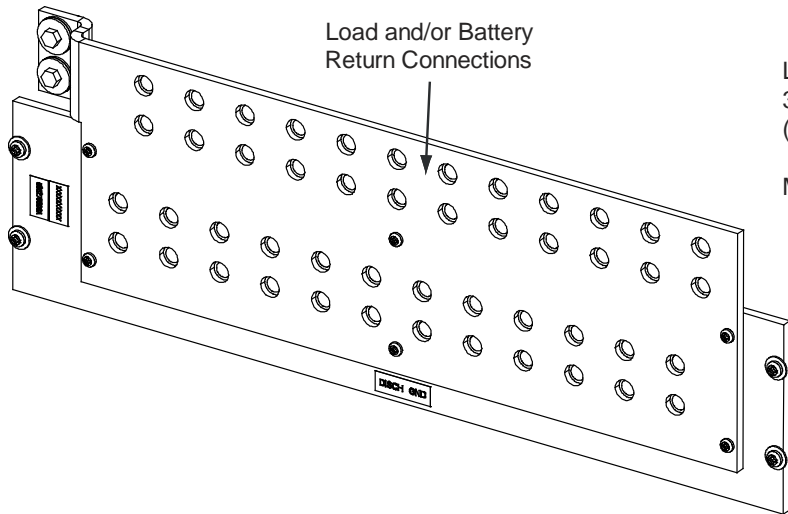
WARNING!
 Observe proper
 polarity when making
 load connections.



Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device.
 A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

5.11.4 Load Connections to Return Bar

Figure 5.36: List GA: Return Bar Panel



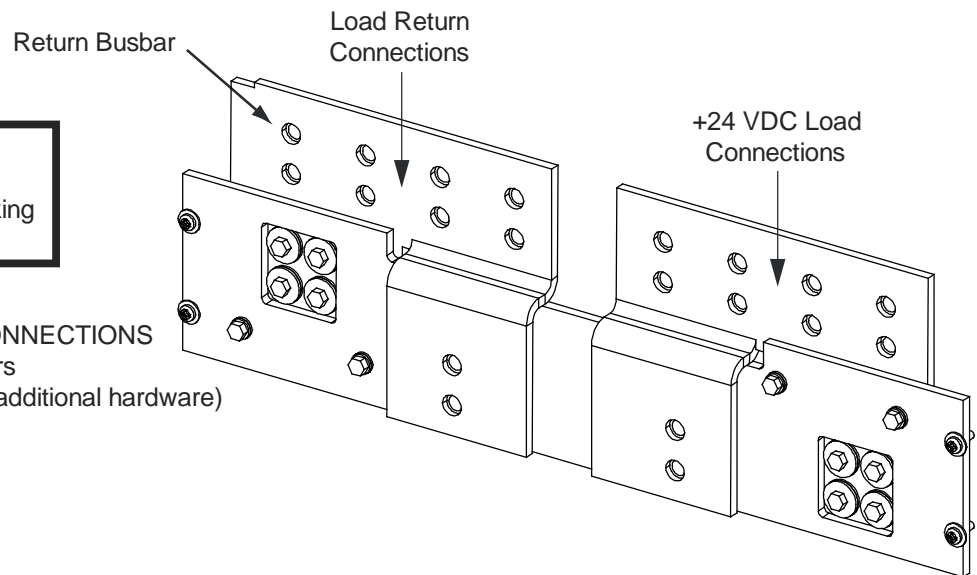
LOAD AND/OR BATTERY RETURN CONNECTIONS
3/8-16 Captive Nuts on 1" Centers
(Customer must supply or order additional hardware)

Maximum Lug Width: 1.38 inches.

5.11.5 Load Connections to Bulk Output Panel

Figure 5.37: List EA: Bulk Output Panel

WARNING!
Observe proper polarity when making load connections.

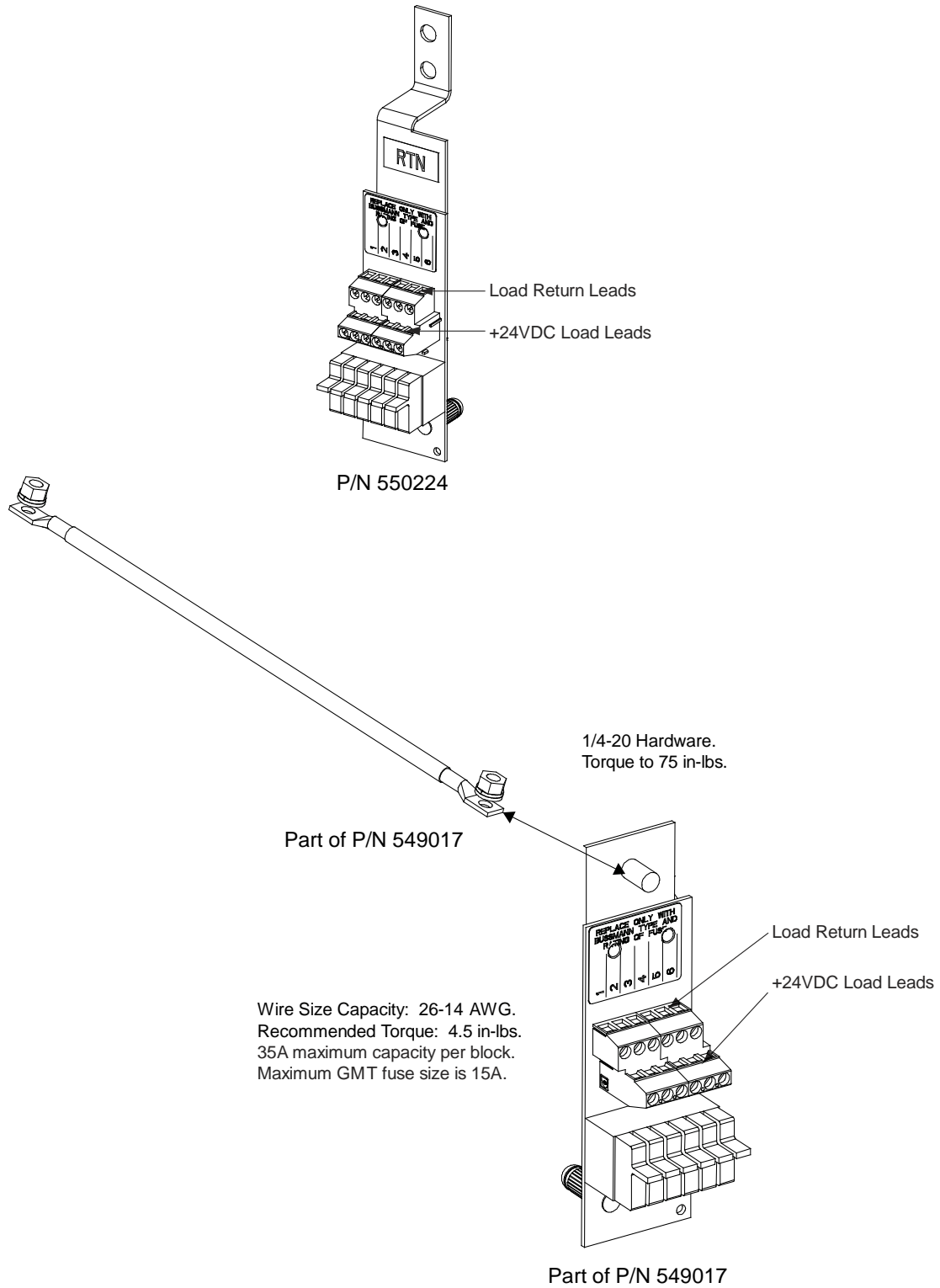


LOAD AND LOAD RETURN CONNECTIONS
3/8-16 Captive Nuts on 1" Centers
(Customer must supply or order additional hardware)

Maximum Lug Width: 2.0 inches.

5.11.6 Load Connections to GMT Distribution Fuse Block

Figure 5.38: Optional Bullet Nose 6-Position GMT Distribution Fuse Block



5.13 Battery Connections

5.13.1 Important Safety Instructions



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



WARNING! Observe proper polarity when making battery connections.

5.13.2 Recommended Torques

- 72 in-lbs for 1/4-inch hardware (when using standard flat and lock washer).
- 300 in-lbs for 3/8-inch hardware (when using standard flat and lock washer).
- 180 in-lbs for 3/8-inch hardware (when using a Belleville lock washer).

5.13.3 Battery Connections to Optional Battery Disconnect Distribution Panels



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

Battery strings are connected to the various battery disconnect distribution panels (if furnished) located inside the distribution cabinet, as detailed in the illustrations in this section.

Figure 5.40: List BA: Battery Disconnect Distribution Panel (with Return Busbar) and List BB: Battery Disconnect Distribution Panel (without Return Busbar), (24) Bullet/TPS/TLS Circuit Breaker/Fuse Battery Disconnect Positions

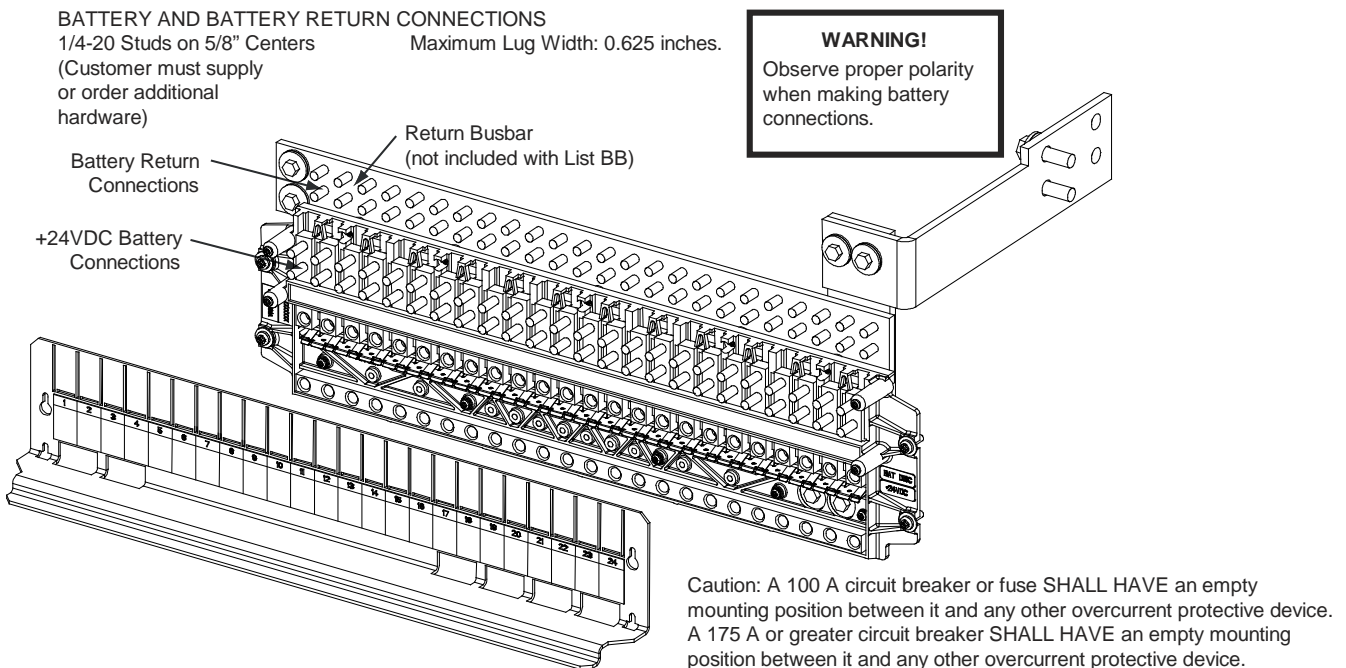


Figure 5.41: List BC: Battery Disconnect Distribution Panel (with Return Busbar) and List BD: Battery Disconnect Distribution Panel (without Return Busbar), (4) GJ/218 Circuit Breaker Battery Disconnect Positions

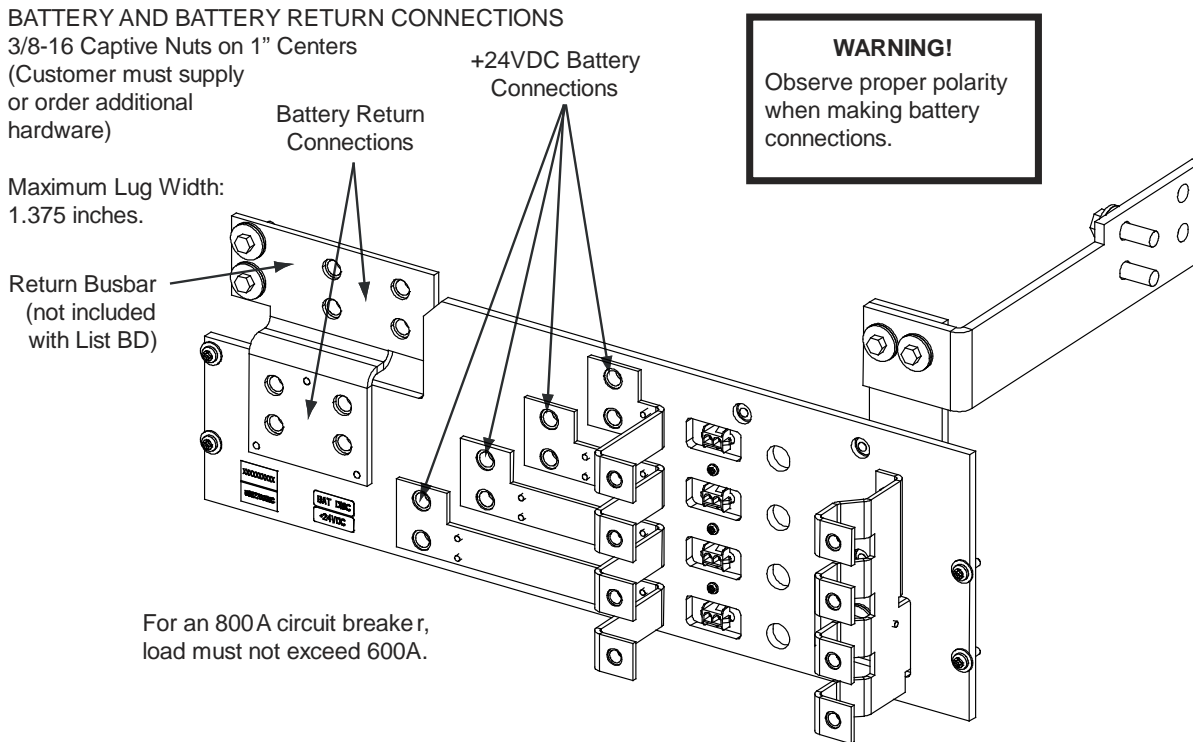


Figure 5.42: List BE: Battery Disconnect Distribution Panel, (2) TPH Fuse Battery Disconnect Position (without Shunts) (without Return Busbar)

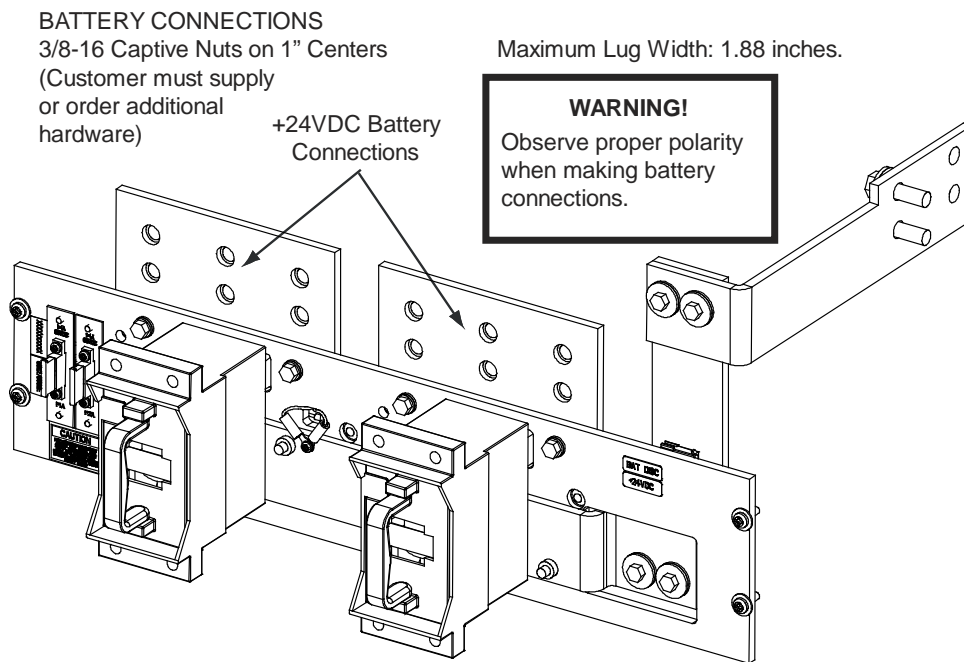


Figure 5.43: List BF: Battery Disconnect Distribution Panel, (2) TPH Fuse Battery Disconnect Positions (with Shunts) (without Return Busbar)

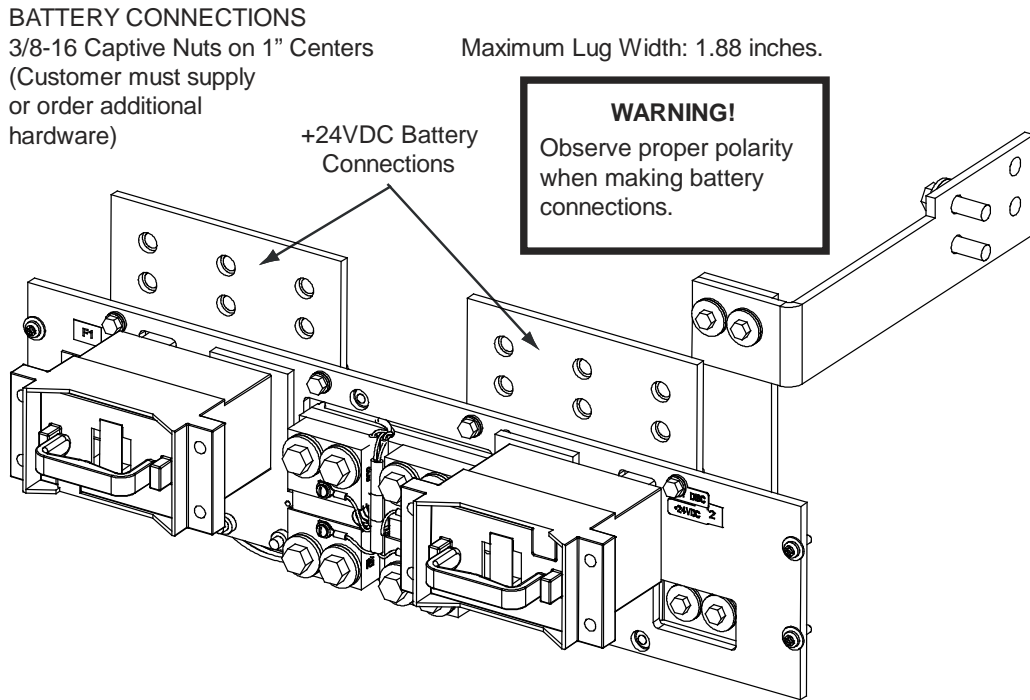


Figure 5.44: List BG: Battery Disconnect Distribution Panel, (4) TPH Fuse Battery Disconnect Positions (without Shunts) (without Return Busbar)

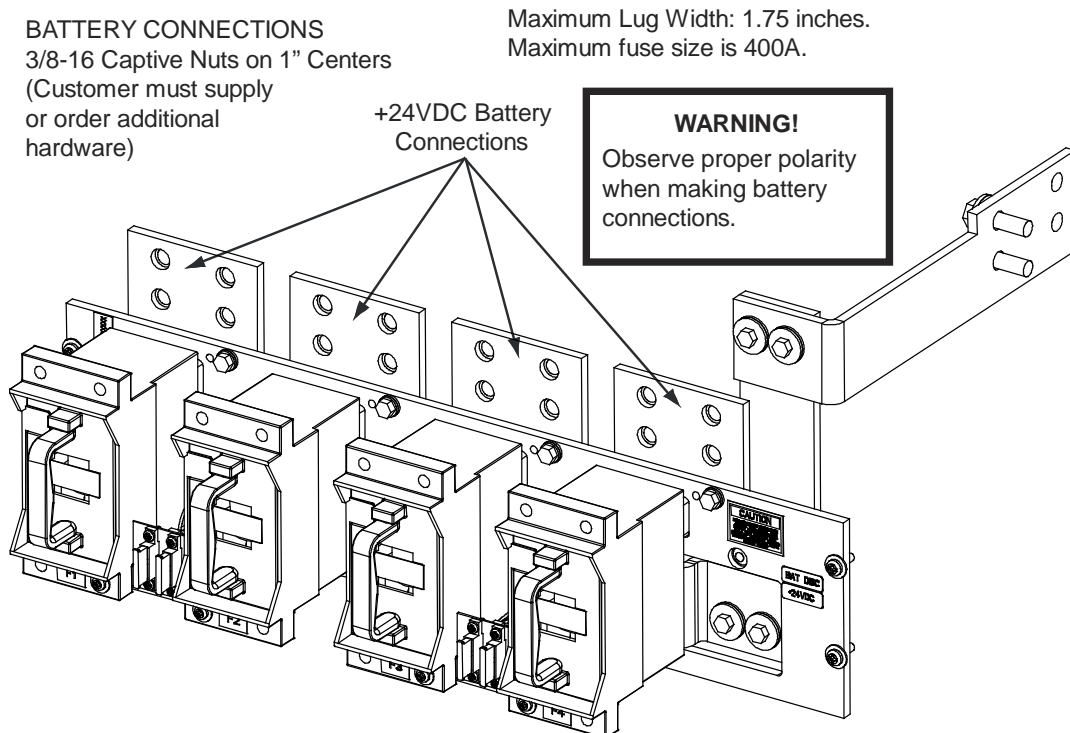
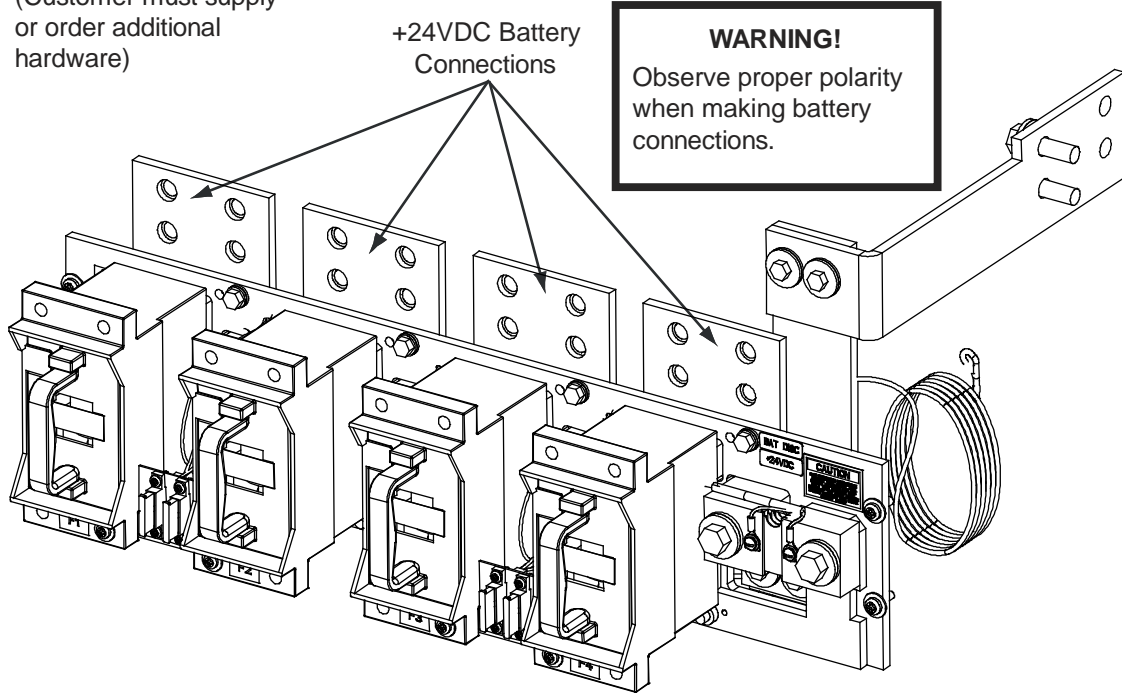


Figure 5.45: List BH: Battery Disconnect Distribution Panel, (4) TPH Fuse Battery Disconnect Positions (with Shunts) (without Return Busbar)

BATTERY CONNECTIONS
3/8-16 Captive Nuts on 1" Centers
(Customer must supply
or order additional
hardware)

Maximum Lug Width: 1.75 inches.
Maximum fuse size is 400A.



5.13.4 Battery Connections to Distribution Cabinet Battery Busbars



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

Battery may be connected to the battery busbars located in the distribution cabinet, as detailed in Figure 5.46 and Figure 5.47, depending on site requirements.

Figure 5.46: Battery Connections to Distribution Cabinet Battery Busbars

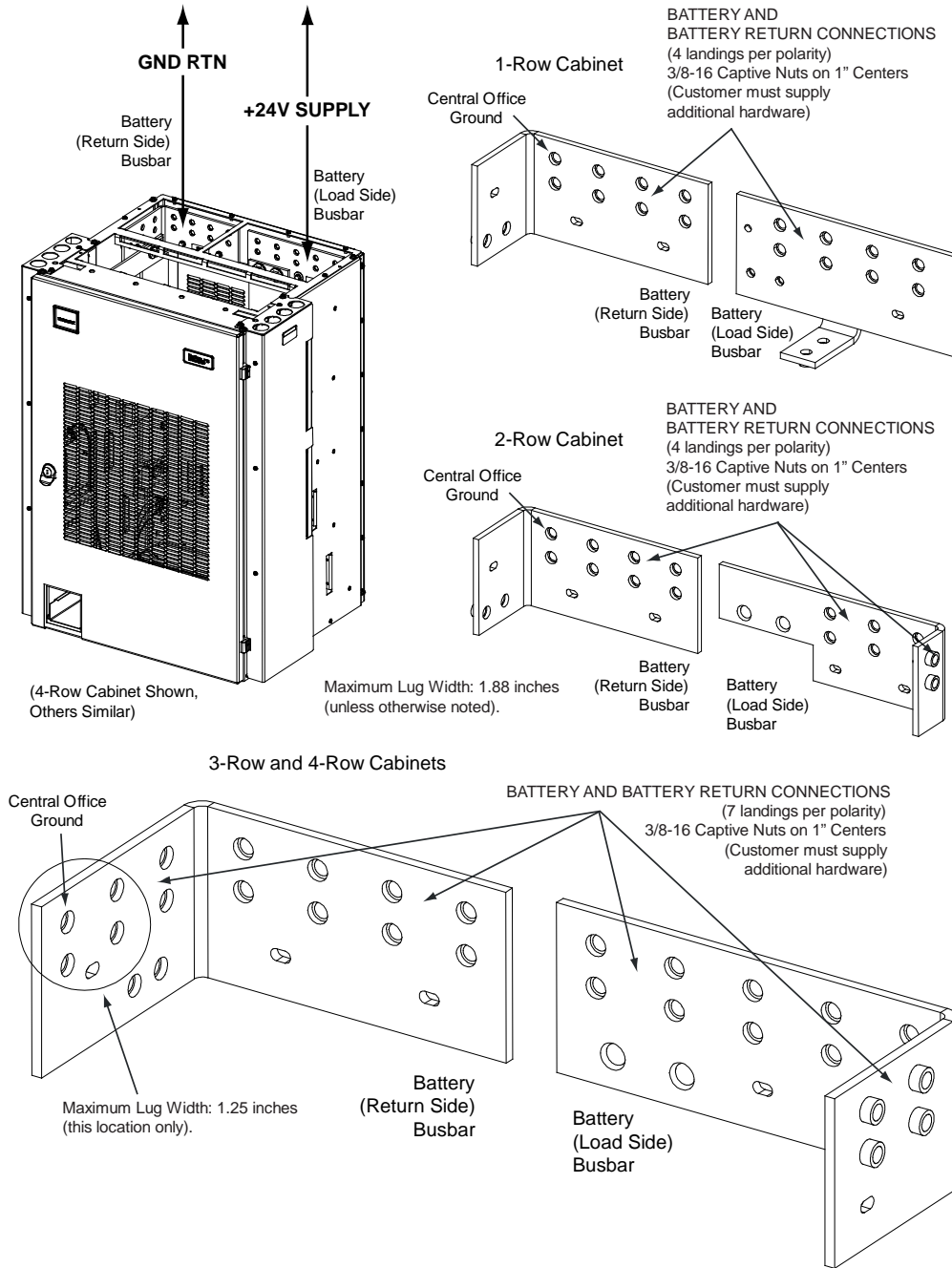
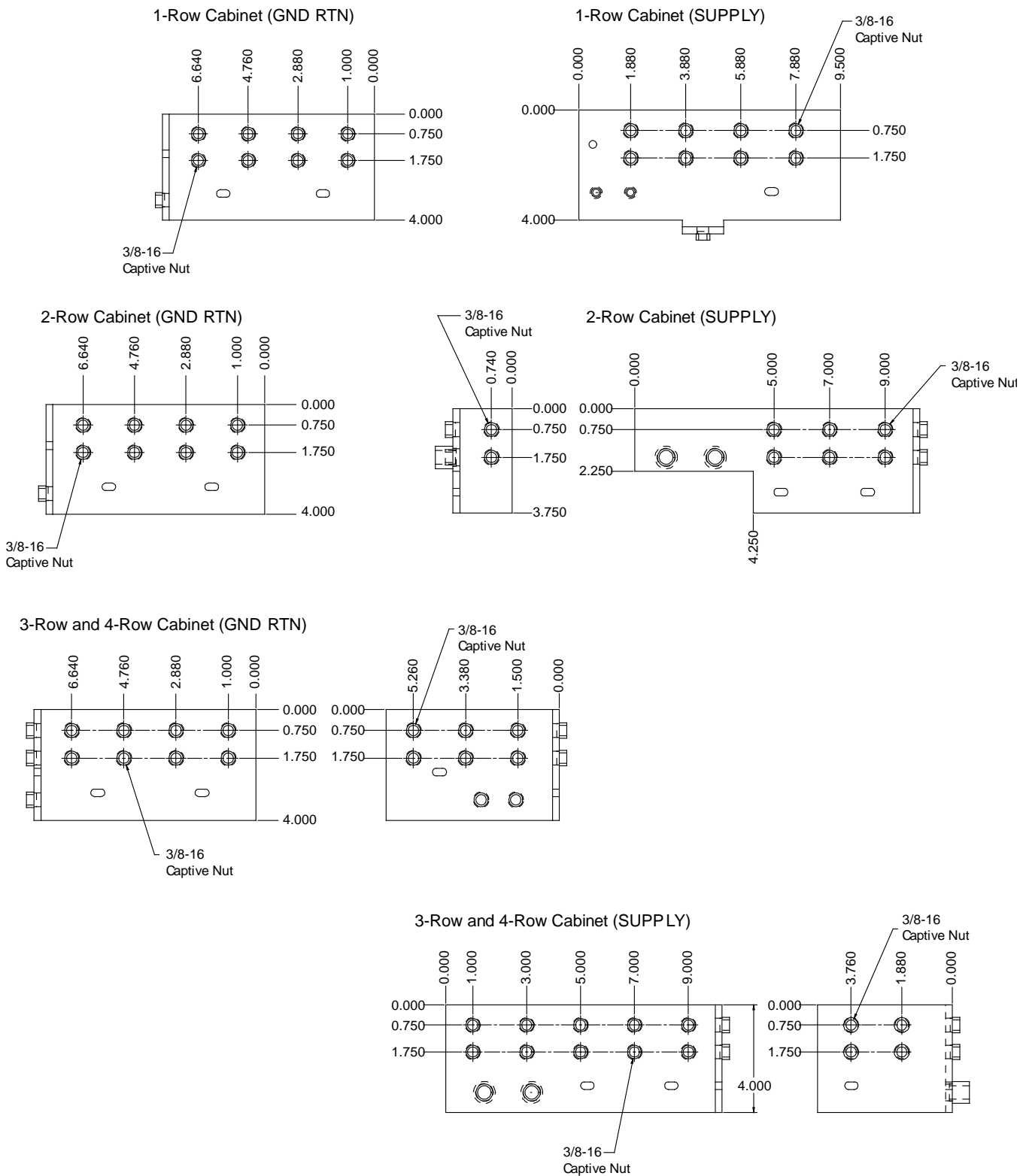


Figure 5.47: Battery Busbar Dimensions



5.13.5 Battery Connections to Optional Battery Busbar Extension Kit P/N 562364

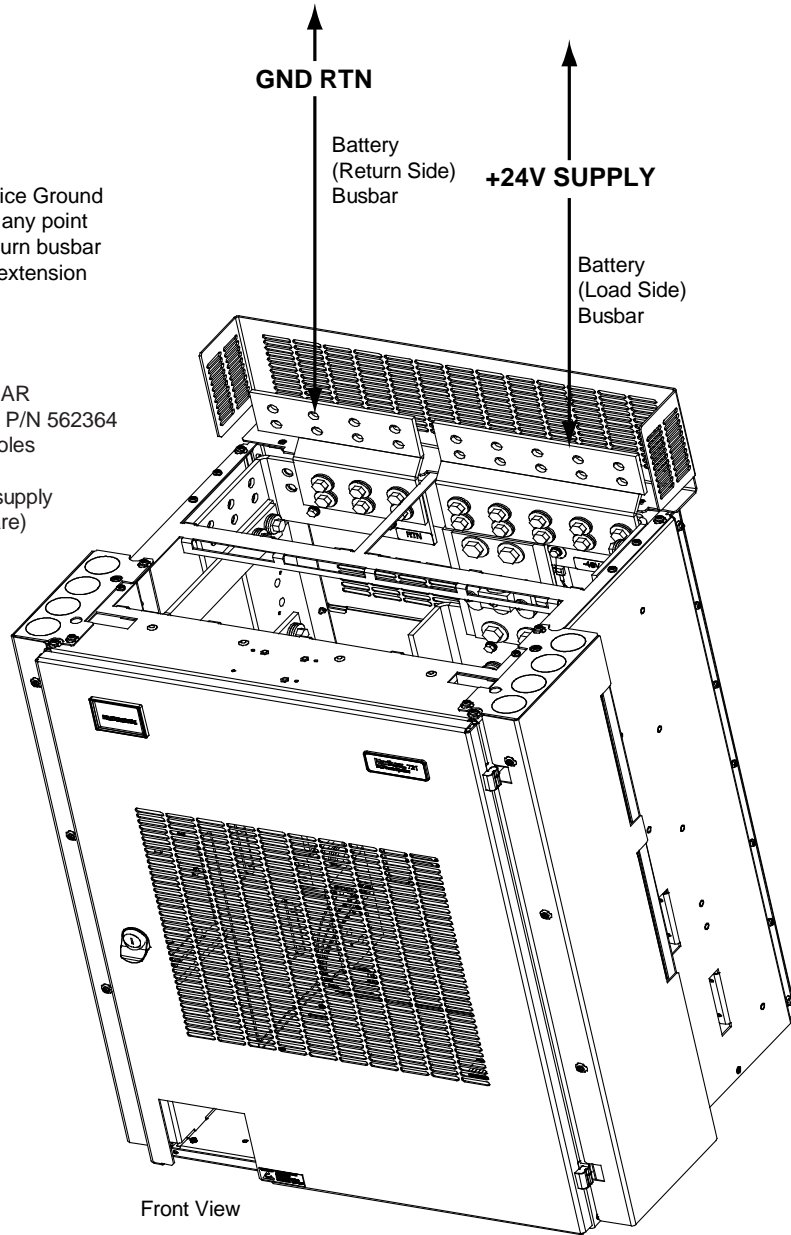


DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

Figure 5.48: Battery Connections to Optional Battery Busbar Extension Kit P/N 562364

Note: Central Office Ground should be tied to any point on the battery return busbar or battery return extension busbar.

BATTERY BUSBAR
EXTENSION KIT P/N 562364
3/8" Clearance Holes
on 1" Centers
(Customer must supply
additional hardware)



Front View

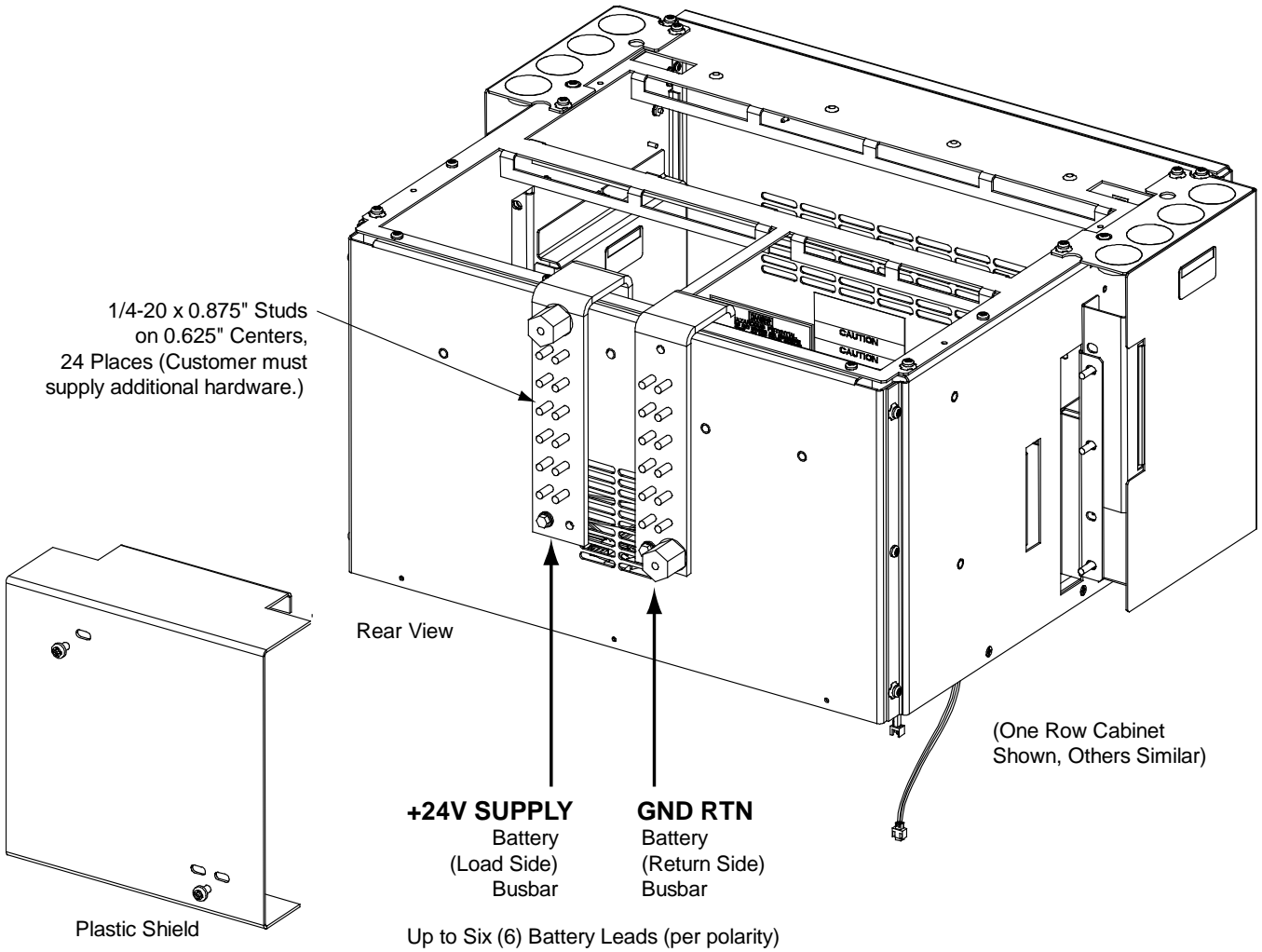
List 24 Distribution Cabinet
(List 23 Similar)

5.13.6 Battery Connections to Optional Battery Landing Busbar Kit P/N 553584



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

Figure 5.49: Battery Connections to Optional Battery Landing Busbar Kit P/N 553584

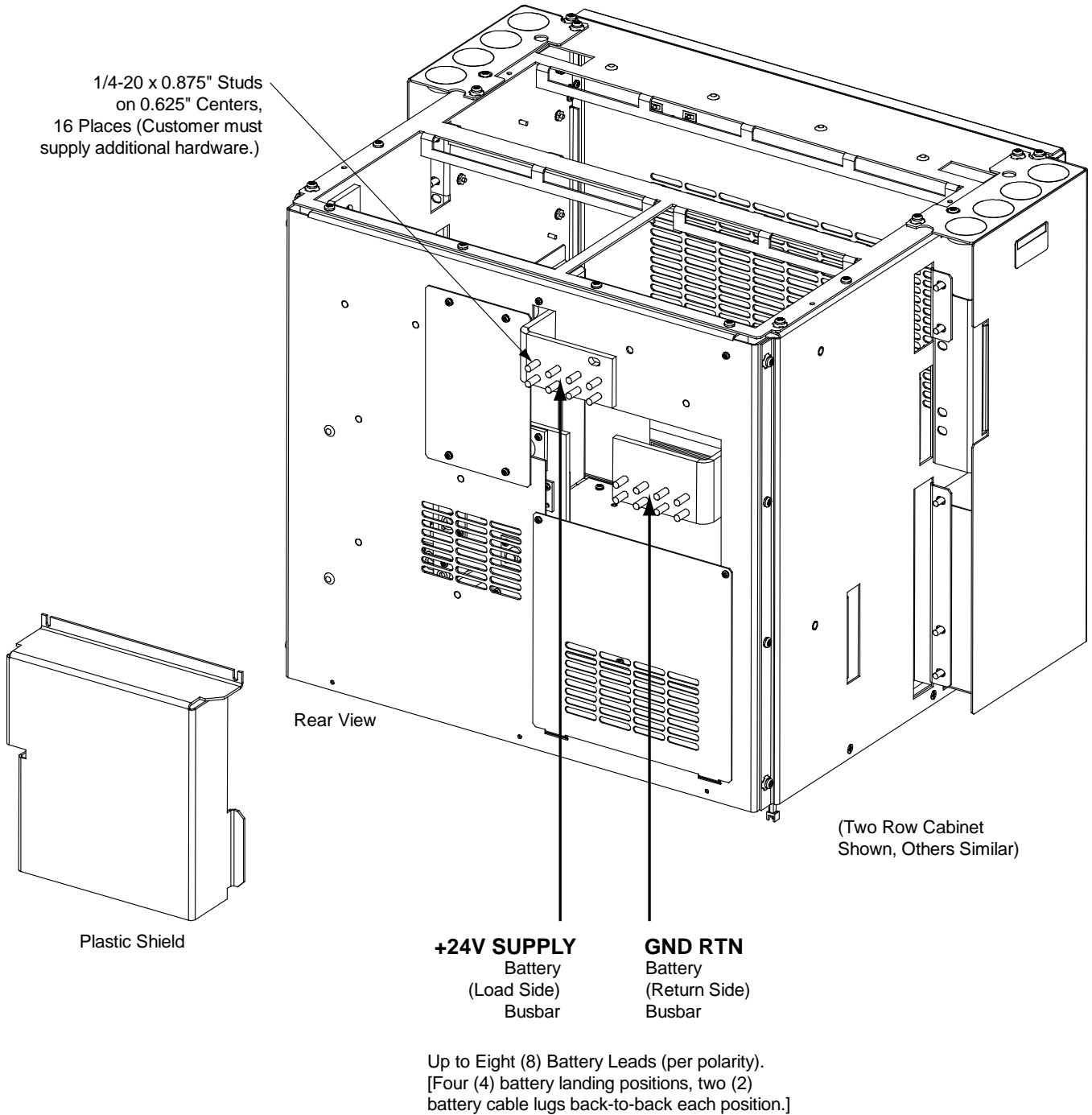


5.13.7 Battery Connections to Optional Battery Landing Busbar Kit P/N 555478



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

Figure 5.50: Battery Connections to Optional Battery Landing Busbar Kit P/N 555478



5.14 Installing and Connecting Batteries in List 93 Battery Tray (if furnished)

Important Safety Instructions



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

Battery Manufacturer Information

Refer to System Application Guide SAG581127000 for specifications and manufacturers of the batteries to be installed in this power system.

Installing Battery Landing Busbar Kit P/N 553584 (List 21) or 555478 (List 22, 23, or 24)



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

If the battery tray(s) was ordered with the system, these kits were installed at the factory. If a battery tray is installed in the field, customer must install the kit.

Procedure

1. Refer to Figure 5.51 or Figure 5.52 and install the Battery Landing Busbar Kit.

Figure 5.51: Battery Landing Busbar Kit P/N 553584

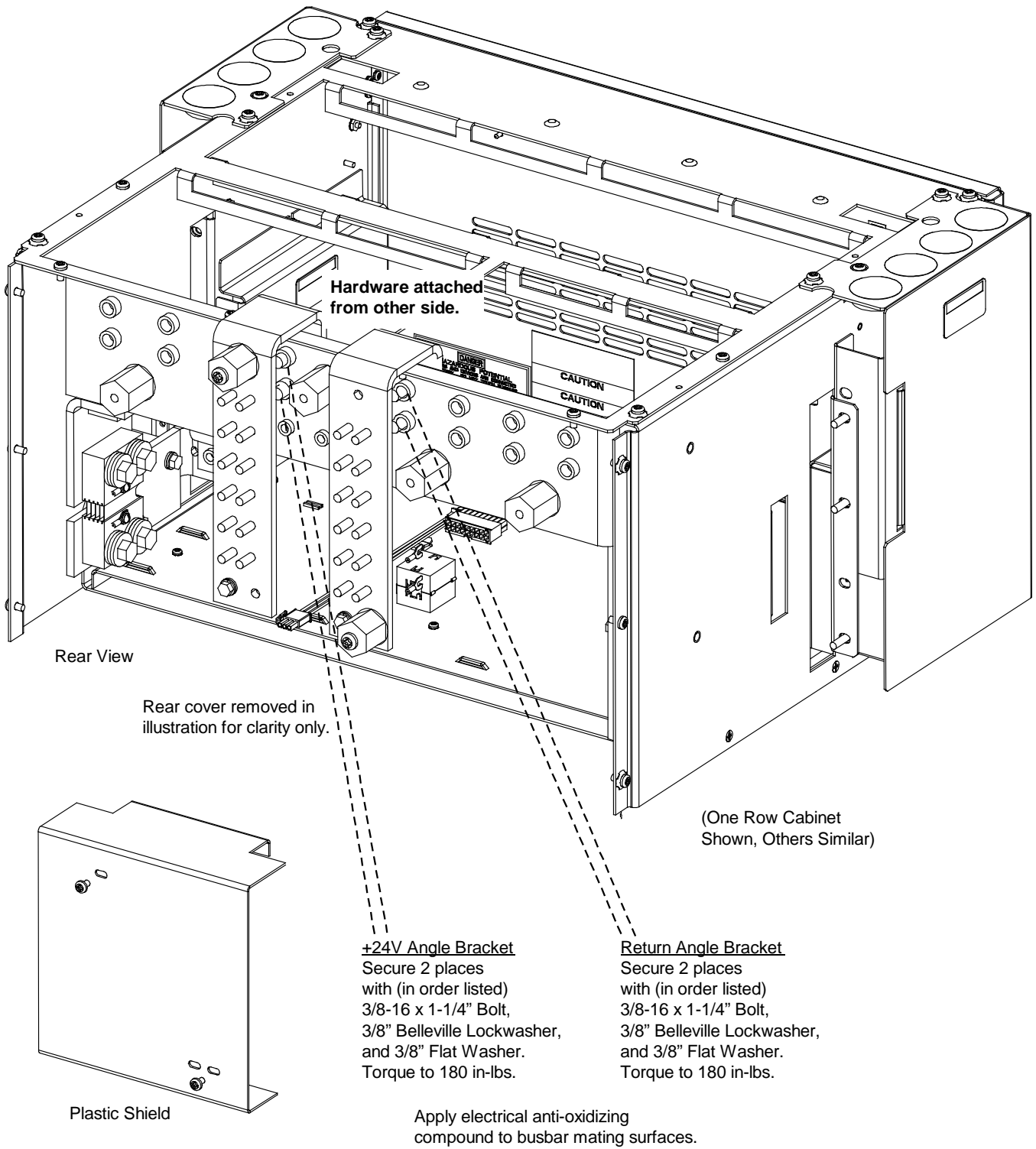
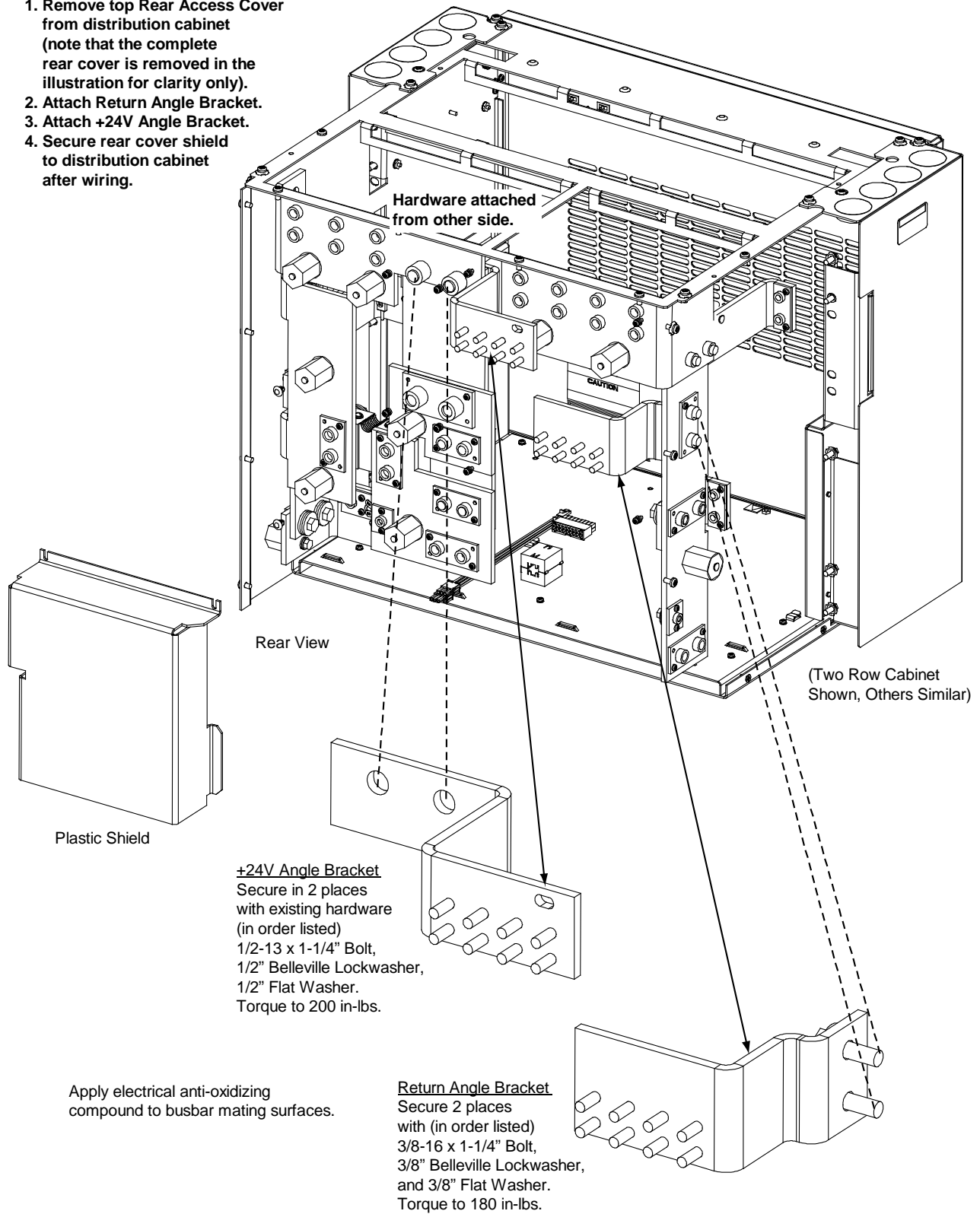


Figure 5.52: Battery Landing Busbar Kit P/N 555478

1. Remove top Rear Access Cover from distribution cabinet (note that the complete rear cover is removed in the illustration for clarity only).
2. Attach Return Angle Bracket.
3. Attach +24V Angle Bracket.
4. Secure rear cover shield to distribution cabinet after wiring.



Wiring to the Battery Tray



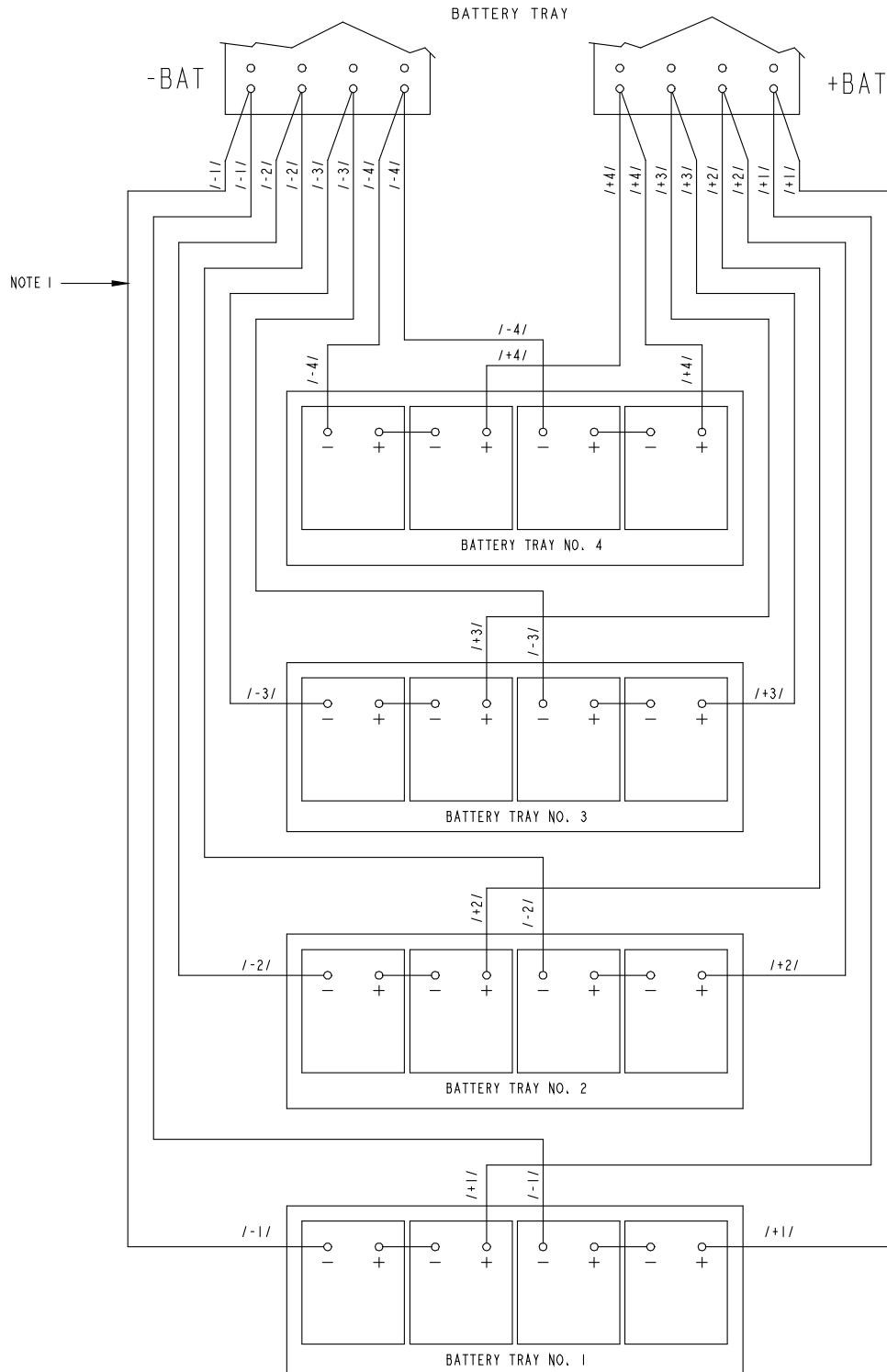
DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

If the battery tray(s) was ordered with the system, wiring to the battery tray was performed at the factory. If a battery tray is installed in the field, customer must wire to the battery tray.

Procedure

1. Refer to the wiring diagram provided in Figure 5.53, and wire the battery tray for your application. Refer also to Figure 5.51 or Figure 5.52.

Figure 5.53: Wiring Diagram - List 93 Battery Tray (cont'd on next page)



1. ALL BATTERY CABLES ARE SUPPLIED WITH LUGS AS PART OF LIST 93. CABLES AND LUGS ARE 1/0 IF NO BATTERY DISCONNECT IS FURNISHED. CABLES ARE 2 GA IF DISCONNECT IS 1-100A AND 1/0 IF 125-200A.

Installing and Connecting Batteries



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

Procedure



NOTE! Refer to Figure 5.54 as this procedure is performed.

1. **If Battery Trays are Equipped With a Circuit Breaker:** Turn OFF the Battery Disconnect circuit breaker located on all battery trays. Refer to Figure 5.54 for locations. Follow local lockout/tagout procedures to ensure circuit breakers remain in the off position during installation.
2. Remove the battery retention bracket as shown in Figure 5.54. To do so, remove the four 1/4-20 x 5/8” bolts and associated washers.
3. Slide batteries into the tray, with the battery terminals toward the front as shown in Figure 5.54. Slide batteries into the tray as far as they will go.



NOTE! The battery retention bracket can be oriented two ways to accommodate batteries of different lengths. A correctly oriented bracket will fit snugly against the batteries. If your batteries require the alternate bracket orientation shown in Detail A of Figure 5.54, remove and reinstall the bullet-shaped spacers as shown in Detail A before performing the next step.

4. Reinstall the battery retention bracket. The spacers on the bracket should separate the batteries from each other. Secure with the hardware removed in a previous step. Refer to Figure 5.54 for washer location.
5. Connect two links supplied by the battery manufacturer between pairs of battery terminals as shown in Figure 5.54. Use hardware furnished by the battery manufacturer. Torque hardware to battery manufacturer’s recommendations.
6. Ensure the battery cable ends in all trays are insulated with sleeving before performing the next step.



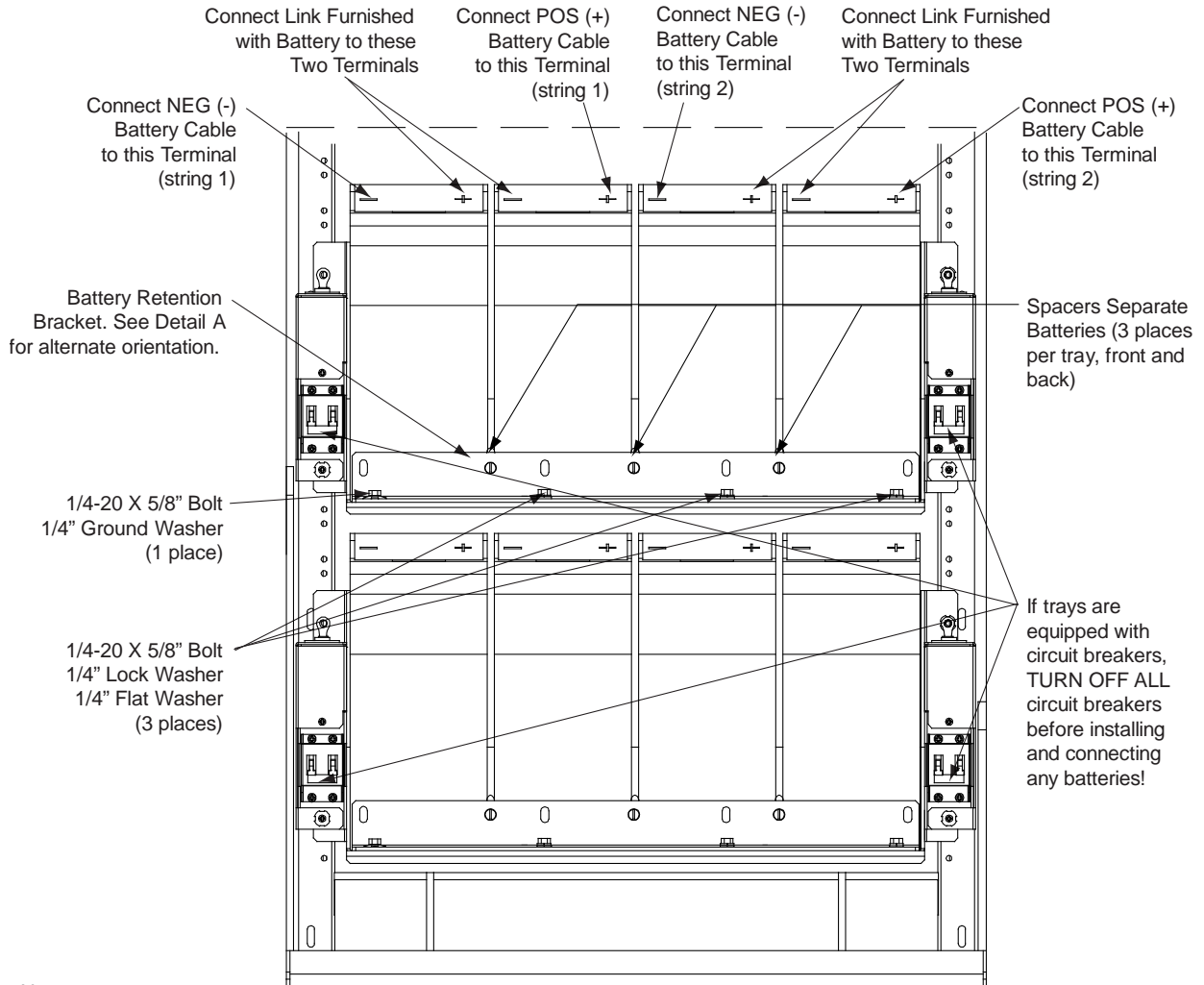
DANGER! In multiple-tray installations, when batteries in one tray are connected, the battery cables in all trays will be energized. Remove sleeving from and connect one cable at a time. Do not allow a cable end to contact the battery tray or equipment rack.



WARNING! In the next step, observe correct polarity. Connect only cables labeled “+” to battery terminals labeled “+”. Likewise, connect only cables labeled “-” to battery terminals labeled “-”.

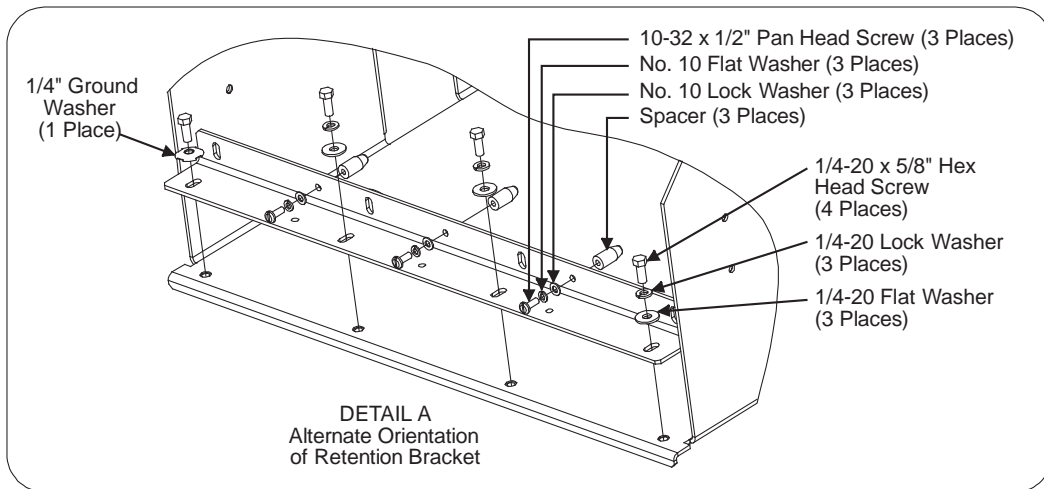
7. Connect the cables found in the battery tray to the battery terminals, “+” to “+” and “-” to “-”. Observe correct polarity. Refer to Figure 5.54. Secure with hardware furnished with the battery. Torque hardware to battery manufacturer’s recommendations.
8. Repeat steps 1 through 7 for any remaining battery trays.
9. **If Battery Trays Are Equipped With a Circuit Breaker:** To connect the batteries to the power system, turn ON the Battery Disconnect circuit breakers located on all battery trays.

Figure 5.54: List 93 Battery Tray Battery Installation Details



Note:

1. Two trays shown as example.
2. Cabling detail omitted.



6 Installing the Rectifier and DC-DC Converter Modules

The module location diagram on the front of each shelf shows which type modules can be operated in that shelf. (See Figure 6.1.) Rectifiers will operate in any mounting position in any shelf. If a shelf accepts DC-DC converter modules, they must be installed in any or all of the four middle mounting positions.



NOTE! Each rectifier and DC-DC converter module locks into the module mounting assembly by means of a latch located on the right-hand side of the module. The latch and module handle are interactive. Pushing the handle into the module front panel causes the latch to extend to the locking position; pulling the handle out from the module front panel causes the latch to retract. See Figure 6.2 for handle operation.



WARNING! To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing a module. NEVER hold the handle in the closed position when installing a module into a shelf.

Procedure

1. Unpack the modules.
2. Note the model number located on the handle of each module. Model numbers starting with the letter “R” (R24-2500 or 24-3000) are rectifiers. Model numbers starting with the letter “C” (C24/48-1500) are DC-DC converter modules.
3. Check the module location diagram on the front of the shelf to determine which type of module (rectifier or DC-DC converter) can be installed in each mounting position. See Figure 6.1.
4. If present, remove blank cover panels from the mounting positions into which rectifier or DC-DC converter modules are to be installed.
5. Place the module into an unoccupied mounting slot without sliding it in completely.
6. Loosen the captive screw on the module handle. Pull the handle to pivot it out of the module front panel (this will also retract the latch mechanism located at the right side of the module). See Figure 6.2.
7. Push the module completely into the shelf.
8. Push the handle into the front panel of the module. This will lock the module securely to the shelf. Tighten the captive screw on the handle.
9. Repeat the above steps for each module being installed in the system.
10. After the modules are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

Figure 6.1: Module Location Diagrams (on the front of each shelf)

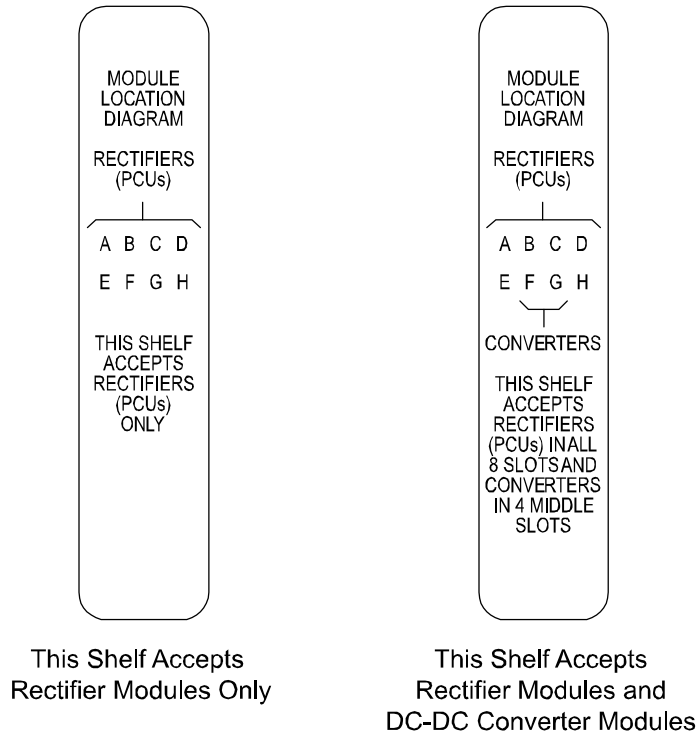
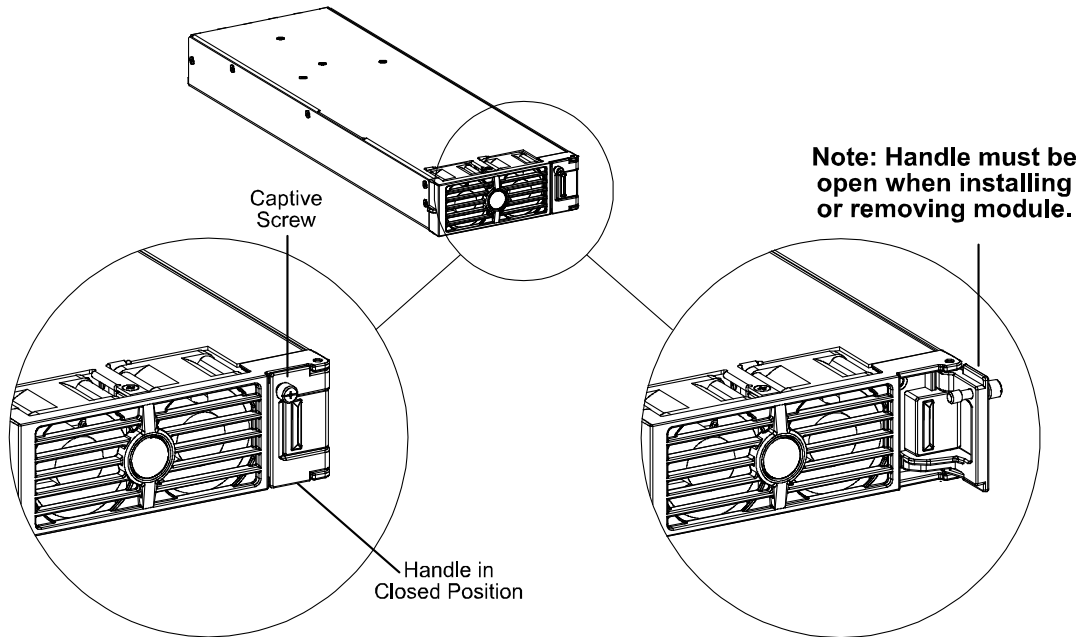


Figure 6.2: Handle/Latch Operation on the Rectifier and DC-DC Converter Modules



7 Initially Starting, Configuring, and Checking System Operation



NOTE! For List A1 and List A2 Inverter startup and checkout procedures, refer to the separate Inverter instruction manuals furnished with this power system. For List D2 and D3 DC-DC Converter startup and checkout procedures, refer to the separate DC-DC Converter instruction manuals furnished with this power system.



CAUTION! Performing various steps in the following procedures may cause a service interruption and/or result in the extension of alarms. Notify any appropriate personnel before starting these procedures. Also, notify personnel when these procedures are completed.

7.1 Initial Startup Preparation

- Ensure that all blocks, except the last one, in the “Installation Acceptance Checklist” starting on page 1 have been checked.
- Ensure that module mounting positions are filled by a rectifier module, converter module, or a blank cover panel, as required. It is acceptable for positions to be left vacant.
- Refer to the configuration drawing (C-drawing) supplied with your power system documentation for factory settings of adjustable parameters.

7.2 Initially Starting the System

Procedure

1. Apply battery power to the system by closing the external battery disconnect(s) or protective device(s) that supplies battery power to the system, if furnished. Close the system’s internal battery disconnect circuit breakers, if furnished.
2. Apply AC or DC input power to the system (depending on configuration ordered) by closing ALL external AC or DC disconnects or protective devices that supply AC or DC input power to the module mounting shelves. Rectifiers and/or converters automatically start.
3. Open the distribution cabinet’s front door by turning the latch in the counterclockwise position.
4. Place each distribution circuit breaker (if furnished) to the ON position.

7.3 ACU+ Controller Procedure

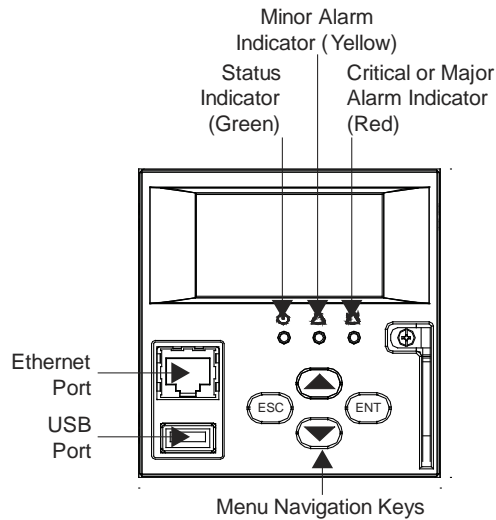
Refer to this section if your system is furnished with an ACU+ Controller.

ACU+ Controller Initialization

Refer to the ACU+ Instructions (UM1M820BNA) for detailed instructions.

Refer to Figure 7.1 for locations of the ACU+ local indicators and navigation keys.

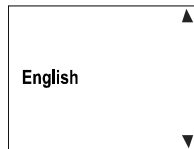
Figure 7.1: ACU+ Local Indicators and Navigation Keys



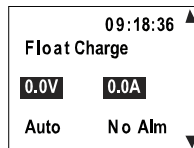
Procedure

NOTE! The initialization routine takes several minutes. During that time various alarm indicators may illuminate on the ACU+ front panel and an audible alarm may sound. Disregard all alarms. An audible alarm can be silenced at any time by momentarily depressing the **ENT** key on the ACU+ Controller.

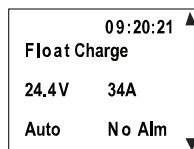
1. After the ACU+ is powered on, the display alternates between the “logo” screen and a screen displaying “**Advanced Control Unit Plus Version ***** Starting...**”
2. Next, the language screen appears. Press the up or down arrow key to select the desired language. Press the **ENT** key to confirm the selection. If no key is pressed within 10 seconds, the ACU+ selects the displayed language automatically.



3. As initialization continues, the Main screen is displayed, but with zero volts. Initialization is not complete.

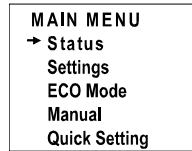


4. When initialization is complete, the Main screen displays voltage and current normally, and no alarms are active.



5. System information is displayed in multiple screens. Repetitively press the up or down arrow key to view other system information screens one by one.

- From the Main screen, press **ENT** to go to the “Main Menu” screen.



- From the Main Menu, select a submenu by repetitively pressing the up or down arrow key. The selected submenu will be indicated by the cursor. Press **ENT** to open the submenu.



NOTE! Repeatedly press the “ESC” key to return in reverse order level by level from any submenu until the Main screen appears.

- Verify and set the ACU+ controller as required for your application. Refer to the ACU+ Instructions (UM1M820BNA) for procedures. Note that you will have to program the ACU+ for any temperature probes and external inputs/outputs connected to the IB2 Interface Board, optional EIB Interface Board, and optional SM-DU+ Shunt Interface Board.



NOTE! When setting total rectifier current limit, the set point to each unit is the total set point divided by the number of units. For example, if the system contains five rectifiers and the current limit is set to 150 amps then each rectifier has a current limit set point of 30 amps. If one or more rectifiers are removed or fail it will take several seconds for the individual set points to the remaining rectifiers to be reset. In the example given, if one rectifier is removed the current limit set point will drop to 120 amps (30 amps times four remaining rectifiers) until the controller can send updated set points to the remaining rectifiers. This takes a couple communication cycles (several seconds) after which each rectifier would have a new set point of 37.5 amps for a total of 150 amps. The total current limit of the rectifiers should not be set such that the loss of the redundant rectifiers will cause this temporary set point to drop below the actual maximum expected load. If batteries are used on the rectifier output, the batteries should support the load until the current limit set points can be re-established due to loss of a rectifier.

Verifying the Configuration File

Your ACU+ was programmed with a configuration file that sets all adjustable parameters. The version number of the configuration file can be found on the configuration drawing (C-drawing) that is supplied with your power system documentation, and on a label located on the ACU+. You can verify that the correct configuration file has been loaded into your ACU+ by performing the following procedure.



NOTE! The quantity of LVD’s and shunt values for your specific system may be different from the values shown on the C-drawing.

Procedure



NOTE! When viewing any of the following screens, if a key is not depressed within approximately 10 seconds, the ACU+ will automatically return to the Main screen.

- With the Main screen displayed, press **ESC**. A screen displays the serial number and software version.
- Press **ENT**. A screen displays the hardware version and MAC address.
- Press **ENT**. A screen displays the configuration version number.
- Press **ESC**, or wait approximately 10 seconds, to return to the Main screen.

Checking Basic System Settings

Navigate through the controller menus and submenus to check system settings. You can adjust any parameter as required. Note that these settings can also be checked (and changed if required) via the WEB Interface.



NOTE! Repeatedly press the “ESC” key to return in reverse order level by level from any submenu until the Main screen appears.

Procedure

1. **To Select a Sub-Menu:**

Press the up or down arrow keys to move the cursor up and down the list of sub-menus in the menu screen (selects the sub-menu), then press **ENT** to enter the selected sub-menu.

2. **To Select a User:**

To select a User, use the UP or DOWN arrow keys to move the cursor to the Select User field. Press ENT. Use the UP and DOWN keys to select a User previously programmed into the ACU+. Press ENT to select the User. Note that only Users programmed into the ACU+ are shown. Users are programmed via the Web Interface. The default User is admin.

3. **To Enter a Password:**

If a password screen opens, a password must be entered to allow the User to make adjustments. To enter a password, use the UP and DOWN keys to move the cursor to the Enter Password field. Press ENT. Use the UP and DOWN keys to choose a character. Press ENT to accept and move to the next character. Continue this process until all characters are entered. Press ENT again to accept the password. The default password is 1.

4. **To Change a Parameter:**

Press the up or down arrow keys to move the cursor up and down the list of parameters in the menu screen (selects the parameter to change), then press **ENT** to change the selected parameter. The parameter field highlights. Press the up or down arrow keys to change the parameter value. Press **ENT** to confirm the change.

Table 7.1 shows the menu navigation for some basic settings. Refer to the separate ACU+ Manual (UM1M820BNA) supplied with your power system for complete Local Display menus.

Table 7.1: ACU+ Basic Settings Menu Navigation

Parameter	Menu Navigation
Date	Main Menu / Settings / Controller / Date
Time	Main Menu / Settings / Controller / Time
IP Communications Parameters (IP address, subnet mask address, gateway address)	Main Menu / Settings / Communication
Float Voltage	Main Menu / Settings / Battery / Charge / Float Voltage
Equalize Voltage	Main Menu / Settings / Battery / Charge / EQ Voltage
Battery Capacity	Main Menu / Settings / Battery / Battery 1 / Rated Capacity
BTRM Feature	Main Menu / Settings / Battery / Basic / BTRM Action Main Menu / Settings / Battery / Basic / BTRM Voltage
Temperature Compensation Center Temperature	Main Menu / Settings / Battery / Temp Comp / Temp CompCenter
Temperature Compensation Slope	Main Menu / Settings / Battery / Temp Comp / Temp Comp Coeff
Temperature Compensation Sensor	Main Menu / Settings / Battery / Temp Comp / TempComp Sensor
Temperature Compensation Maximum Voltage	Main Menu / Settings / Battery / Temp Comp / Temp Comp Max V
Temperature Compensation Minimum Voltage	Main Menu / Settings / Battery / Temp Comp / Temp Comp Min V
HVSD Limit	Main Menu / Settings / Rectifier / All Rect Set / HVSD Limit
Rectifier Current Limit	Main Menu / Settings / Rectifier / All Rect Set / Curr Limit Pt
Over Voltage Alarm 1	Main Menu / Settings / Power System / General / Over Voltage 1
Over Voltage Alarm 2	Main Menu / Settings / Power System / General / Over Voltage 2
Under Voltage Alarm 1	Main Menu / Settings / Power System / General / Under Voltage 1
Under Voltage Alarm 2	Main Menu / Settings / Power System / General / Under Voltage 2

Changing Battery Capacity Rating in the ACU+

To change the battery capacity setting of the ACU+ to match the battery connected to the power system, perform the following procedure.

Procedure

1. With the Main screen displayed, press **ENT** to go to the Main Menu. Navigate to and select “**Settings**” (ENT).
2. If a password screen opens, a password must be entered to allow the User to make adjustments. If a password was previously entered and has not yet timed out, skip this step and proceed to step 3). Otherwise, to enter a password, with the cursor at the User Name field (default is “Admin”), press the down arrow key to move cursor down to the password line. Press **ENT**. “0” is highlighted. Press the up arrow key once to change the “0” to “1” (default password is “1”), then press **ENT** twice. (*Note: If you have been assigned a unique User Name and password, follow this procedure to enter these.*)
3. With the Settings menu screen displayed, navigate to and select “**Battery**” (ENT) / “**Battery 1**” (ENT).
4. Navigate to “**Rated Capacity**”. Press **ENT**. Use the up or down keys to adjust the value as required. Press **ENT**.
5. Return to the Main screen by repeatedly pressing **ESC** (escape).

Configuring the ACU+ Identification of Rectifiers and Assigning which Input Phase is Connected to the Rectifiers

When rectifiers are all installed prior to applying power and starting the system, the order in which the ACU+ identifies the rectifiers is by serial number (lowest serial number is Rect 1, next lowest is Rect 2, etc.). If you prefer the ACU+ to identify the rectifiers by position in the system, perform the following procedure.

Upon power up, the ACU+ arbitrarily assigns Phase A, B, or C to each rectifier. This assignment is used to display rectifier AC input phase voltage(s). The User may reassign the phase to each rectifier per your specific installation by following the procedure below.

Procedure

1. With the Main screen displayed, press **ENT** to go to the Main Menu. Navigate to and select “**Settings**” (ENT).
2. If a password screen opens, a password must be entered to allow the User to make adjustments. If a password was previously entered and has not yet timed out, skip this step and proceed to step 3). Otherwise, to enter a password, with the cursor at the User Name field (default is “Admin”), press the down arrow key to move cursor down to the password line. Press **ENT**. “0” is highlighted. Press the up arrow key once to change the “0” to “1” (default password is “1”), then press **ENT** twice. (*Note: If you have been assigned a unique User Name and password, follow this procedure to enter these.*)
3. With the Settings menu screen displayed, navigate to and select “**Rectifier**” (ENT).
4. Navigate to “**Rect #**” (# is used here to represent the rectifier identification number). Press **ENT**. The rectifier # menu screen is displayed, and the green LED on one rectifier starts flashing. This is the rectifier currently identified by the ACU+ as rectifier #. (If this is not the rectifier you want, press **ESC** to return to rectifier menu screen and select a different rectifier.)
5. If you wish to change the Rectifier IDs, navigate to and select “**Rectifier ID**”. Press **ENT**. Use the up or down keys to change the ACU+ identification number for the flashing rectifier. Press **ENT**.
6. If you wish to change the Rectifier Phase Assignment, navigate to and select “**Rect Phase**”. Press **ENT**. Use the up or down keys to change the phase connected to the flashing rectifier. Press **ENT**.



NOTE! The new ID and/or phase assignment will not take effect until this entire procedure is completed and the new ID's have been confirmed.

7. Press **ESC** to return to rectifier menu screen.
8. Navigate to and select the next rectifier.

9. Repeat steps 4) through 8) for each of the remaining rectifiers in the system.
10. When you have finished selecting identification numbers for all rectifiers, repeatedly press **ESC** to return to the Main Menu.
11. Navigate to and select **“Manual”** (ENT) / **“Rectifier”** (ENT) / **“All Rect Ctrl”** (ENT).
12. Navigate to **“Confirm ID/PH”**. Press **ENT**. **“Yes”** highlights.
13. Press **ENT** to select the operation. Press **ENT** again to confirm.



NOTE! Check you numbering to be sure it is correct. If there where conflicts in your numbering, rectifiers with conflicts will be assigned the next available sequential number.

14. Return to the Main screen by repeatedly pressing **ESC** (escape).

Configuring the ACU+ Identification of Converter Modules

When converters are all installed prior to applying power and starting the system, the order in which the ACU+ identifies the converters is by serial number (lowest serial number is Conv 1, next lowest is Conv 2, etc.).

If you prefer the ACU+ to identify the converters by position in the system, perform the following procedure.

Procedure

1. With the Main screen displayed, press **ENT** to go to the Main Menu. Navigate to and select **“Settings”** (ENT).
2. If a password screen opens, a password must be entered to allow the User to make adjustments. If a password was previously entered and has not yet timed out, skip this step and proceed to step 3). Otherwise, to enter a password, with the cursor at the User Name field (default is “Admin”), press the down arrow key to move cursor down to the password line. Press **ENT**. “0” is highlighted. Press the up arrow key once to change the “0” to “1” (default password is “1”), then press **ENT** twice. (*Note: If you have been assigned a unique User Name and password, follow this procedure to enter these.*)
3. With the Settings menu screen displayed, navigate to and select **“Converter”** (ENT).
4. Navigate to **“Conv #”** (# is used here to represent the converter identification number). Press **ENT**. The converter # menu screen is displayed, and the green LED on one converter starts flashing. This is the converter currently identified by the ACU+ as converter #. (If this is not the converter you want, press **ESC** to return to converter menu screen and select a different converter.)
5. Navigate to and select **“Set Conv ID”**. Press **ENT**. Use the up or down keys to change the ACU+ identification number for the flashing converter. Press **ENT**.
6. Press **ESC** to return to converter menu screen.
7. Navigate to and select the next converter.
8. Repeat steps 4) through 7) for each of the remaining converters in the system.
9. When you have finished selecting identification numbers for all converters, repeatedly press **ESC** to return to the Main Menu.
10. Navigate to and select **“Manual”** (ENT) / **“Converter”** (ENT) / **“All Conv Ctrl”** (ENT).
11. Navigate to **“Confirm ID”**. Press **ENT**. **“Yes”** highlights.
12. Press **ENT** to select the operation. Press **ENT** again to confirm.



NOTE! Check you numbering to be sure it is correct. If there where conflicts in your numbering, converters with conflicts will be assigned the next available sequential number.

- Return to the Main screen by repeatedly pressing **ESC** (escape).

ACU+ Alarm Relay Check

To verify operation of the external alarm relays, use the ACU+ alarm relay test feature. Refer to the ACU+ Instructions (UM1M820BNA) for instructions in using this feature.



NOTE! The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.

7.4 NCU Controller Procedure

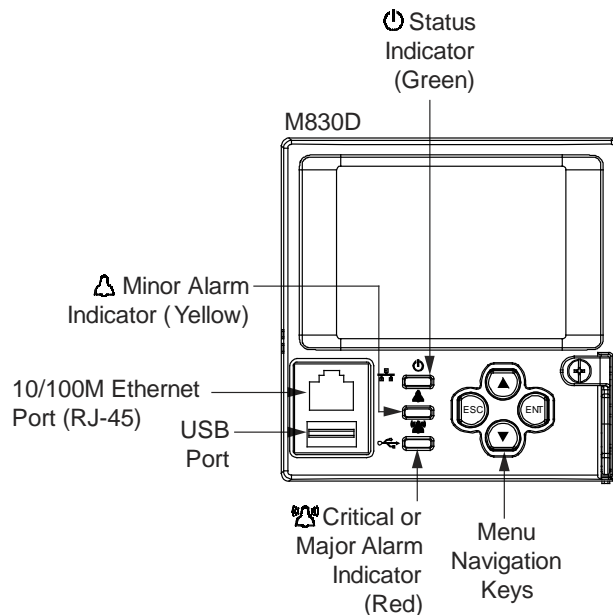
Refer to this section if your system is furnished with an NCU Controller.

NCU Controller Initialization

Refer to the NCU Instructions (UM1M830BNA) for detailed instructions.

Refer to Figure 7.2 for locations of the NCU local indicators and navigation keys.

Figure 7.2: NCU Local Indicators and Navigation Keys



Procedure



NOTE! The initialization routine takes several minutes. During that time various alarm indicators may illuminate on the NCU front panel and an audible alarm may sound. Disregard all alarms. An audible alarm can be silenced at any time by momentarily depressing the **ENT** key on the NCU Controller.

- After the NCU is powered on, the display shows the “**logo**” screen. The controller is initializing.
- When initialization is complete, the language screen appears. Press the up or down arrow key to select the desired language. Press the ENT key to confirm the selection.
- The Main Menu displays. See Figure 7.3.

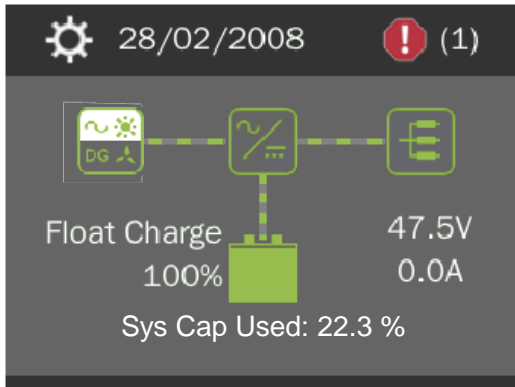
Figure 7.3: NCU Local Display Main Menu

Main Menu

Date and time are alternately displayed.

Green - No Alarm
Red - Alarm

The number in () indicates the total number of alarms.



Press the UP and DOWN keys to highlight the desired Menu graphic in the Main Menu.

Press the ENT key to enter the selected menu.

Graphics	Menu Name	Description
	Alarm (Green - No Alarm) (Red - Alarm)	View active alarms and alarm history.
	Settings	Gain access to the NCU Controller's settings menus.
	Input Power	View AC, Solar, DG, and Wind related information.
	Module	View rectifier, solar converter, and converter module related information.
	DC	View DC equipments related information.
	Battery	View battery related information.

To reboot the Controller, from the Main Menu press the ENT and ESC keys at the same time. Release both keys. Press ENT to confirm.



NOTE! "Sys Cap Used" is based on the number of installed rectifiers and solar converters (if furnished).

- System information is displayed in multiple screens. Press the ESC key to view other system information. Press the down arrow key to view the next screen. Press the ESC key to return to the Main Menu.
- From the Main Menu, press the UP and DOWN keys to highlight the desired Menu graphic in the Main Menu. Press the ENT key to enter the selected menu.



NOTE! Repeatedly press the "ESC" key to return in reverse order level by level from any submenu until the Main Menu appears.

- Verify and set the NCU controller as required for your application. Refer to the NCU Instructions (UM1M830BNA) for procedures. Note that you will have to program the NCU for any temperature probes and external inputs/outputs connected to the IB2 Interface Board, optional EIB Interface Board, and optional SM-DU+ Shunt Interface Board. Refer also to "NCU Start Wizard" on page 130.



NOTE! When setting total rectifier current limit, the set point to each unit is the total set point divided by the number of units. For example, if the system contains five rectifiers and the current limit is set to 150 amps then each rectifier has a current limit set point of 30 amps. If one or more rectifiers are removed or fail it will take several seconds for the individual set points to the remaining rectifiers to be reset. In the example given, if one rectifier is removed the current limit set point will drop to 120 amps (30 amps times four remaining rectifiers) until the controller can send updated set points to the remaining rectifiers. This takes a couple communication cycles (several seconds) after which each rectifier would have a new set point of 37.5 amps for a total of 150 amps. The total current limit of the rectifiers should not be set such that the loss of the redundant rectifiers will cause this temporary set point to drop below the actual maximum expected load. If batteries are used on the rectifier output, the batteries should support the load until the current limit set points can be re-established due to loss of a rectifier.

NCU Start Wizard

For initial startup, you can perform the Start Wizard from the local keypad and display to enter basic programmable parameters in one session. Refer to the “Start Wizard” section in the NCU Instructions (UM1M830BNA).

Verifying the Configuration File

Your NCU was programmed with a configuration file that sets all adjustable parameters. The version number of the configuration file can be found on the configuration drawing (C-drawing) that is supplied with your power system documentation, and on a label located on the NCU. You can verify that the correct configuration file has been loaded into your NCU by performing the following procedure.



NOTE! The quantity of LVD's and shunt values for your specific system may be different from the values shown on the C-drawing.

Procedure

1. With the Main Menu displayed, press **ESC**. A screen displays the NCU name, serial number, IP number, software version, hardware version, and configuration version number.
2. Press **ESC** to return to the Main Menu.

Checking Basic System Settings

Navigate through the controller menus and submenus to check system settings. You can adjust any parameter as required. Note that these settings can also be checked (and changed if required) via the WEB Interface. Refer also to “NCU Start Wizard” on page 130.



NOTE! Repeatedly press the “ESC” key to return in reverse order level by level from any submenu until the Main Menu appears.

Procedure

1. **To Select a Sub-Menu:**
Press the UP and DOWN keys to highlight the desired sub-menu. Press the ENT key to enter the selected sub-menu.
2. **To Select a User:**
To select a User, use the UP and DOWN keys to move the cursor to the Select User field. Press ENT. Use the UP and DOWN keys to select a User previously programmed into the NCU. Press ENT to select the User. Note that only Users programmed into the NCU are shown. Users are programmed via the Web Interface. The default User is admin.
3. **To Enter a Password:**
To enter a password, use the UP and DOWN keys to move the cursor to the Enter Password field. Press ENT. Use the UP and DOWN keys to choose a character. Press ENT to accept and move to the next character. Continue this process until all characters are entered. Press ENT again to accept the password. The default password is 640275.
4. **To Change a Parameter:**
Press the UP and DOWN keys to move up and down the list of parameters. Press ENT to select the parameter. Press the UP and DOWN keys to change the parameter. Press ENT to make the change. Press ESC to cancel the change.

Table 7.2 shows the menu navigation for some basic settings. Refer to the separate NCU Manual (UM1M830BNA) supplied with your power system for complete Local Display menus.

Table 7.2: NCU Basic Settings Menu Navigation

Parameter	Menu Navigation
Date	Main Menu / Settings Icon / Sys Settings / Date.
Time	Main Menu / Settings Icon / Sys Settings / Time.
IP Communications Parameters (IP address, subnet mask address, gateway address)	Main Menu / Settings Icon / Comm Settings / enter parameters.
Float Voltage	Main Menu / Settings Icon / Batt Settings / Charge / Float Voltage.
Equalize Voltage	Main Menu / Settings Icon / Batt Settings / Charge / EQ Voltage.
Battery Current Limit	Main Menu / Settings Icon / Batt Settings / Charge / Curr Limit Mode and Batt Curr Limit.
Battery Capacity	Main Menu / Settings Icon / Batt Settings / Batt1 Settings or Batt2 Settings / Rated Capacity.
Reset Battery Capacity	Main Menu / Settings Icon / Batt Settings / Basic Settings / Reset Batt Cap
BTRM Feature	Web Menu Navigation Only: Settings Menu / Battery Tab.
Battery Charge Temperature Compensation	Main Menu / Settings Icon / Batt Settings / Temp Comp (enter parameters).
HVSD Limit	Web Menu Navigation Only: Settings Menu / Rectifiers Tab / HVSD (set to enabled) then set HVSD Limit.
Rectifier Current Limit	Main Menu / Settings Icon / Rect Settings / Current Limit (set to enabled) then set Curr Limit Pt.
Over Voltage Alarm 1	Main Menu / Settings Icon / Other Settings / Over Voltage 1.
Over Voltage Alarm 2	Main Menu / Settings Icon / Other Settings / Over Voltage 2.
Under Voltage Alarm 1	Main Menu / Settings Icon / Other Settings / Under Voltage 1.
Under Voltage Alarm 2	Main Menu / Settings Icon / Other Settings / Under Voltage 2.

Changing Battery Capacity Rating in the NCU



NOTE! After setting the battery capacity, the User should also reset the battery capacity (battery must be fully charged).

1. Change the battery capacity setting of the NCU to match the battery connected to the power system.

Local Menu Navigation:

Main Menu / Settings Icon / Batt Settings / Batt1 Settings or Batt2 Settings / Rated Capacity.

Web Menu Navigation:

Settings Menu / Battery Tab / Batt1 Rated Capacity and Batt2 Rated Capacity.

2. Reset the battery capacity (resets the battery capacity calculation).



NOTE! Only reset the battery capacity when the battery is fully charged; otherwise, the battery charge status may not be accurate.

Local Menu Navigation:

Main Menu / Settings Icon / Batt Settings / Basic Settings / Reset Batt Cap.

Web Menu Navigation:

Settings Menu / Battery Tab / Reset Battery Capacity.

Refer to the NCU Instructions (UM1M830BNA) for detailed instructions.

Configuring the NCU Identification of Rectifiers and Assigning which Input Phase is Connected to the Rectifiers

When rectifiers are all installed prior to applying power and starting the system, the order in which the NCU identifies the rectifiers is by serial number (lowest serial number is Rect 1, next lowest is Rect 2, etc.). If you prefer the NCU to identify the rectifiers by position in the system, perform the following procedure.

Upon power up, the NCU arbitrarily assigns Feed AC1, AC2, or AC3 to each rectifier. This assignment is used to display rectifier AC input feed voltage(s). The User may reassign the feed to each rectifier per your specific installation by following the procedure below.

Local Menu Navigation:

None.

Web Menu Navigation:

Refer to the NCU Instructions (UM1M830BNA) for detailed instructions.

Configuring the NCU Identification of Converters

When converters are all installed prior to applying power and starting the system, the order in which the NCU identifies the converters is by serial number (lowest serial number is Conv 1, next lowest is Conv 2, etc.). If you prefer the NCU to identify the converters by position in the system, perform the following procedure.

Local Menu Navigation:

None.

Web Menu Navigation:

Refer to the NCU Instructions (UM1M830BNA) for detailed instructions.

NCU Alarm Relay Check

To verify operation of the external alarm relays, use the NCU alarm relay test feature. Refer to the NCU Instructions (UM1M830BNA) for instructions in using this feature.









NOTE! *The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.*

7.5 Checking System Status

Procedure

1. Observe the status of the indicators located on the controller, rectifiers, and converters (if furnished). If the system is operating normally, the status of these is as shown in Table 7.3.

Table 7.3: Status and Alarm Indicators

Component	Indicator		Normal State
ACU+		Status (Green)	On
		Minor (Yellow)	Off
		Critical or Major Alarm (Red)	Off
NCU		Status (Green)	On
		Minor (Yellow)	Off
		Critical or Major Alarm (Red)	Off
Rectifier Modules		Power (Green)	On
		Protection (Yellow)	Off
		Alarm (Red)	Off
Converter Modules		Power (Green)	On
		Protection (Yellow)	Off
		Alarm (Red)	Off

7.6 Final Steps

Procedure

1. If any controller configuration settings were changed, refer to the ACU+ Instructions (UM1M820BNA) or NCU Instructions (UM1M830BNA) and save a copy of the configuration file. This file can be used to restore the controller settings, if required, at a later date.



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

2. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.
3. Verify all rectifier and converter modules and the controller are fully seated, latched, and the latch handle screws secured.
4. Verify there are no external alarms and the local indicators are as shown in Table 7.3.

Connect with Vertiv on Social Media



<https://www.facebook.com/vertiv/>



<https://www.instagram.com/vertiv/>



<https://www.linkedin.com/company/vertiv/>



<https://www.x.com/vertiv/>



Vertiv.com | Vertiv Headquarters, 505 N Cleveland Ave, Westerville, OH 43082, USA

© 2026 Vertiv Group Corp. All rights reserved. Vertiv™ and the Vertiv logo are trademarks or registered trademarks of Vertiv Group Corp. All other names and logos referred to are trade names, trademarks or registered trademarks of their respective owners. While every precaution has been taken to ensure accuracy and completeness here, Vertiv Group Corp. assumes no responsibility, and disclaims all liability, for damages resulting from use of this information or for any errors or omissions.