NetSure™ 710 Series +24 VDC Power System

Quick Start Guide

Specification Number: 581127000
Model Number: 710NPBA

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Technical Support Site

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

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

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Admonishments Used in this Document

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

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

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

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

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

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

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

Important Safety Instructions

Safety Admonishments Definitions

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

Safety and Regulatory Statements

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

Déclarations de Sécurité et de Réglementation

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

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1 Customer Documentation Package

This document (QS581127000) provides *Quick Start 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

Vertiv™ NetSure™ ACU+ Controller User Manual

- ACU+ Controller User Instructions: UM1M820BNA

Vertiv™ NetSure™ 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
- Vertiv™ NetSure™ ACU+ Controller User Instructions: UM1M820BNA
- Vertiv™ NetSure™ 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 Physical Installation

To do this…	See this in the *Installation Instructions* (IM582127000)
Choose a mounting location	*General Requirements* in the INSTALLING THE SYSTEM section.
Secure the relay rack to the floor	*Securing the Relay Rack to the Floor* in the INSTALLING THE SYSTEM section.
Mount the Power System	*Mounting System Components in an Equipment Rack* in the INSTALLING THE SYSTEM section.
Install optional lug adapter busbar kits	*Installing Optional Lug Adapter Busbar Kits, Part Nos. 534449 and 514714* in the INSTALLING THE SYSTEM section.

3 Installing Circuit Breakers and Fuses

Load and battery distribution devices were factory-installed if ordered with the power system. If additional installation is required, refer to **Figure 3.1** through **Figure 3.7**. For detailed procedures, refer to *Installing Circuit Breakers and Fuses* in the INSTALLING THE SYSTEM section of the Installation Instructions (IM581127000).

Figure 3.1 Installing a Bullet Nose Type Fuseholder and TPS/TLS Fuse

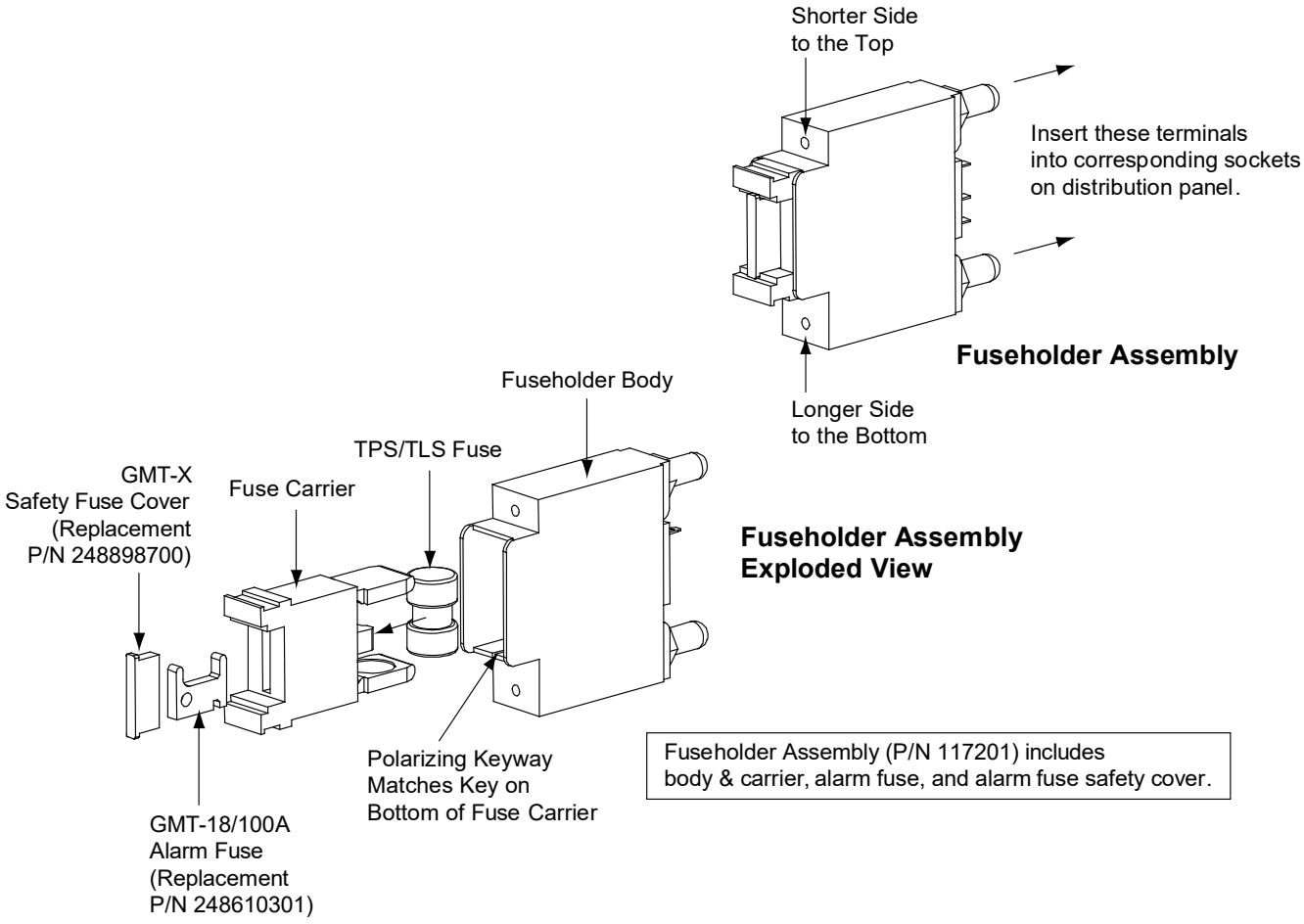


Figure 3.2 Installing a Bullet Nose Type Circuit Breaker

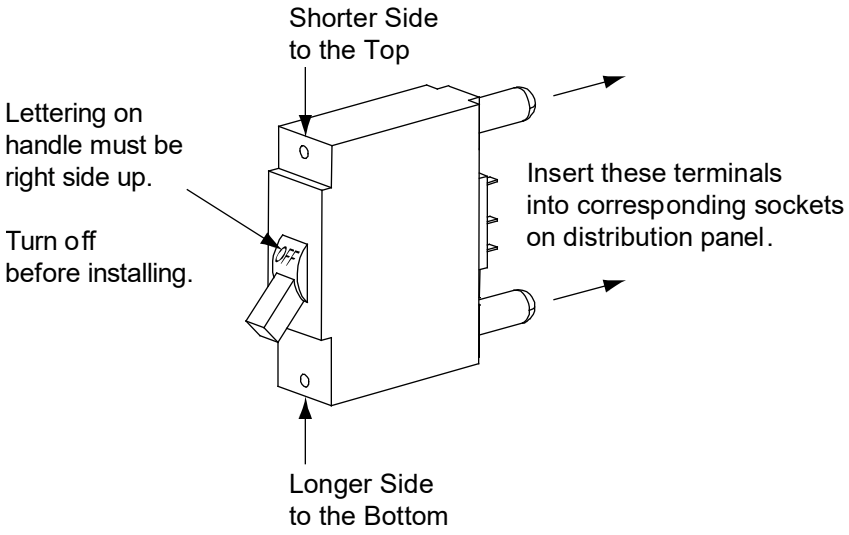


Figure 3.3 Installing a TPH Fuse

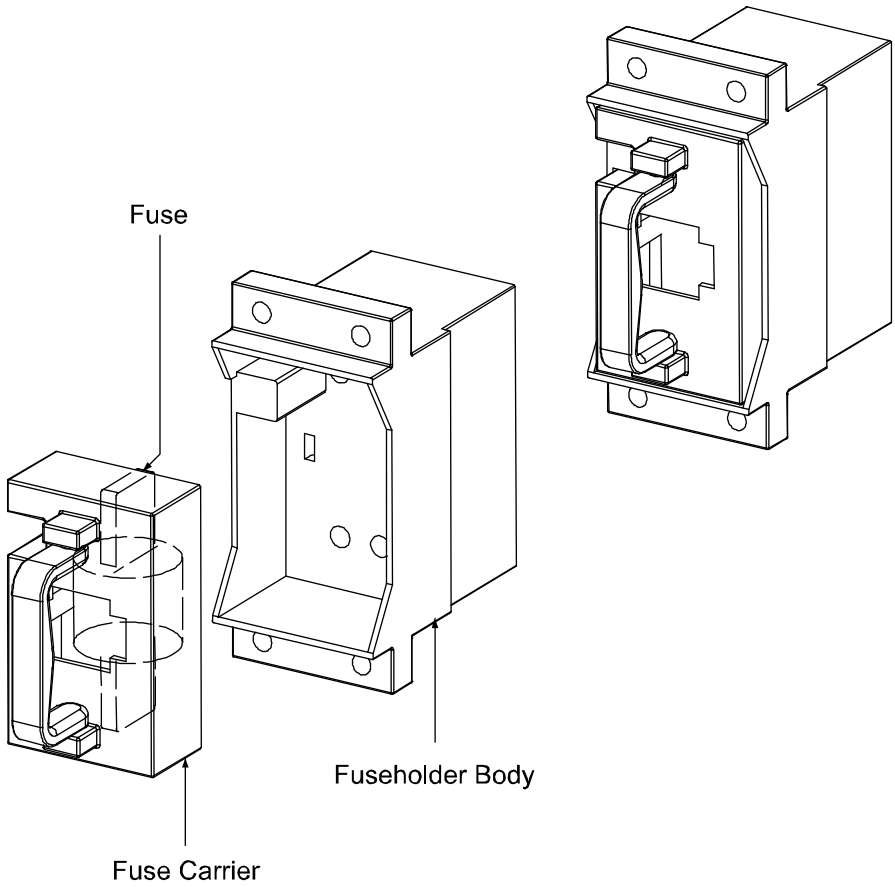


Figure 3.4 Installing TPL-B Fuses

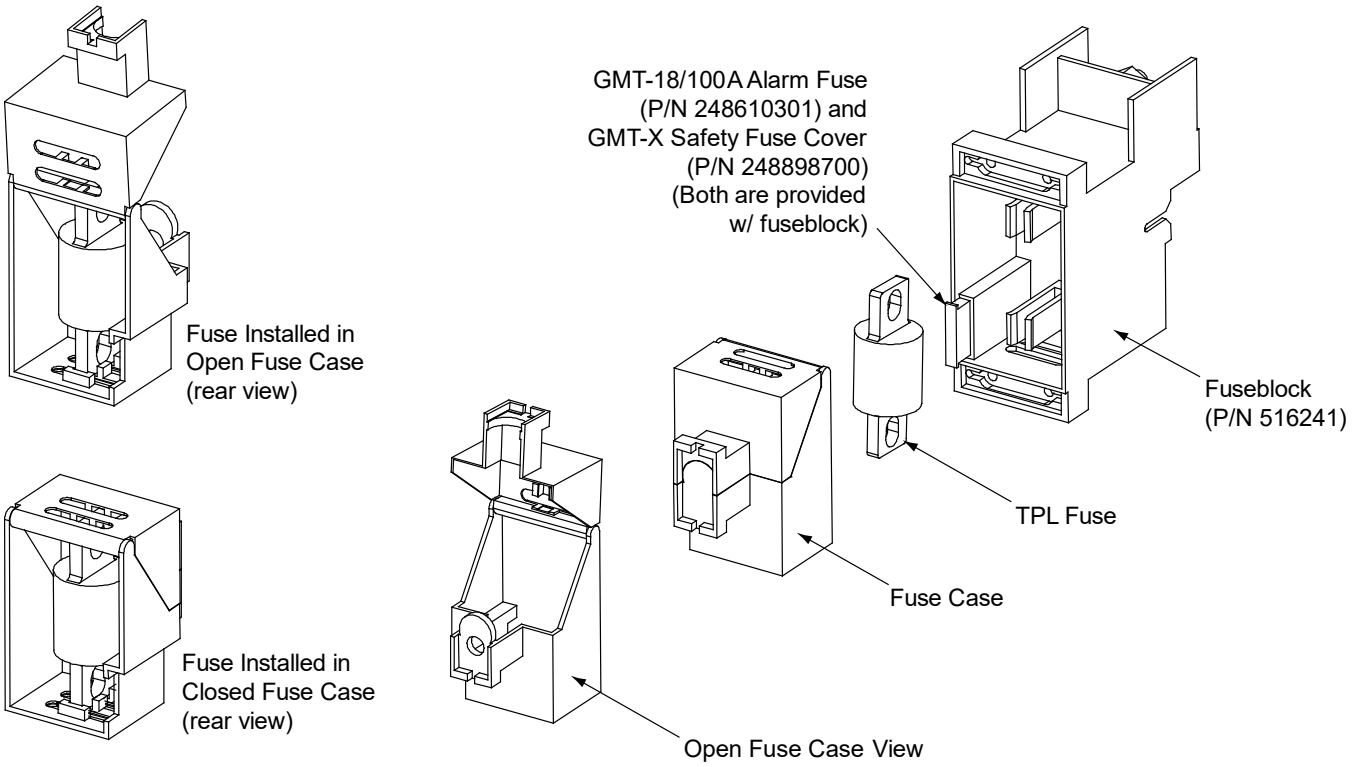


Figure 3.5 Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 550224)

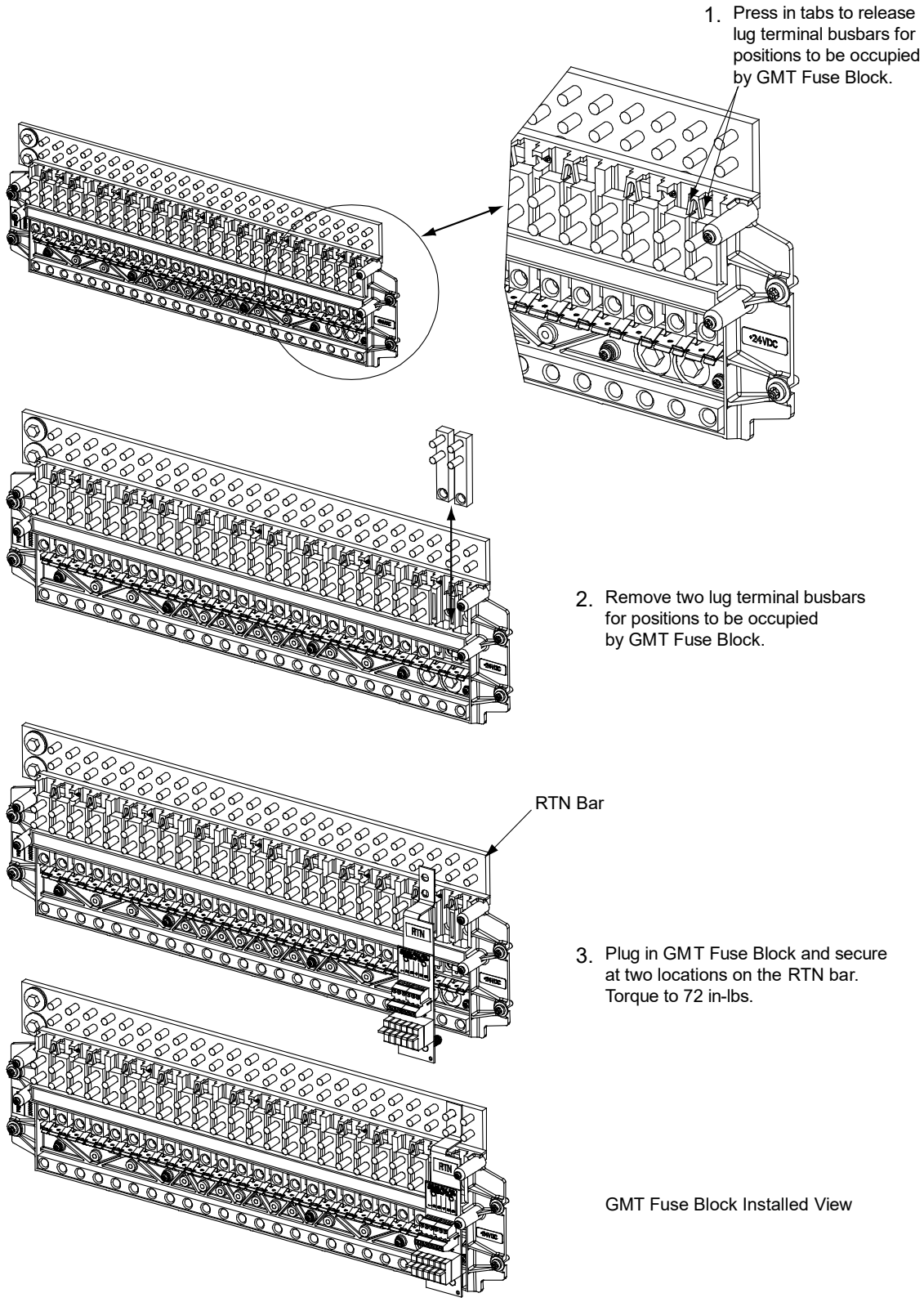


Figure 3.6 Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017)

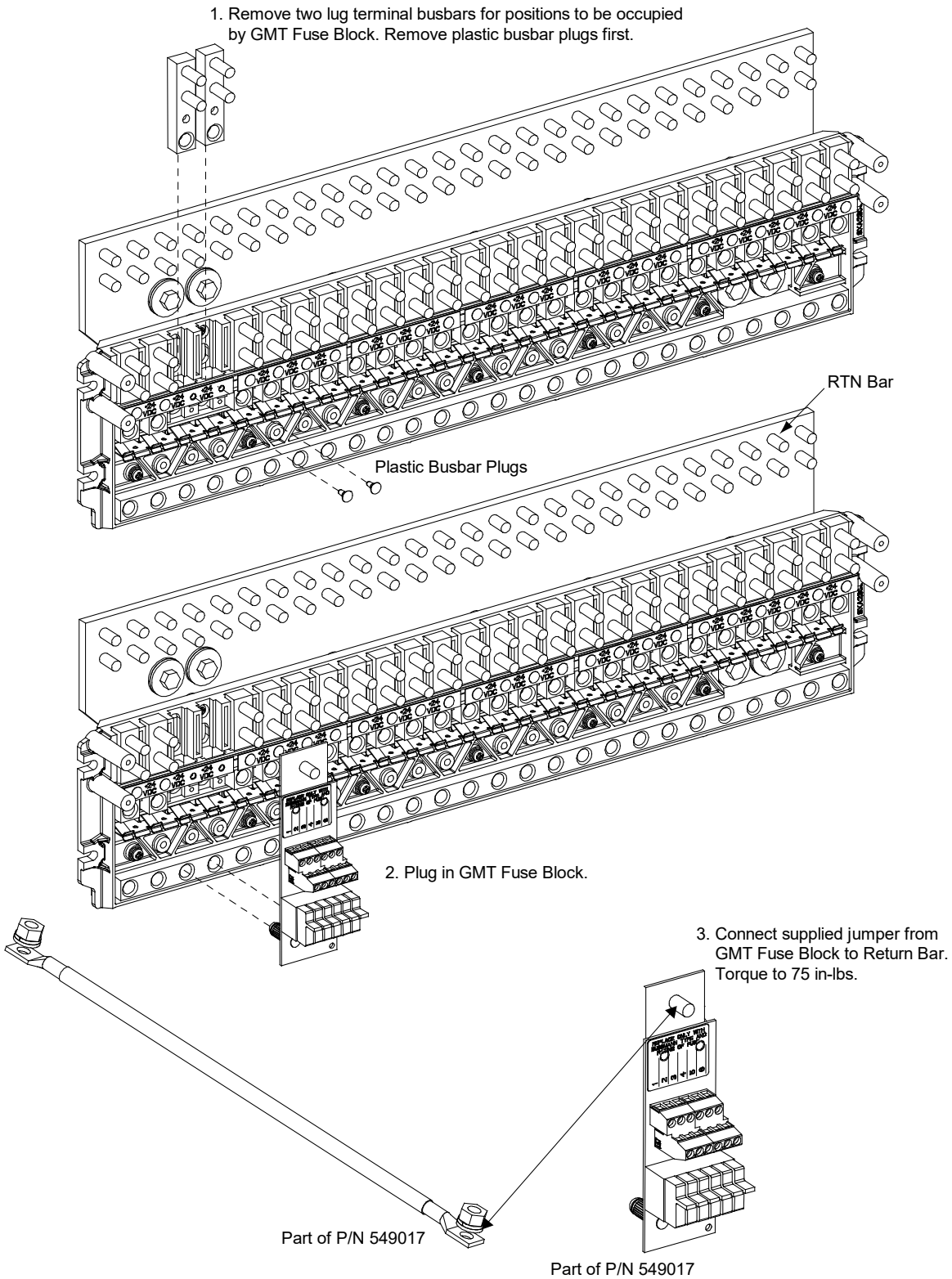
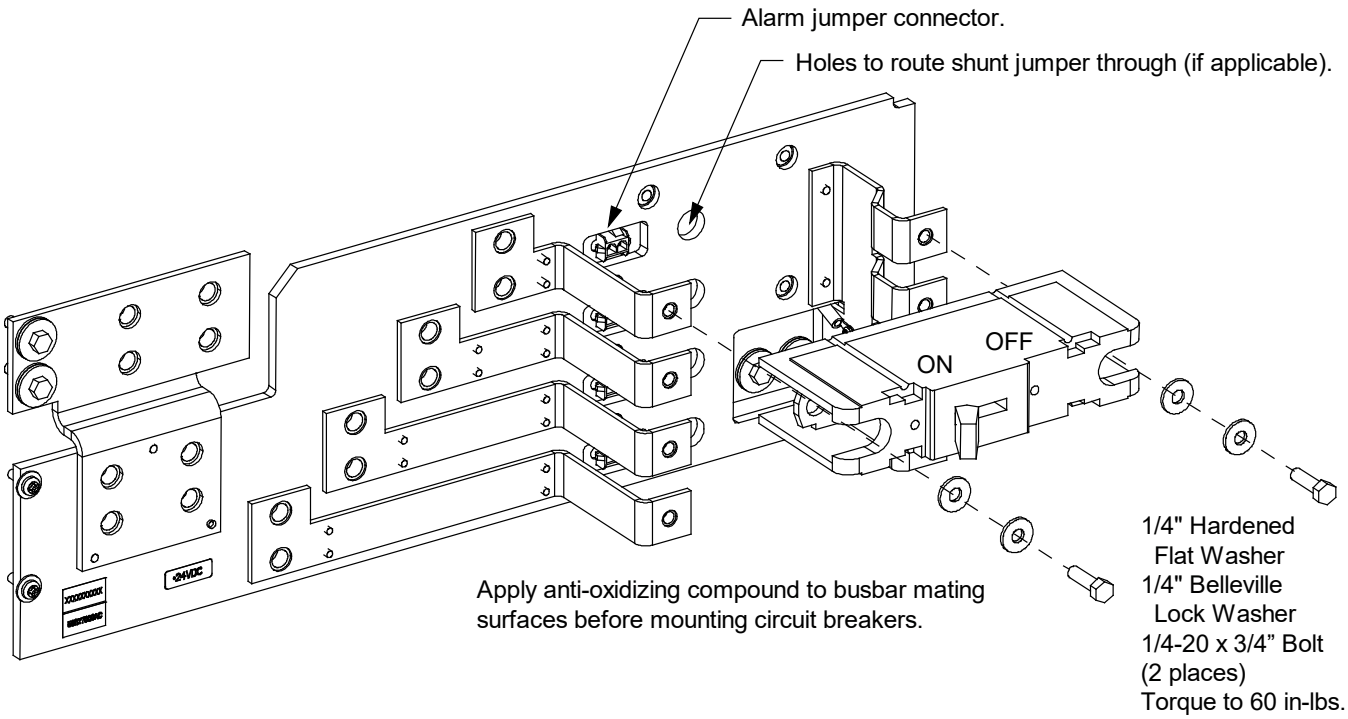
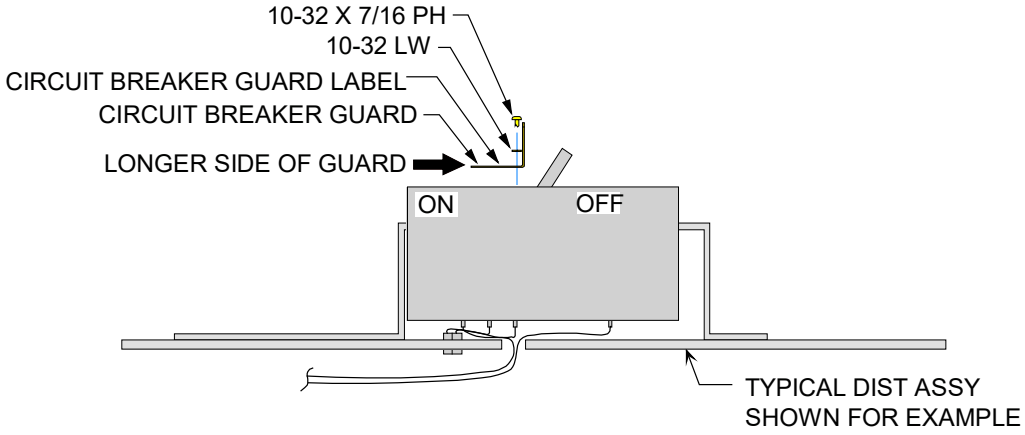


Figure 3.7 Installing a GJ/218 Circuit Breaker (1-Pole) (Lists AC, AD, BC, BD) (cont'd on next page)

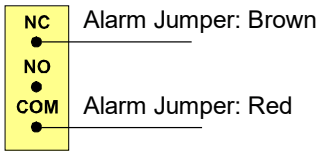
INSTALLING CIRCUIT BREAKER



INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS W/OUT SHUNTS)



Standard and Electrical Trip Breaker

ALARM WIRING (BREAKERS WITH SHUNTS)

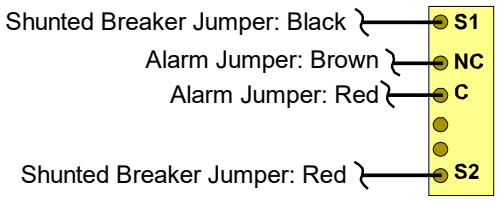
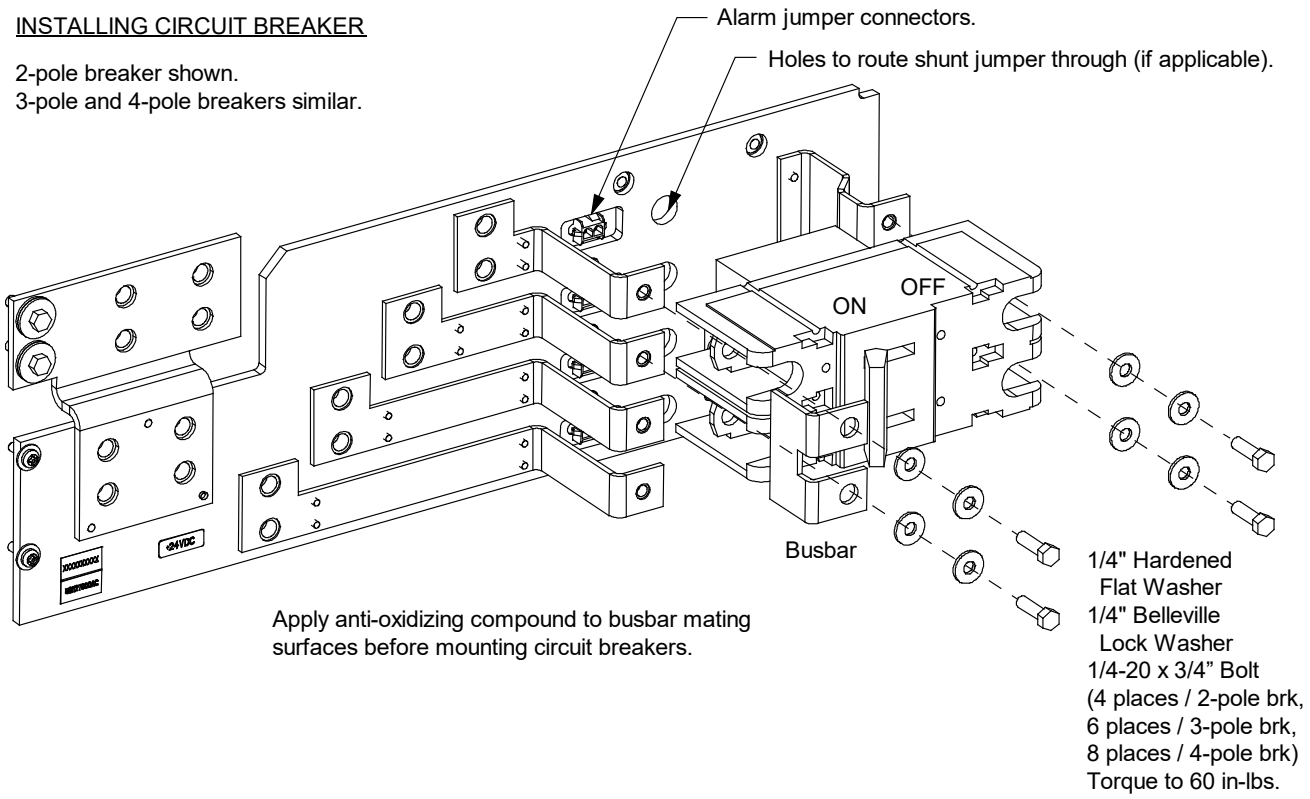
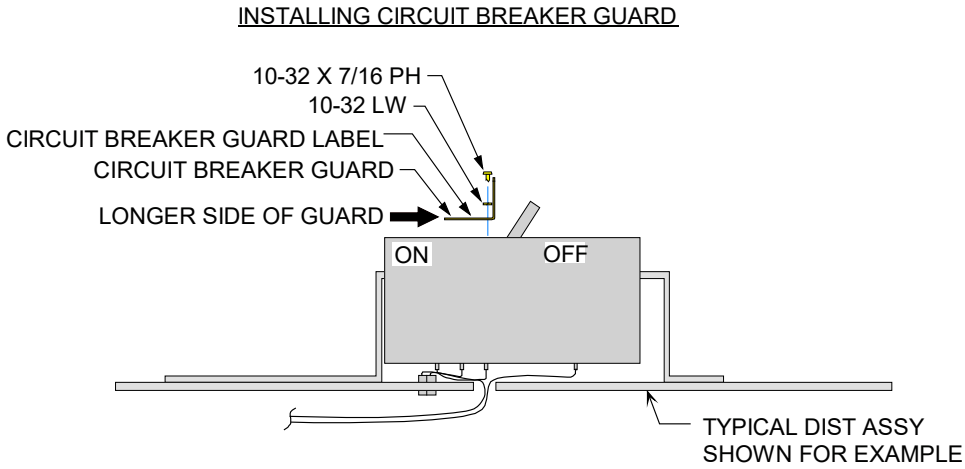


Figure 3.7 Installing a GJ/218 Circuit Breaker (2-Pole, 3-Pole, 4-Pole) (Lists AC, AD, BC, BD) (cont'd from previous page, cont'd on next page)





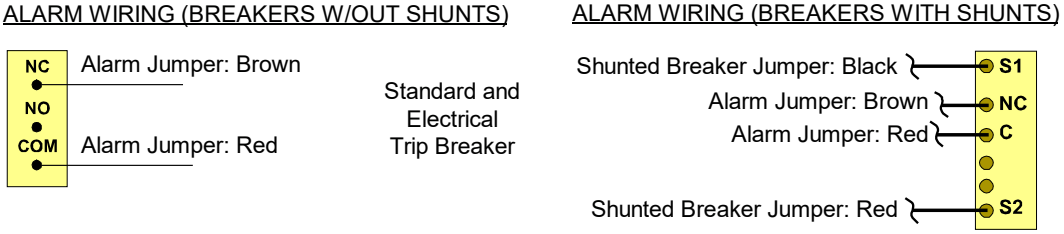
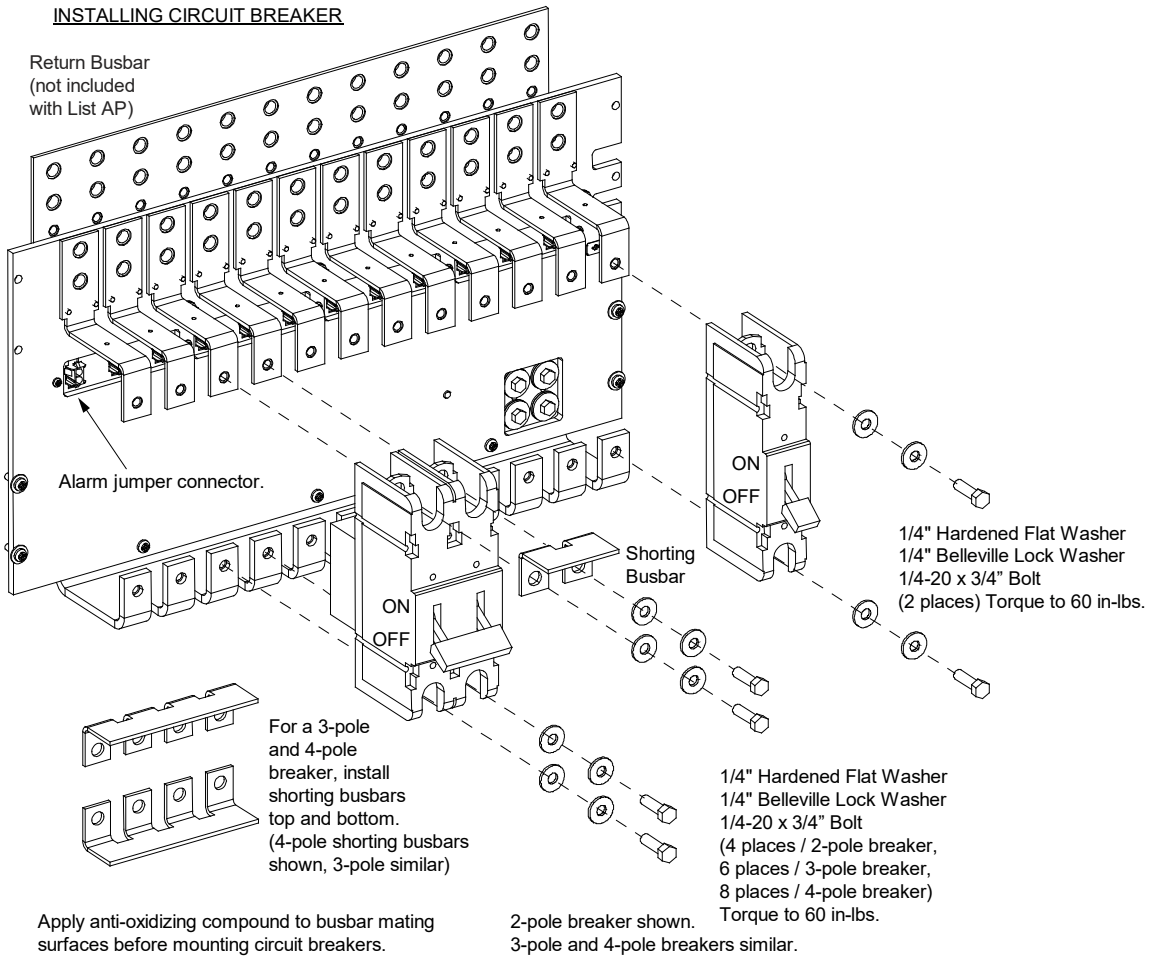
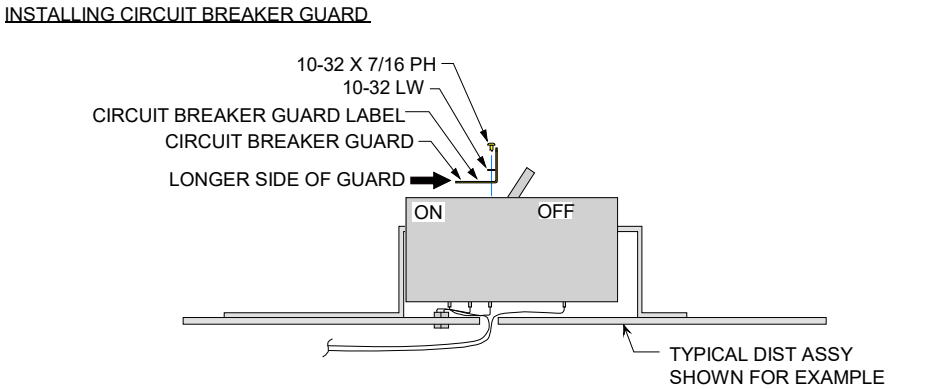
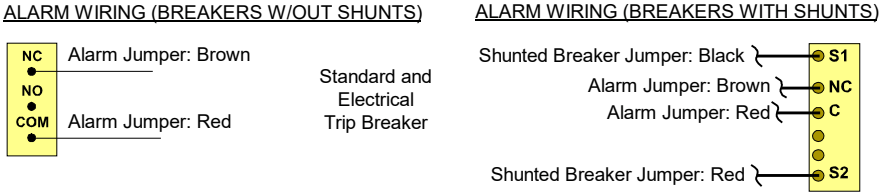


Figure 3.7 Installing a GJ/218 Circuit Breaker (1-Pole, 2-Pole, 3-Pole, 4-Pole) (List AM and List AP) (cont'd from previous page)







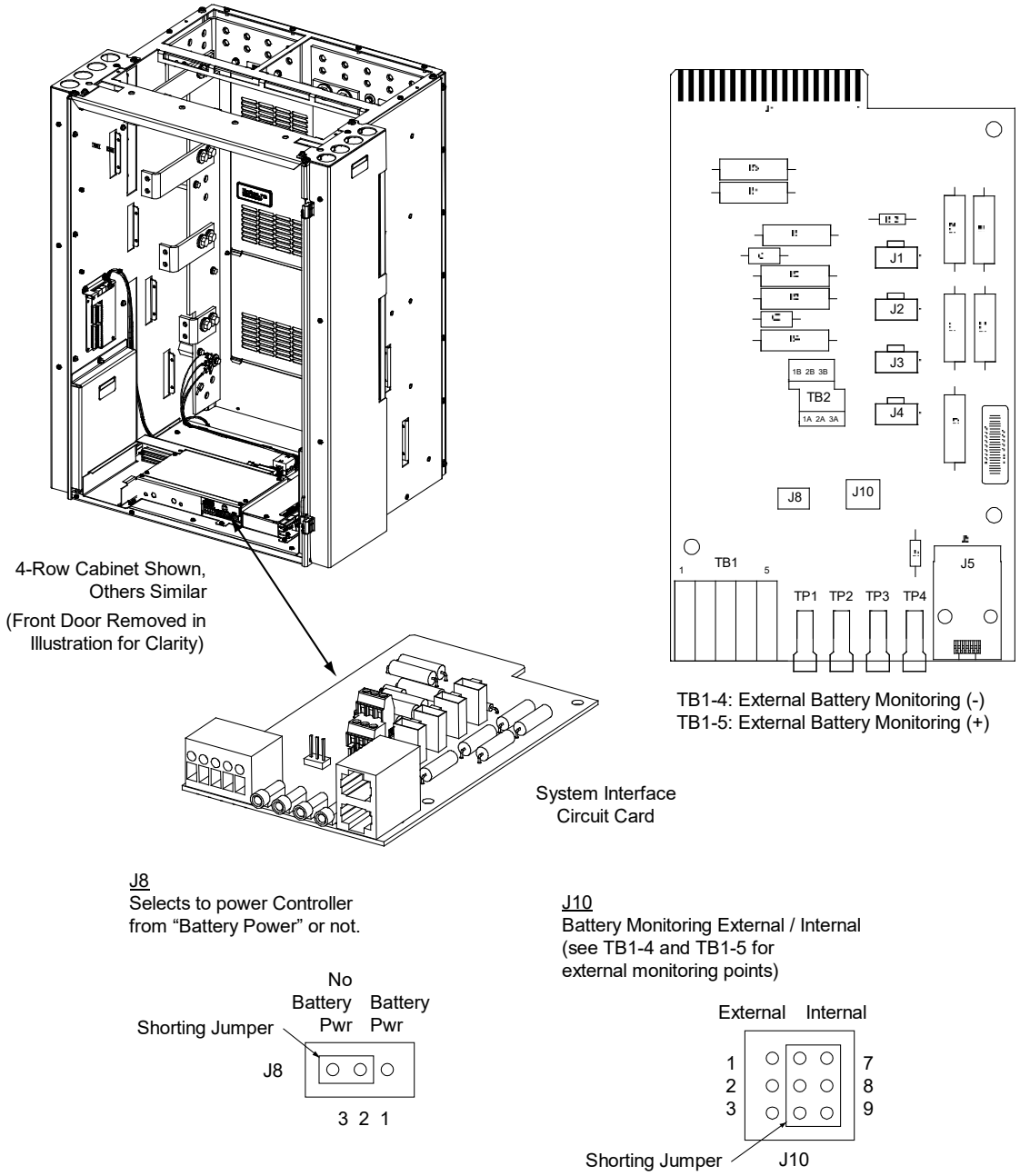
4 Making Jumpers and Switch Options

Various circuit cards installed in the system have switch and jumper settings.

Switch Settings: All switch settings set the various circuit cards to operate properly with this system and have been factory set.

Jumper Settings: The jumpers located on the system interface circuit card are customer selectable. Refer to **Figure 4.1** for jumper locations and function. Refer to SETTING JUMPERS AND SWITCH OPTIONS in the Installation Instructions (IM581127000) for a complete procedure.

Figure 4.1 System Interface Circuit Card Jumper Locations



5 Electrical Connections

5.1 Important Safety Instructions

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

5.2 Make Frame Grounding Connections

To do this...	See this in the *Installation Instructions* (IM582127000)
Make Frame Grounding Connection to Relay Rack	*Relay Rack Grounding Connection (Frame Ground)* in the MAKING ELECTRICAL CONNECTIONS section.
Make Central Office Ground Connection	*Central Office Ground Connection* in the MAKING ELECTRICAL CONNECTIONS section.

5.3 Make AC Input and AC Input Equipment Grounding Connections

Refer to *AC Input and AC Input Equipment Grounding Connections* in the MAKING ELECTRICAL CONNECTIONS section of the Installation Instructions (IM581127000) for a complete procedure.

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. Refer to the label provided on the AC input connector cover and **Figure 5.1**.

Figure 5.1 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.

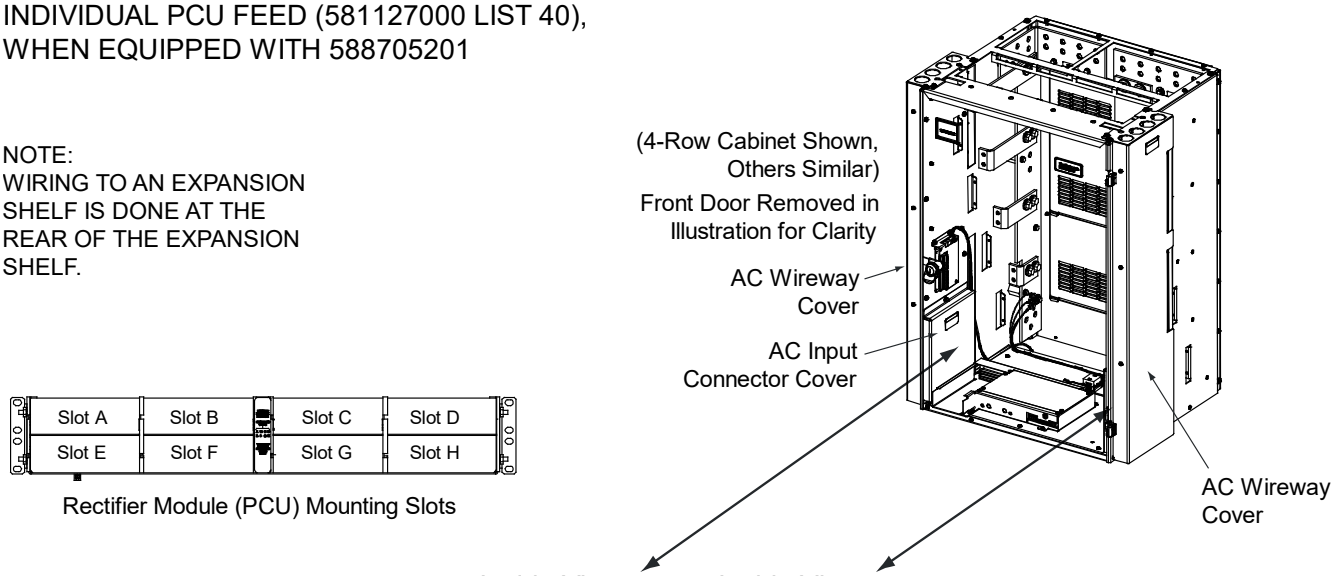
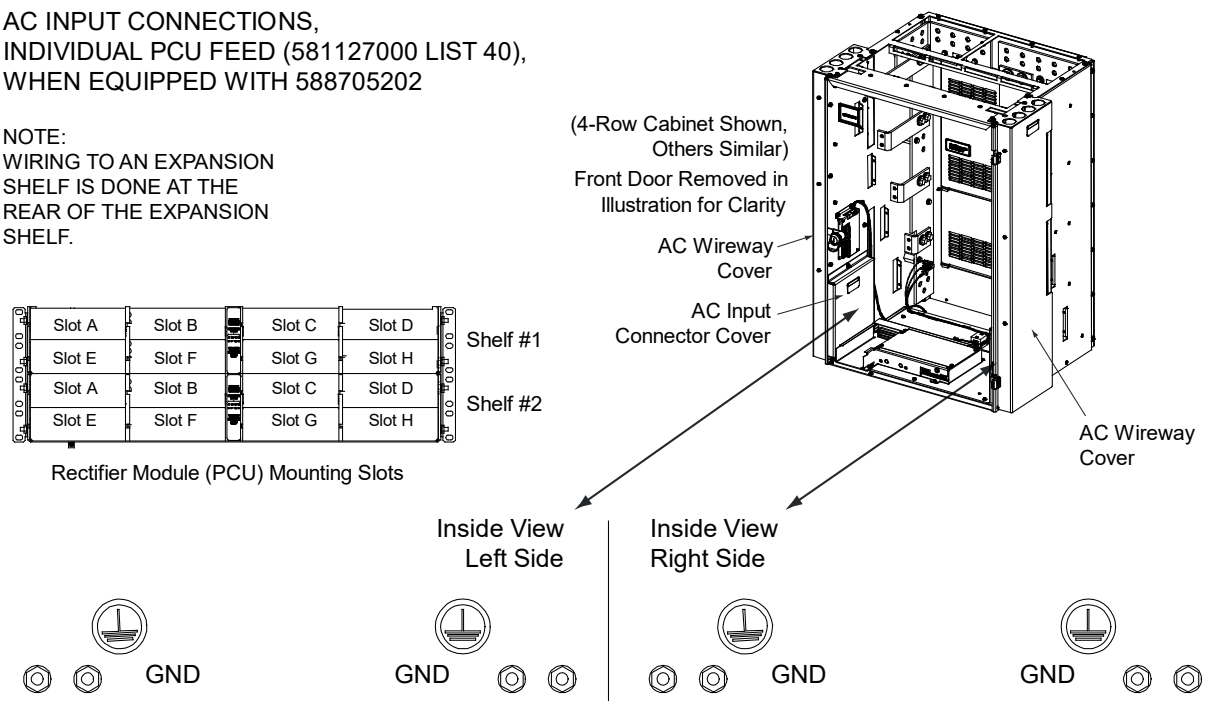
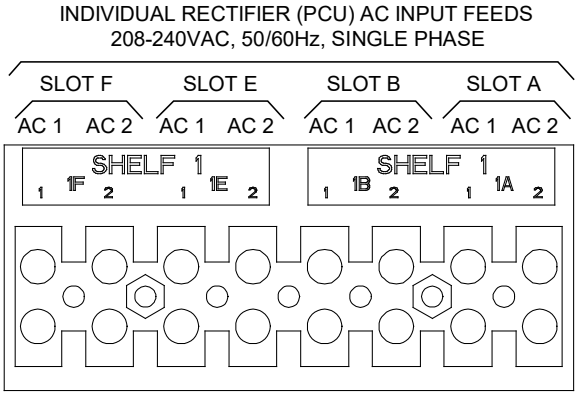
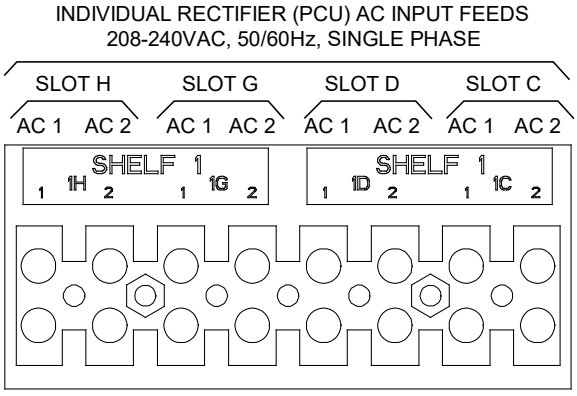
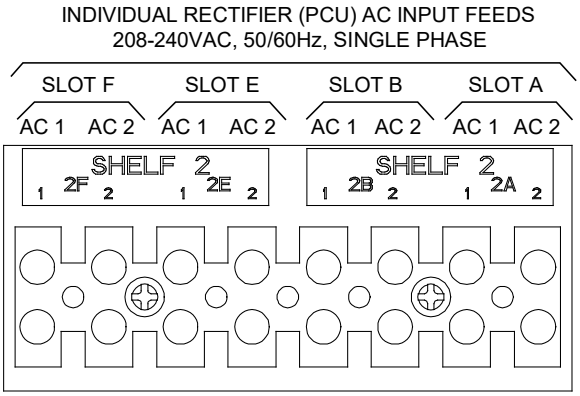


Figure 5.1 AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)









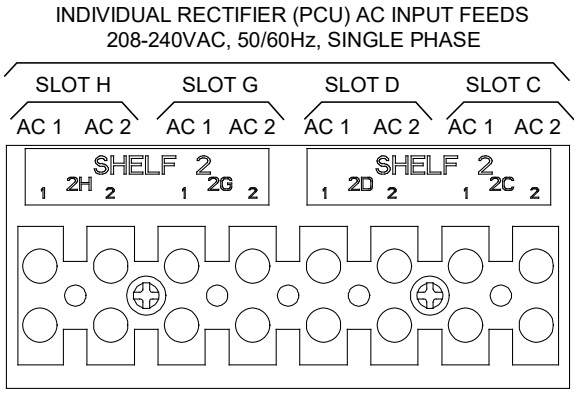


Figure 5.1 AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

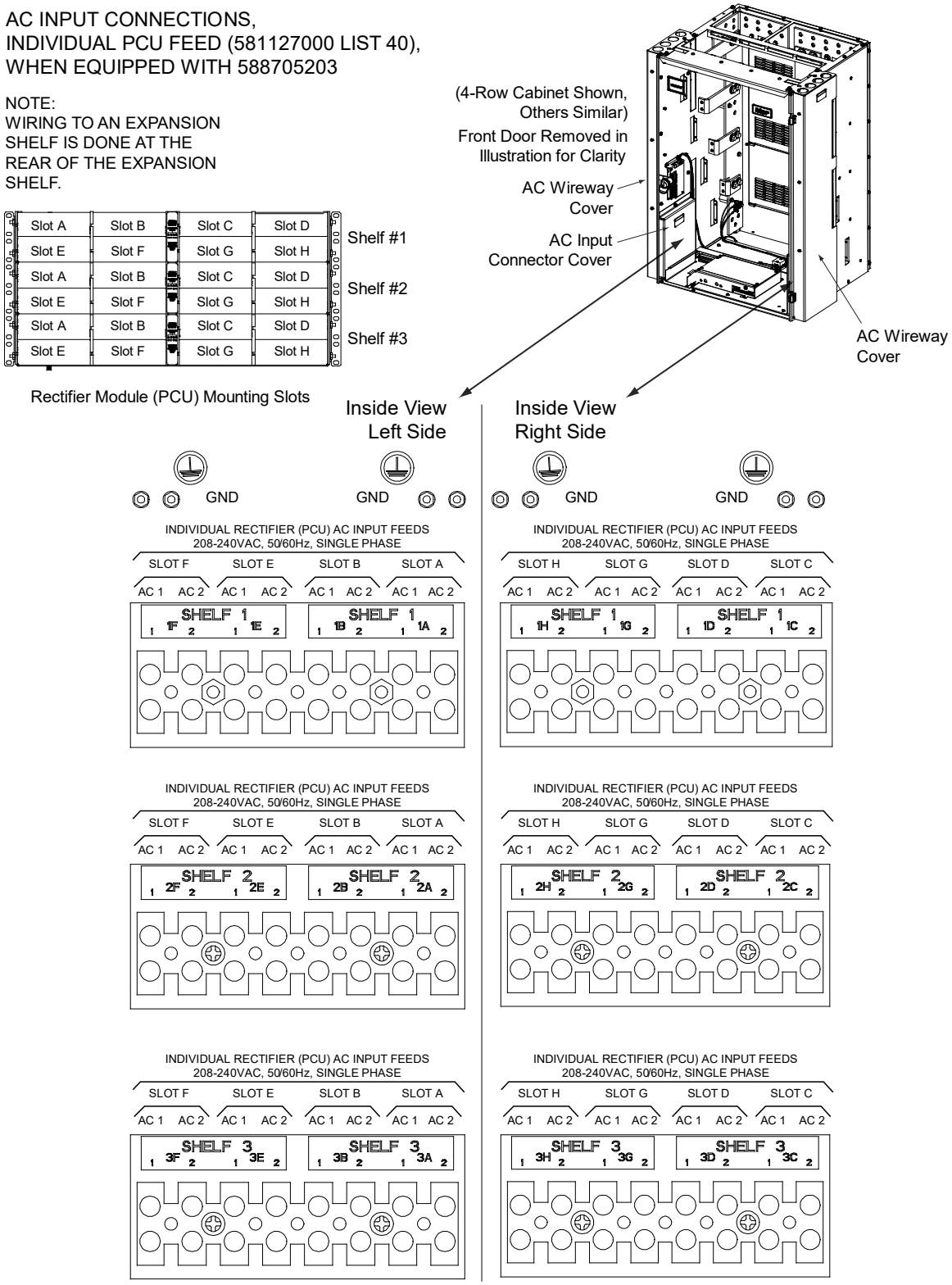
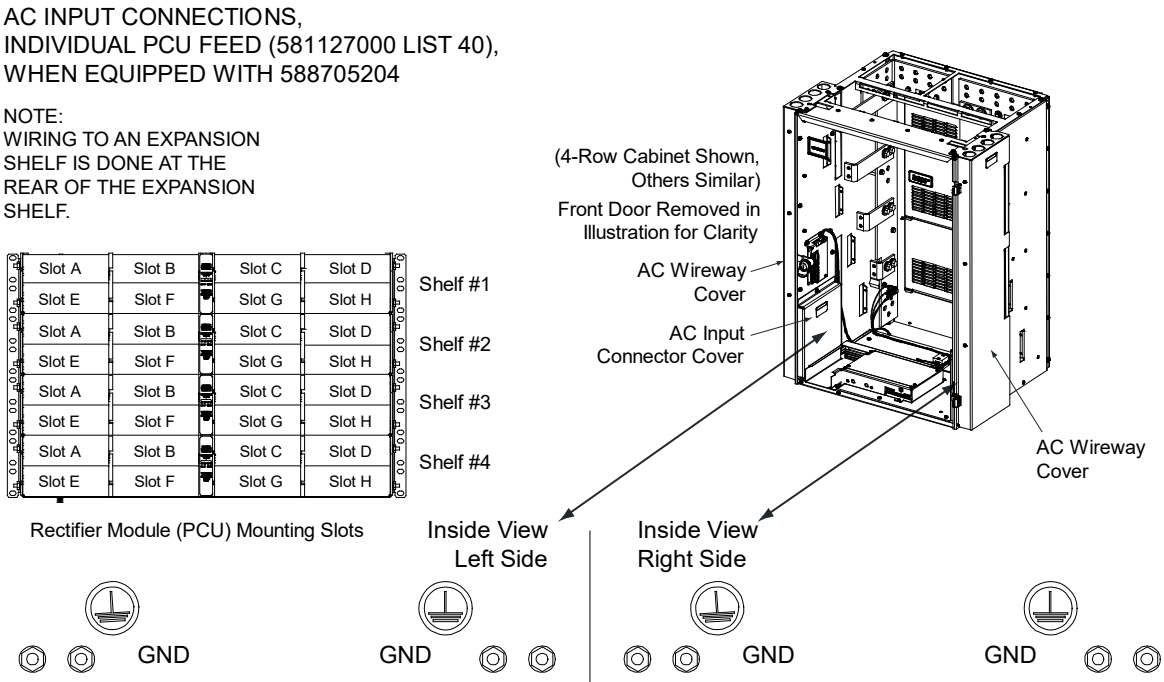
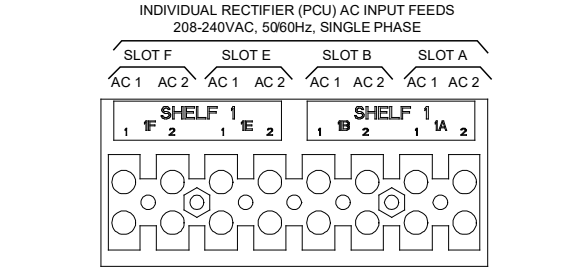
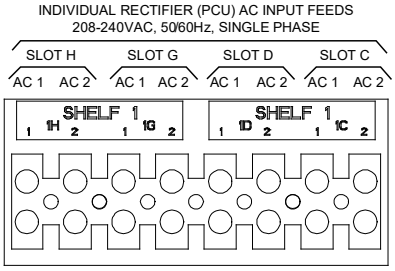
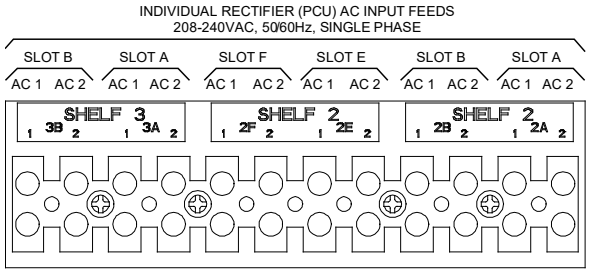


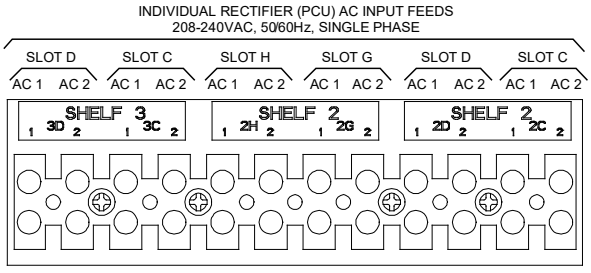
Figure 5.1 AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

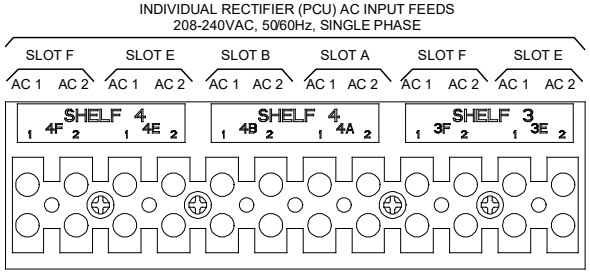












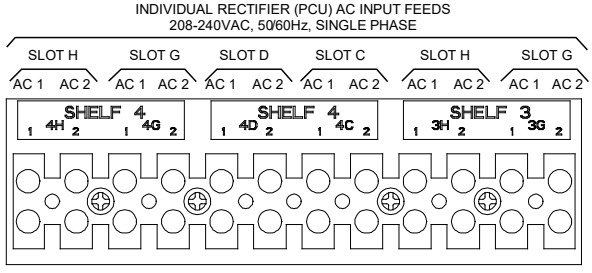


Figure 5.1 AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

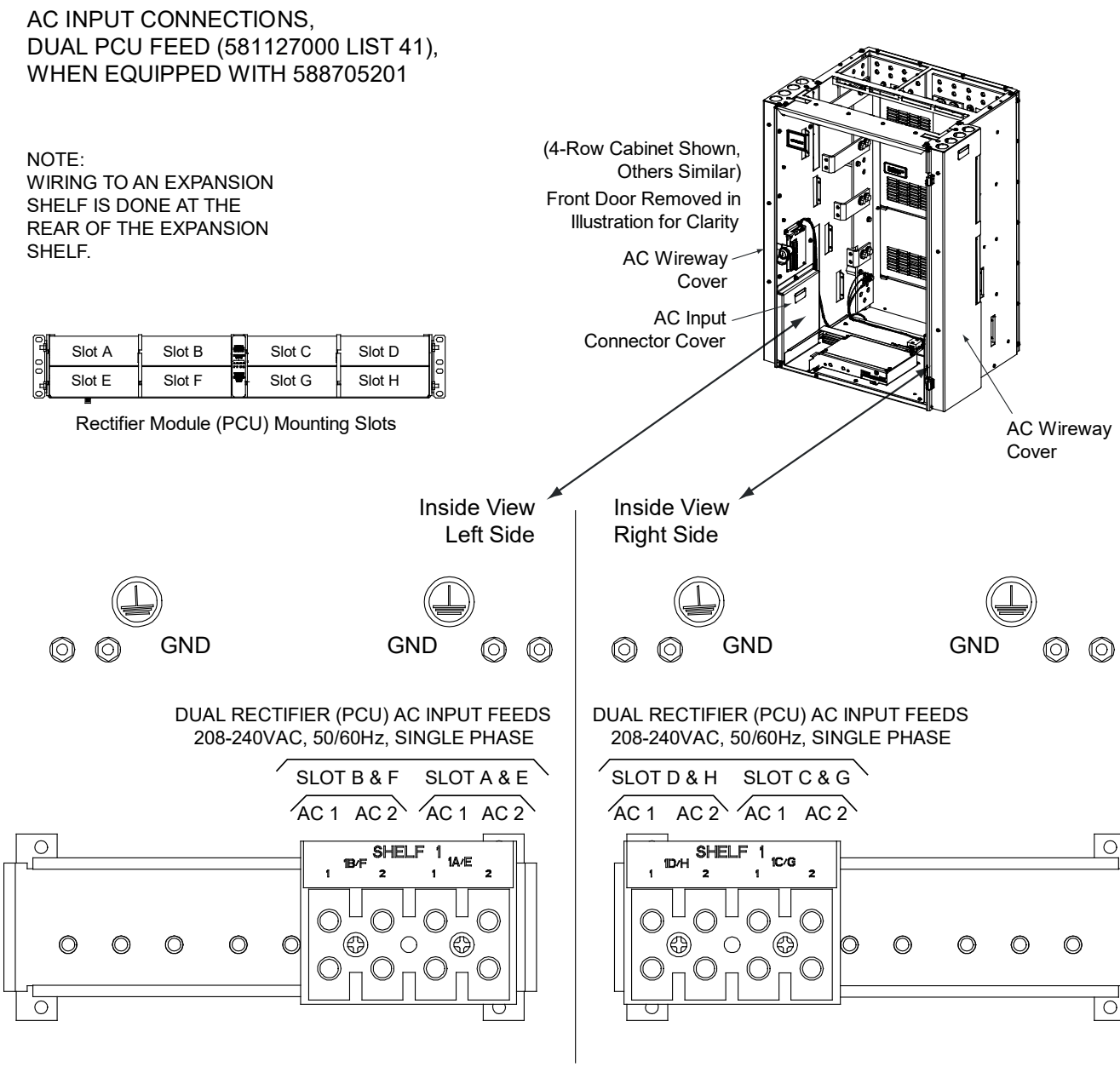


Figure 5.1 AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

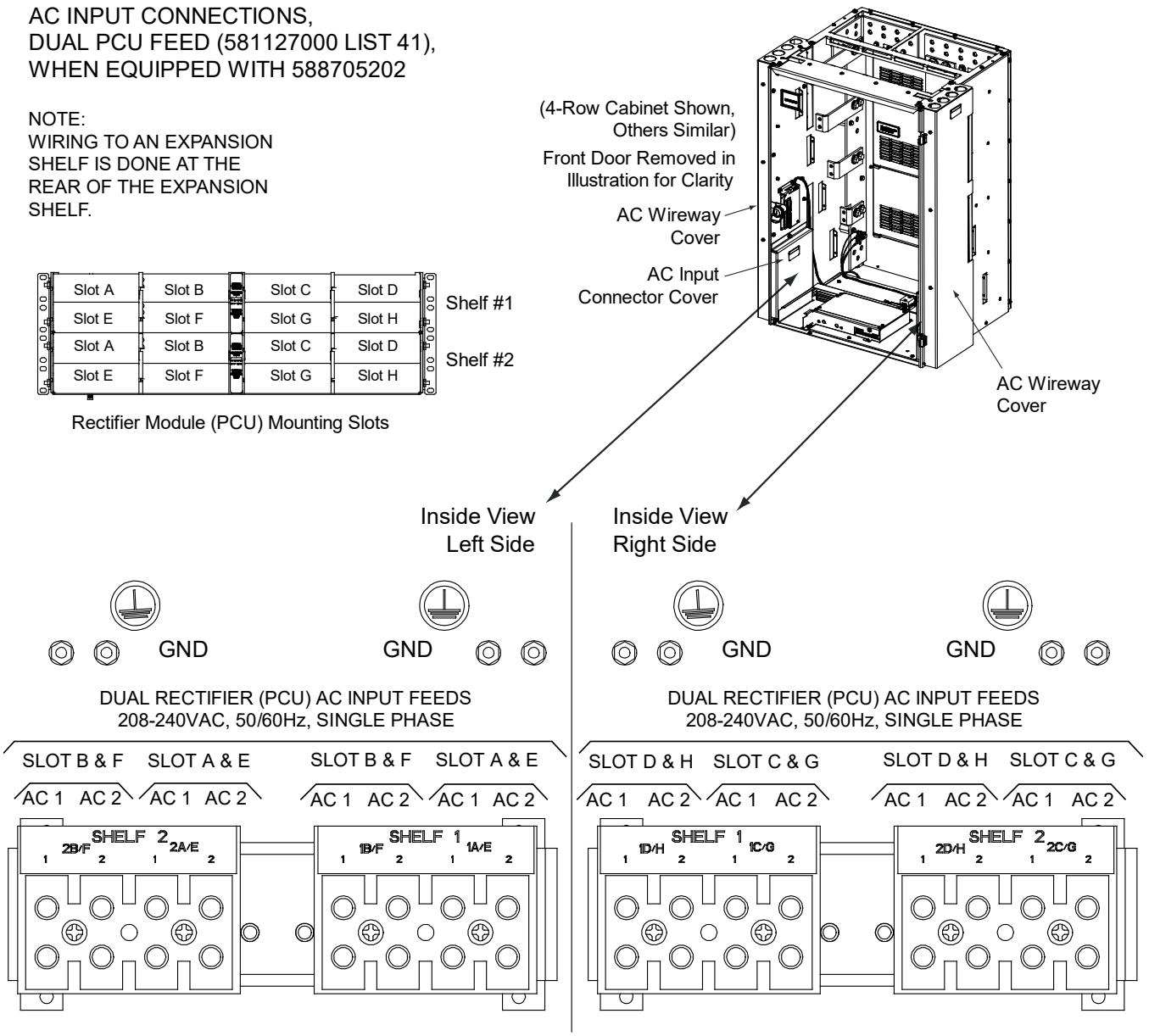


Figure 5.1 AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page, cont'd on next page)

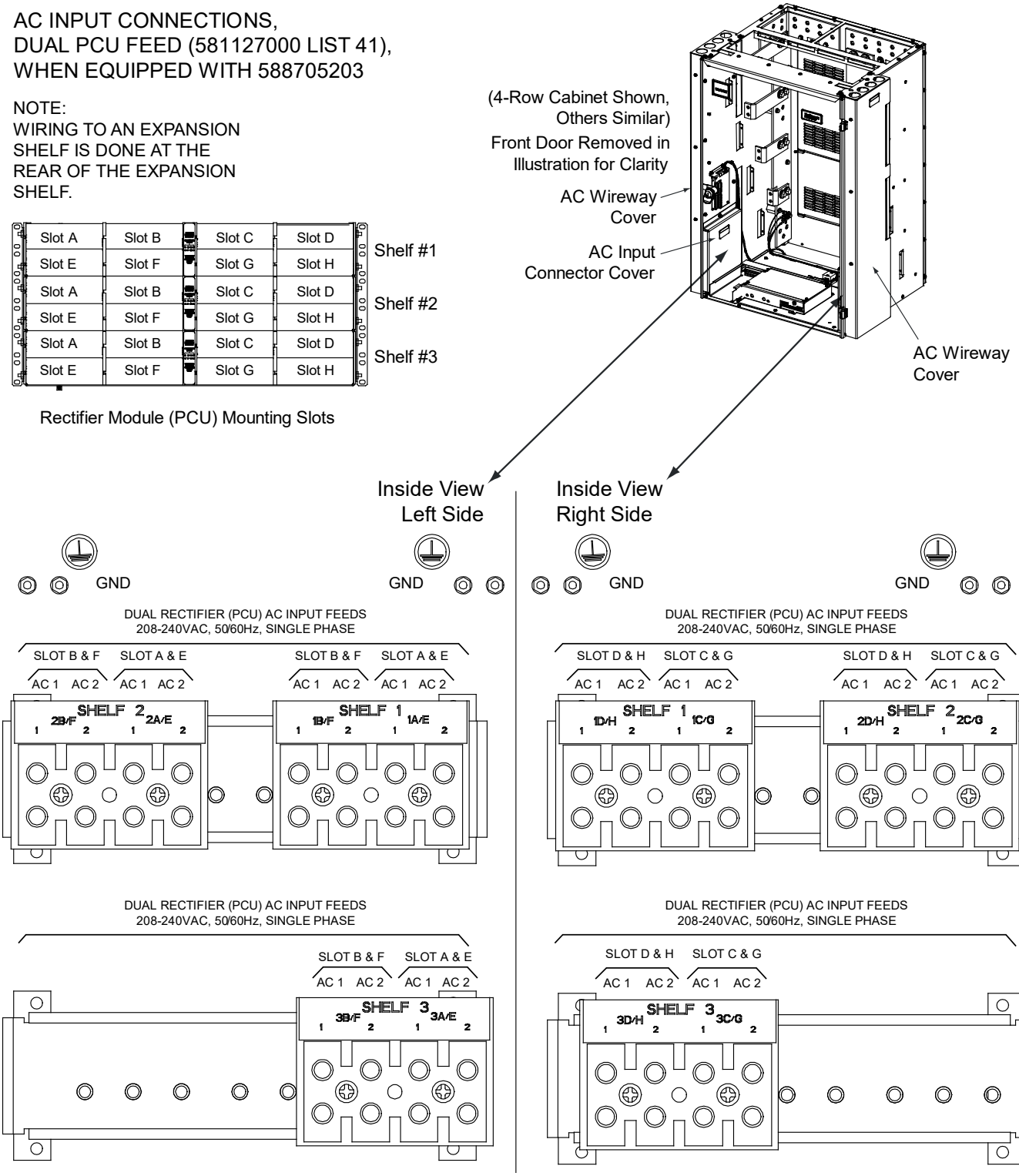
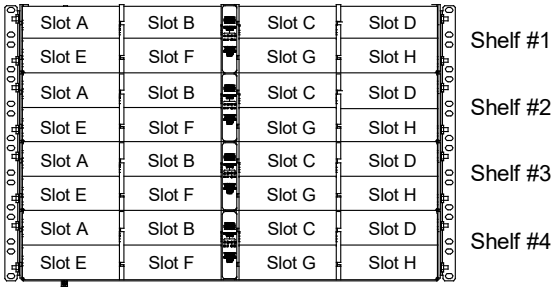
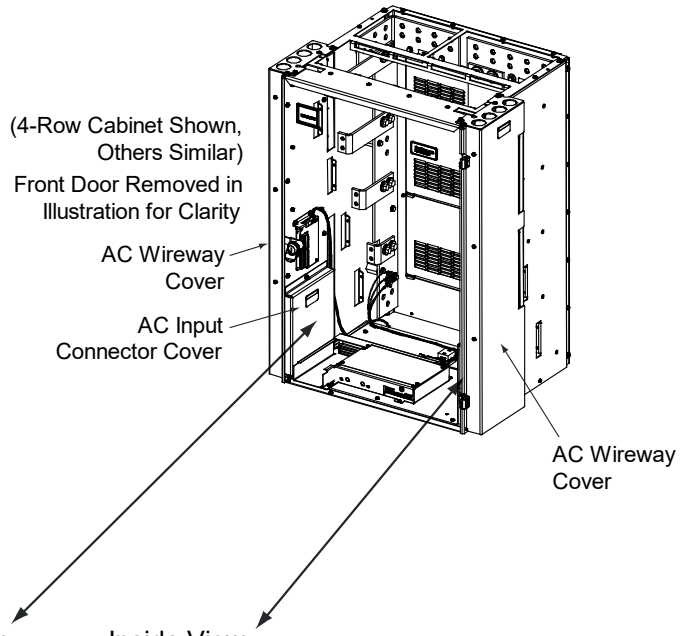


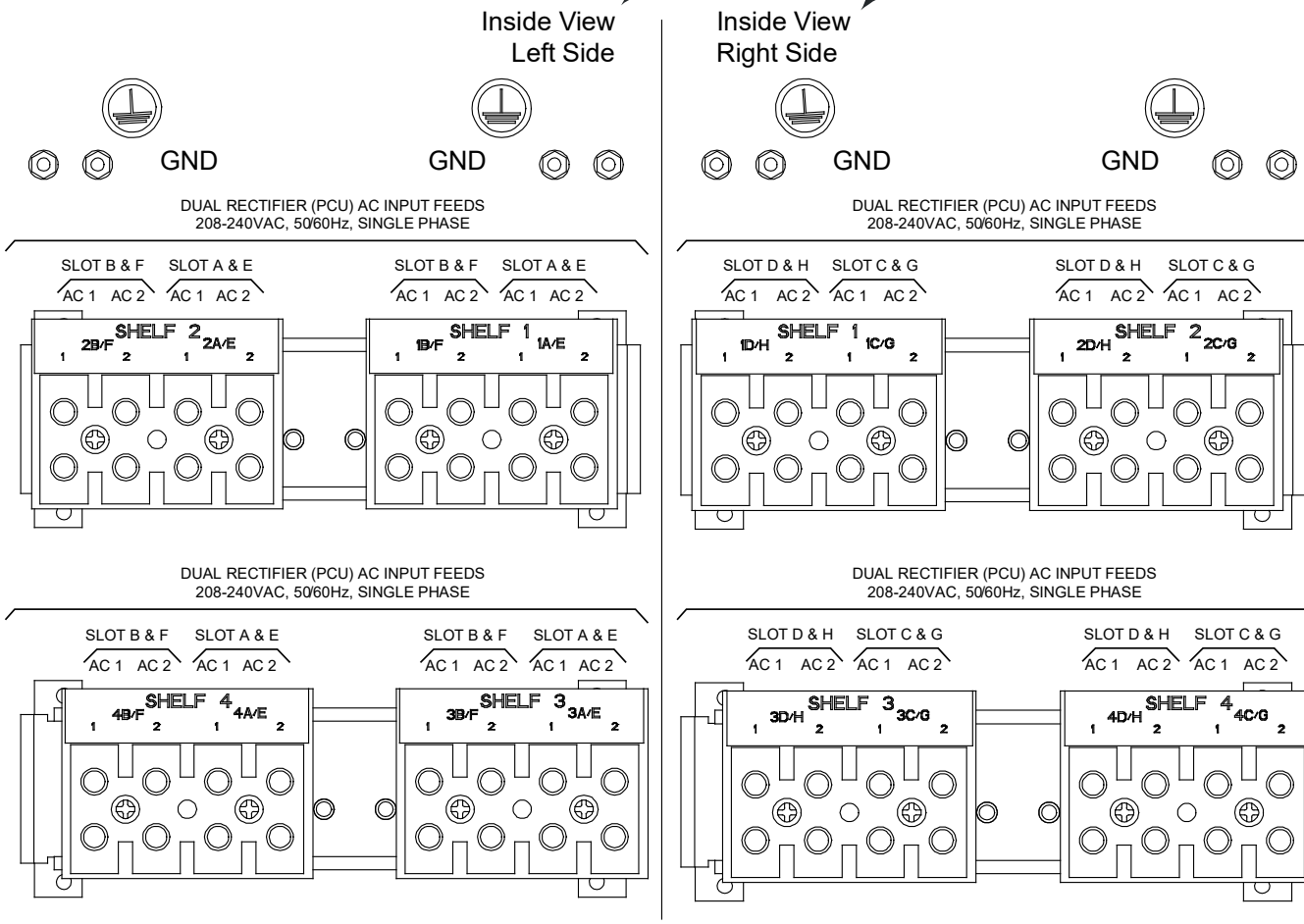
Figure 5.1 AC Input and Equipment Grounding Connections to Factory Installed Module Mounting Shelves (cont'd from previous page)

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.







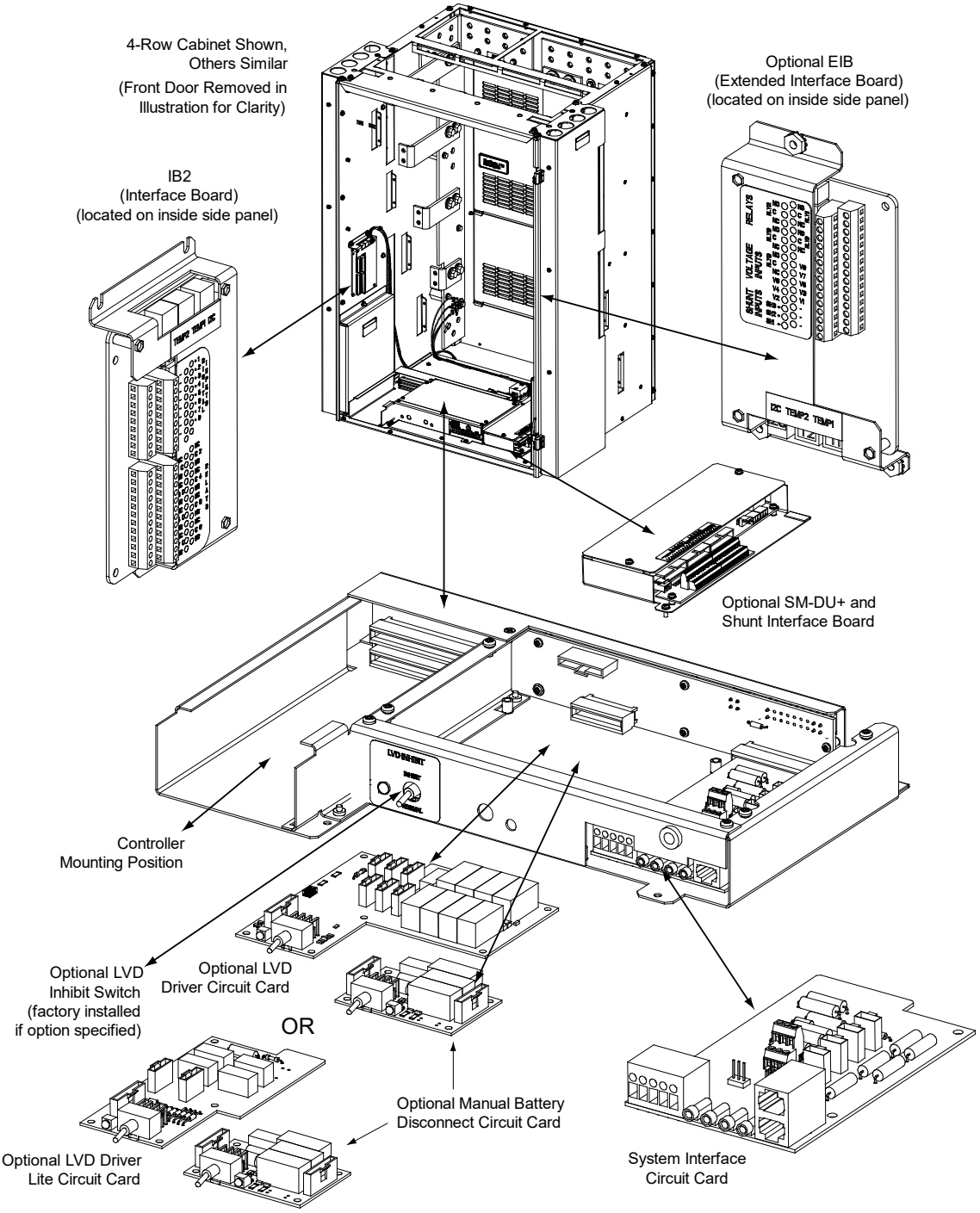
5.4 Make External Interface Connections

Refer to *External Alarm, Reference, Monitoring, and Control Connections* in the MAKING ELECTRICAL CONNECTIONS section of the Installation Instructions (IM581127000) for complete procedures.

5.4.1 Circuit Card Locations

Refer to **Figure 5.2**.

Figure 5.2 Circuit Card Locations



5.4.2 System Interface Circuit Card

The System Interface Circuit Card provides connections for the following. Refer to **Figure 5.3**.

- 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 4.1**), connect TB1-4 and TB1-5 to the desired battery voltage sensing point. Observe proper polarity per the **Figure 4.1**. 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 5.3**. 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.

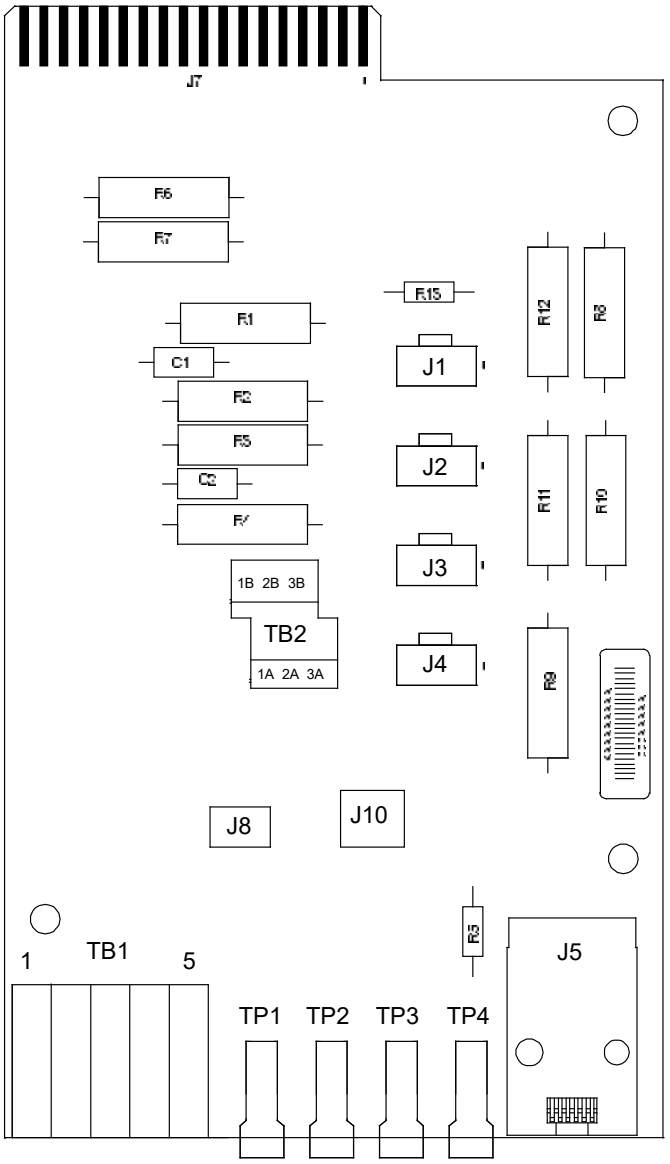
  List 21, 1-Row Distribution Cabinet: 800A / 25mV (32A per mV)

  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 5.3 System Interface Circuit Card Connections



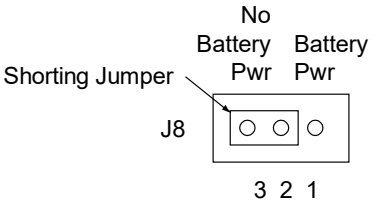
TB2

RS485 Connection
TB2 1A: RS485+
TB2 2A: RS485-

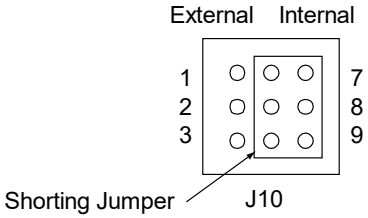
RS232 Connection
TB2 1B: CGND
TB2 2B: TXD232
TB2 3B:RXD232

J1, J2, J3, J4
Distribution Panels FA Inputs

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)



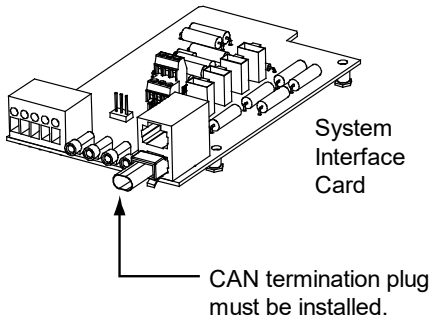
J5
CAN

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.



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

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 5.2**.

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 5.4** for terminal locations. Refer to **Table 5.1**and **Table 5.2** 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 5.4** for terminal locations and **Table 5.1** for pin-out information.

NOTE! *+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. The ESTOP function shuts down and locks out the rectifiers, opens the LVD's, and shuts down the converters. When the ESTOP signal is removed, LVD's close (if battery present) and converters restart. To restart the rectifiers; turn AC power to the rectifiers OFF, wait 30 seconds or more (until the LEDs on the module extinguish), then turn AC power to the rectifiers ON.*

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.

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 5.4** for terminal locations and **Table 5.2** for pin-out information.

NOTE! *The relay assigned to "Critical Summary" alarm 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 5.4** and **Figure 5.6**.

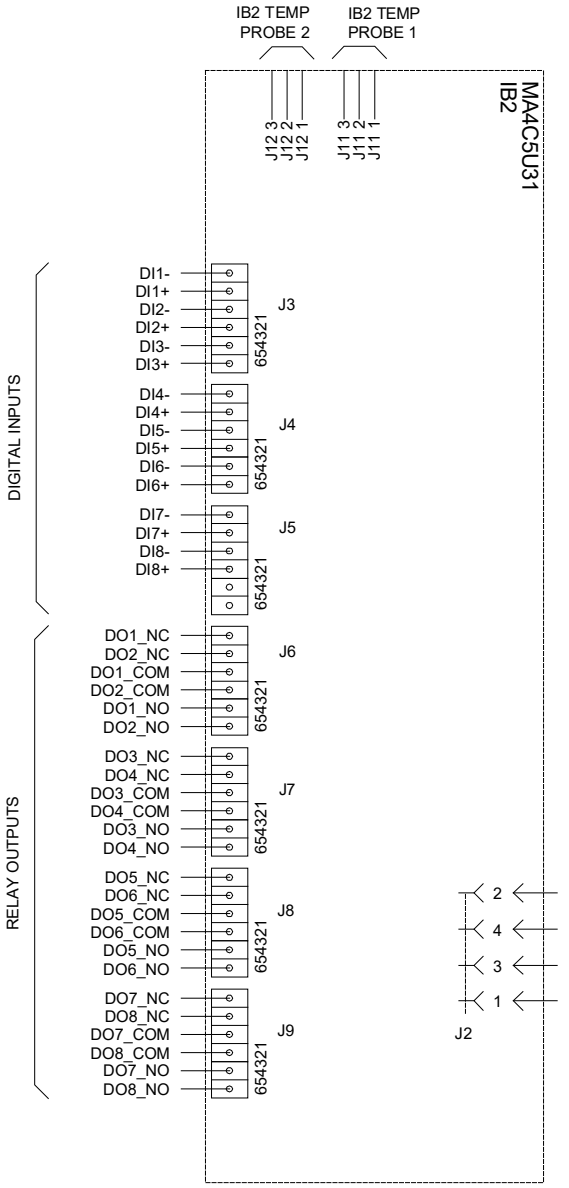
The IB2 and EIB board allows for the connection of two (2) temperature probes. Any combination of the four (4) temperature probes can be programmed to monitor ambient temperature and/or battery temperature. A temperature probe set to monitor battery temperature can also be used for the rectifier battery 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.

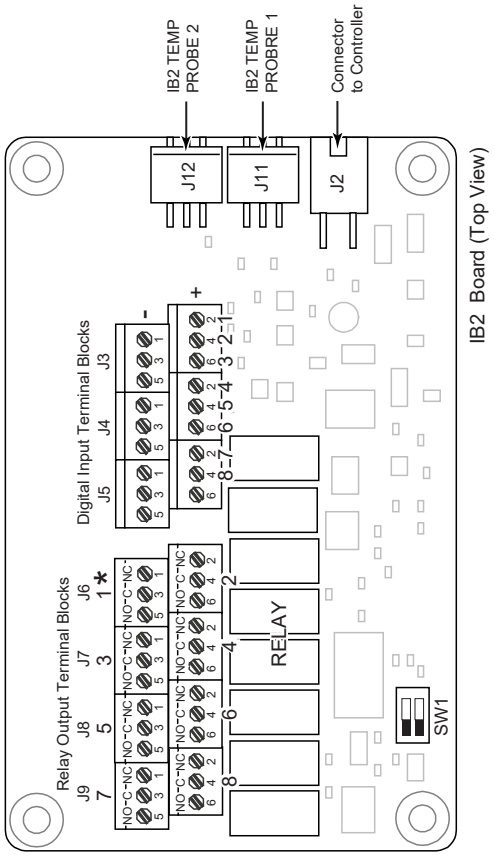
The temperature sensor end of the probe contains a tab with a 5/16" clearance hole for mounting.

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 5.4 IB2 (Interface Board) Connections

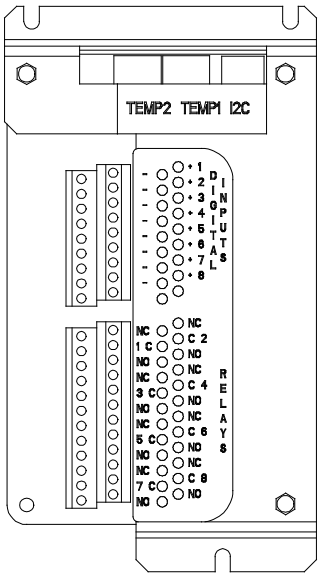
Schematic Diagram of IB2 Board





J3-J9:
Wire Size Capacity: 16-26 AWG.
Recommended Torque: 2.2 in-lbs.

IB2 Board Assembly



* The relay assigned to “Critical Summary” alarm 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.

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

Not all I/O points are available for customer connection (some are used for factory system connections).

Table 5.1 Programmable Digital Inputs – IB2 Board

Programmable Digital Input	IB2 Pin No.		Factory Wiring	Default Digital Input Function	Customer Defined Digital Input Function
1	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	–			
2	J3-4	+			
	J3-3	–			
3	J3-6	+			
	J3-5	–			
4	J4-2	+			
	J4-1	–			
5	J4-4	+			
	J4-3	–			
6	J4-6	+			
	J4-5	–			
7	J5-2	+			
	J5-1	–			
8	J5-4	+	+24 VDC	ESTOP	
	J5-3	–	(to customer ESTOP switch)		
--	J5-5		not used	not used	not used
--	J5-6				

NOTE! *+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. The ESTOP function shuts down and locks out the rectifiers, opens the LVD's, and shuts down the converters. When the ESTOP signal is removed, LVD's close (if battery present) and converters restart. To restart the rectifiers; turn AC power to the rectifiers OFF, wait 30 seconds or more (until the LEDs on the module extinguish), then turn AC power to the rectifiers ON.*

Table 5.2 Programmable Relay Outputs – IB2 Board

Programmable Relay Output		IB2 Pin No.	Alarms Assigned to this Relay (Default)	Alarms Assigned to this Relay (Custom)
1	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		
2	NO	J6-6		
	COM	J6-4		
	NC	J6-2		
3	NO	J7-5		
	COM	J7-3		
	NC	J7-1		
4	NO	J7-6		
	COM	J7-4		
	NC	J7-2		
5	NO	J8-5		
	COM	J8-3		
	NC	J8-1		
6	NO	J8-6		
	COM	J8-4		
	NC	J8-2		
7	NO	J9-5		
	COM	J9-3		
	NC	J9-1		
8	NO	J9-6		
	COM	J9-4		
	NC	J9-2		

NOTE! *The relay assigned to "Critical Summary" alarm (relay 1 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.

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

The 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 5.2**.

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 5.6** for terminal locations. Refer to **Table 5.3**, **Table 5.4**, and **Table 5.5** for pin-out information.

Current Inputs

Connect up to three (3) shunt inputs to the EIB. Observe proper polarity. Refer to **Figure 5.6** for terminal locations and **Table 5.3** 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. The 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 5.6** for terminal locations and **Table 5.4** for pin-out information.

Refer to **Figure 5.5** 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.

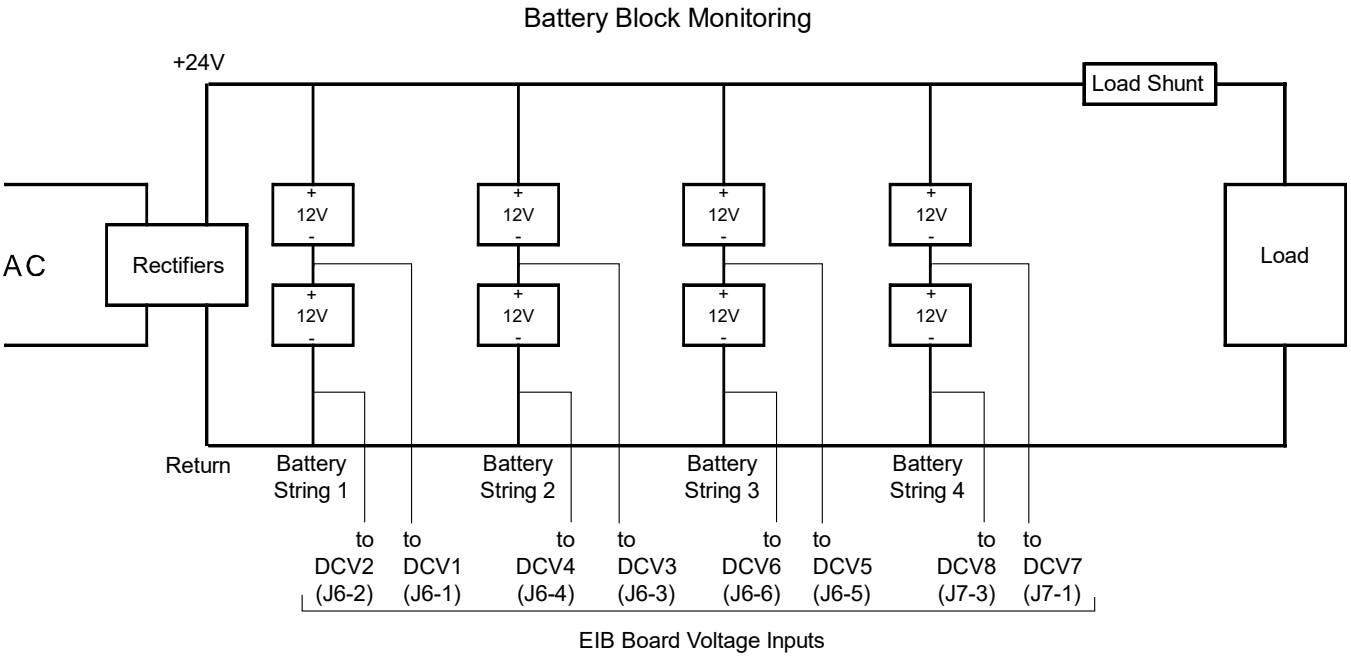
  Block In-Use: Set to the number of 12V battery blocks being used.

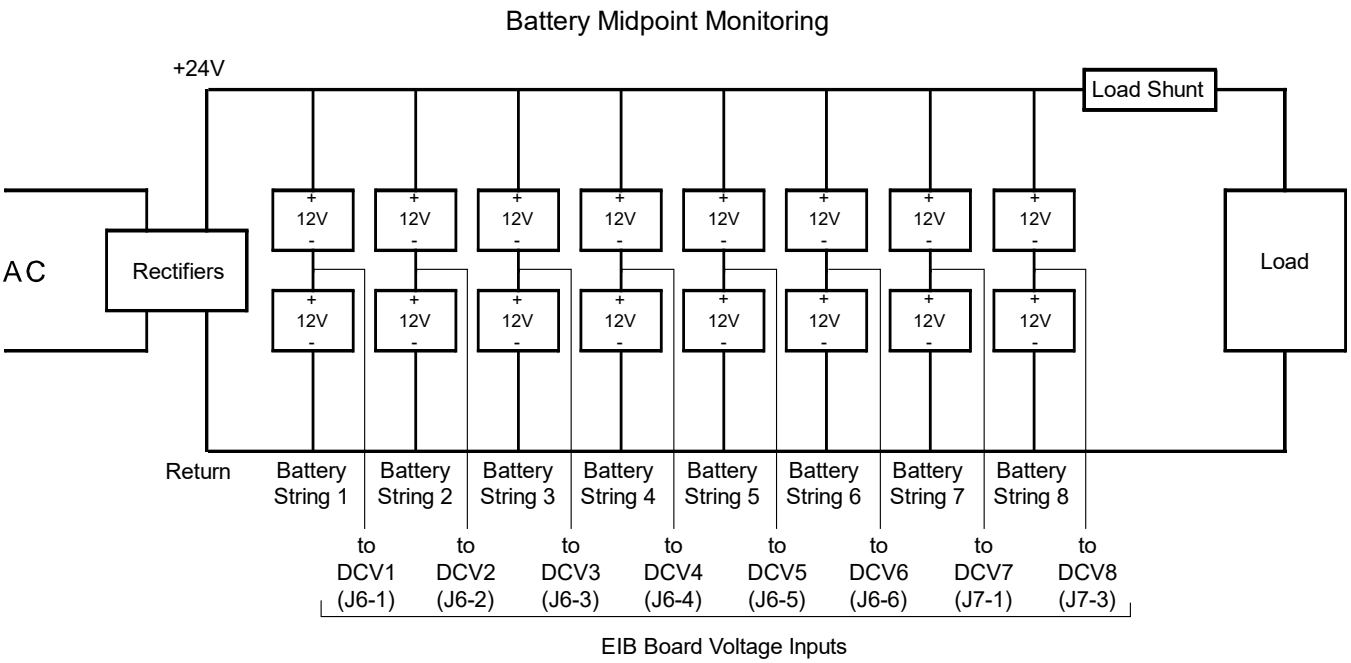
- Midpoint Monitoring
  Voltage Type: Set to “Midpoint”. This selects the EIB to monitor the midpoint voltage of up to eight (8) battery strings.

  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 5.5 Sample Battery Block or Battery Midpoint Monitoring Connections





Programmable Relay Outputs

The 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 5.6** for terminal locations and **Table 5.4** 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.

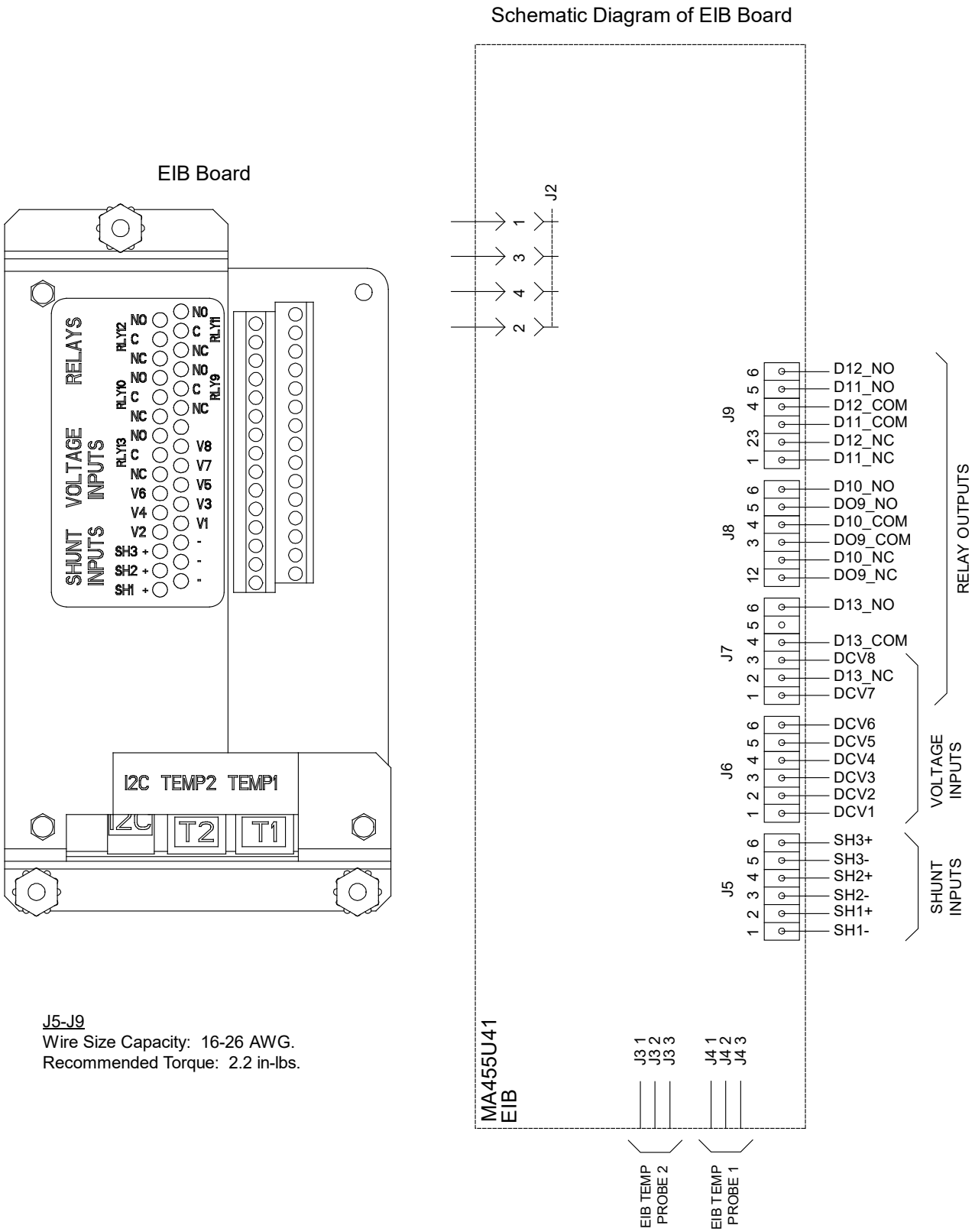
b) Peak: 3 A @ 30V DC.

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 24.

Figure 5.6 EIB (Extended Interface Board) Connections



J5-J9
Wire Size Capacity: 16-26 AWG.
Recommended Torque: 2.2 in-lbs.

Table 5.3 Shunt Inputs – EIB

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

Table 5.4 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 5.5 Programmable Relay Outputs – EIB

Programmable Relay Output		EIB Pin No.	Alarms Assigned to this Relay (Default)	Alarms Assigned to this Relay (Custom)
9	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		
10	NO	J8-6		
	COM	J8-4		
	NC	J8-2		
11	NO	J9-5		
	COM	J9-3		
	NC	J9-1		
12	NO	J9-6		
	COM	J9-4		
	NC	J9-2		
13	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.

5.4.5 Optional SM-DU+ and Shunt Interface Board

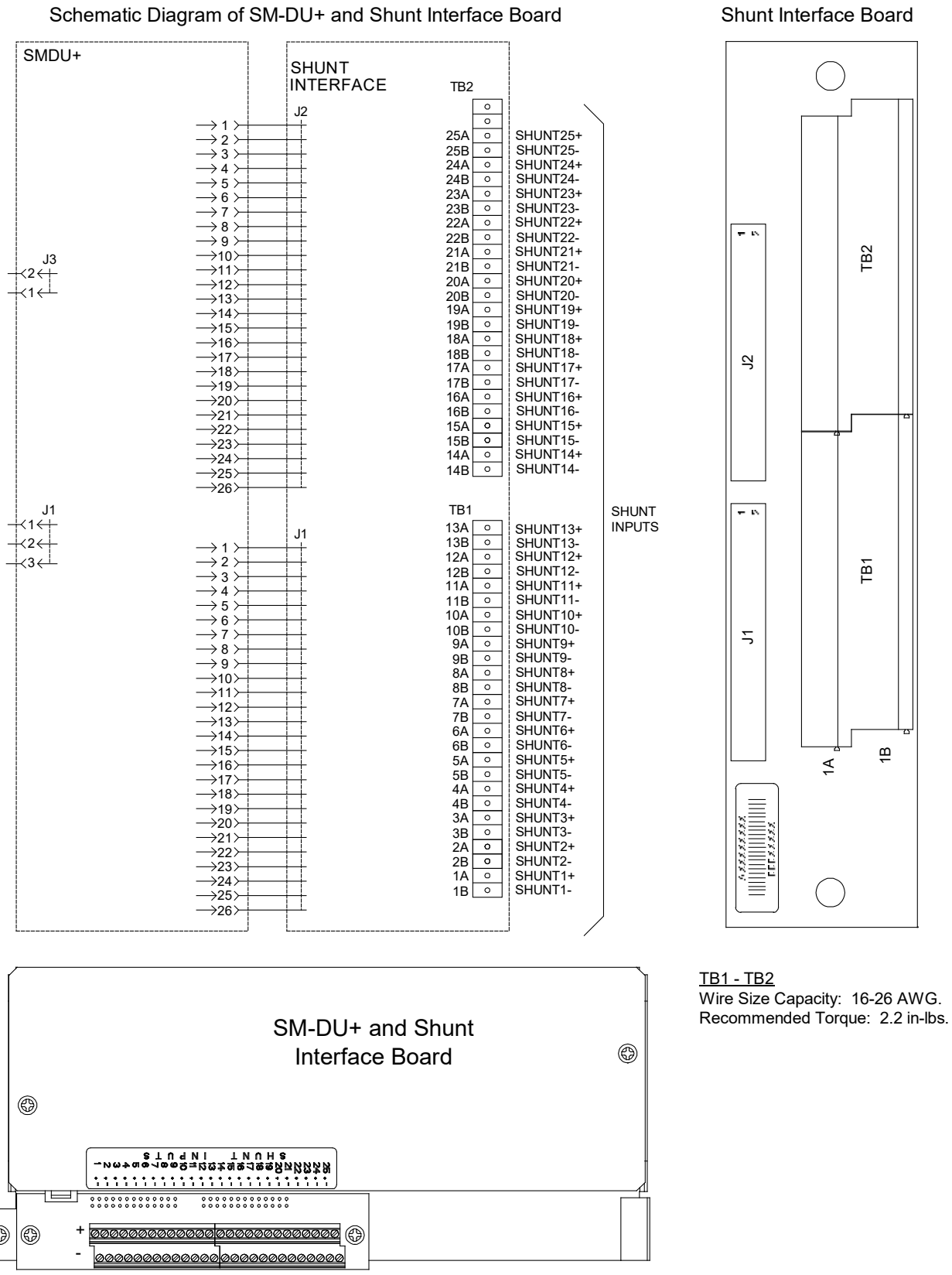
The optional SM-DU+ and Shunt Interface Board provides connections for up to twenty-five (25) shunt inputs. Inputs are factory connected to any distribution positions/devices containing shunts. Refer to **Figure 5.7**.

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 5.7 SM-DU+ and Shunt Interface Board Connections



TB1 - TB2
Wire Size Capacity: 16-26 AWG.
Recommended Torque: 2.2 in-lbs.

5.4.6 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 5.3** for location. Refer to **Table 5.6** for pin-outs. Refer also to the external device's or system's instruction manual.

General Procedure

- Remove the CAN termination plug from the bottom CAN connector on the System Interface circuit card (see **Figure 5.3** for location). Connect the device or system to the bottom CAN connector on the System Interface circuit card. Refer to **Table 5.6** 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.

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 5.6** 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 5.6 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	--	--

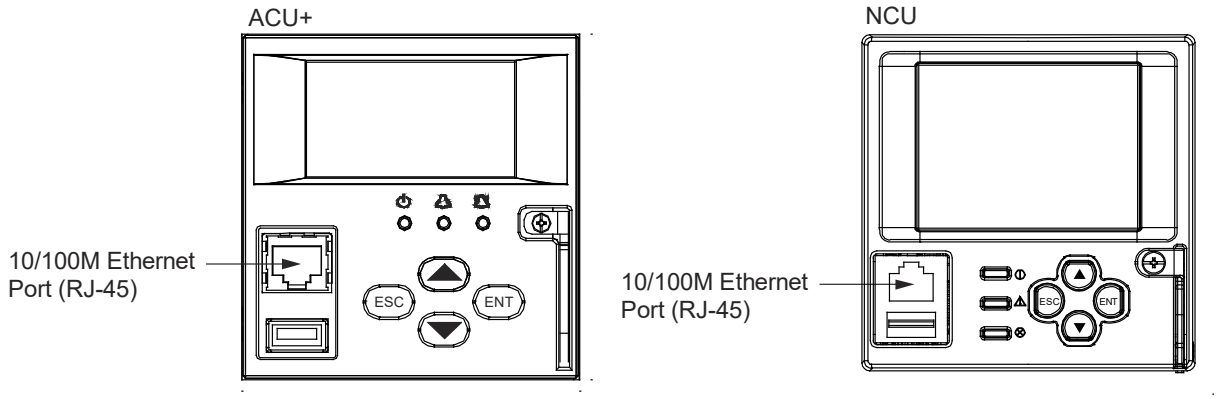
5.5 Make Controller Ethernet Connection (if required)

If the Web Interface will be used, connect to the Ethernet port on the front of the Controller. Location is shown in **Figure 5.8**.

Refer to *External Alarm, Reference, Monitoring, and Control Connections* in the MAKING ELECTRICAL CONNECTIONS section of the Installation Instructions (IM581127000) for Ethernet connection 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.*

Figure 5.8 Controller Ethernet Port



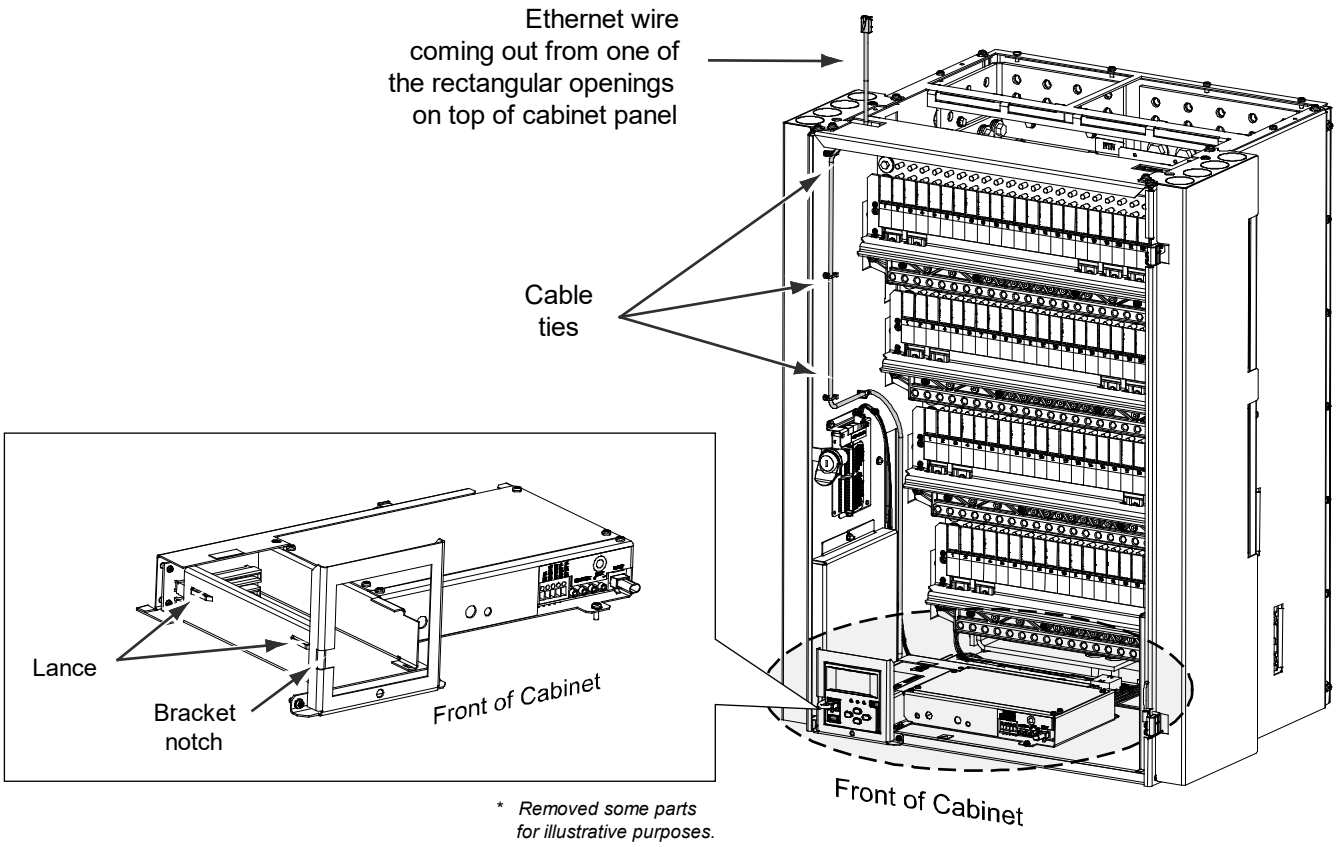
NOTE! *NCU ONLY: If your system has an IB4 board, DO NOT connect your Local Area Network (LAN) to the NCU front Ethernet port. See "NCU Controller Second Ethernet Port Connection (if IB4 board furnished)" on page 38.*

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 5.9 Network Connection through Power System

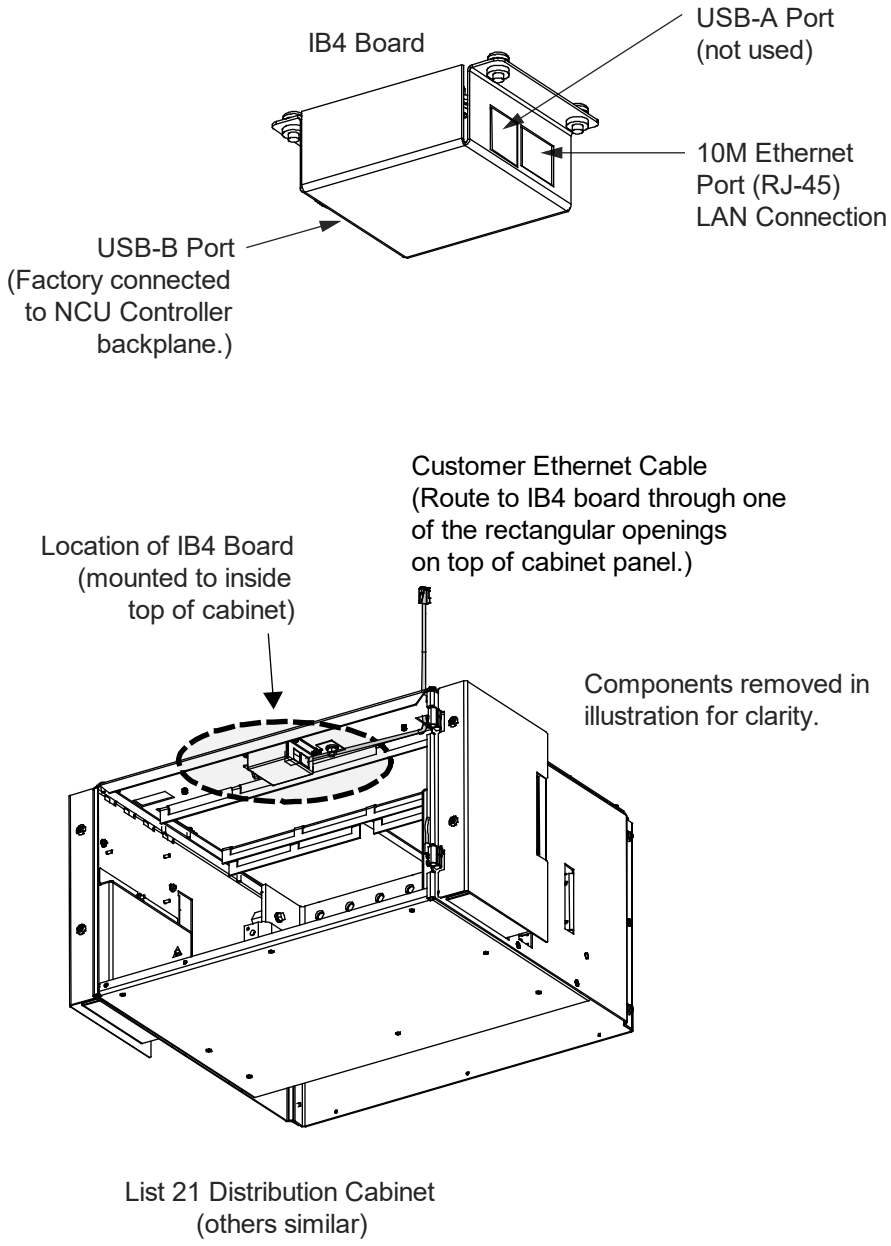


NCU Controller Second Ethernet Port Connection (if IB4 board furnished)

Your system may be furnished with an IB4 board connected to the NCU backplane via a factory furnished and connected cable. The IB4 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 IB4 board can be used to connect the NCU to your Local Area Network (LAN). Refer to **Figure 5.10** for location.

NOTE! *If your system has an IB4 board, DO NOT connect your Local Area Network (LAN) to the NCU front Ethernet port.*

Figure 5.10 IB4 Board NCU Controller Second Ethernet Port



5.6 Make Load Connections

Refer to *Load Connections* in the MAKING ELECTRICAL CONNECTIONS section of the Installation Instructions (IM581127000) for complete procedures.

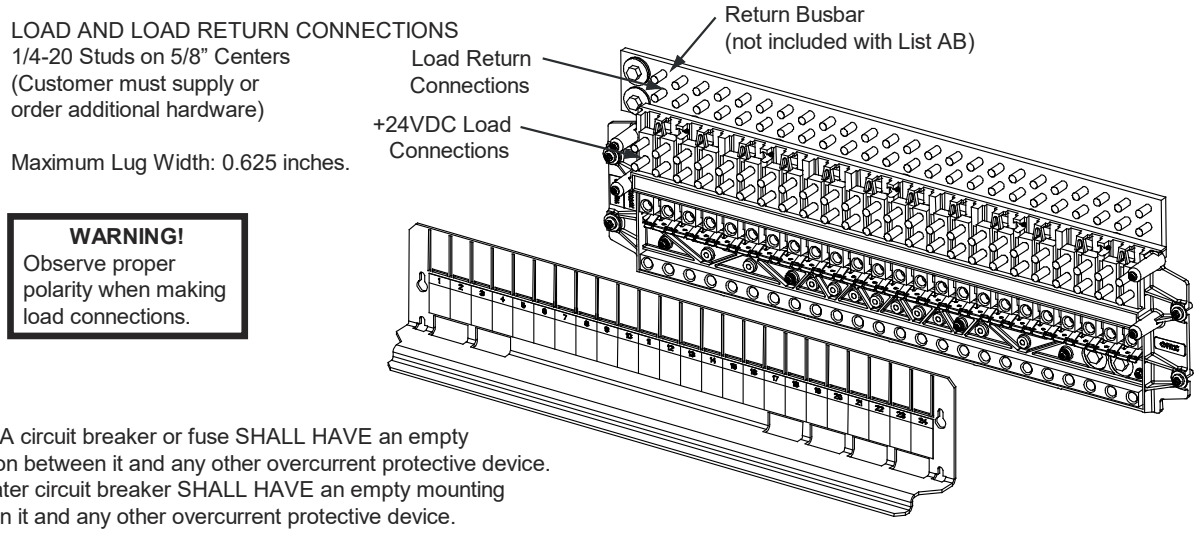
Loads are connected to the various distribution panels located inside the distribution cabinet. See **Figure 5.11** through **Figure 5.33**.

5.6.1 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).

5.6.2 Load Connections to Single Voltage Distribution Panels

Figure 5.11 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



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

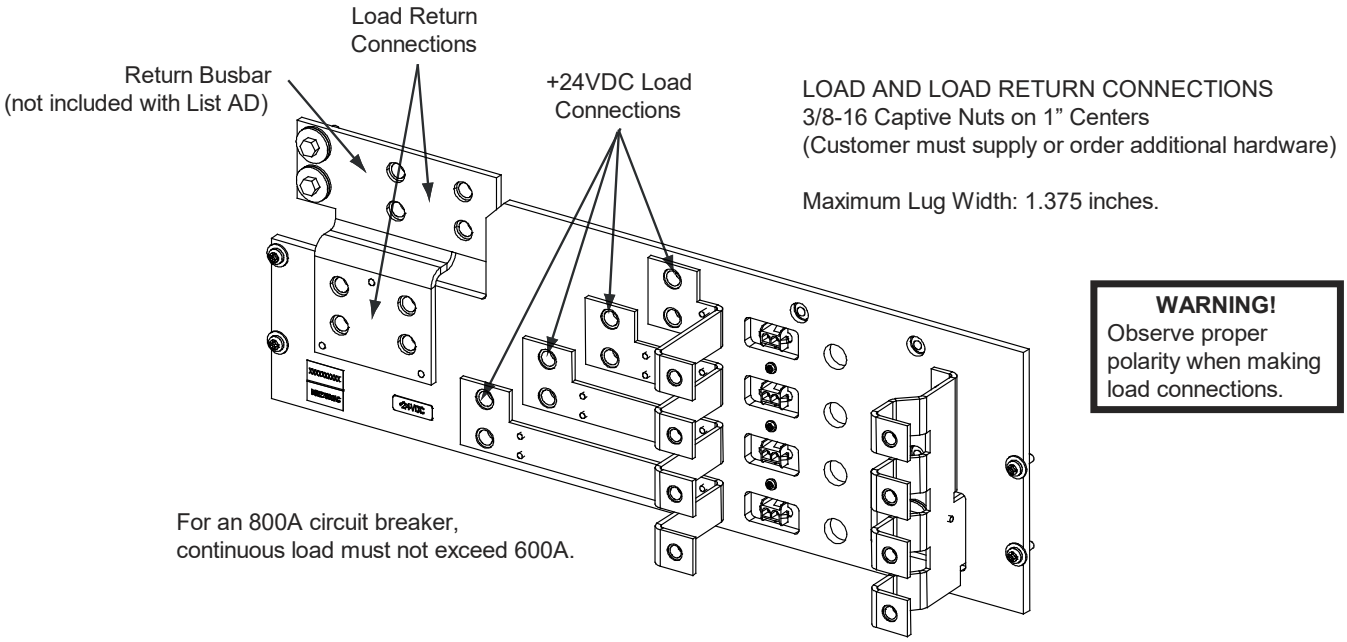


Figure 5.13 List AE: +24V Distribution Panel, (2) TPH Fuse Positions (without Shunts) (without Return Busbar)

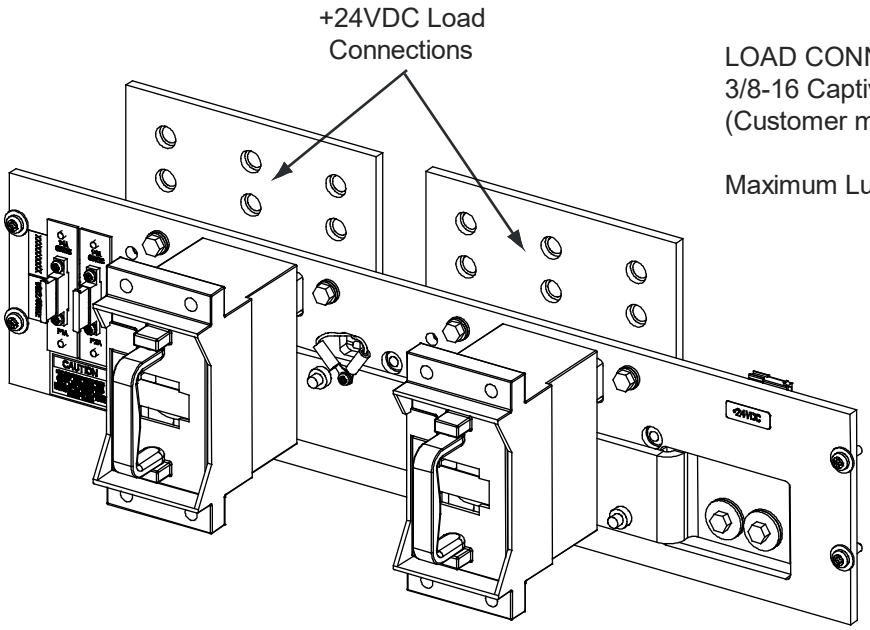


Figure 5.14 List AF: +24V Distribution Panel, (2) TPH Fuse Positions (with Shunts) (without Return Busbar)

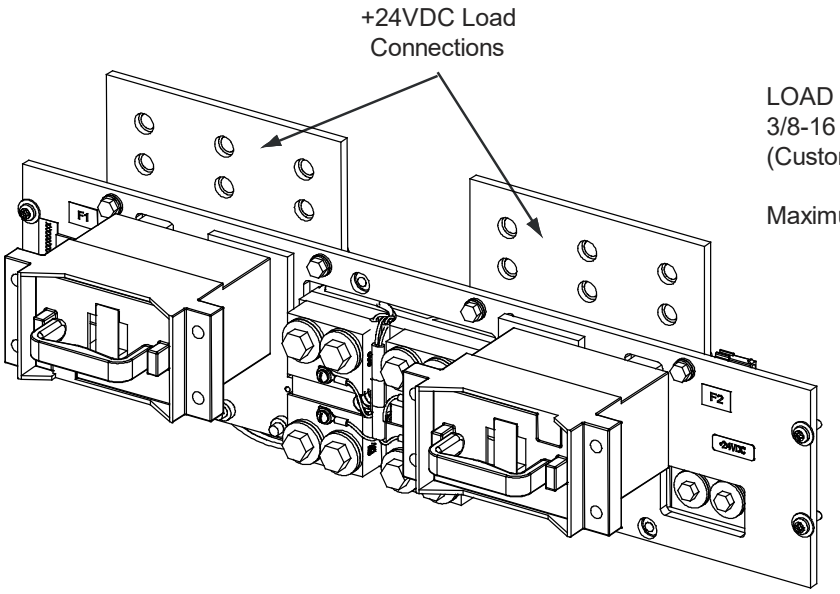


Figure 5.15 List AG: +24V Distribution Panel, (4) TPH Fuse Positions (without Shunts) (without Return Busbar)

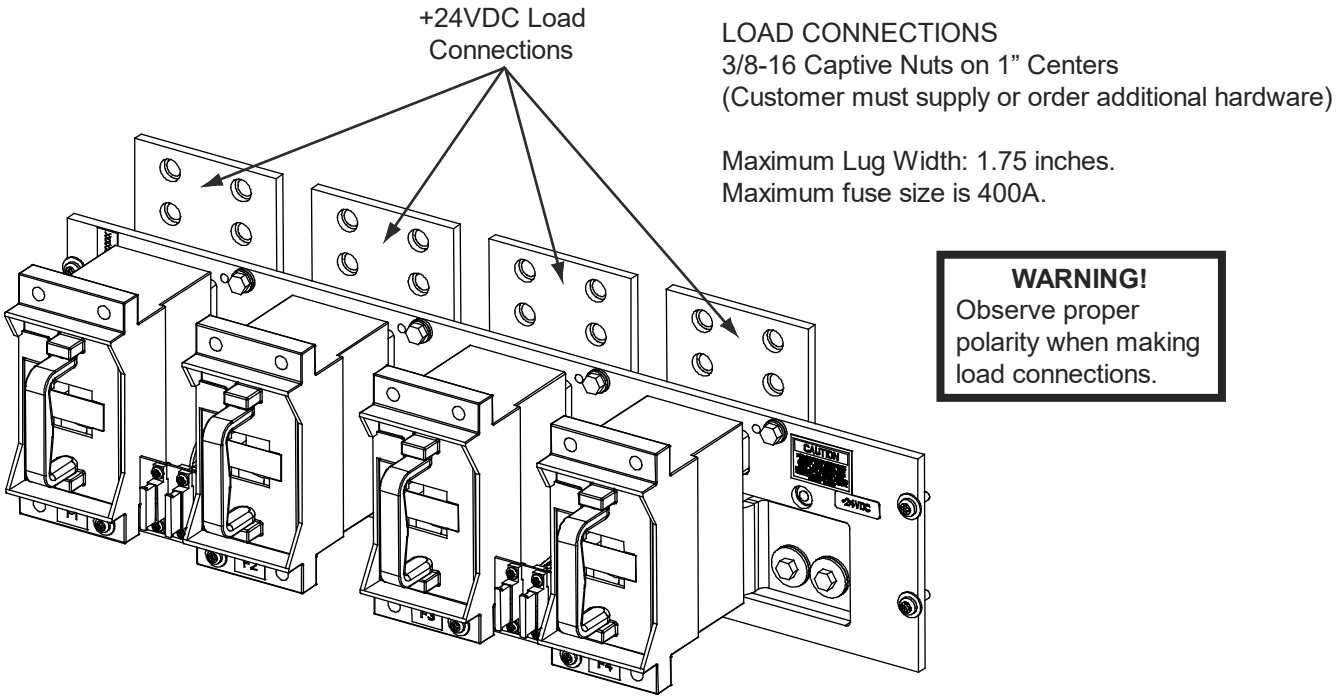


Figure 5.16 List AH: +24V Distribution Panel, (4) TPH Fuse Positions (with Shunts) (without Return Busbar)

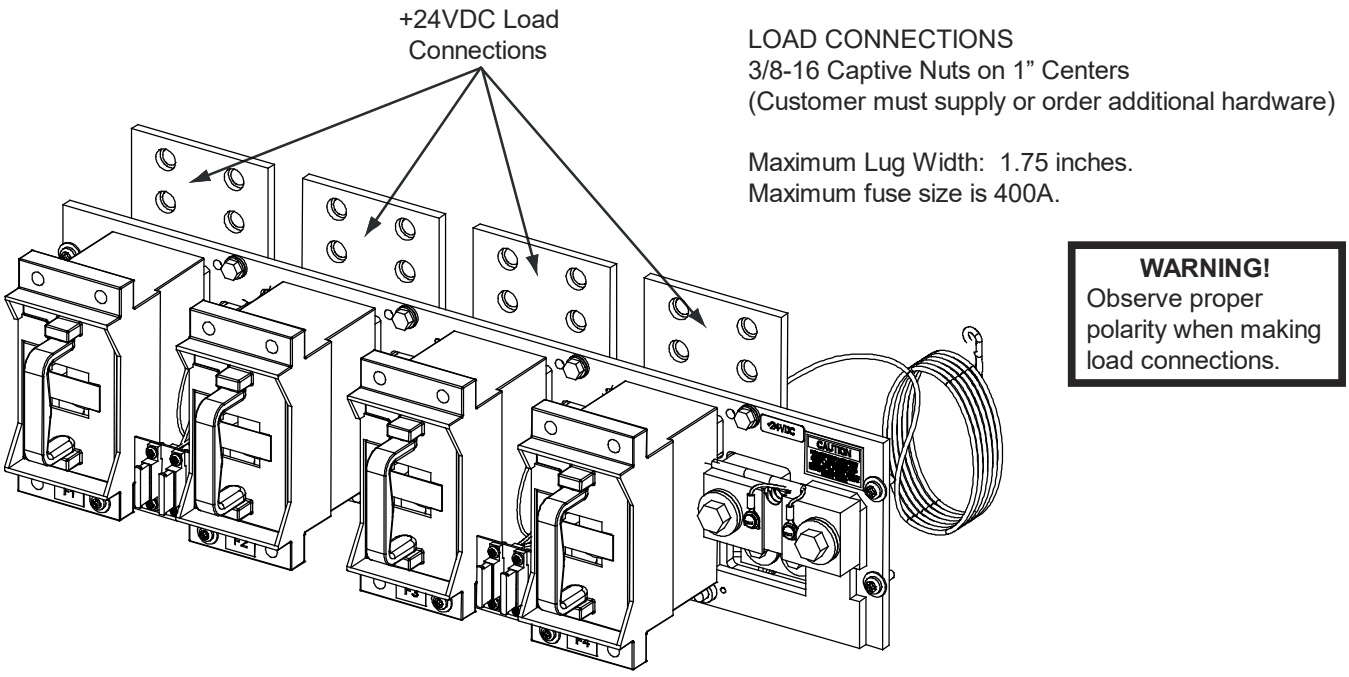


Figure 5.17 List AJ: +24V Distribution Panel, (4) TPL-B Fuse Positions (without Shunts) (without Return Busbar)

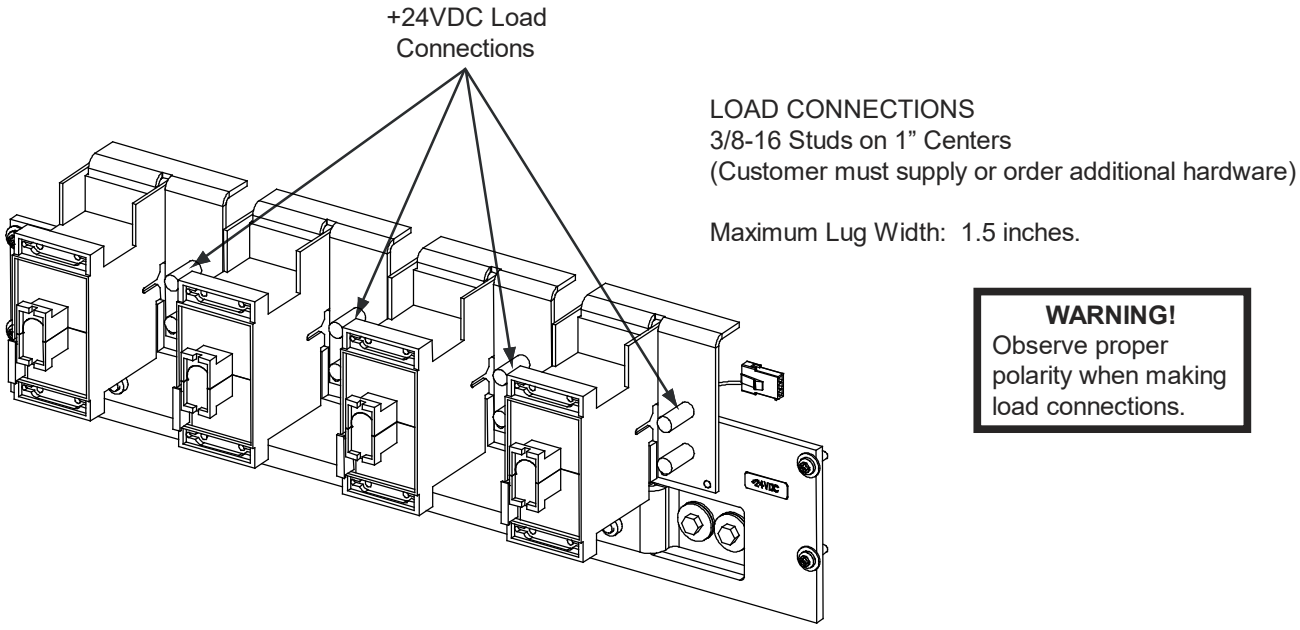


Figure 5.18 List AK: +24V Distribution Panel, (4) TPL-B Fuse Positions (with Shunts) (without Return Busbar)

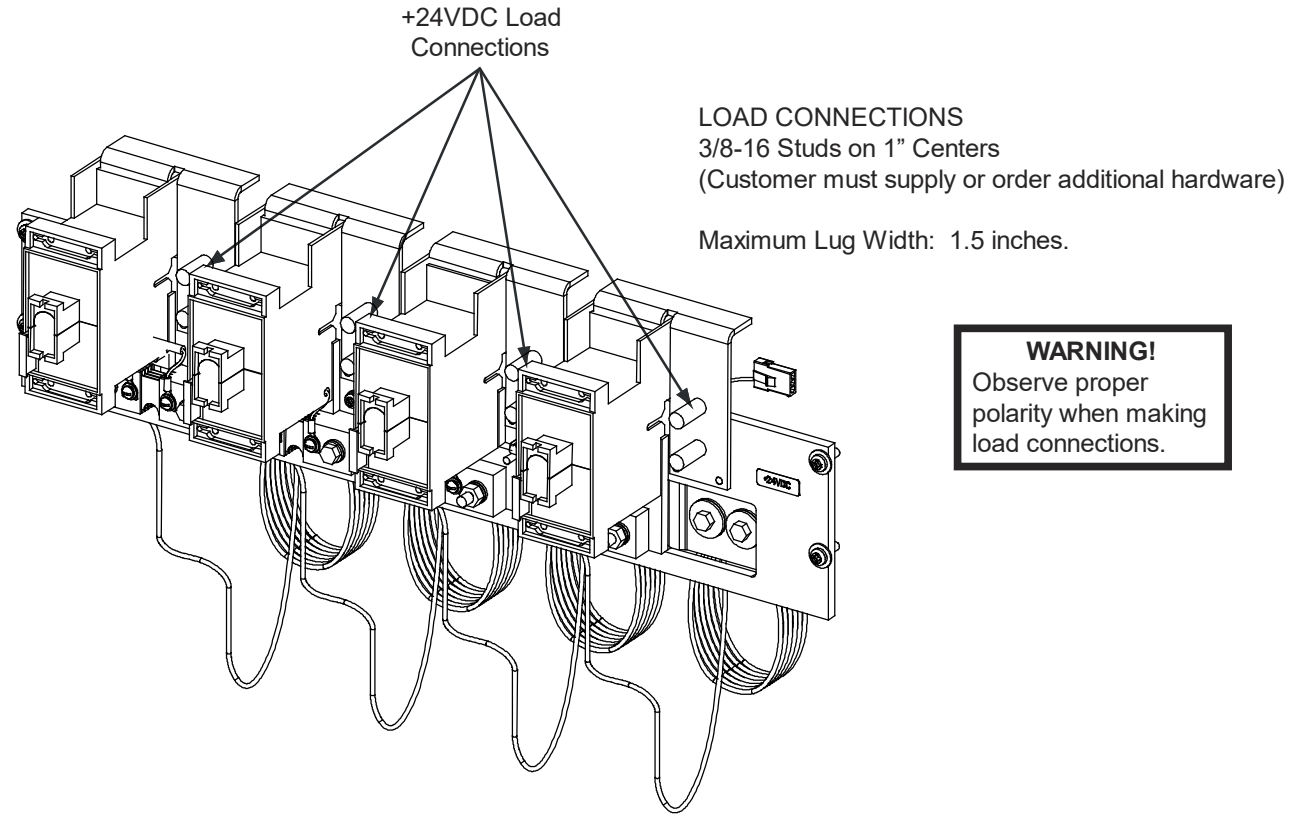
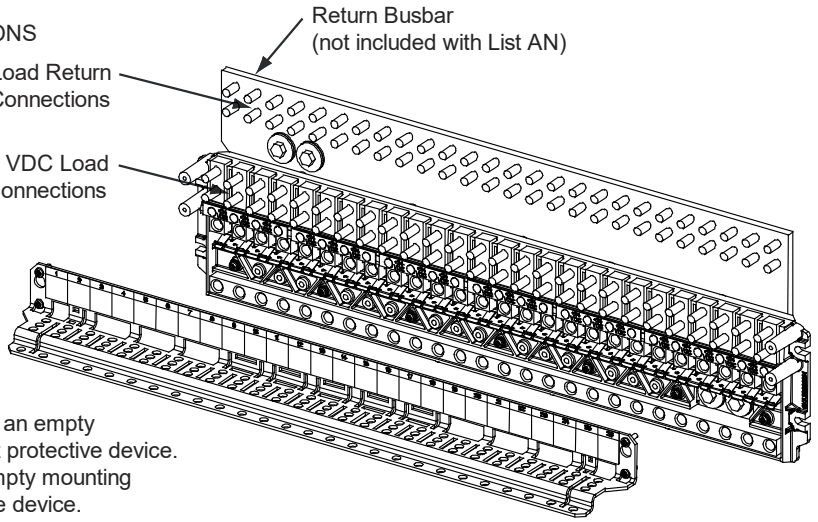


Figure 5.19 List AL and List AN: +24V Distribution Panel, (26) Bullet/TPS/TLS Circuit Breaker/Fuse Positions

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

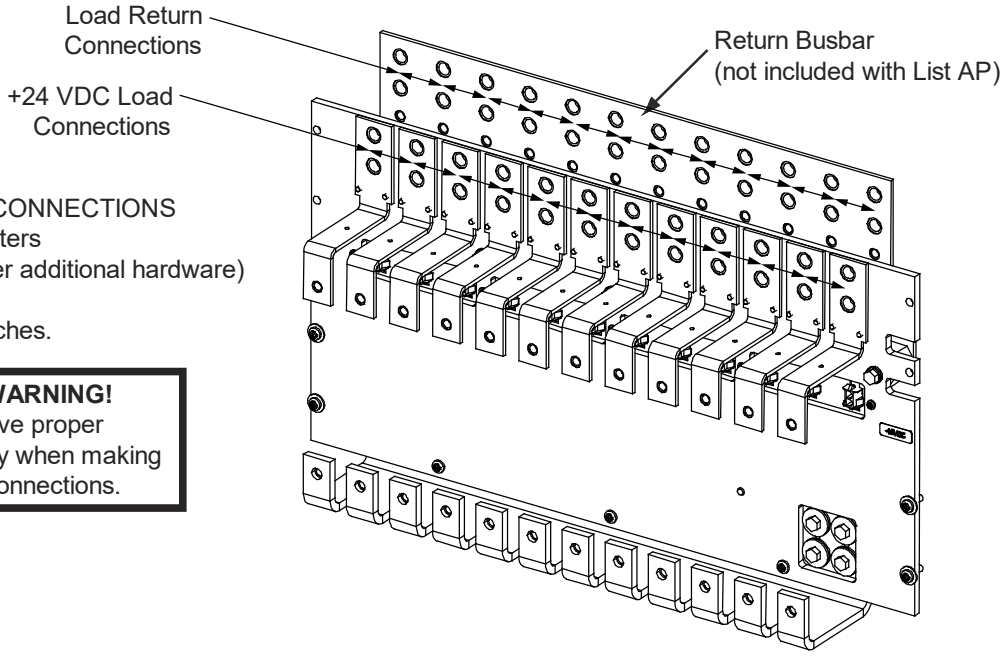
Maximum Lug Width: 0.625 inches.

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



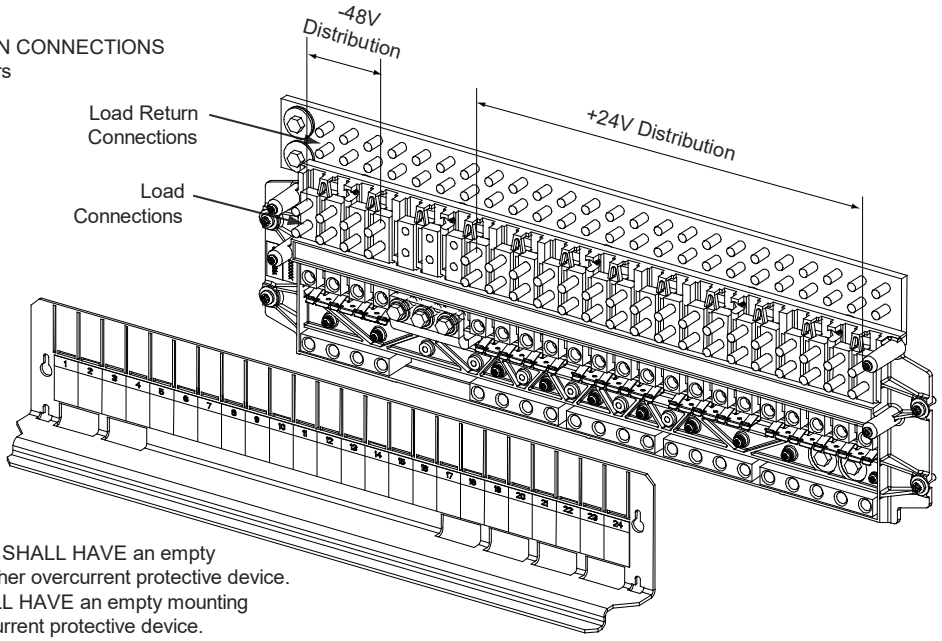
LOAD AND LOAD RETURN CONNECTIONS
3/8-16 Captive Nuts on 1” Centers
(Customer must supply or order additional hardware)

Maximum Lug Width: 1.375 inches.

WARNING!
Observe proper polarity when making load connections.

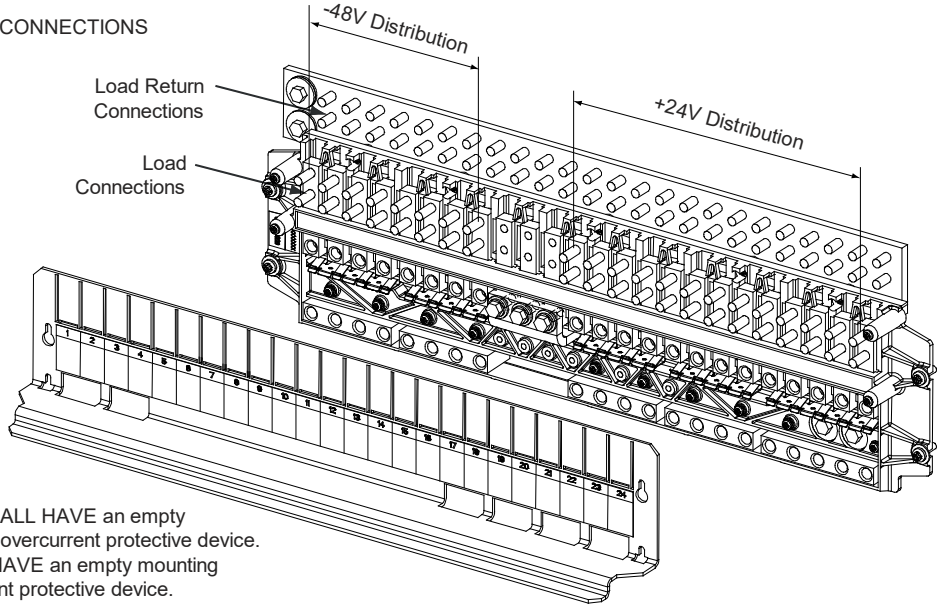
5.6.3 Load Connections to Dual Voltage Distribution Panels

Figure 5.21 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)



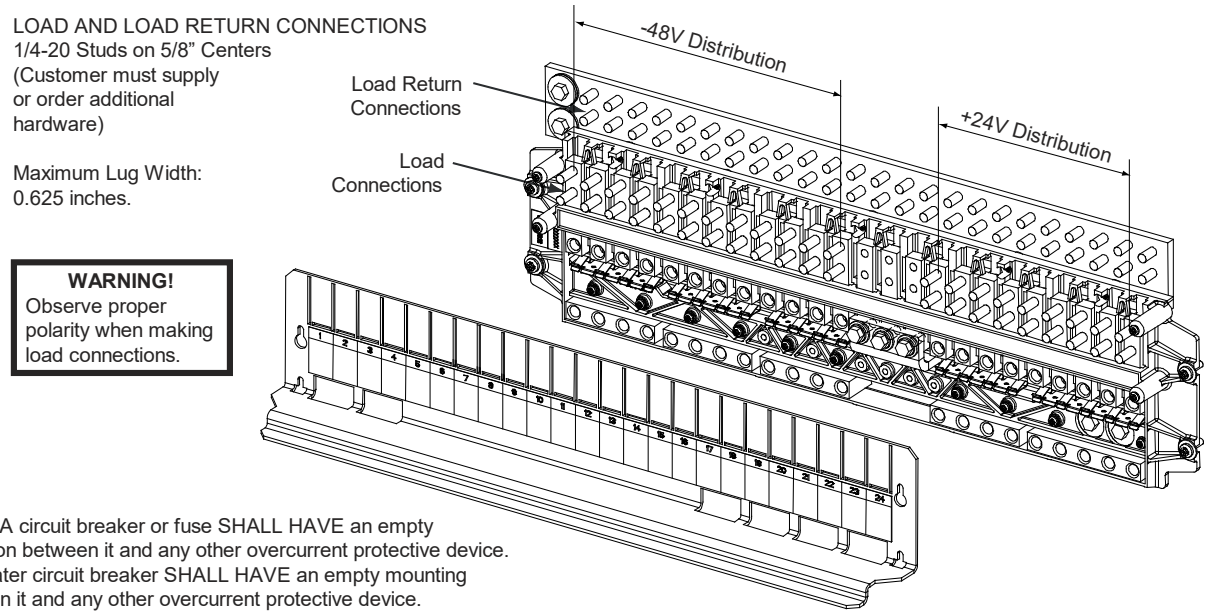
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.22 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)



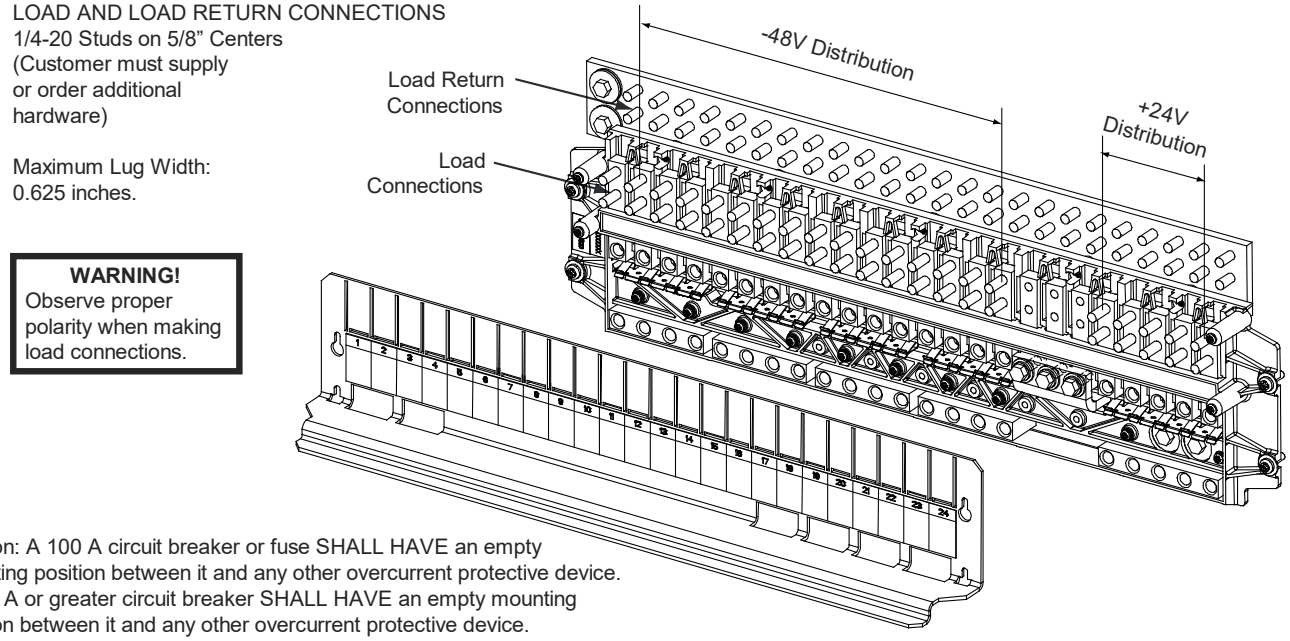
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.23 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)



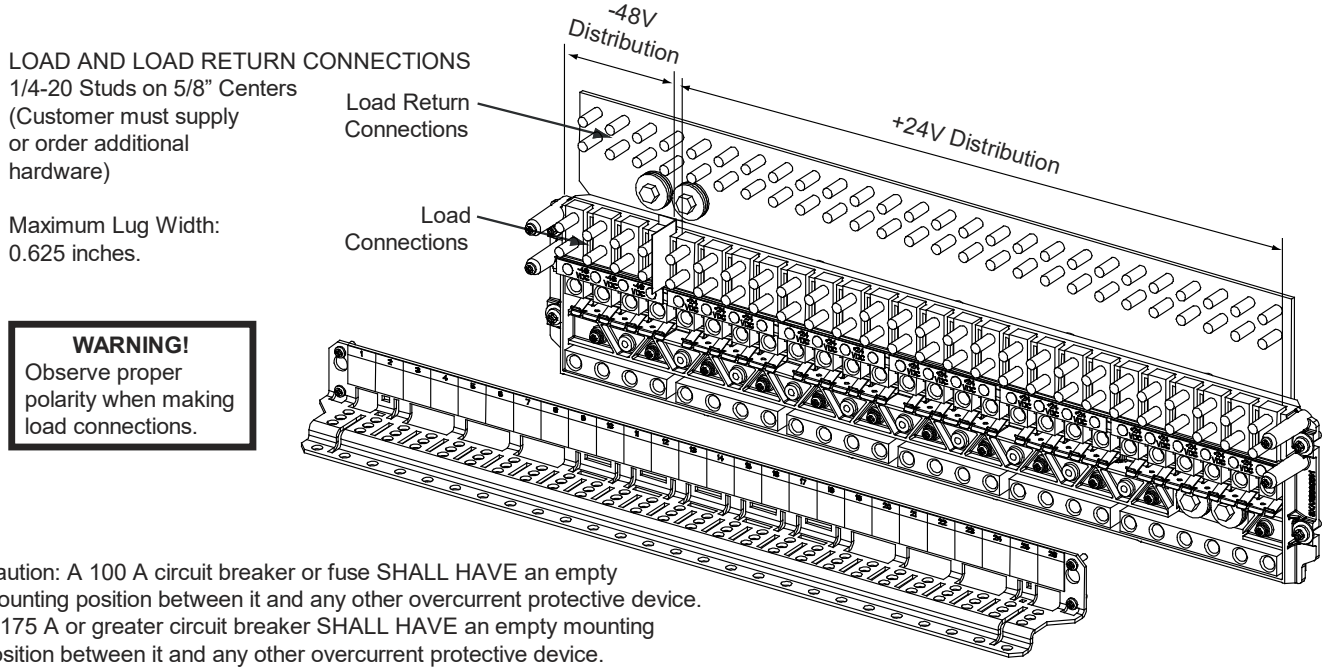
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.24 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)



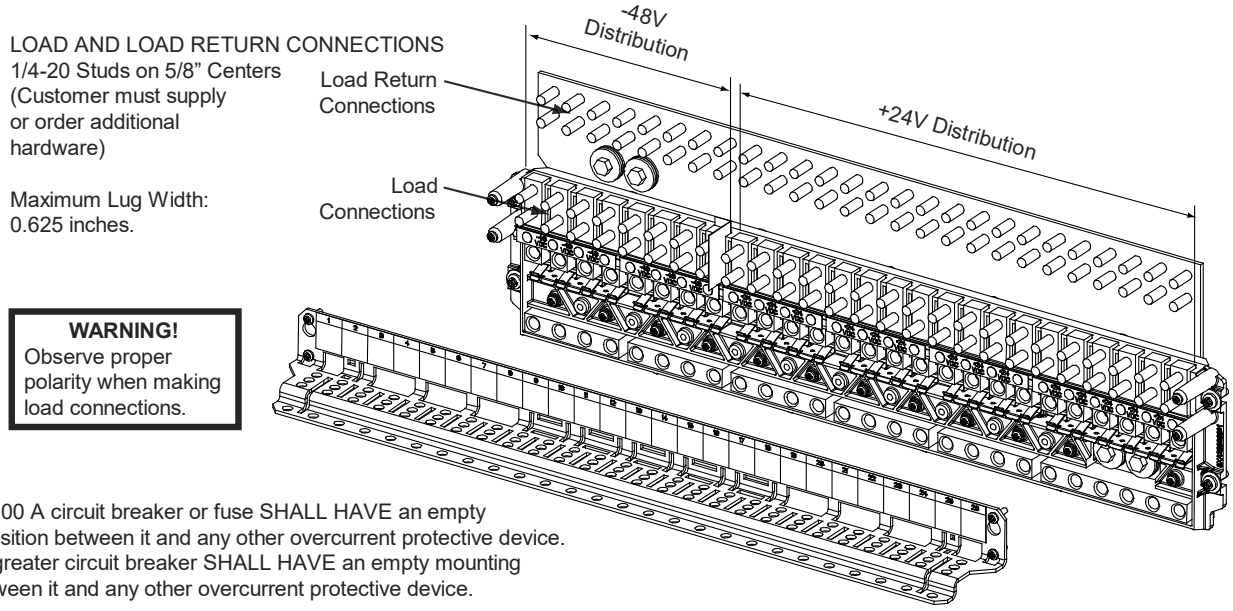
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.25 List 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)



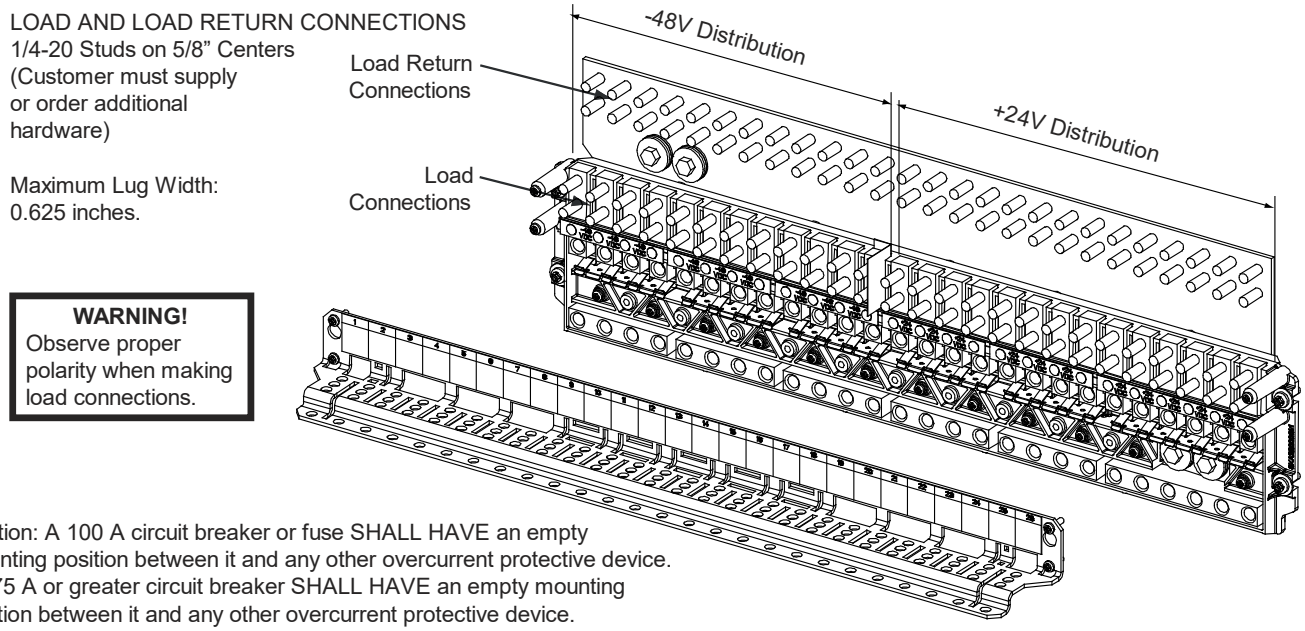
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.26 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)



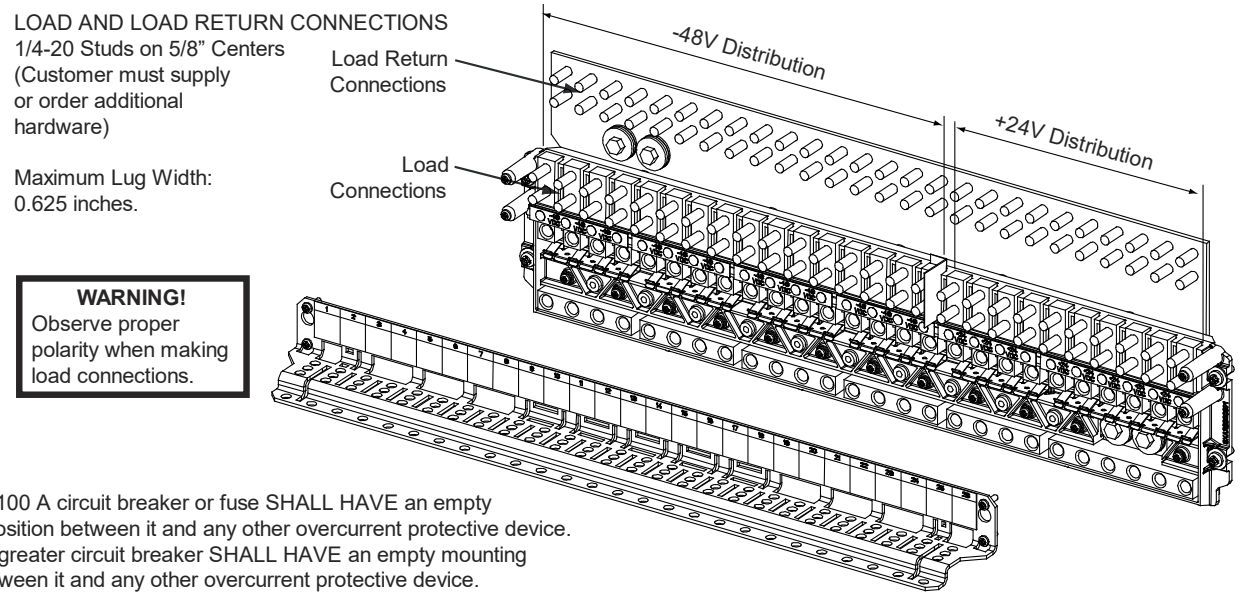
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.27 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)



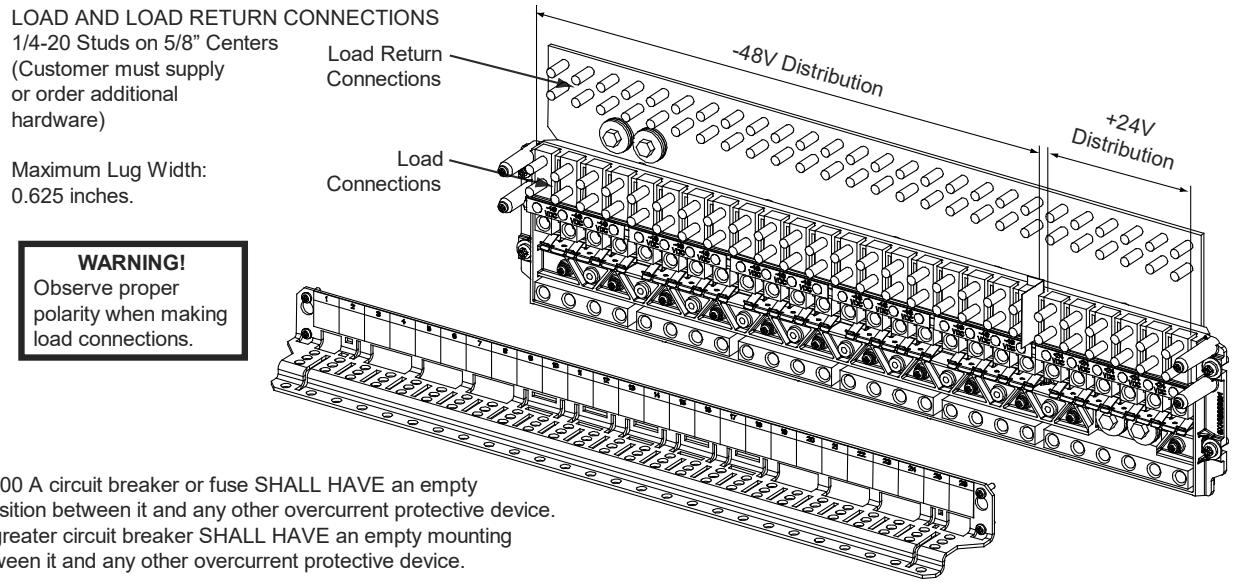
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.28 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)



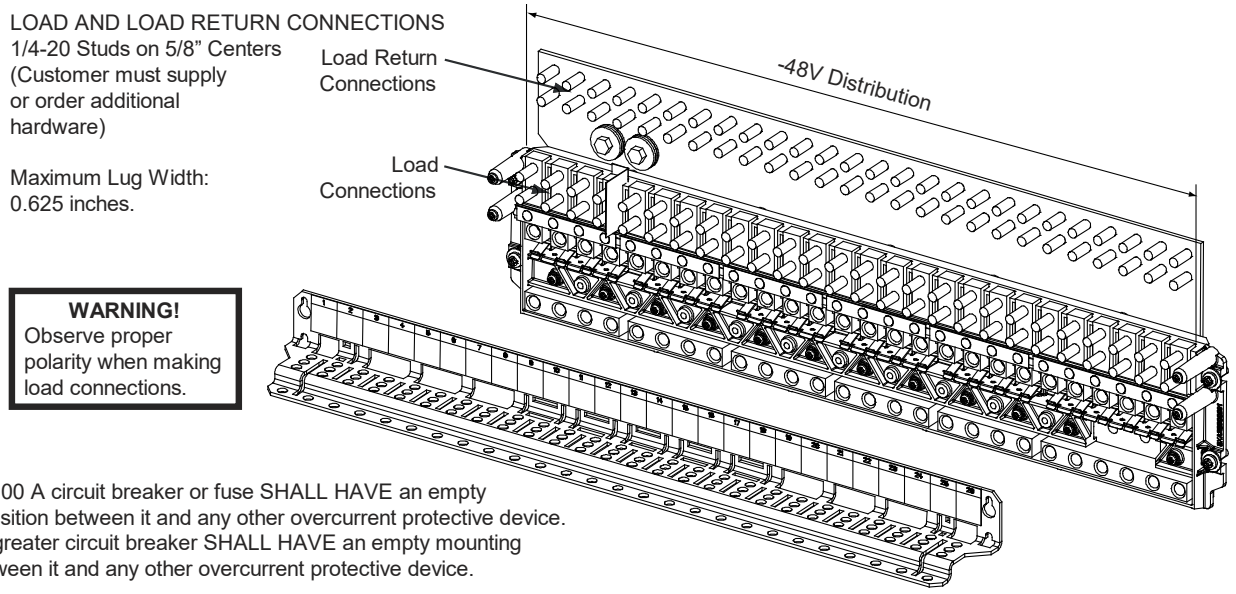
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.29 List 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)



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.

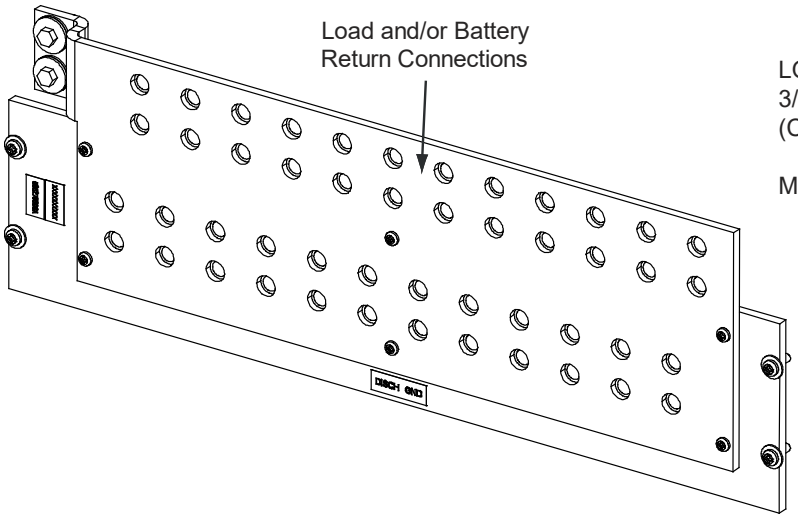
Figure 5.30 List DK: +24V/-48V Distribution Panel, (26) -48V Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)



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.

5.6.4 Load Connections to Return Bar

Figure 5.31 List GA: Return Bar Panel

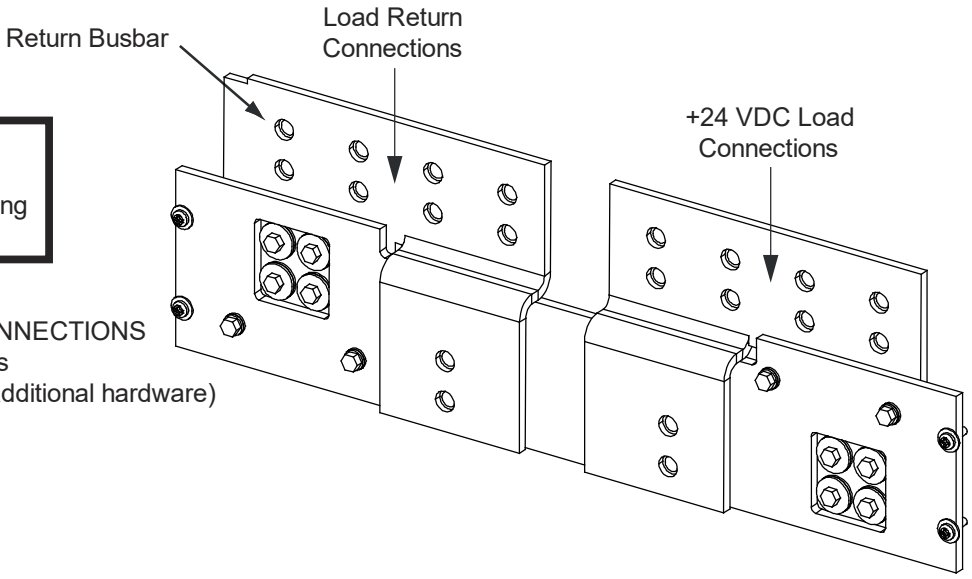


LOAD AND/OR BATTERY RETURN CONNECTIONS
3/8-16 Captive Nuts on 1” Centers
(Customer must supply or order additional hardware)

Maximum Lug Width: 1.38 inches.

5.6.5 Load Connections to Bulk Output Panel

Figure 5.32 List EA: Bulk Output Panel



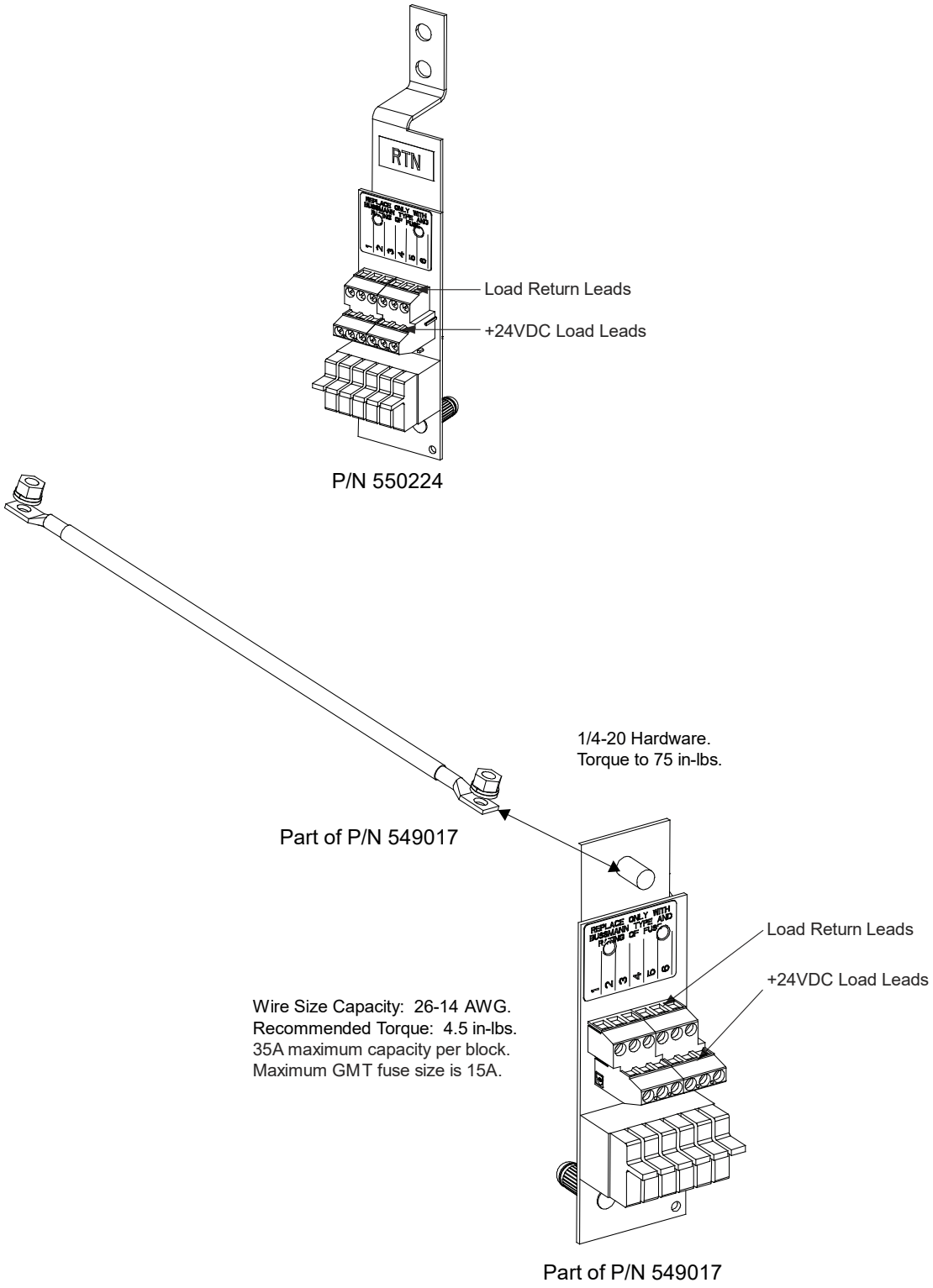
WARNING!
Observe proper polarity when making load connections.

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.

5.6.6 Load Connections to GMT Distribution Fuse Block

Figure 5.33 Optional Bullet Nose 6-Position GMT Distribution Fuse Block



5.7 Make Battery Connections

Refer to *Battery Connections* in the MAKING ELECTRICAL CONNECTIONS section of the Installation Instructions (IM581127000) for complete procedures.

5.7.1 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).
- 180 in-lbs for 3/8-inch hardware (when using a Belleville lock washer).

5.7.2 Battery Connections to Optional Battery Disconnect Distribution Panels

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 5.34 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

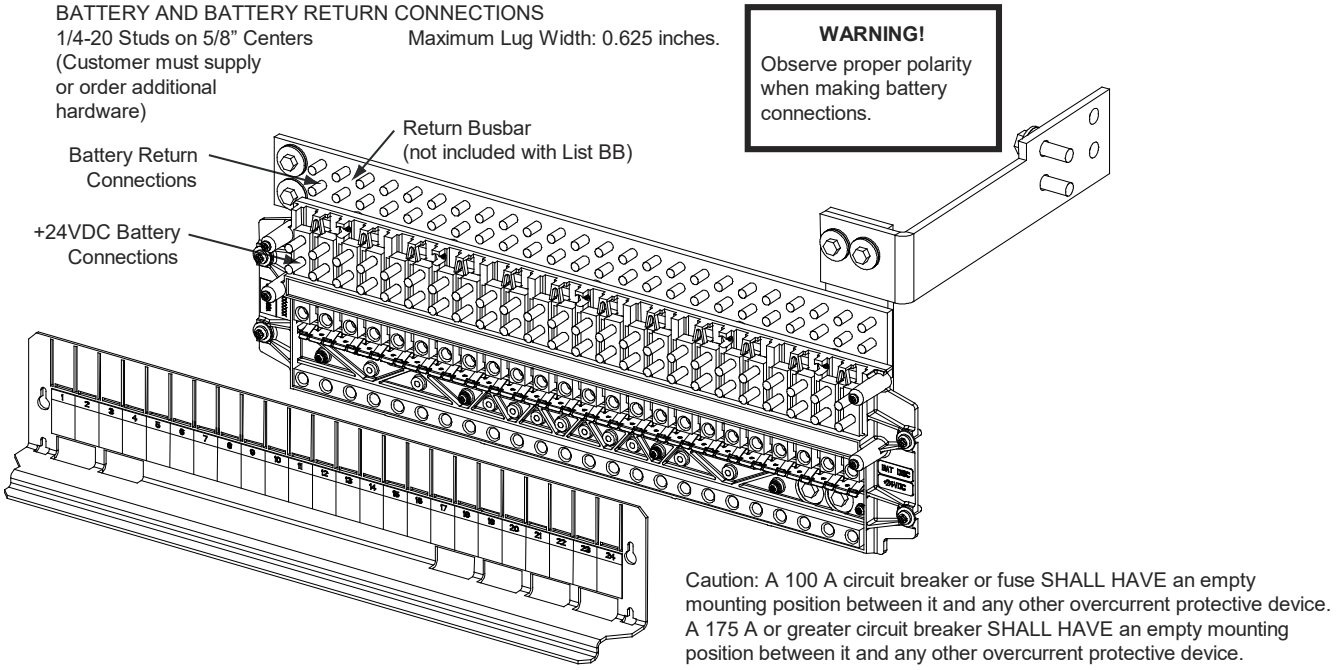


Figure 5.35 List BC: Battery Disconnect Distribution Panel (with Return Busbar) and List BD: Battery Disconnect Distribution Panel (without Return Busbar), (4) GJ/218 Circuit Breaker Battery Disconnect Positions

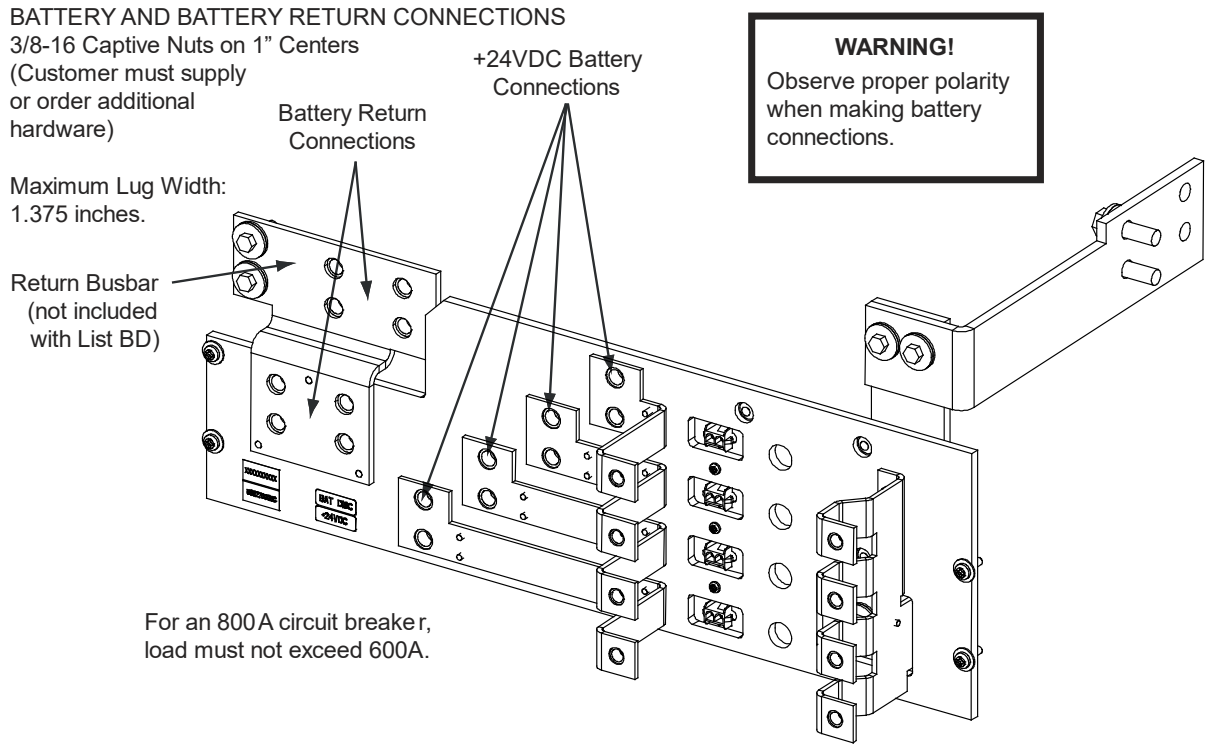


Figure 5.36 List BE: Battery Disconnect Distribution Panel, (2) TPH Fuse Battery Disconnect Position (without Shunts) (without Return Busbar)

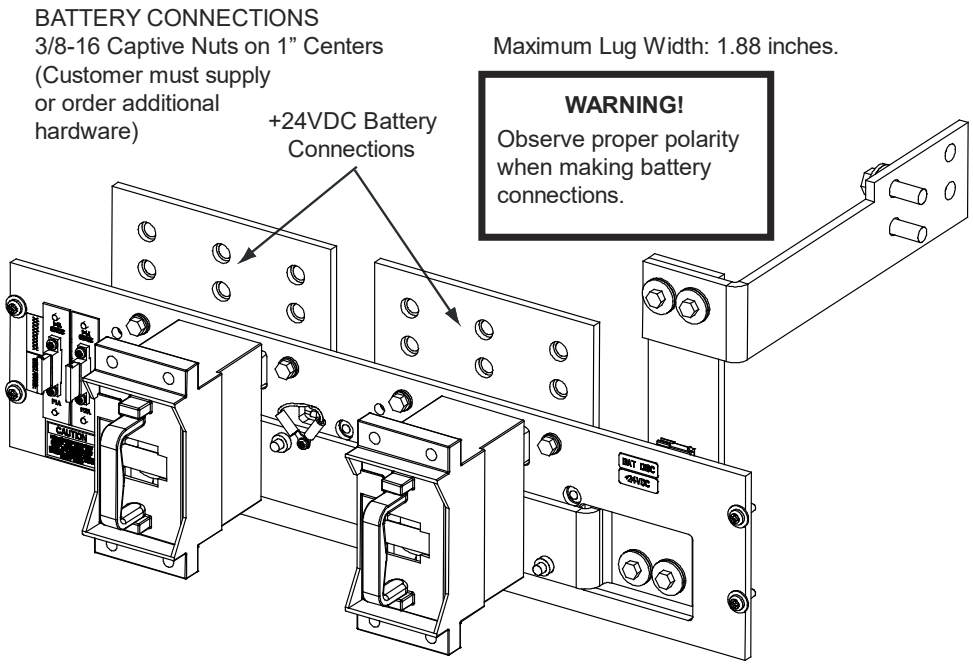


Figure 5.37 List BF: Battery Disconnect Distribution Panel, (2) TPH Fuse Battery Disconnect Positions (with Shunts) (without Return Busbar)

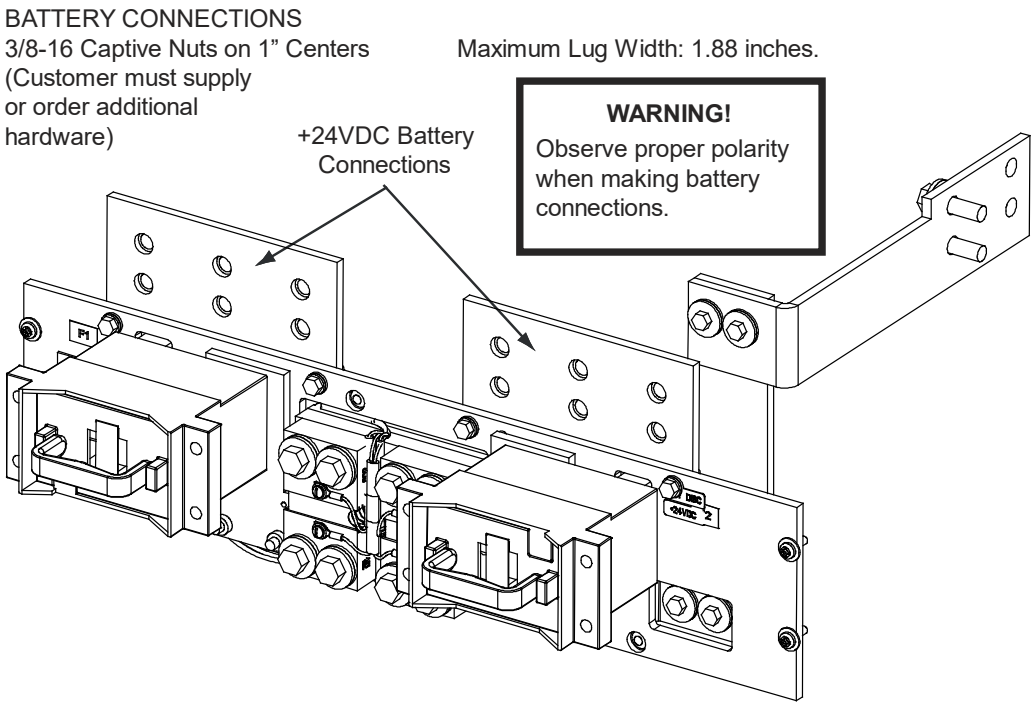


Figure 5.38 List BG: Battery Disconnect Distribution Panel, (4) TPH Fuse Battery Disconnect Positions (without Shunts) (without Return Busbar)

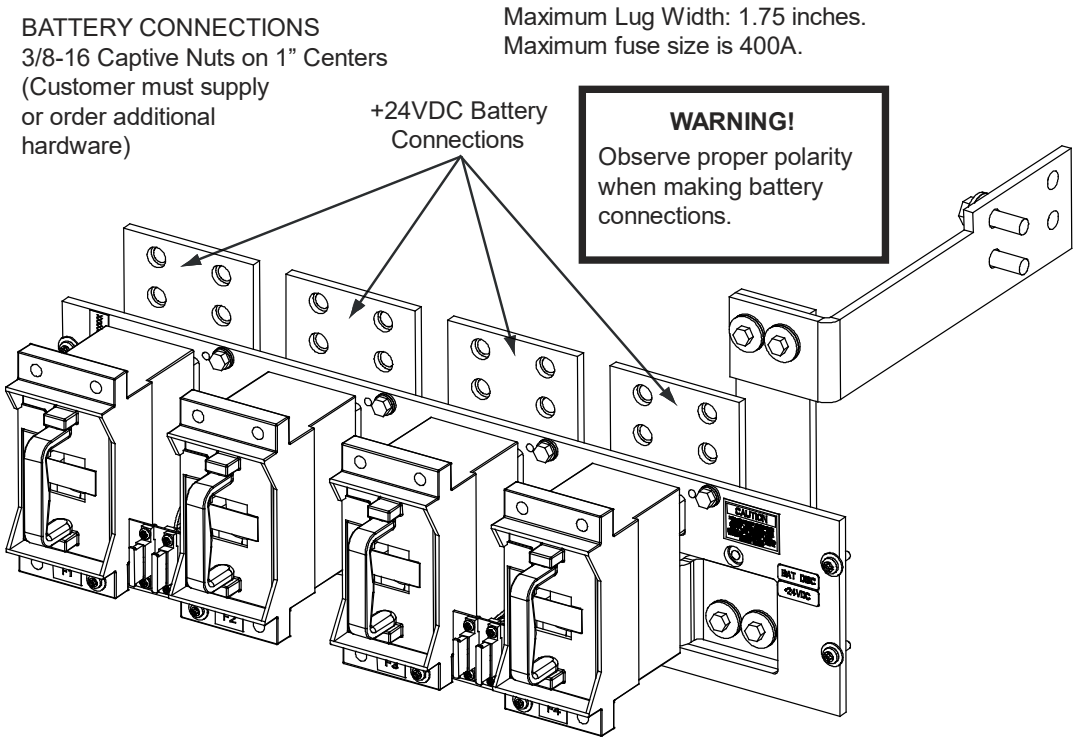
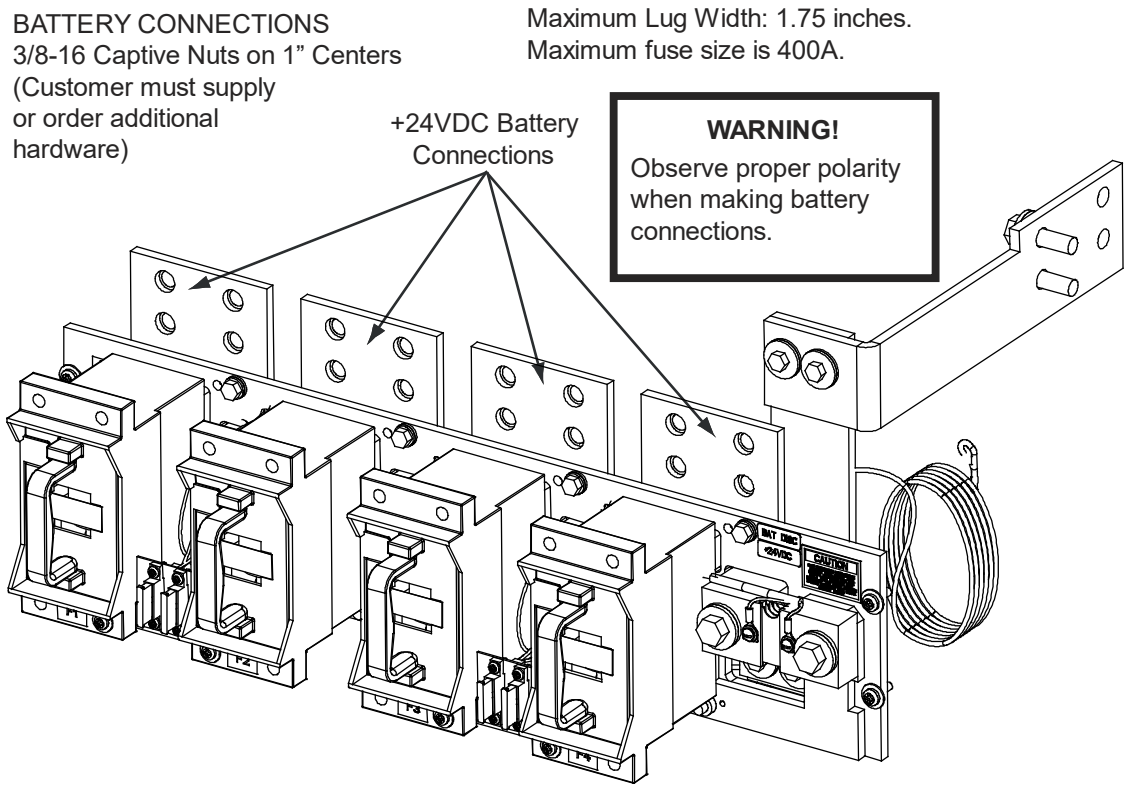


Figure 5.39 List BH: Battery Disconnect Distribution Panel, (4) TPH Fuse Battery Disconnect Positions (with Shunts) (without Return Busbar)

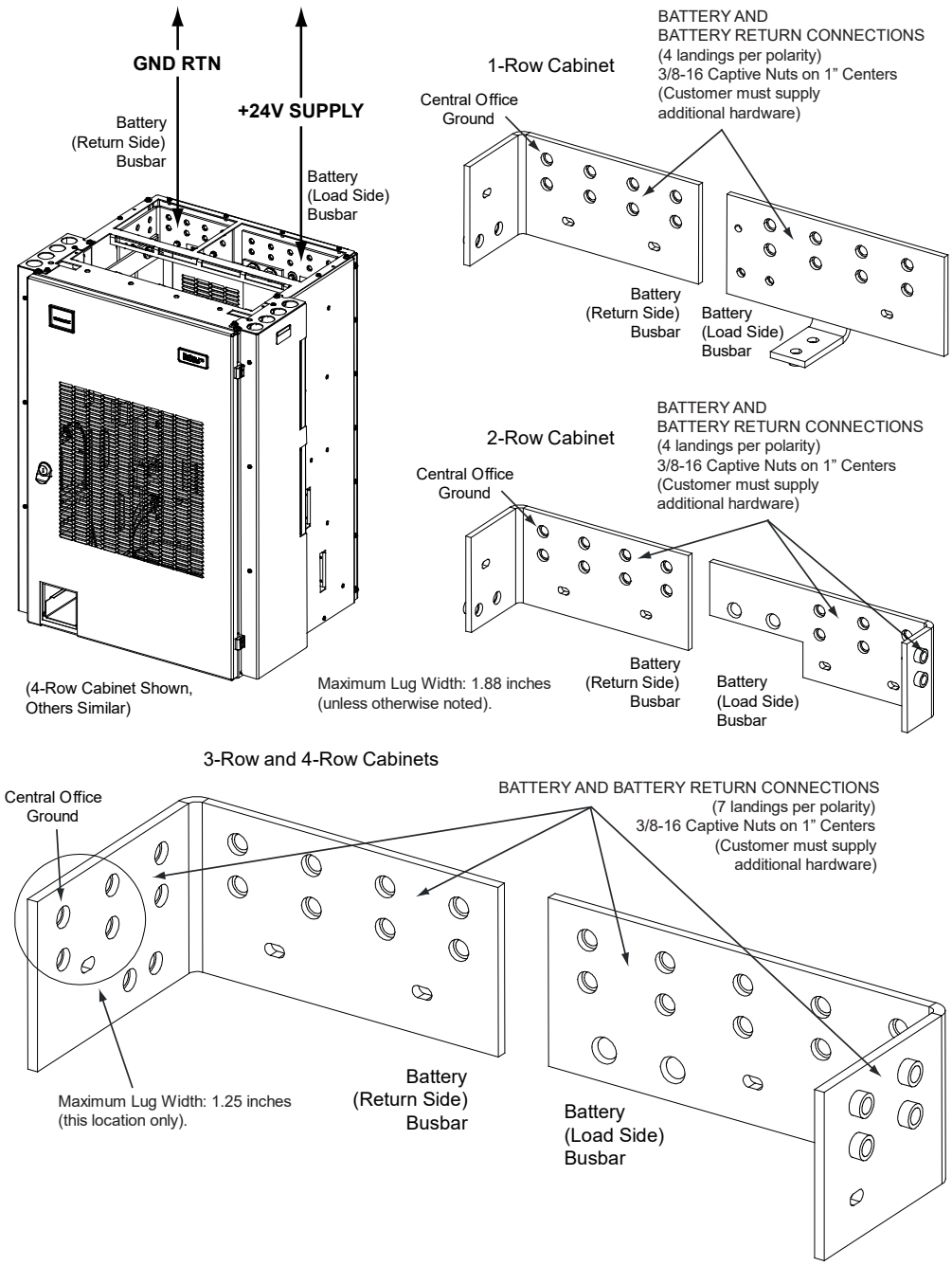


5.7.3 Battery Connections to Distribution Cabinet Battery Busbars

WARNING! Observe proper polarity when making battery connections.

Battery may be connected to the battery busbars located in the distribution cabinet, as detailed in **Figure 5.40**, depending on site requirements.

Figure 5.40 Battery Connections to Distribution Cabinet Battery Busbars



5.8 List 93 Battery Tray

Refer to *Installing and Connecting Batteries in a List 93 Battery Tray (if furnished)* in the MAKING ELECTRICAL CONNECTIONS section of the Installation Instructions (IM581127000) for a complete procedure.

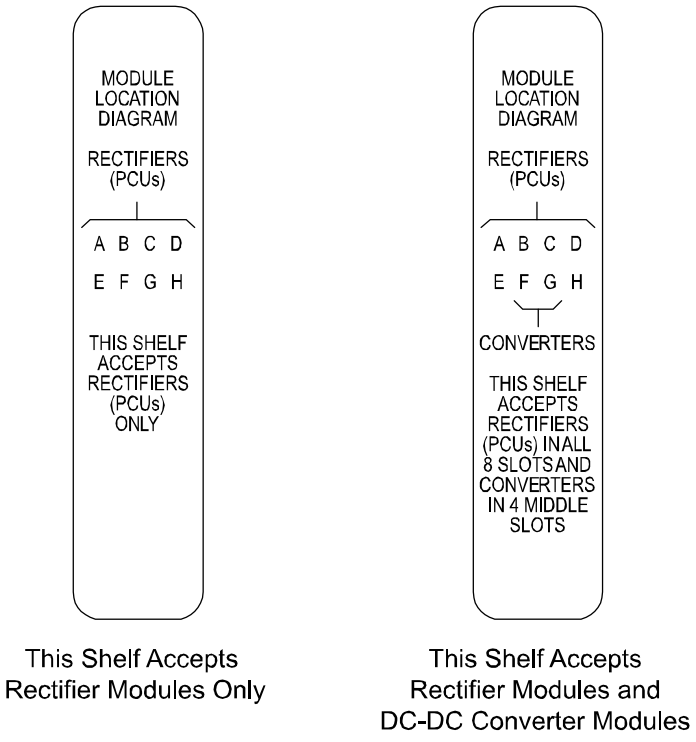
6 Installing the Rectifier and DC-DC Converter Modules

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.

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.

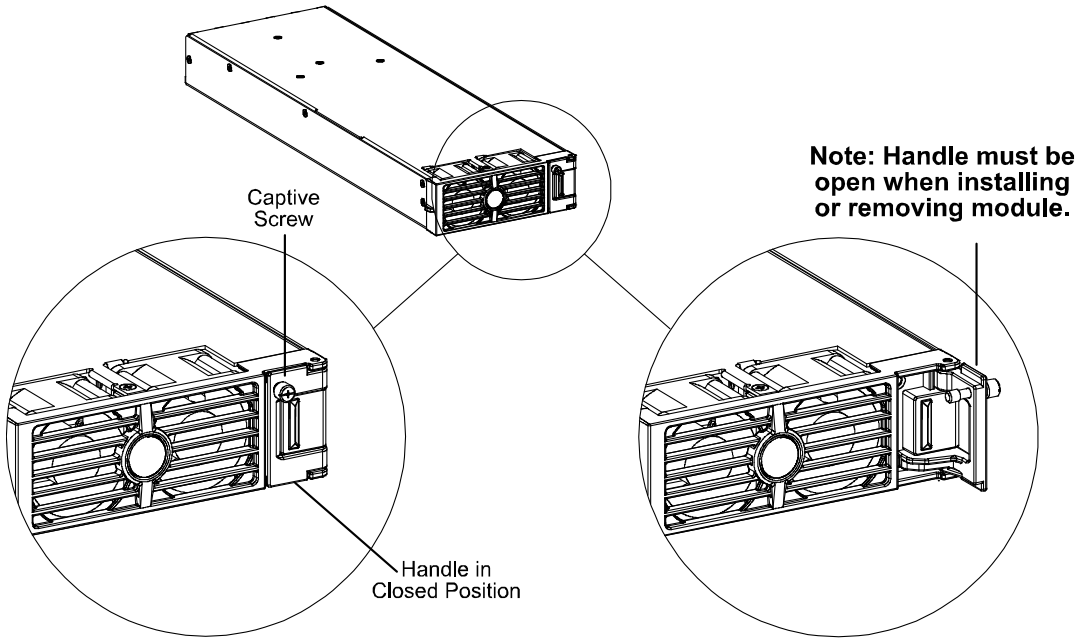
Figure 6.1 Module Location Diagrams (on the front of each shelf)



This Shelf Accepts Rectifier Modules Only

This Shelf Accepts Rectifier Modules and DC-DC Converter Modules

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



7 Initially Starting, Configuring, and Checking System Operation

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 “Physical Installation” 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

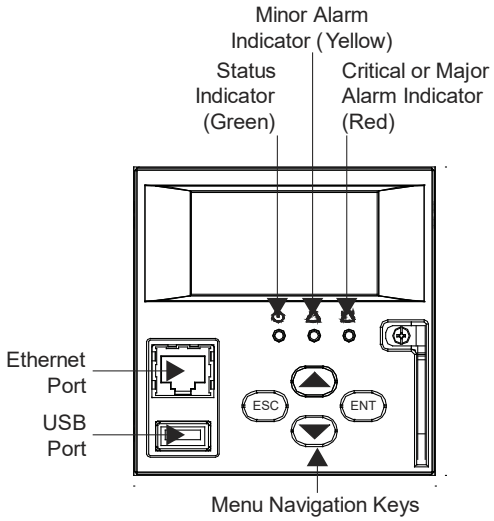
Refer to this section if your system is furnished with an ACU+ Controller.

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



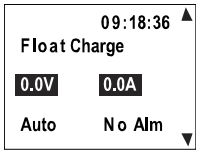
Procedure

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.*

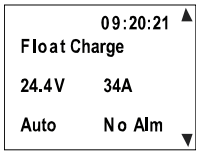
1. After the ACU+ is powered on, the display alternates between the "logo" screen and a screen displaying "Advanced Control Unit Plus Version ***** Starting....

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.

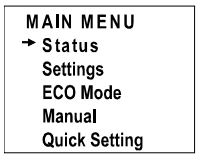


4. When initialization is complete, the Main screen displays voltage and current normally, and no alarms are active.



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.

6. From the Main screen, press ENT to go to the "Main Menu" screen.



7. 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.*

8. 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.*

1. With the Main screen displayed, press ESC. A screen displays the serial number and software version.
2. Press ENT. A screen displays the hardware version and MAC address.
3. Press ENT. A screen displays the configuration version number.
4. 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.*

13. 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

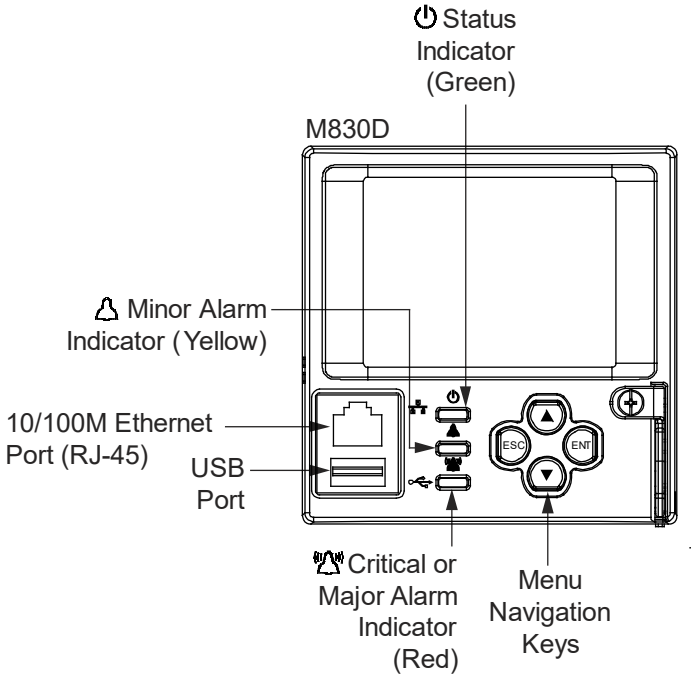
Refer to this section if your system is furnished with an NCU Controller.

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

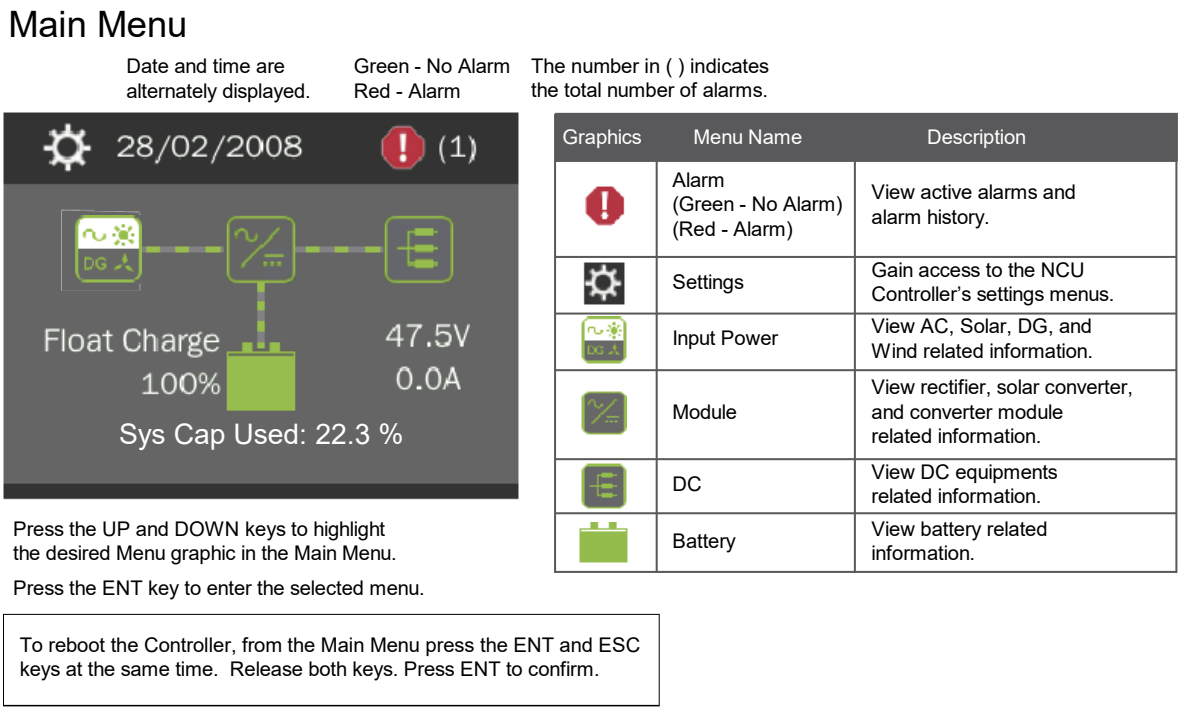


Procedure

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.*

1. After the NCU is powered on, the display shows the "logo" screen. The controller is initializing.
2. 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.
3. The Main Menu displays. See **Figure 7.3**.

Figure 7.3 NCU Local Display Main 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.

4. 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.

5. 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.*

6. 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 68.

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 the *DOWN* key. A screen displays the NCU file system and MAC address.
3. 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 68.

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 Capacity	Main Menu / Settings Icon / Batt Settings / Batt1 Settings or Batt2 Settings / Rated Capacity.
Battery Charge Temperature Compensation	Main Menu / Settings Icon / Batt Settings / Temp Comp (enter parameters).
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

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.

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 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**.

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