NetSure™ 7100 Series
-48 VDC Power System

Installation Manual

Specification Number: 582127000100, 582127000101, 582127000102, 582127000103, 582127000203, 582127000500
582127000501, 582127000502, 582127000503
Model Number: 7100

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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 v.

Safety and Regulatory Statements

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

Déclarations de Sécurité et de Réglementation

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

1 Customer Documentation Package

This document (IM582127000100) provides *Installation Instructions* for Vertiv™ NetSure™ -48 VDC Power System Model 7100, Spec. No. 582127000, Lists 100, 101, 102, 103, 203, 500, 501, 502, and 503 only.

The complete Customer Documentation Package for Lists 100, 101, 102, 103, 203, 500, 501, 502, and 503 consists of…

-48 VDC Power System Installation Manual

- Power System Installation Instructions: IM582127000100

-48 VDC Power System User Manual

- Power System User Instructions: UM582127000100

NCU Controller User Manual

- NCU Controller User Instructions: UM1M830BNA

USB Drive with All Customer Documentation for 582127000

Applicable documents for this system are as follows.

- Power System Installation Instructions: IM582127000100 (instructions for Lists 100, 101, 102, 103, 203, 500, 501, 502, and 503)
- Power System User Instructions: UM582127000100 (instructions for Lists 100, 101, 102, 103, 203, 500, 501, 502, and 503)
- NCU Controller User Instructions: UM1M830BNA
- Rectifier Instructions: UM1R482000e3
- -48 VDC to +24 VDC Converter Instructions: UM1C48241500
- -48 VDC to -58 VDC Converter Instructions: UM1C48582000P3
- Power System “System Application Guide”: SAG582127000
- Engineering Drawings
- Also provided on the USB drive is a controller configuration drawing and the controller configuration files loaded into the controller as shipped.

2 Installation Acceptance Checklist

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

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

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

Installing the System

- ❑ Relay Rack Secured to Floor
- ❑ Optional Battery Tray Installed
- ❑ Optional Battery Tray Battery Disconnect Circuit Breaker Installed
- ❑ Optional Lug Adapter Busbar Kits Installed
- ❑ Circuit Breakers Installed
- ❑ Fuses Installed

Setting Jumper and Switch Options

- ❑ Jumper on System Interface Board Set
- ❑ Factory Switch Setting on IB2 Interface Board Verified
- ❑ Factory Switch Setting on Optional EIB Interface Board Verified

Making Electrical Connections

- ❑ Relay Rack Frame Ground Connection Made
- ❑ Central Office Ground Connection Made
- ❑ SPD (Surge Protection Device) (if furnished) Earth Ground Connection Made
- ❑ AC Input and AC Input Equipment Grounding Connections Made
- ❑ External Alarm, Reference, Monitoring, and Control Connections Made
- ❑ Ethernet Connection Made
- ❑ Load Connections Made
- ❑ Battery Connections Made
- ❑ Batteries Installed and Connected in the Battery Trays (if furnished)

Installing the Modules

- ❑ Rectifier and Converter Modules Installed

Initially Starting the System

- ❑ System Started, Configured, and Checked

3 Installing the System

3.1 General Requirements

- This product is intended only for installation in a restricted access location on or above a non-combustible surface.
- This product must be located in a controlled environment with access to Crafts persons only.
- This product is intended for installation in network telecommunication facilities (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).

- This product is intended for connection to the common bonding network in a network telecommunication facility (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).
- The DC return connection to this system can remain isolated from system frame and chassis (DC-I).
- This system is suitable for installation as part of the Common Bonding Network (CBN).
- The installer should be familiar with the installation requirements and techniques to be used in securing the relay rack to the floor.
- Rectifier, converter, and mounting assembly ventilating openings must not be blocked and temperature of air entering rectifiers and converters must not exceed rated operating ambient temperature range found in SAG582127000.
- Clearance requirements are:

  a) Recommended minimum aisle space clearance for the front of the bay is 2' 6".

  b) Recommended minimum aisle space clearance for the rear of the bay to a wall or other solid surface is that which is specified for proper module mounting assembly ventilation. Refer to System Application Guide SAG582127000 for ventilation spacing requirements.

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

3.2 Securing the Relay Rack to the Floor

Secure the relay rack to the floor per site requirements. Refer to “General Requirements” on page 2.

Ventilation Requirements

Refer to the “General Requirements” on page 2.

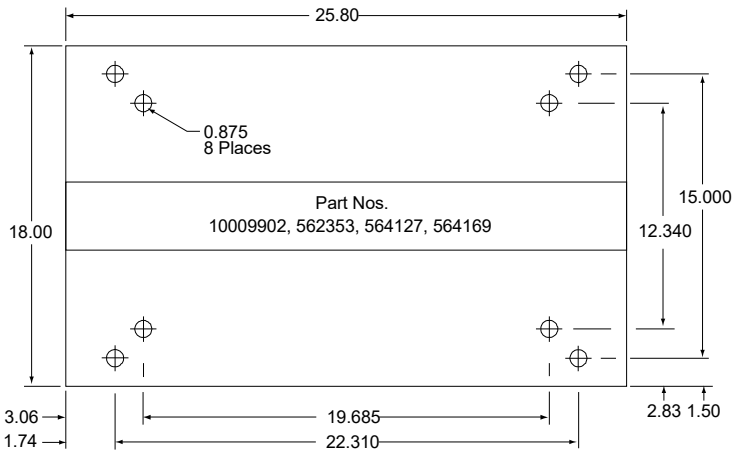
Relay Rack Floor Mounting Dimensions

Refer to Figure 3.1 for relay rack floor mounting dimensions.

Optional Relay Rack Isolation Kit

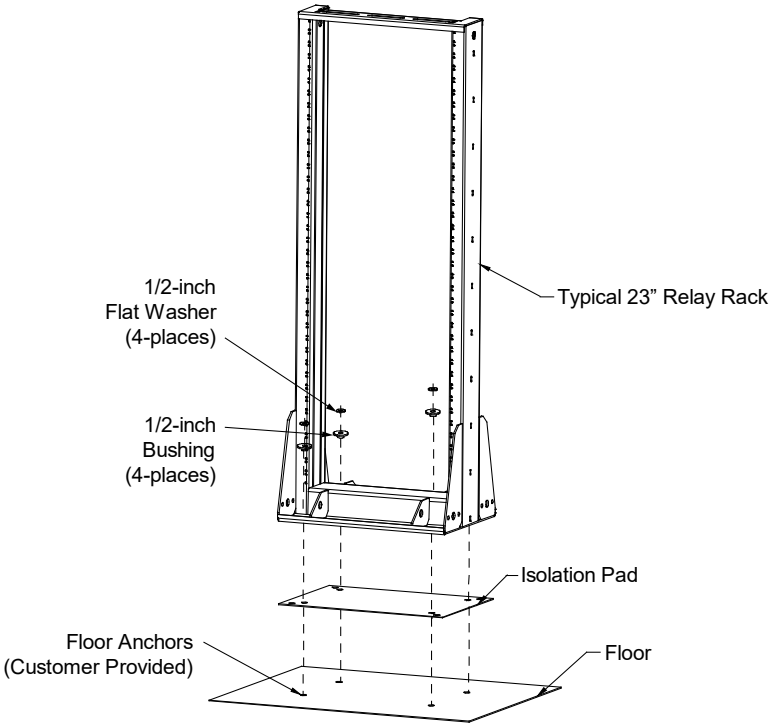
Refer to Figure 3.2 when using the Optional Relay Rack Isolation Kit.

Figure 3.1 Relay Rack Floor Mounting Dimensions



Notes:
1. All dimensions are in inches.

Figure 3.2 Optional Relay Rack Isolation Kit Mounting



3.3 Installing Battery Trays

If battery trays are furnished with the system, battery trays are factory installed and wired. If battery trays are installed in the field, customer must install and wire to the battery trays per the following procedures.

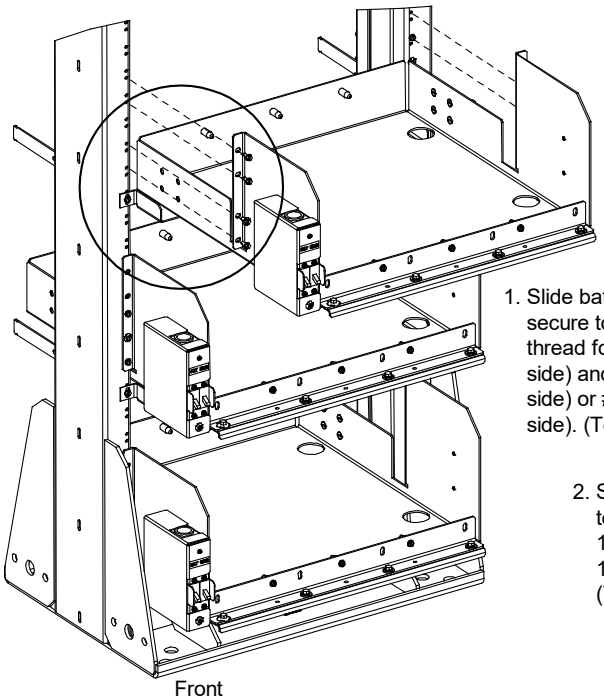
DANGER! The relay rack must be securely anchored to the floor before a battery tray is installed.

Installing Battery Trays

Procedure

1. To install battery trays, perform the procedure detailed in Figure 3.3.

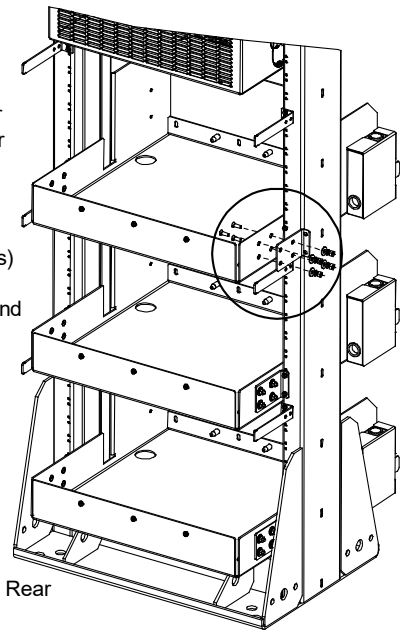
Figure 3.3 Installing Battery Trays

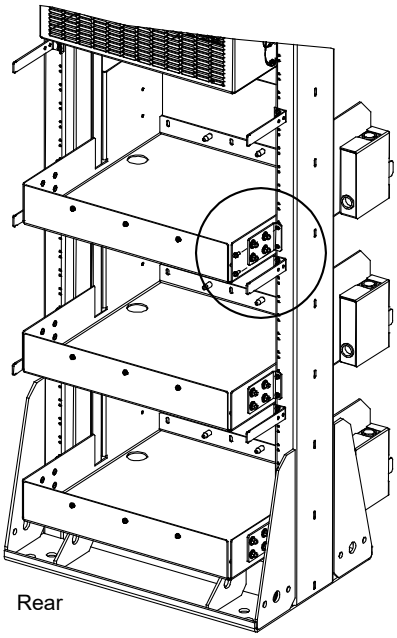


P/N 562674
Battery Tray

1. Slide battery tray into relay rack and secure to relay rack with 12-24 x 1/2" thread forming hex head screws (4 places per side) and #10/12 ground washers (1 place per side) or #12 flat washers (3 places per side). (Torque to 70 in-lbs).

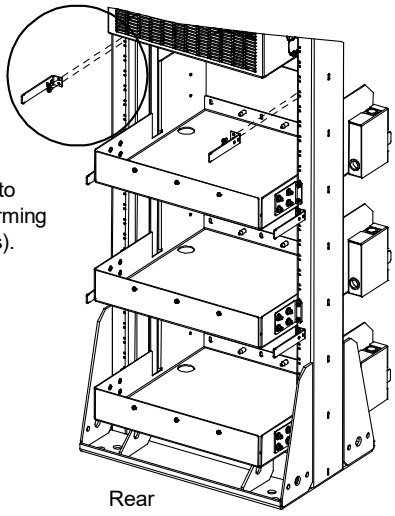
2. Secure rear angle brackets (both sides) to battery tray with 1/4-20 x 3/4” bolts, 1/4” flat washers, 1/4” lock washers, and 1/4” nuts. (4 places per bracket) (Torque to 84 in-lbs).





3. Secure rear angle brackets (both sides) to relay rack with 12-24 x 1/2" thread forming hex head screws (2 places per side) and #10/12 ground washers (1 place per bracket) or #12 flat washers (1 place per bracket). (Torque to 70 in-lbs).

4. Secure cabling brackets (both sides) to relay rack with 12-24 x 1/2" thread forming hex head screws. (Torque to 70 in-lbs).

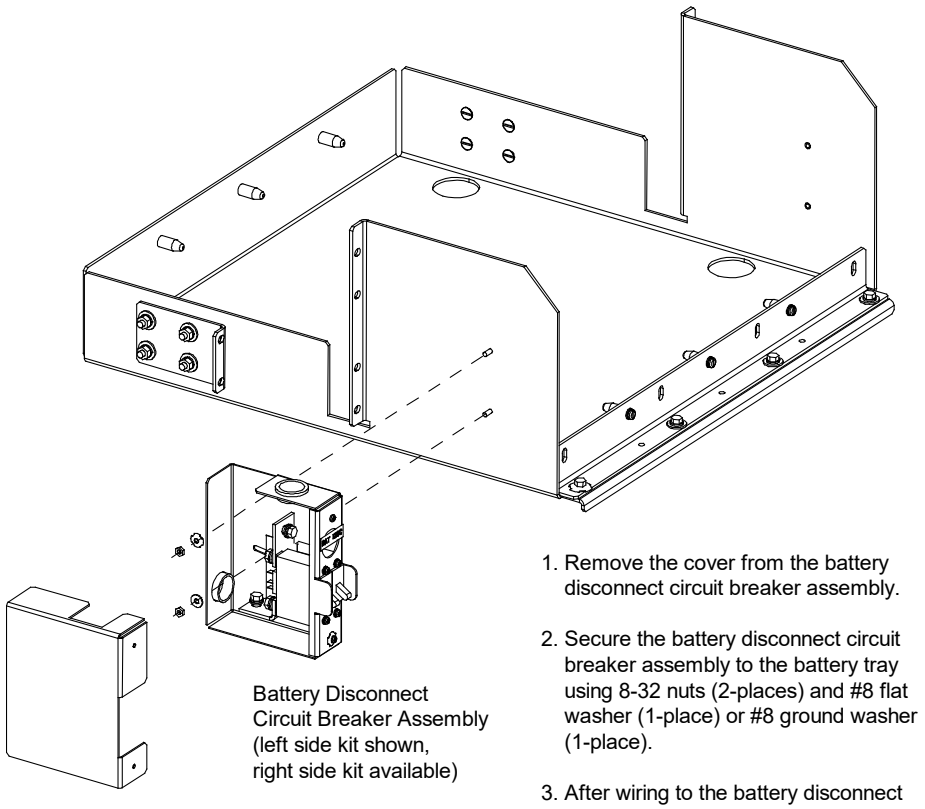


Installing Battery Disconnect Circuit Breakers onto Battery Trays

Procedure

1. To install battery, disconnect circuit breakers onto battery trays, perform the procedure detailed in Figure 3.4.

Figure 3.4 Installing Battery Disconnect Circuit Breakers onto Battery Trays



Connecting Battery Tray Cables from the Battery Trays to the System Busbars

Procedure

1. Connect battery tray cables to the system's -48V and return busbars. Battery tray cables are labeled +1, -1, +2, -2, +3, and -3. Connect the negative cables to the system's -48V busbar. Connect the positive cables to the system's return busbar. Refer to Figure 3.5. Refer also to the wiring diagram provided in Figure 3.6.
2. Rout the cables into the battery trays. Route the cables labeled +1 and -1 into the bottom tray. Route the cables labeled +2 and -2 into the middle tray. Route the cables labeled +3 and -3 into the top tray.
3. Connect the -1, -2, and -3 cables to the battery disconnect circuit breaker located on the respective battery tray. Refer to Figure 3.8. Cables labeled +1, +2, and +3 are connected to the battery strings in a later procedure.

Figure 3.5 Cables from Battery Trays to System Power Busbars

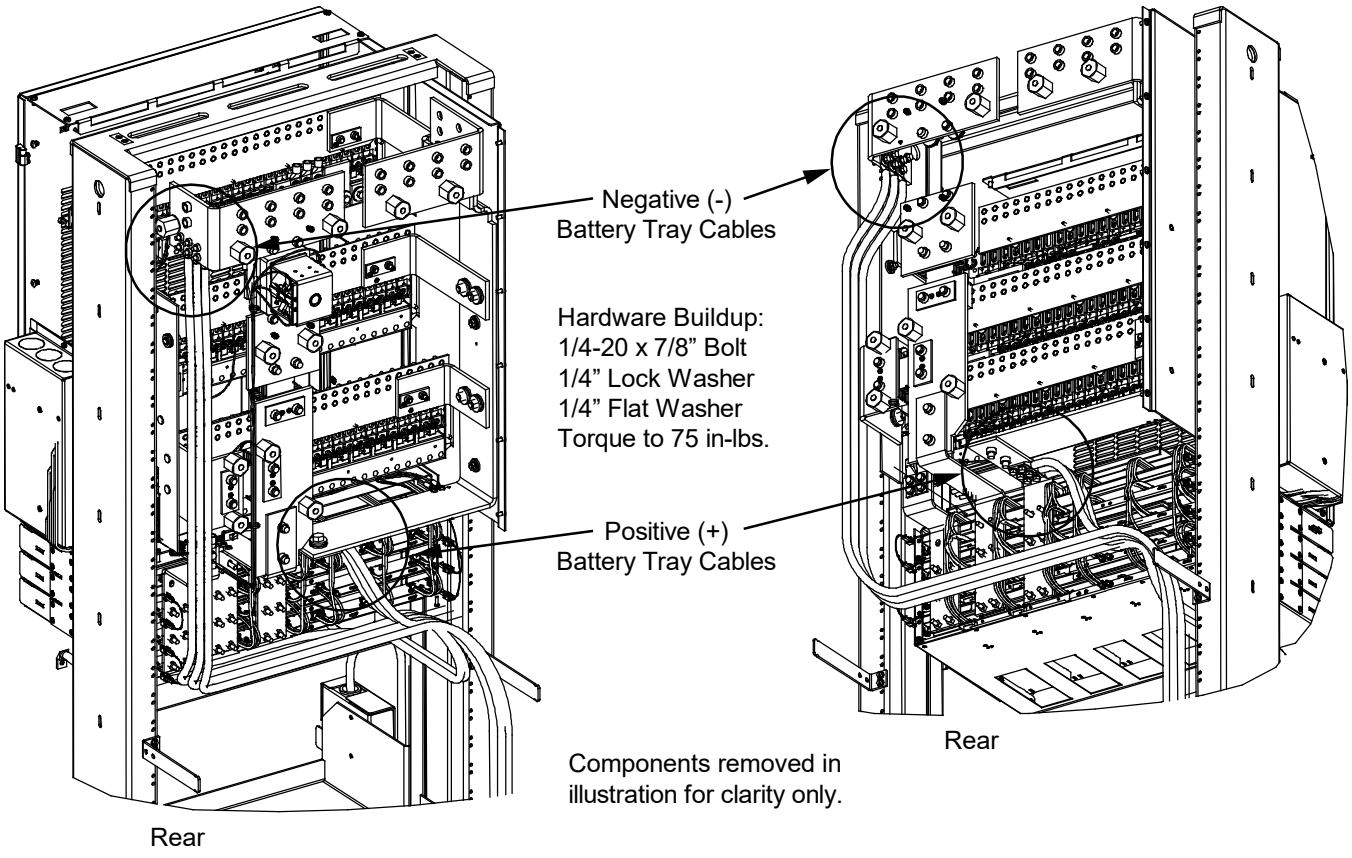


Figure 3.6 Battery Tray Wiring Diagram (582127000103 only)

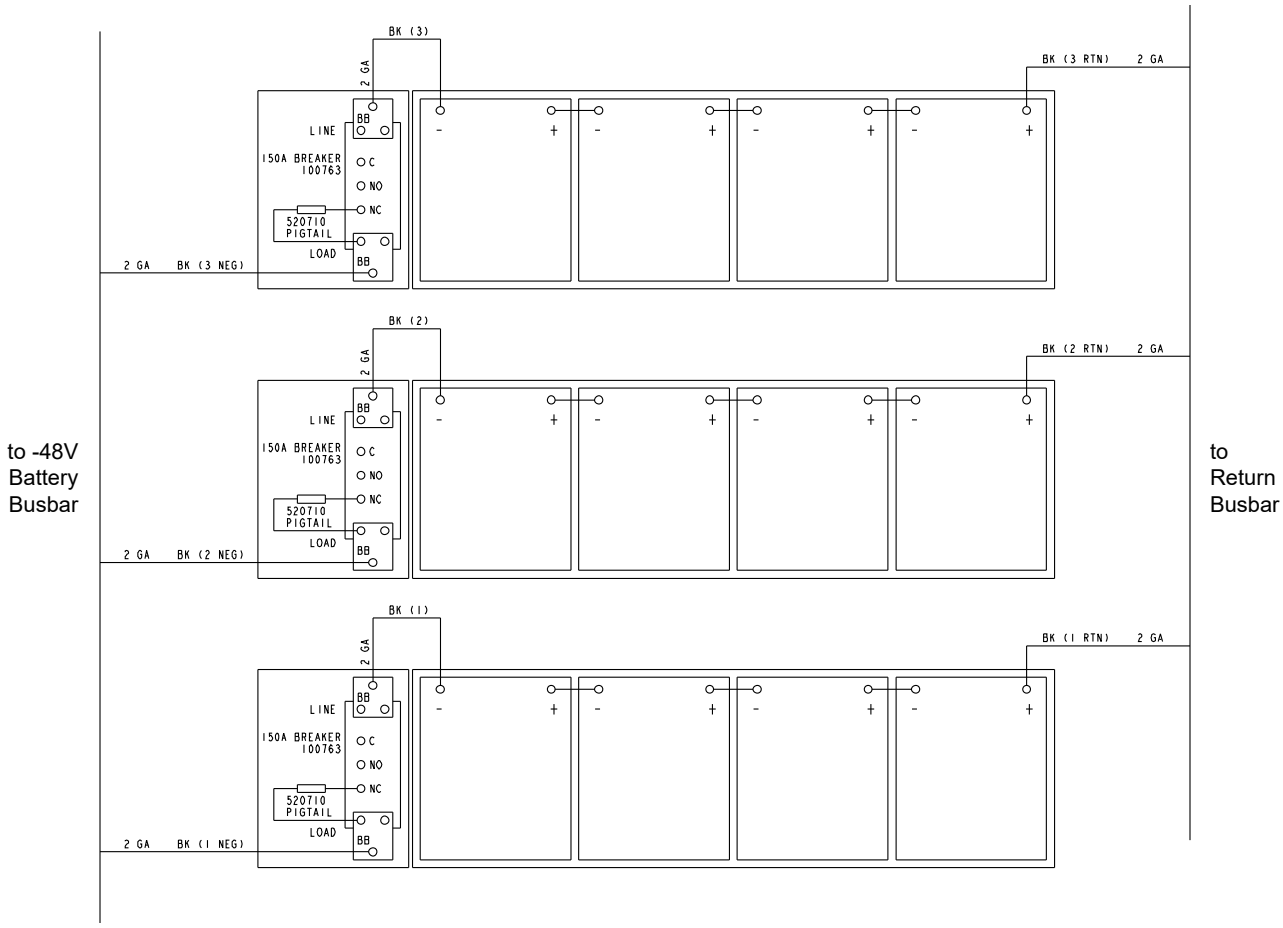
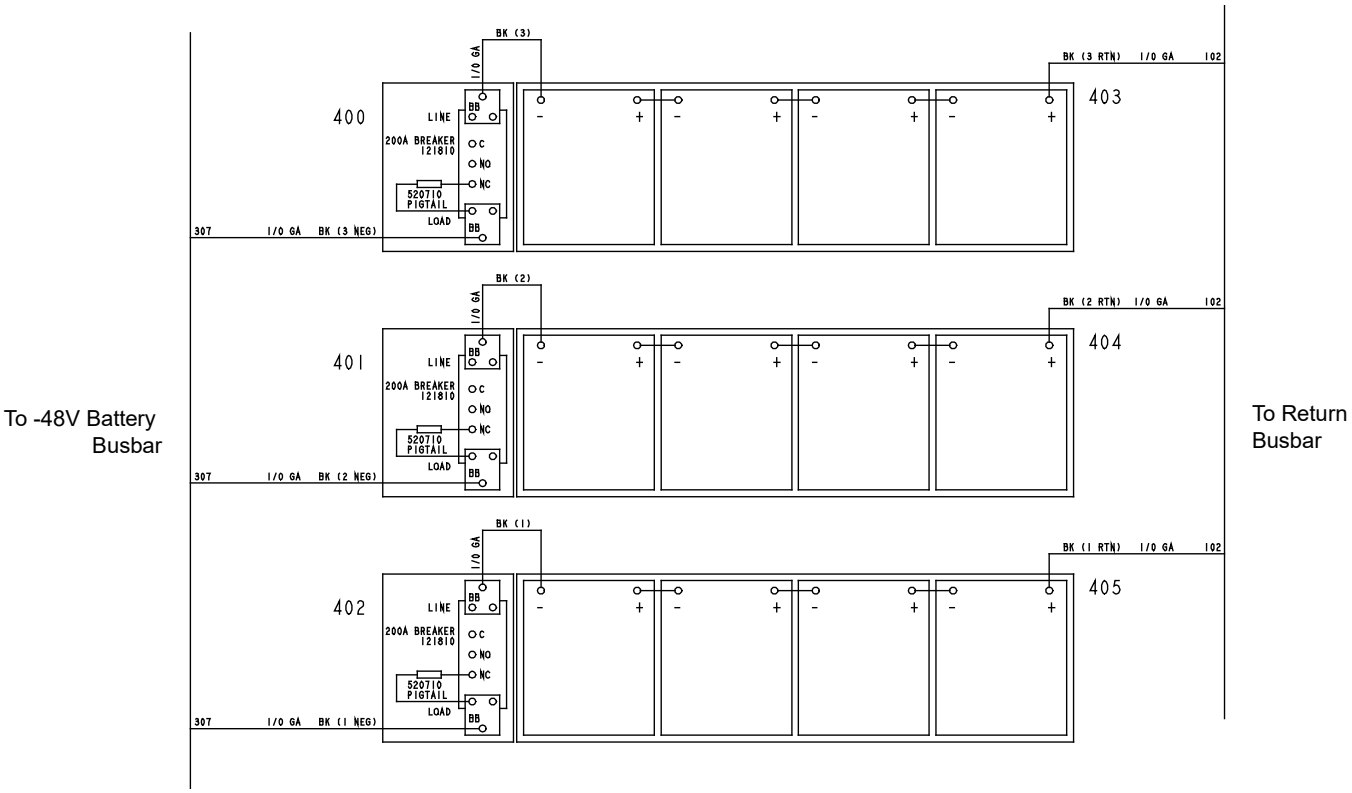


Figure 3.7 Battery Tray Wiring Diagram (582127000203 and 582127000503 only)



NOTE! *Same diagram applies to 582127000101 and 582127000501 (one battery tray) and 582127000102 and 582127000502 (two battery trays).*

Connecting Battery Tray Cables to the Battery Tray's Battery Disconnect Circuit Breaker

Procedure

1. Connect battery tray cables labeled (-) to the battery disconnect circuit breaker located on each battery tray. Refer to Figure 3.8.
2. Rout the cables into the battery trays. The unconnected ends are connected to the battery strings in a later procedure.

Battery Tray Battery Disconnect Circuit Breaker Alarm Wiring

Procedure

1. Connect alarm jumper P/N 524384 to the battery disconnect circuit breakers located on the battery trays by performing the procedure detailed in Figure 3.8.
2. Connect the stripped end of alarm jumper P/N 524384 to TB1 located on the System Interface Board. –48VDC is applied to the alarm lead when the circuit breaker is in the OFF position. Refer to Figure 3.8. Refer also to Figure 5.4.

Connecting Battery Temperature Probes

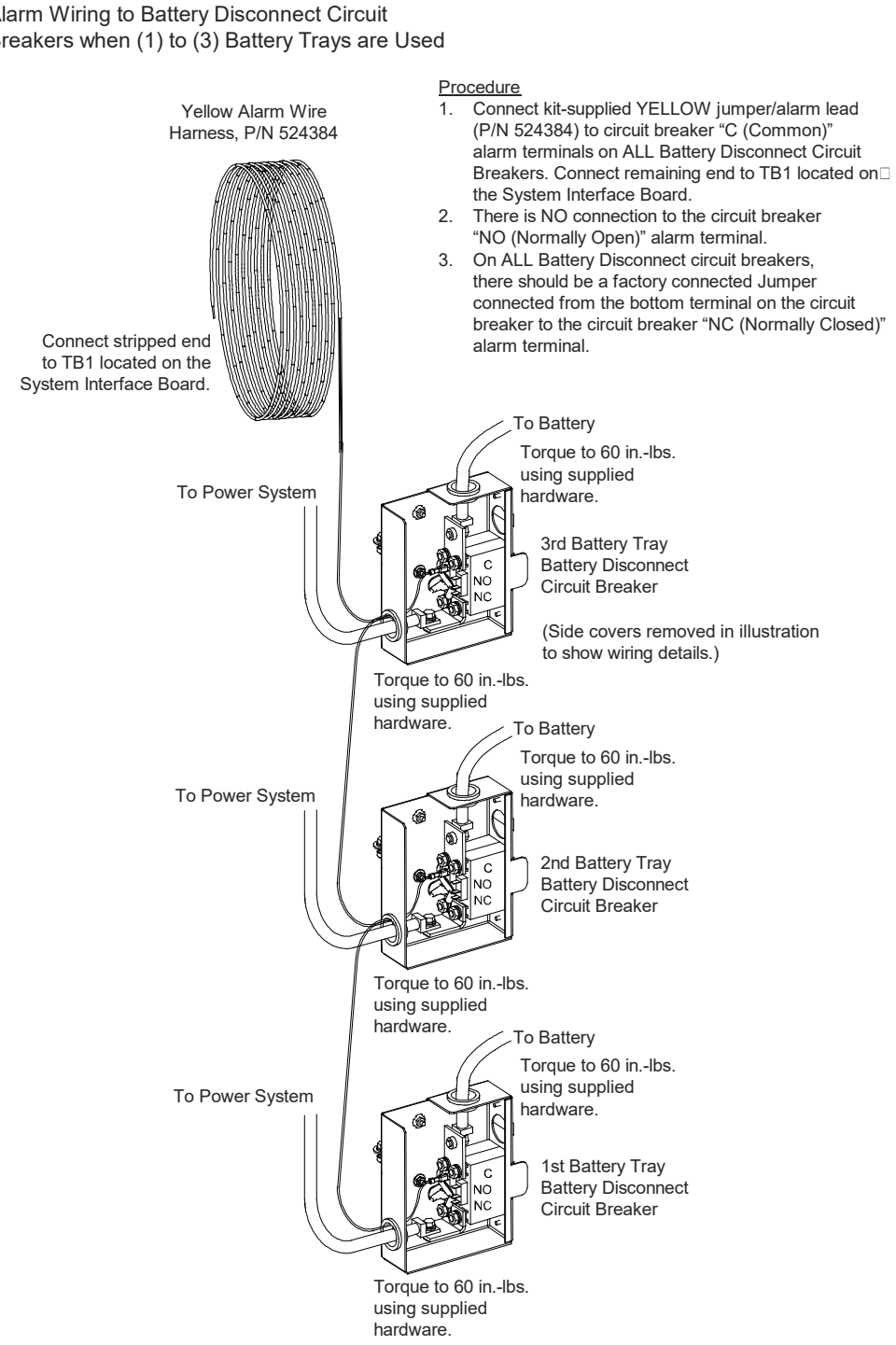
Procedure

Three battery temperature probes are provided with Lists 100, 103, 203, 500 and 503, two probes with List 102 and 502, and one probe with List 101 and 501. These connections may be provided from the factory.

1. Connect a temperature probe to the System Temp 1 input on the System Interface Board. Route this probe to the bottom battery tray. Refer to Figure 5.4.

2. Connect a temperature probe to the System Temp 2 input on the System Interface Board. Route this probe to the center battery tray. Refer to Figure 5.4.
3. Connect a temperature probe to the Temp 1 input on the IB2-1 interface board. Route this probe to the top battery tray. Refer to Figure 5.5.
4. In the event there is excess length of the probe wires, coil the wires up and tie in a convenient location along the path of the battery power cable.

Figure 3.8 Battery Tray Battery Disconnect Circuit Breaker Alarm Wiring

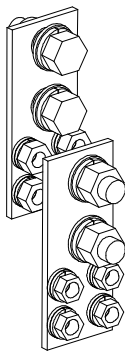


3.4 Installing Optional Lug Adapter Busbar Kits, Part Nos. 534449 and 514714

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

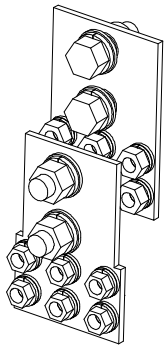
Contents of Kit P/N 534449 (for 2-pole circuit breakers)

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



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

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



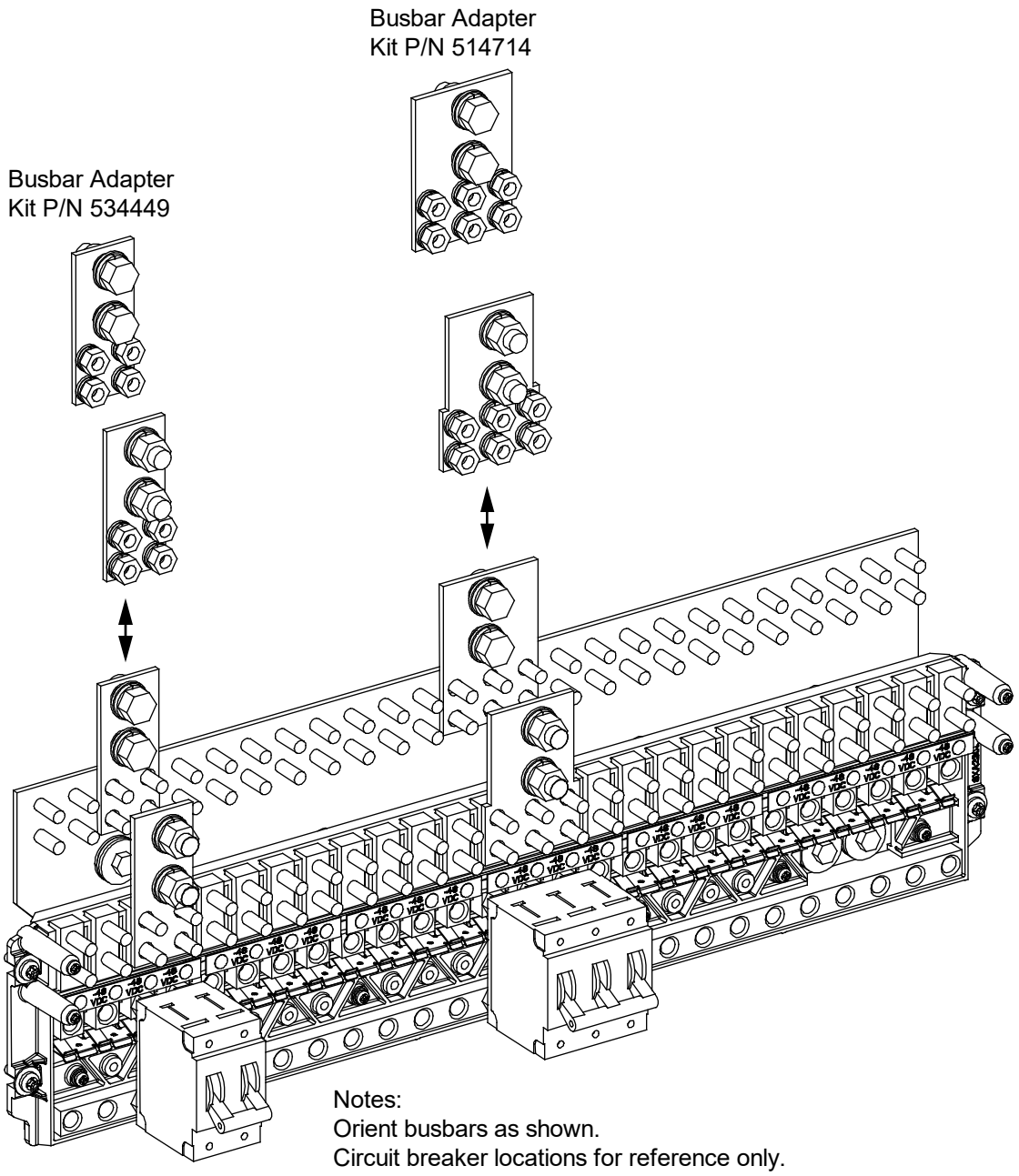
Perform the following steps to install the lug adapter busbars.

Procedure

Refer to Figure 3.9 as the procedure is performed. Note also the restrictions on location in Figure 3.9.

1. Open the distribution cabinet’s front door by turning the latch in the counterclockwise position.
2. Install the lug adapter busbars as shown in Figure 3.9. Apply anti-oxidizing compound to busbar mating surfaces before assembling. Recommended torque is 72 in-lbs using the supplied 1/4” bolts and hardware.
3. Orient the load lug hardware as shown in Figure 3.9. Recommended torque is 300 in-lbs using the supplied 3/8” bolts and hardware.
4. Close the distribution cabinet’s front door. Turn the latch clockwise to secure the door.

Figure 3.9 Installing Lug Adapter Busbar Kits



3.5 Installing Circuit Breakers and Fuses

Installing Bullet Nose Type Fuseholders and TPS/TLS Fuses

CAUTION! A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. 100 A circuit breakers can be used without a space provided the continuous current in each 100 A device does not exceed 64 A. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Refer to SAG582127000 for any other restrictions.

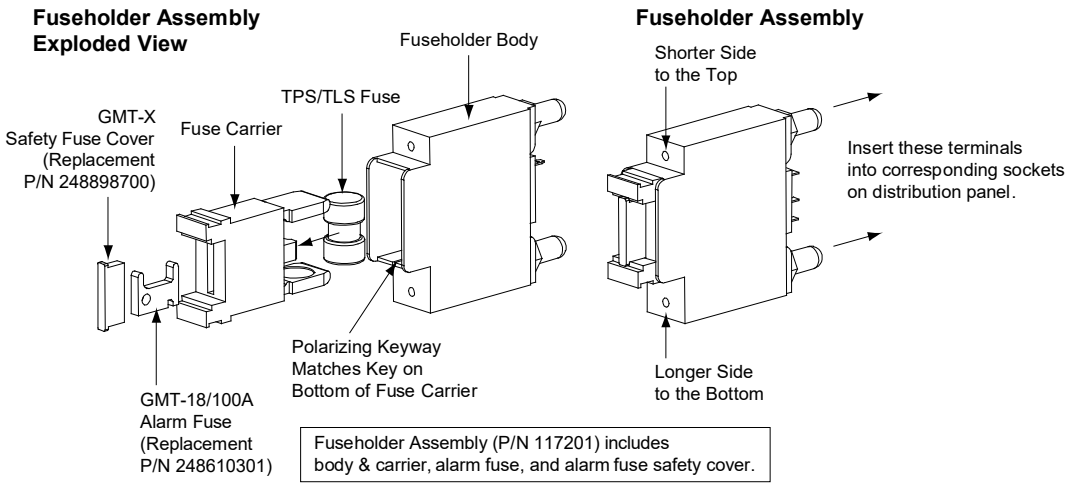
Refer to the following procedure and install bullet nose type fuseholders and appropriately sized TPS/TLS fuses into the proper mounting positions in the distribution cabinet.

Procedure

NOTE! *Refer to Figure 3.10 as this procedure is performed.*

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Orient the fuseholder as shown in Figure 3.10. Insert the terminals on the rear of the fuseholder into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the fuseholder makes contact with the alarm terminal on the spring strip. Push fuseholder in firmly until fully seated in the distribution panel.
3. When all fuseholders are installed, install an appropriately sized TPS/TLS fuse in each. To do this, remove the fuse carrier from the mounted fuseholder body. Hold the fuseholder body while you pull the fuse carrier from the body. Slide the fuse in place between the contacts of the fuse carrier. When done, push the fuse carrier back into the fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
4. Verify that an 18/100 ampere alarm fuse is present in each fuseholder and that a plastic safety cover is installed on this fuse.
5. Record all fuse sizes on the label provided on the shield.
6. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.10 Installing a Bullet Nose Type Fuseholder and TPS/TLS Fuse



Installing Bullet Nose Type Circuit Breakers

CAUTION! A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. 100 A circuit breakers can be used without a space provided the continuous current in each 100 A device does not exceed 64 A. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Refer to SAG582127000 for any other restrictions.

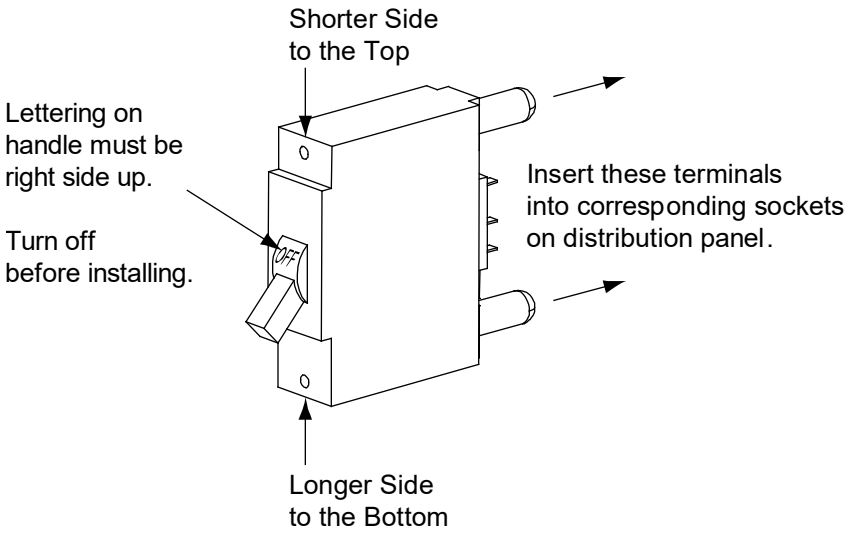
Refer to the following procedure and install appropriately sized bullet nose type circuit breakers into the proper mounting positions in the distribution cabinet.

Procedure

NOTE! *Refer to Figure 3.11 as this procedure is performed.*

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Ensure that the circuit breaker is in the OFF position and is of the correct rating. Orient the circuit breaker as shown in Figure 3.11. Insert the terminals on the rear of the circuit breaker into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the circuit breaker makes contact with the alarm terminal on the spring strip. Push distribution device in firmly until fully seated in the distribution panel.
3. Record all circuit breaker sizes on the label provided on the shield.
4. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.11 Installing a Bullet Nose Type Circuit Breaker



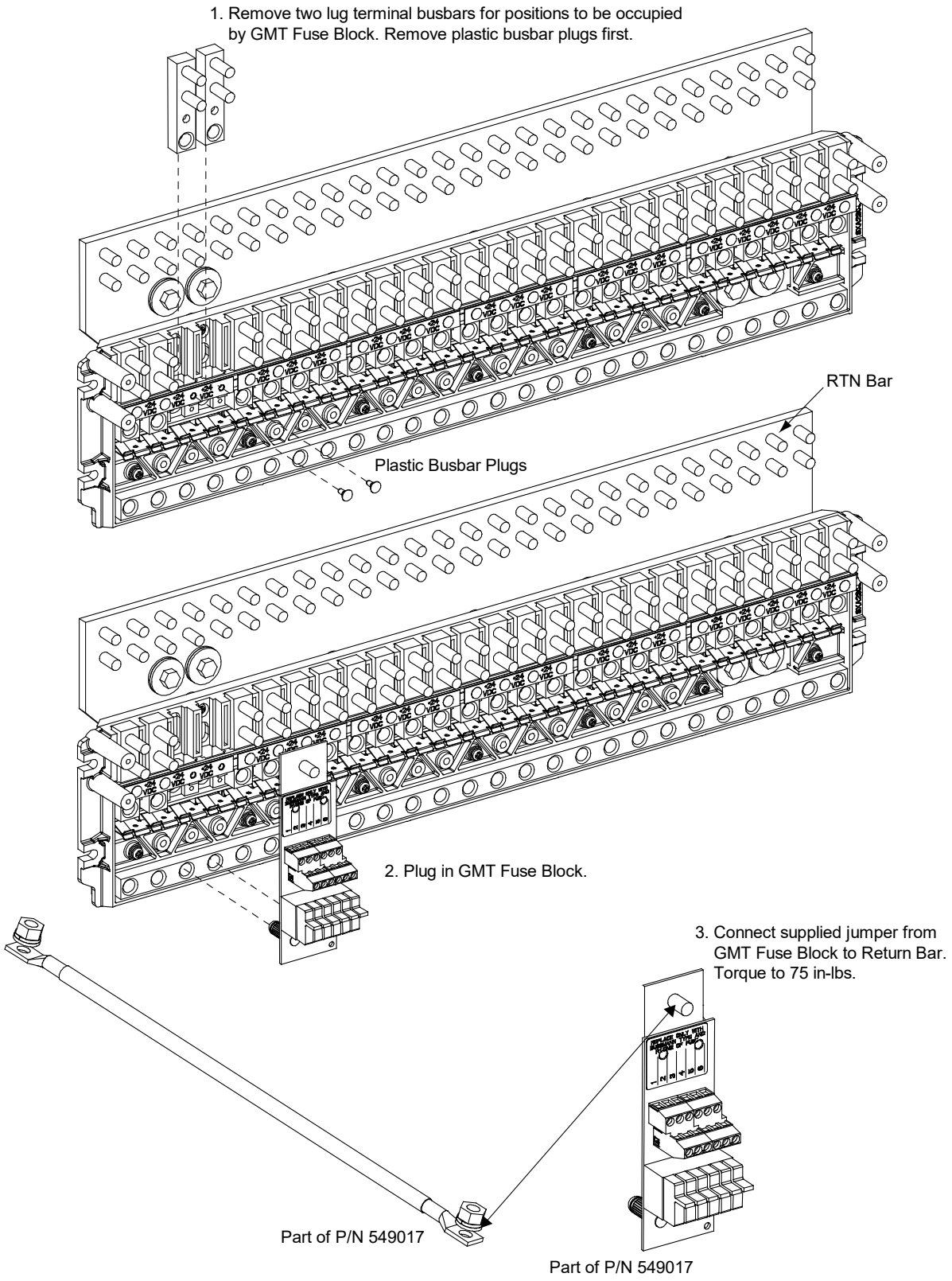
Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017)

NOTE! *Refer to Figure 3.12 as this procedure is performed.*

Procedure

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position.
2. Follow the steps in Figure 3.12.
3. Install an appropriately sized GMT fuse in each fuse mounting position on the GMT Distribution Fuse Block as required. If dummy fuses are installed, first remove the dummy fuse.
   a) Verify that dummy fuses are installed in all unused fuse positions on the GMT distribution fuse block.
   b) Verify that a plastic safety cover is installed on all GMT fuses on the GMT distribution fuse block.
4. Record all fuse sizes (installed on the GMT distribution fuse block) on the label provided on the shield.
5. Close the distribution cabinet's front door. Turn the latch clockwise to secure the door.

Figure 3.12 Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017)

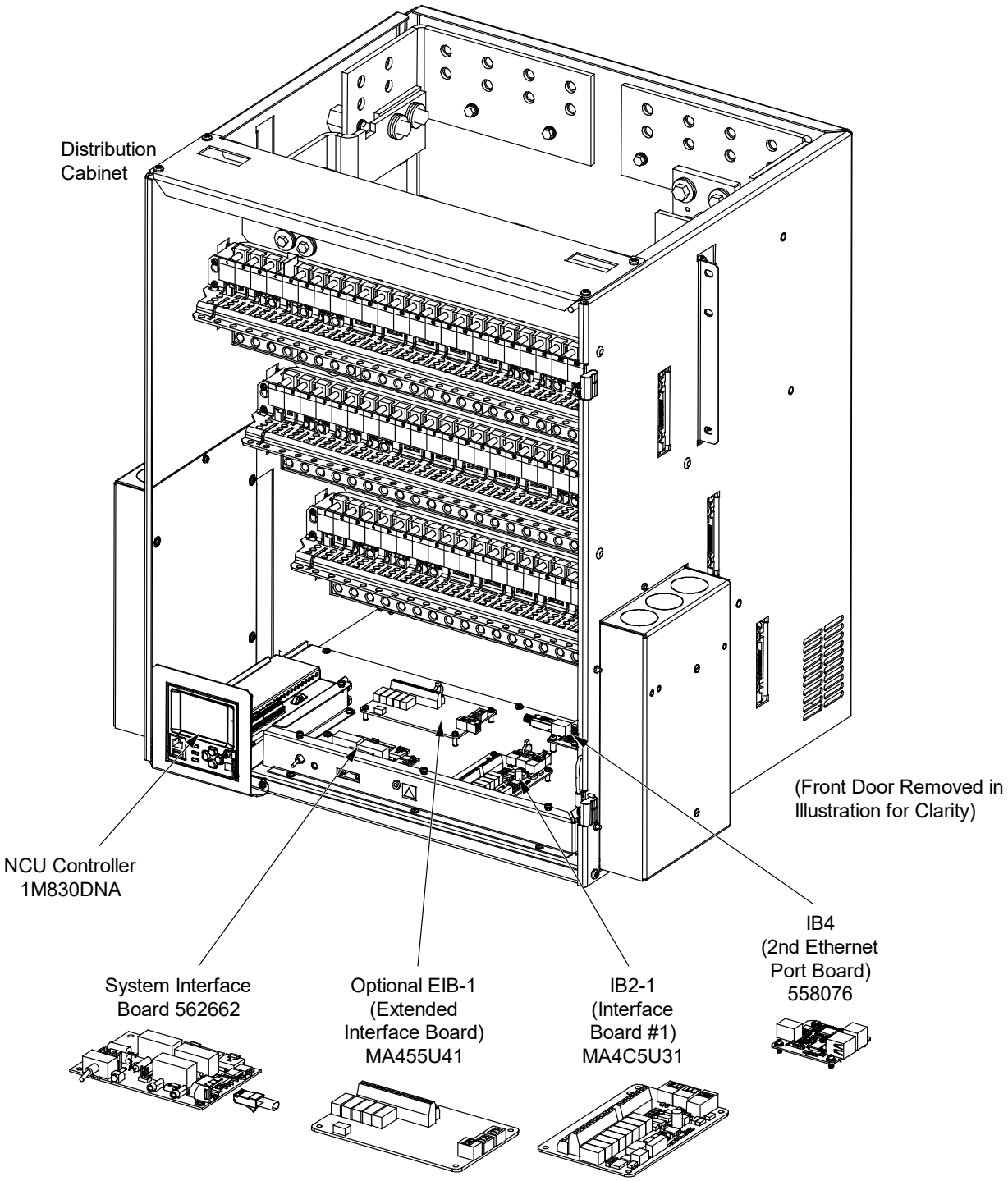


4 Setting Jumpers and Switch Options

4.1 Circuit Card Locations

Refer to Figure 4.1.

Figure 4.1 Circuit Card Locations



4.2 Jumper on System Interface Board

Perform the following procedure to make the required setting per your site requirements. This procedure can also be used to make adjustments on a replacement circuit card.

Controller Power Option

This option allows the controller to remain powered if the battery contactor opens. The controller is powered from the internal "system" bus. Rectifiers and battery are connected to this "system" bus, so the controller is powered both by the rectifiers and by the battery. A jumper option allows the controller to be powered from the "system side" of the battery contactor or the "battery side" of the battery contactor. Refer to Figure 4.2 for jumper location. Refer to Figure 4.1 for circuit card location.

- Jumper in "No Battery Power" Position: The controller is powered from the "system side" of the battery contactor. If the battery contactor opens, the controller is powered by the rectifiers (if functional). This is the default setting.

  If you lose AC power and your battery contactor opens, the controller will shut down.

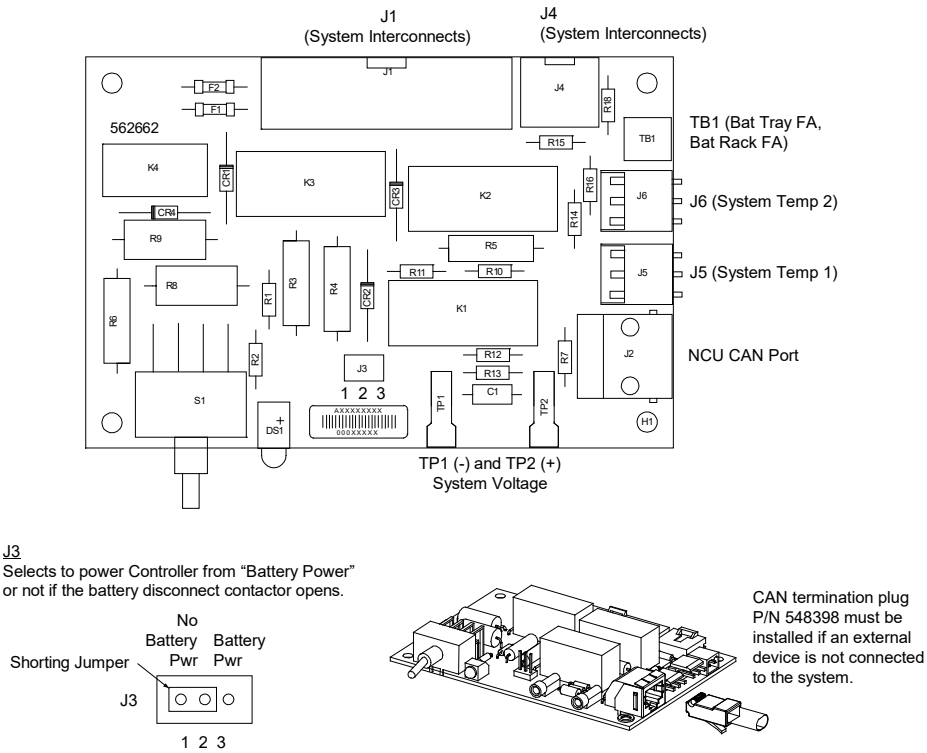
- Jumper in "Battery Power" Position: The controller is powered from the "battery side" of the battery contactor. If the battery LVD contactor opens, the controller is powered by the battery and the battery will drain. The controller's power consumption is 5W.

  If you lose AC power and your battery contactor opens, the controller will continue to operate.

Procedure

1. Refer to Figure 4.2 and place the jumper on J3 in the "Battery Pwr" or "No Battery Pwr" position. Refer to Figure 4.1 for circuit card location.

Figure 4.2 System Interface Board Jumper Location



4.3 Switch Setting on IB2 Controller Interface Board

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

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

Procedure

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

Table 4.1 IB2 Controller Interface Board Switch Setting

Setting	DIP Switch SW1	
	1	2
IB2-1	OFF	OFF

4.4 Switch Setting on Optional EIB Controller Extended Interface Board

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

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

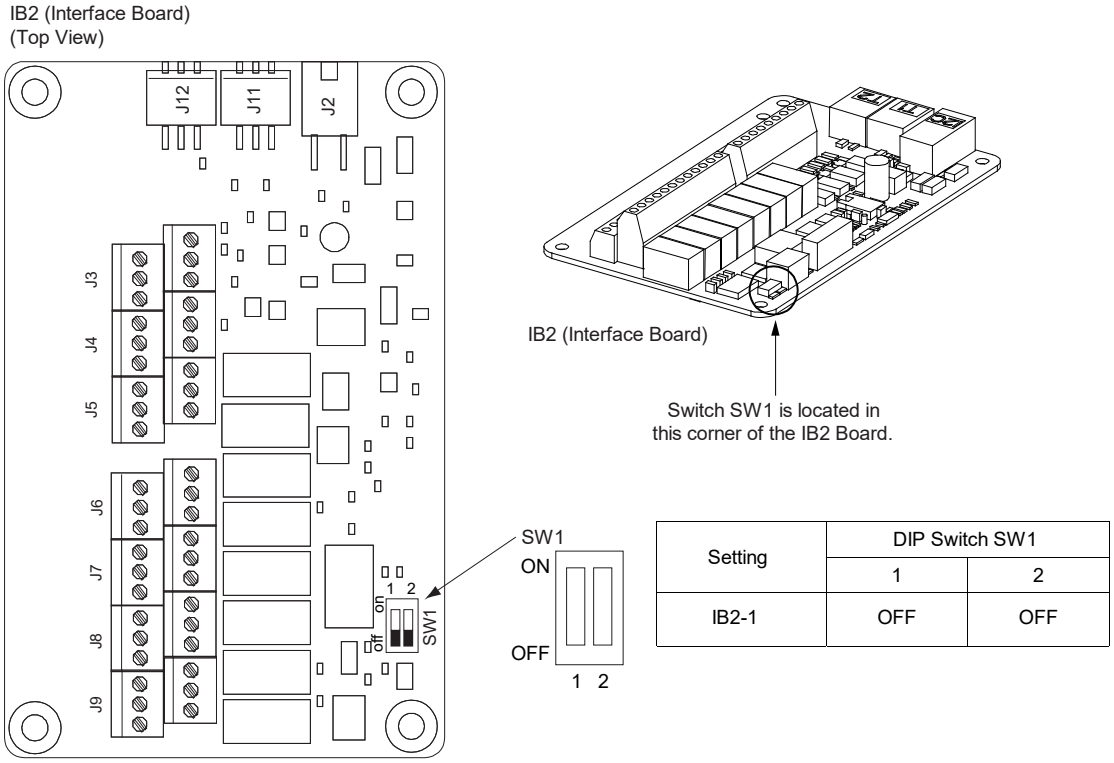
Procedure

1. Ensure SW1 is set per Table 4.2. Refer to Figure 4.1 for circuit card location. Refer to Figure 4.4 for switch location.

Table 4.2 Optional EIB Controller Extended Interface Board Switch Setting

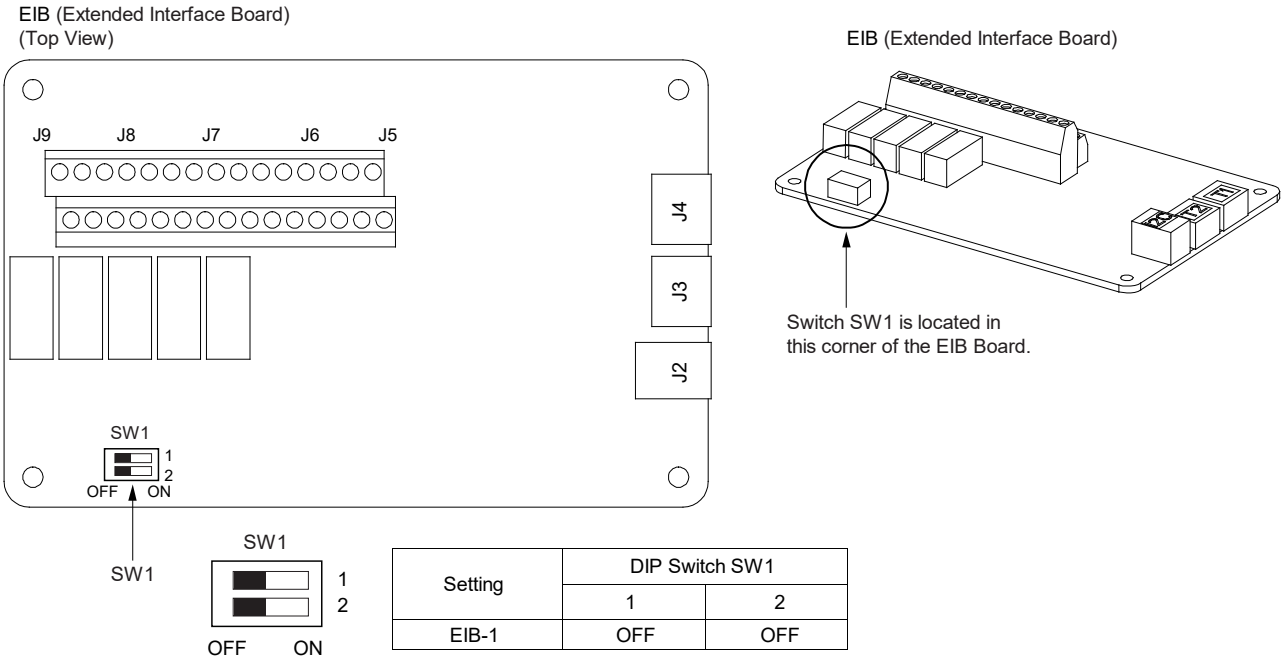
Setting	DIP Switch SW1	
	1	2
EIB-1	OFF	OFF

Figure 4.3 IB2 Controller Interface Board Switch Location and Setting



Setting	DIP Switch SW1	
	1	2
IB2-1	OFF	OFF

Figure 4.4 Optional EIB Controller Extended Interface Board Switch Location and Setting



Setting	DIP Switch SW1	
	1	2
EIB-1	OFF	OFF

5 Making Electrical Connections

5.1 Important Safety Instructions

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

5.2 Wiring Considerations

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

For wire size, branch circuit protection, crimp lug, and general wiring recommendations; refer to System Application Guide SAG582127000.

Lugs should be crimped per lug manufacturer’s specifications.

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

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

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

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

5.3 Relay Rack Grounding Connection (Frame Ground)

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

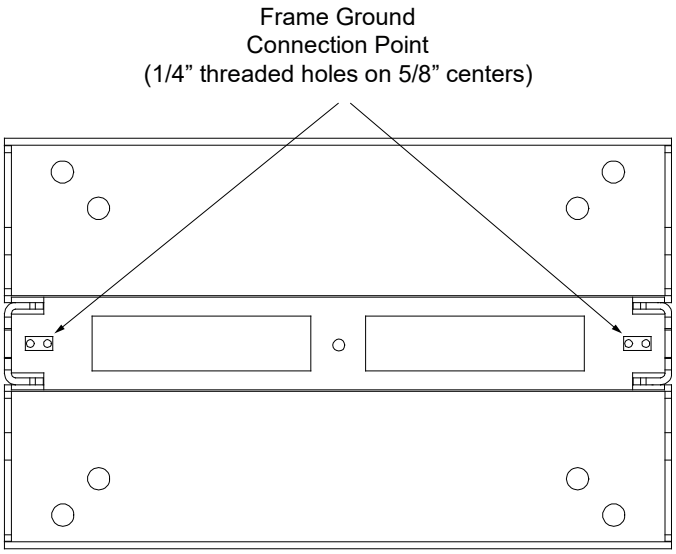
A customer's grounding network lead can be attached to the top of the relay rack. Provision is made for installing a lead with a two-hole lug that has 1/4" bolt clearance holes on 5/8" centers. When using 1/4-inch hardware, recommended torque is 84 in-lbs when a standard flat washer and lock washer are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

NOTE! *REMOVE TAPE FROM HOLE LOCATIONS BEFORE INSTALLING LUG.*

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

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

Figure 5.1 Relay Rack Frame Grounding Connection Points



5.4 Central Office Ground Connection

Landing points are provided on the battery return bus for a central office ground lead (see Figure 5.14). For central office grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

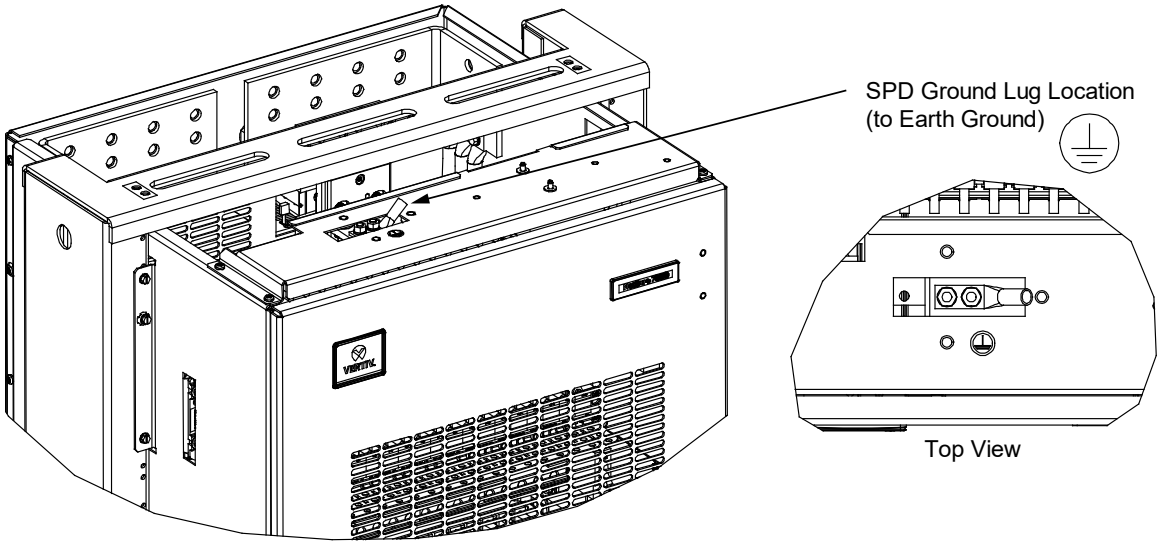
5.5 SPD (Surge Protection Device) (if equipped) Earth Ground Connection

A landing point is provided on the top of the distribution cabinet for an SPD (Surge Protection Device) (if installed) earth ground lead. If installed, the SPD (Surge Protection Device) Assemblies are located on the underneath side of the distribution cabinet top cover panel. A busbar accessed from the top of the distribution cabinet is provided for the SPD earth ground connection. The busbar has two (2) 1/4-20 x 1/2" long threaded studs on 5/8" centers. A 2-hole, 5/8" centers, 1/4" hardware, 2 AWG flex wire crimp lug is provided with the power system. An opening in the top cover permits the compression lug to be routed either to the left of to the right. Refer to Figure 5.2.

Procedure

1. Remove and save the factory-installed 1/4-20 hardware and 2-hole crimp lug from the power system's SPD earth ground connection busbar threaded studs.
2. Crimp the customer provided earth ground wire to the 2-hole crimp lug.
3. Install the 2-hole crimp lug (with customer provided earth ground wire) to the power system's SPD earth ground connection busbar as shown in Figure 5.2. Apply anti-oxidizing compound to busbar mating surfaces before assembling. Re-assemble the 1/4" hardware saved from a prior step. Recommended torque is 72 in-lbs.

Figure 5.2 SPD (Surge Protection Device) Earth Ground Connection (if equipped)



5.6 Nominal 208 VAC / 240 VAC Input and Equipment Grounding Connections

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

Wiring Considerations

Refer to Table 5.2 for recommended wire sizes and branch circuit protection.

Connections to AC Input Termination Assemblies

The AC input termination assemblies provide circular openings at the top for AC input and grounding conductors. The openings accept 1-inch conduit fittings. It is recommended that AC input wiring be provided to all rectifier mounting positions, including currently unused positions. This wiring will ease future installation of rectifiers to meet increased load requirements.

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

Procedure

Refer to Figure 5.3 as these procedures are performed.

Accessing Connections and Routing Wire

1. Remove the two AC input connector covers from inside the distribution cabinet.
2. Install conduit fittings as required in the top of the AC input termination assembly. Plug buttons are provided and must be installed in the openings not being used.
3. Route wiring into the AC input termination assembly through the previously installed conduit fittings.

Making AC Input Connections

1. Make AC input connections as shown in Figure 5.3. Connect each wire by inserting the stripped end into the wire opening, and then tightening the screw. Torque connections to value shown in Figure 5.3.

Making Equipment Grounding Connections

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

1. Connect equipment grounding leads to the frame ground studs using installer-provided lugs and factory-supplied mounting hardware. Torque connections to value shown in Figure 5.3.

Reinstalling Covers

1. After all AC input and equipment grounding connections have been made and checked, reinstall the two AC input connector covers.

Table 5.2 Recommended AC Input Branch Circuit Protection and Wire Size

AC Input Termination Assembly (Nominal 208 VAC / 240 VAC, Single Phase, 50 Hz / 60 Hz) Provides "1 AC Feed per 2 Rectifiers" Single Phase Input Terminations				
Input Voltage	Input Current [7]	Overcurrent Protection [1]	40 °C Ambient Temperature	
			Wire [3] [4] [5]	Conduit Size [6]
208 VAC	20 A	25 A [2]	10 AWG	3/4"
240 VAC	17.5 A	25 A [2]	10 AWG	3/4"

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

2 Maximum over current protection device is 30 A.

3 Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310.15 (B) (16) for copper wire at 90 °C conductor temperature. For operation in countries where the NEC is not recognized, follow applicable codes.

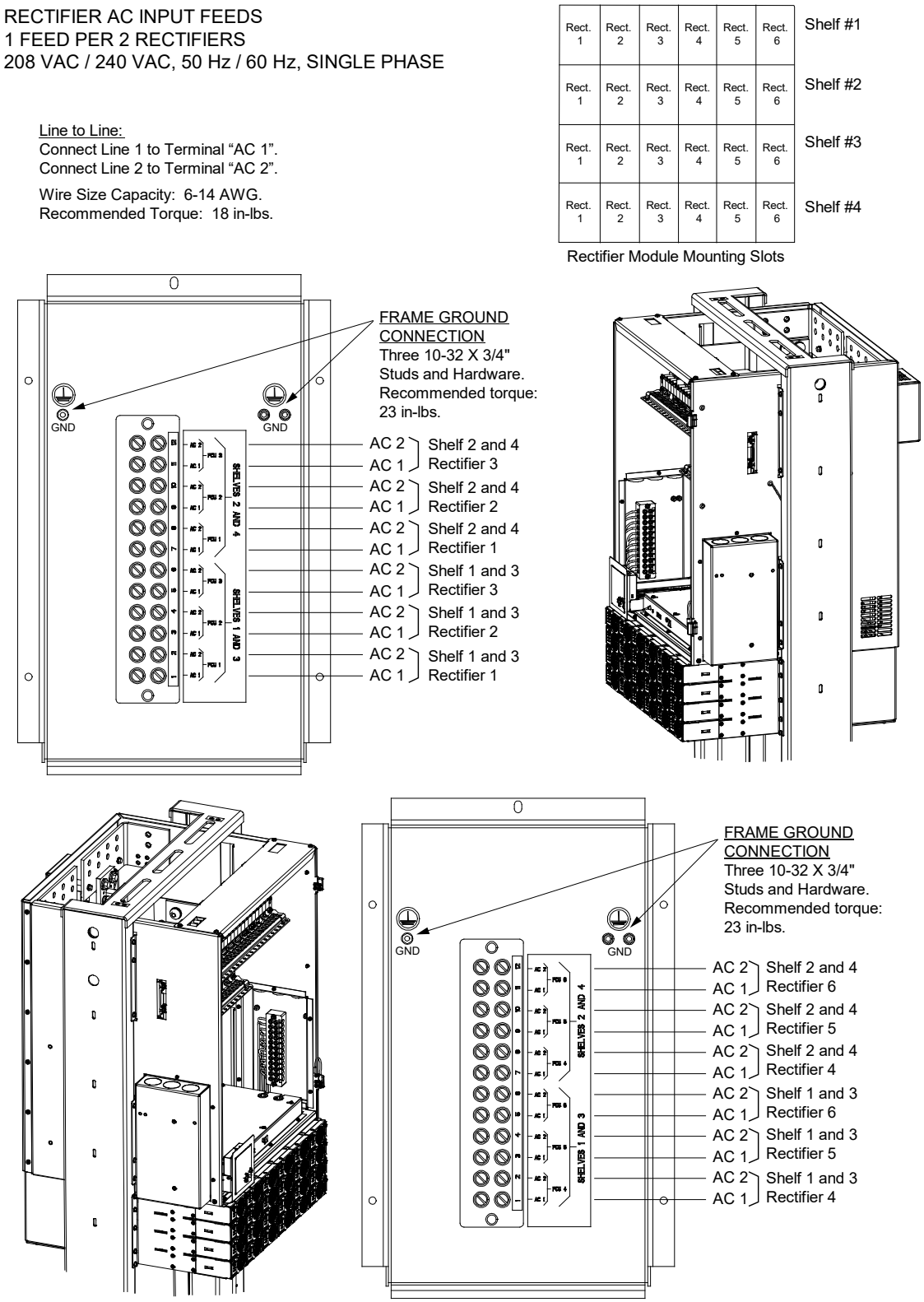
4 Equipment grounding conductors must be provided with the AC input conductors supplied to the assembly. Frame ground terminals must be connected to earth ground, not power system neutral. Equipment grounding conductor size based on recommendations of the NEC Table 250-122 for copper wire. If aluminum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

5 THHN 90°C Wire.

6 System with Four (4) Spec. No. 588705300 Rectifier Module Assemblies: Conduit sized for six (6) current carrying conductors and one (1) ground conductor per conduit (based on NEC recommendations), for six (6) PCUs. For operation in countries where the NEC is not recognized, follow applicable codes.

7 Input current based on R48-2000e3 rectifier module.

Figure 5.3 Nominal 208 VAC / 240 VAC Input and Equipment Grounding Connections (1 Feed per 2 Rectifiers, Single Phase)



5.7 External Alarm, Reference, Monitoring, and Control Connections

5.7.1 Circuit Card Locations

Refer to Figure 4.1.

5.7.2 Temperature Probes

NOTE! *Each temperature probe consists of two or three pieces that plug together to make a complete probe. See SAG582127000 for part numbers and descriptions.*

Two temperature probes can be connected to the System Interface Board mounted inside the distribution cabinet. See Figure 5.4.

Two temperature probes can be connected to the IB2 (Controller Interface Board) mounted inside the distribution cabinet. See Figure 5.5.

Two temperature probes can be connected to the optional EIB (Controller Extended Interface Board) mounted inside the distribution cabinet. See Figure 5.7.

Any combination of the 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.

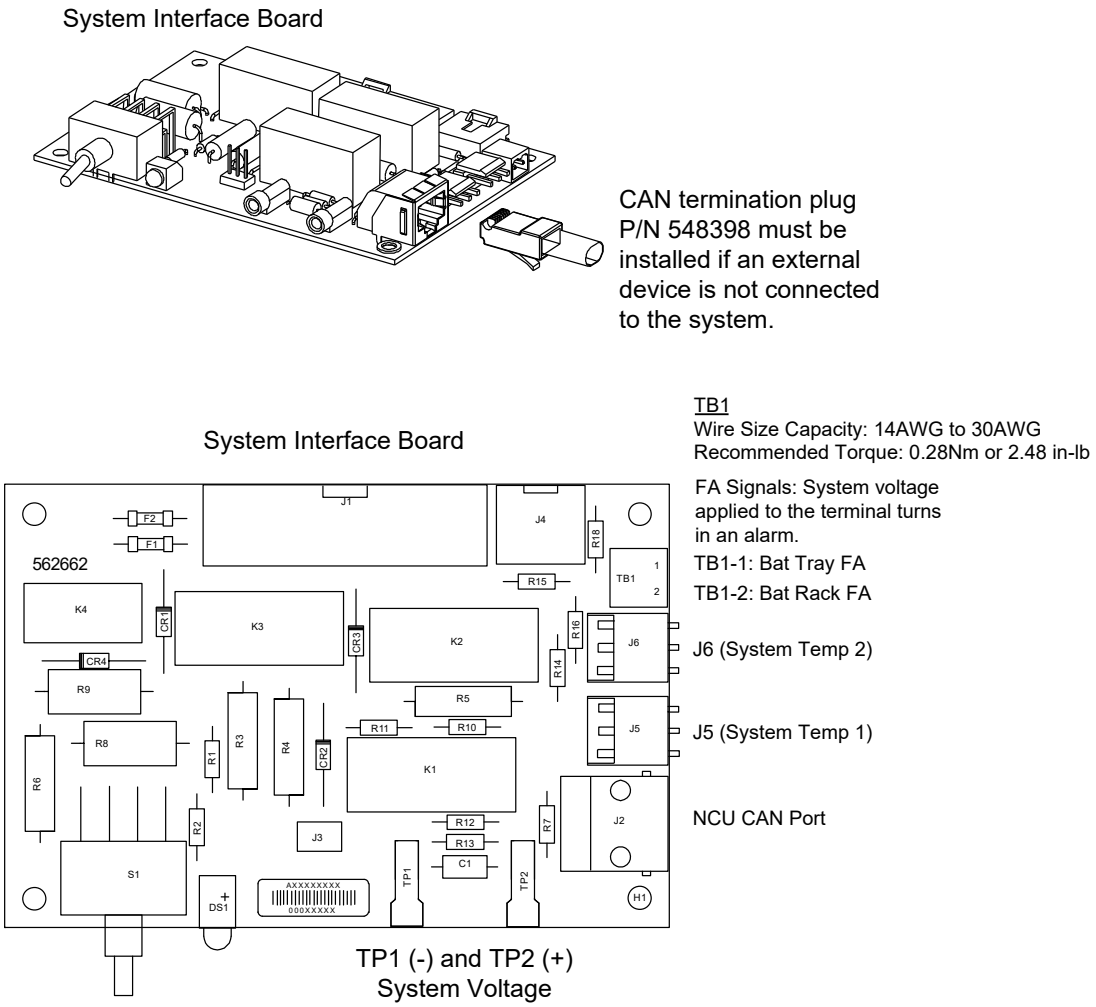
Three temperature probe inputs (System Temp 1, System Temp 2, and IB2-1 Temp 1) are factory programmed as battery type. Battery temperature compensation and battery thermal runaway management is also factory programmed. Install the three temperature probes included with the system into these inputs. The battery string in the bottom tray is considered Battery #1. The temperature probe for this string should be connected to System Temp 1. The battery string in the second tray is considered Battery #2. The temperature probe for this string should be connected to System Temp 2. The battery string in the top (third) tray is considered Battery #3. The temperature probe for this string should be connected to IB2-1 Temp 1. For systems equipped with fewer than three battery strings in the power bay, the unused temperature probes should be programmed off. Refer to the controller user manual, UM1M830BNA, provided with the system for instructions.

5.7.3 System Interface Board

The System Interface Board provides connections for the following. Refer to Figure 5.4.

- Battery Tray Fuse Alarm: 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.
- Battery Rack Fuse Alarm Signal: This input is used to provide a battery rack fuse alarm (FA) on the controller due to a tripped battery disconnect device on a battery 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.
- System Voltage Monitoring Test Points
- Temperature Probes (see “Temperature Probes” starting on page 27)
- NCU CAN Port (see “Connecting a Device or System to the NCU CAN Bus (if required)” starting on page 40)

Figure 5.4 System Interface Board Connections



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

The IB2 (Controller Interface Board) provides connection points for programmable relay outputs, digital inputs, and temperature probes. The IB2 interface board is mounted inside the distribution cabinet. Refer to Figure 4.1.

Programmable Relay Outputs and Digital Inputs

Relay output and digital input 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 5.5 for terminal locations. Refer to Table 5.3 through Table 5.4 for pin-out information.

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 5.5 for terminal locations. Refer to Table 5.3 for pin-out information.

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

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

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

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 5.5 for terminal locations and Table 5.4 for pin-out information.

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

Digital Input Ratings: Refer to the following.

a) Maximum Voltage Rating: 60 VDC.

b) Active High: > 19 VDC.

c) Active Low: < 1 VDC.

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

ESTOP Function

If an ESTOP switch is wired to the IB2-1 Controller Interface Board, customer-furnished system ground applied to terminal DI8+ activates the ESTOP function. The ESTOP function shuts down and locks out the rectifiers, shuts down and locks out the optional -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters, and opens the optional low voltage disconnect (LVD) contactors (battery and load type). If the system has battery connected and does not contain a battery LVD or the controller power option is set to Battery Pwr (jumper J3 on the system interface board is set to Battery Pwr), the controller will remain operational. If the system does not contain battery or load LVD(s) and has battery connected, the loads will be sustained by the battery voltage.

For Systems NOT Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will close after the "LVD Reconnect Delay" has elapse (customer configurable via the controller) if battery voltage is present on the bus. Rectifiers and -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). To restart the -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters: remove the converter, wait 30 seconds or more (until the LEDs on the converter extinguish), then re-insert the converter.

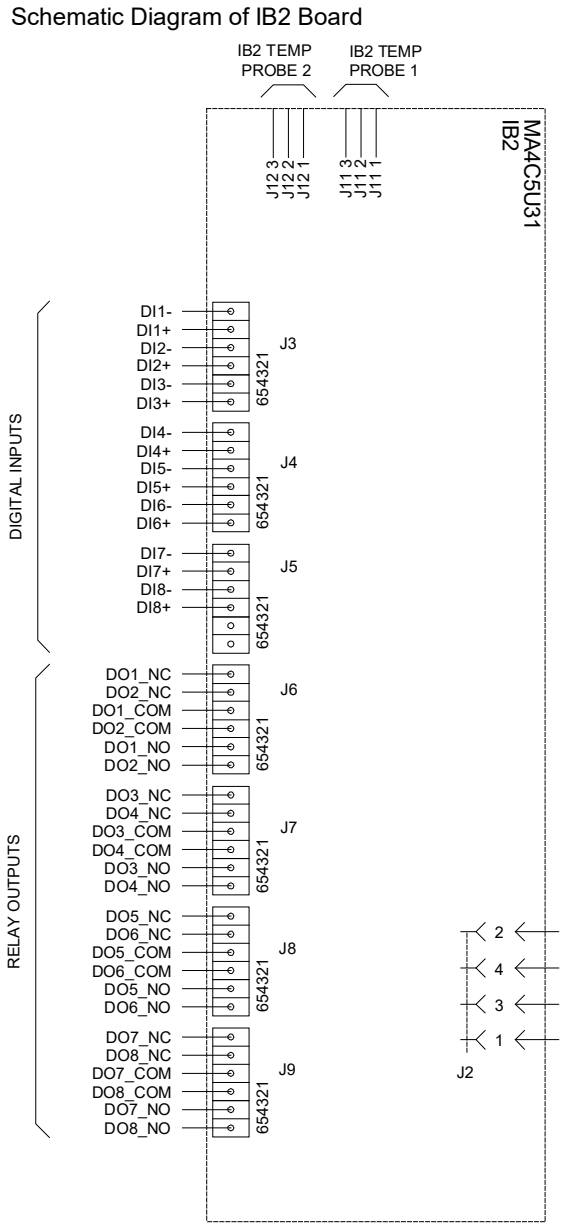
For Systems Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will remain open. Rectifiers and -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). When the rectifiers restart, LVD contactors (battery and load type) will close after the "LVD Reconnect Delay" has elapse (customer configurable via the controller) and the -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters will restart.

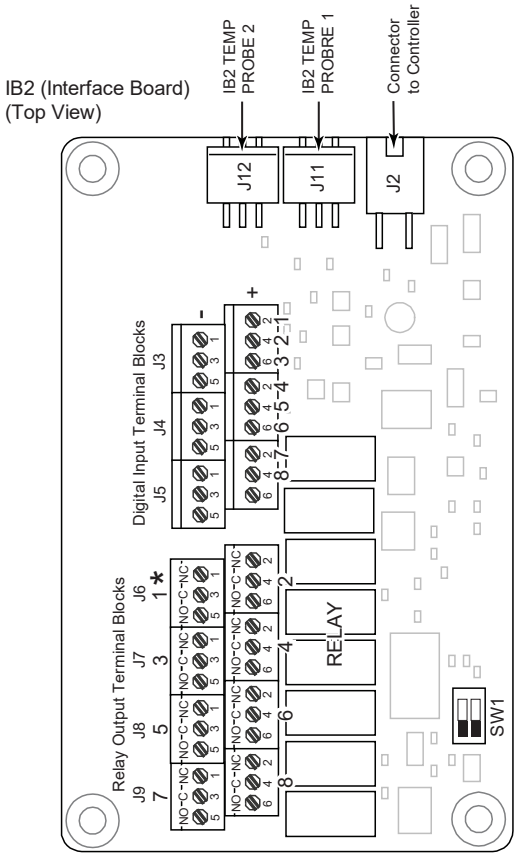
NOTE! *If a customer-furnished method to disconnect the input power to the system is not provided, the rectifiers will stay locked OFF until the input power is recycled. If the ESTOP signal is removed without recycling the input power, the rectifiers will remain off and have a local alarm visible on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

Temperature Probes

Two temperature probes can be connected to the IB2 (Controller Interface Board) mounted inside the distribution cabinet. Refer to "Temperature Probes" on page 27.

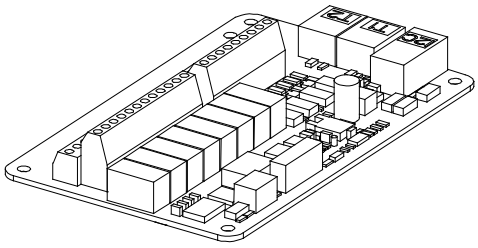
Figure 5.5 IB2 (Controller Interface Board) Connections





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

IB2 (Interface Board)



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

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

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 5.3 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 on the IB2 by default) will operate in the "Fail Safe Mode". "Fail Safe Mode" means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals.*

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

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

Table 5.4 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	+	(to customer ESTOP switch)	ESTOP	
	J5-3	–	-48 VDC		
--	J5-5		not used	not used	not used
--	J5-6				

NOTE! *-48V is factory wired to the Digital Input #8 (-) terminal for your convenience and function predefined for ESTOP. Customer-furnished system ground applied to terminal Digital Input #8 (+) activates the ESTOP function.* *See "ESTOP Function" on page 30.*

5.7.5 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 optional EIB extended interface board is mounted inside the distribution cabinet. Refer to Figure 4.1.

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 5.7 for terminal locations. Refer to Table 5.5, Table 5.6, and Table 5.7 for pin-out information.

Current Inputs

Connect up to three (3) shunt inputs to the optional EIB. Observe proper polarity. Refer to Figure 5.7 for terminal locations and Table 5.5 for pin-out information.

Refer to the NCU Instructions (UM1M830BNA) and program the shunt input parameters.

NOTE! *The shunt needs to be installed in the hot (-48V) 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 optional 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 5.7 for terminal locations and Table 5.6 for pin-out information.

Refer to Figure 5.6 for connection details. Refer to the NCU Instructions (UM1M830BNA) and program the following parameters.

- Battery Block Monitoring

  Voltage Type: Set to “48 (Block 4)”. This selects the EIB to monitor up to two (2) 48V battery strings with four (4) 12V blocks per string.

  BlockVDiff(12V): This menu item appears if “48 (Block 4)” 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.

Programmable Relay Outputs

The optional 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 5.7 for terminal locations and Table 5.7 for pin-out information.

Refer to the 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.

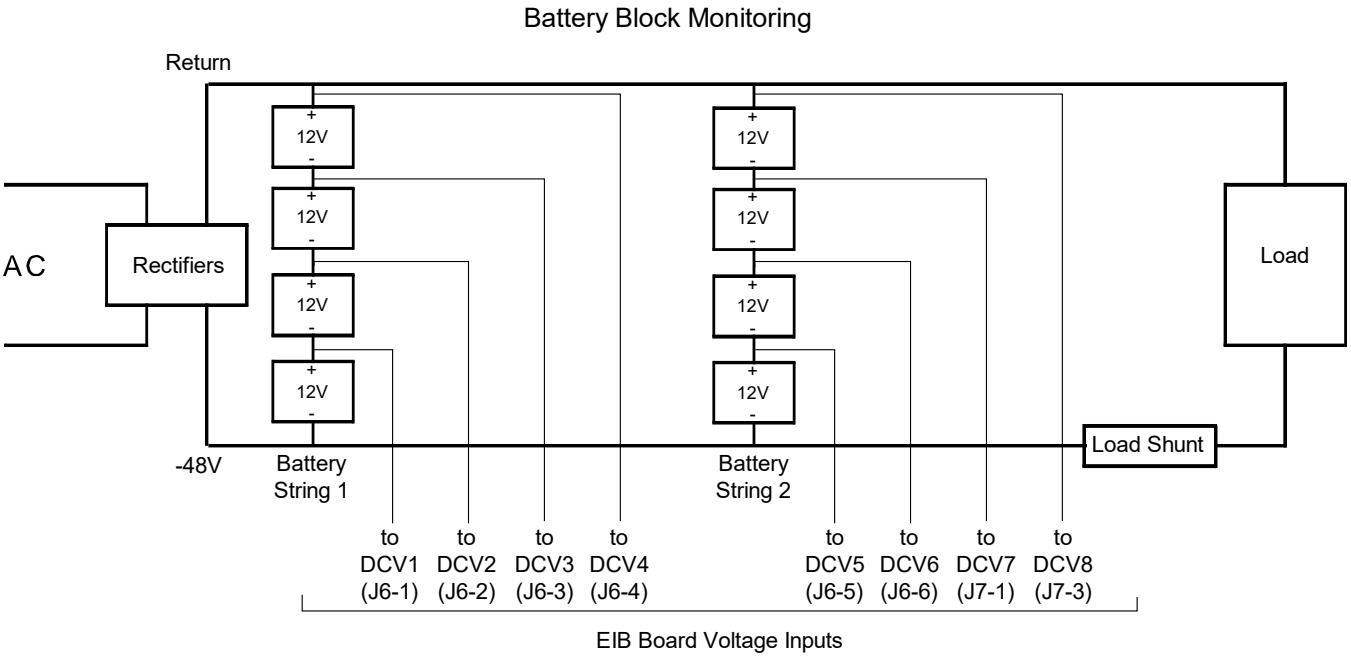
b) Peak: 3 A @ 30V DC.

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

Two temperature probes can be connected to the optional EIB (Controller Extended Interface Board) mounted inside the distribution cabinet. Refer to "Temperature Probes" on page 27.

Figure 5.6 Sample Battery Block or Battery Midpoint Monitoring Connections



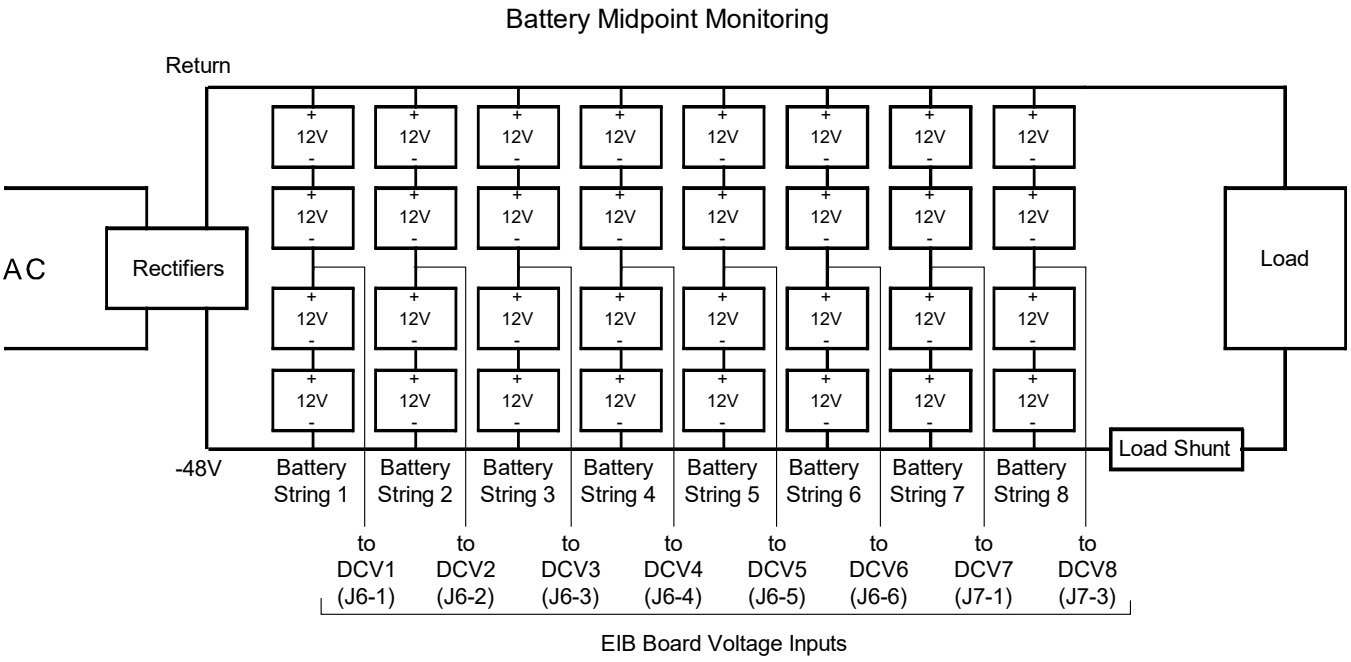
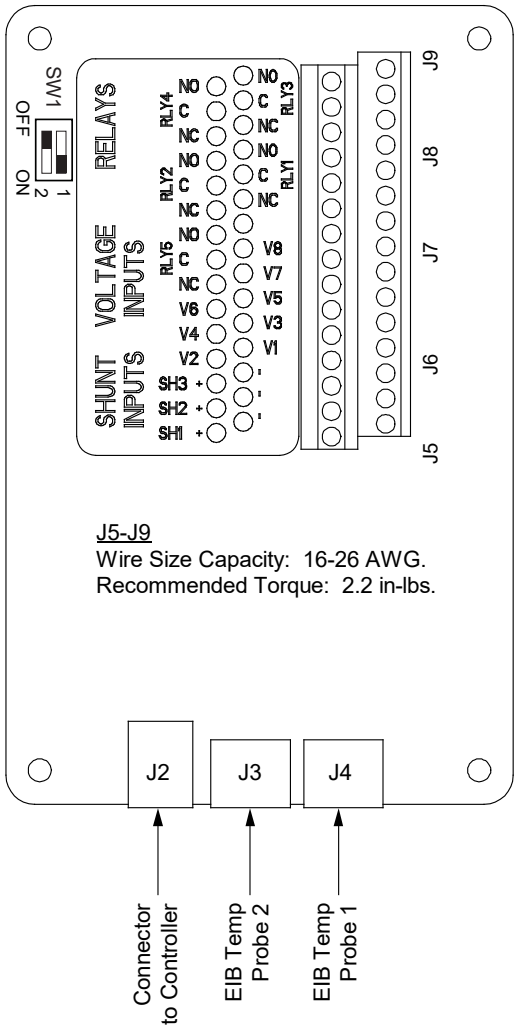
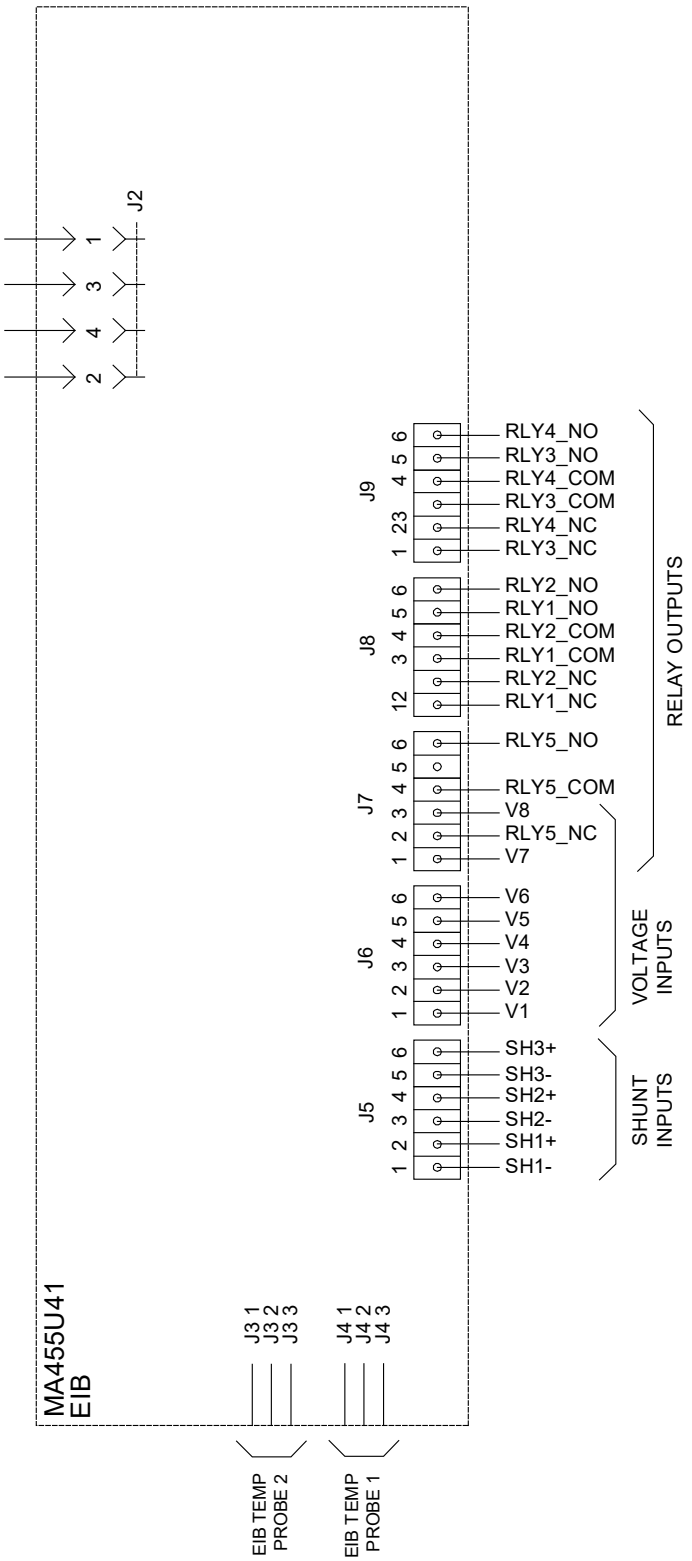


Figure 5.7 Optional EIB (Controller Extended Interface Board) Connections

EIB (Extended Interface Board)
(Top View)



Schematic Diagram of EIB Board



EIB (Extended Interface Board)

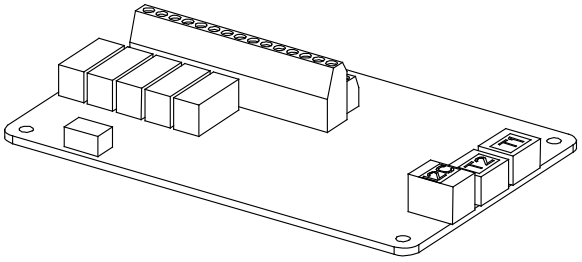


Table 5.5 Shunt Inputs – EIB

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 5.6 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 5.7 Programmable Relay Outputs – EIB

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

5.8 Connecting a Device or System to the NCU CAN Bus (if required)

A supporting device or system may be connected to the NCU CAN Port located on the system interface board. Refer to Figure 4.1 for system interface board location. Refer to Figure 5.4 for connections details. Refer to Table 5.8 for pin-outs. Refer also to the external device's or system's instruction manual.

General Procedure

1. Remove the CAN termination plug from the CAN Port connector (see Figure 5.4 for location). Connect the device or system to the NCU Controller's CAN port. Refer to Table 5.8 for pin-outs. Ensure that the last device on the controller's CAN bus has a CAN termination plug. Refer also to the external device's or system's instruction manual.

2. Reboot the Controller
   Local Menu Navigation: At the Main Screen, press ENT and ESC at the same time to reset the NCU Controller.
   Web Menu Navigation: Go to Advance Settings Menu / SW Maintenance Tab / Reboot Controller button.

Optional SM-Temp Module

The analog output of the SM-Temp Module may be connected to an NCU temperature port input. In lieu of connecting the analog output of the SM-TEMP module to an NCU temperature port input, the SM-TEMP module can simply be connected at the end of the NCU CAN bus. Refer to the SM-Temp Module Instructions (UM547490) for details.

CAN Bus Procedure

1. Remove the CAN termination plug from the CAN Port connector (see Figure 5.4 for location). Connect the SM-Temp Module CAN bus to the CAN Port connector. Refer to Table 5.8 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 5.8 CAN Port Connections

NCU 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	--	--

5.9 NCU Controller Ethernet Connection (if required)

The controller provides a Web Interface via an Ethernet connection to a TCP/IP network. This interface can be accessed locally on a computer and/or remotely through a network. The system has two Ethernet ports. One located on the NCU front panel and the other located on the IB4 board. The function of these Ethernet ports are as follows.

NCU Front Panel Ethernet Port

An RJ-45 10BaseT jack is provided on the front of the controller for connecting a computer directly to the NCU. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 5.8 for location. Refer to the NCU Instructions (UM1M830BNA) for operational details. Default address: 192.168.100.100.

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.*

NOTE! *DO NOT connect your Local Area Network (LAN) to the NCU front Ethernet port.*

IB4 Board Ethernet Port

An RJ-45 10BaseT jack is provided on the IB4 board for connection into a customer's network. Use this Ethernet port to connect the NCU to your Local Area Network (LAN). This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 4.1 for IB4 board location. Refer to Figure 5.8 for Ethernet port location. Use shielded Ethernet cable (grounded at both ends). Note that the IB4 board's RJ-45 jack is connected to chassis ground. Refer to the NCU Instructions (UM1M830BNA) for operational details.

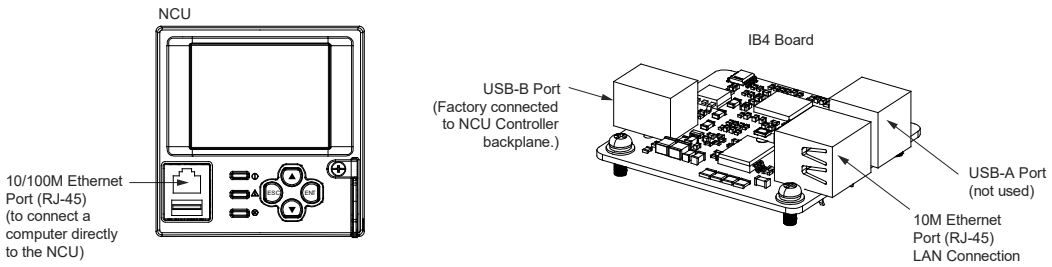
WARNING! The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to the interfaces that connect to the OSP or its wiring.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

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

Default IB4 Ethernet Port Parameters

IPv4		IPv6	
IP Address:	192.168.1.2	IPv6 Address:	20fa:fffd:fffc:fffb:fffa:fff9:fff8:fff7
Subnet Mask:	255.255.255.0	IPv6 Prefix:	0
Default Gateway:	192.168.1.1	IPv6 Gateway:	20fa:1:fffe:ffff:fffe:fffd:ffff:fffe

Figure 5.8 System Ethernet Ports



5.10 Load Connections

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

5.10.1 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).

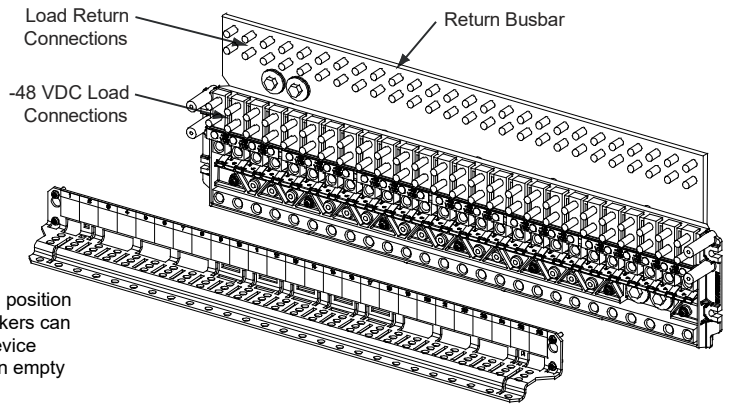
5.10.2 Load Connections to Single Voltage Distribution Panels

Figure 5.9 List AL: -48 VDC Distribution Panel (with Return Busbar), (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. 100 A circuit breakers can be used without a space provided the continuous current in each 100 A device does not exceed 64 A. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

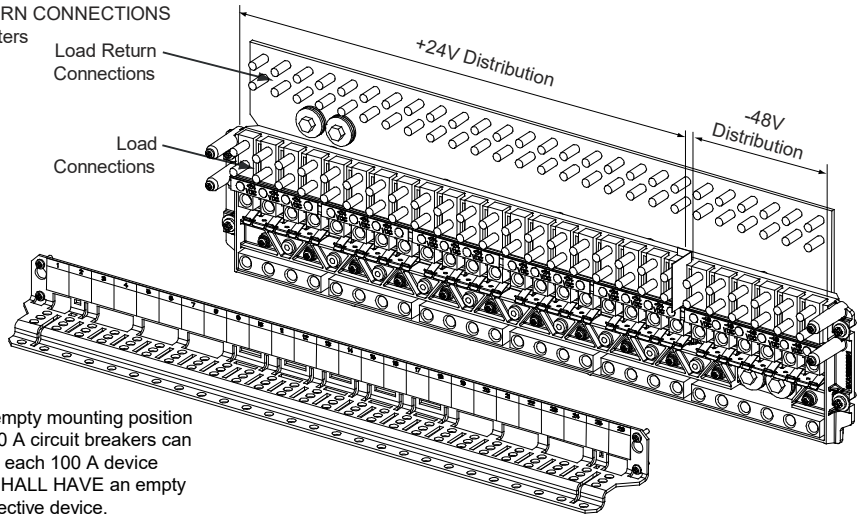
5.10.3 Load Connections to Dual Voltage Distribution Panels

Figure 5.10 List DJ: -48 VDC / +24 VDC Distribution Panel, (6) -48 VDC Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and (20) +24 VDC Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)

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

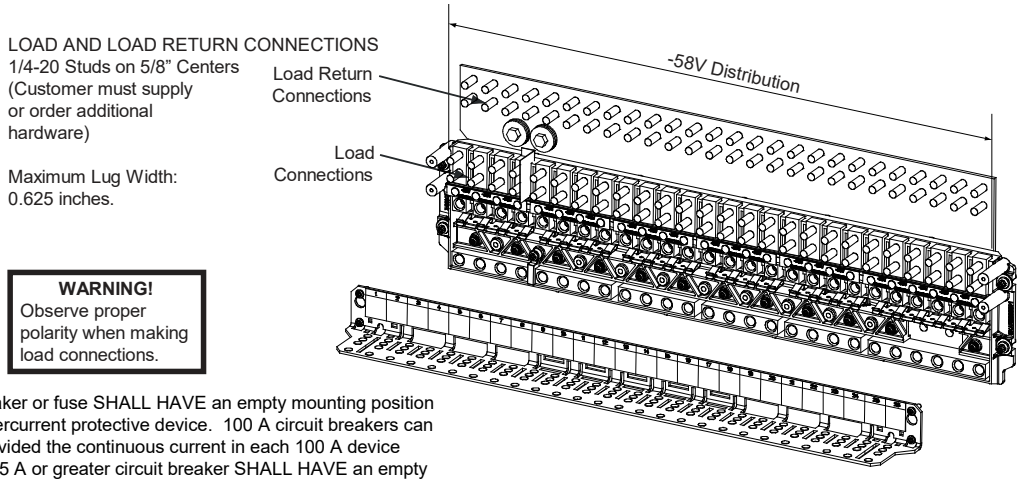
Maximum Lug Width: 0.625 inches.

WARNING!
Observe proper polarity when making load connections.



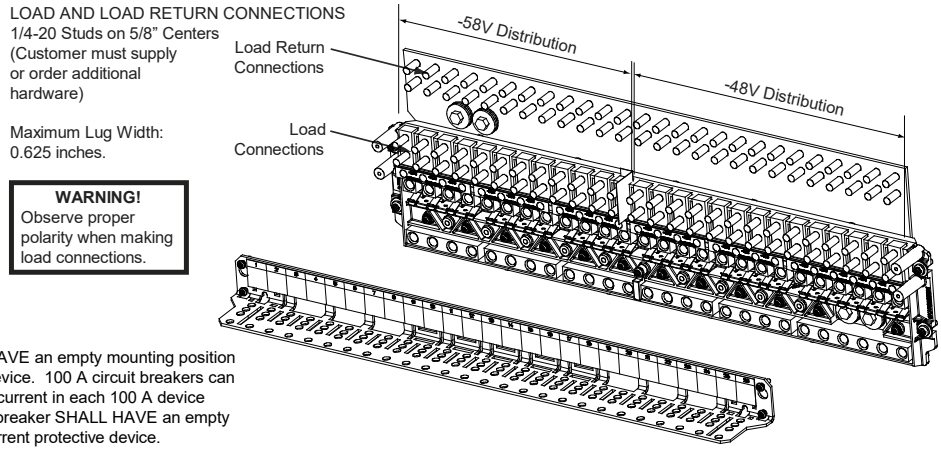
Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. 100 A circuit breakers can be used without a space provided the continuous current in each 100 A device does not exceed 64 A. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Figure 5.11 List FK: -48 VDC / -58 VDC Distribution Panel, (0) -48 VDC Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and (26) -58 VDC 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. 100 A circuit breakers can be used without a space provided the continuous current in each 100 A device does not exceed 64 A. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

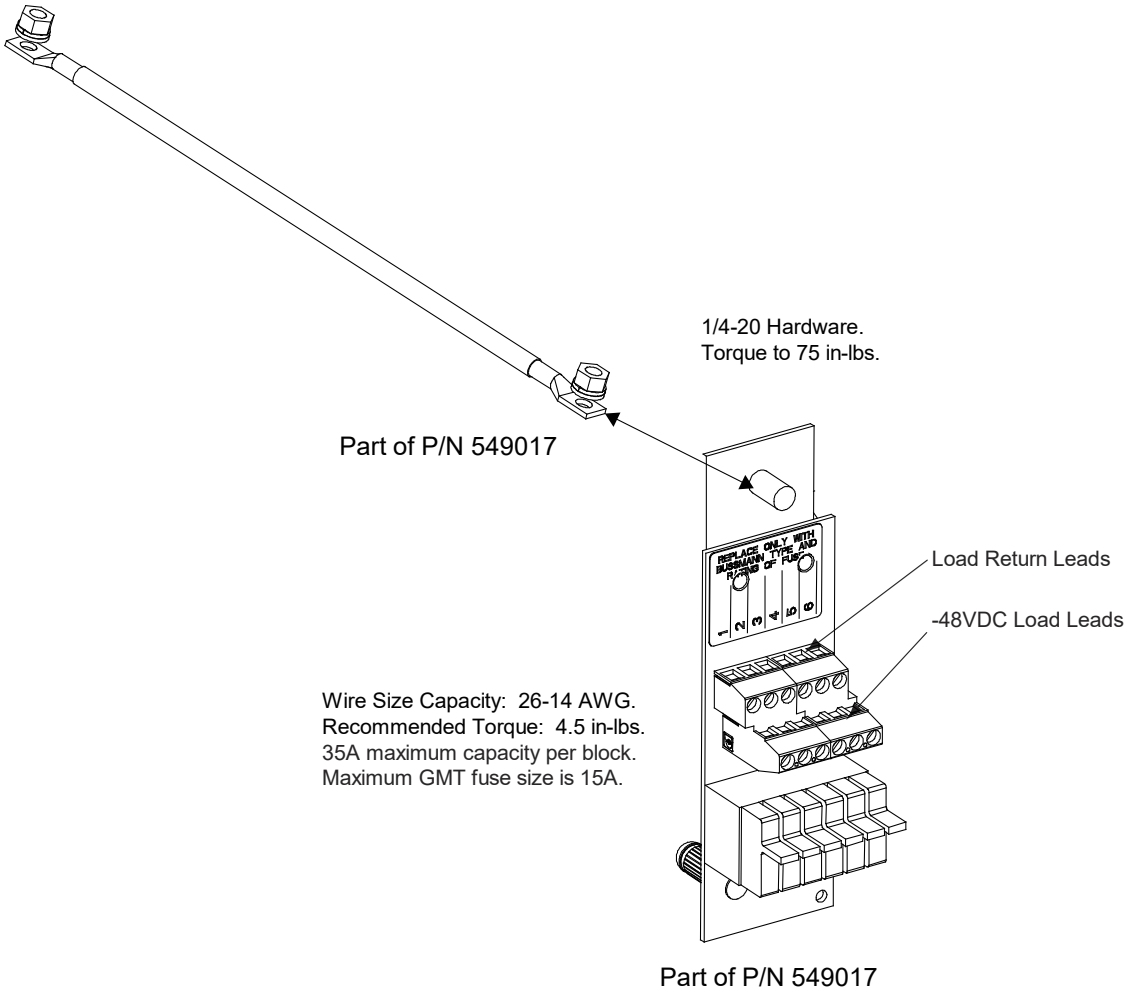
Figure 5.12 List FG: -48 VDC / -58 VDC Distribution Panel, (14) -48 VDC Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar) and (12) -58 VDC Bullet/TPS/TLS Circuit Breaker/Fuse Positions (with Return Busbar)



Caution: A 100 A circuit breaker or fuse SHALL HAVE an empty mounting position between it and any other overcurrent protective device. 100 A circuit breakers can be used without a space provided the continuous current in each 100 A device does not exceed 64 A. A 175 A or greater circuit breaker SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

5.10.4 Load Connections to GMT Distribution Fuse Block

Figure 5.13 Optional Bullet Nose 6-Position GMT Distribution Fuse Block, P/N 549017



5.11 External Battery Connections

5.11.1 Important Safety Instructions

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

WARNING! Observe proper polarity when making battery connections.

5.11.2 Recommended Torques

- 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).

5.11.3 Battery Connections to Distribution Cabinet Battery Busbars

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

Battery is connected to the battery busbars located in the distribution cabinet, as detailed in Figure 5.14 and Figure 5.15.

Figure 5.14 Battery Connections to Distribution Cabinet Battery Busbars

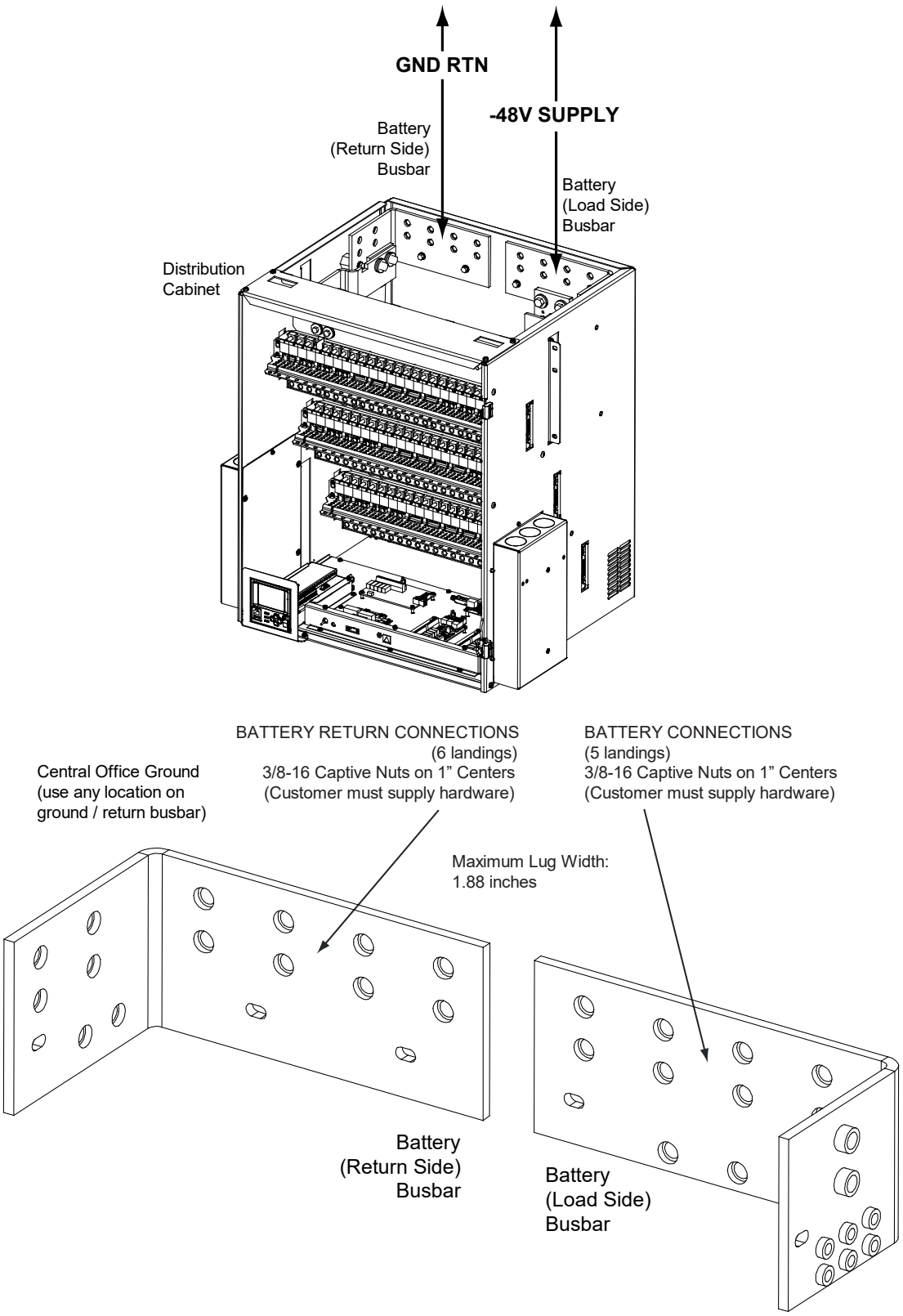
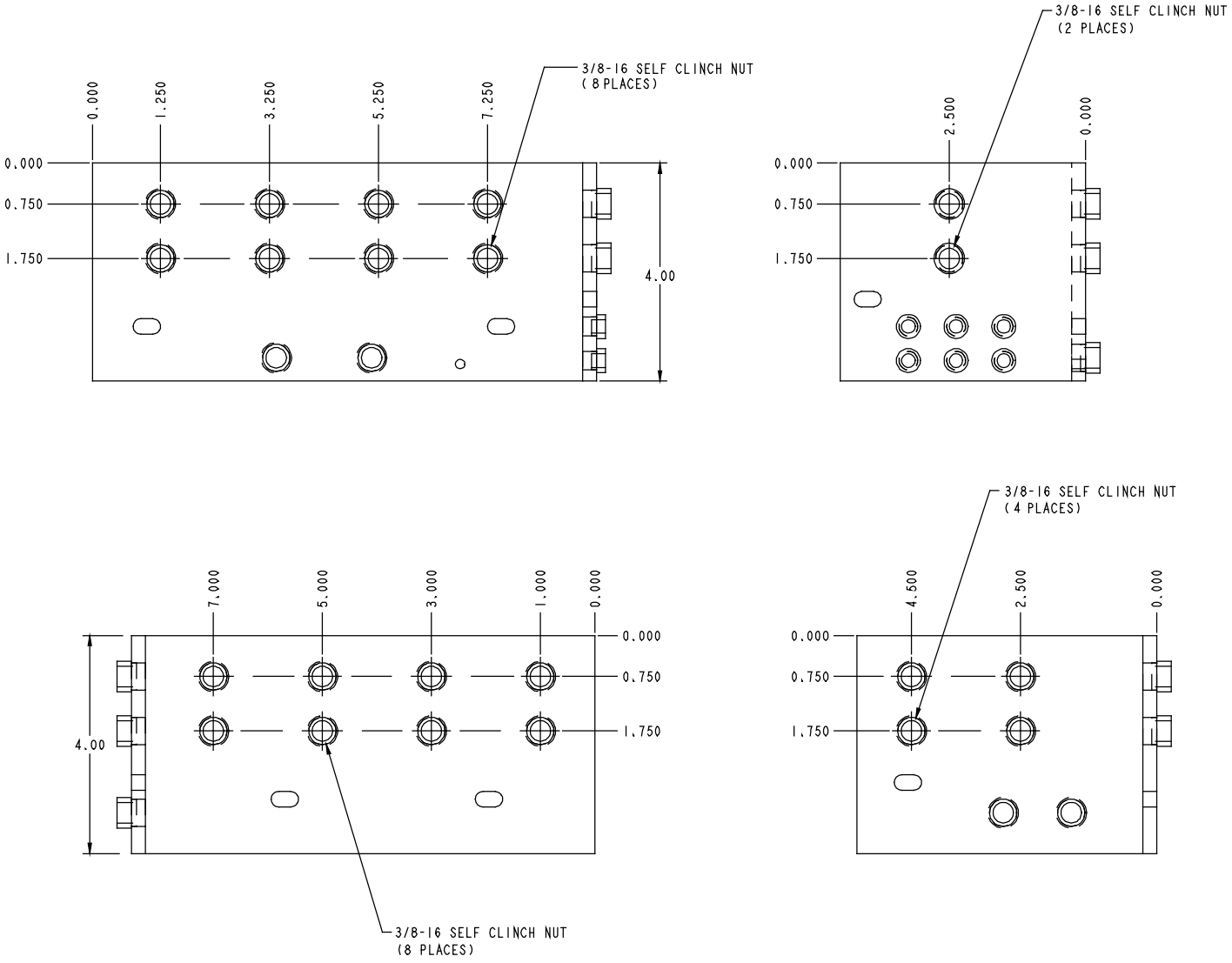


Figure 5.15 Battery Busbar Dimensions



Notes:
1. All dimensions are in inches.

5.12 Installing and Connecting Batteries in the Battery Trays (if furnished)

Important Safety Instructions

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

Battery Manufacturer Information

Refer to System Application Guide SAG582127000 for specifications and manufacturers of the batteries to be installed in this power system.

Installing and Connecting Batteries

Procedure

NOTE! *Refer to Figure 5.16 as this procedure is performed.*

1. Turn OFF the battery disconnect circuit breaker located on all battery trays. Refer to Figure 5.16 for locations. Follow local lockout/tagout procedures to ensure circuit breakers remain in the off position during installation.
2. Remove the battery retention bracket as shown in Figure 5.16. To do so, remove the four 1/4-20 x 5/8" bolts and associated washers.
3. Slide batteries into the tray, with the battery terminals toward the front as shown in Figure 5.16. Slide batteries into the tray as far as they will go.

NOTE! *The battery retention bracket can be oriented two ways to accommodate batteries of different lengths. A correctly oriented bracket will fit snuggly against the batteries. If your batteries require the alternate bracket orientation shown in Detail A of Figure 5.16 remove and reinstall the bullet-shaped spacers as shown in Detail A before performing the next step.*

4. Reinstall the battery retention bracket. The spacers on the bracket should separate the batteries from each other. Secure with the hardware removed in a previous step. Refer to Figure 5.16 for hardware location.
5. Connect three links supplied by the battery manufacturer between pairs of battery terminals as shown in Figure 5.16. Use hardware furnished by the battery manufacturer. Torque hardware to battery manufacturer's recommendations.
6. Ensure the battery cable ends in all trays are insulated with sleeving before performing the next step.

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

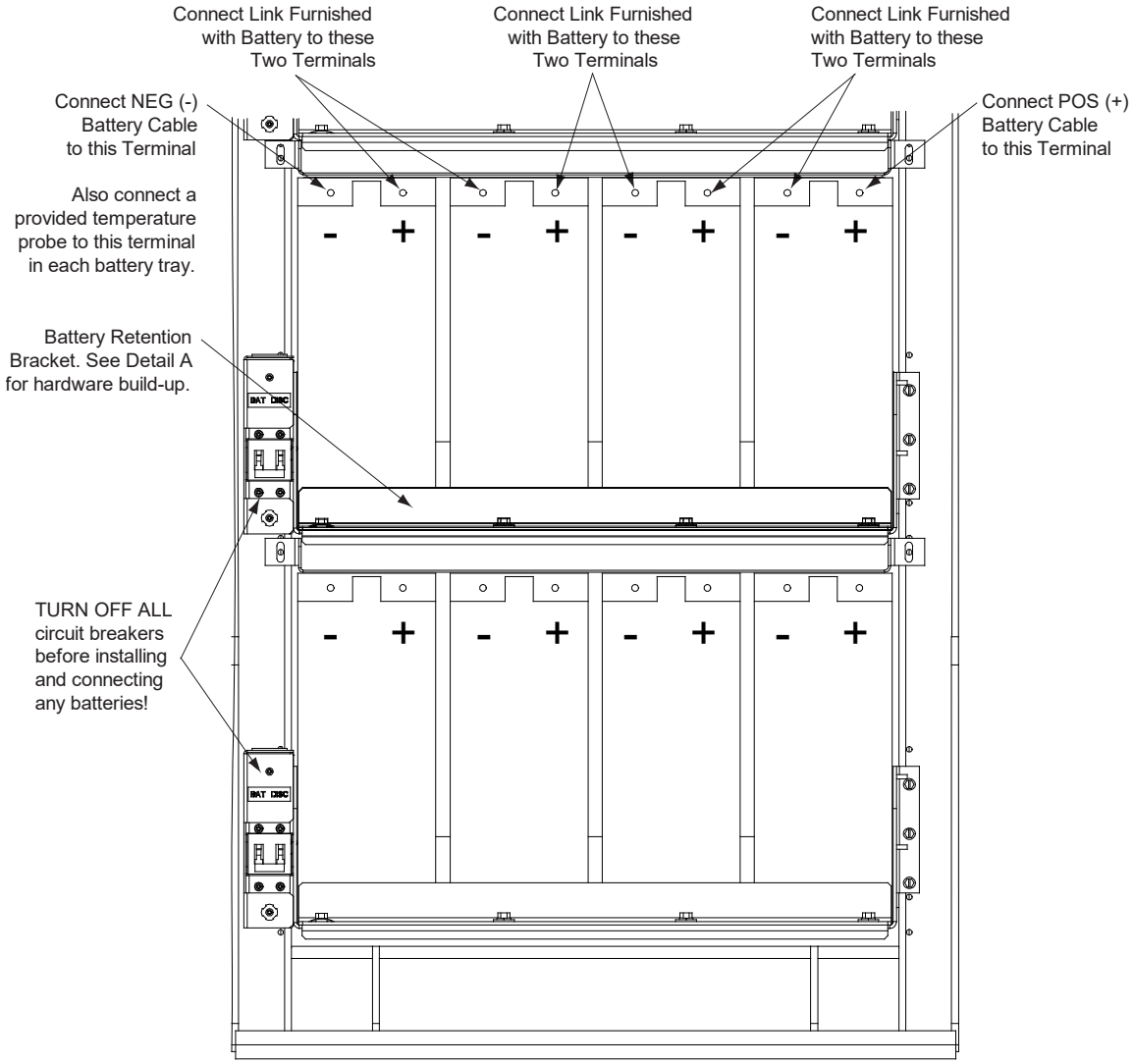
WARNING! In the next step, observe correct polarity. Connect only cables labeled "+" to battery terminals labeled "+". Likewise, connect only cables labeled "–" to battery terminals labeled "–".

7. Connect the cables found in the battery tray to the battery terminals, "+" to "+" and "–" to "–". Observe correct polarity. Refer to Figure 5.16. Secure with hardware furnished with the battery. Torque hardware to battery manufacturer's recommendations.

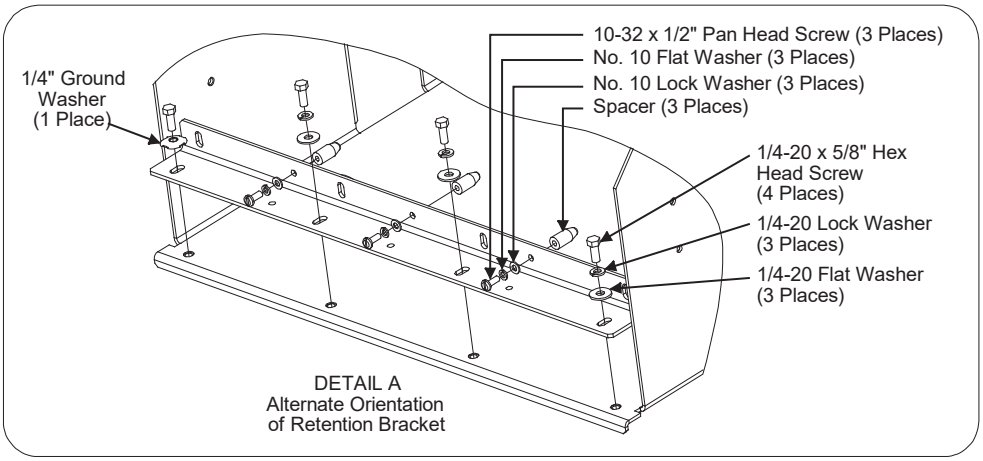
NOTE! *Three battery temperature probes are provided. Connect a temperature probe to the left-most battery module's negative terminal in each battery tray (see Figure 5.16). Connect the temperature probe in the bottom tray to the System Temp 1 input on the system interface board. Connect the temperature probe in the middle tray to the System Temp 2 input on the system interface board. Connect the temperature probe in the top tray to the Temp 1 input on the IB2-1 board. Refer to "Temperature Probes" on page 27. In the event there is excess length of the probe wires, coil the wires up and tie in a convenient location along the path of the battery power cable. For systems equipped with fewer than three battery strings in the power bay, the unused temperature probes should be programmed off. Refer to the controller user manual, UM1M830BNA, provided with the system for instructions.*

8. Repeat steps 1 through 7 for any remaining battery trays.
9. To connect the batteries to the power system, turn ON the battery disconnect circuit breaker located on all battery trays.

Figure 5.16 Battery Tray Battery Installation Details



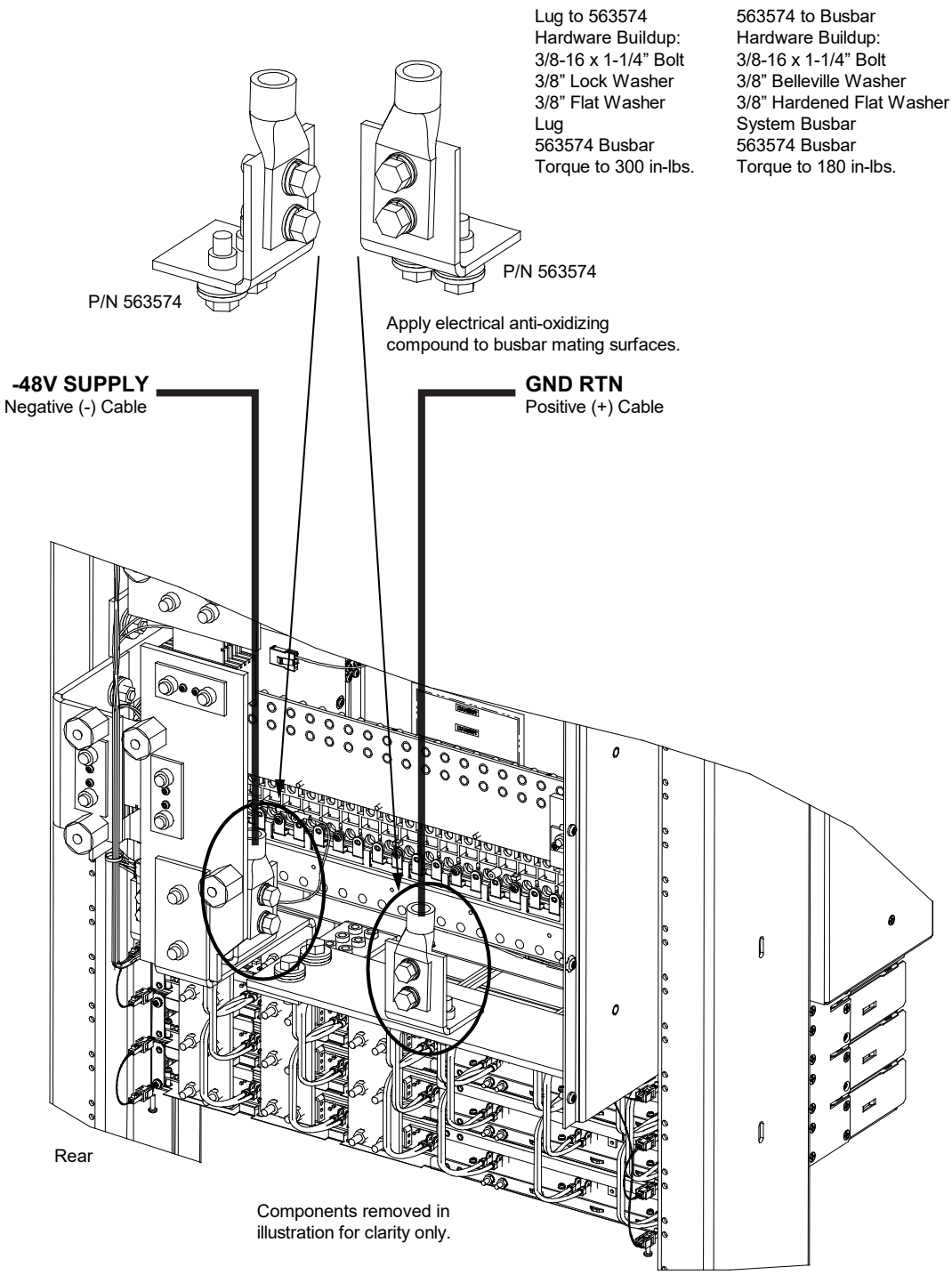
Note:
1. Two trays shown as example.
2. Cabling detail omitted.



5.13 Special Application Rectifier Bus Landing Point Kit P/N 563686

Special application rectifier bus landing point kit P/N 563686 is available for use with these systems. Kit P/N 563686 includes two (2) P/N 563574 Bus Landing Point Assemblies. When installed, the kit provides rectifier bus landing points for 350 kcmil cables. Refer to Figure 5.17.

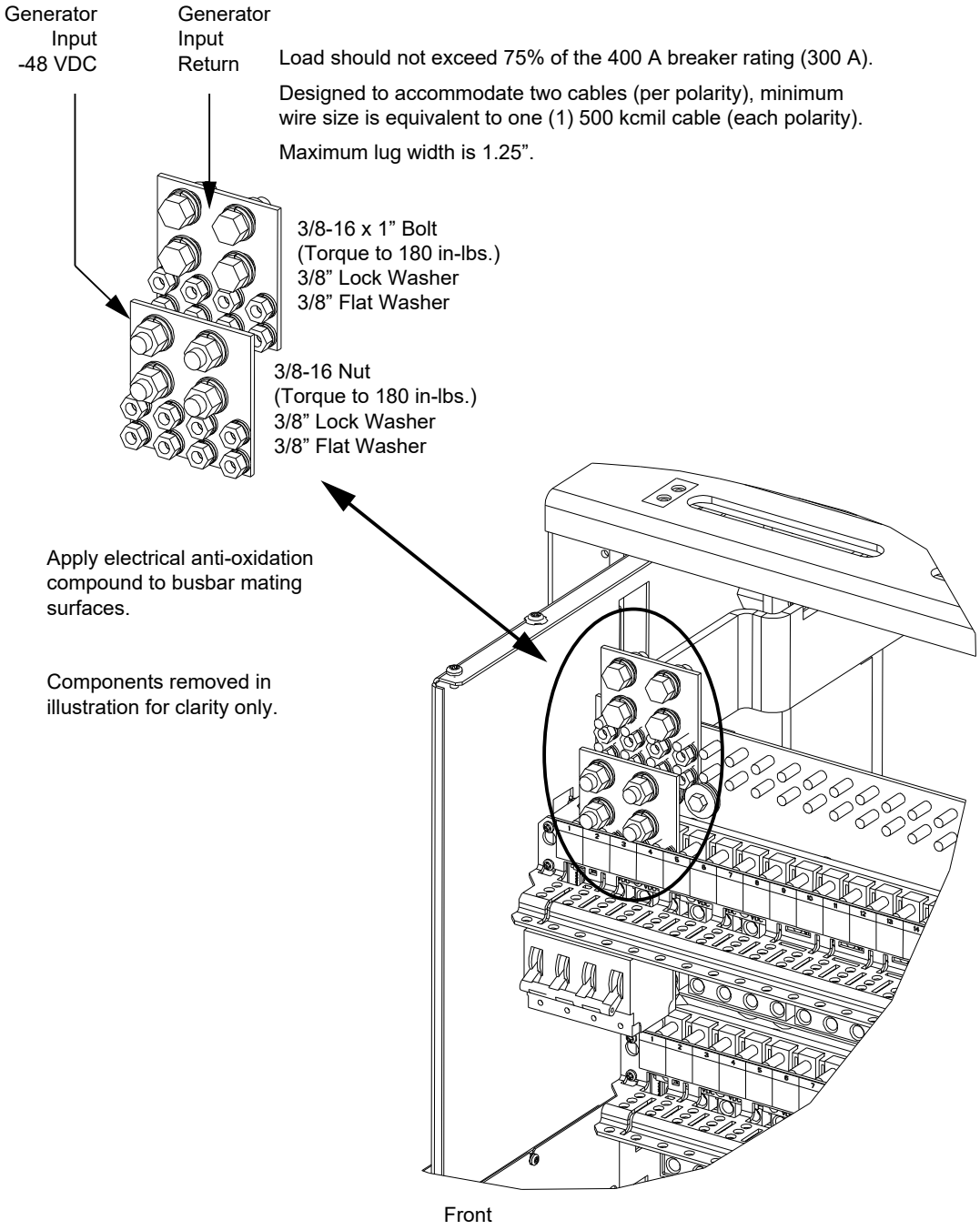
Figure 5.17 Special Application Rectifier Bus Landing Point Kit P/N 563686



5.14 Generator Input Breaker Kit (P/N 564219)

This kit provides the components to install a 400 A circuit breaker to feed the rectifier output bus of the power system through a shunt. A customer connects an external generator output to this circuit breaker which then supplies generator input power to the system. For field installation, refer to IM564219. For wiring a generator to the circuit breaker, refer to Figure 5.18.

Figure 5.18 Wiring Input Generator Kit (P/N 564219)



6 Installing the Rectifier and Converter Modules

Rectifier and converter modules can be inserted or removed with power applied (hot swappable).

Rectifier modules can be installed in any mounting position of each module mounting assembly. Converter modules can be installed in any of the three far right mounting positions of the three lower module mounting assemblies (as viewed from the front). See Figure 6.3. See Alerts below for restrictions.

NOTE! *Each rectifier and converter module locks into the module mounting assembly by means of a latch located on the bottom of the module. The latch and module handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract. See Figure 6.3.*

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

ALERT! The system can either have +24V DC-DC converters installed or -58V DC-DC converters installed. The system cannot have both types of converters installed at the same time.

ALERT! The -48 VDC to +24 VDC converter modules must only be installed in a system position that accepts a +24V DC-DC converter. Refer to labeling on the system's module mounting shelf. A sample of this labeling is provided in Figure 6.1.

Figure 6.1 Sample Module Mounting Shelf Labeling

ALERT! The -48 VDC to -58 VDC converter modules must only be installed in a system position that accepts a -58V DC-DC converter. Refer to labeling on the system's module mounting shelf. A sample of this labeling is provided in Figure 6.2.

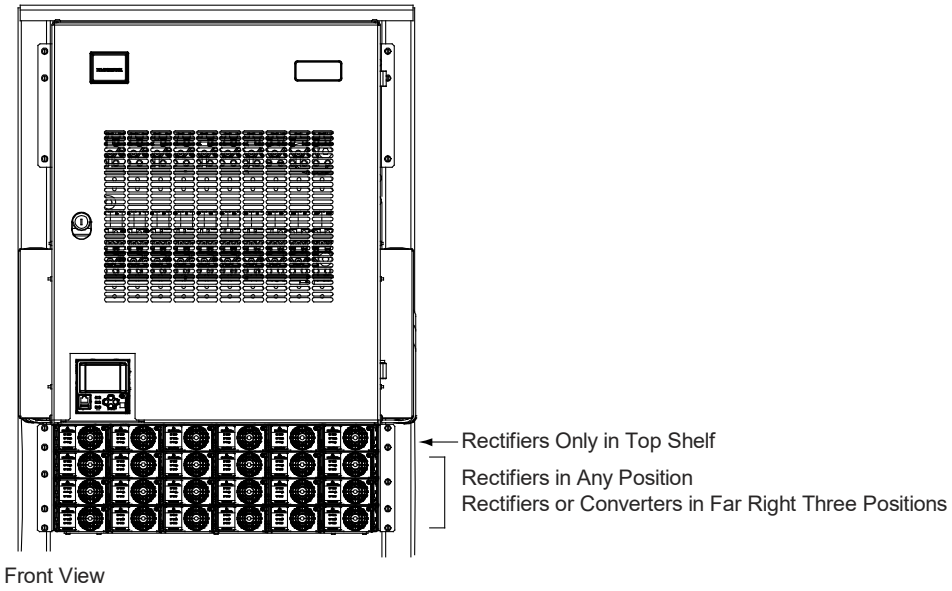
Figure 6.2 Sample Module Mounting Shelf Labeling

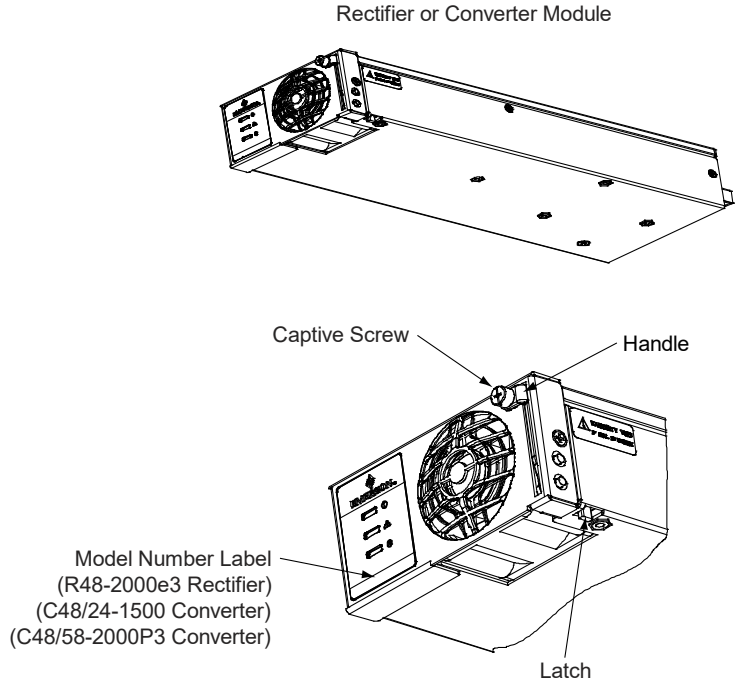
Procedure

1. Unpack the modules.
2. Note the model number located on the front of each module. Model numbers starting with the letter "R" are rectifier modules. Model numbers starting with the letter "C" are converter modules.
3. Place the module into an unoccupied mounting position without sliding it in completely. Rectifiers modules can be installed in any mounting position of each module mounting assembly. Converter modules can be installed in any of the three far right mounting positions of the three lower module mounting assemblies (as viewed from the front). See Figure 6.3.
4. Loosen the captive screw on the module's handle. Pull the handle down out from the module's front panel (this will also retract the latch mechanism). See Figure 6.3.

5. Push the module completely into the shelf.
6. Push the handle up into the module's front panel. This will lock the module securely to the shelf. Tighten the captive screw on the handle.
7. Repeat the above steps for each module being installed in the system.
8. After the modules are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

Figure 6.3 Installing Rectifier and Converter Modules into Spec. No. 588705300 Module Mounting Assembly





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 “Installation Acceptance Checklist” 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

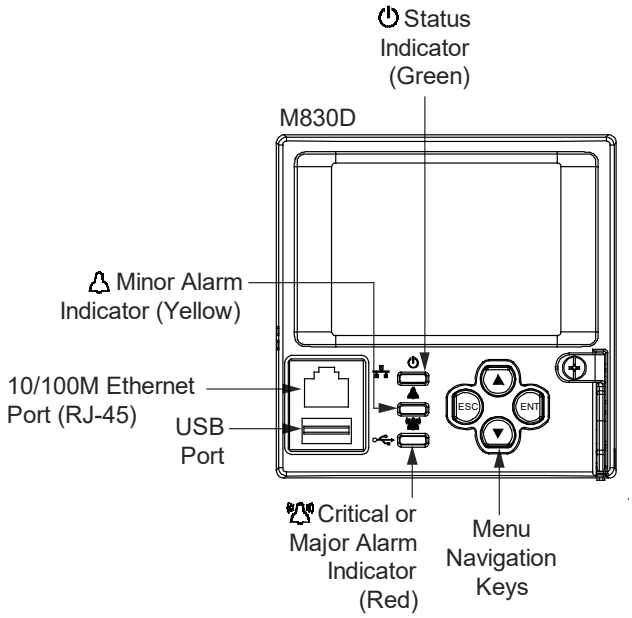
1. Apply battery power to the system by closing the external battery disconnect(s) or protective device(s) that supplies battery power to the system, if furnished. Close the system’s internal battery disconnect circuit breakers, if furnished.
2. Apply AC input power to the system by closing ALL external AC disconnects or protective devices that supply AC input power to the module mounting assemblies. Rectifiers and 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 NCU Controller Initialization

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

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

Figure 7.1 NCU Local Indicators and Navigation Keys

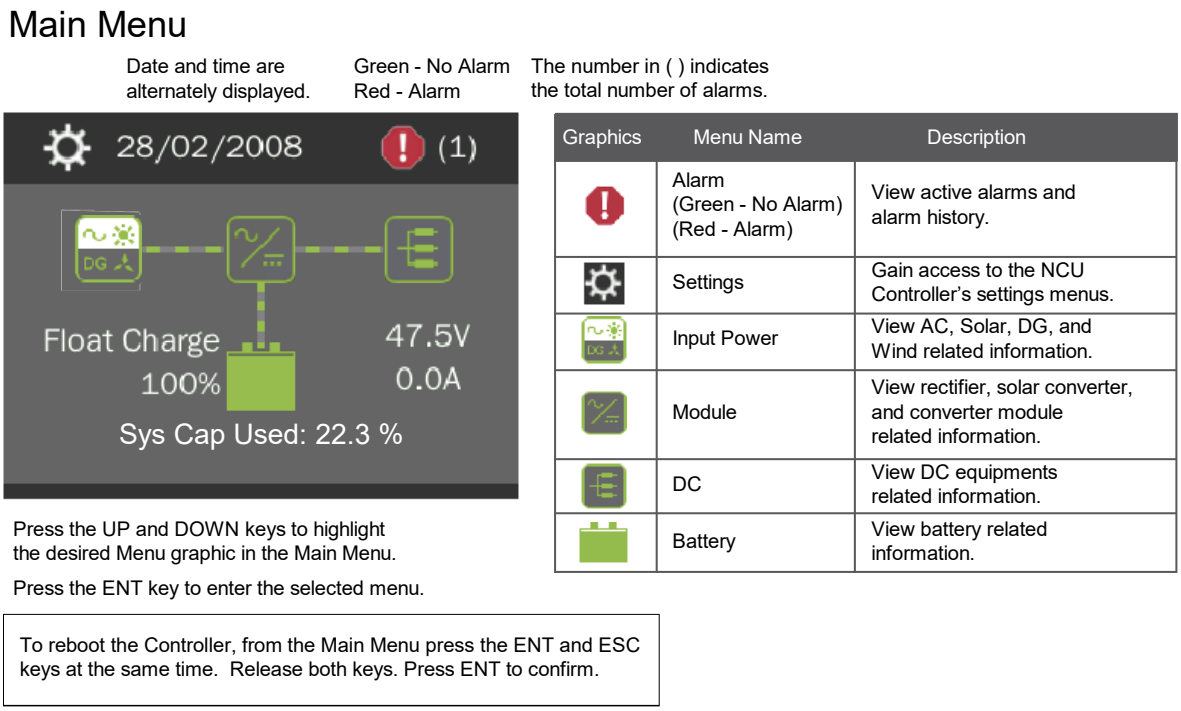


Procedure

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 "Network Power" 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 7.2.

Figure 7.2 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 beyond the first three supplied with the system and external inputs/outputs connected to the IB2 interface board and the optional EIB extended interface board. Refer also to "NCU Start Wizard" on page 58.

NOTE! *When setting total rectifier current limit, the set point to each rectifier is the total set point divided by the number of rectifiers. 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.

Procedure

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

Checking Basic System Settings

Navigate through the controller menus and submenus to check system settings. You can adjust any parameter as required. Note that these settings can also be checked (and changed if required) via the WEB Interface. Refer also to "NCU Start Wizard" on page 58.

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 7.1 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 7.1 NCU Basic Settings Menu Navigation

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

NOTE! *All above parameters are preset at the factory and should not need to be adjusted with the exception of the date, time, and battery capacity.*

Changing Battery Capacity Rating in the NCU

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

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

   Local Menu Navigation:
   Main Menu / Settings Icon / Batt Settings / Batt1 Settings / Rated Capacity.

   Web Menu Navigation:
   Settings Menu / Battery Tab / Batt1 Rated Capacity.

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

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

Local Menu Navigation:
Main Menu / Settings Icon / Batt Settings / Basic Settings / Reset Batt Cap.

Web Menu Navigation:
Settings Menu / Battery Tab / Reset Battery Capacity.

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

Configuring the NCU Identification of Rectifiers and Assigning which Input Feed is Connected to the Rectifiers (Optional)

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 (Optional)

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.*

7.4 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 7.2.

Table 7.2 Status and Alarm Indicators

Component	Indicator		Normal State
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

7.5 Final Steps

Procedure

1. If any controller configuration settings were changed, refer to the 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 7.2.

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