



NetSure™ 7200 Series -48 VDC Power System

Installation Manual

Specification Number: 582127200

Model Number: 7200

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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 (IM582127200) provides *Installation Instructions* for Vertiv™ NetSure™ -48 VDC Power System Model 7200, Spec. No. 582127200.

The complete Customer Documentation Package consists of...

Power System Installation Manual

- Power System Installation Instructions: IM582127200

NCU Controller User Manual

- NCU Controller User Instructions: UM1M830BNA

USB Drive with All Customer Documentation

- Power System Installation Instructions: IM582127200
- Power System User Instructions: UM582127200
- Power System “System Application Guide”: SAG582127200
- NCU Controller User Instructions: UM1M830BNA
- Rectifier Instructions: UM1R483500e
- 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

- Bays Placed, Secured to Floor, and Bolted Together
- Optional Power Bay 8000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies Installed
- Optional Power Bay 12000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies Installed
- Optional Distribution Bay 8000 A Internal Top Mount -48 VDC Power Bus Assembly Installed
- Optional Distribution Bay 12000 A Internal Top Mount -48 VDC Power Bus Assembly Installed

- Optional Distribution Bay Internal Top Mount Return Bus Assembly Installed
- Internal Top Mount -48 VDC Power and Return Bus Interconnect Links Installed
- Circuit Breakers and Fuses Installed

Making Switch Settings

- Switch Settings on IB2 Interface Board Set
- Switch Settings on EIB Interface Board Set
- Switch Settings on SM-DU Set
- Switch Settings on SM-DU+ Set

Making Electrical Connections

- Bay Grounding Connection (Frame Ground) Made
- AC Input and AC Input Equipment Grounding Connections Made
- External Alarm, Reference, Monitoring, and Control Connections Made
- Remote Access Ethernet Connection Made (if required)
- Bay-to-Bay Cable Connections Made
- Load Connections Made
- Power and Distribution Bays Busbars Connections Made

Installing the Modules

- Rectifier 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 bay(s) to the floor.
- Rectifier and mounting shelf ventilating openings must not be blocked and temperature of air entering rectifiers must not exceed rated operating ambient temperature range found in SAG582127200.
- 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 each bay is 2' 0".

3.2 List of Non-Common Tools

These tools are not common and are required to install the system.

- T27 Torx driver.
- Torque wrench capable of 60 foot-pounds.
 - 3/4" deep socket for torque wrench.
 - 9/16" deep socket for torque wrench.
 - 6" extension for torque wrench.
 - 17mm deep socket for torque wrench.
- Torque driver with straight bit capable of 30+/- 2 in-lbs.
- Torque wrench with a 7/16" deep socket capable of 45 in-lbs.

3.3 Installing the Bays

Ventilation Requirements

Refer to the "General Requirements" on page 2.

Placing and Securing the Bays to the Floor

Refer to "General Requirements" on page 2.

The system consists of one (1) primary power bay and up to two (2) secondary power bays, and one (1) to five (5) distribution bays; depending upon your power requirements. It is recommended to place the primary power bay on the far right or far left end of the bay line-up, and to expand the system to the left or right of the primary power bay. This allows simple cable connections between bays. Bays are typically placed next to each other and bolted together.

Procedure

- [] 1. Locate where the bays are to be placed.
- [] 2. Drill mounting holes in the floor. Refer to Figure 3.1 and Figure 3.2 for bay floor drilling dimensions.
- [] 3. Place the bays in position.
- [] 4. Open bay's front and rear doors.
- [] 5. Install mounting hardware into floor per site requirements.



NOTE! Do not tighten. Leave extremely loose.

- [] 6. Install shims between bottom of each bay and the floor as required to distribute floor loading and to align outside of bays.

Bolting Bays Together

Procedure



NOTE! Refer to Figure 3.3 as this procedure is performed.

- [] 1. Remove the top rear shield from the power bays. Retain for reinstallation.



NOTE! Clearance holes for 3/8" bolts are provided in the side panels of each bay. These holes are for bolting the bays together.

- [] 2. Level bays as required. Level the bays so that all bays are even at top, and bolt holes in the side of each bay line up with holes in the adjacent bay.
- [] 3. Install cable bushings as required in the bay to bay access holes. See Figure 3.3.
- [] 4. Install the bay to bay bolts (three in the front, three in the rear) (paint piercing washer both sides). Use provided 3/8" hardware, six places per bay.



NOTE! Do not tighten. Leave extremely loose.

Shimming Internal Top Mount Bus Assemblies

Procedure

- [] 1. Remove the shield that covers the top of the -48 VDC busbars.
- [] 2. From inside the bays, loosen the nut plate bolts on the top mount bus assemblies for all bays to be connected. See Figure 3.4.



NOTE! On distribution bays only the left side as viewed from the rear nut plate bolts can be adjusted.

- [] 3. If the busbars from one bay to the next are out of alignment by greater than 1/8", loosen the bolts that secure the nut plate in place. Refer to Figure 3.4.



NOTE! See note above.

Installing Upgrade Top Mount Bus Kits

- [] 1. If upgraded top mount bus kits were not factory installed and need to be installed, refer to the following procedures to install the appropriate upgrade kit.
 - a) Refer to "Installing Optional Power Bay 8000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies, P/N 557824" on page 9.
 - b) Refer to "Installing Optional Power Bay 12000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies, P/N 557823" on page 10.
 - c) Refer to "Installing Optional Distribution Bay 8000 A Internal Top Mount -48 VDC Power Bus Assembly, P/N 557828" on page 11.

- d) Refer to “Installing Optional Distribution Bay 12000 A Internal Top Mount -48 VDC Power Bus Assembly, P/N 557827” on page 12.
 - e) Refer to “Installing Optional Distribution Bay Internal Top Mount Return Bus Assembly, P/N 557829, 557830, 557831” on page 13.
- [] 2. Refer to “Installing Internal Top Mount -48 VDC Power and Return Bus Interconnect Links, P/N 558005, 558006, 558007” on page 14 to install the busbar links between bays.

Finishing the Installation

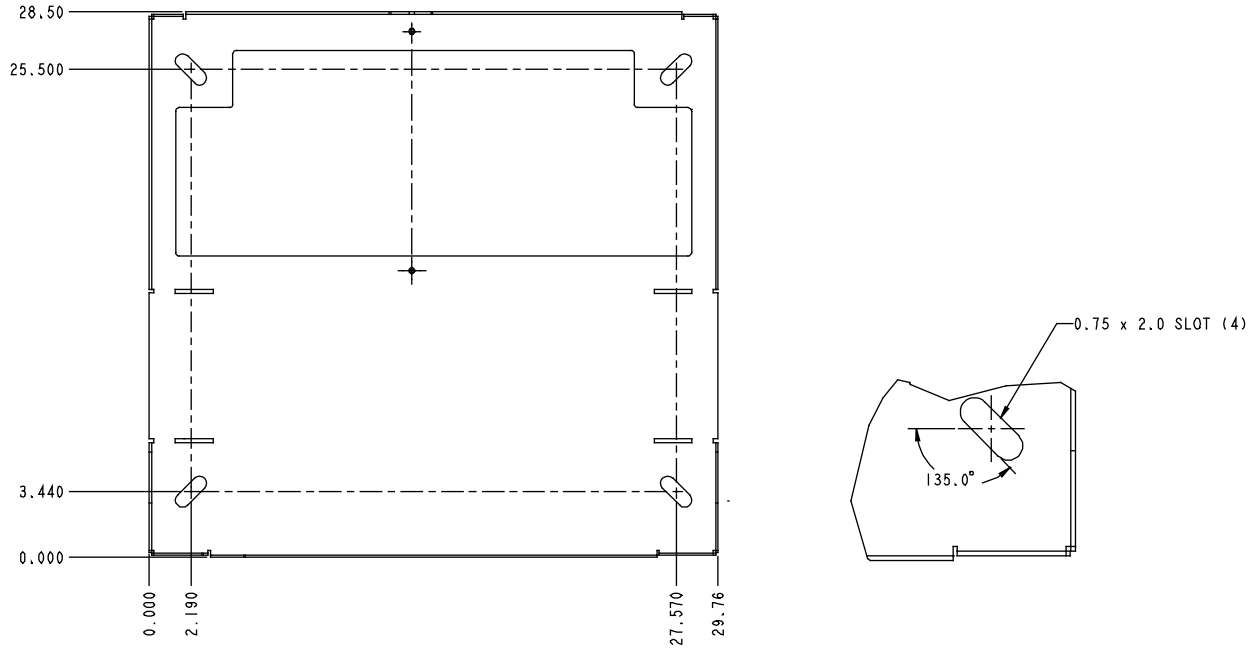
- [] 1. Perform these steps to finish the installation.
- a) Check the torque on all bus connections.

1/2” hardware (3/4” socket size) torque to 550 in lbs.

M10 hardware (17 mm socket size) torque to 420 in lbs.

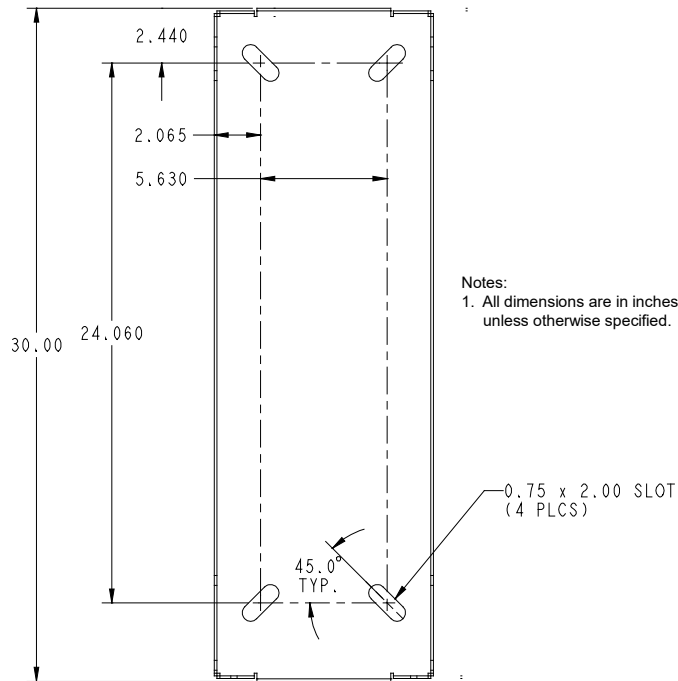
3/8” hardware (9/16 socket size) torque to 180 in lbs.
 - b) After all the 1/4” nut plate hardware is torqued, tighten the bay to bay bolts (3 in the front and 3 in the rear) for all bays. Torque to 180 in-lbs.
 - c) Tighten the floor mounting hardware per hardware manufacturer specifications.
 - d) Replace power bays top rear shields.
 - e) Replace -48V top mount bus shields.
 - f) Close front and rear doors.

Figure 3.1 Power and Distribution Bay Floor Drilling Dimensions



- Notes:**
1. All dimensions are in inches, unless otherwise specified.

Figure 3.2 Transition Bay Floor Drilling Dimensions



- Notes:**
1. All dimensions are in inches, unless otherwise specified.

Figure 3.3 Bolting Bays Together

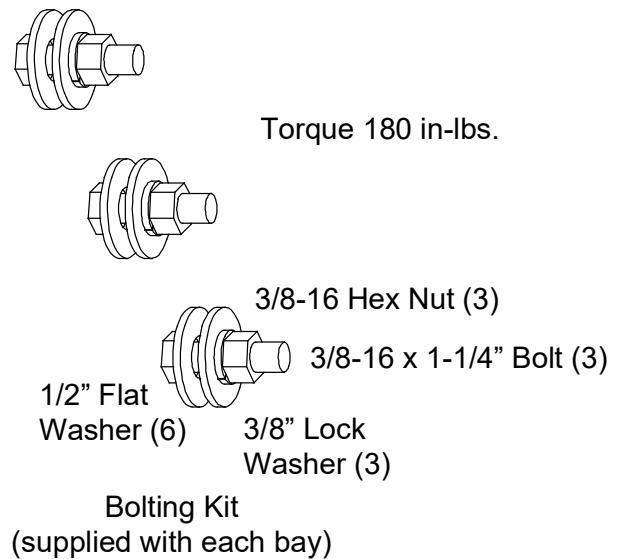
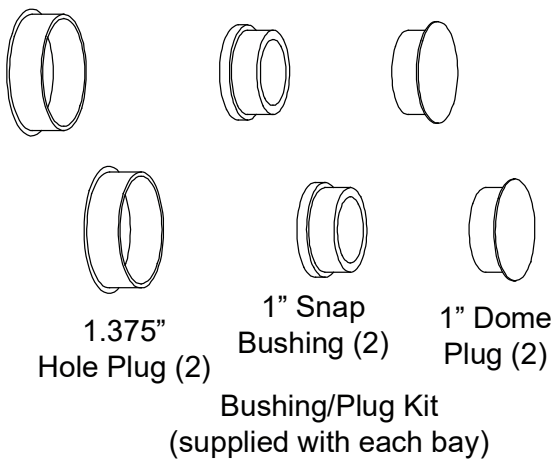
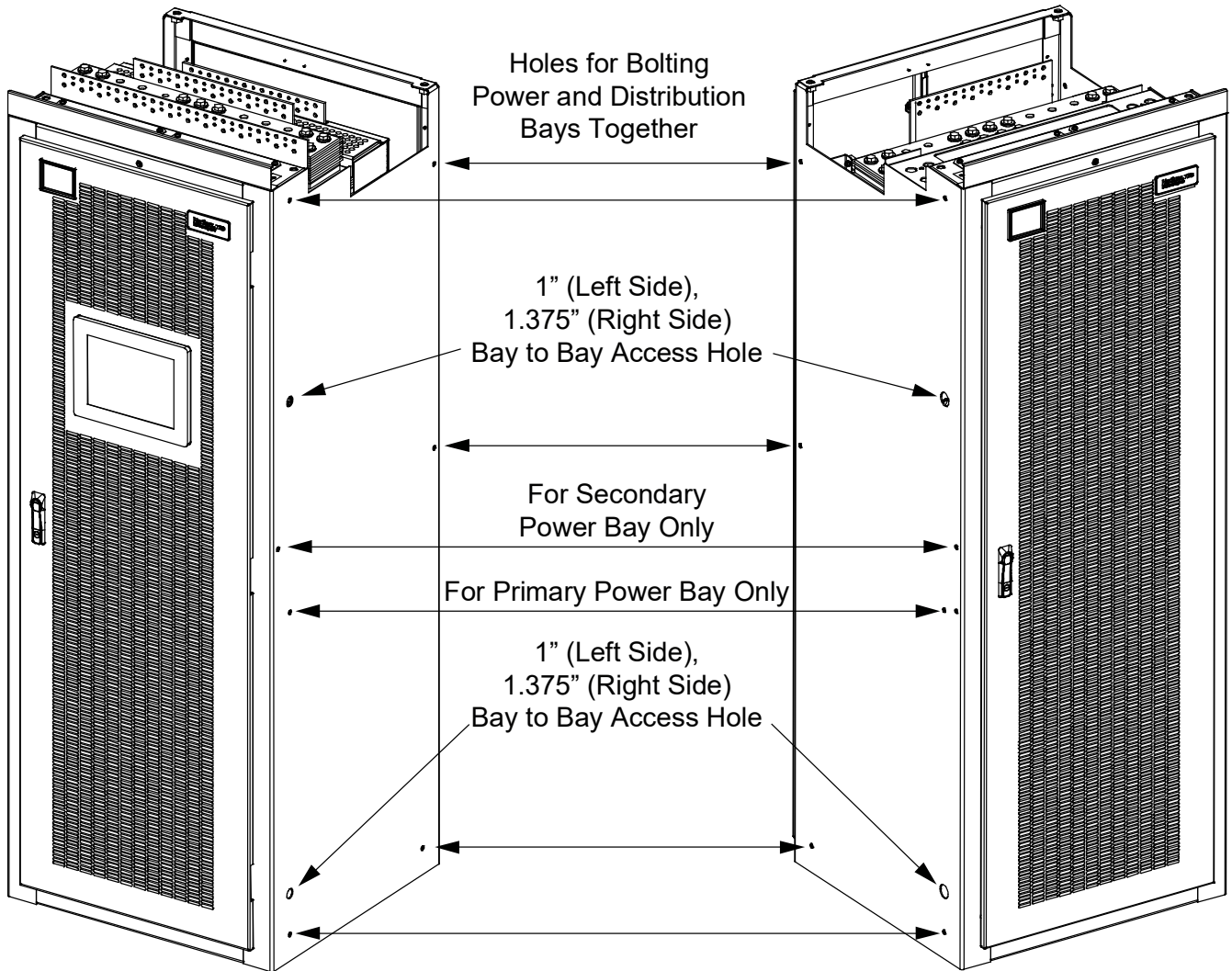
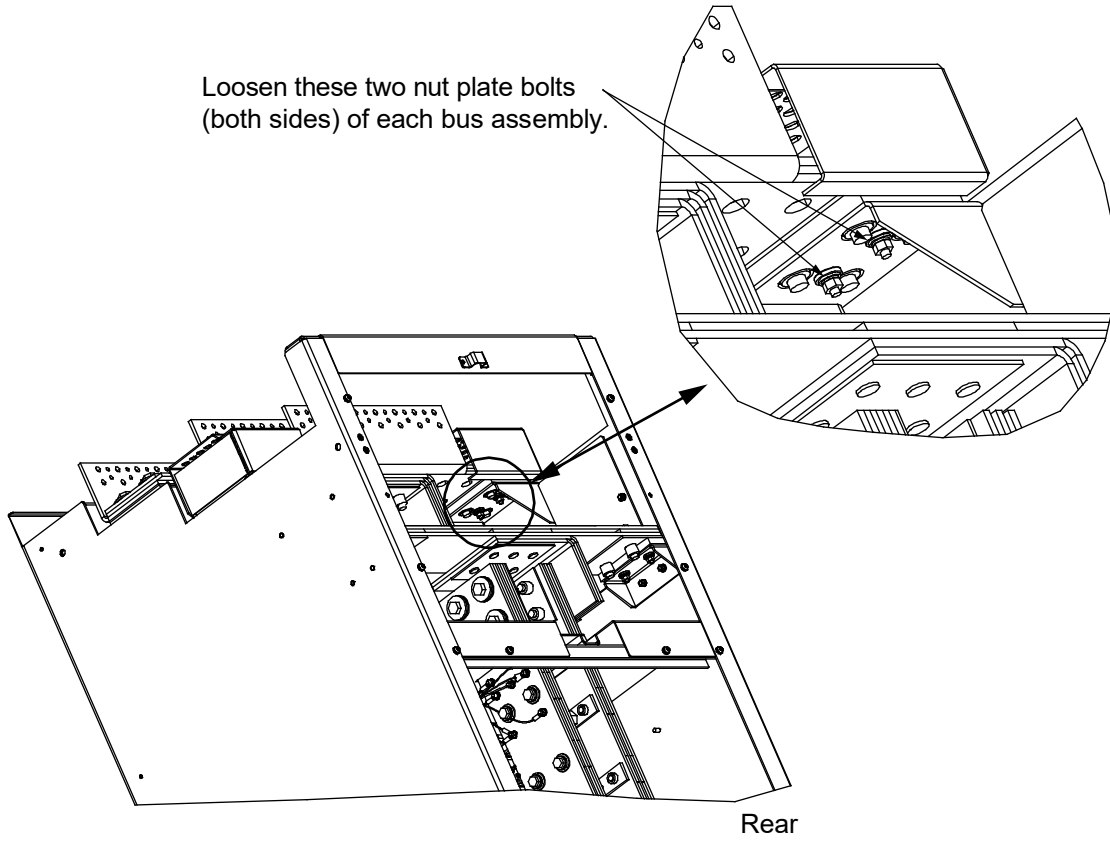
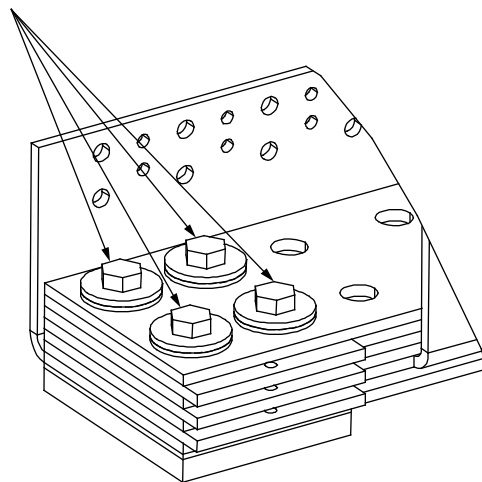


Figure 3.4 Loosening the Nut Plate Bolts



If busbars from one bay to next are out of alignment by greater than 1/8", loosen these bolts on both bus assemblies

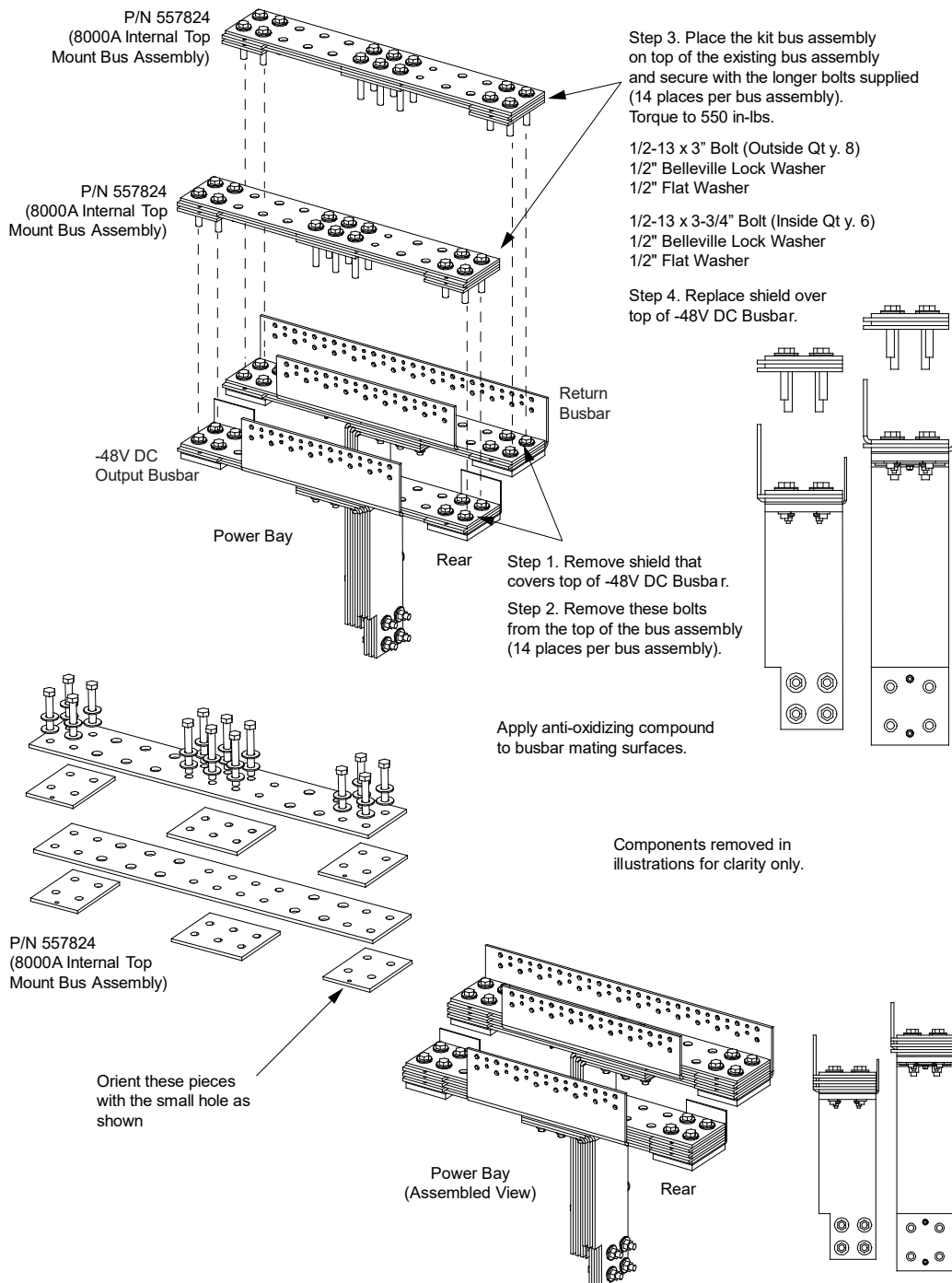


3.4 Installing Optional Power Bay 8000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies, P/N 557824

Procedure

- [] 1. Assemble the busbar kit to the top of the bay as shown in Figure 3.5.
Apply anti-oxidation compound and torque connections as indicated in Figure 3.5.

Figure 3.5 Installing Optional Power Bay 8000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies

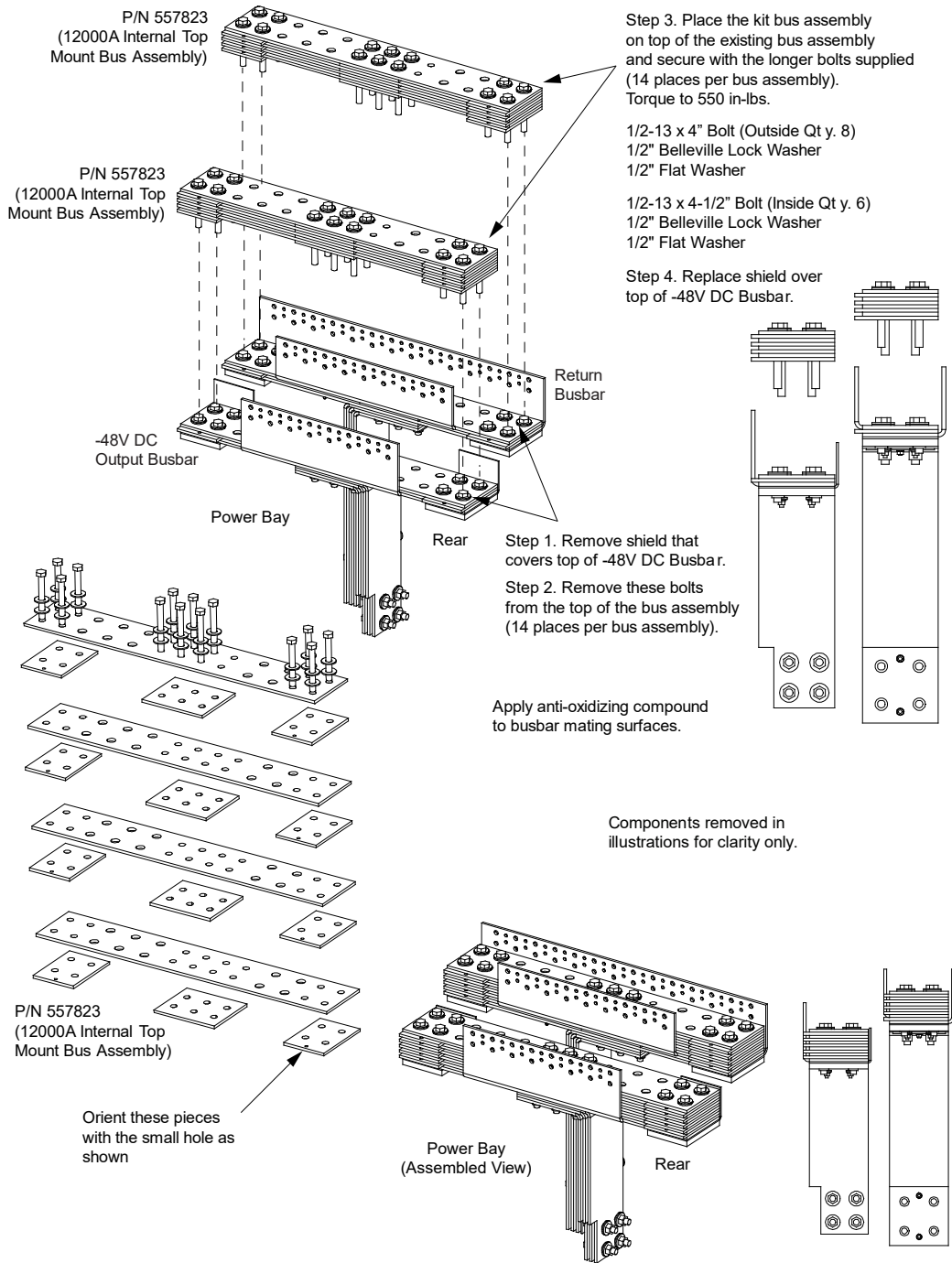


3.5 Installing Optional Power Bay 12000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies, P/N 557823

Procedure

- [] 1. Assemble the busbar kit to the top of the bay as shown in Figure 3.6.
Apply anti-oxidation compound and torque connections as indicated in Figure 3.6.

Figure 3.6 Installing Optional Power Bay 12000 A Internal Top Mount -48 VDC Power and Return Bus Assemblies

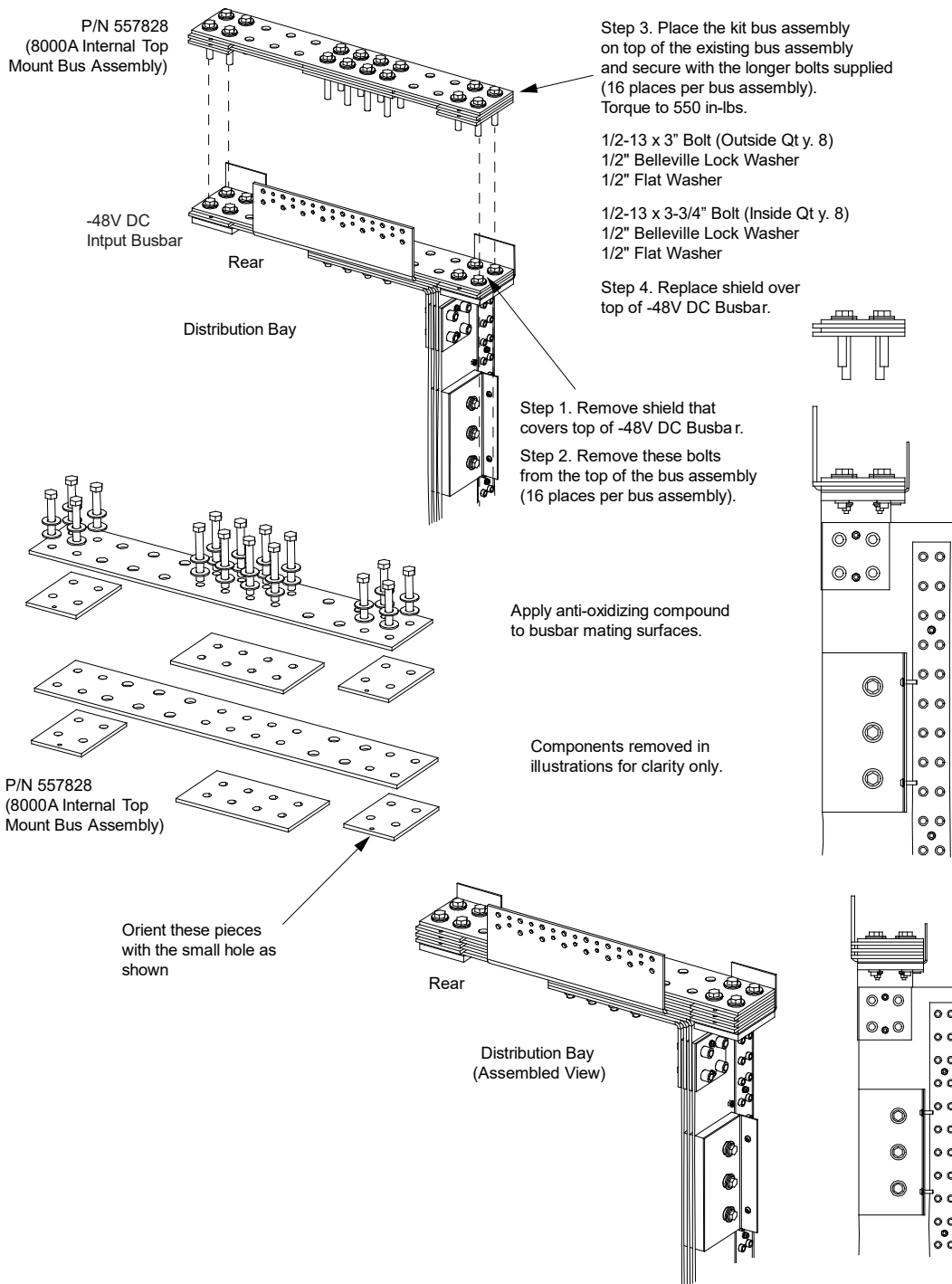


3.6 Installing Optional Distribution Bay 8000 A Internal Top Mount -48 VDC Power Bus Assembly, P/N 557828

Procedure

- [] 1. Assemble the busbar kit to the top of the bay as shown in Figure 3.7.
Apply anti-oxidation compound and torque connections as indicated in Figure 3.7.

Figure 3.7 Installing Optional Distribution Bay 8000 A Internal Top Mount -48 VDC Power Bus Assembly

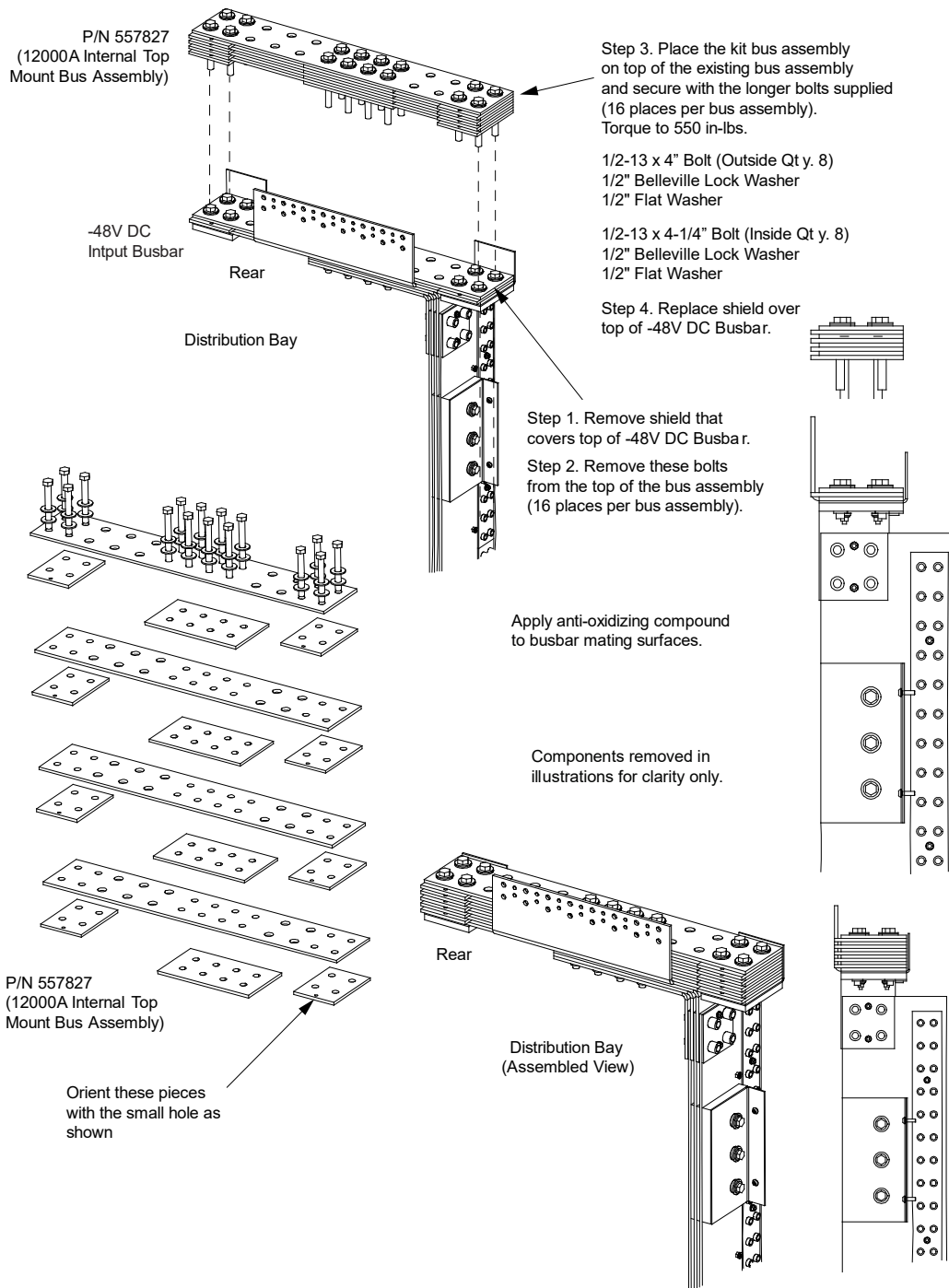


3.7 Installing Optional Distribution Bay 12000 A Internal Top Mount -48 VDC Power Bus Assembly, P/N 557827

Procedure

- [] 1. Assemble the busbar kit to the top of the bay as shown in Figure 3.8.
Apply anti-oxidation compound and torque connections as indicated in Figure 3.8.

Figure 3.8 Installing Optional Distribution Bay 12000 A Internal Top Mount -48 VDC Power Bus Assembly



3.8 Installing Optional Distribution Bay Internal Top Mount Return Bus Assembly, P/N 557829, 557830, 557831

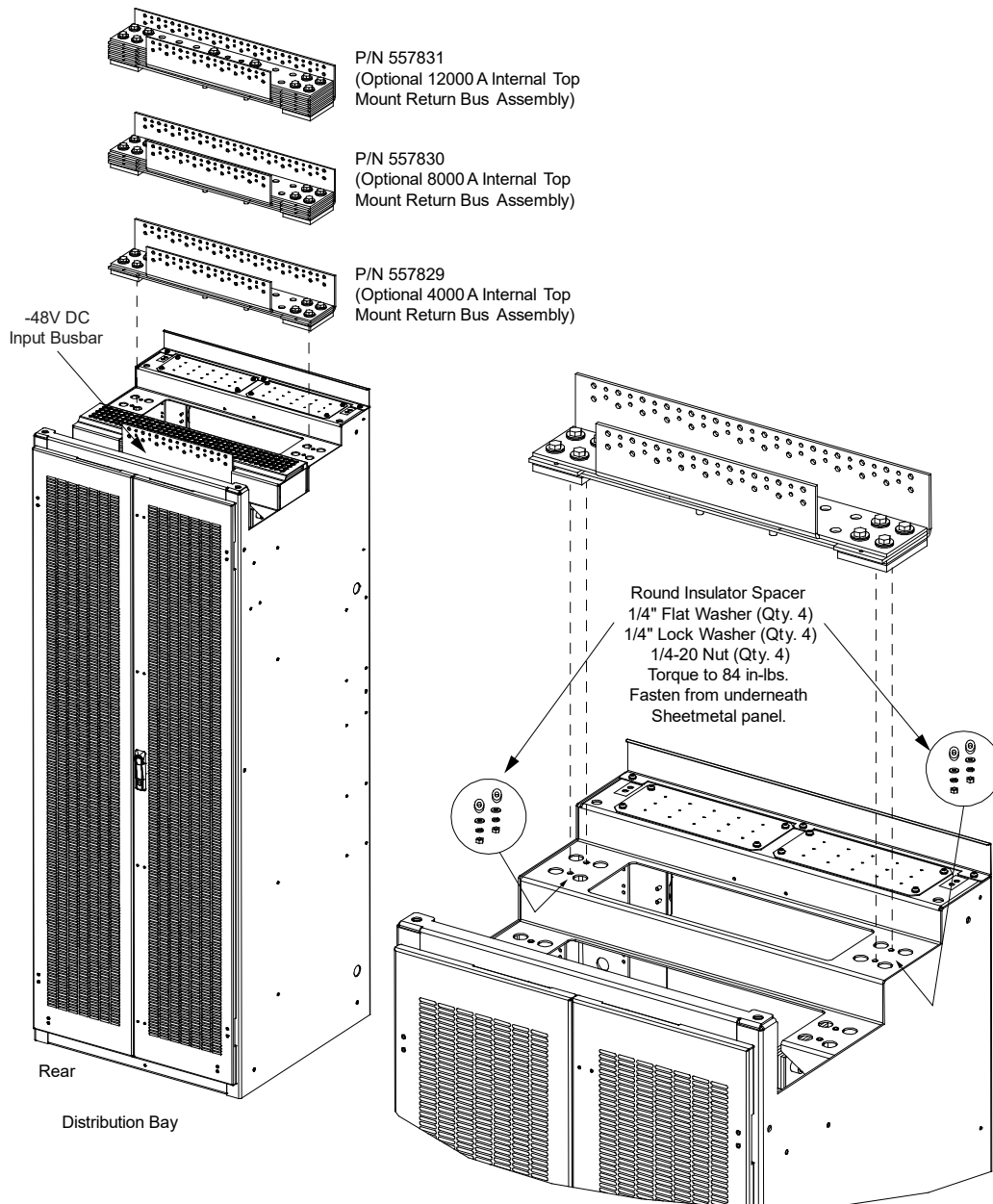


WARNING! The optional distribution bay internal top mount return bus assemblies are heavy. Take appropriate precautions when lifting the assemblies.

Procedure

1. Assemble the busbar kit to the top of the bay as shown in Figure 3.9.

Figure 3.9 Installing Optional Distribution Bay Internal Top Mount Return Bus Assembly



Components removed in illustration for clarity only.

3.9 Installing Internal Top Mount -48 VDC Power and Return Bus Interconnect Links, P/N 558005, 558006, 558007

Procedure

- [] 1. Join the internal top mount bus assemblies of each bay to the same bus assemblies in an adjacent bay as shown in Figure 3.10 and described in this procedure. Apply anti-oxidation compound and torque connections as indicated in Figure 3.10.
- [] 2. Remove clear shield on the -48V top mount bus. Retain for reinstallation.
- [] 3. Remove the four bolts on each side of the joint.
- [] 4. Remove the spacer busbars.
- [] 5. Install the busbar links (remember the anti-oxidation compound) and replace the bolts. Do not tighten.
- [] 6. Repeat the above for all power bays and the distribution bays.
- [] 7. Start at one end and torque the bolts (550 in-lbs). First torque the -48V bus end bolts then the RTN end bolts. Move to the center -48V bolts then to the center RTN bolts. Next torque the -48V bus end bolts on the other end of the bay then the RTN bolts on the other end of the bay.
- [] 8. Continue to the end of the line-up of bays, torquing the connections as described in step 7.
- [] 9. Next tighten the 1/4" hardware securing the nut plates (torque to 45 in-lbs).
- [] 10. If there remains a gap between the insulator and the nut plate or the insulator and the enclosure, loosen the 1/4" nut plate bolts and insert a shim between the insulator and the nut plate. Re-torque the 1/4" nut plate bolts. See Figure 3.11.

Figure 3.10 Installing Internal Top Mount -48 VDC Power and Return Bus Interconnect Links

Step 1. Remove shield that covers top of -48V DC Busbar.

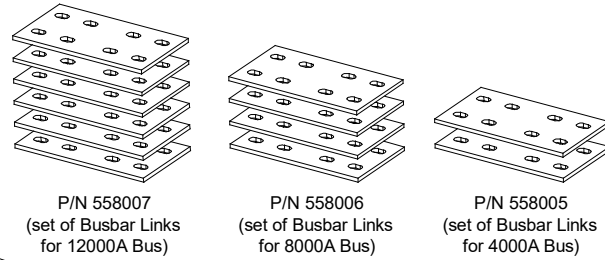
Step 2. Remove these bolts from the top of the bus assemblies (8 places per bus assembly).

Step 3. Remove the spacer busbars located here and here.

Step 4. Insert busbar links in places spacer busbars were removed from.

Step 5. Replace these bolts (8 places per bus assembly). Torque to 550 in-lbs.

Step 6. Replace shield over top of -48V DC Busbar.



Apply anti-oxidizing compound to busbar mating surfaces.

Components removed in illustrations for clarity only.

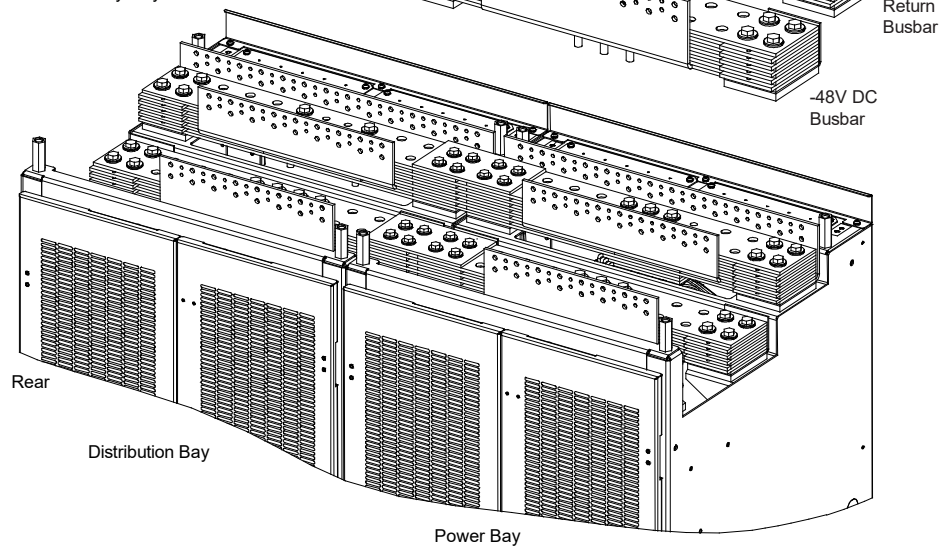
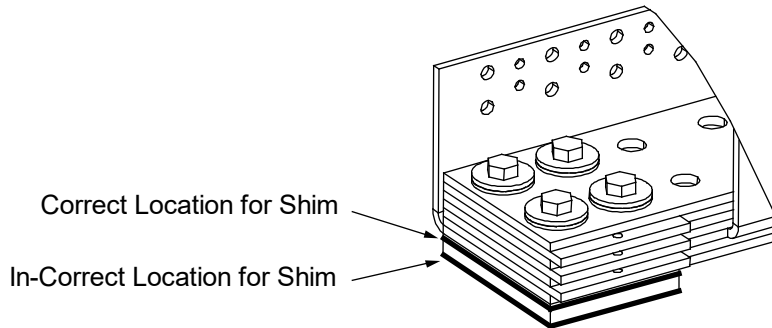


Figure 3.11 Installing Nut Plate Shim (if required)

3.10 Installing Return Bus Load Shunt Monitoring Cable Assembly Kit, P/N 559404 (if furnished)

This kit provides a wire harness to reverse the shunt reference voltage to the SM-DU Shunt Monitoring Module located in the primary power bay. The SM-DU module mounted in the primary power bay contains connections for the internal load shunts provided in each power bay (the system can consist of up to three power bays). The SM DU module also provides an additional external shunt monitoring input. When used as shipped, any external shunt needs to be installed in the hot (-48V) bus. Use this kit to connect up to four (4) external shunts located in the return bus. This requires all internal shunts connected to the SM-DU module to be disconnected and the associated shunt leads isolated.

Procedure

- [] 1. Kit instructions (IM559404) are provided with P/N 559404. Follow these instructions to install this kit.

3.11 Installing Circuit Breakers and Fuses

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

Installing TPL Fuses into a List A Distribution Panel



CAUTION! Maximum fuse size is 800 A.

Refer to the following procedure and install appropriately sized TPL fuses into a List A distribution panel.

Procedure

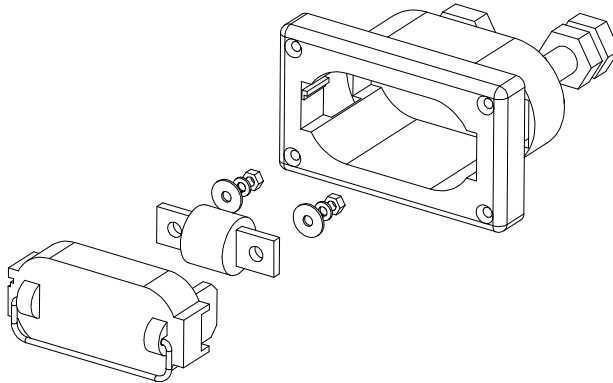


NOTE! Refer to Figure 3.12 as this procedure is performed.

- [] 1. Open the distribution bay's front door.
- [] 2. Remove the TPL fuse carrier from the mounted fuseholder body by grasping its handle and pulling straight out.
- [] 3. Install the TPL fuse into the fuse carrier. Secure the fuse with the flat washer, lock washer, and nut provided. Recommended torque is 168 in-lbs.
- [] 4. Push the fuse carrier securely back into the mounted fuseholder body.
- [] 5. Record all fuse sizes.

- [] 6. Verify that an alarm fuse is installed on the distribution panel associated with this fuse. Ensure that a plastic safety cover is installed on the alarm fuse.
- [] 7. Close the distribution bay's front door and secure.

Figure 3.12 Installing TPL Fuses in a List A Distribution Panel



Installing TPH Fuses into a List B Distribution Panel



CAUTION! Maximum fuse size is 600 A.

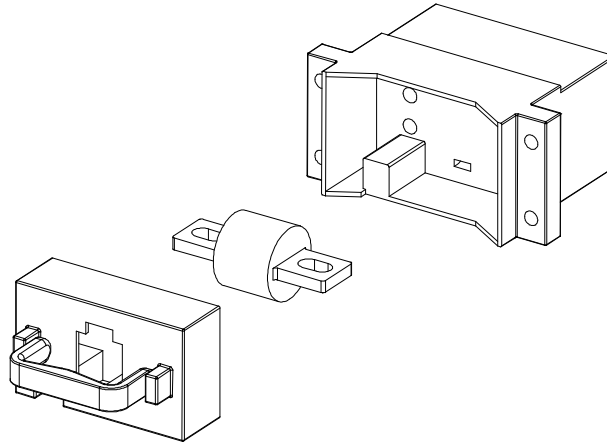
Refer to the following procedure and install appropriately sized TPH fuses into a List B distribution panel.

Procedure



NOTE! Refer to Figure 3.13 as this procedure is performed.

- [] 1. Open the distribution bay's front door.
- [] 2. Remove the TPH fuse carrier from the mounted fuseholder body by grasping its handle and firmly pulling it straight out.
- [] 3. Install the TPH fuse into the fuse carrier.
- [] 4. Push the fuse carrier securely back into the mounted fuseholder body.
- [] 5. Record all fuse sizes.
- [] 6. Verify that an alarm fuse is installed on the distribution panel associated with this fuse. Ensure that a plastic safety cover is installed on the alarm fuse.
- [] 7. Close the distribution bay's front door and secure.

Figure 3.13 Installing a TPH Fuse in a List B Distribution Panel

Installing Bullet Nose Type Fuseholders and TPS/TLS Fuses into a List C Distribution Panel

Refer to the following procedure and install bullet nose type fuseholders and appropriately sized TPS/TLS fuses into a List C distribution panel.

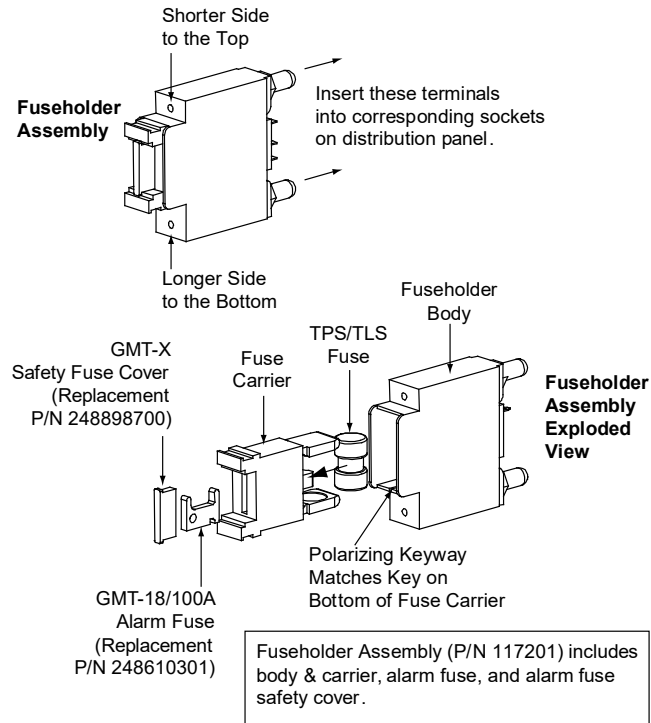
Procedure



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

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

Figure 3.14 Installing a Bullet Nose Type Fuseholder and TPS/TLS Fuse in a List C Distribution Panel



Installing Bullet Nose Type Circuit Breakers into a List C Distribution Panel



CAUTION! A circuit breaker with a rating greater than 100 A SHALL HAVE an empty mounting position between it and any other overcurrent protective device.

Refer to the following procedure and install appropriately sized bullet nose type circuit breakers into a List C distribution panel.

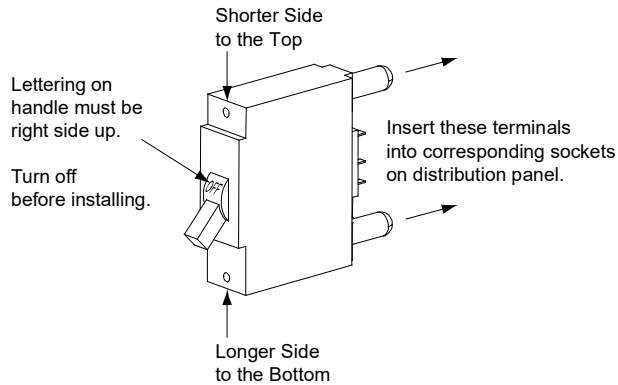
Procedure



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

- [] 1. Open the distribution bay's front door.
- [] 2. Ensure that the circuit breaker is in the OFF position and is of the correct rating. Orient the circuit breaker as shown in Figure 3.15. Insert the terminals on the rear of the circuit breaker into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the circuit breaker makes contact with the alarm terminal on the spring strip. Push distribution device in firmly until fully seated in the distribution panel.
- [] 3. Record all circuit breaker sizes.
- [] 4. Close the distribution bay's front door and secure.

Figure 3.15 Installing a Bullet Nose Type Circuit Breaker in a List C Distribution Panel



Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017) into a List C Distribution Panel



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

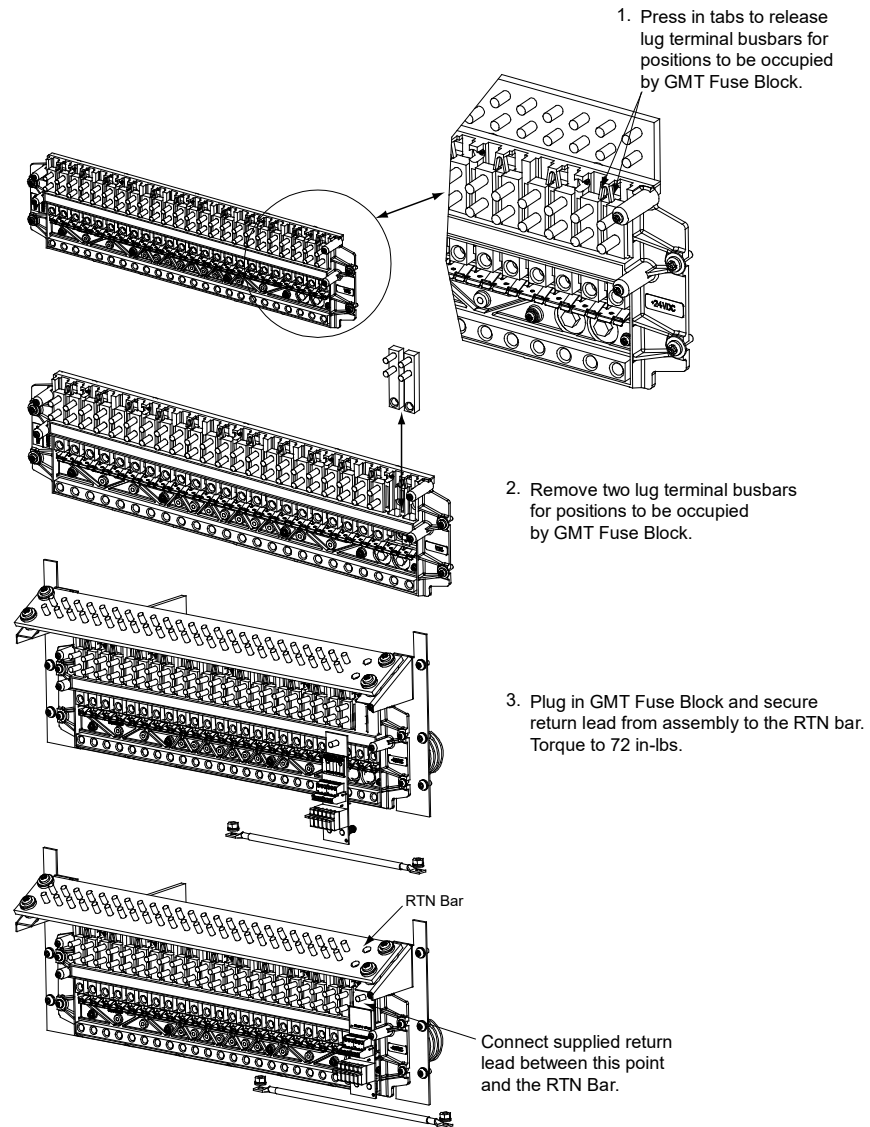
Procedure



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

- [] 1. Open the distribution bay's front door.
- [] 2. Follow the steps in Figure 3.16.
- [] 3. Install an appropriately sized GMT fuse in each fuse mounting position on the GMT Distribution Fuse Block as required. If dummy fuses are installed, first remove the dummy fuse.
- [] 4. Verify that dummy fuses are installed in all unused fuse positions on the GMT distribution fuse block.
- [] 5. Verify that a plastic safety cover is installed on all GMT fuses on the GMT distribution fuse block.
- [] 6. Record all fuse sizes.
- [] 7. Close the distribution bay's front door and secure.

Figure 3.16 Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017) in a List C Distribution Panel



Installing GJ/218 Circuit Breakers into a List D, E Distribution Panel



CAUTION! Maximum circuit breaker size is 800 A.

Refer to the following procedure and install appropriately sized GJ/218 circuit breakers into a List D, E distribution panel.

Procedure



NOTE! Refer to Figure 3.17 and Figure 3.18 as this procedure is performed.



NOTE! Apply anti-oxidation compound and torque connections as indicated in Figure 3.17 and Figure 3.18.

- [] 1. Locate the appropriate circuit breaker mounting kit ordered with the circuit breaker. The circuit breaker mounting kit contains installation hardware and shunt jumpers. Refer to SAG582127200 for part numbers of the circuit breaker mounting kits.
- [] 2. Open the distribution bay's front and rear doors.
- [] 3. Ensure that the circuit breaker is in the OFF position, and is of the correct rating and type (electrical trip/mechanical trip or electrical trip only). Orient the circuit breaker over its mounting location and secure to the front of the distribution panel with the hardware provided.



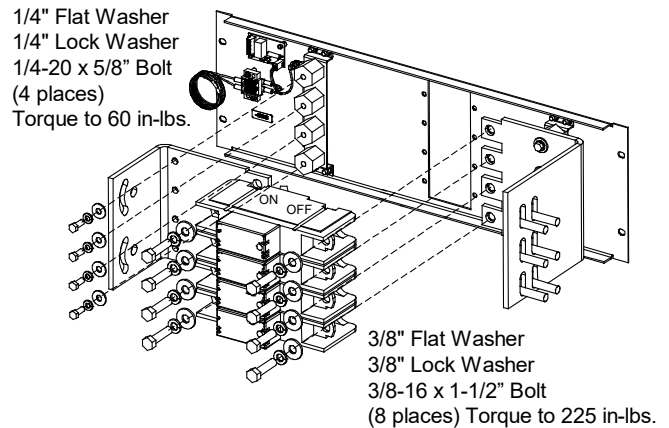
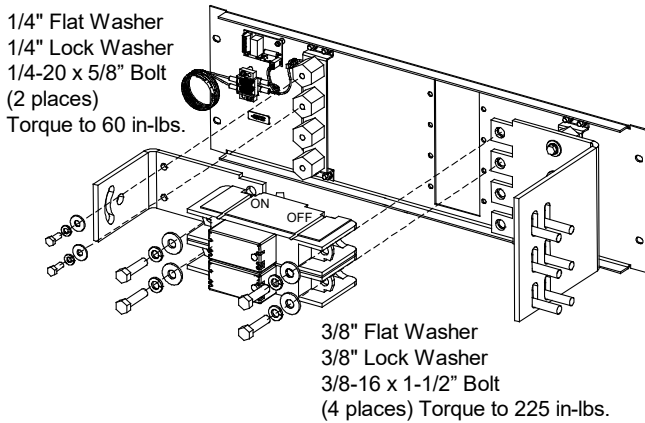
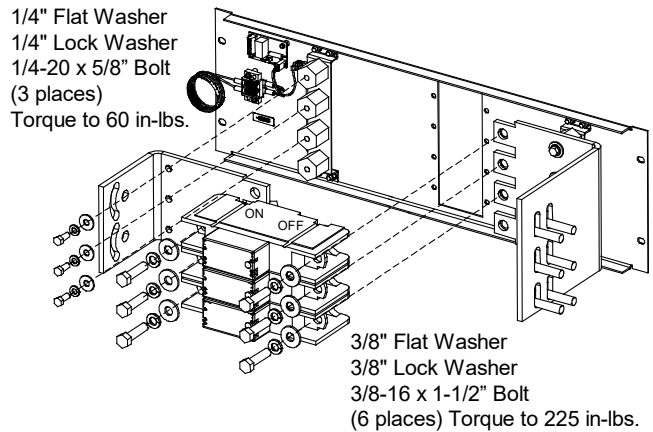
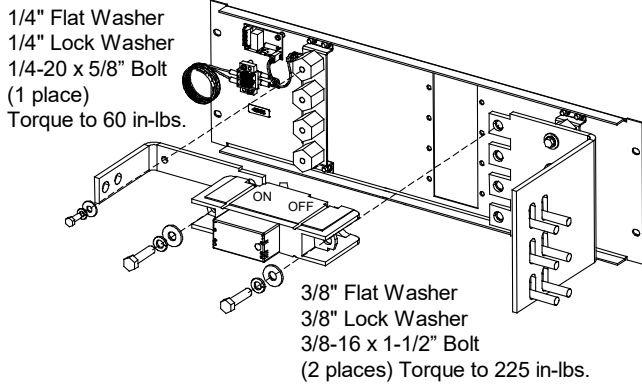
DANGER! The bolts being installed in the following step may be at system potential. Use insulated tools.

- [] 4. Secure the circuit breaker to the rear of the distribution panel with the hardware provided.
- [] 5. Install the load lug bracket to the circuit breaker with the hardware provided.
- [] 6. Install the circuit breaker into its mounting position and secure with the provided hardware. Torque to 60 in-lbs.
- [] 7. Install the circuit breaker guard and label if provided (refer to Figure 3.17 and Figure 3.18).
- [] 8. Record all circuit breaker sizes.
- [] 9. Attach the alarm wiring and shunt leads to the back of the circuit breaker. Route and connect these leads to the SM-DU+ and Shunt Interface Assembly. Refer to "SM DU+ and FA/Shunt Interface Assembly" on page 55 for proper wiring procedure. Leads must be terminated before switching breaker ON to avoid circuit fault.
- [] 10. Close the distribution bay's front and rear doors and secure the doors.

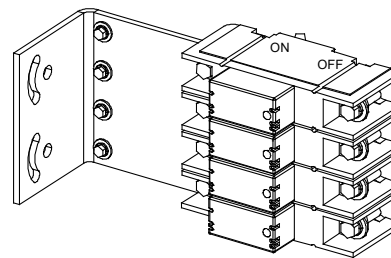
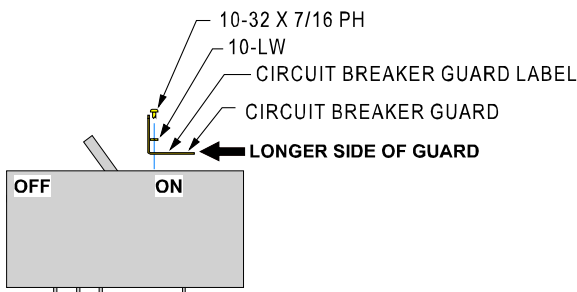
Figure 3.17 Installing a GJ/218 Circuit Breaker in a List D Distribution Panel

INSTALLING CIRCUIT BREAKER

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



INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS WITH SHUNTS)

STANDARD TRIP BREAKER (BLACK HANDLE)
ELECTRICAL TRIP BREAKER (WHITE HANDLE)

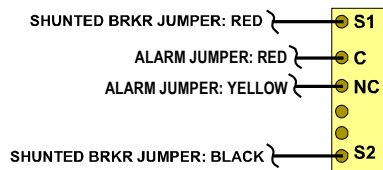
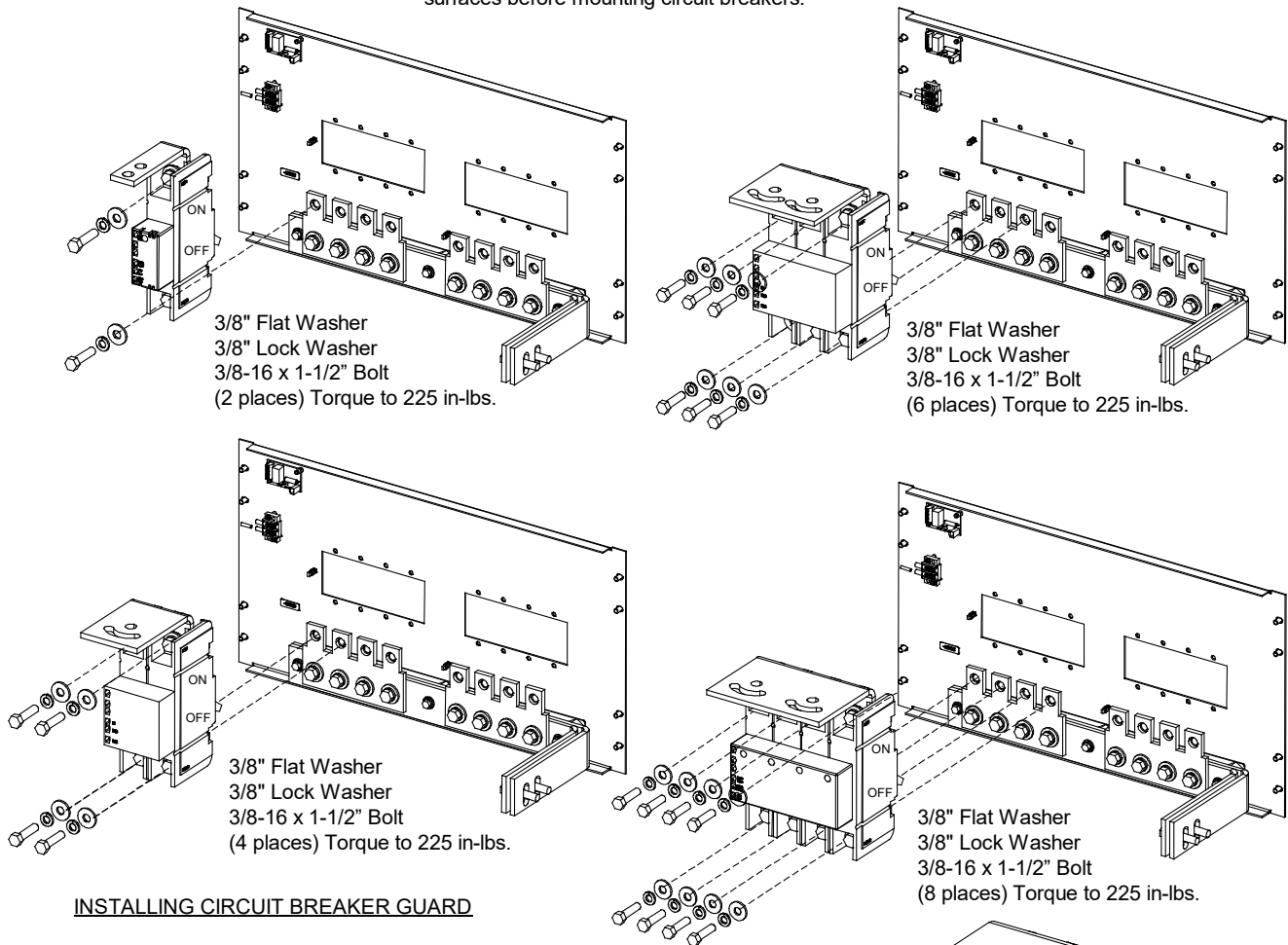


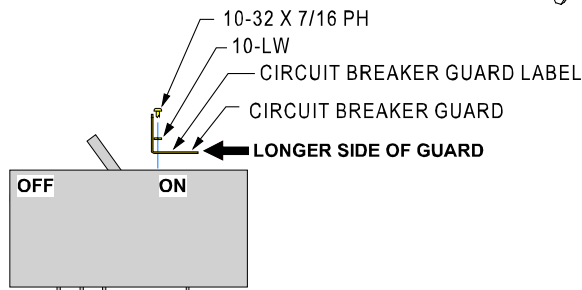
Figure 3.18 Installing a GJ/218 Circuit Breaker in a List E Distribution Panel

INSTALLING CIRCUIT BREAKER

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

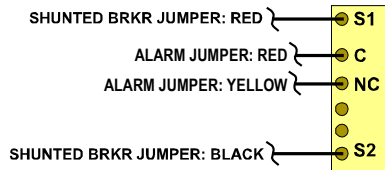


INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS WITH SHUNTS)

STANDARD TRIP BREAKER (BLACK HANDLE)
ELECTRICAL TRIP BREAKER (WHITE HANDLE)



3.12 Installing the Optional SM-DU+ and Shunt/FA Assembly P/N 557136 into a Distribution Bay

Procedure



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

- [] 1. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
- [] 2. Follow the procedure in Figure 3.19.

3.13 Installing the Optional Remote Mounting Kit P/N 562974 onto SM-DU+ and Shunt/FA Assembly P/N 557136

Procedure



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

- [] 1. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
- [] 2. Follow the procedure in Figure 3.20.

Figure 3.19 Installing the Optional SM-DU+ and Shunt/FA Assembly P/N 557136 into a Distribution Bay

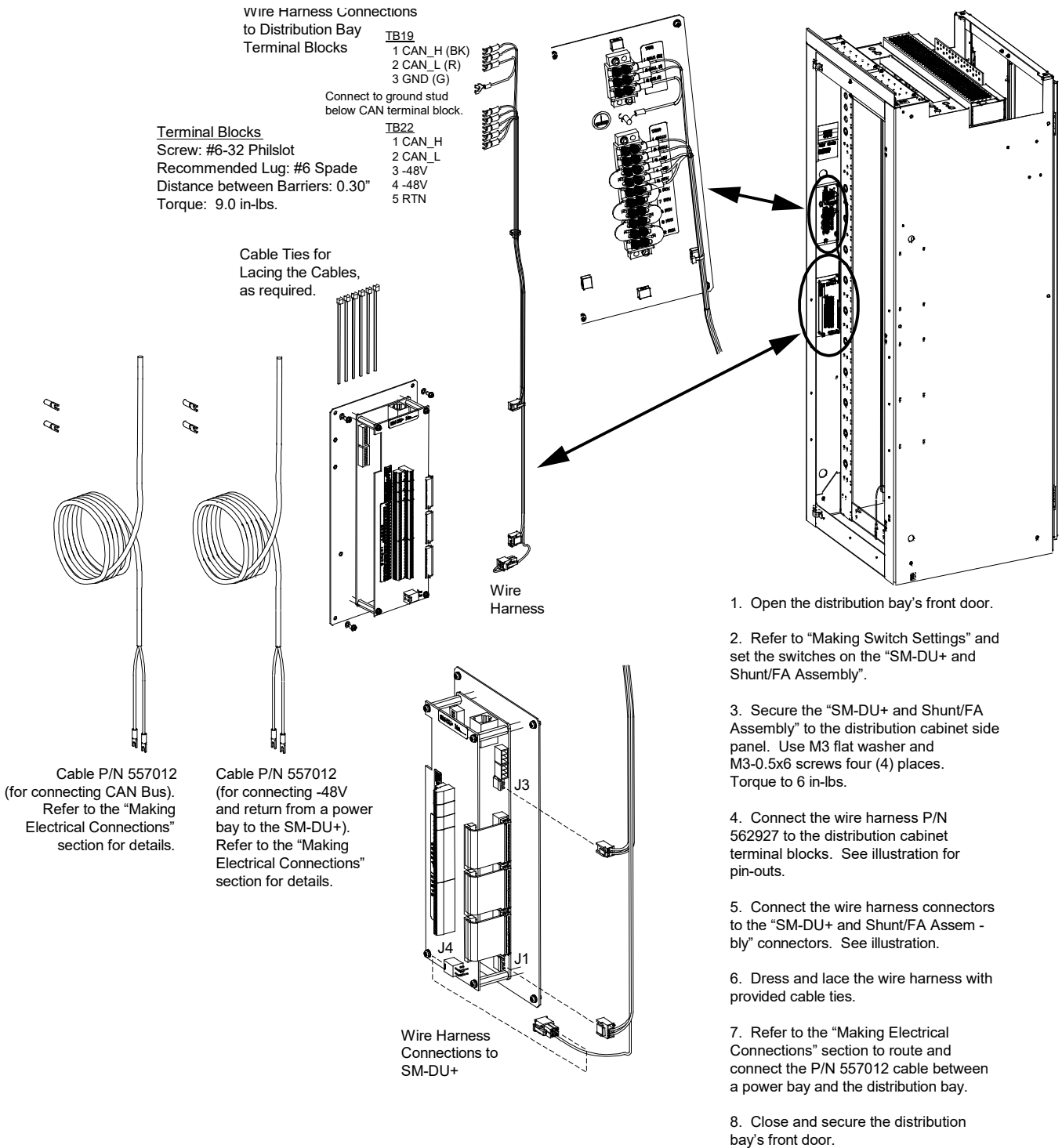
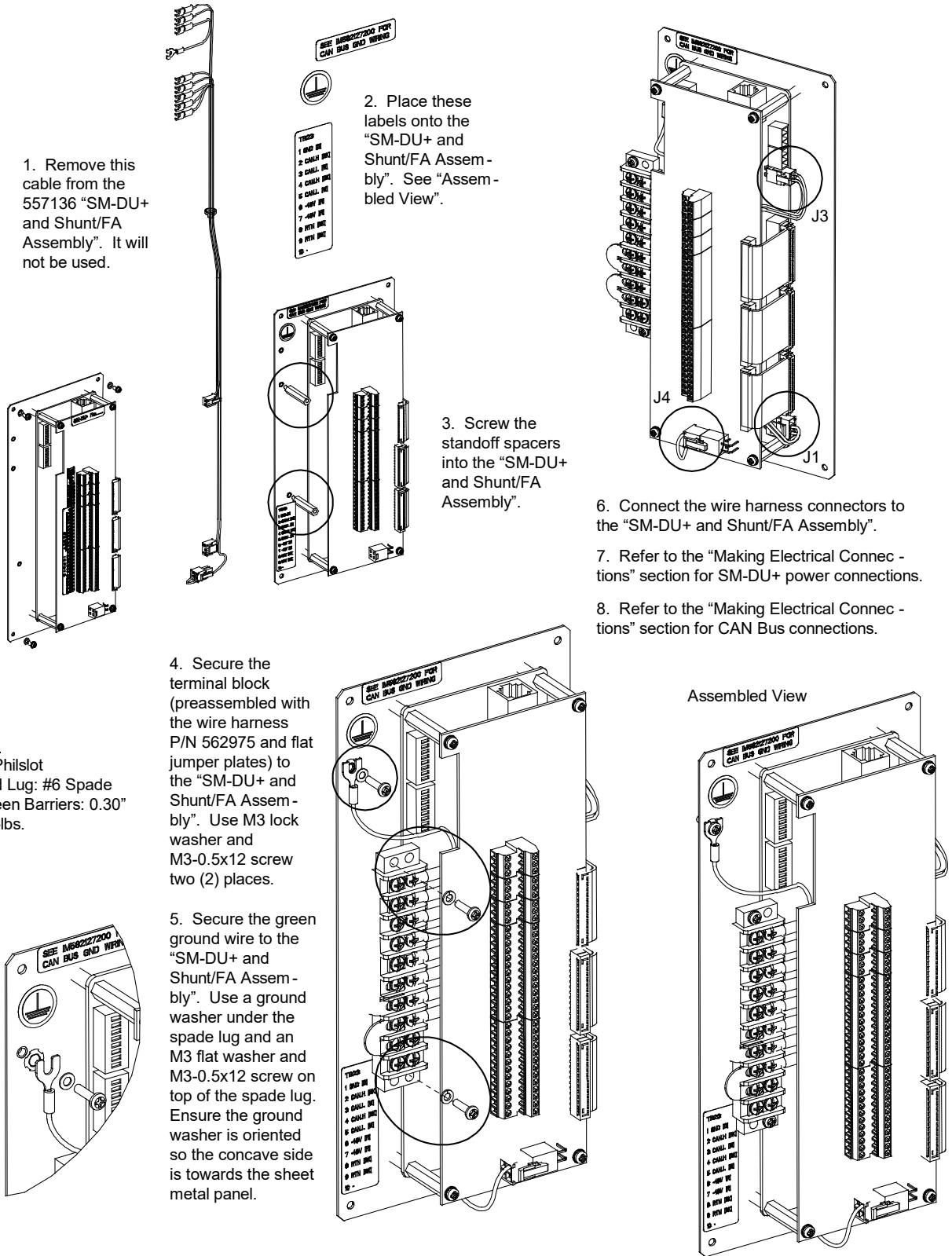


Figure 3.20 Installing the Optional Remote Mounting Kit P/N 562974 onto SM-DU+ and Shunt/FA Assembly P/N 557136

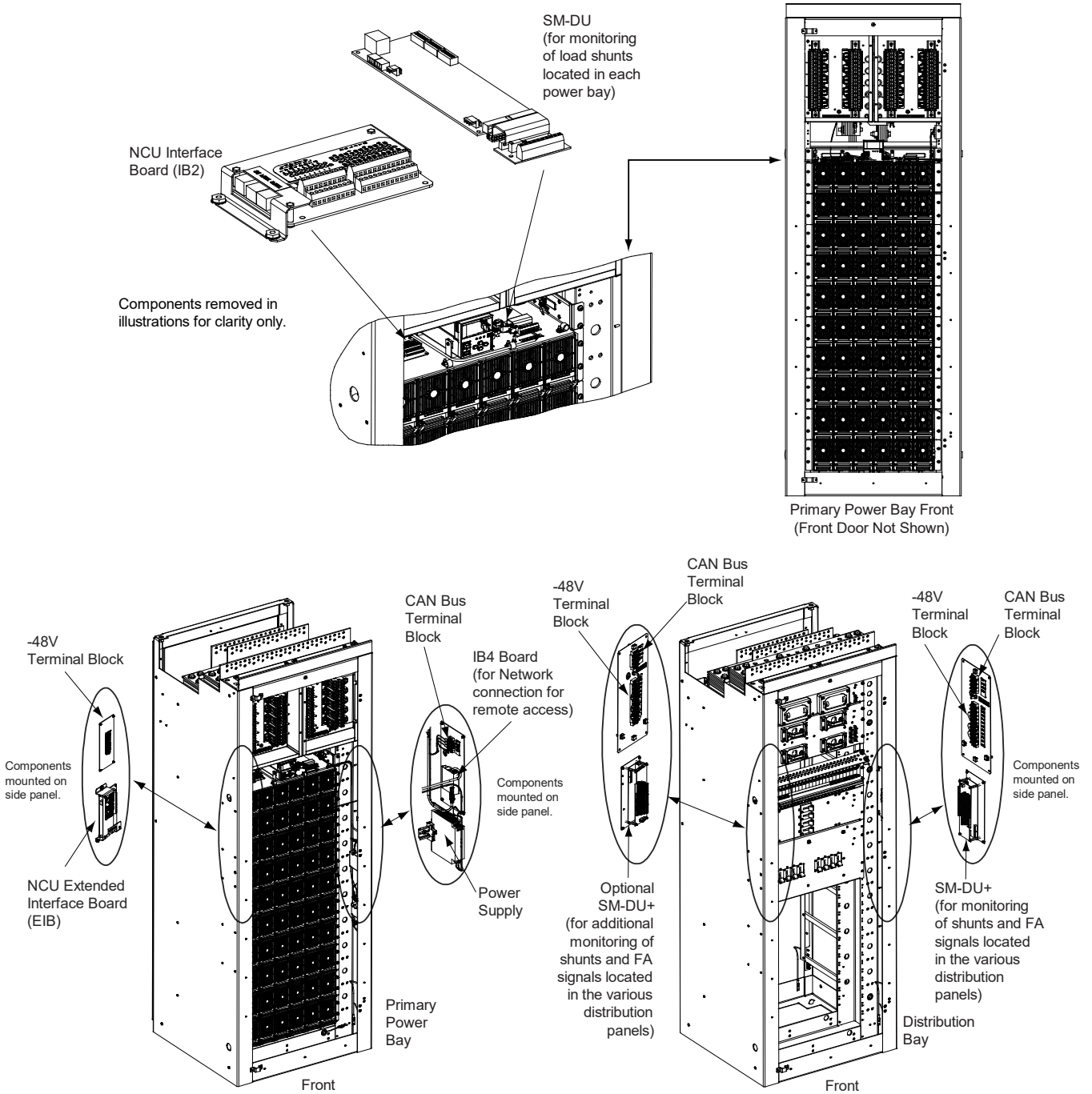


4 Making Switch Settings

4.1 Circuit Card Locations

Refer to Figure 4.1.

Figure 4.1 Circuit Card Locations



4.2 Switch Settings on IB2 Interface Board

Dip Switch SW1 on the IB2 board is used to set the communications address for this board. Refer to Table 4.1 for SW1 settings. Refer to Figure 4.1 for circuit card location. Refer to Figure 4.2 for SW1 location.

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

Procedure

- [] 1. Ensure SW1 is set per Table 4.1. Refer to Figure 4.2 for location.

Table 4.1 IB2 Interface Board Switch Settings

Setting	DIP Switch SW1	
	1	2
IB2 in Primary Power Bay	OFF	OFF
Optional IB2 in 1st Secondary Power Bay (if ESTOP required)	OFF	OFF
Optional IB2 in 2nd Secondary Power Bay (if ESTOP required)	OFF	OFF

4.3 Switch Settings on EIB Interface Board (Primary Power Bay Only)

Dip Switch SW1 on the EIB board is used to set the communications address for this board. Refer to Table 4.2 for SW1 settings. Refer to Figure 4.1 for circuit card location. Refer to Figure 4.3 for SW1 location.

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

Procedure

- [] 1. Ensure SW1 is set per Table 4.2. Refer to Figure 4.3 for location.

Table 4.2 EIB Interface Board Switch Settings

Setting	DIP Switch SW1	
	1	2
EIB in Primary Power Bay	ON	OFF

Figure 4.2 IB2 Interface Board Switch Location and Settings

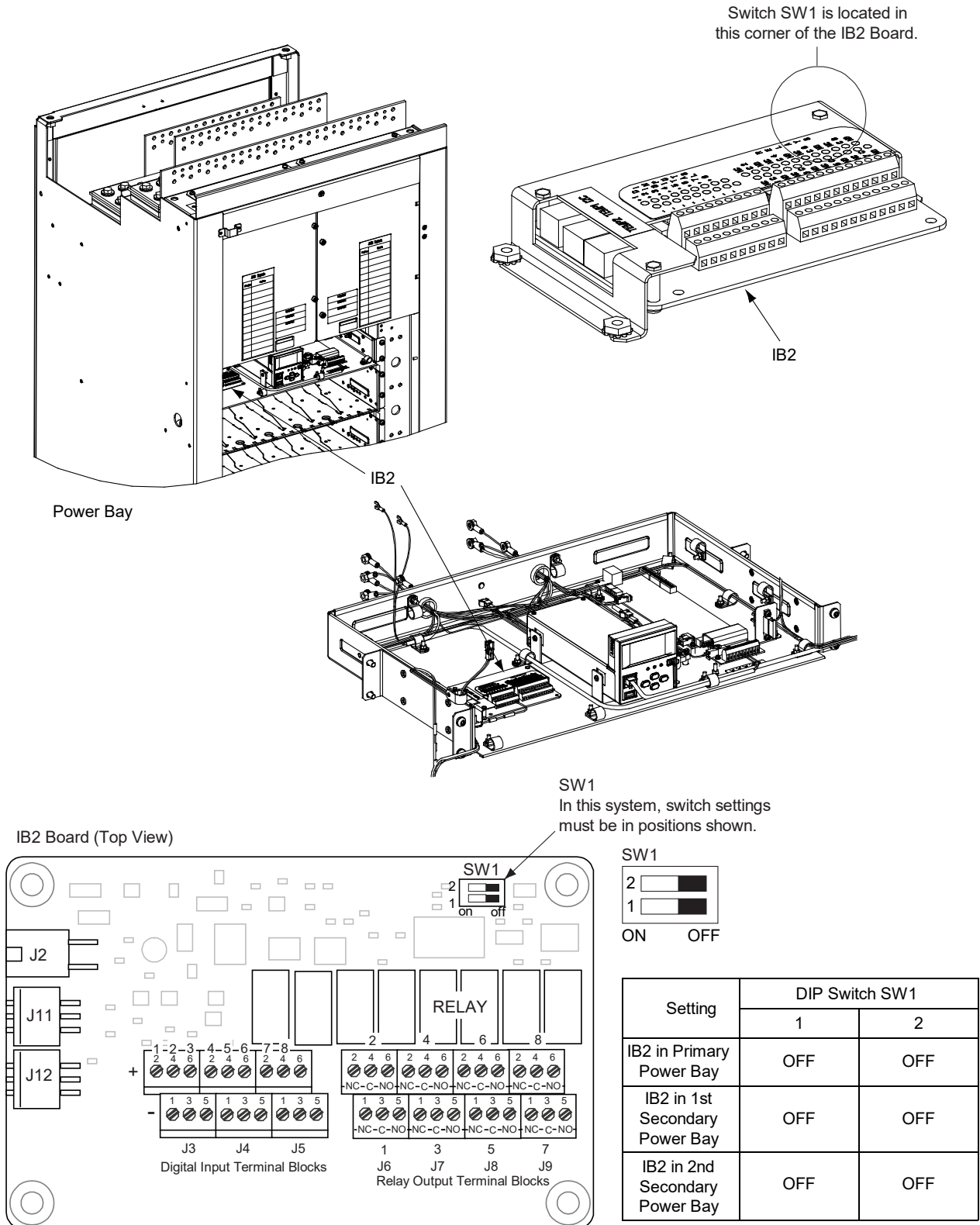
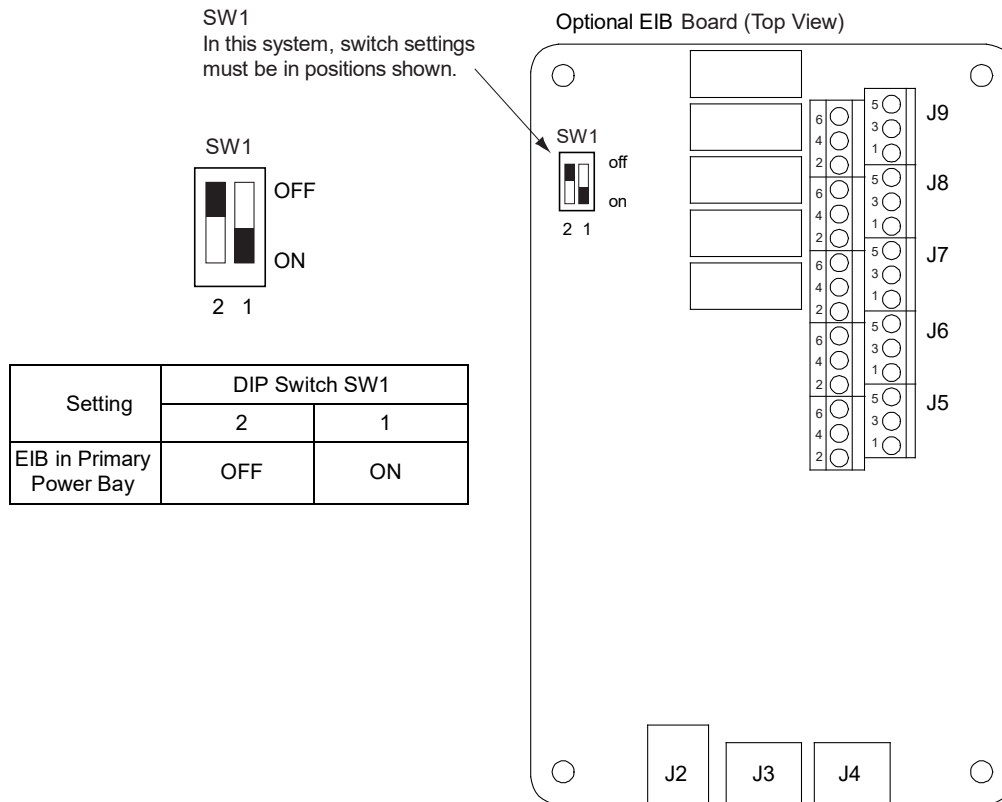
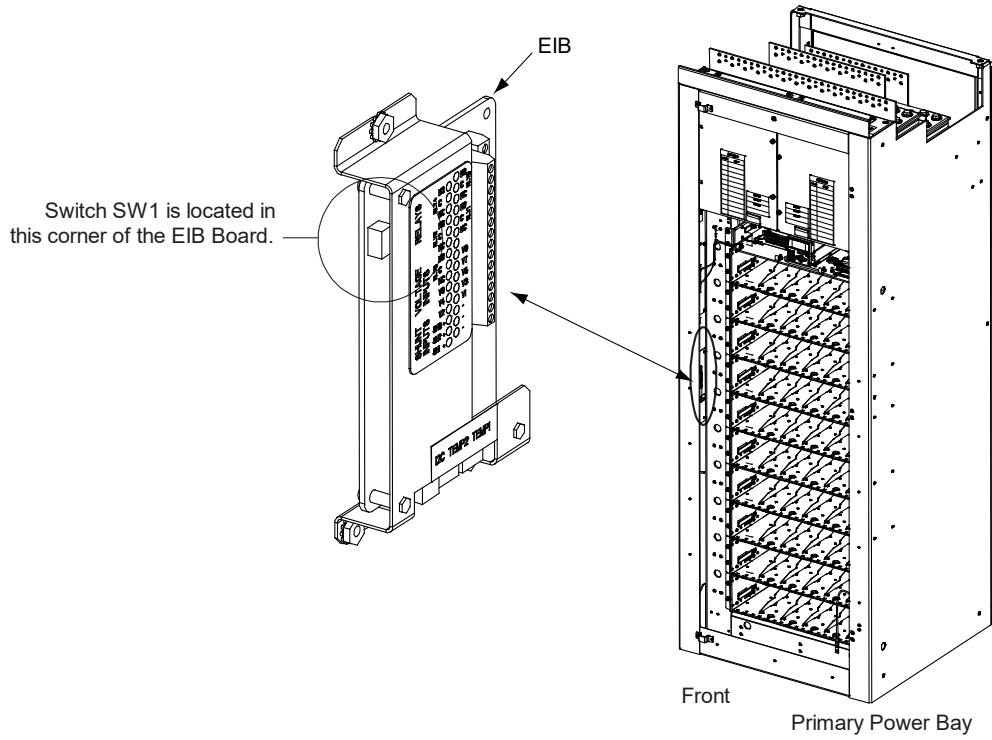


Figure 4.3 EIB Interface Board Switch Location and Settings (installed in Primary Power Bay only)



4.4 Switch Settings on SM-DU (Primary Power Bay Only)

SM-DU uses three (3) 8-bit switches for parameter setting (S1, S2, and S3). Refer to Table 4.3 for switch settings. Refer to Figure 4.1 for circuit card location. Refer to Figure 4.4 for switch locations.

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

Procedure

- [] 1. Ensure S1, S2, and S3 are set per Table 4.3. Refer to Figure 4.4 for location.

Figure 4.4 SM-DU Switch Location (installed in Primary Power Bay only)

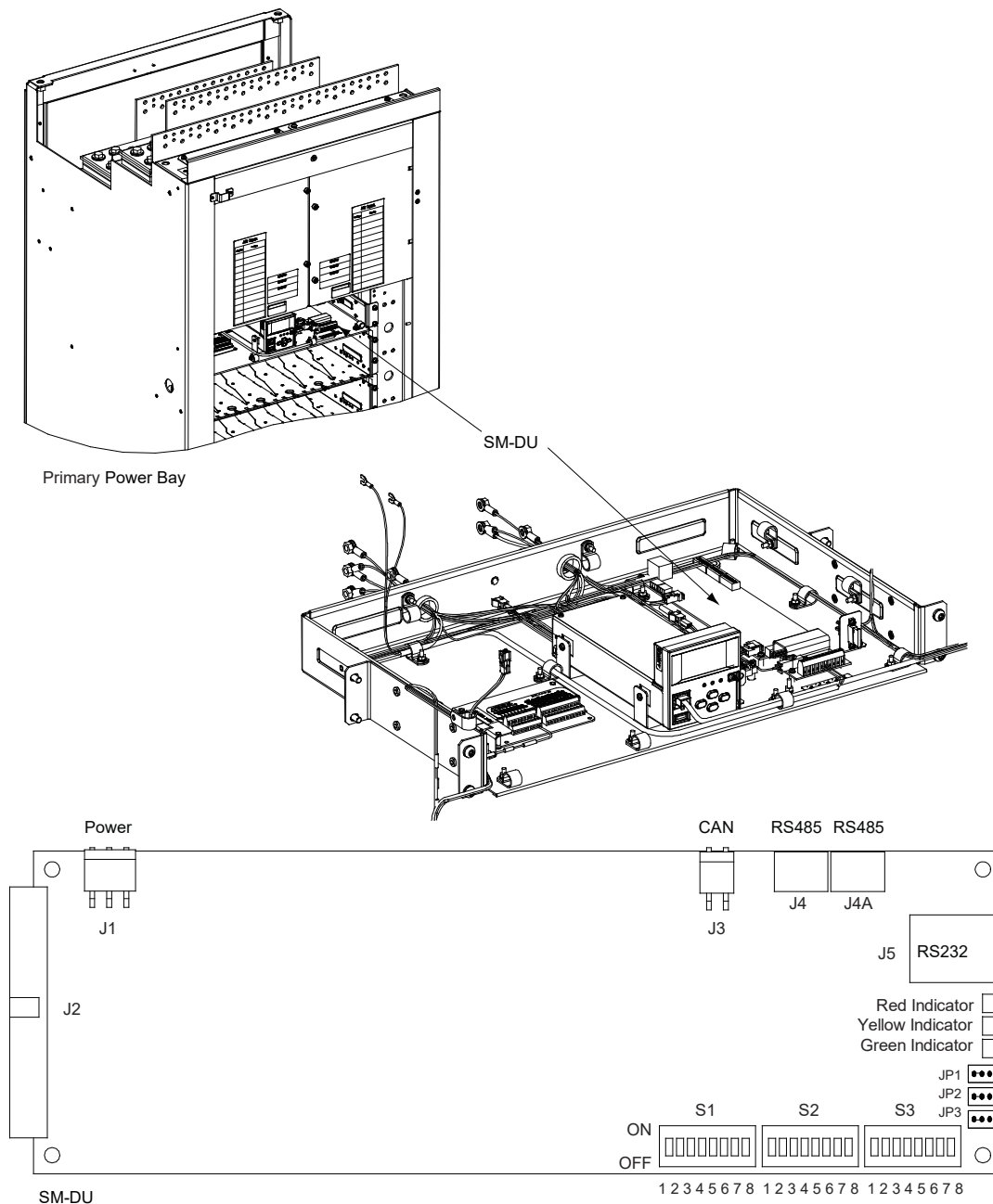


Table 4.3 SM-DU Switch Settings (cont'd on next page)

DIP Switch S1								Description of Status
Communication Address			Shunt Voltage		Shunt Current			
1	2	3	4	5	6	7	8	
OFF	OFF	OFF	NA					Address 8#
OFF	OFF	ON						Address 1# (Note 1)
OFF	ON	OFF						Address 2#
OFF	ON	ON						Address 3#
ON	OFF	OFF						Address 4#
ON	OFF	ON						Address 5#
ON	ON	OFF						Address 6#
ON	ON	ON						Address 7#
NA			OFF	OFF	NA			Shunt Voltage: 75mV (Note 1)
			OFF	ON				Shunt Voltage: 25mV
			ON	OFF				Shunt Voltage: 50mV
			ON	ON				Shunt Voltage: 60mV
NA					OFF	OFF	OFF	Shunt Current: 500 A (Note 1)
					OFF	OFF	ON	Shunt Current: 100 A
					OFF	ON	OFF	Shunt Current: 200 A
					OFF	ON	ON	Shunt Current: 300 A
					ON	OFF	OFF	Shunt Current: 400 A
					ON	OFF	ON	Shunt Current: 1000 A
					ON	ON	OFF	Shunt Current: 1500 A
					ON	ON	ON	Shunt Current: 2000 A

Note 1: Setting for this system.

Table 4.3 SM-DU Switch Settings (cont'd from previous page, cont'd on next page)

DIP Switch S2								Description of Status										
Shunt 1 Setting		Shunt 2 Setting		Shunt 3 Setting		Shunt 4 Setting												
1	2	3	4	5	6	7	8											
OFF	OFF	NA						Shunt 1 is Disabled										
OFF	ON											Shunt 1 is Used for Battery						
ON	OFF															Shunt 1 is Used for Load		
ON	ON																	
NA		OFF	OFF	NA														
		OFF	ON															
		ON	OFF															
		ON	ON															
NA			OFF	OFF	NA													
			OFF	ON														
			ON	OFF														
			ON	ON														
NA				OFF	OFF													
				OFF	ON													
				ON	OFF													
				ON	ON													

Note 1: Setting for this system.

Table 4.3 SM-DU Switch Settings (cont'd from previous page)

DIP Switch S3				
Set via Software	Contactor Type	Safe Mode	Dry Contact	Description of Status
1	2	3	4	
Off	NA			Shunt parameter is set through DIP switch.
On	NA			Shunt parameter is set via software. (Note 1)
NA	Off	NA		Bi-Stable Contactor (Note 1)
	On	NA		Mono-Stable Contactor
NA		Off	NA	LVD / reconnection is disabled upon communication failure. (Note 1)
		On		LVD / reconnection is enabled upon communication failure.
NA			On	LVD2 is a Dry Contact
			Off	LVD2 (Note 1)
DIP Switch S3				
Shunt 5 Setting	Reserved	Calibration Mode	Description of Status	
5	6	7	8	
Off	Off	NA		Shunt 5 is Disabled (Note 1)
Off	On	NA		Shunt 5 is Used for Battery
On	Off	NA		Shunt 5 is Used for Load
On	On	NA		Set via Software
NA			Off	Operation Mode (Note 1)
			On	Calibration Mode

Note 1: Setting for this system.

4.5 Switch Settings on SM-DU+ (Distribution Bays and Remote SM-DU+ Only)

SM-DU+ uses two (2) 8-bit switches for parameter settings (SW1 and SW2). Refer to Table 4.4 for SW1 and SW2 settings. Refer to Figure 4.1 for circuit card location. Refer to Figure 4.5 for SW1 and SW2 locations.

Perform the following procedure to verify the factory settings and to set the addressing switches on each SM-DU+ assembly installed in the system. This procedure can also be used to make adjustments on a replacement circuit card.

Procedure

- [] 1. Ensure SW1 and SW2 are set per Table 4.4. Refer to Figure 4.5 for location.
- [] 2. Set the addressing switches on each SM-DU+ installed in the system to a unique address per Table 4.4. Refer also to “SM DU+ and FA/Shunt Interface Assembly (Distribution Bays Only and Remote Assembly)” on page 60 to determine appropriate SM-DU+ addressing.

Figure 4.5 SM-DU+ Switch Location and Settings (installed in Distribution Bays only)

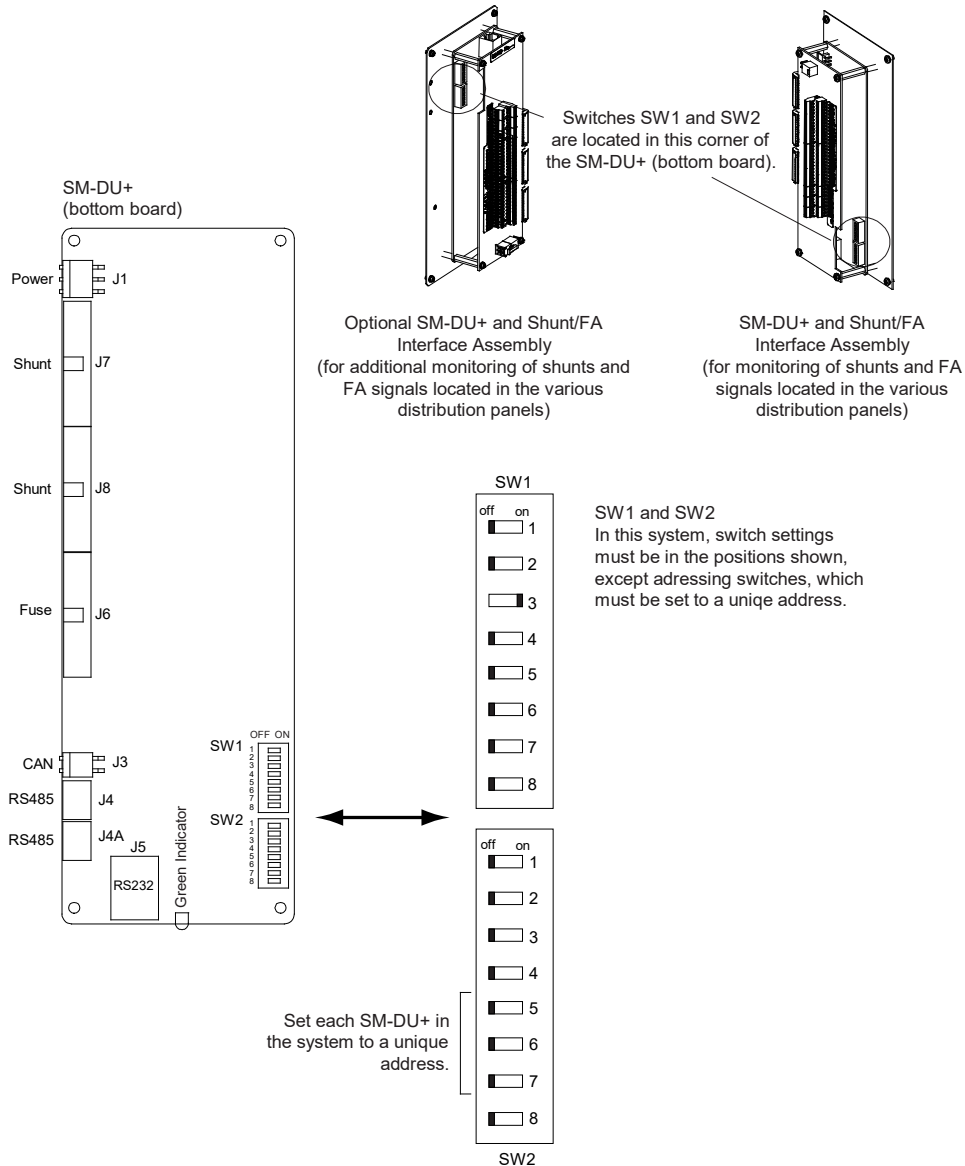


Table 4.4 SM-DU+ Switch Settings

DIP Switch SW1								Description of Status
Reserved		HW/S W	Shunt Voltage		Shunt Current			
1	2	3	4	5	6	7	8	
NA	OFF	NA					Shunt parameter is set through DIP switch.	
	ON	NA					Shunt parameter is set through software (note 1) .	
NA	OFF	OFF	NA				Shunt Voltage: 25mV (note 1)	
	OFF	ON	NA				Shunt Voltage: 50mV	
	ON	OFF	NA				Shunt Voltage: 60mV	
	ON	ON	NA				Shunt Voltage: 75mV	
NA	OFF	OFF	OFF	NA			Shunt Current: 500 A (note 1)	
	OFF	OFF	ON	NA			Shunt Current: 100 A	
	OFF	ON	OFF	NA			Shunt Current: 200 A	
	OFF	ON	ON	NA			Shunt Current: 300 A	
	ON	OFF	OFF	NA			Shunt Current: 400 A	
	ON	OFF	ON	NA			Shunt Current: 1000 A	
	ON	ON	OFF	NA			Shunt Current: 1500 A	
	ON	ON	ON	NA			Shunt Current: 2000 A	

DIP Switch SW2								Description of Status
Reserved		Communications Address			Baud Rate			
1	2	3	4	5	6	7	8	
NA	OFF	OFF	OFF	NA			Address 1# (Setting for 1st SM-DU+ in System)	
	OFF	OFF	ON	NA			Address 2# (Setting for 2nd SM-DU+ in System)	
	OFF	ON	OFF	NA			Address 3# (Setting for 3rd SM-DU+ in System)	
	OFF	ON	ON	NA			Address 4# (Setting for 4th SM-DU+ in System)	
	ON	OFF	OFF	NA			Address 5# (Setting for 5th SM-DU+ in System)	
	ON	OFF	ON	NA			Address 6# (Setting for 6th SM-DU+ in System)	
	ON	ON	OFF	NA			Address 7# (Setting for 7th SM-DU+ in System)	
	ON	ON	ON	NA			Address 8# (Setting for 8th SM-DU+ in System)	
NA							OFF	19200 (note 1)
NA							ON	9600

Note 1: Setting for this system.

5 Making Electrical Connections

5.1 Important Safety Instructions



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

5.2 Wiring Considerations

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

For wire size, branch circuit protection, crimp lug, and general wiring recommendations; refer to System Application Guide SAG582127200.

Refer to drawing 031110100 for lug crimping information. Refer to drawings 031110200 and 031110300 for additional lug information.

Refer to Table 5.5 for supplemental lug crimping information when using the special application crimp lug / strap combination.

Table 5.5 Supplemental Lug Crimping Information when Using the Special Application Crimp Lug / Strap Combination

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

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

5.3 Bay Grounding Connection (Frame Ground)

For bay 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. For operation in countries where the NEC is not recognized, follow applicable codes.

A customer's grounding network lead can be attached to the top of each bay. Provision is made for installing a lead with a two-hole lug that has 1/4" bolt clearance holes on 5/8" centers. Refer to Figure 5.1 for locations.



NOTE! REMOVE TAPE FROM HOLE LOCATIONS BEFORE INSTALLING LUG.

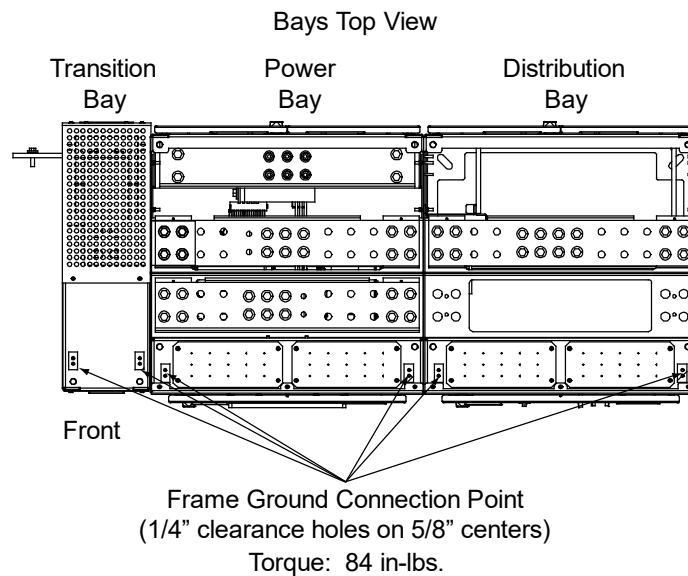


NOTE! The DC return connection to this system can remain isolated from system frame and chassis (DC-I).



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

Figure 5.1 Bay Frame Grounding Connection Points



5.4 Nominal 208 VAC / 240 VAC or 277 VAC / 480 VAC Input and Equipment Grounding Connections (depending on List option furnished)



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

The available AC input options for the power bays are:

AC Input Options

- [582127200 List 1, 2:](#) The power bays can be equipped with an AC input termination assembly which provides connections for twenty (20) nominal 208 VAC / 240 VAC, 3 phase feeds (1 feed per 3 rectifiers).
- [582127200 List 3, 4:](#) The power bays can be equipped with an AC input termination assembly which provides connections for four (4) nominal 208 VAC / 240 VAC, 3 phase feeds (1 feed per 15 rectifiers).
- [582127200 List 5, 6:](#) The power bays can be equipped with an AC input termination assembly which provides connections for ten (10) nominal 208 VAC / 240 VAC, 3 phase feeds (1 feed per 6 rectifiers).
- [582127200 List 7, 8:](#) The power bays can be equipped with an AC input termination assembly which provides connections for twenty (20) nominal 208 VAC / 240 VAC, 1 phase feeds (1 feed per 3 rectifiers).
- [582127200 List 11, 12:](#) The power bays can be equipped with an AC input termination assembly which provides connections for twenty (20) nominal 277 VAC / 480 VAC, 3 phase feeds (1 feed per 3 rectifiers).
- [582127200 List 13, 14:](#) The power bays can be equipped with an AC input termination assembly which provides connections for four (4) nominal 277 VAC / 480 VAC, 3 phase feeds (1 feed per 15 rectifiers).
- [582127200 List 15, 16:](#) The power bays can be equipped with an AC input termination assembly which provides connections for ten (10) nominal 277 VAC / 480 VAC, 3 phase feeds (1 feed per 6 rectifiers).

Conduit Plates

The power bays provide blank conduit plates located at the top of the bay. Cutout or punch the appropriate holes for the conduit and fittings being used.



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

Procedure

Refer to Figure 5.2, Figure 5.3, Figure 5.4, Figure 5.5, Figure 5.6, Figure 5.7, or Figure 5.8 as these procedures are performed.

Wire Routing

- [] 1. Install conduit fittings as required in the top blank conduit plates.
- [] 2. Route wiring into the bay through the previously installed conduit fittings.

Making AC Input Connections



NOTE! 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.

- [] 1. Make AC input connections as shown in Figure 5.2, Figure 5.3, Figure 5.4, Figure 5.5, Figure 5.6, Figure 5.7, or Figure 5.8. Torque connections to value shown in the appropriate illustration.

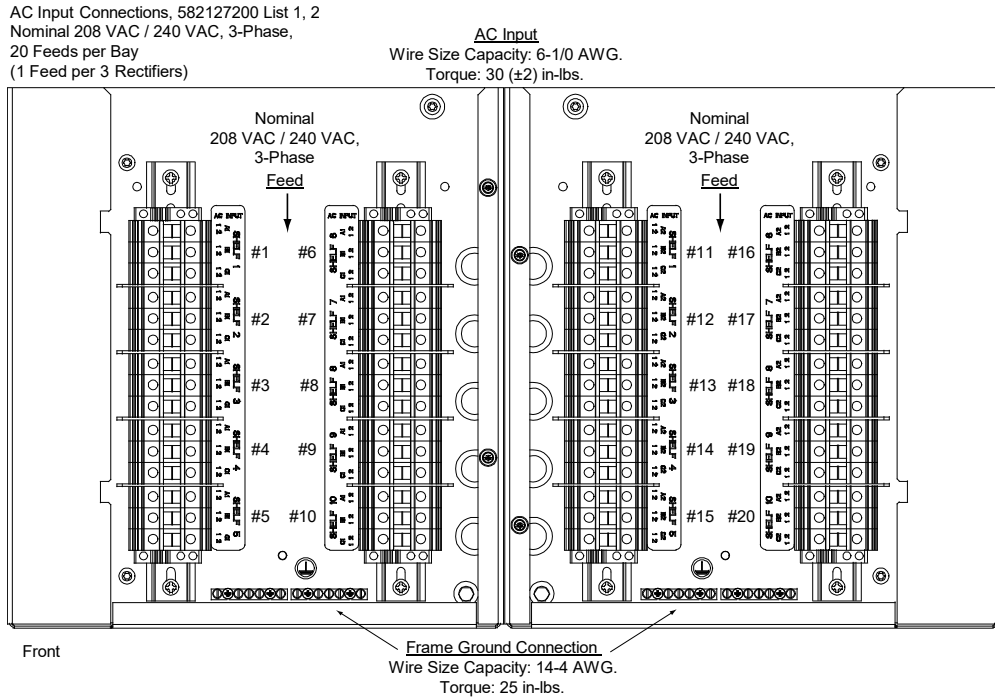
Making Equipment Grounding Connections



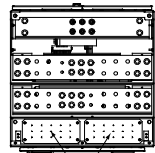
NOTE! Make equipment grounding connections to earth ground, not to the branch circuit neutral conductor.

- [] 1. Connect equipment grounding leads to the frame ground studs as shown in Figure 5.2, Figure 5.3, Figure 5.4, Figure 5.5, Figure 5.6, Figure 5.7, or Figure 5.8 using installer-provided ring lugs and factory-supplied mounting hardware. Torque connections to value shown in the appropriate illustration.

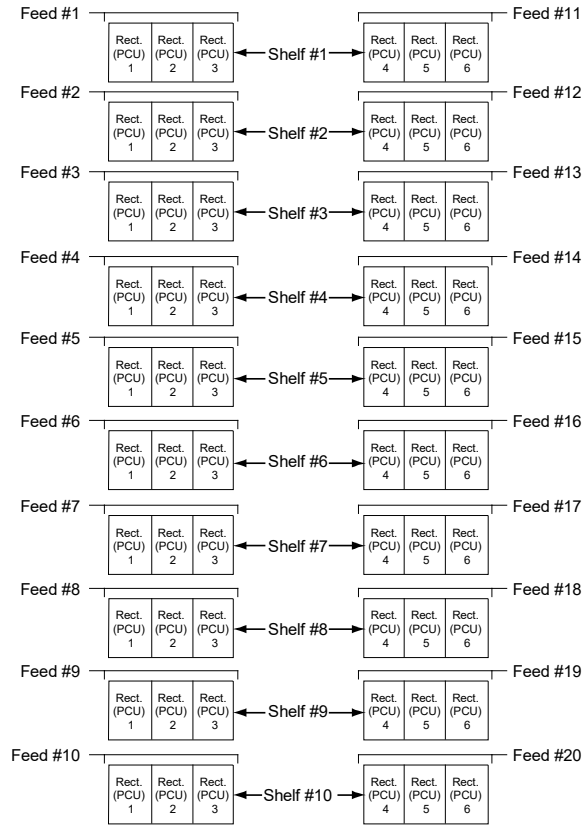
Figure 5.2 AC Input Connections to List 1, 2 Power Bays (Nominal 208 VAC / 240 VAC, 3-Phase, 20 Feeds per Bay)



Top of Power Bay



front
 Conduit Plates
 (cutout appropriate
 holes for conduit and
 fittings being used)



Rectifier Module (PCU) Mounting Slots

Figure 5.3 AC Input Connections to List 3, 4 Power Bays Illustration (Nominal 208 VAC / 240 VAC, 3-Phase, 4 Feeds per Bay)

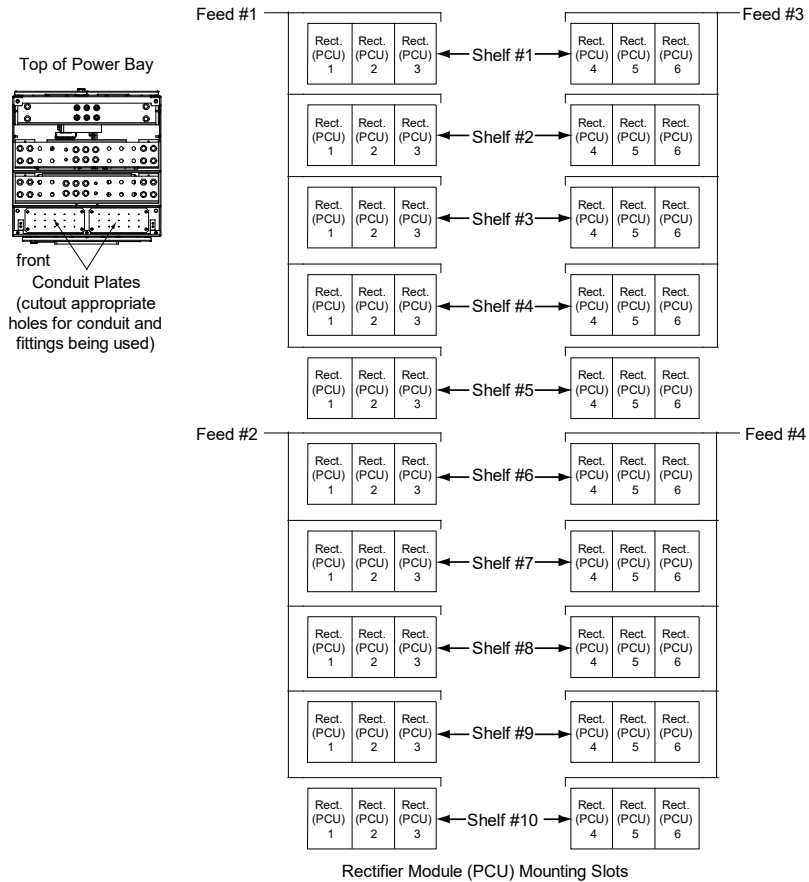
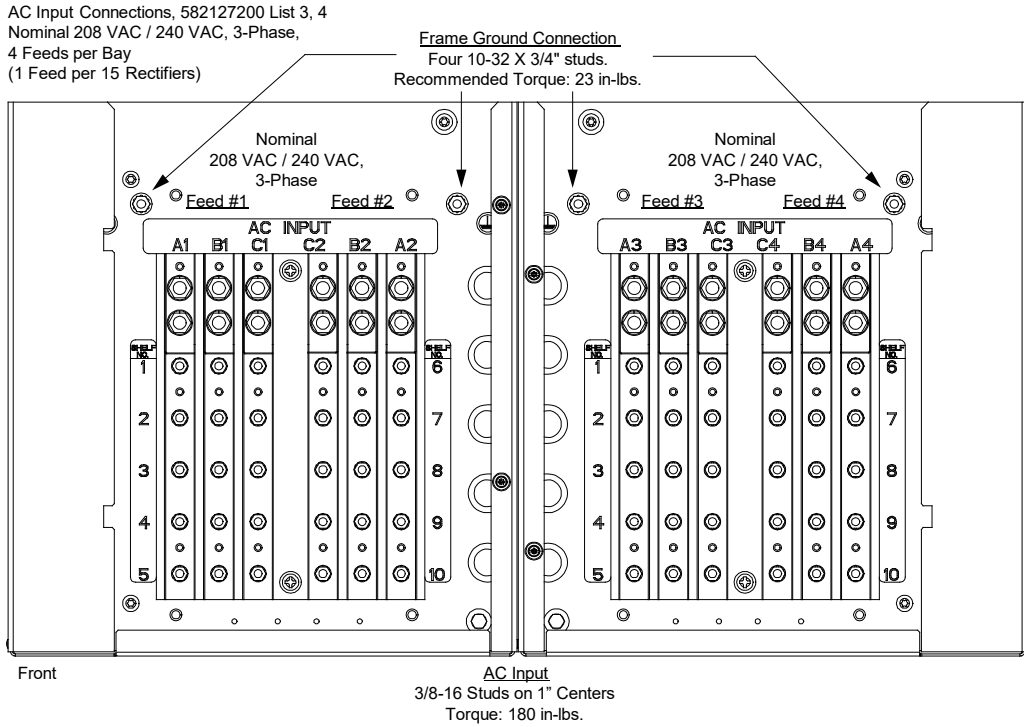


Figure 5.4 AC Input Connections to List 5, 6 Power Bays Illustration (Nominal 208 VAC / 240 VAC, 3-Phase, 10 Feeds per Bay)

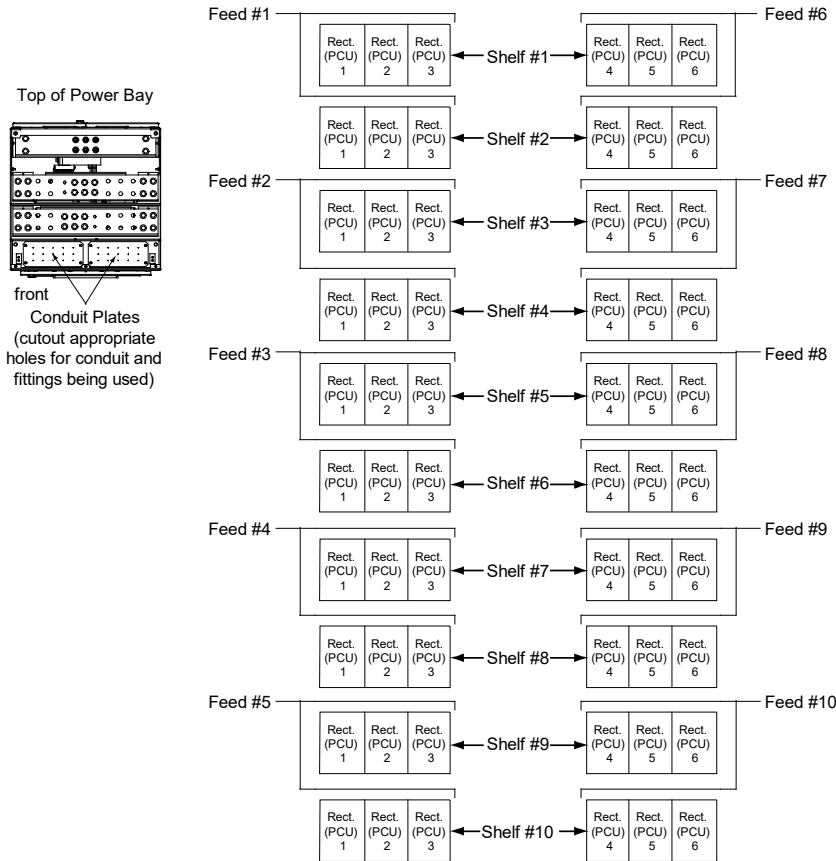
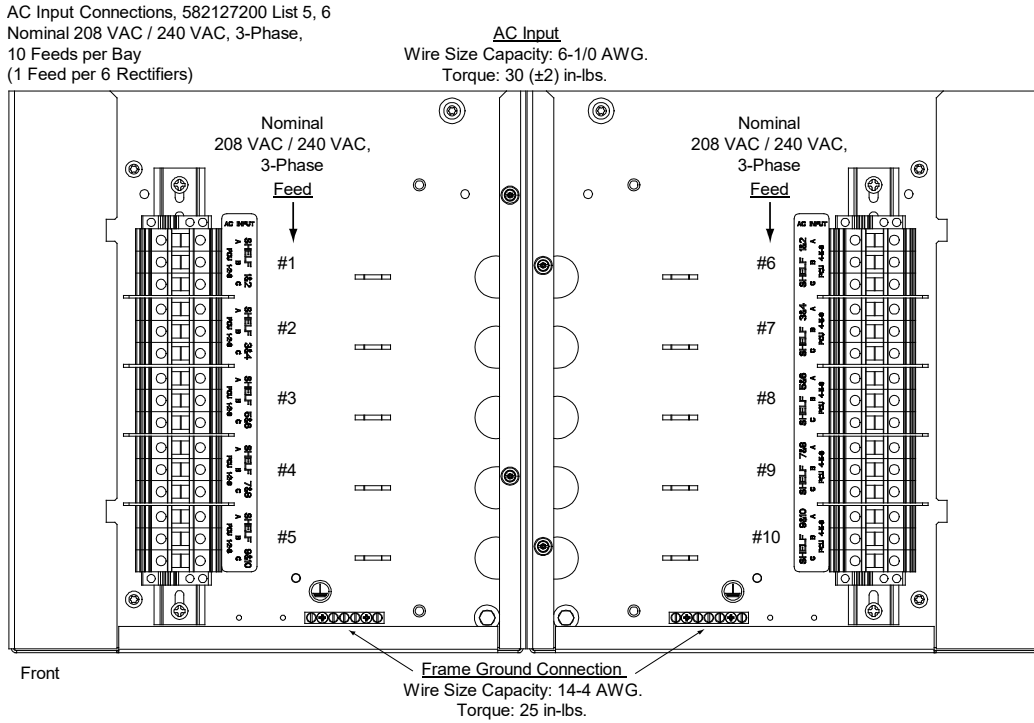
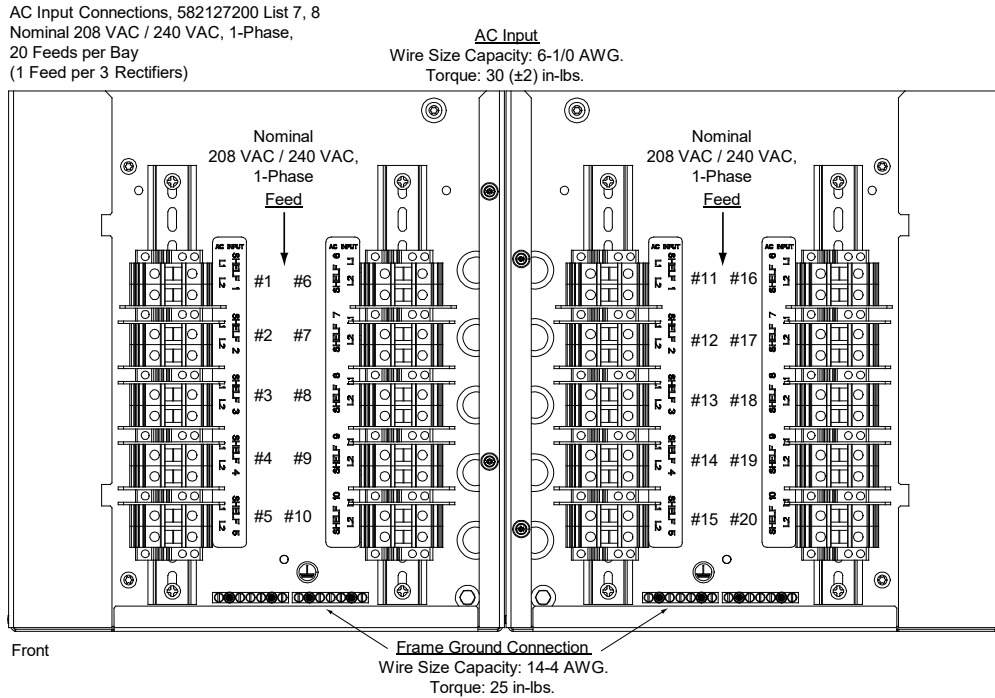
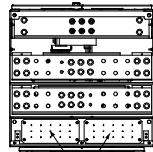


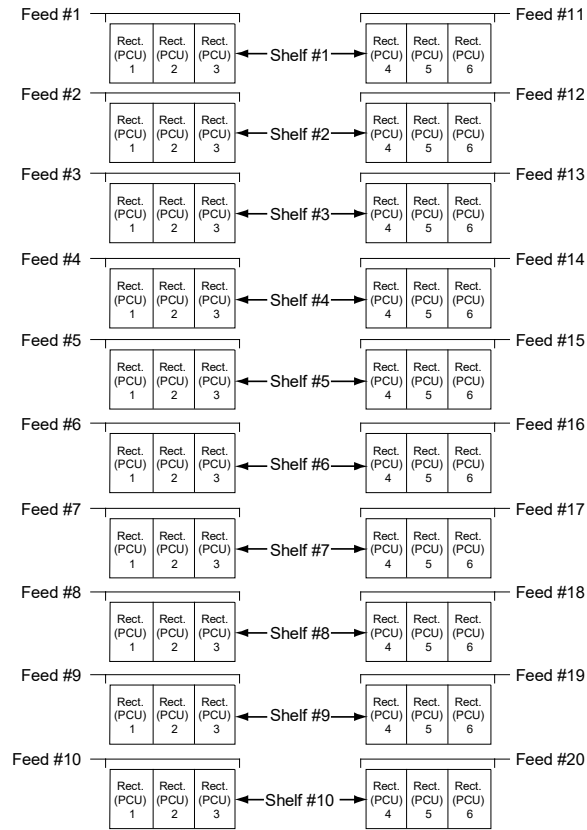
Figure 5.5 AC Input Connections to List 7, 8 Power Bays Illustration (Nominal 208 VAC / 240 VAC, 1-Phase, 20 Feeds per Bay)



Top of Power Bay

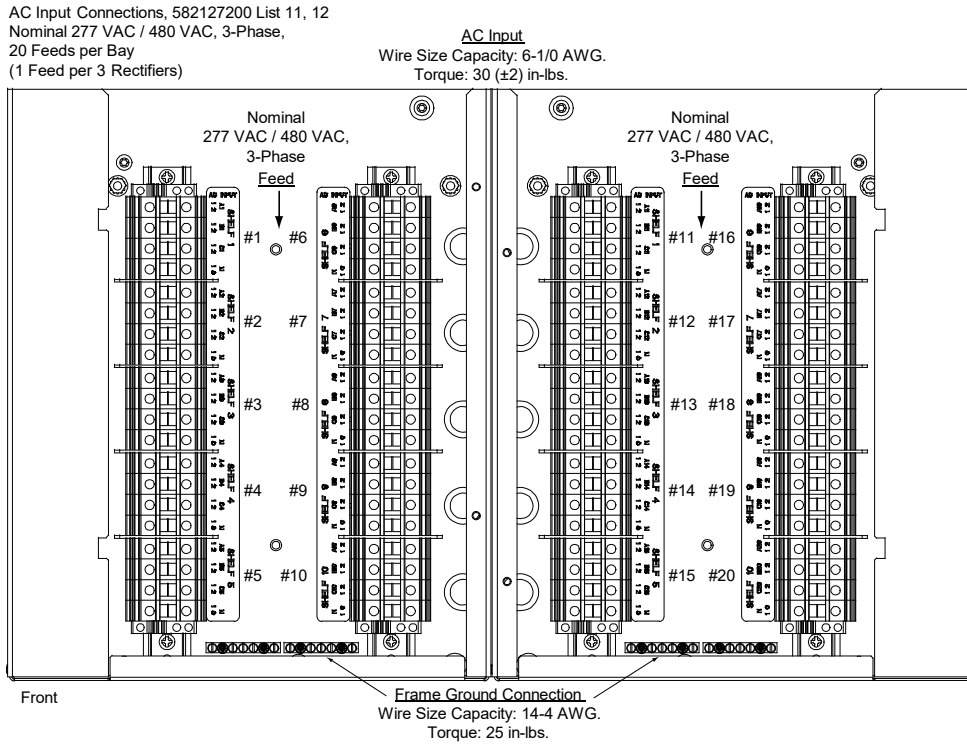


front
 Conduit Plates
 (cutout appropriate
 holes for conduit and
 fittings being used)

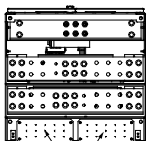


Rectifier Module (PCU) Mounting Slots

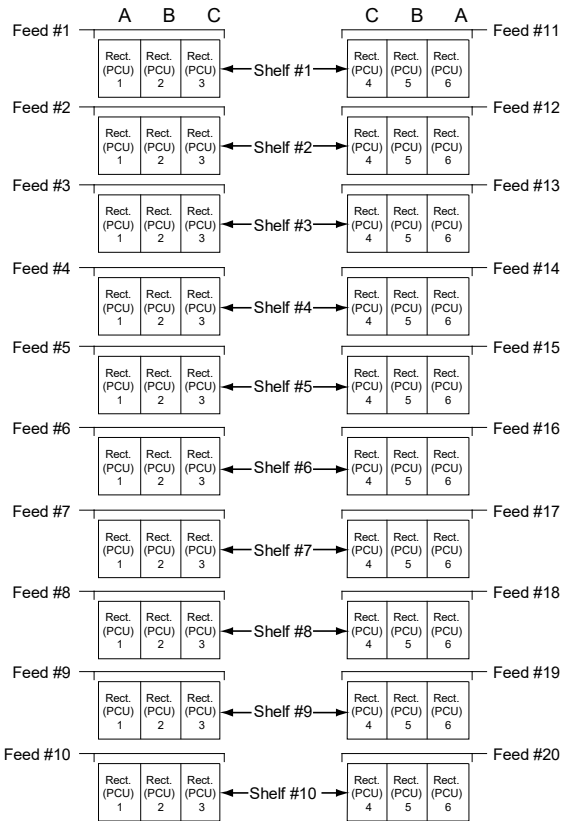
Figure 5.6 AC Input Connections to List 11, 12 Power Bays (Nominal 277 VAC / 480 VAC, 3-Phase, 20 Feeds per Bay)



Top of Power Bay



front
 Conduit Plates
 (cutout appropriate
 holes for conduit and
 fittings being used)



Rectifier Module (PCU) Mounting Slots

Figure 5.7 AC Input Connections to List 13, 14 Power Bays Illustration (Nominal 277 VAC / 480 VAC, 3-Phase, 4 Feeds per Bay)

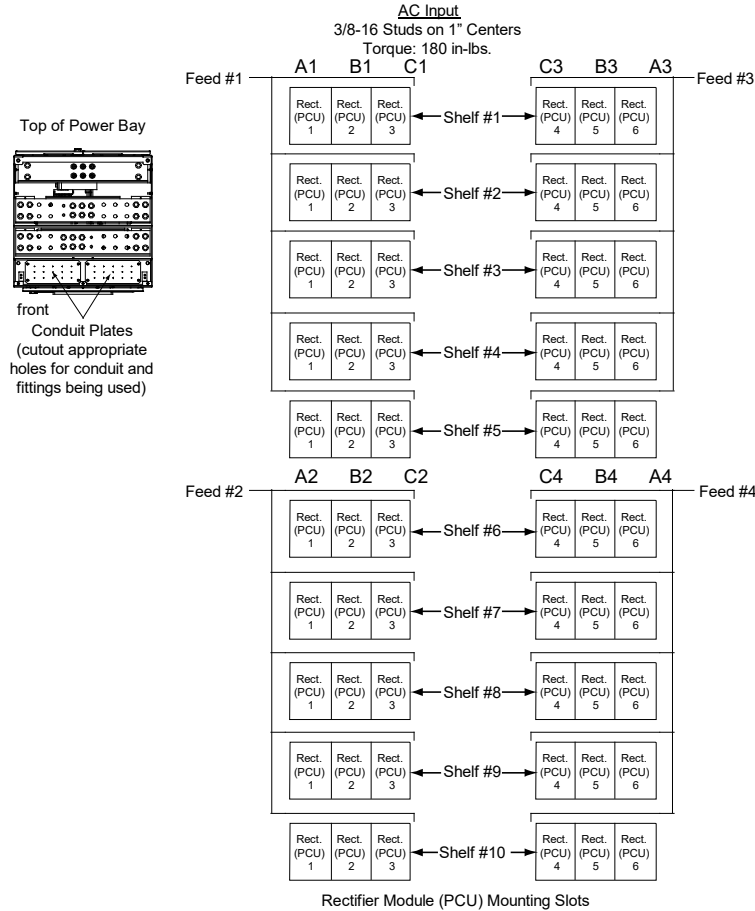
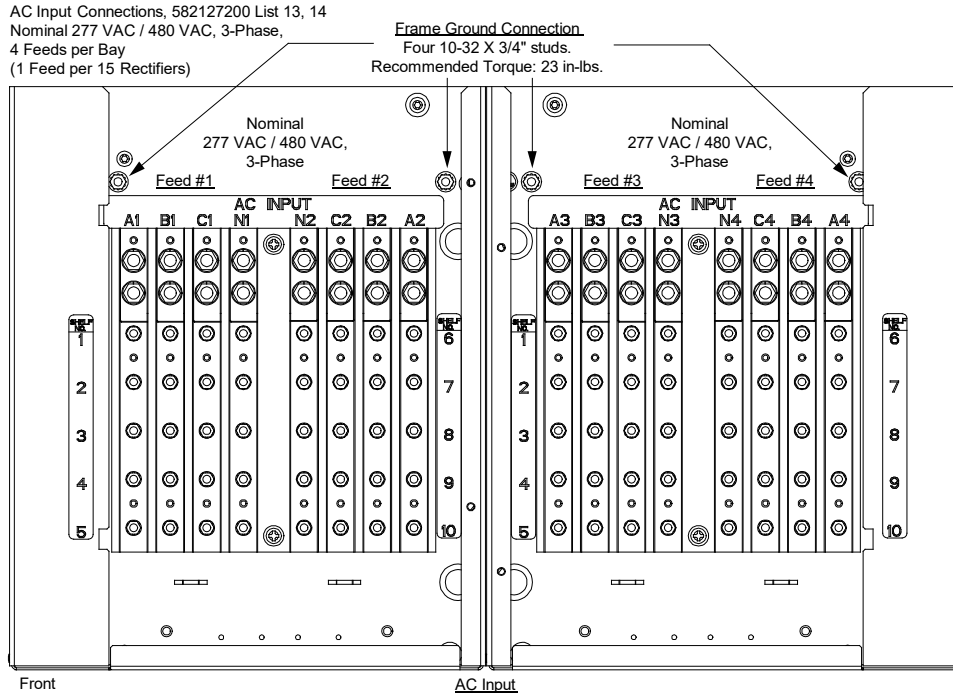
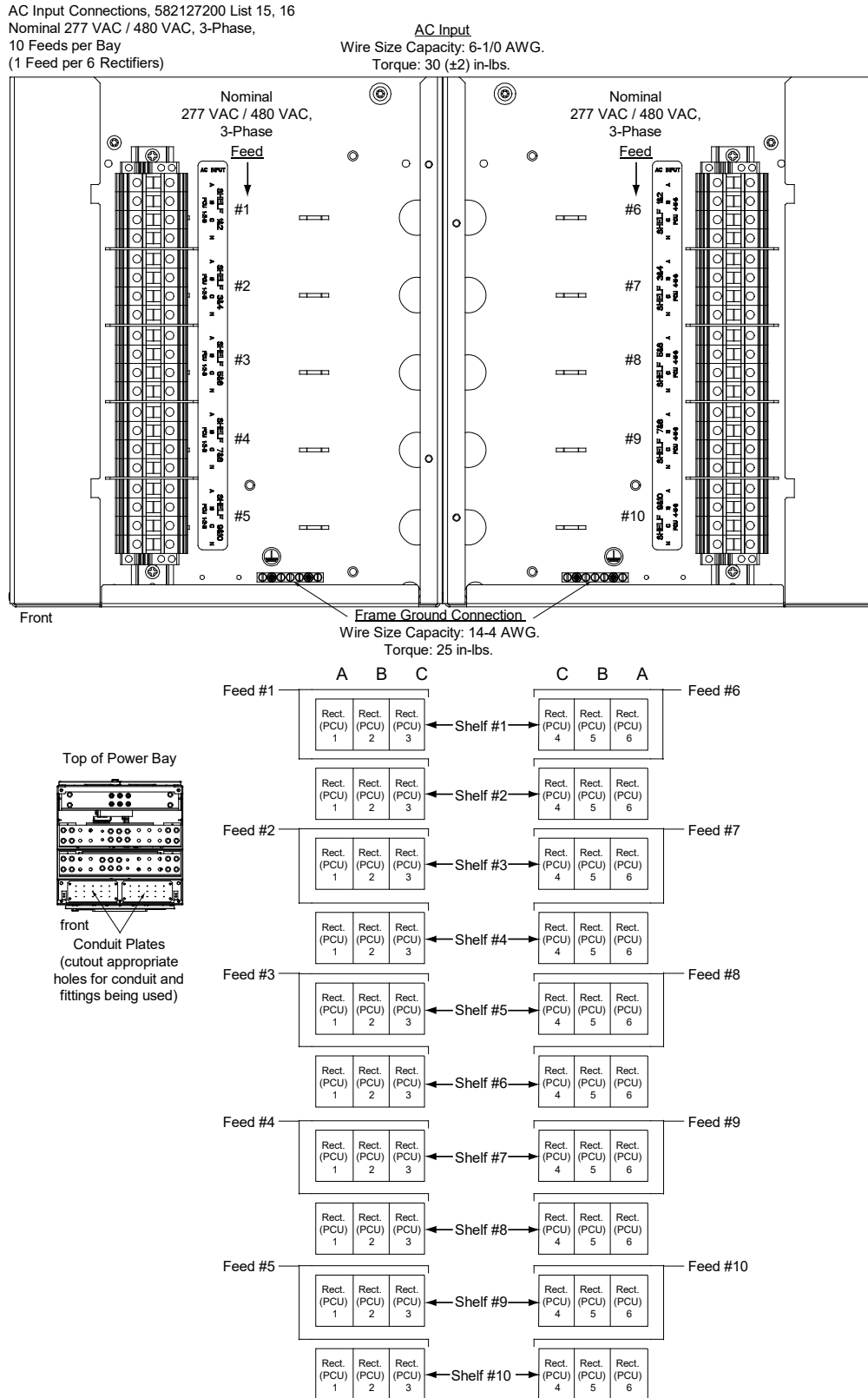


Figure 5.8 AC Input Connections to List 15, 16 Power Bays Illustration (Nominal 277 VAC / 480 VAC, 3-Phase, 10 Feeds per Bay)

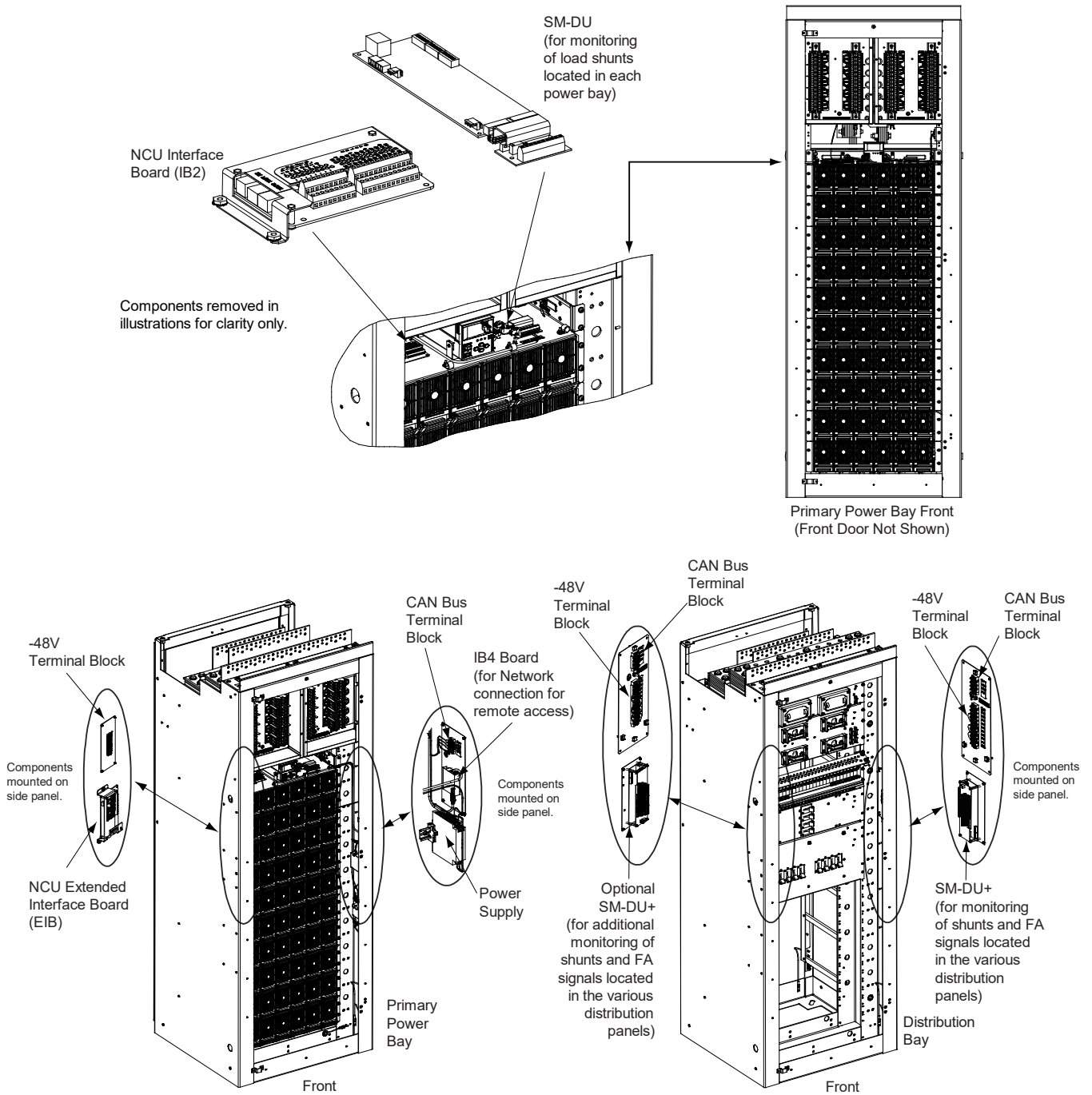


5.5 External Alarm, Reference, Monitoring, and Control Connections

5.5.1 Circuit Card Locations

Refer to Figure 5.9.

Figure 5.9 Circuit Card Locations



5.5.2 IB2 (NCU Interface Board) Connections (If Required)

The IB2 (NCU Interface Board) provides connection points for digital inputs, programmable relay outputs, and temperature probes. The IB2 interface board is mounted inside the primary power bay. If emergency shutdown (ESTOP) is required, IB2 interface boards are also mounted inside the secondary power bays. Refer to Figure 5.9.

Digital Inputs and Programmable Relay Outputs - IB2

Digital input and relay output leads are connected to screw-type terminal blocks located on the IB2. Refer to Figure 5.10 for terminal locations. Refer to Table 5.6 and Table 5.7 for pin-out information.

Digital Inputs - IB2

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 a negative signal and the opposite polarity return path). Observe proper polarity. Refer to Figure 5.10 for terminal locations and Table 5.6 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.

Programmable Relay Outputs - IB2

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 5.10 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 - IB2 and EIB



NOTE! Each temperature probe consists of two or three pieces that plug together to make a complete probe. See SAG582127200 for part numbers and descriptions.

Temperature probes are connected to the IB2 (NCU Interface Board) and/or EIB (NCU Extended Interface Board) mounted inside the primary power bay. See Figure 5.10 and Figure 5.13.

Up to two (2) temperature probes can be connected to the IB2. Up to two (2) additional temperature probes can be connected to the EIB. 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.

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. The controller will remain operational and the loads will be sustained by the battery voltage, if battery is connected.

When the ESTOP signal is removed, rectifiers 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).



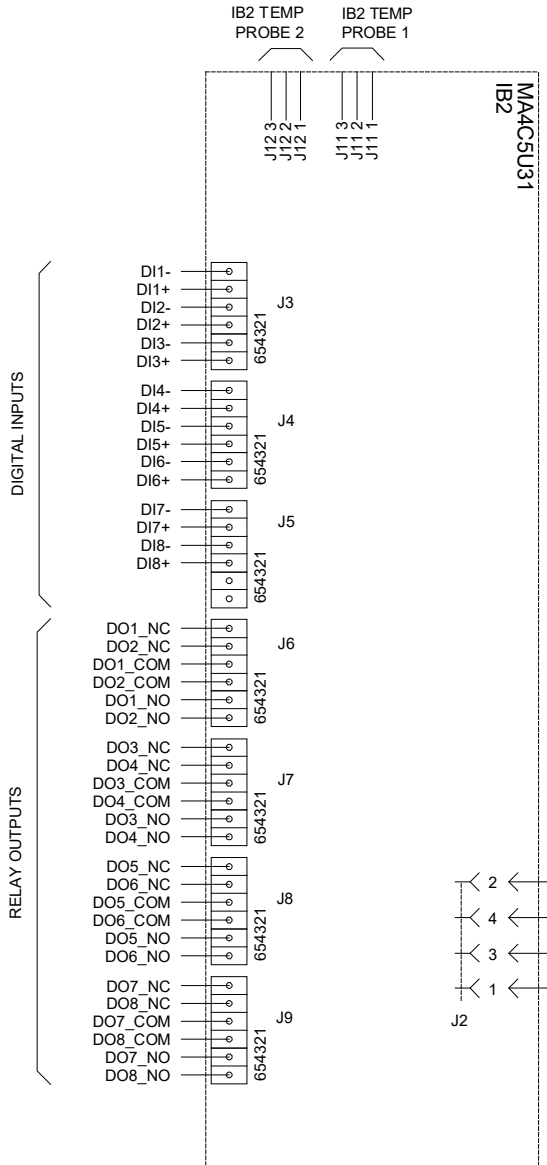
NOTE! *If a customer-furnished method to disconnect the input power to the system is not provided, the rectifiers will stay locked OFF until the input power is recycled. If the ESTOP signal is removed without recycling the input power, the rectifiers will remain off and have a local alarm visible on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

Wiring for ESTOP Function

Wire per Figure 5.11.

Figure 5.10 IB2 (Interface Board) Connections

Schematic Diagram of IB2 Board



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

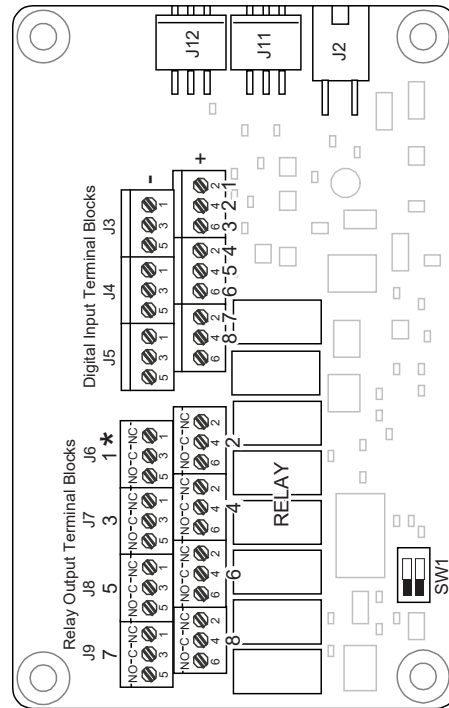
Not all I/O points are available for customer connection (some are used for factory system connections).

J3-J9:

Wire Size Capacity: 16-26 AWG.

Recommended Torque: 2.2 in-lbs.

IB2 Board (Top View)



IB2 Board Assembly

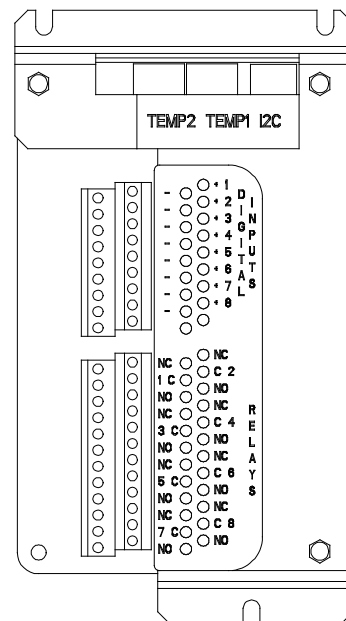


Table 5.6 Programmable Digital Inputs – IB2

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	-	-48VDC (customer connected)		
--	J5-5		not used	not used	not used
--	J5-6				



NOTE! Digital Input #8 function is predefined for ESTOP. For ESTOP, -48V is to be wired to the Digital Input #8 (-) terminal. Customer-furnished system ground applied to terminal Digital Input #8 (+) activates the ESTOP function. See “ESTOP Function” on page 51.

Table 5.7 Programmable Relay Outputs – IB2

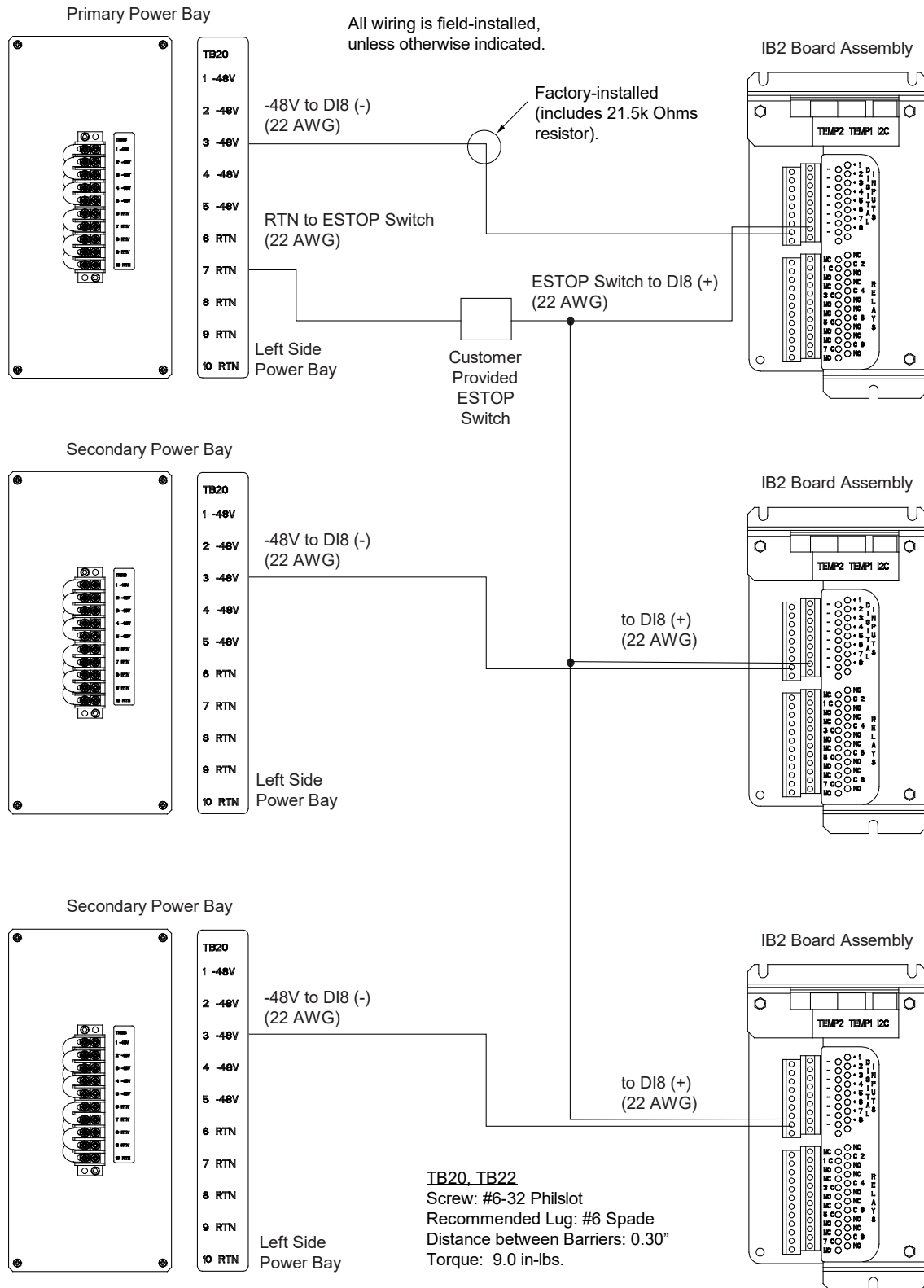
Programmable Relay Output		IB2 Pin No.	Alarms Assigned to this Relay (Default)	Alarms Assigned to this Relay (Custom)							
1	NO	J6-5	The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.								
	COM	J6-3									
	NC	J6-1									
2	NO	J6-6		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	J6-4									
	NC	J6-2									
3	NO	J7-5			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	J7-3									
	NC	J7-1									
4	NO	J7-6				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	J7-4									
	NC	J7-2									
5	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									
6	NO	J8-6						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	J8-4									
	NC	J8-2									
7	NO	J9-5							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	J9-3									
	NC	J9-1									
8	NO	J9-6								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	J9-4									
	NC	J9-2									



NOTE! The NCU 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 NCU 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.

Figure 5.11 ESTOP Wiring



5.5.3 EIB (NCU Extended Interface Board) Connections (If Required) (Primary Power Bay Only)

The EIB (NCU Extended Interface Board) provides additional connection points for current and voltage inputs, programmable relay outputs, and temperature probes. The EIB extended interface board is mounted inside the primary power bay. Refer to Figure 5.9.

Current Inputs, Voltage Inputs, and Programmable Relay Outputs - EIB

Current input, voltage input, and relay output leads are connected to screw-type terminal blocks located on the EIB. Refer to Figure 5.13 for terminal locations. Refer to Table 5.8, Table 5.9, and Table 5.10 for pin-out information.

Current Inputs - EIB

Connect up to three (3) shunt inputs to the EIB. Observe proper polarity. Refer to Figure 5.13 for terminal locations and Table 5.8 for pin-out information.

Refer to the NCU Instructions (UM1M830BNA) and program the shunt input parameters found in the EIB menu.



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 - EIB

The NCU 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 5.13 for terminal locations and Table 5.9 for pin-out information.

Refer to Figure 5.12 for connection details. Refer to the NCU Instructions (UM1M830BNA) and program the following parameters found in the EIB menu.

- **Battery Block Monitoring - EIB**

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 NCU 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 - EIB**

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 NCU 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 - EIB

The EIB provides five (5) programmable alarm relays with dry Form-C contacts. Connect up to five (5) relay outputs to the IB2. Refer to Figure 5.13 for terminal locations and Table 5.9 for pin-out information.

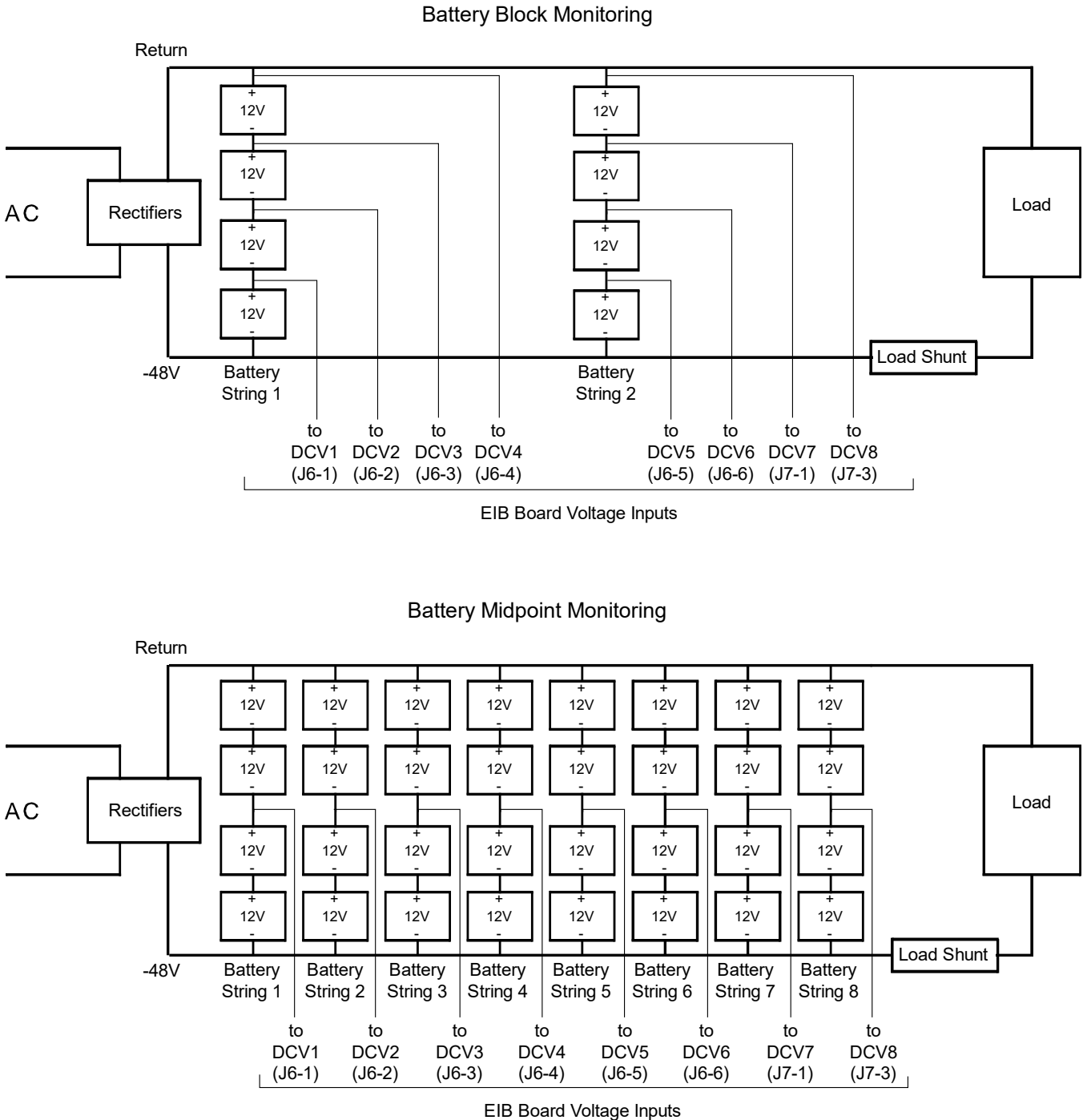
Refer to the NCU Instructions (UM1M830BNA) for programming information.

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.

Figure 5.12 Example Battery Block or Battery Midpoint Monitoring Connections - EIB



Temperature Probes - EIB

Up to two (2) temperature probes can be connected to the EIB (NCU Extended Interface Board). Refer to “Temperature Probes - IB2 and EIB” on page 50.

Figure 5.13 EIB (Extended Interface Board) Connections

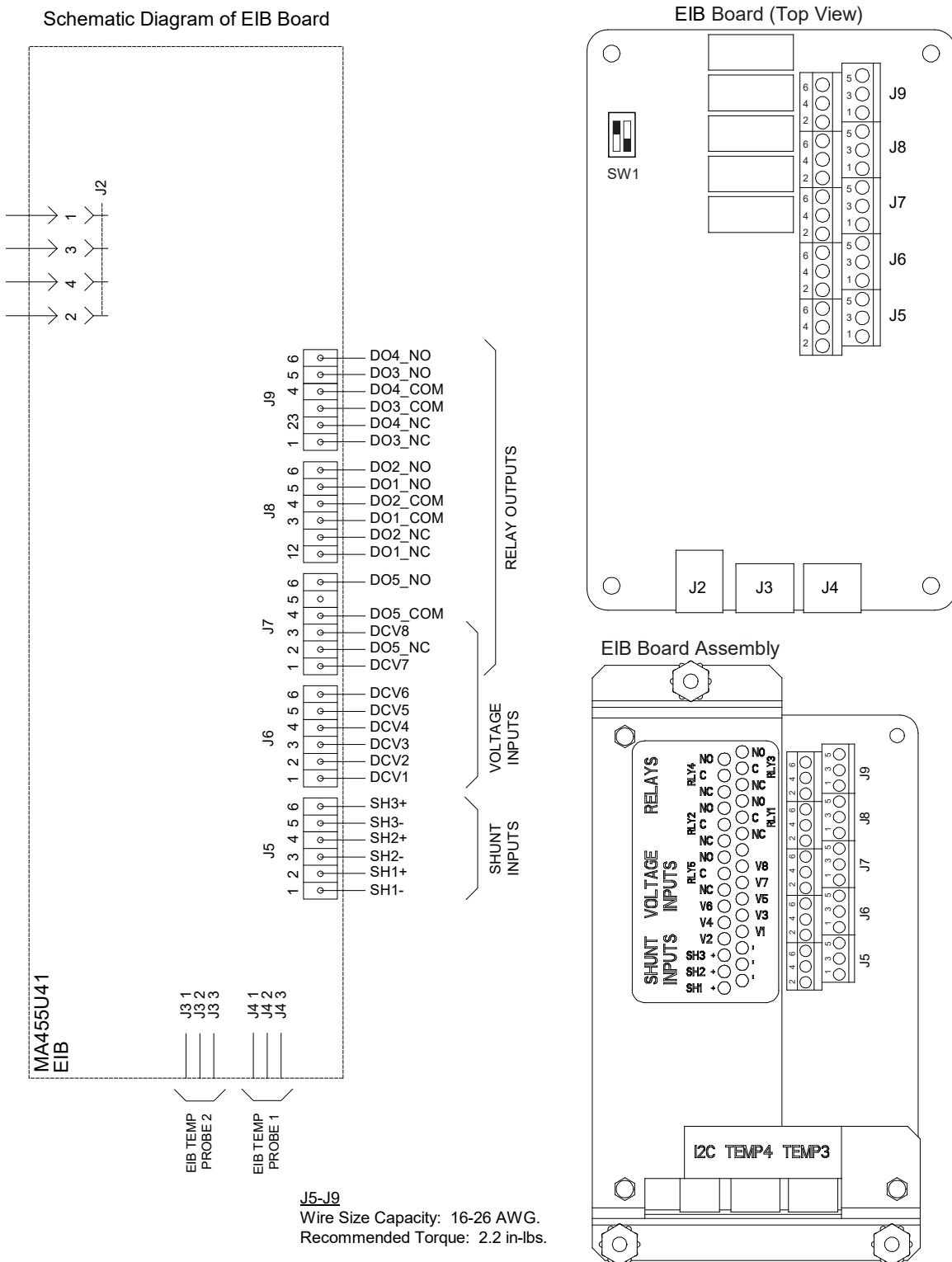


Table 5.8 Shunt Inputs – EIB

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 5.9 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 5.10 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	Critical / Major Alarm	
	COM	J8-3		
	NC	J8-1		
10	NO	J8-6		
	COM	J8-4		
	NC	J8-2		
11	NO	J9-5	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	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.

5.5.4 SM-DU+ and FA/Shunt Interface Assembly (Distribution Bays Only and Remote Assembly)

One (1) SM-DU+ and shunt/FA interface assembly is always provided in each distribution bay. This assembly provides connections for up to twenty-five (25) shunt inputs and fourteen fuse alarm inputs. Inputs are factory connected to any distribution positions/devices containing shunts and fuse alarms. A distribution bay may also contain an optional SM-DU+ and shunt/FA interface assembly which provides an additional twenty-five (25) shunt inputs and fourteen fuse alarm inputs. Inputs are factory connected to any distribution positions/devices containing shunts when there are more shunt inputs in the bay than the standard SM-DU+ and shunt/FA interface assembly has inputs for. Refer to Figure 5.14.



NOTE! *The optional SM-DU+ and shunt/FA interface assembly may be provided with a remote mounting kit which allows the assembly to be mounted external to the power system. Wiring the shunt inputs to this assembly is same as shown in this section for the optional SM-DU+ and shunt/FA interface assembly mounted in the distribution bay.*

Procedure

Current Inputs

Connect up to twenty-five (25) shunt inputs to the standard SM-DU+ and shunt/FA interface assembly. Connect up to twenty-five (25) shunt inputs to the optional SM-DU+ and shunt/FA interface assembly. Observe proper polarity. Note that some inputs may be factory connected, depending on distribution devices installed. Refer to the NCU Instructions (UM1M830BNA) for programming information for the unused inputs. Refer to Figure 5.14 for SM-DU+ connection points. Refer to Figure 5.15 for List A, B, C distribution panels connection points. Refer to Figure 5.16 for List D, E distribution panels connection points.



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 SM-DU+. Connect the negative side of the shunt to the negative shunt input on the SM-DU+.*

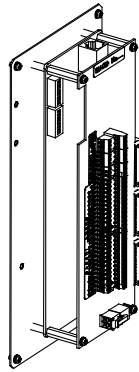
Fuse Alarm Inputs

Connect up to fourteen (14) fuse alarm inputs to the standard SM-DU+ shunt/FA interface assembly. Connect up to fourteen (14) fuse alarm inputs to the optional SM-DU+ shunt/FA interface assembly. Note that some inputs may be factory connected, depending on distribution devices installed. Refer to the NCU Instructions (UM1M830BNA) for programming information for the unused inputs. Refer to Figure 5.14 for SM-DU+ connection points. Refer to Figure 5.15 for List A, B, C distribution panels connection points. Refer to Figure 5.16 for List D, E distribution panels connection points.

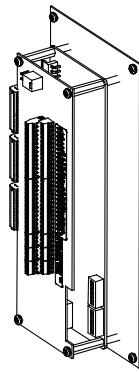
SM-DU+ Labeling

There are labels on the SM-DU+ assemblies and on the distribution panels near each distribution component installed in the panel. Record on the SM-DU+ label the number of the SM-DU+ based on the location in the power system and the SM-DU+'s switch settings. Record on the distribution panel labels for each distribution component the SM-DU+ information based on the destination of each distribution shunt wire set and fuse alarm wire. Refer to Figure 5.17. See also "Switch Settings on SM-DU+ (Distribution Bays and Remote SM-DU+ Only)" on page 36.

Figure 5.14 SM-DU+ and FA/Shunt Interface Assembly Connections



Terminal Blocks
 Wire Size Capacity: 16-26 AWG.
 Recommended Torque: 2.2 in-lbs.



Optional SM-DU+ and Shunt/FA Interface Assembly (for additional monitoring of shunts and FA signals located in the various distribution panels)

SM-DU+ and Shunt/FA Interface Assembly (for monitoring of shunts and FA signals located in the various distribution panels)

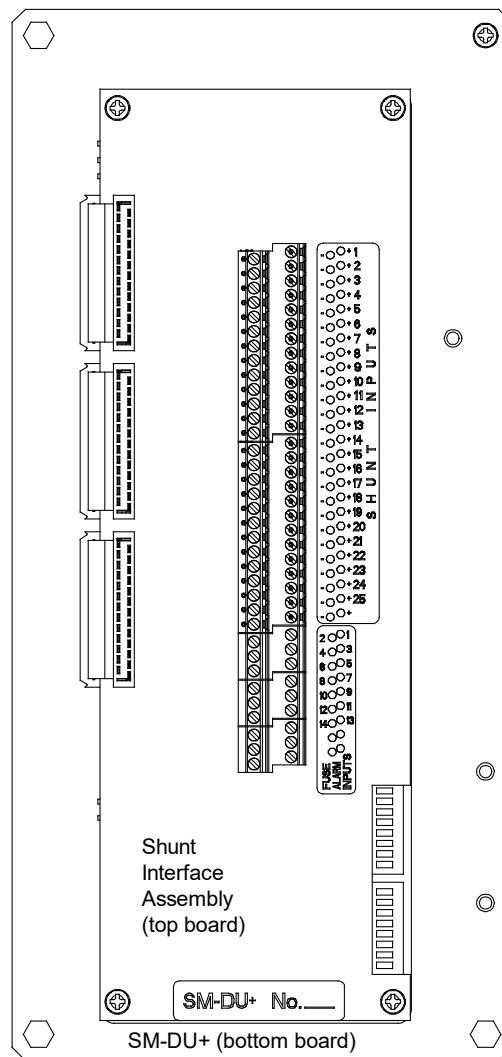
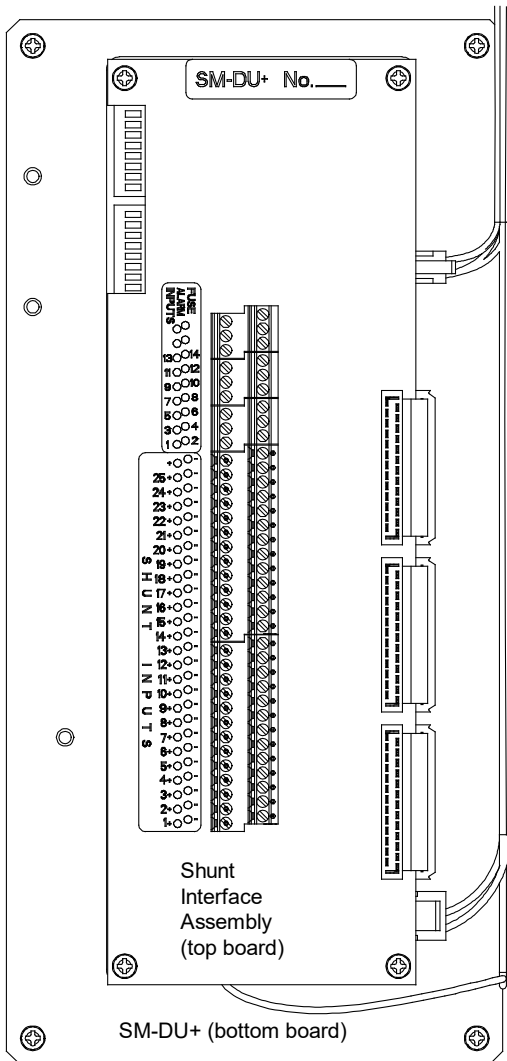
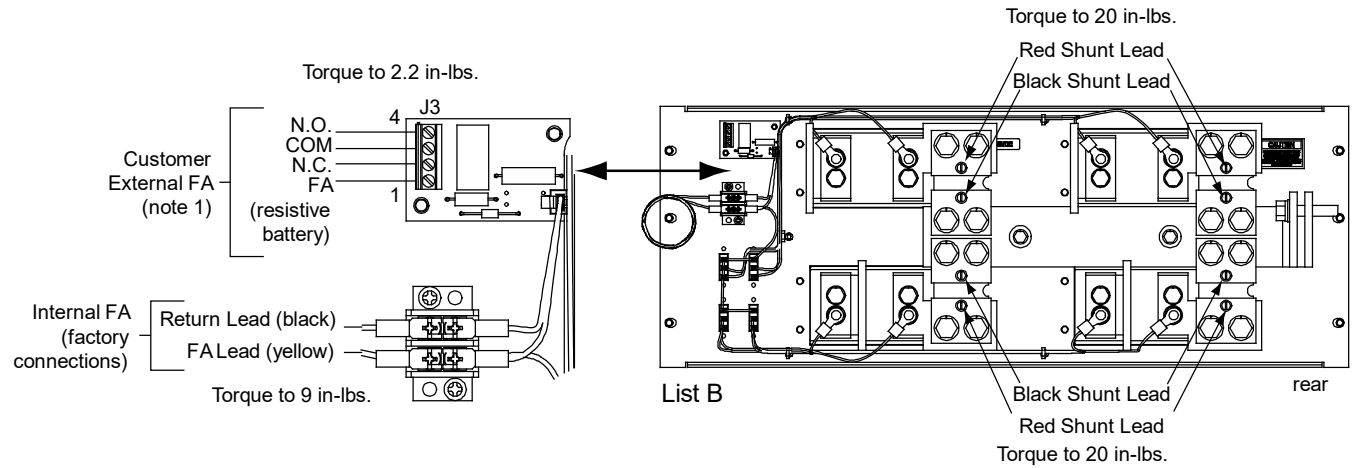
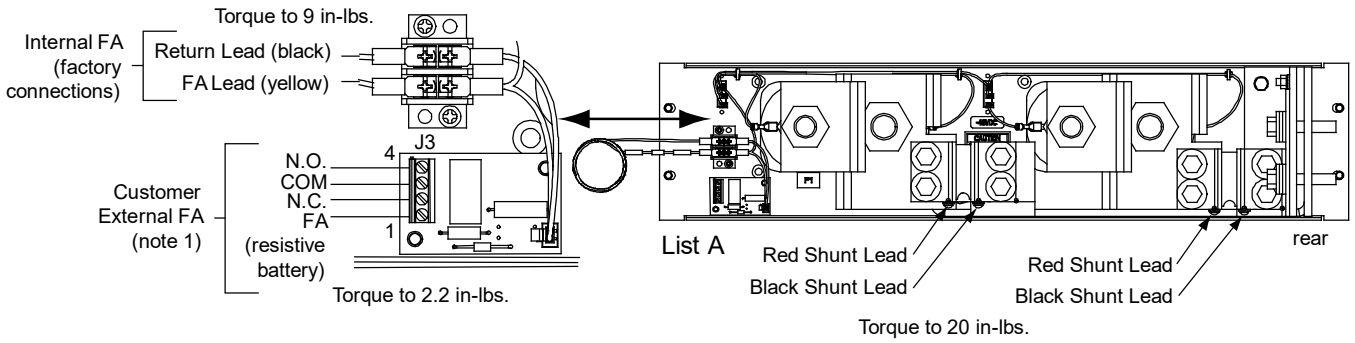


Figure 5.15 FA and Shunt Lead Connections to List A, B, C



Note 1:
 Relay contacts shown in the deenergized state.
 Relay energizes during alarm condition.
 Relay contacts rated for 30V DC @ 2A.

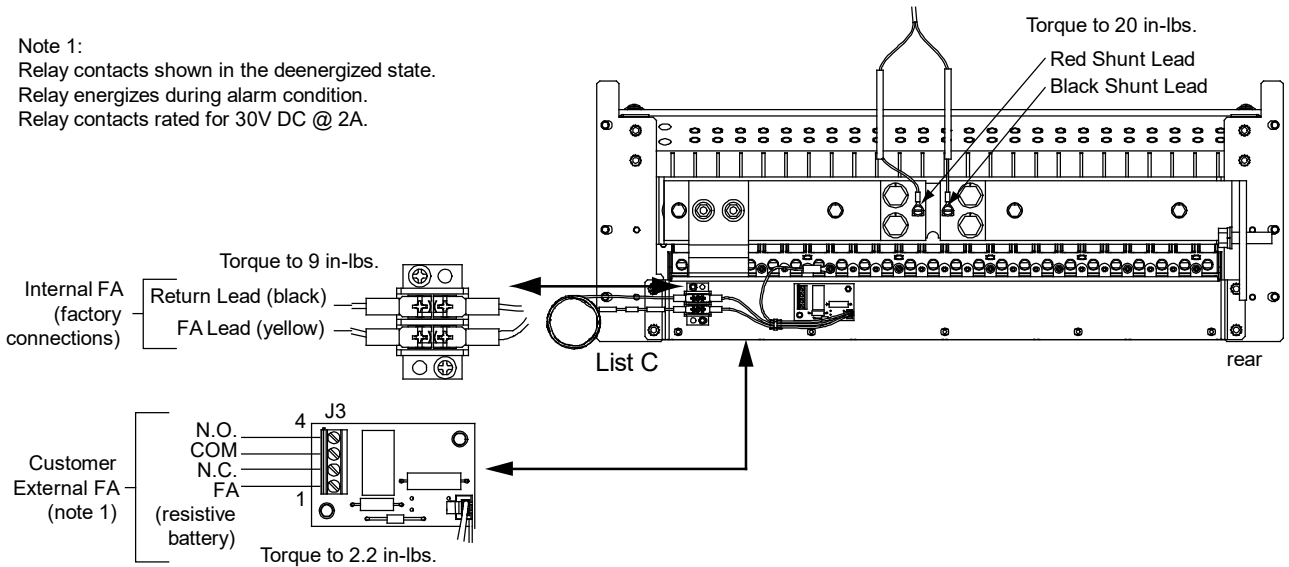
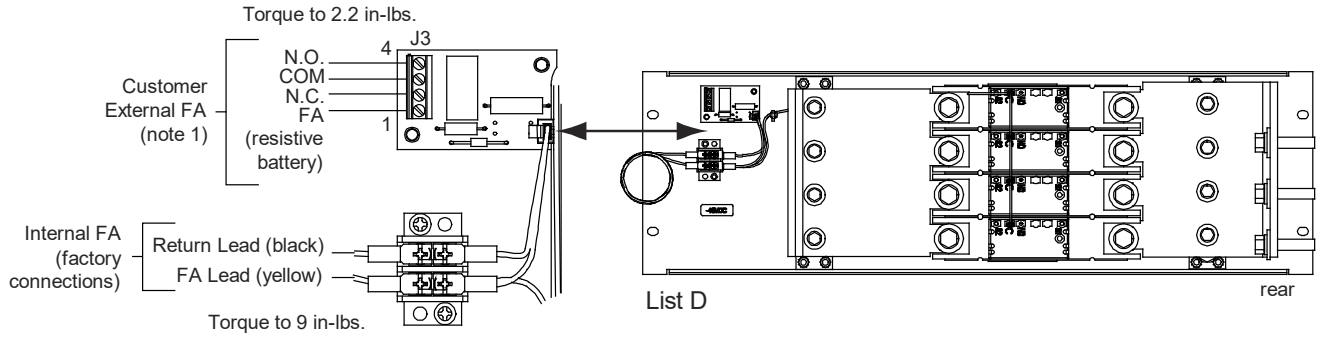
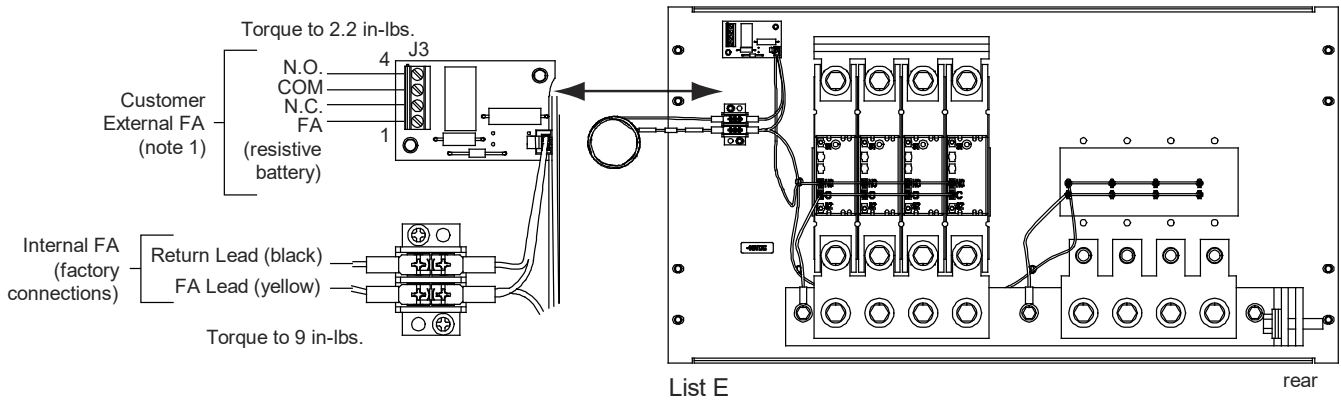


Figure 5.16 FA and Shunt Lead Connections to List D, E



Note 1:
 Relay contacts shown in the deenergized state.
 Relay energizes during alarm condition.
 Relay contacts rated for 30V DC @ 2A.



ALARM WIRING (BREAKERS WITH SHUNTS)

STANDARD TRIP BREAKER (BLACK HANDLE)
 ELECTRICAL TRIP BREAKER (WHITE HANDLE)

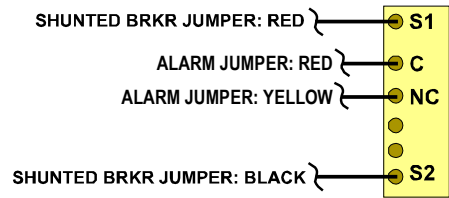
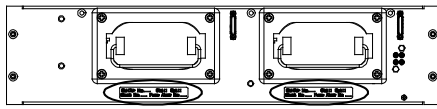
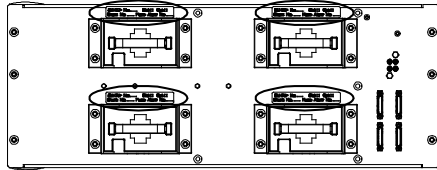


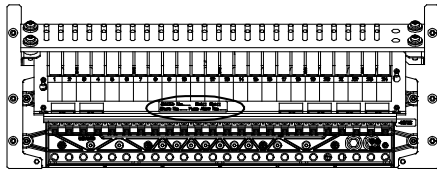
Figure 5.17 SM-DU+ Labeling



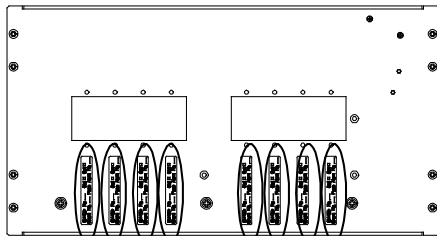
List A Distribution Panel



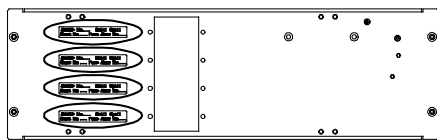
List B Distribution Panel



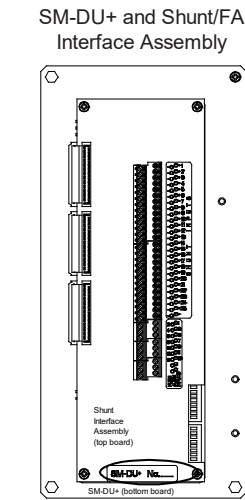
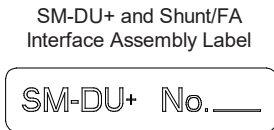
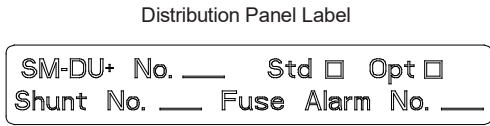
List C Distribution Panel



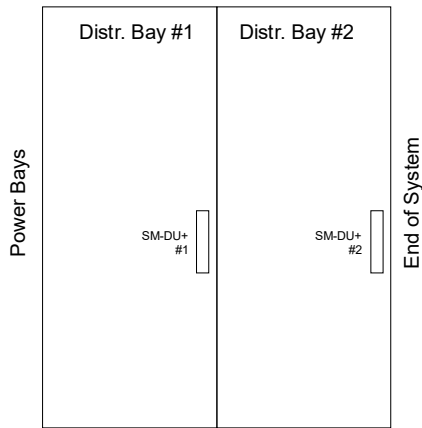
List D Distribution Panel



List E Distribution Panel

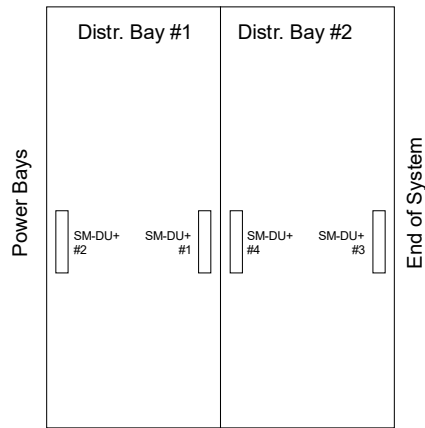


SM-DU+ Designations when
Only Standard SM-DU+ Furnished



Front View

SM-DU+ Designations when
Standard and Optional SM-DU+ Furnished



Front View

5.5.5 SM DU External Shunt Connections

An SM-DU module is mounted in the primary power bay for connection of the internal load shunts provided in each power bay. The SM DU module also provides an additional external shunt monitoring input. Refer to the following procedure and Figure 5.21 for connections details.

Procedure



NOTE! Refer to Figure 5.21 as this procedure is performed.

- [] 1. Open the primary power bay's front door.
- [] 2. If desired, connect an external shunt to the SM-DU. Observe proper polarity. Refer to the NCU Instructions (UM1M830BNA) for programming information for the shunt inputs.



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 SM-DU. Connect the negative side of the shunt to the negative shunt input on the SM-DU. To connect external load shunts located in the return bus to the SM-DU module in the primary power bay, order kit P/N 559404 and follow the kit instructions (IM559404).

- [] 3. Close the primary power bay's front door.

Return Bus Load Shunt Monitoring Cable Assembly Kit, P/N 559404

This kit provides a wire harness to reverse the shunt reference voltage to the SM-DU Shunt Monitoring Module located in the primary power bay. When used as shipped, any external shunt needs to be installed in the hot (-48V) bus. Use this kit to connect up to four (4) external shunts located in the return bus. This requires all internal shunts connected to the SM-DU module to be disconnected and the associated shunt leads isolated. For installation instructions, refer to IM559404 furnished with the kit.

5.6 System Ethernet Connection for Remote NCU Controller Access

Your system is 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).



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

An RJ-45 10BaseT jack is provided on the IB4 board for connection into a customer's network. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 5.18 for location and Table 5.11 for pin outs. 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, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

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

Figure 5.18 IB4 Board NCU Controller Second Ethernet Port

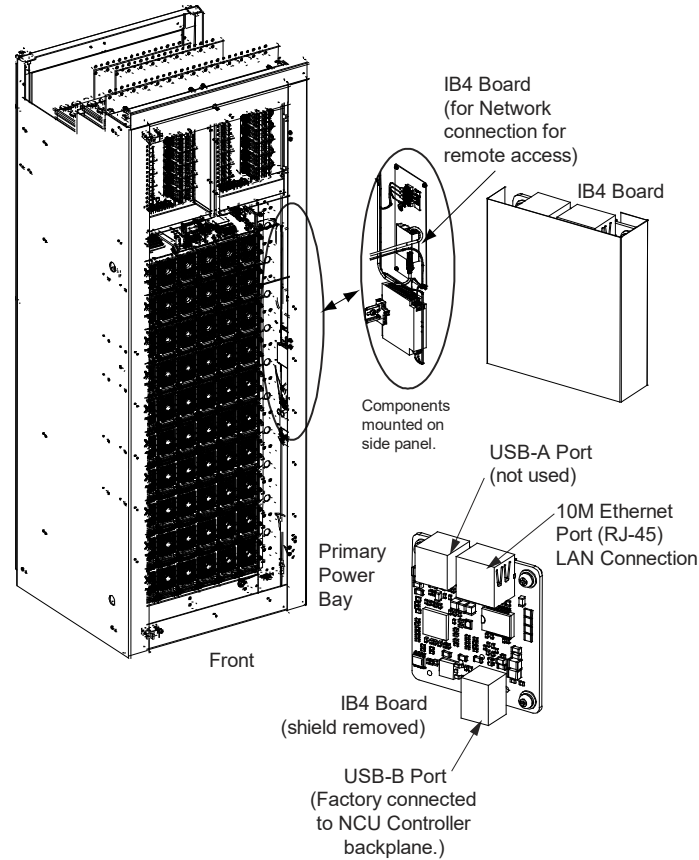


Table 5.11 NCU RJ-45 Ethernet Port Pin Configuration

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

5.7 Bay-to-Bay Cable Connections

P-clips are provided on the front of the inside side panels for securing wire routings. Holes are provided in bays side panels to allow wire routing between bays. Ensure a bushing is installed in all holes used for wire routing.

5.7.1 Bay-To-Bay NCU Can Bus Connections

This system utilizes the NCU CAN Bus to interconnect the following components to the NCU controller: Primary Power Bay SM-DU, Primary Power Bay Rectifiers, Distribution Bay Standard SM-DU+, and Distribution Bay Optional SM-DU+. Note that a termination

resistor must be installed at the end of this CAN Bus run as described in the procedure below. Note also that each secondary power bay contains its own CAN Bus run for that bay only. Refer to Figure 5.19 for a “Bay-to-Bay NCU CAN Bus Connections” cable diagram.

Procedure



NOTE! Refer to Figure 5.19 as this procedure is performed.

- [] 1. Open the primary power bay’s front and rear doors.
- [] 2. Open the distribution bays’ front and rear doors.
- [] 3. Remove the termination resistor (P/N 561768) from the NCU CAN bus terminal block in the primary power bay (TB19) and place it on the appropriate NCU CAN bus terminal block in the last distribution bay in the bay line-up (TB19). See Figure 5.19.
- [] 4. Connect and route NCU CAN bus cable(s) (P/N 557012) between the primary power bay and the distribution bay(s) as required, per Figure 5.19. Cut this cable to length and terminate it with the supplied spade lugs.
- [] 5. For each bay in the system, close the bay’s front and rear doors and secure.

Connecting a Device or System to the NCU CAN Bus

A supporting device or system may be connected to the last NCU CAN bus terminal block in the bay line-up (remove the termination resistor first). Refer to Figure 5.19 for location of the NCU CAN bus terminal blocks located in this system. Refer to Table 5.12 for pin-outs. Refer also to the external device’s or system’s instruction manual.

Table 5.12 NCU CAN Bus Connections

NCU CAN Bus Terminal Block (TB19 or TB20)		SM-Temp Module CAN Port Pin Number
Pin Number	Function	
1	CAN H	TB1-3 (CAN H)
2	CAN L	TB1-5 (CAN L)

General Procedure

Remove the termination resistor from the appropriate NCU CAN bus terminal block in the system (see Figure 5.19 for location). Connect the device or system to this terminal block. Refer to Table 5.12 for pin-outs. 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 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 bu. Refer to the SM-Temp Module Instructions (UM547490) for details.

Connecting the SM-Temp Module to the NCU CAN Bus

- [] 1. Remove the termination resistor from the appropriate NCU CAN bus terminal block in the system (see Figure 5.19 for location). Connect the SM-Temp Module CAN bus to this terminal block. Refer to Table 5.12 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).

Figure 5.19 Bay-to-Bay NCU CAN Bus Connections (cont'd on next page)

Terminal Locations

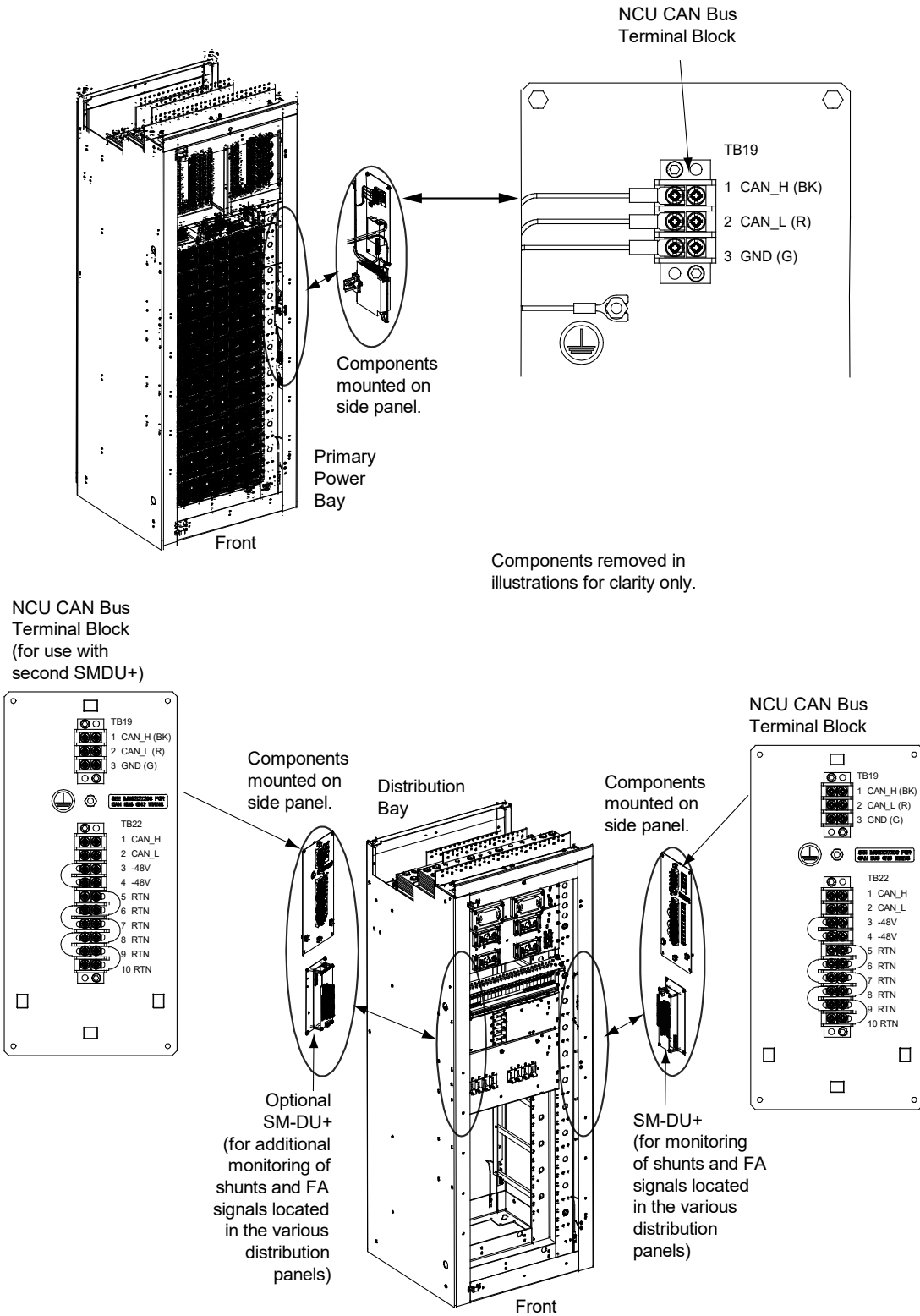


Figure 5.19 Bay-to-Bay NCU CAN Bus Connections (cont'd from previous page, cont'd on next page)

Primary Power Bay Only

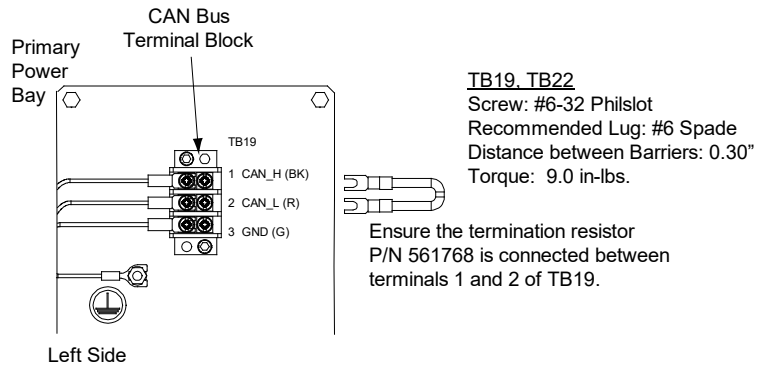
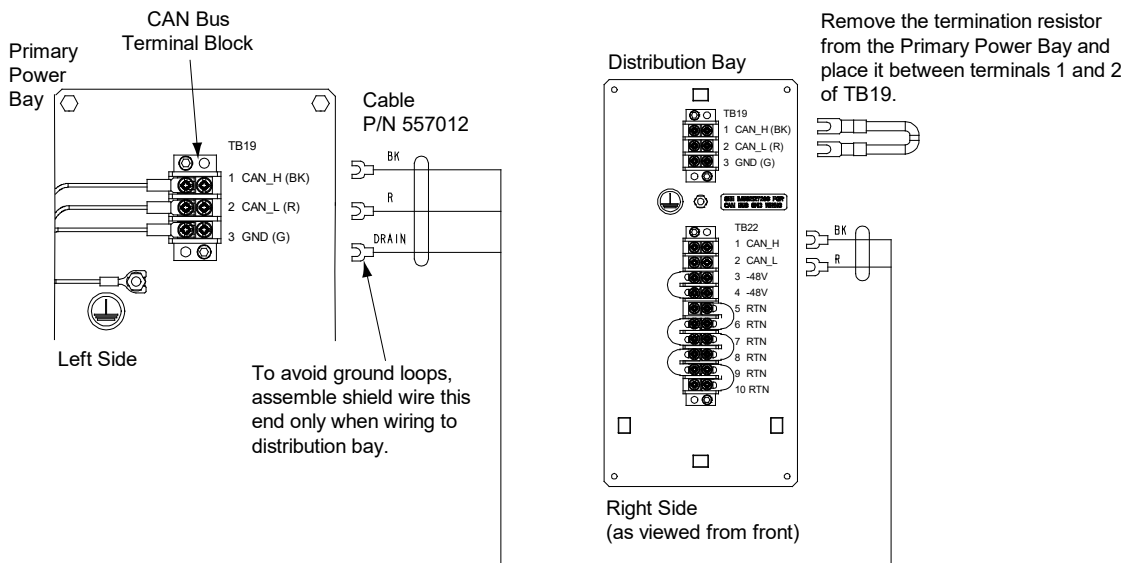


Figure 5.19 Bay-to-Bay NCU CAN Bus Connections (cont'd from previous page, cont'd on next page)

Primary Power Bay and Distribution Bay with One (1) Standard SM-DU+

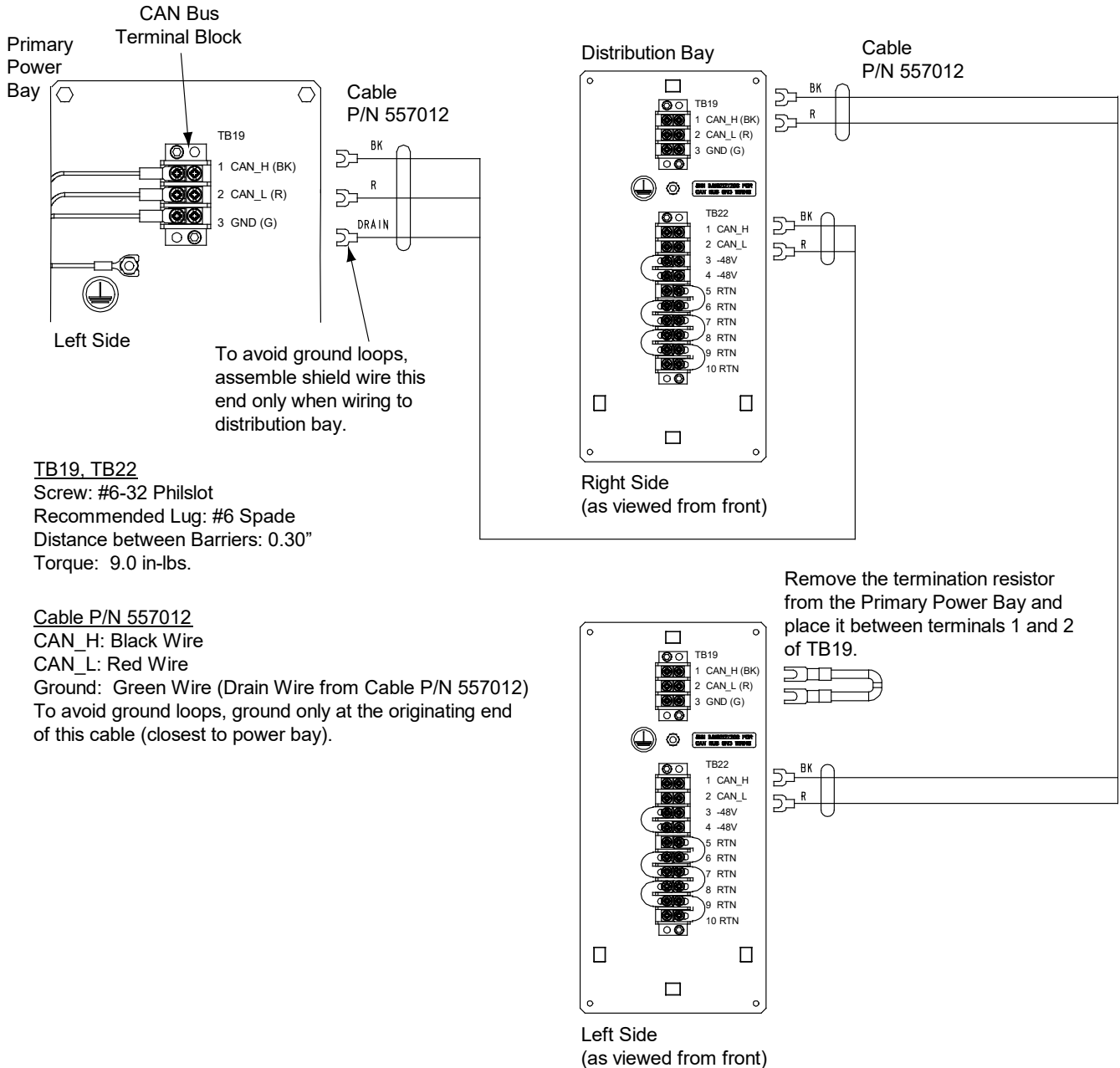


TB19, TB22
Screw: #6-32 Philslot
Recommended Lug: #6 Spade
Distance between Barriers: 0.30"
Torque: 9.0 in-lbs.

Cable P/N 557012
CAN_H: Black Wire
CAN_L: Red Wire
Ground: Green Wire (Drain Wire from Cable P/N 557012)
To avoid ground loops, ground only at the originating end of this cable (closest to power bay).

Figure 5.19 Bay-to-Bay NCU CAN Bus Connections (cont'd from previous page, cont'd on next page)

Primary Power Bay and Distribution Bay with One (1) Standard SM-DU+ and One (1) Optional SM-DU+



TB19, TB22

Screw: #6-32 Philips
 Recommended Lug: #6 Spade
 Distance between Barriers: 0.30"
 Torque: 9.0 in-lbs.

Cable P/N 557012

CAN_H: Black Wire
 CAN_L: Red Wire
 Ground: Green Wire (Drain Wire from Cable P/N 557012)
 To avoid ground loops, ground only at the originating end of this cable (closest to power bay).

Figure 5.19 Bay-to-Bay NCU CAN Bus Connections (cont'd from previous page, cont'd on next page)

Primary Power Bay
and 1st Distribution Bay
with One (1) Standard SM-DU+
and 2nd Distribution Bay with
One (1) Standard SM-DU+

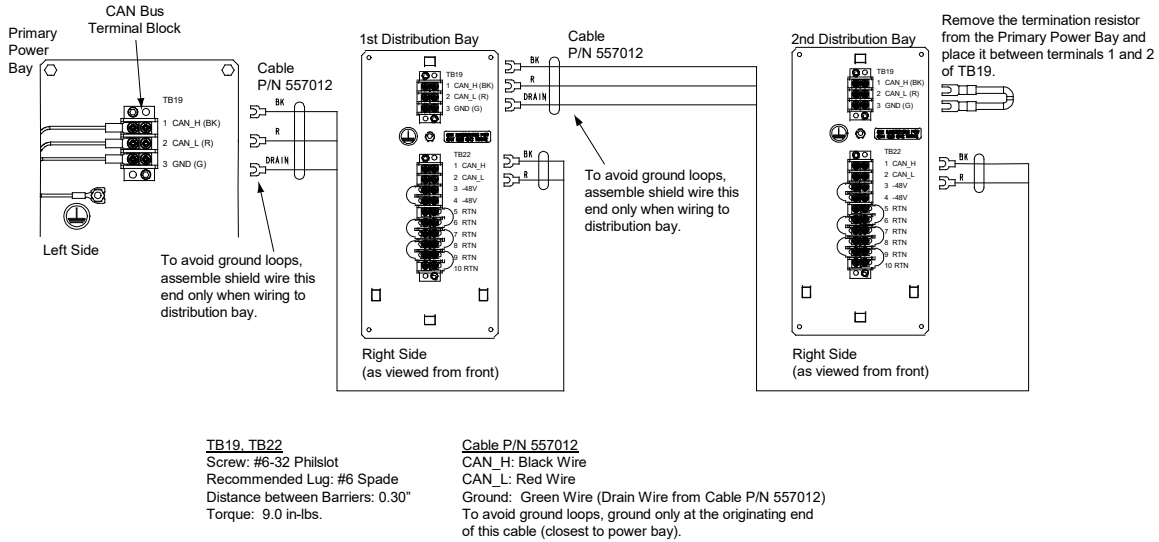


Figure 5.19 Bay-to-Bay NCU CAN Bus Connections (cont'd from previous page, cont'd on next page)

Primary Power Bay
and 1st Distribution Bay
with One (1) Standard SM-DU+
and One (1) Optional SM-DU+
and 2nd Distribution Bay with
One (1) Standard SM-DU+

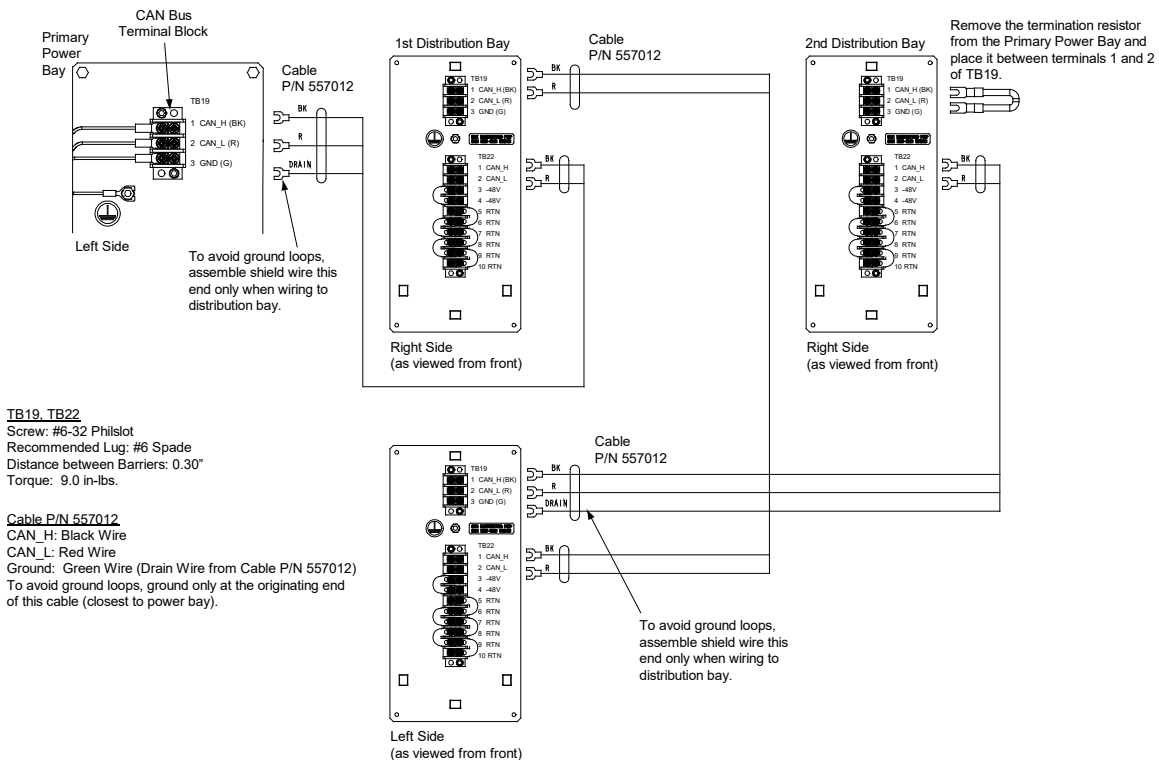
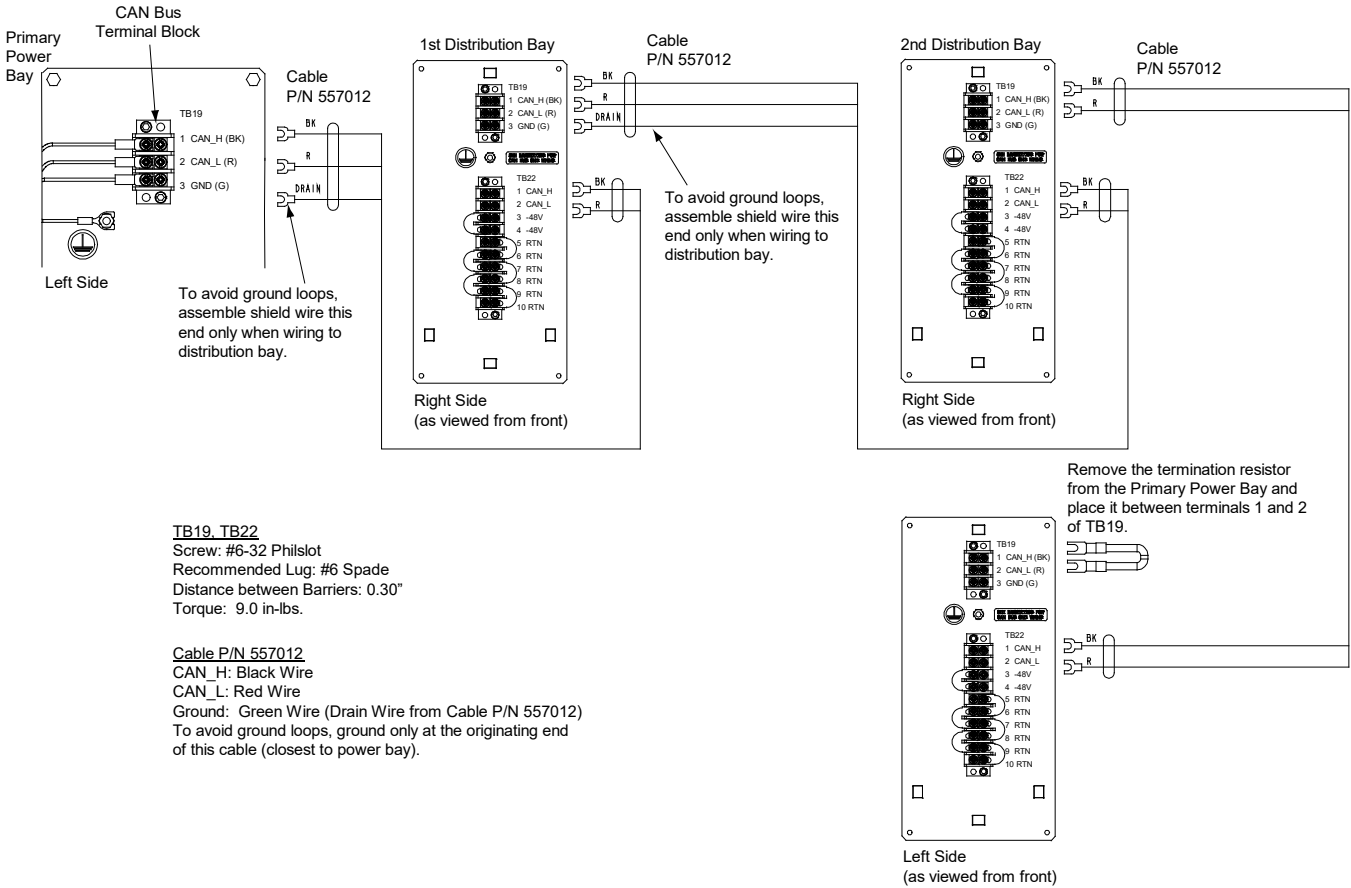


Figure 5.19 Bay-to-Bay NCU CAN Bus Connections (cont'd from previous page)

Primary Power Bay
and 1st Distribution Bay
with One (1) Standard SM-DU+
and 2nd Distribution Bay with
One (1) Standard SM-DU+
and One (1) Optional SM-DU+



5.7.2 Bay-To-Bay RS-485 Connections

This system utilizes the NCU RS-485 Bus to interconnect the NCU controller in the primary power bay to the secondary control module located in each secondary power bay. Note that a termination resistor must be installed at the end of this RS-485 run as described in the procedure below. Refer to Figure 5.20 for a “Bay-to-Bay RS-485 Connections” cable diagram.

Procedure

NOTE! Refer to Figure 5.20 as this procedure is performed.

- [] 1. For each power bay in the system, open the bay’s front door.
- [] 2. Remove the termination resistor (P/N 561768) from the NCU RS-485 terminal block (TB21) in the primary power bay and place it on the NCU RS-485 terminal block (TB21) in the last power bay in the bay line-up. See Figure 5.20.
- [] 3. Connect the spade lug end of cable P/N 557012 to terminal block TB21 located in the primary power bay. Route this cable through the access holes located in the sides of the bays from the primary power bay to the first secondary power

bay. Cut this cable to length and terminate it with the supplied spade lugs to terminal block TB21 located in the first secondary power bay. See Figure 5.20 for cable wire color to terminal block TB21 pinouts.

- [] 4. Interconnect a second secondary power bay in the above fashion, if furnished.
- [] 5. For each power bay in the system, close the bay's front door and secure.

Figure 5.20 Bay-to-Bay RS-485 Connections (cont'd on next page)

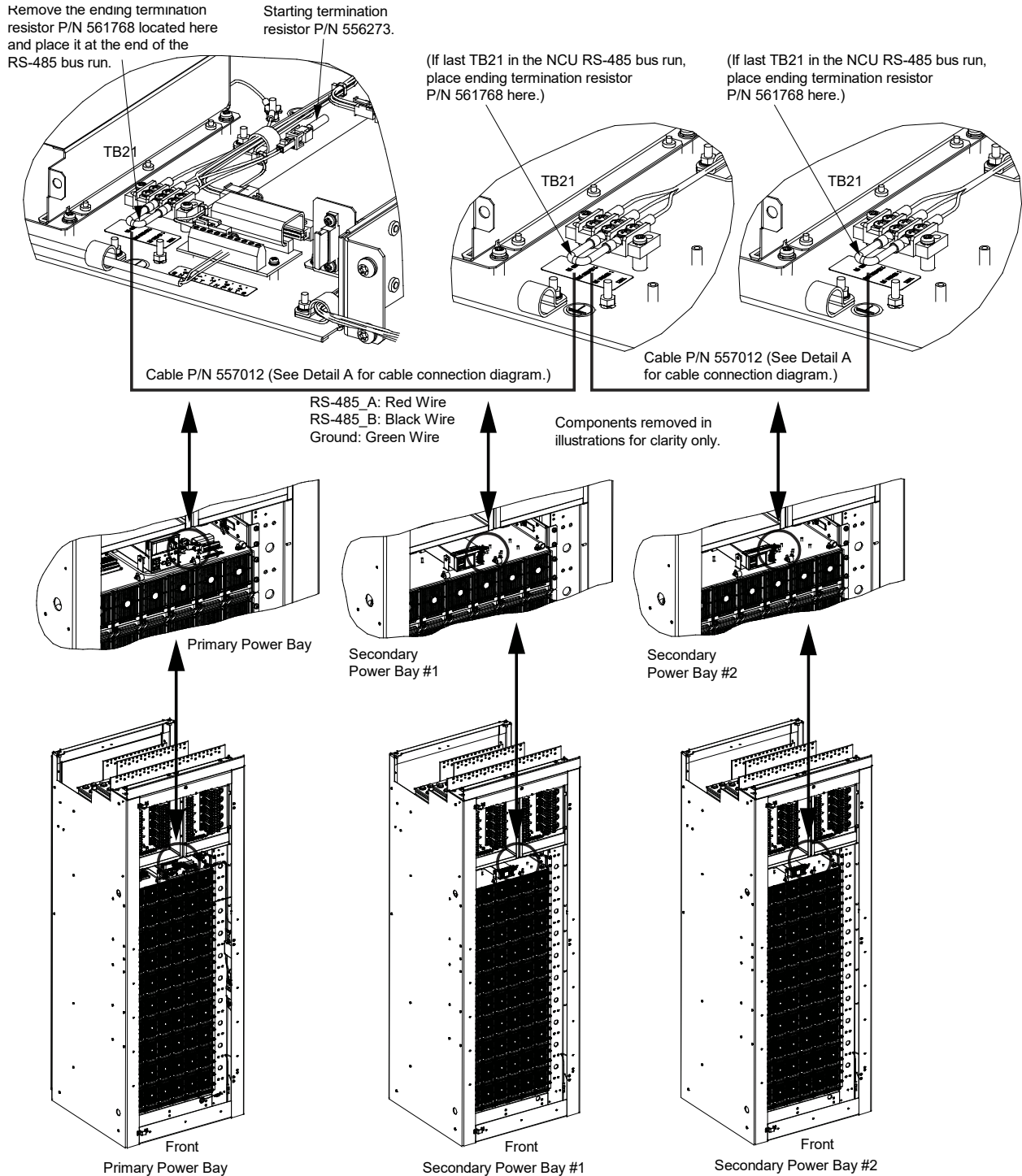
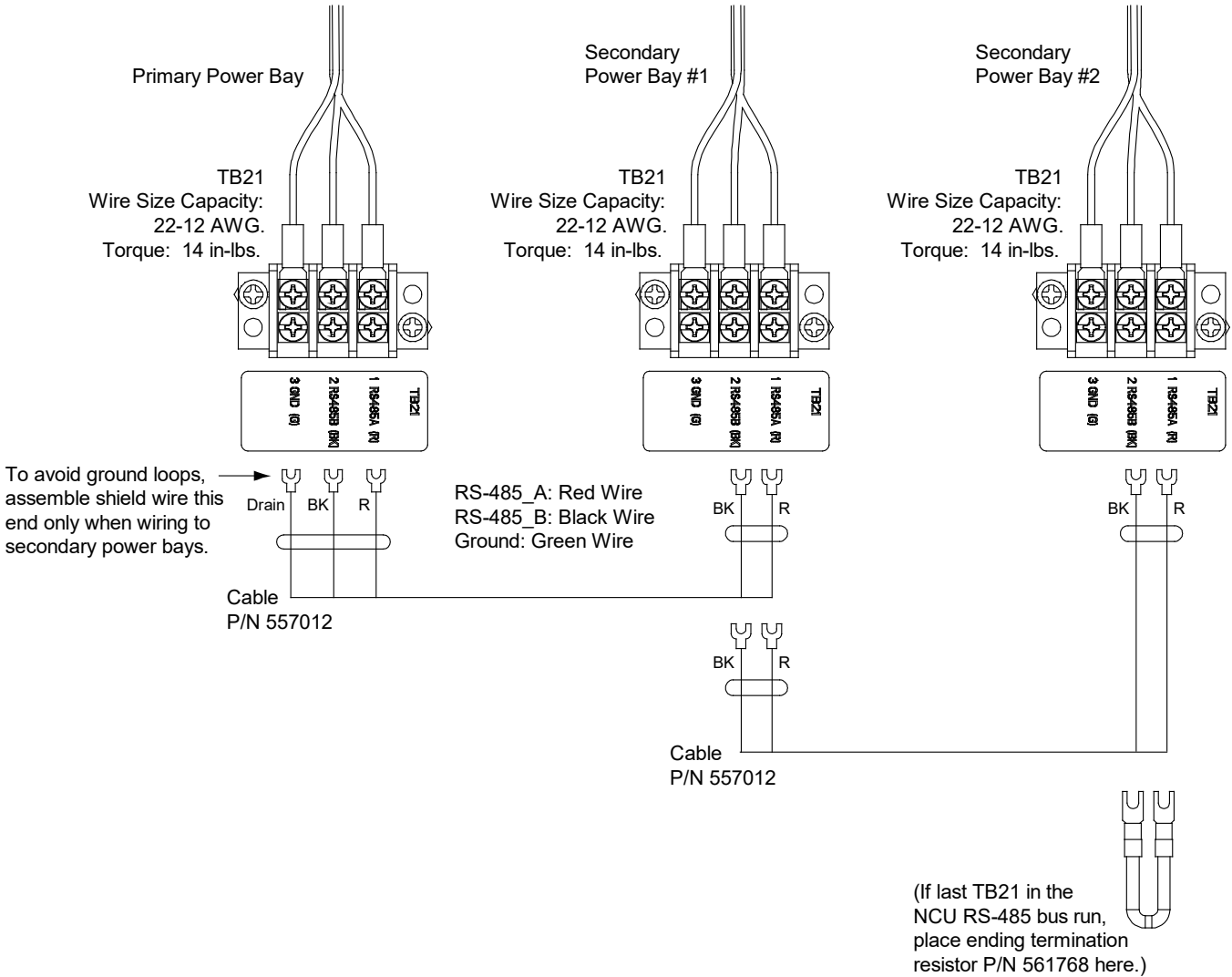


Figure 5.20 Bay-to-Bay RS-485 Connections (cont'd from previous page)

Detail A
Cable Connection Diagram



5.7.3 Secondary Power Bays to Primary Power Bay Shunt Connections

An SM-DU module is mounted in the primary power bay for connection of the internal load shunts provided in each power bay. The SM DU module also provides an additional external shunt monitoring input. Refer to Figure 5.21 for a “Secondary Power Bays to Primary Power Bay Shunt Connections” cable diagram.

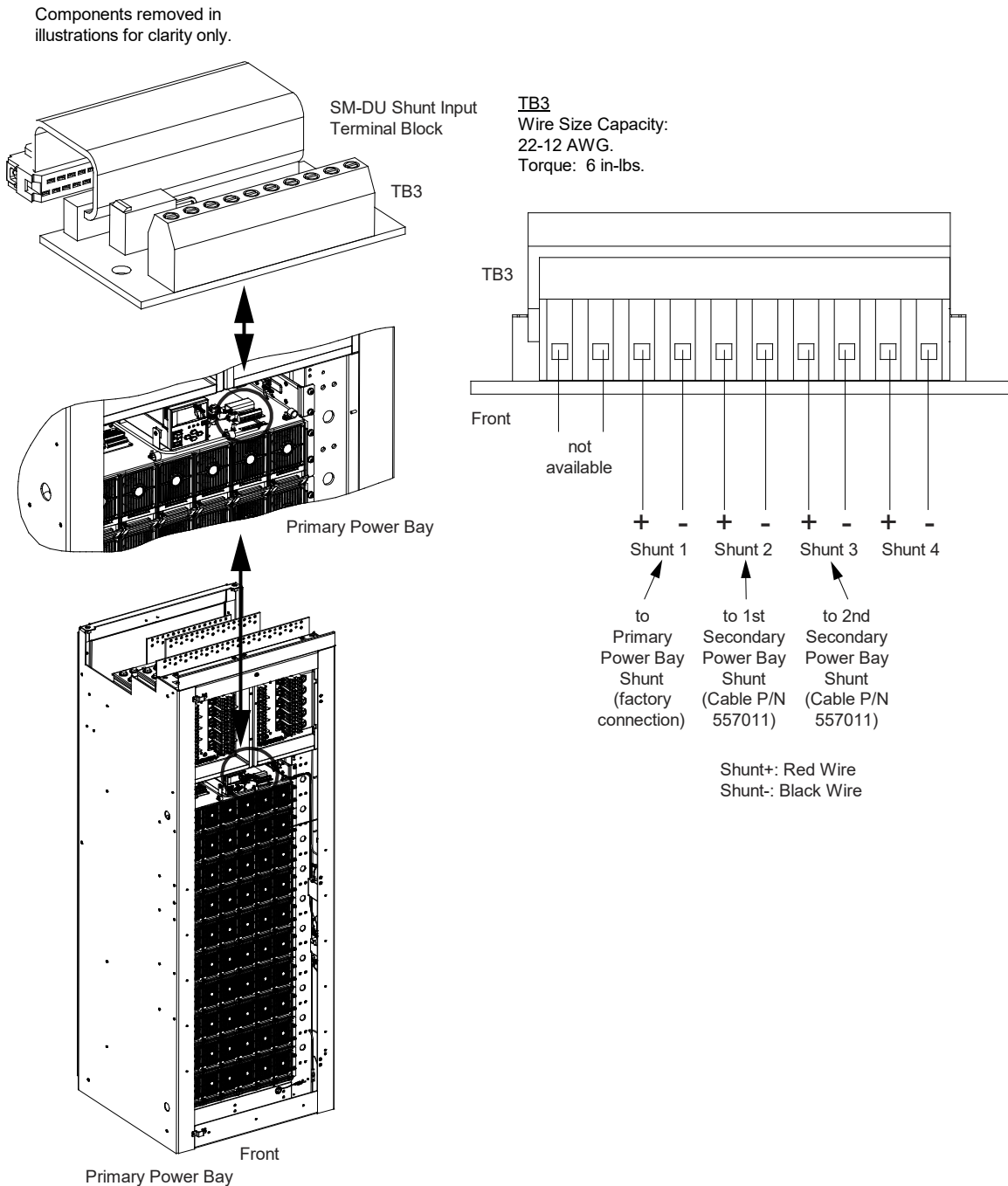
Procedure

NOTE! Refer to Figure 5.21 as this procedure is performed.

- [] 1. For each power bay in the system, open the bay’s front door.

- [] 2. Connect the spade lug end of cable P/N 557011 to the load shunt located in a secondary power bay (red wire to shunt+, black wire to shunt-). Route this cable through the access holes located in the sides of the bays from the secondary power bay to the primary power bay. Cut this cable to length and terminate it to terminal block TB3 located in the primary power bay. See Figure 5.21 for cable wire color to terminal block TB3 pinouts.
- [] 3. Interconnect a second secondary power bay in the above fashion, if furnished.
- [] 4. For each bay in the system, close the bay's front door and secure.

Figure 5.21 Secondary Power Bays to Primary Power Bay Shunt Connections



5.7.4 Distribution Bay SM-DU+ Power Connections

Power must be supplied to each SM-DU+ installed in a distribution bay (and the optional SM-DU+ with remote mounting kit) from the appropriate terminals in any power bay. Refer to Figure 5.22 for a “Distribution Bay SM-DU+ Power Connections” cable diagram.

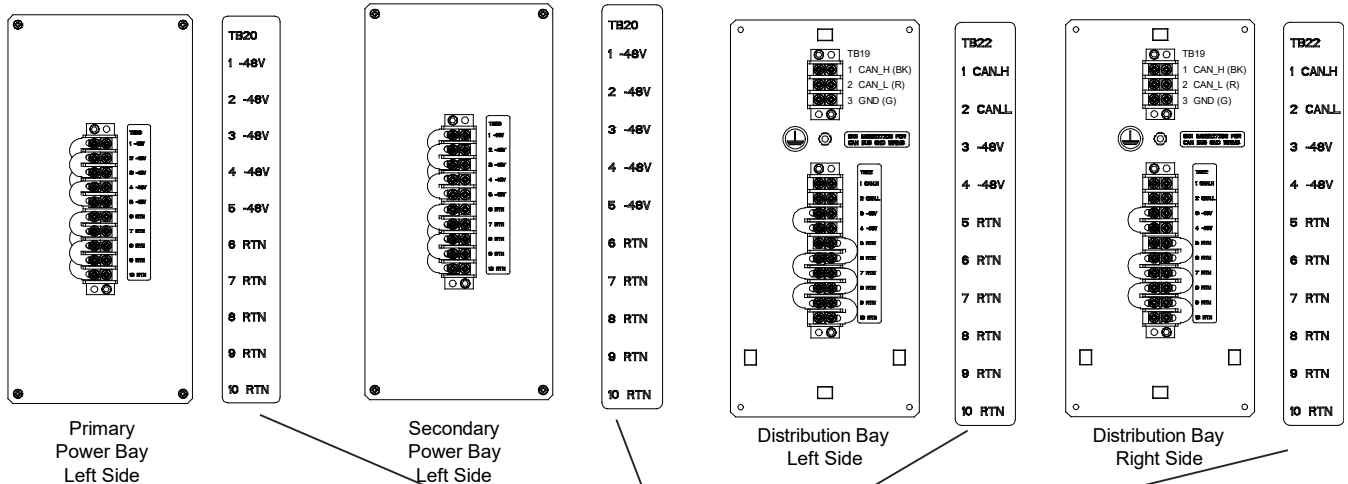
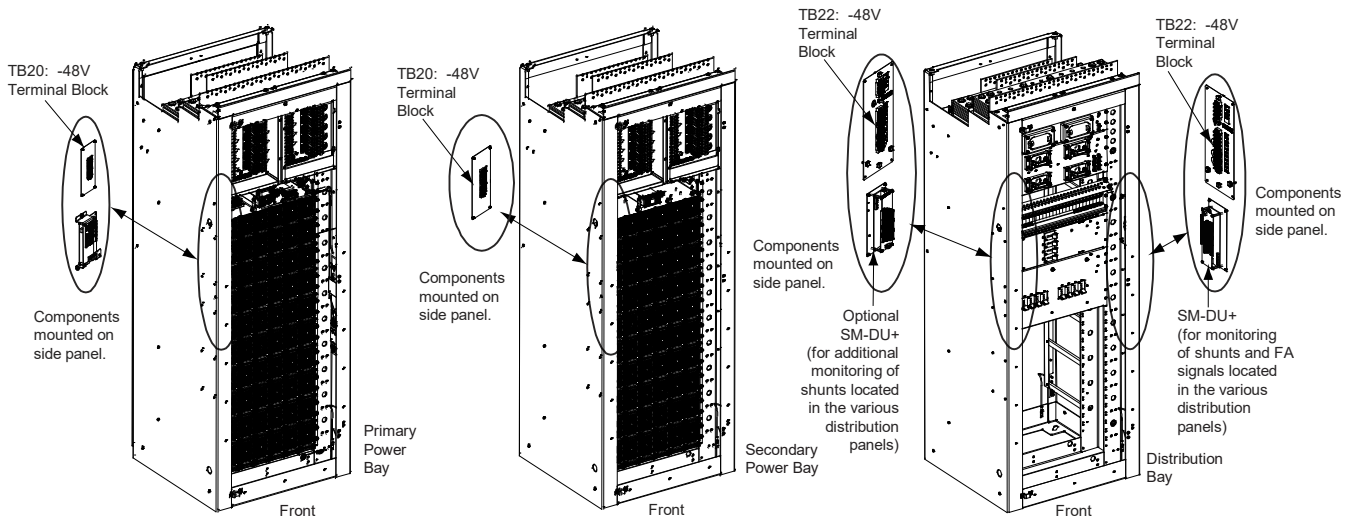
Procedure



NOTE! Refer to Figure 5.22 as this procedure is performed.

- [] 1. Open the power bay's front doors.
- [] 2. Open the distribution bay's front doors.
- [] 3. Connect the spade lug end of cable P/N 557012 to terminal block TB20 located on the left side wall of the primary power bay or a secondary power bay (as viewed from the front). Red to a -48V terminal, Black to a RTN terminal.
- [] 4. Route this cable through the access holes located in the sides of the bays from the power bay to the distribution bay. Cut this cable to length and terminate it with the supplied spade lugs to terminal block TB22 located on the right side wall of the distribution bay (as viewed from the front). Red to a -48V terminal, Black to a RTN terminal.
- [] 5. If the distribution bay has two (2) SM-DU+ installed, connect the spade lug end of another cable P/N 557012 to terminal block TB20 located on the left side wall of the primary power bay or a secondary power bay (as viewed from the front). Red to a -48V terminal, Black to a RTN terminal. Route this cable through the access holes located in the sides of the bays from the power bay to the distribution bay. Cut this cable to length and terminate it with the supplied spade lugs to terminal block TB22 located on the left side wall of the distribution bay (as viewed from the front). Red to a -48V terminal, Black to a RTN terminal.
- [] 6. Repeat this procedure if other distribution bays are present in the system.
- [] 7. For each bay in the system, close the bay's front door and secure.

Figure 5.22 Distribution Bay SM-DU+ Power Connections



TB20, TB22
 Screw: #6-32 Philslot
 Recommended Lug: #6 Spade
 Distance between Barriers: 0.30"
 Torque: 9.0 in-lbs.

Use cable P/N 557012 to connect -48V and RTN from a power bay to the left or right side terminals of a distribution bay. Connect -48V power bay terminal to -48V distribution bay terminal and RTN power bay terminal to RTN distribution bay terminal. Use a cable for each SM-DU+ installed in the distribution bay.

-48V: Red Wire
 RTN: Black Wire

Components removed in illustrations for clarity only.

5.7.5 Optional SM-DU+ with Remote Mounting Kit Wiring

Refer to Figure 5.23.

Switch Settings

Refer to "Switch Settings on SM-DU+ (Distribution Bays and Remote SM-DU+ Only)" on page 36.

5.8 Load Connections

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

Figure 5.24 -48V Distribution Panel (without Return Busbar), (2) TPL Fuse Positions

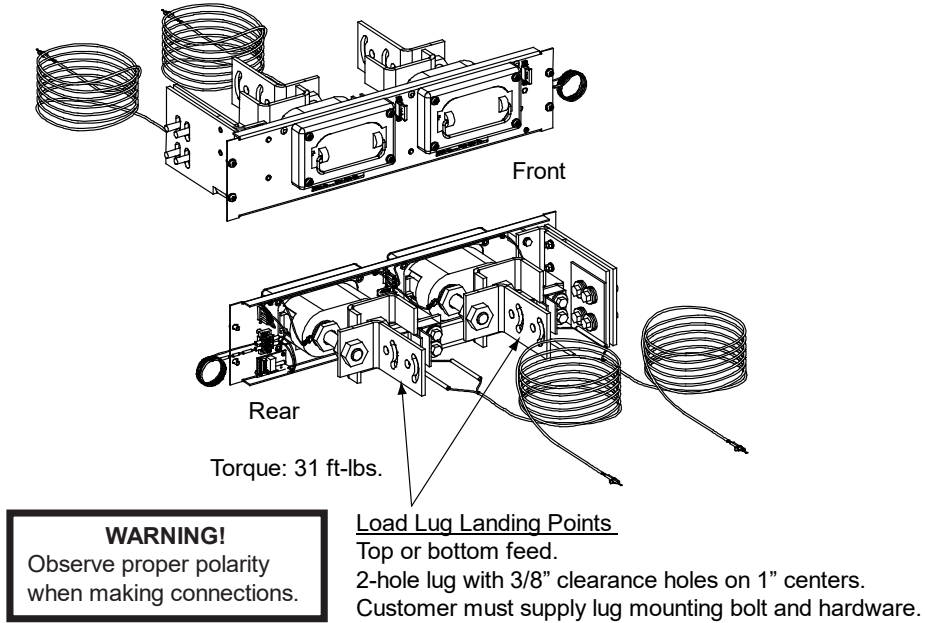


Figure 5.25 -48V Distribution Panel (without Return Busbar), (4) TPH Fuse Positions

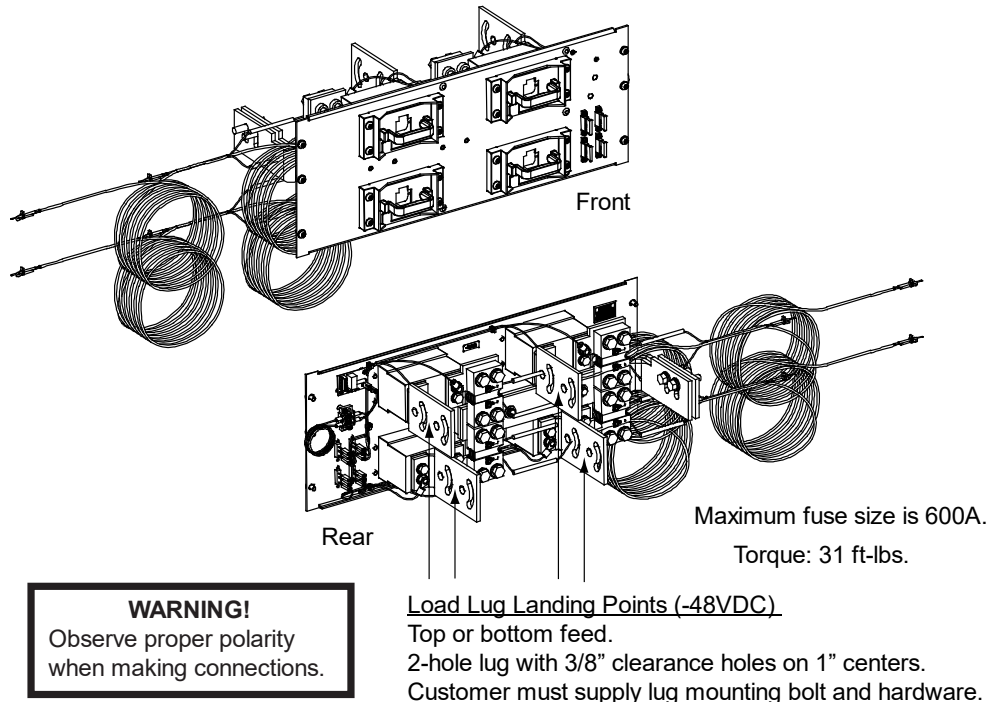


Figure 5.26 -48V Distribution Panel (with Return Busbar), (24) Bullet/TPS/TLS Circuit Breaker/Fuse Positions

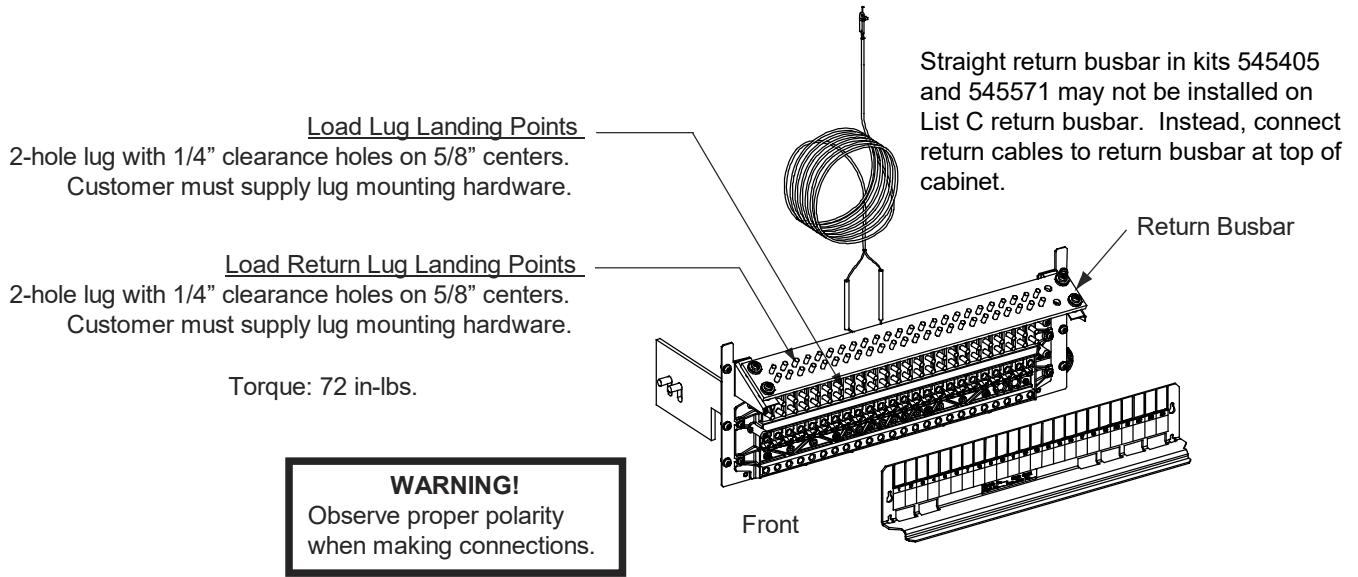


Figure 5.27 Optional Bullet Nose 6-Position GMT Distribution Fuse Block

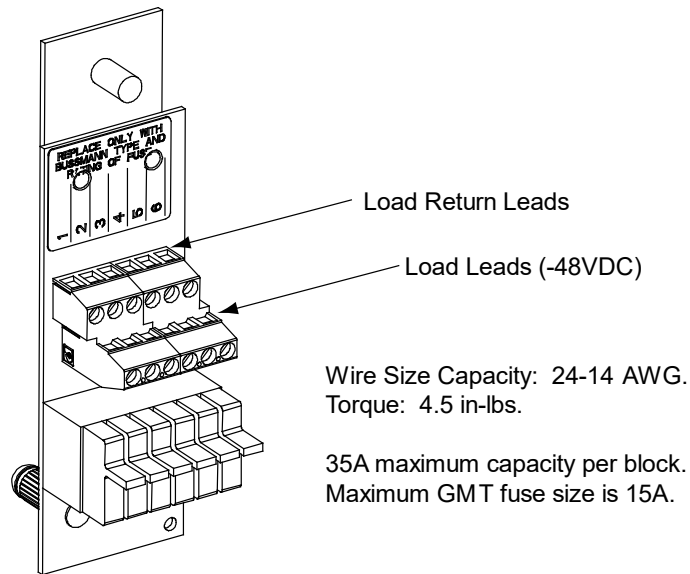


Figure 5.28 -48V Distribution Panel (with Return Busbar), (4) GJ/218 Circuit Breaker Positions

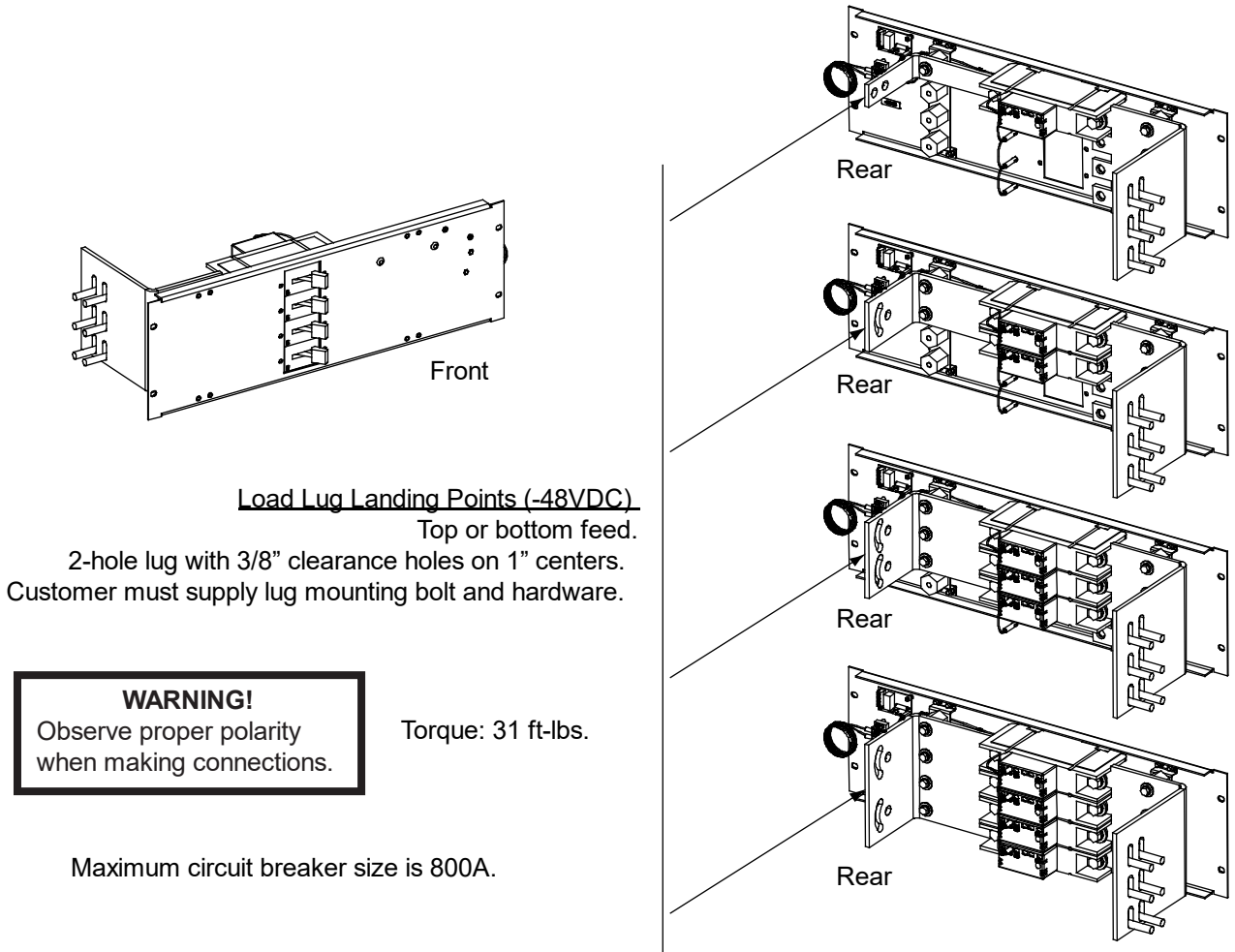
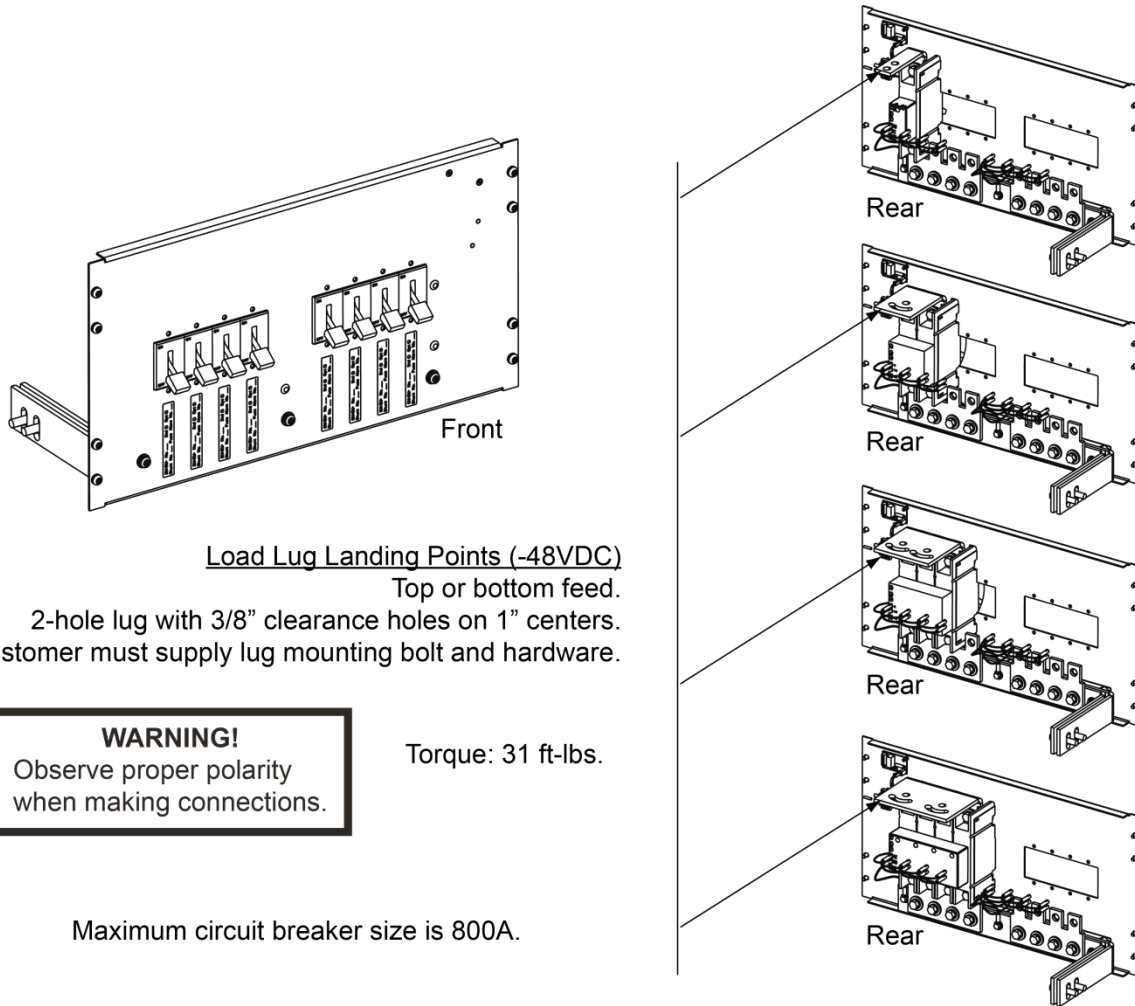


Figure 5.29 -48V Distribution Panel (with Return Busbar), (8) GJ/218 Circuit Breaker Positions



Load Lug Landing Points (-48VDC)

Top or bottom feed.

2-hole lug with 3/8" clearance holes on 1" centers.
Customer must supply lug mounting bolt and hardware.

WARNING!
Observe proper polarity
when making connections.

Torque: 31 ft-lbs.

Maximum circuit breaker size is 800A.

5.9 Power and Distribution Bay Connections to Internal Top Mount Busbars

Important Safety Instructions



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



WARNING! Observe proper polarity when making connections.

-48 VDC Battery Connections to Power Bays

Power bay -48 VDC battery leads are connected to the battery busbar and return busbar located in the power bays as shown in Figure 5.30 and Figure 5.31 (observe correct polarity).

-48 VDC Output Connections from Power Bays

Power bay -48 VDC output leads can be connected to the -48 VDC output busbar and return busbar located in the power bays as shown in Figure 5.30 and Figure 5.31 (observe correct polarity).

-48 VDC Input Connections to Distribution Bays

Distribution bay -48 VDC input leads can be connected to the -48 VDC input busbar and optional return busbar located in the distribution bays as shown in Figure 5.30 and Figure 5.32 (observe correct polarity).

Figure 5.30 Power and Distribution Bay Internal Top Mount Busbar Overall Illustration

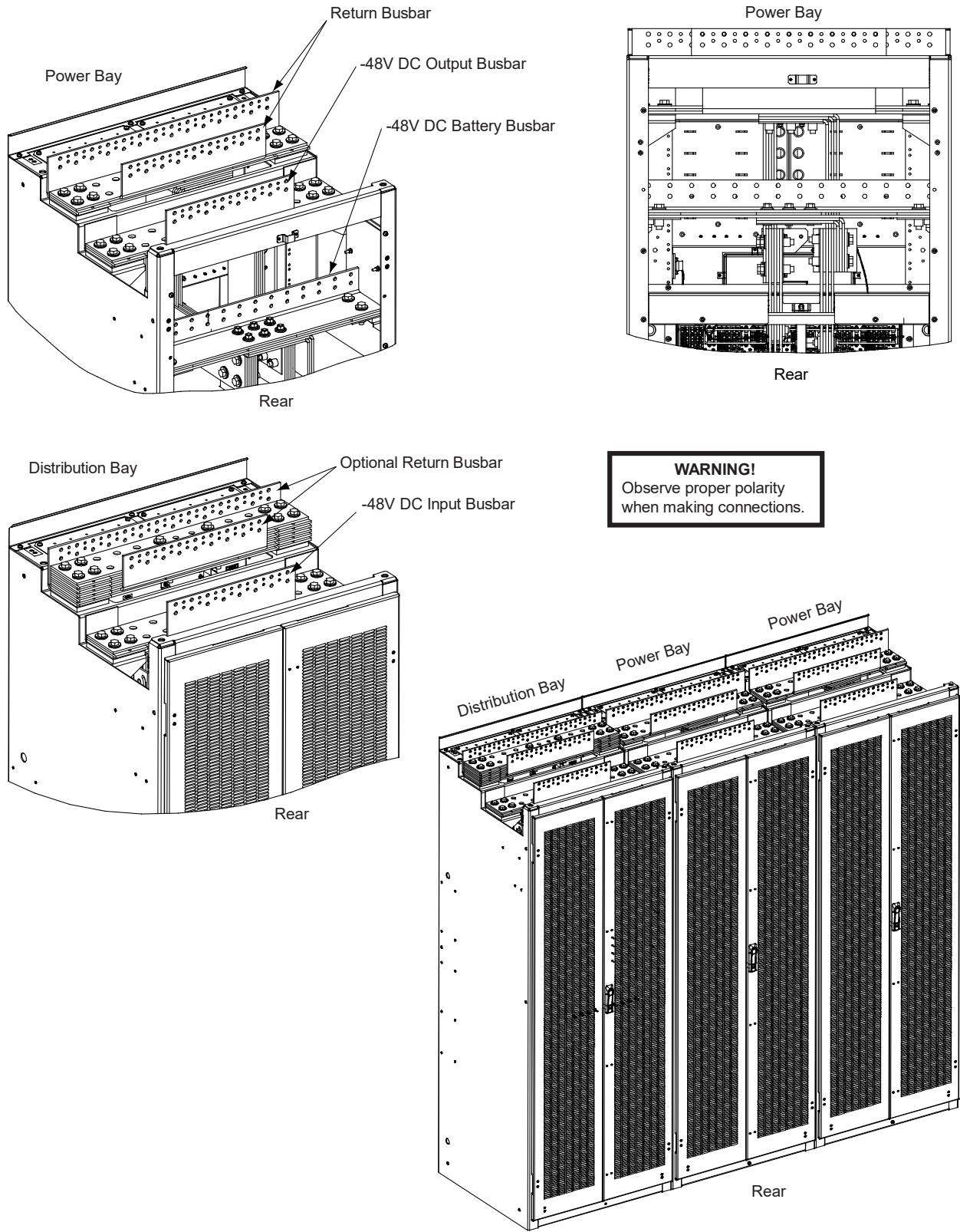
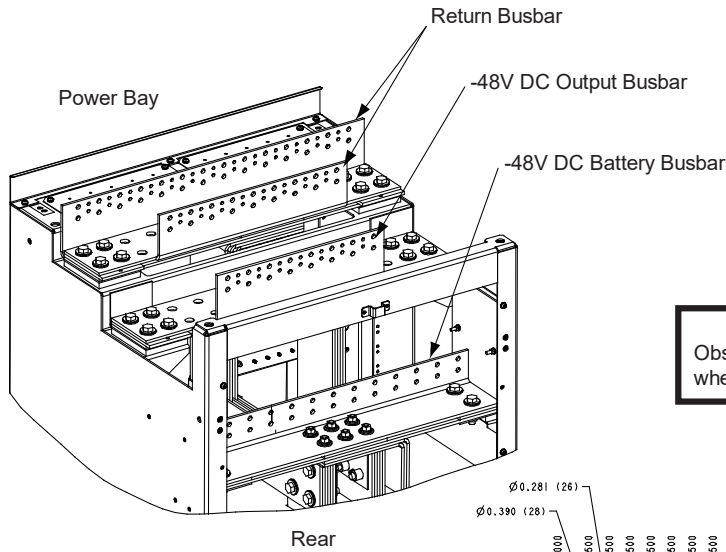
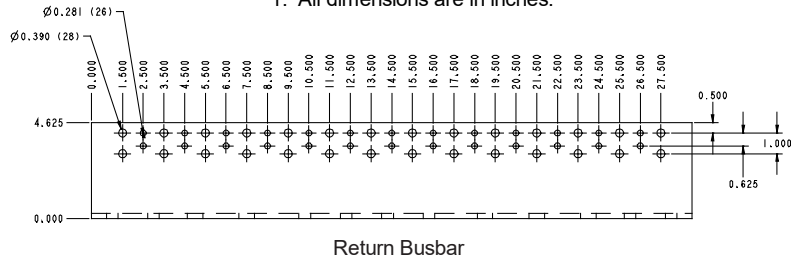


Figure 5.31 Power Bay Internal Top Mount Busbar Illustration



WARNING!
Observe proper polarity
when making connections.

Notes:
1. All dimensions are in inches.



Busbars are provided with 3/8" Holes on 1" Centers and 1/4" Holes on 5/8" Centers. (Customer must supply lug mounting bolts and lug mounting hardware.)

Torque (3/8" Hardware using Standard Lock Washer): 300 in-lbs.

Torque (3/8" Hardware using Belleville Lock Washer): 180 in-lbs.

Torque (1/4" Hardware using Standard Lock Washer): 84 in-lbs.

Torque (1/4" Hardware using Belleville Lock Washer): 60 in-lbs.

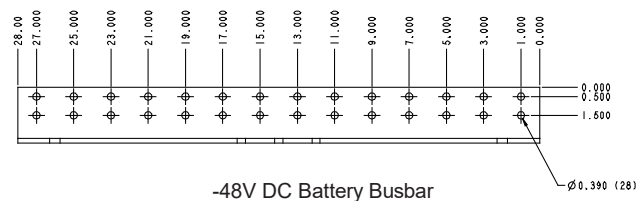
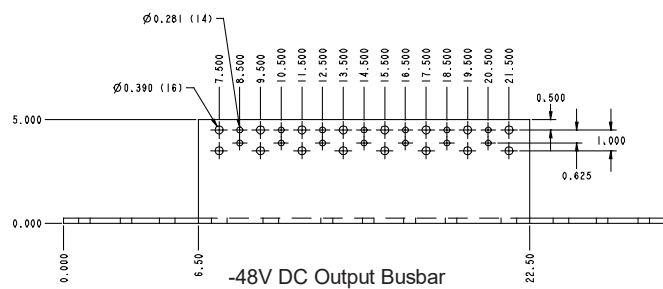
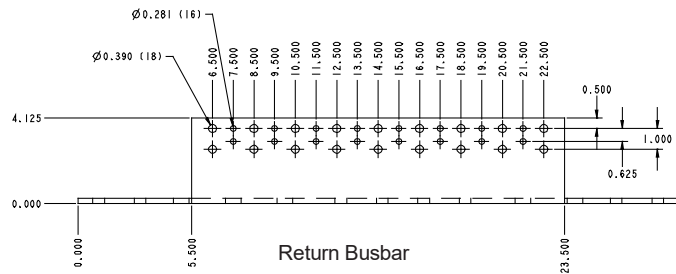
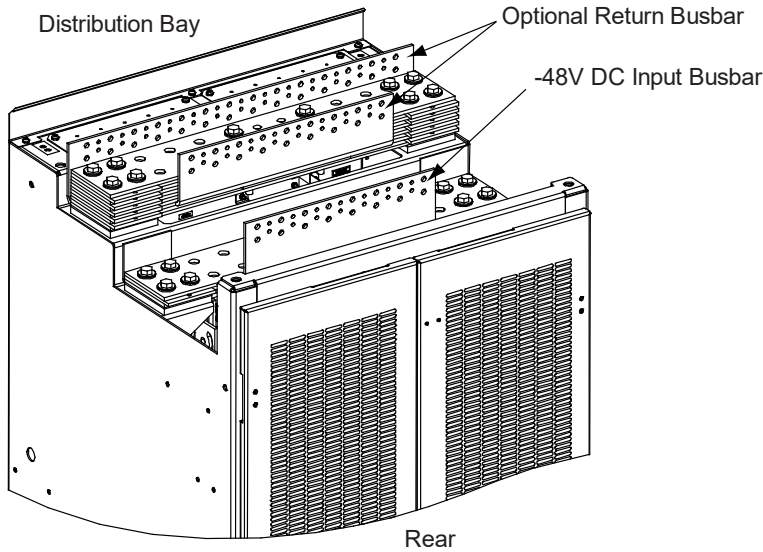


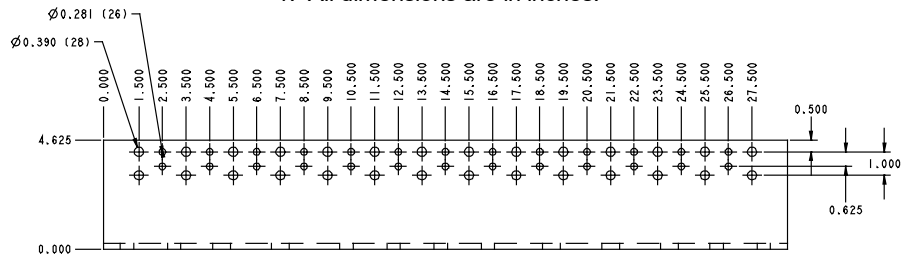
Figure 5.32 Distribution Bay Internal Top Mount Busbar Illustration



WARNING!
Observe proper polarity
when making connections.

Notes:

1. All dimensions are in inches.



Optional Return Busbar

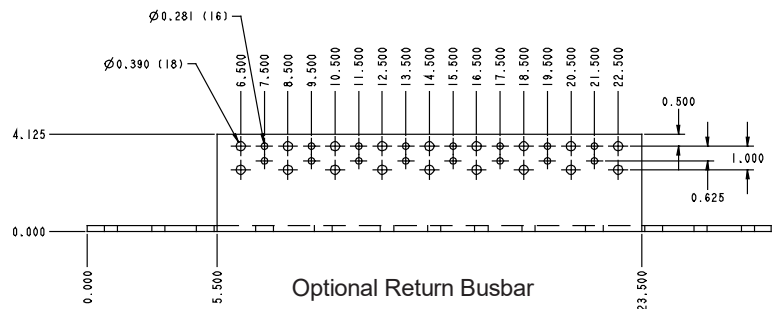
Busbars are provided with 3/8" Holes on 1" Centers and 1/4" Holes on 5/8" Centers. (Customer must supply lug mounting bolts and lug mounting hardware.)

Torque (3/8" Hardware using Standard Lock Washer): 300 in-lbs.

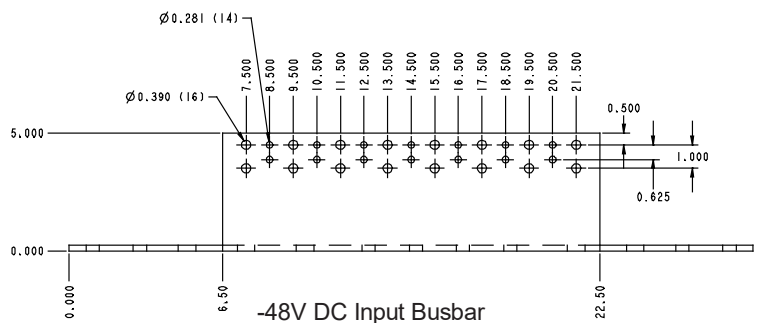
Torque (3/8" Hardware using Belleville Lock Washer): 180 in-lbs.

Torque (1/4" Hardware using Standard Lock Washer): 84 in-lbs.

Torque (1/4" Hardware using Belleville Lock Washer): 60 in-lbs.



Optional Return Busbar



-48V DC Input Busbar

5.10 Installing Rectifier Modules

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



NOTE! The rectifier module locks into the module mounting shelf through a latch located on the underside of the module. The latch and module handle are interactive. Push the handle into the module's front panel, and the latch will pop out from the module bottom. Click the handle to pop it out from the module's front panel, and the latch will retract back into the module. The latch mechanism is shown in Figure 5.33.

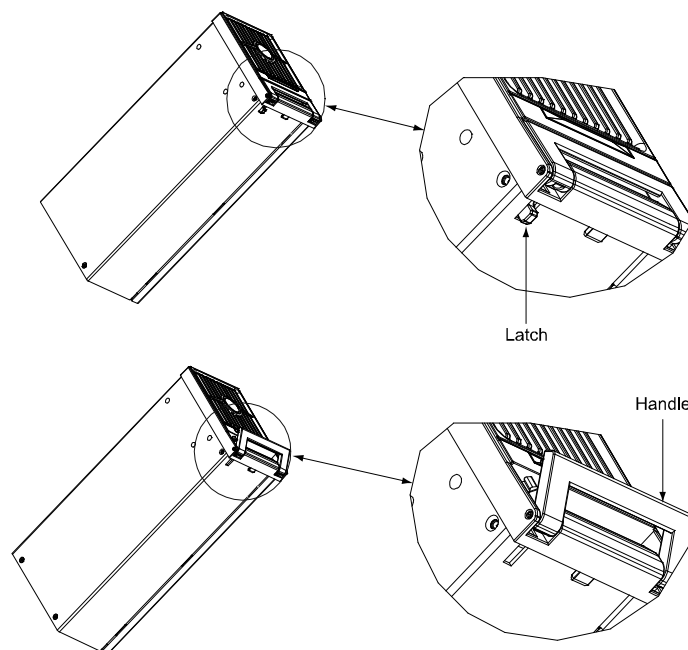


WARNING! To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing a rectifier module. NEVER hold the handle in the closed position when installing a rectifier module into a shelf.

Procedure

- [] 1. Unpack the rectifier modules.
- [] 2. If present, remove blank cover panels from the module mounting positions into which rectifier modules are to be installed.
- [] 3. Place the rectifier module into an unoccupied mounting slot without sliding it in completely.
- [] 4. Push the rectifier module handle in and release in order to pop it forwards out of the rectifier module's front panel (this will also retract the latch mechanism located on the underside of the rectifier module).
- [] 5. Push the rectifier module completely into the shelf.
- [] 6. Push the handle into the front panel of the rectifier module. This will also cause the latch mechanism located on the underside of the rectifier module to lock the rectifier module securely to the shelf.
- [] 7. Repeat the above steps for each rectifier module being installed in the system.
- [] 8. After the rectifier modules are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

Figure 5.33 Installing a Rectifier Module



6 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.

6.1 Initial Startup Preparation

- Ensure that all blocks, except the last one, in the “Installation Acceptance Checklist” starting on page 1 have been checked.
- Ensure that module mounting positions are filled by a rectifier module 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.

6.2 Initially Starting the System

Procedure

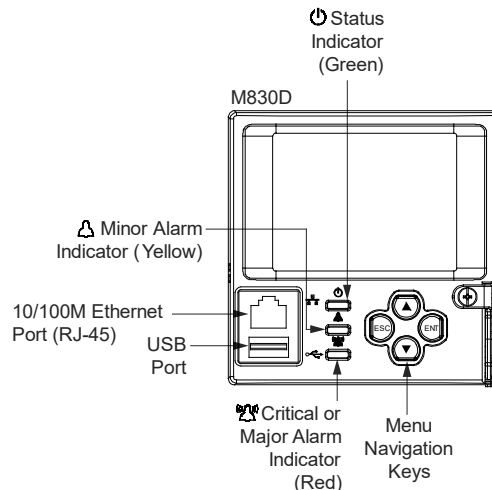
1. Apply battery power to the system by closing the external battery disconnect(s) or protective device(s) that supplies battery power to the system, if furnished.
2. Apply AC input power to the system by closing ALL external AC disconnects or protective devices that supply AC input power to the rectifier bays’ module mounting shelves. Rectifiers automatically start.
3. Open the distribution bays’ front door.
4. Place each distribution circuit breaker (if furnished) to the ON position.

6.3 NCU Controller Initialization

The NCU Controller is located inside the primary power bay.

Refer to Figure 6.1 for locations of the NCU local indicators and navigation keys.

Figure 6.1 NCU Local Indicators and Navigation Keys



Procedure (NCU Local Display and Keypad)



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 6.2.
4. System information is displayed in multiple screens. If desired, 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. Refer to the following procedures to verify and set the NCU controller as required for your application.

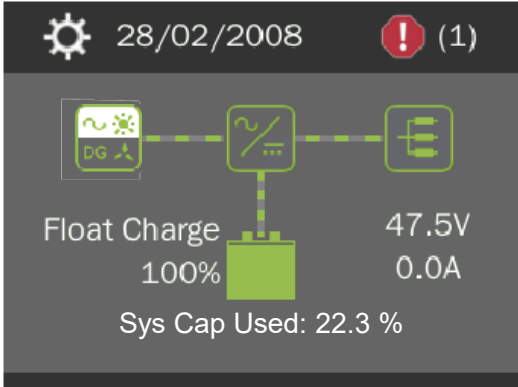
Figure 6.2 NCU Local Display Main Menu

Main Menu

Date and time are alternately displayed.

Green - No Alarm
Red - Alarm

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



Press the UP and DOWN keys to highlight the desired Menu graphic in the Main Menu.
Press the ENT key to enter the selected menu.

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

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

6.4 Setting the System to Work with Secondary Power Bays

To use secondary power bays with a primary power bay you must perform the following procedures. New configuration files must be loaded into the controllers and the controllers must be programmed for primary/secondary bay operation. Perform the following procedures exactly in the order listed.

Procedures

Load a Secondary Power Bay's Configuration Package

After a secondary power bay has been wired up properly, load the secondary power bay's configuration package (located on a USB memory device supplied with the secondary power bay) into the secondary power bay's "secondary control module". This is configuration P/N 563198.

1. Connect the USB memory device (with P/N 563198 configuration) supplied with the secondary power bay to the USB port on the front of the bay's controller.
2. On the secondary power bay's controller, navigate to "Main Menu / Settings Icon / Sys Settings / Update App". Select yes. Once Yes is selected and confirmed, the configuration file located on the memory device located in the controller's USB port is loaded into the controller.
3. The controller enters an initialization routine, which takes a few minutes. The routine is complete and the controller is operational when normal system voltage is displayed on the screen.
4. Remove the memory device.

Set a Secondary Power Bay's Controller to "Secondary" and Assign an Address

1. On the secondary power bay's controller, navigate to "Main Menu / Settings Icon / Other Settings / Rect Expansion". Set to "secondary".



NOTE! When secondary is selected, the controller will start auto configure. This process may take more than three (3) minutes.

2. An "Address" menu item appears after the controller automatically reboots. Set the address to 201, 202, or 203. Note that each secondary controller (bay) must be set to a different address. Set this parameter to 201 for the 1st secondary power bay and 202 for the 2nd secondary power bay.

Additional Secondary Power Bays

1. Repeat the above two procedures if there are additional secondary power bays.

Load the Primary Power Bay's Configuration Package

After the above steps are performed, load the primary power bay's configuration package (located on a USB memory device supplied with the secondary power bay) into the primary power bay's "primary control module". This is configuration P/N 562997.

1. Connect the USB memory device (with P/N 562997 configuration) supplied with the secondary power bay to the USB port on the front of the primary power bay's controller.
2. Navigate to "Main Menu / Settings Icon / Sys Settings / Update App". Select yes. Once Yes is selected and confirmed, the configuration file located on the memory device located in the controller's USB port is loaded into the controller.
3. The controller enters an initialization routine, which takes a few minutes. The routine is complete and the controller is operational when normal system voltage is displayed on the screen.
4. Remove the memory device.

Set the Primary Power Bay's Controller to "Primary"

1. On the primary power bay's controller, navigate to "Main Menu / Settings Icon / Other Settings / Rect Expansion". Set to "primary".



NOTE! When primary is selected, the NCU will start auto configure. This process may take more than three (3) minutes.

2. The controller automatically reboots.

6.5 Verifying and Setting the NCU Controller as Required for Your Application

You can verify and set the NCU controller as required for your application using the NCU local display and keypad or via the primary power bay's front panel touch screen PC by accessing the NCU webpages. You can also use the NCU Start Wizard from the NCU local display and keypad.

Refer to the NCU Instructions (UM1M830BNA) for additional information.

Note that you will have to program the NCU for any temperature probes and external inputs/outputs connected to the IB2 Interface Board, EIB Interface Board, and optional SM-DU+ Shunt Interface Board.



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.

The “Nominal AC Voltage” setting is factory set to 208 V. If this does not match your system's AC configuration, set this parameter as required for your installation. The “Nominal AC Voltage” setting is the nominal line-to-neutral voltage (single phase rectifier) or nominal line-to-line voltage (three phase rectifier). The navigation in the web interface menu is Settings Menu / Rectifiers Tab / Nominal AC Voltage. The navigation in the local menu is Settings Menu / AC Settings / Nominal AC Volt.

Using the NCU Local Display and Keypad

Procedure

1. From the Main Menu (see Figure 6.2), 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.

2. Verify and set the NCU controller as required for your application.

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).

Accessing the NCU Webpages via the Primary Power Bay's Front Panel Touch Screen PC

The NCU Controller's Ethernet port is factory connected to a front panel touch screen PC. This allows local access to the NCU Webpages via the front panel touch screen PC's internet browser.

Enter the address 192.168.100.100 in the Web browser of the front panel touch screen PC to access the NCU's Web Interface.

Refer also to the NCU Controller Instructions (UM1M830BNA) for webpage interface information.

Procedure

1. Using the front panel touch screen PC, log into the NCU webpages by typing the NCU IP address into the front panel touch screen PC's internet browser (192.168.100.100). An NCU login window opens. Enter a valid User Name and Password then click LOGIN.



NOTE! By default, the "User Name" is "admin" and the "Password" is "640275".

2. After entering a valid User Name and Password and clicking LOGIN, the "HOMEPAGE" window opens.
3. Verify and set the NCU controller as required for your application.

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 (NCU Web Pages)

1. Using the front panel touch screen PC, log into the NCU webpages.
2. The NCU hardware version, software version, and configuration version are displayed on the homepage.

Procedure (NCU Local Display and Keypad)

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.

Procedure (NCU Web Pages)

1. Using the front panel touch screen PC, log into the NCU webpages.
2. Refer to the "WEB Interface Menus" in the NCU Controller Instructions (UM1M830BNA) for navigation instructions. Table 6.13 shows the menu navigation for some basic settings.

Procedure (NCU Local Display and Keypad)

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



NOTE! Refer also to "NCU Start Wizard" on page 91.

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.

5. Table 6.13 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.

Changing Battery Capacity Rating in the NCU

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



NOTE! After setting the battery capacity, the User should also reset the battery capacity (battery must be fully charged). (from the Web Interface; Settings Menu / Battery Tab / Reset Battery Capacity) (from the Local Interface; Settings Menu / Batt Settings / Basic Settings / Reset Batt Cap).

Procedure (NCU Web Pages)

1. Using the front panel touch screen PC, log into the NCU webpages.
2. Go to Settings Menu / Battery Tab / Batt1 Rated Capacity and Batt2 Rated Capacity.

Procedure (NCU Local Display and Keypad)

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

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.

Procedure (NCU Web Pages)

1. Using the front panel touch screen PC, log into the NCU webpages.
2. See “Individual Rectifier Settings Page” in the NCU Instructions (UM1M830BNA) and set the Rectifier ID and AC Feed (repeat for every rectifier).
then
Go to Settings Menu / Rectifiers Tab / “Confirm Rect ID/Feed”.

Procedure (NCU Local Display and Keypad)

1. Not available.

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.

Table 6.13 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.

6.6 Checking System Status

Procedure

1. Observe the status of the indicators located on the NCU and rectifiers. If the system is operating normally, the status of these is as shown in Table 6.14.

Table 6.14 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

6.7 Final Steps

Procedure

1. Ensure the labels on the SM-DU+ assemblies and on the front of the distribution panels are filled in. Record on the SM-DU+ label the number of the SM-DU+ based on the location in the power system and the SM DU+'s switch settings. Record on the distribution panel labels for each distribution component the SM-DU+ information based on the destination of each distribution shunt wire set and fuse alarm wire. Refer to "SM DU+ and FA/Shunt Interface Assembly (Distribution Bays Only and Remote Assembly)" on page 60 and "Switch Settings on SM-DU+ (Distribution Bays and Remote SM-DU+ Only)" on page 36.
2. If any NCU 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 NCU Controller settings, if required, at a later date.
 - Note that provided on a USB drive furnished with the system is an NCU configuration drawing (C-drawing) and the NCU configuration files loaded into the NCU as shipped.
3. Verify all rectifier modules and the NCU are fully seated, latched, and the latch handle screws secured (if present).
4. Verify there are no external alarms and the local indicators are as shown in Table 6.14.
5. Ensure all bays' front and rear doors are closed and secured.

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