



NetSure™ -48 VDC to -58 VDC Converter System

Installation and User Manual

Specification Number: 584641000

Model Number: DCS48/58-600

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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.

TABLE OF CONTENTS

Admonishments Used in this Document	v
Important Safety Instructions	vi
Safety Admonishments Definitions.....	vi
Safety and Regulatory Statements.....	vi
Déclarations de Sécurité et de Réglementation.....	vi
1 Customer Documentation Package	1
2 System Description	1
3 Installation Acceptance Checklist	3
4 Installing the System	4
4.1 General Requirements.....	4
4.2 Securing the System to a Relay Rack or a Cabinet Equipment Rack.....	5
4.3 Installing Optional Lug Adapter Busbar Kits.....	6
4.4 Installing Circuit Breakers and Fuses.....	7
4.4.1 Installing bullet nose type circuit breakers (if equipped).....	7
4.4.2 Installing bullet nose type fuseholders and TPS/TLS fuses (if equipped).....	7
4.4.3 Installing an optional bullet nose type 6-position GMT distribution fuse block (P/N 549017) (List 01, List 02, List AL, and List CL).....	9
4.4.4 Installing GJ/218 circuit breakers (if equipped).....	10
5 Setting Jumper and Switch Options	13
5.1 Jumper Settings on the System Interface Board.....	13
5.2 Switch Settings on the IB2 (Controller Interface Board).....	14
6 Making Electrical Connections	15
6.1 Important Safety Instructions.....	15
6.2 Wiring Considerations.....	15
6.3 System Shelf Frame Grounding Connection.....	15
6.4 Central Office Ground Connection.....	17
6.5 SPD (Surge Protection Device) Earth Ground Connection.....	18
6.6 Nominal -48 VDC Input Connections.....	19
6.7 External Alarm, Reference, Monitoring, and Control Connections.....	22
6.7.1 System interface circuit card connections.....	22
6.7.2 IB2 (controller interface board) connections.....	23
6.7.3 Connecting a device or system to the NCU can bus.....	28
6.8 NCU Controller Ethernet Connection.....	29
6.8.1 General.....	29
6.8.2 NCU front panel ethernet port.....	29
6.8.3 IB4 board ethernet port.....	30
6.9 Load Connections.....	31
6.9.1 Recommended torque.....	31
6.9.2 Load and load return connections in a List 01, List 02, List AL, and List CL distribution cabinet.....	31
6.9.3 Load connections to an optional bullet nose 6-position GMT distribution fuse block, P/N 549017.....	32
6.9.4 Load and load return connections in a List 03 and List 04 distribution cabinet.....	33
7 Installing Converter Modules	34

8	Initially Starting, Configuring, and Checking System Operation	35
8.1	Initial Startup Preparation	35
8.2	Initially Starting the System	35
8.3	NCU Controller Initialization	35
8.4	Verifying and Setting the NCU Controller as Required for Your Application.....	36
8.5	Checking System Status	39
8.6	Final Steps	39
9	Operating Procedures	40
9.1	Controller and Converters	40
9.1.1	General	40
9.1.2	Controller and converters local controls and indicators.....	40
10	Maintenance.....	40
10.1	System Maintenance Procedures.....	40
10.2	Adding a Converter Module to an Empty Converter Module Mounting Position	40
10.3	Installing a Field Expansion Converter Module Mounting Shelf (584641000 List 10).....	40
10.4	Installing a Field Expansion DC Distribution Cabinet (584641000 List AL and List CL)	54
10.5	Field Installation of Load Disconnect Contactor Remote Driver Jumper (P/N 60067965).....	59
10.6	Field Installation of Load Disconnect Contactor Kit, P/N 60082562	64
11	Troubleshooting and Repair	67
11.1	Contact Information.....	67
11.2	Controller and Converters	67
11.3	Controller Configuration	67
11.4	System Troubleshooting Information	67
11.5	Replacement Information.....	68
11.6	Replacement Procedures.....	68
11.6.1	Replacing a converter module	68
11.6.2	Replacing the NCU controller.....	68
11.6.3	Replacing a distribution device.....	68
11.6.4	Circuit card replacement procedures.....	75
11.6.5	Replacing a load disconnect contactor (if equipped).....	81
11.6.6	Replacing an SPD (Surge Protection Device).....	83

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 (UM584641000) provides *Installation and User Instructions* for the Vertiv™ NetSure™ -48 VDC to -58 VDC Converter System: Spec. No. 584641000.

The complete Customer Documentation Package consists of...

USB Drive with All Customer Documentation

- System Installation and User Instructions: UM584641000
- System “System Application Guide”: SAG584641000
- NCU Controller User Instructions: UM1M830BNA
- Converter Instructions: UM1C48582000P3
- Engineering Drawings
 - SD584641000
 - T584641000
- Also provided on the USB drive are the controller configuration files loaded into the controller as shipped and a controller configuration drawing (C-drawing).

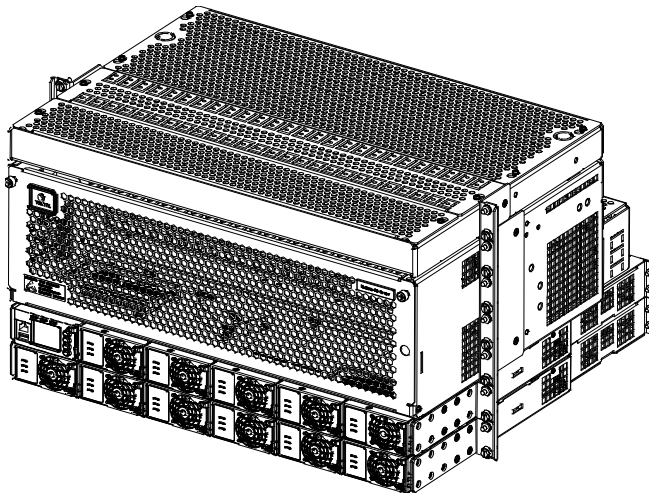
For factory settings of all configurable controller parameters, refer to the controller configuration drawing (C-drawing) supplied with your system.

2 System Description

-48 VDC to -58 VDC @ up to 600 Amperes Converter System

The Vertiv™ NetSure™ DCS48/58-600 Converter System is a complete integrated converter system containing -48 VDC to -58 VDC converters, intelligent control, metering, monitoring, and distribution.

The converter system is designed for operation with the positive output grounded.



This system consists of the following components.

- **DC Distribution Cabinet**

The base system includes one (1) distribution cabinet, which provides DC distribution through fuses and/or circuit breakers. The distribution cabinet can be equipped either with a 1-row, 26-position bullet nose type circuit breaker and TPS/TLS fuseholder distribution panel or a distribution panel equipped with four (4) GJ/218 type circuit breaker positions. The distribution cabinet may be equipped with a load disconnect contactor.

A field installed only expansion distribution cabinet is available which provides DC distribution through fuses and/or circuit breakers. The expansion distribution cabinet is equipped with a 1-row, 26-position bullet nose type circuit breaker and TPS/TLS fuseholder distribution panel. The expansion distribution cabinet may be equipped with a load disconnect contactor.

- **Controller**

NCU (NetSure™ Control Unit) Controller: The NCU controller provides power system control, converter module control, metering functions, monitoring functions, local/remote alarm functions, and connections for binary inputs and programmable relay outputs. The system also accepts up to two (2) temperature probes to monitor ambient and/or battery temperature. The controller also provides data acquisition and system alarm management. The controller contains a color TFT display and keypad for local access. The controller provides an Ethernet port and comes with comprehensive webpages for local/remote access. The controller has SNMP V3 capability for remote system management. The controller supports software upgrade via its USB port. Refer to the NCU Controller Instructions (UM1M830BNA) for more information.

- **Converter Module Mounting Shelf (Spec. No. 588705300)**

The system contains two (2) Spec. No. 588705300 converter module mounting shelves, each of which houses converter modules. The top converter module mounting shelf also houses the NCU controller.

A field installed only expansion converter module mounting shelf is available. Up to two (2) expansion converter module mounting shelves can be installed in an existing system.

- **-48 VDC to -58 VDC Converter Modules**

The system accepts 2000 watt peak, 1600 watt average converter modules to provide -58 VDC load power. Refer to the Converter Instructions (UM1C48582000P3) for more information.

3 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

- System Secured to Relay Rack or Cabinet Equipment Rack
- Optional Lug Adapter Busbar Kits Installed
- Circuit Breakers and/or Fuses Installed

Setting Jumper and Switch Options

- Factory Jumper Setting on System Interface Circuit Card Verified
- Factory Switch Setting on IB2 (Controller Interface Board) Verified

Making Electrical Connections

- System Shelf Frame Grounding Connection Made
- Central Office Ground Connection Made
- SPD (Surge Protection Device) Earth Ground Connection Made
- DC Input Connections Made
- External Alarm, Reference, Monitoring, and Control Connections Made
- NCU Controller Ethernet Connection Made
- Load Connections Made

Installing the Converter Modules

- Converter Modules Installed

Initially Starting the System

- System Started, Configured, and Checked

4 Installing the System

4.1 General Requirements

- The installer should be familiar with the installation requirements and techniques to be used in securing the system to a relay rack or equipment rack.
- This product is recommended to be installed in a restricted access location on or above a non-combustible surface.
- This product is recommended to 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 to be connected 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 system must be mounted in an environment that does not exceed the rated operating ambient temperature range found in SAG584641000.
- Clearance requirements are as follows.
 - Recommended minimum aisle space clearance for the front of each bay is 2' 6".
 - Recommended minimum aisle space clearance for the rear of each bay is 2' 0" for any of the following conditions:
 - o Addition of a module mounting assembly in the field.
 - o Making input connections to a field installed module mounting assembly.
 - For all other conditions:
 - o For rear entry and **rear bending** of -48 VDC input feed cables, required minimum spacing from the **rear** of the input feed box to a wall or other solid structure must not be less than seven (7) inches for 4/0 TelcoFlex wire; or as determined by wire bending requirements for the actual wire size used at the site.
 - o For rear entry and **side bending** of -48 VDC input feed cables, required minimum spacing is:
 - from the **rear** of the input feed box to a **rear** wall or other solid structure must not be less than five (5) inches for 4/0 TelcoFlex wire;
 - from the **side** of the input feed box to a **side** wall or other solid structure must not be less than five (5) inches for 4/0 TelcoFlex wire;
 - or as determined by wire bending requirements for the actual wire size used at the site.
 - Required minimum spacing from the **front** of the system must not be less than four (4) inches. (This will assure proper airflow through the converter modules.)



NOTE! Minimum spacing specified for ventilation and wire bending may not permit replacement of certain components such as busbars, module mounting assemblies, and load disconnect contactors.

4.2 Securing the System to a Relay Rack or a Cabinet Equipment Rack



DANGER! If the system is mounted in a relay rack, the relay rack must be securely anchored to the floor before the system is installed.



NOTE! Refer to “General Requirements” on page 4 for mounting restrictions and ventilation requirements.



NOTE! The shelves comprising this system are factory connected together. The shelves are mounted as a complete system.

This system is designed to mount in a standard 23” wide relay rack or equipment rack having 1” or 1-3/4” multiple drillings. Refer to System Application Guide SAG584641000 for mounting dimensions.

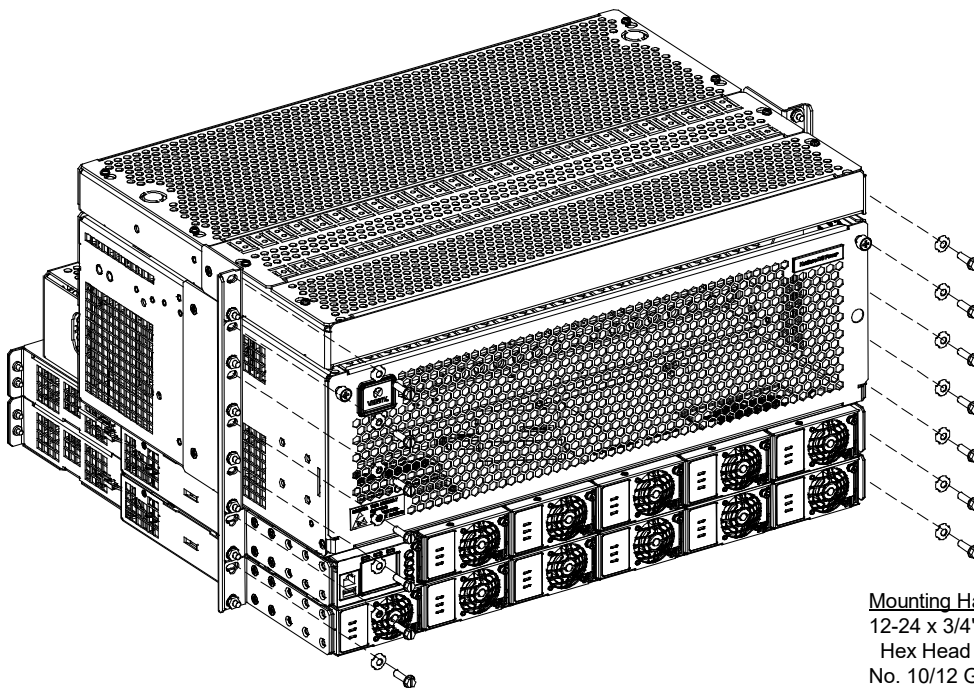
Procedure

1. Position the system in the relay rack or cabinet equipment rack.
2. Secure the system to the relay rack or cabinet equipment rack using hardware as shown in Figure 4.1 (use grounding washers as shown). Torque hardware as indicated in Figure 4.1.



NOTE! Install (orient) the ground washers so the teeth dig into the mounting angles for a secure ground connection.

Figure 4.1 Mounting the System in a Relay Rack or a Cabinet Equipment Rack



Mounting Hardware
12-24 x 3/4" Thread Forming
Hex Head Screw
No. 10/12 Ground Washer
Torque: 65 in-lbs.

Mounting Hardware
12-24 x 3/4" Thread Forming
Hex Head Screw
No. 10/12 Ground Washer
Torque: 65 in-lbs.

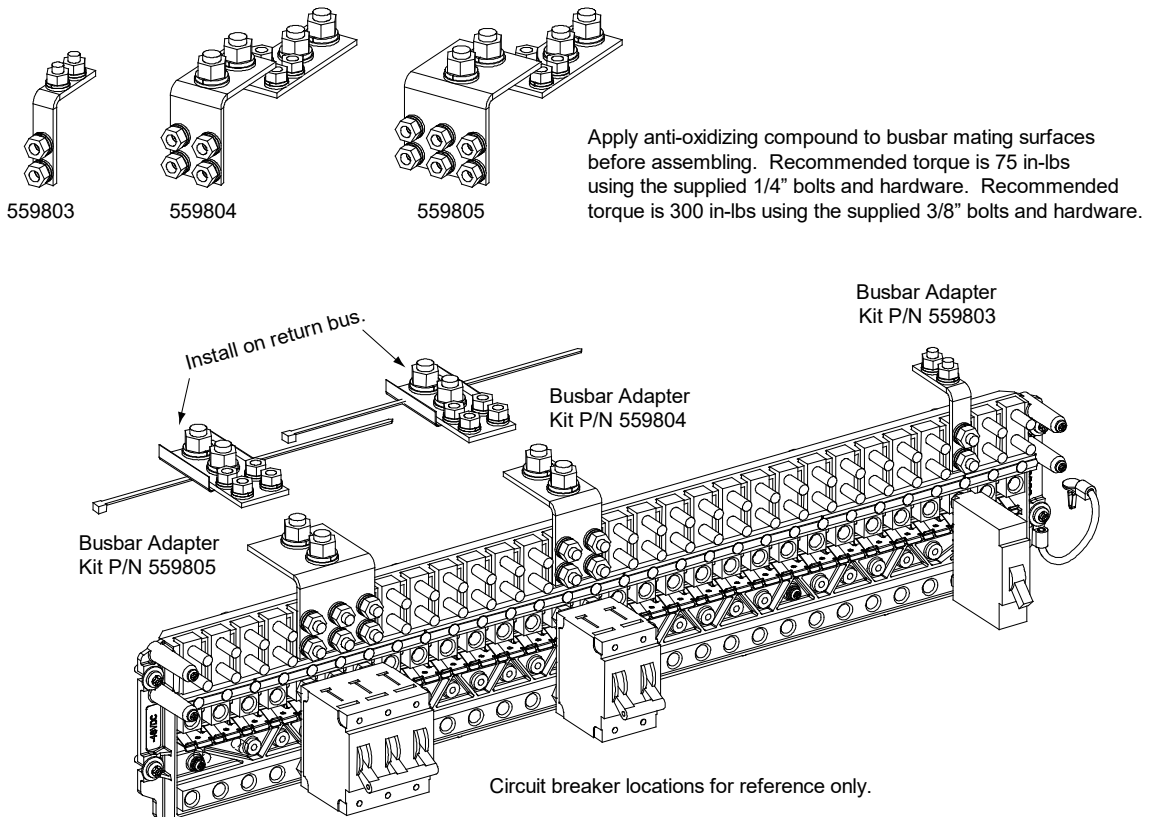
4.3 Installing Optional Lug Adapter Busbar Kits

These kits provide lug adapter busbars plus hardware for use with 2-pole and 3-pole circuit breakers (right angle load busbar and straight return busbar). A right-angle kit is also available for 1-pole devices.

Procedure

1. Refer to Figure 4.2 to install the lug adapter busbars kits.

Figure 4.2: Installing Optional Lug Adapter Busbar Kits



4.4 Installing Circuit Breakers and Fuses

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

4.4.1 Installing bullet nose type circuit breakers (if equipped)



CAUTION! A 150 A or greater circuit breaker shall have an empty mounting position between it and any other overcurrent protective device.

Refer to SAG584641000 for any other restrictions.

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

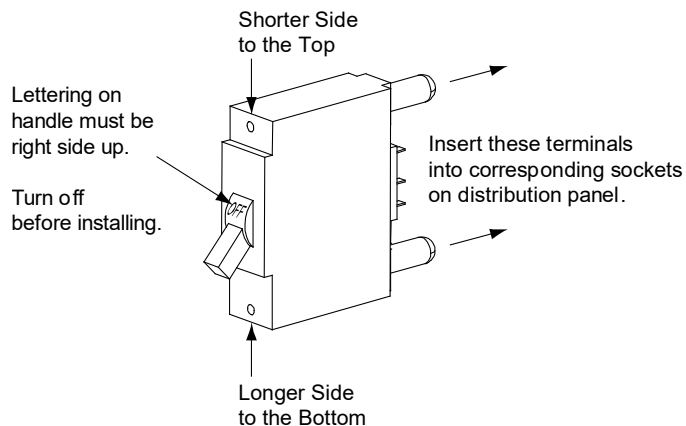
Procedure



NOTE! Refer to Figure 4.3 as this procedure is performed.

1. Open the distribution cabinet's front door by loosening the captive fasteners.
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 4.3. Insert the terminals on the rear of the circuit breaker into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the circuit breaker makes contact with the alarm terminal on the spring strip. Push distribution device in firmly until fully seated in the distribution panel.
3. Record all circuit breaker sizes on the label provided on the shield.
4. Close the distribution cabinet's front door and secure by tightening the captive fasteners.

Figure 4.3 Installing a Bullet Nose Type Circuit Breaker



4.4.2 Installing bullet nose type fuseholders and TPS/TLS fuses (if equipped)



CAUTION! A 150 A or greater circuit breaker shall have an empty mounting position between it and any other overcurrent protective device.

Refer to SAG584641000 for any other restrictions.

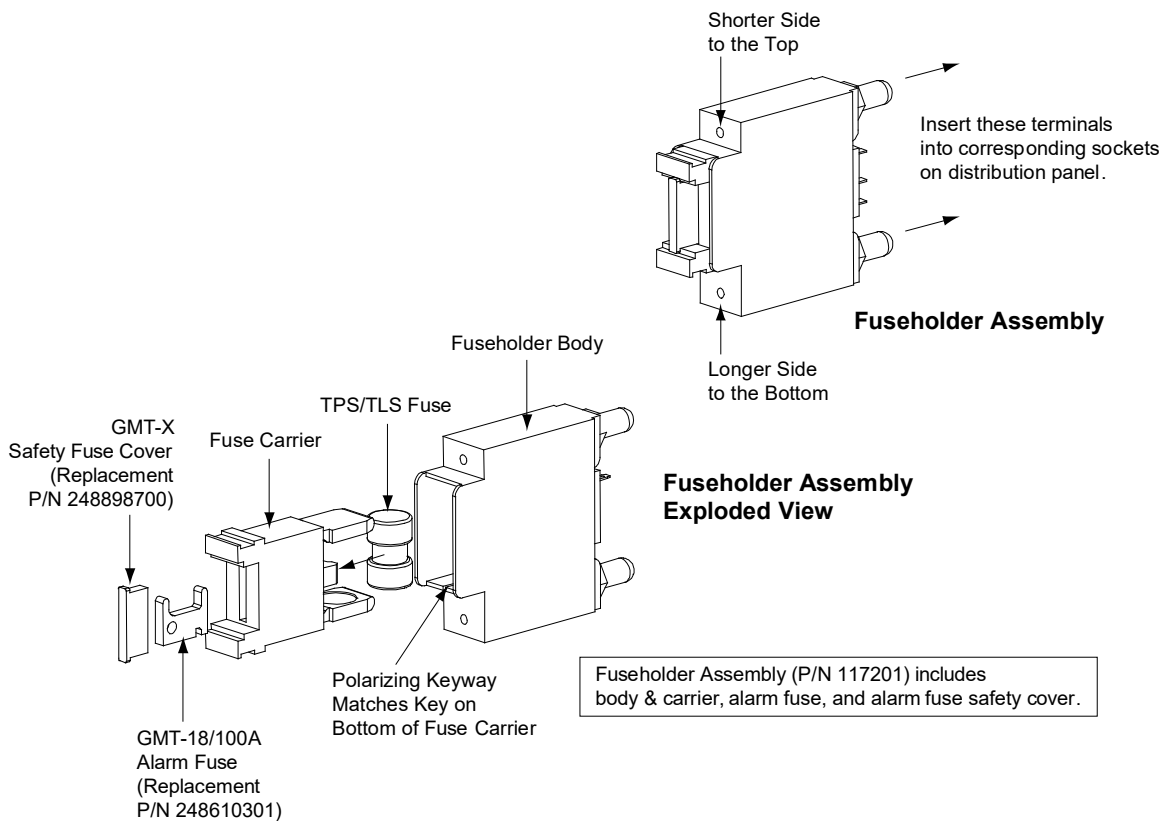
Refer to the following procedure and install bullet nose type fuseholders and appropriately sized TPS/TLS fuses into the proper mounting positions in the distribution cabinet.

Procedure

NOTE! Refer to Figure 4.4 as this procedure is performed.

1. Open the distribution cabinet’s front door by loosening the captive fasteners.
2. Orient the fuseholder as shown in Figure 4.4. Insert the terminals on the rear of the fuseholder into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the fuseholder makes contact with the alarm terminal on the spring strip. Push fuseholder in firmly until fully seated in the distribution panel.
3. When all fuseholders are installed, install an appropriately sized TPS/TLS fuse in each. To do this, remove the fuse carrier from the mounted fuseholder body. Hold the fuseholder body while you pull the fuse carrier from the body. Slide the fuse in place between the contacts of the fuse carrier. When done, push the fuse carrier back into the fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
4. Verify that an 18/100 ampere alarm fuse is present in each fuseholder and that a plastic safety cover is installed on this fuse.
5. Record all fuse sizes on the label provided on the shield.
6. Close the distribution cabinet’s front door and secure by tightening the captive fasteners.

Figure 4.4 Installing a Bullet Nose Type Fuseholder and TPS/TLS Fuse



4.4.3 Installing an optional bullet nose type 6-position GMT distribution fuse block (P/N 549017) (List 01, List 02, List AL, and List CL)

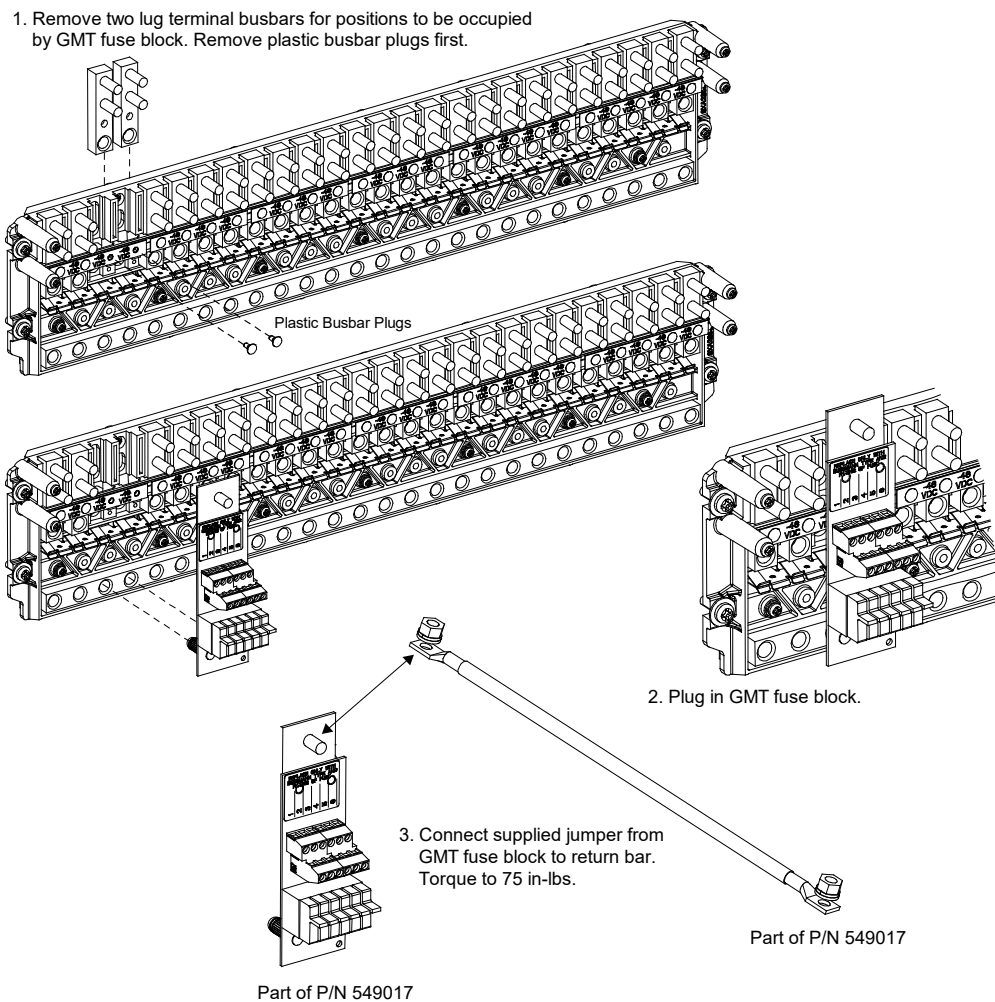
Procedure



NOTE! Refer to Figure 4.5 as this procedure is performed.

1. Open the distribution cabinet's front door by loosening the captive fasteners.
2. Follow the steps in Figure 4.5.
3. Install an appropriately sized GMT fuse in each fuse mounting position on the GMT distribution fuse block as required. If dummy fuses are installed, first remove the dummy fuse.
 - a) Verify that dummy fuses are installed in all unused fuse positions on the GMT distribution fuse block.
 - b) Verify that a plastic safety cover is installed on all GMT fuses on the GMT distribution fuse block.
4. Record all fuse sizes (installed on the GMT distribution fuse block) on the label provided on the shield.
5. Close the distribution cabinet's front door and secure by tightening the captive fasteners.

Figure 4.5 Installing an Optional Bullet Nose Type 6-Position GMT Distribution Fuse Block (P/N 549017)



4.4.4 Installing GJ/218 circuit breakers (if equipped)

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

Refer to SAG584641000 for any restrictions.

Procedure



NOTE! Refer to Figure 4.6 as this procedure is performed.

1. Locate the appropriate circuit breaker mounting kit ordered with the circuit breaker. The circuit breaker mounting kit contains installation hardware, an alarm jumper, a busbar (for 2-pole, 3-pole, and 4-pole circuit breakers), and a circuit breaker guard. Refer to SAG584641000 for part numbers of the circuit breaker mounting kits.
2. Open the distribution cabinet's front door by loosening the captive fasteners.
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).
4. Apply anti-oxidizing compound to busbar mating surfaces on the distribution panel and the circuit breaker. Orient the circuit breaker over its mounting location.
5. Attach the alarm jumper connectors to the back of the circuit breaker, then plug the other end of the alarm jumper into its corresponding connector located on the distribution panel. See Figure 4.6.
6. Install the circuit breaker into its mounting position and secure with the provided hardware. Torque hardware as indicated in Figure 4.6.

2-Pole, 3-Pole, and 4- Pole Circuit Breakers Only: Also install the mounting kit supplied shorting busbar as shown in Figure 4.6.
7. Install the circuit breaker guard and label (refer to Figure 4.6).
8. Record all circuit breaker sizes on the label provided on the shield.
9. Close the distribution cabinet's front door and secure by tightening the captive fasteners.

Figure 4.6 Installing a GJ/218 Circuit Breaker (1-Pole) (cont'd on next page)

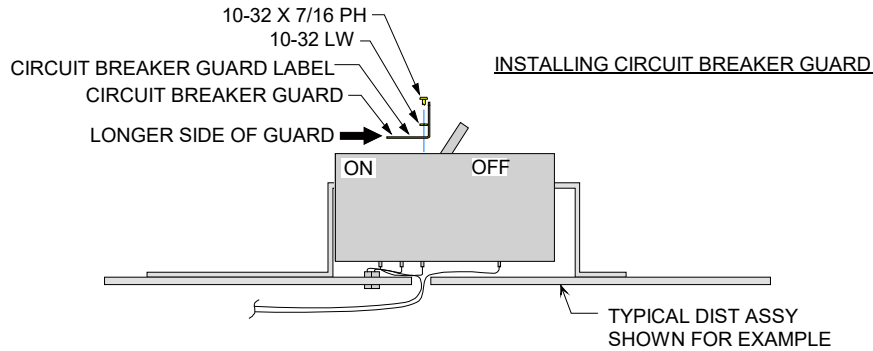
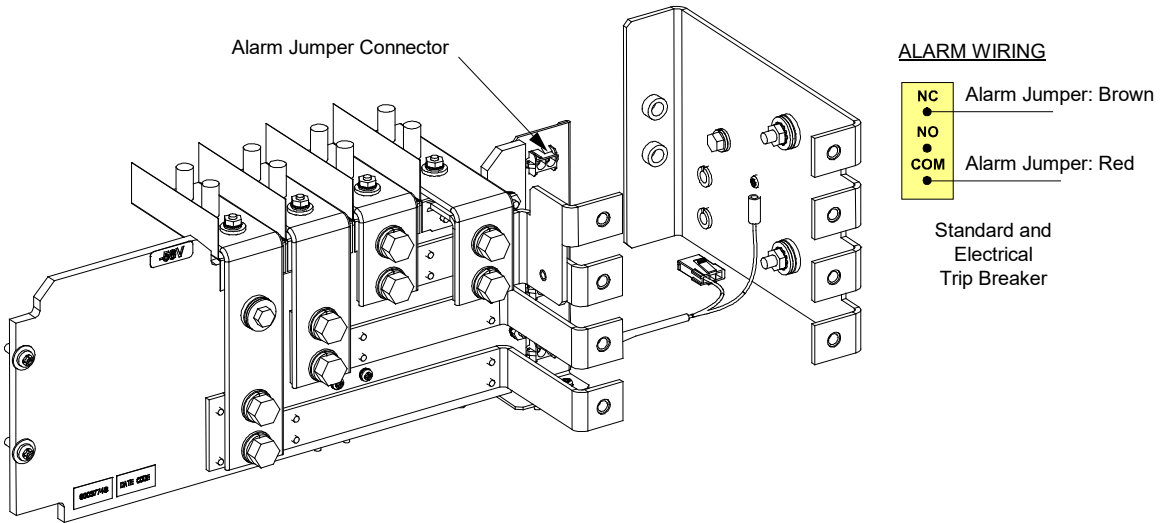
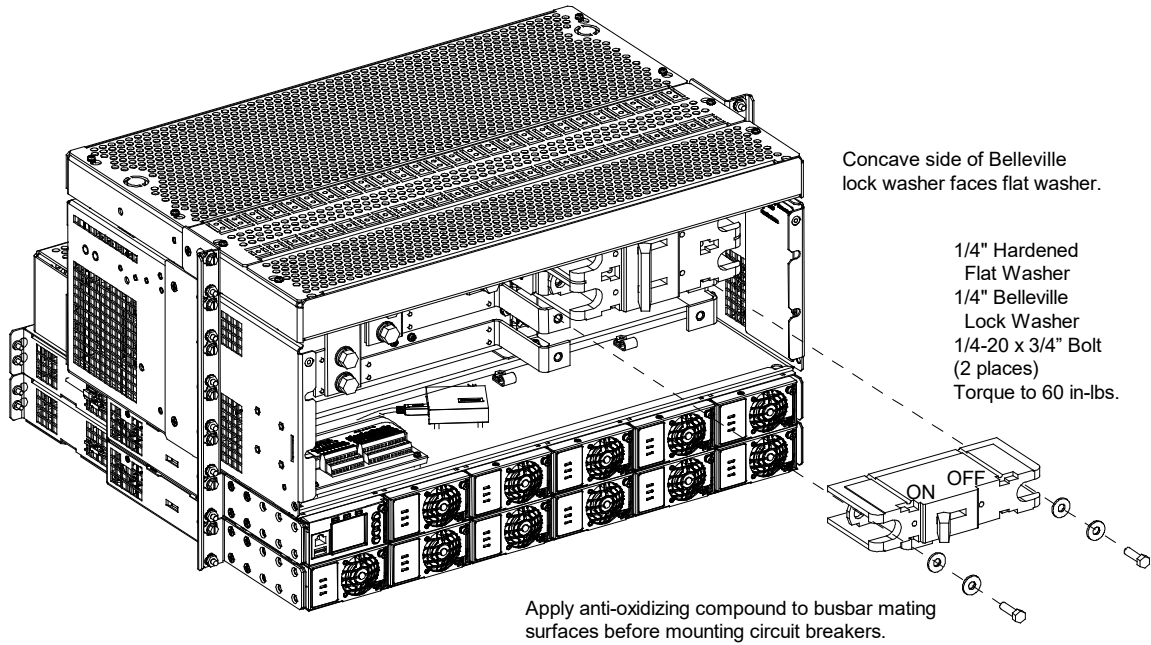
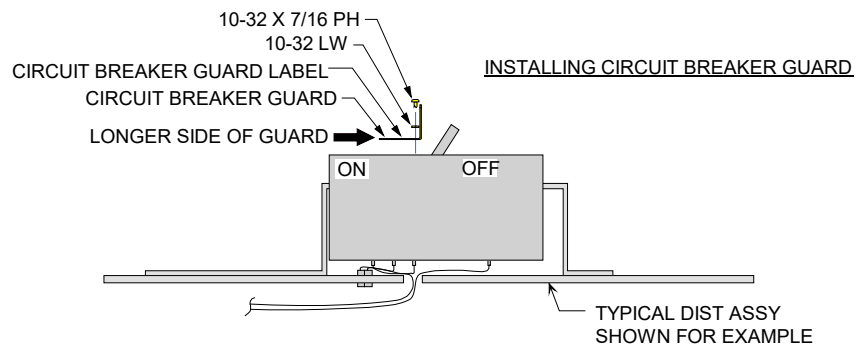
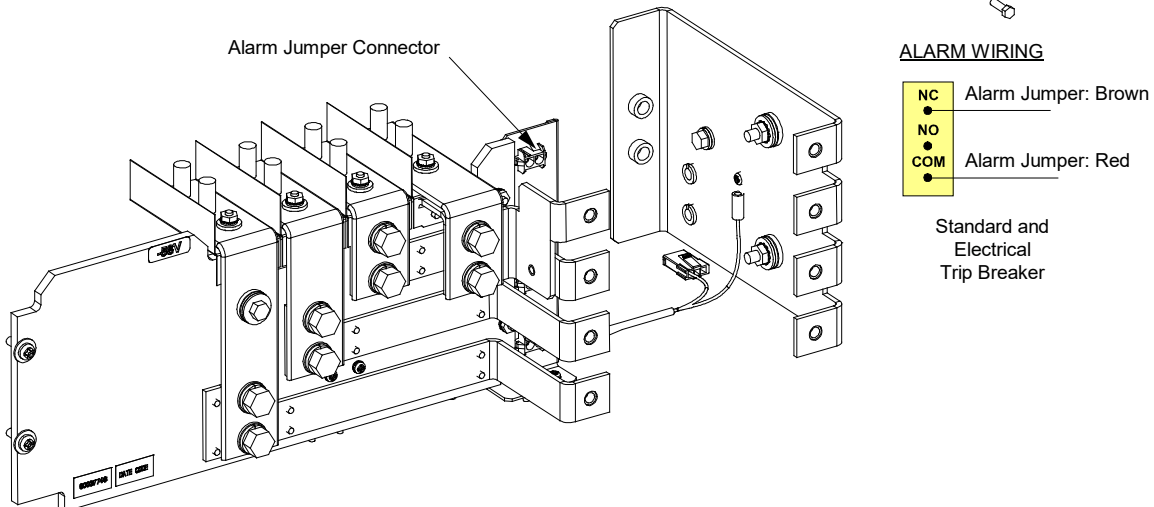
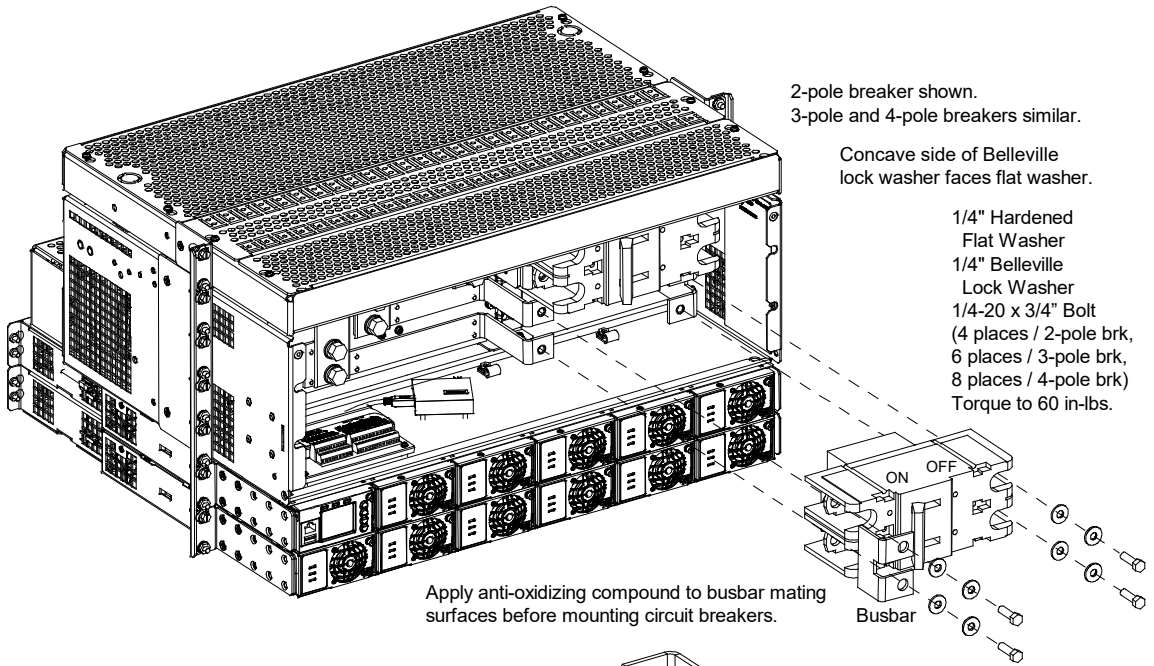


Figure 4.6 Installing a GJ/218 Circuit Breaker (2-Pole, 3-Pole, 4-Pole) (cont'd from previous page)

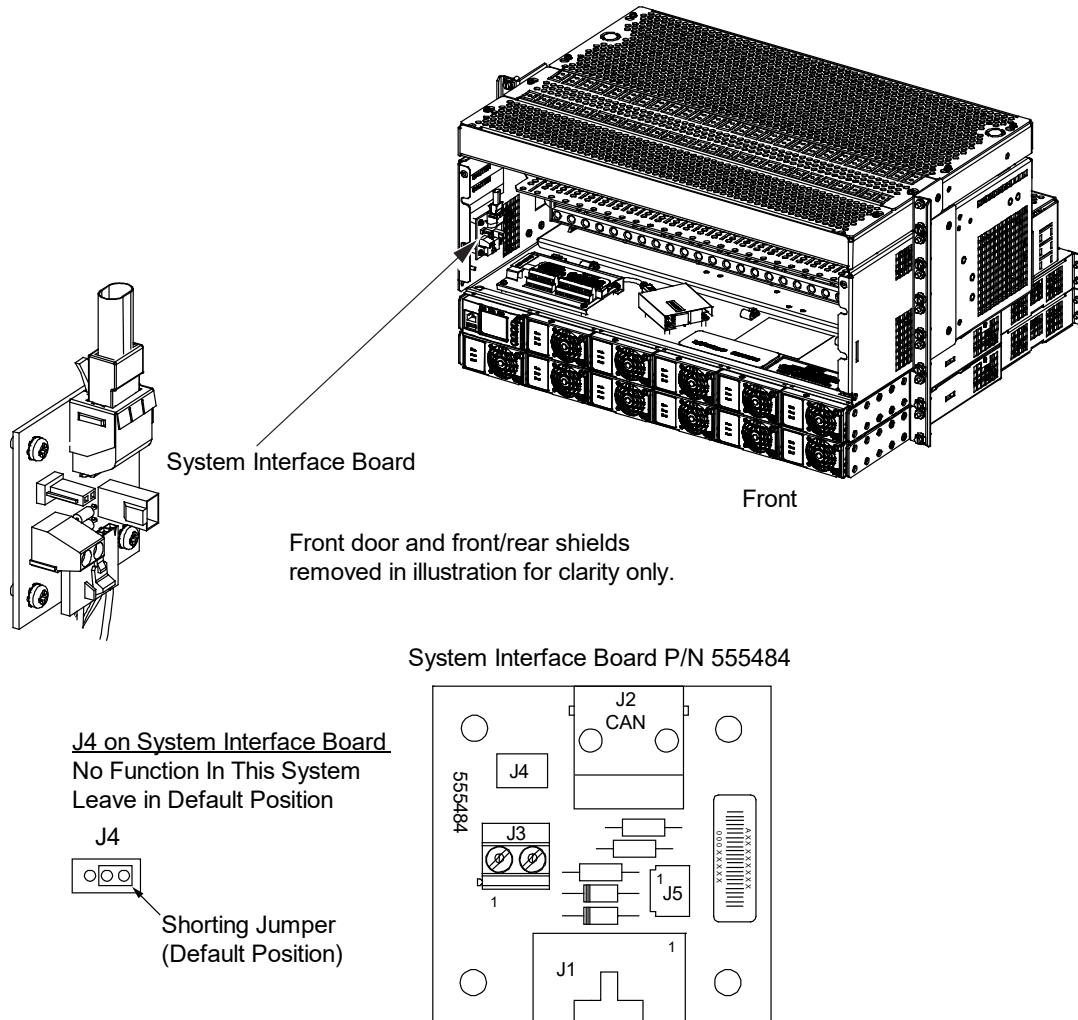


5 Setting Jumper and Switch Options

5.1 Jumper Settings on the System Interface Board

Jumper J4 on the System Interface Board has no function in this system. Refer to Figure 5.1 for System Interface Board and J4 location. Leave this jumper in the factory default position as shown in Figure 5.1.

Figure 5.1 System Interface Board Jumper Location and Settings



5.2 Switch Settings on the IB2 (Controller Interface Board)

Dip Switch SW1 on the IB2 board is used to set the communications address for this board. Refer to Table 5.1 for SW1 settings. Refer to Figure 5.2 for IB2 board and switch 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.

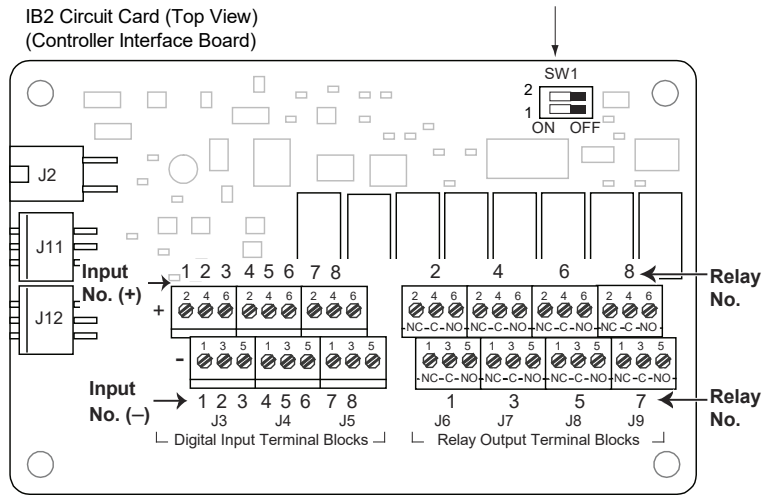
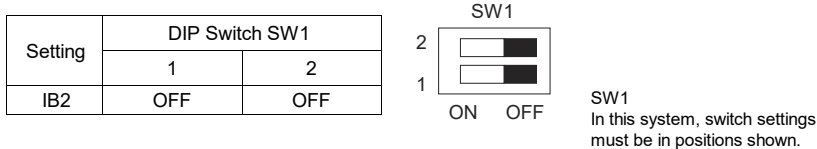
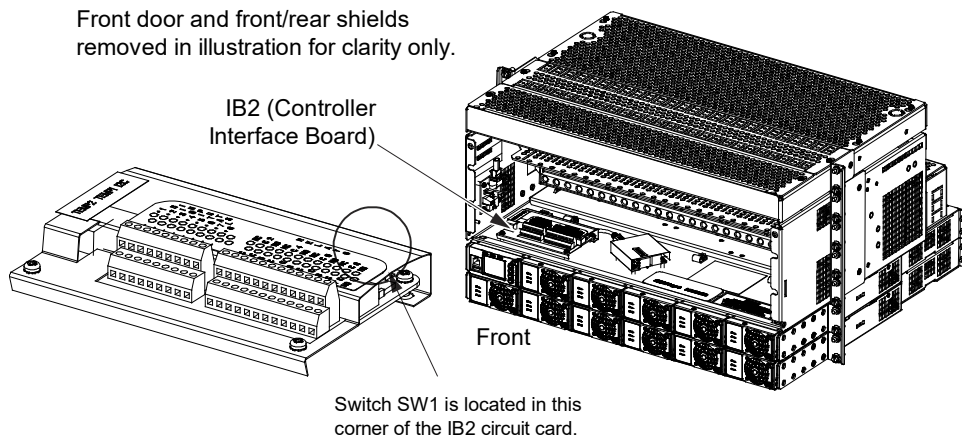
Procedure

1. Ensure switch SW1 is set per Table 5.1. Refer to Figure 5.2 for location.

Table 5.1 IB2 Interface Board Switch Settings

Setting	DIP Switch SW1	
	1	2
IB2-1	OFF	OFF

Figure 5.2 IB2 Controller Interface Board Switch Location and Setting



6 Making Electrical Connections

6.1 Important Safety Instructions



DANGER! Adhere to the “Important Safety Instructions” on page vi.

6.2 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 recommended wire sizes, branch circuit protection, crimp lugs, alarm relay contact ratings, and general wiring information and restrictions; refer to System Application Guide SAG584641000. Lugs must be crimped per lug manufacturer's specifications.



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).

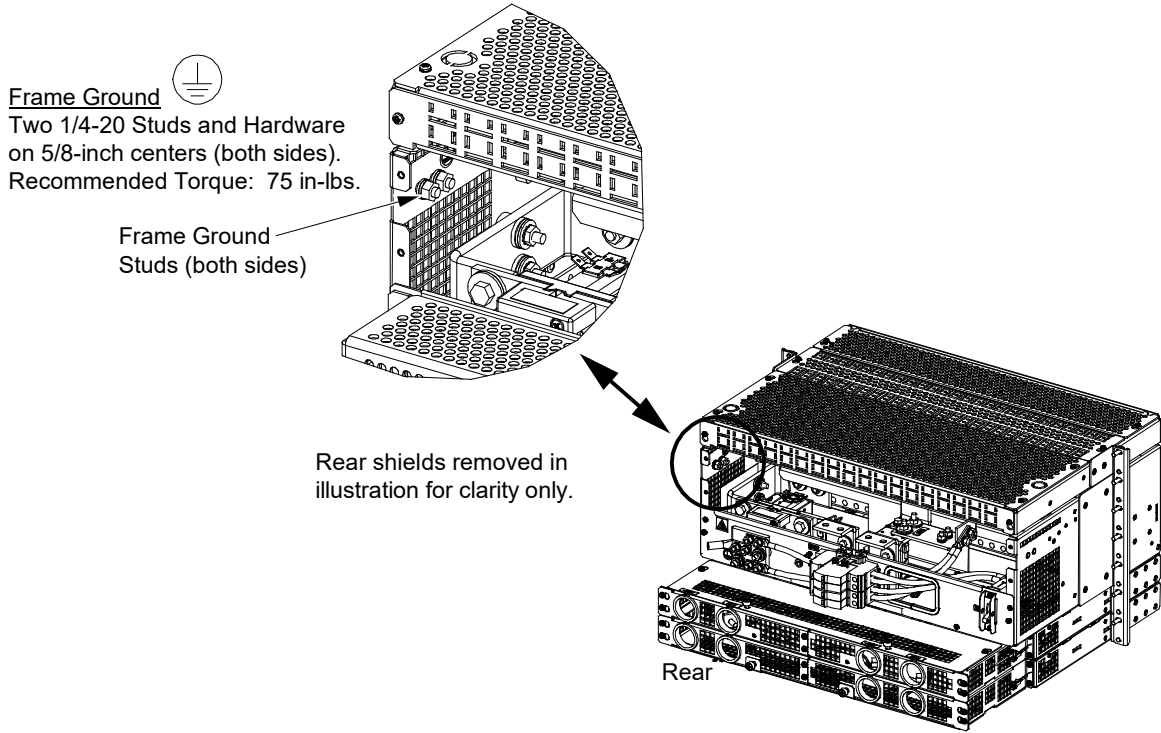
6.3 System Shelf Frame Grounding Connection

For system shelf frame 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.

Procedure

1. The frame grounding connection to the system shelves are made by using grounding washers with the mounting hardware used to secure the shelves to the relay rack or equipment rack. Refer to “Securing the System to a Relay Rack or a Cabinet Equipment Rack” on page 5. Ensure that the relay rack or equipment rack is properly grounded.
2. Two sets of frame grounding studs and hardware are also provided on the inside rear of the DC distribution cabinet. This provides for the connection of a frame grounding lead with a two-hole lug that has 1/4” bolt clearance holes on 5/8” centers. Connect a frame grounding lead to either set of studs as required. Refer to Figure 6.1 for location. Torque hardware as indicated in Figure 6.1.

Figure 6.1 System Shelf Frame Grounding Connection



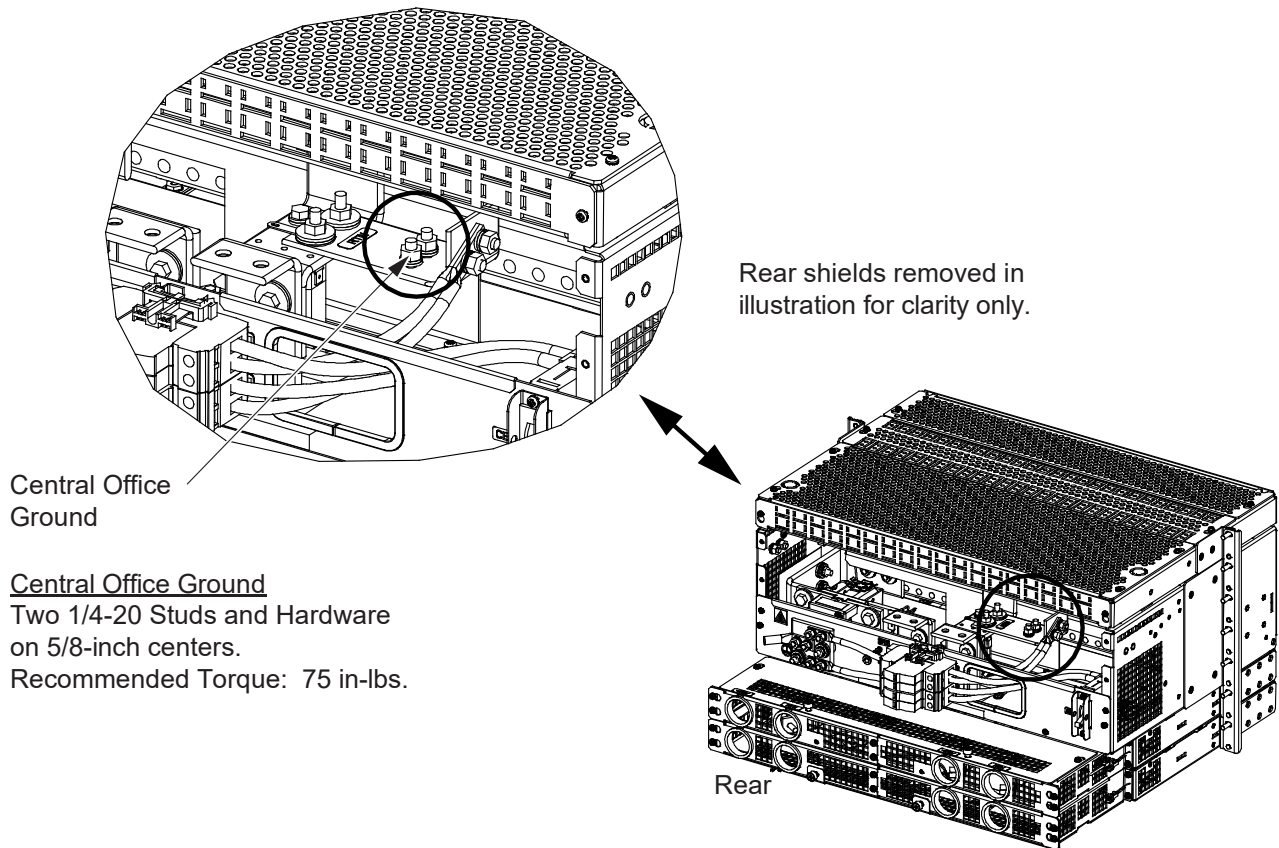
6.4 Central Office Ground Connection

For central office ground 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.

Procedure

1. A set of studs and hardware are provided on the -58 VDC return bus located on the inside rear of the DC distribution cabinet. This provides for the connection of a central office ground lead with a two-hole lug that has 1/4" bolt clearance holes on 5/8" centers. Connect a central office ground lead to these studs as required. Refer to Figure 6.2 for location. Torque hardware as indicated in Figure 6.2.

Figure 6.2 Central Office Ground Connection



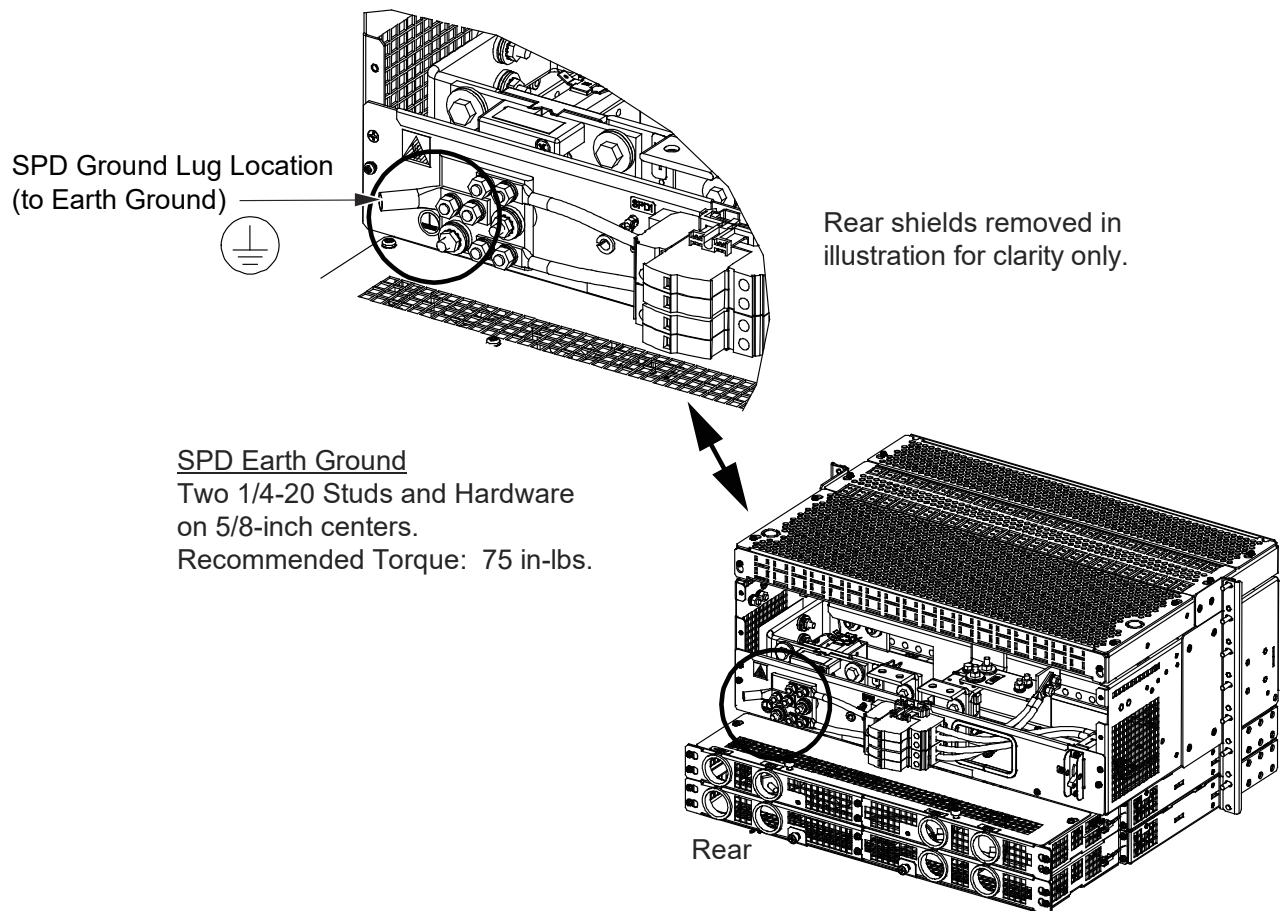
6.5 SPD (Surge Protection Device) Earth Ground Connection

A set of studs and hardware are provided on a panel mounted on the rear of the DC distribution cabinet. This provides for the connection of an SPD (Surge Protection Device) earth ground lead with a two-hole lug that has 1/4" bolt clearance holes on 5/8" centers. A 2 AWG flex wire crimp lug is also provided with the system (two-hole lug, 1/4" bolt clearance holes on 5/8" centers). Connect an SPD (Surge Protection Device) earth ground lead to these studs. Refer to Figure 6.3 for location.

Procedure

1. Remove and save the factory-installed 1/4-20 hardware and 2-hole crimp lug from the power system's SPD earth ground connection busbar threaded studs.
2. Crimp the customer provided earth ground wire to the 2-hole crimp lug.
3. Install the 2-hole crimp lug (with customer provided earth ground wire) to the power system's SPD earth ground connection busbar as shown in Figure 6.3. Apply anti-oxidizing compound to busbar mating surfaces before assembling. Secure the lug with the 1/4" hardware saved from a prior step. Torque hardware as indicated in Figure 6.3.

Figure 6.3 SPD (Surge Protection Device) Earth Ground Connection



6.6 Nominal -48 VDC Input Connections

The DC input connections are made to the converter module mounting shelves comprising the system. Each converter module mounting shelf provides for connection of two (2) DC input feeds. Each DC input is internally connected to three (3) converter module mounting positions. Two (2) 1/4-20 studs on 5/8-inch centers are provided for each input (each polarity) for installation of customer provided DC input leads terminated in 2-hole lugs. Customer must supply additional lug mounting hardware.



WARNING! Observe proper polarity when making input connections.

Procedure



NOTE! Refer to Figure 6.4 as this procedure is performed.

1. Remove the access covers from the rear of the system as required to gain tool access to the DC input lug terminations as described next.
2. To remove the SPD rear access cover, loosen but do not remove the two (2) screws shown in Figure 6.4. Remove the SPD rear access cover. Set the SPD rear access cover aside for later re-installation.
3. To remove the upper DC input access cover, loosen but do not remove the two (2) screws shown in Figure 6.4. Then loosen the two (2) captive fasteners shown in Figure 6.4 and remove the upper DC input access cover. Set the upper DC input access cover aside for later re-installation.
4. To remove the lower DC input access cover, loosen the two (2) captive fasteners shown in Figure 6.4 and remove by sliding the access cover out. Set the lower DC input access cover aside for later re-installation.
5. To remove the rear DC input access covers from each converter module mounting shelf (as required for tool access), loosen but do not remove the six (6) screws shown in Figure 6.4. Remove the rear DC input access covers. Set the rear DC input access covers aside for later re-installation.
6. Route DC input leads with 2-hole lugs through the appropriate bushings in the rear DC input access covers and into the converter module mounting shelves.
7. Connect the DC input leads to the appropriate DC input terminals inside the converter module mounting shelf(s) as shown in Figure 6.4. Torque hardware as indicated in Figure 6.4.
8. After all DC input connections have been made and checked, reinstall the rear access covers as described next.



ALERT! Observe proper polarity when making input connections. Reversing the polarity of the connections will damage equipment!

9. To replace the rear DC input access covers to each converter module mounting shelf, orient the access covers over their mounted position and slide the keyhole slots in the covers over the screw-heads, as shown in Figure 6.4. Tighten the screws to 18 in-lbs.
 - Note: Feed 1 rear bracket has narrow spacing on right-side keyhole slots.
 - Note: Feed 2 rear bracket has wide spacing on left-side keyhole slots.
10. To replace the lower DC input access cover, slide the access cover in so that the tabs on the lower DC input access cover slide on top of the corresponding tabs on the converter module mounting shelf, as shown in Figure 6.4. Secure by tightening the two (2) captive fasteners.
11. To replace the upper DC input access cover, orient the access cover over its mounted position and slide the keyhole slots in the cover over the screw-heads, as shown in Figure 6.4. Secure by tightening the two (2) captive fasteners.

12. To replace the SPD rear access cover, orient the access cover over its mounted position and slide the keyhole slots in the cover over the screw-heads, as shown in Figure 6.4. Tighten the screws to 9.6 in-lbs.

Figure 6.4 Nominal -48 VDC Input Connections (cont'd on next page)

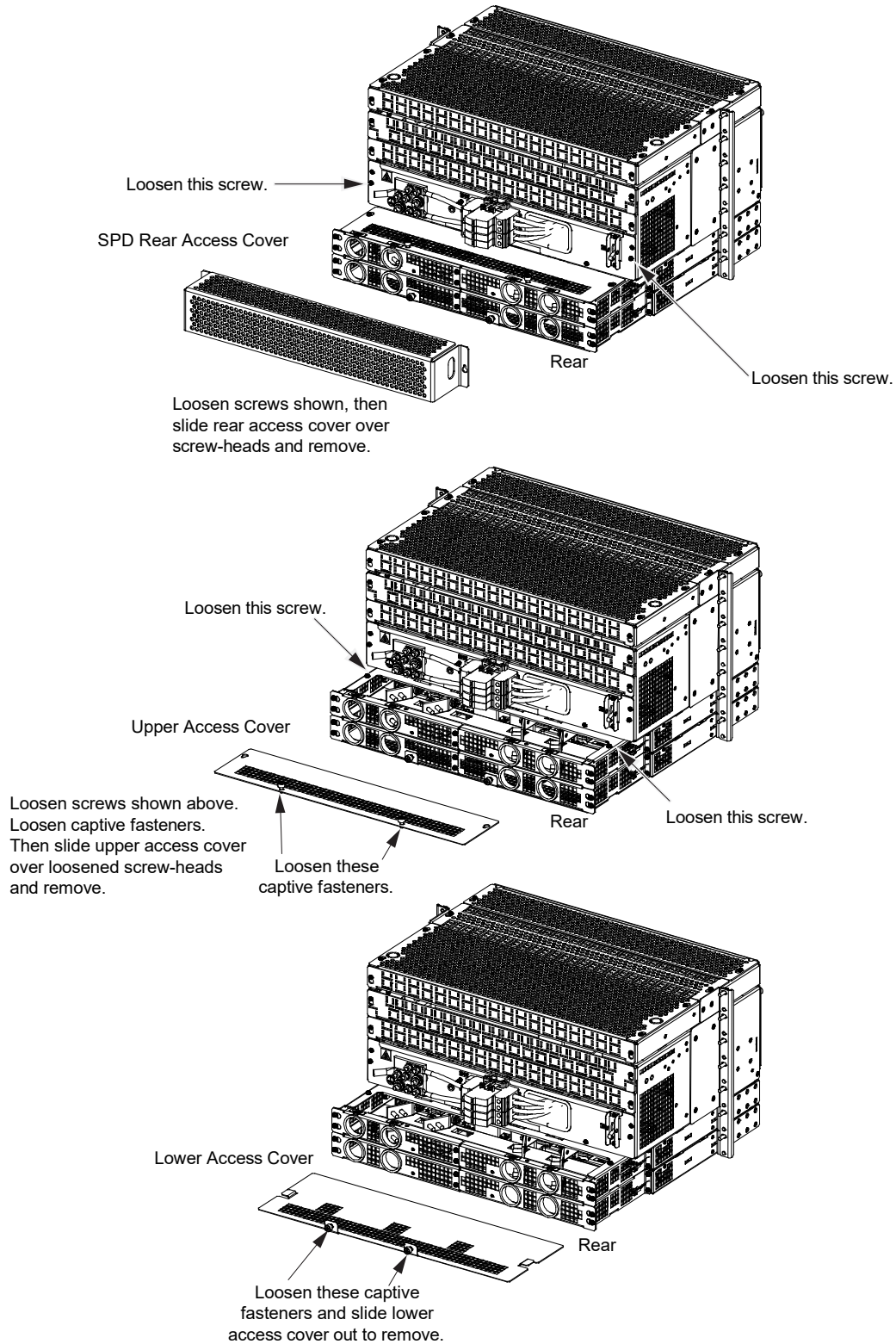
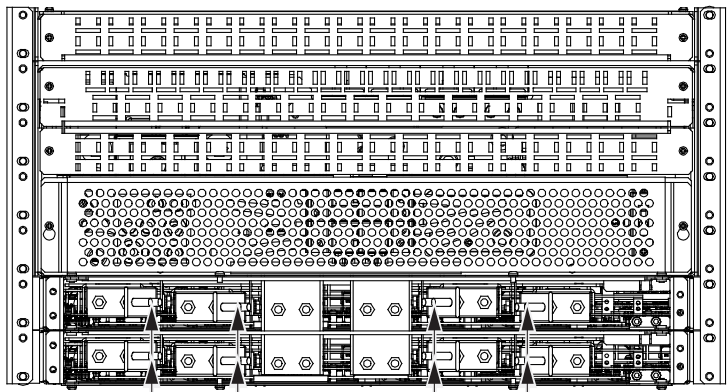
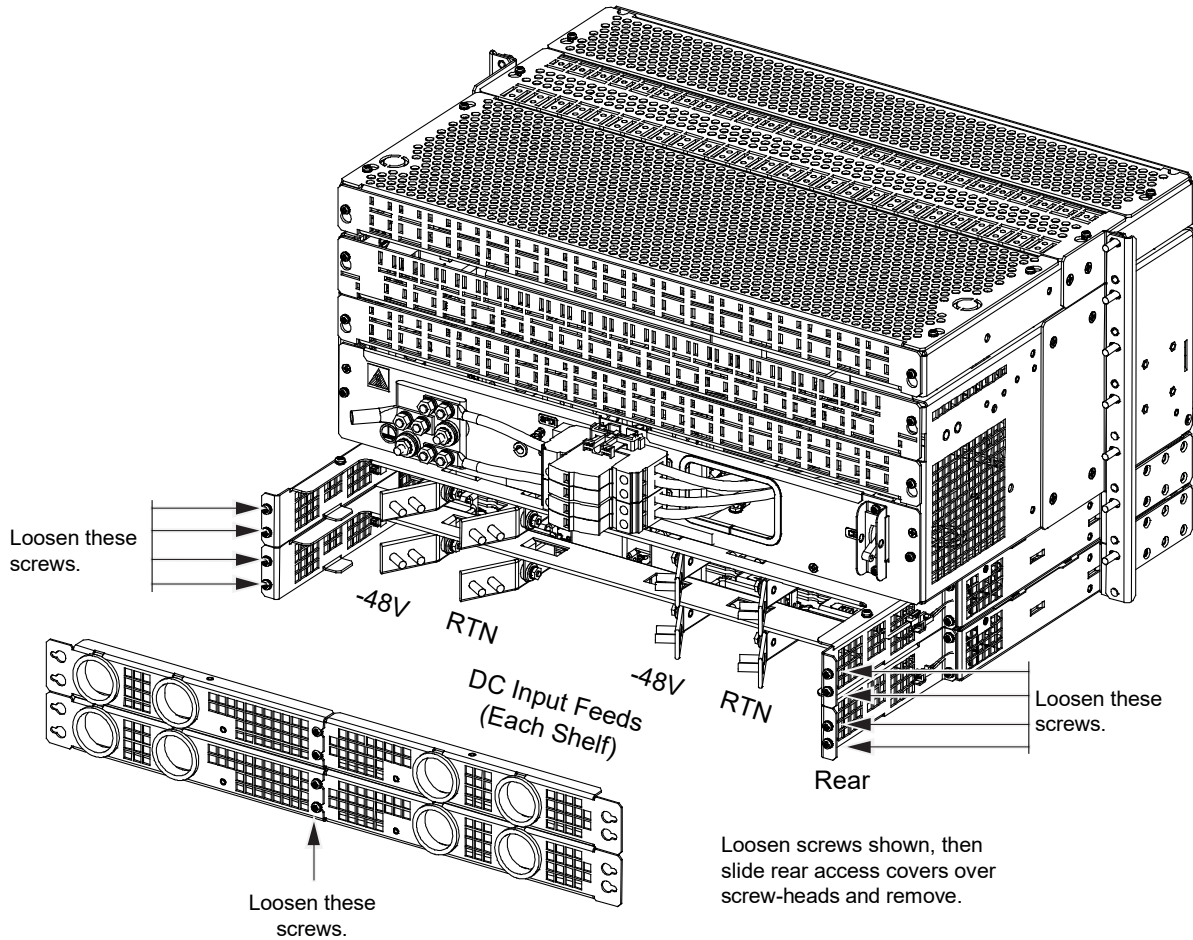


Figure 6.4 Nominal -48 VDC Input Connections (cont'd from previous page)



Converter Mounting Positions #4, #5, #6 of the Respective Shelf

Converter Mounting Positions #1, #2, #3 of the Respective Shelf

Converters are numbered #1 through #6 from left to right as viewed from the front of the shelf.

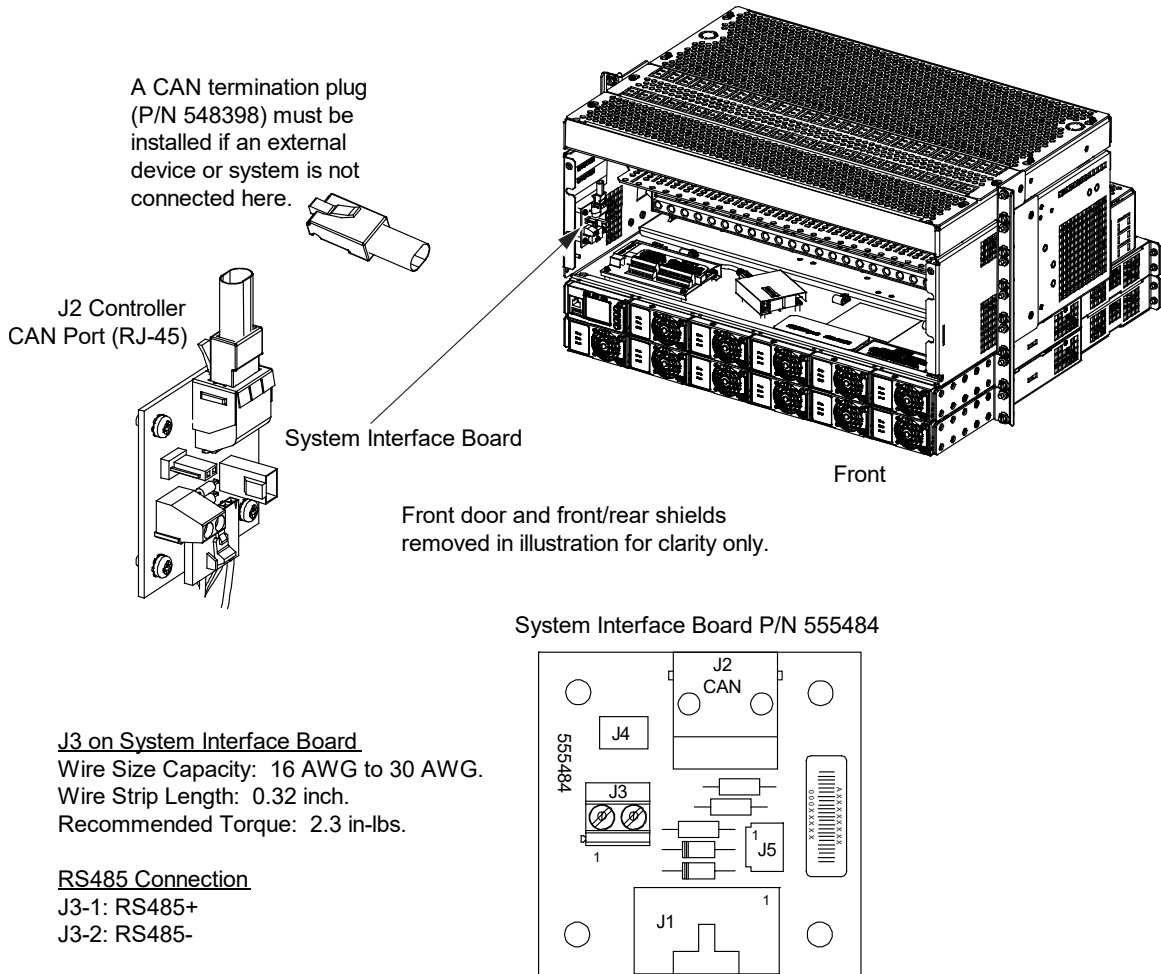
Rear -48 VDC DC Input
 Two 1/4-20 Studs on 5/8-inch centers (each input, each polarity).
 Recommended Torque:
 75 in-lbs. when using split lock washers.
 66 in-lbs. when using Belleville washers.
 (Customer must supply additional hardware.)

6.7 External Alarm, Reference, Monitoring, and Control Connections

6.7.1 System interface circuit card connections

The system interface circuit card provides RS-485 connection terminals (used for communication with SM modules). Refer to Figure 6.5 for circuit card location and connections details.

Figure 6.5 System Interface Circuit Card Connections



6.7.2 IB2 (controller interface board) connections

The IB2 (Controller Interface Board) provides connection points for digital inputs, programmable relay outputs, and temperature probes. Refer to Figure 6.6 for IB2 circuit card location and connections details.

Programmable Digital Inputs and Relay Outputs

Digital input and relay output leads are connected to screw-type terminal blocks located on the IB2. Recommended torque for these connections is 2.2 in-lbs. Refer to Figure 6.6 for terminal locations. Refer to Table 6.1 and Table 6.2 for pin-out information.

Digital Inputs

Connect up to eight (8) digital inputs to the IB2. Note that you must supply both paths for the digital input (either a positive or negative signal and the opposite polarity return path). Observe proper polarity. Refer to Figure 6.6 for terminal locations and Table 6.1 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: 60V DC.
- b) Active High: > 19V DC.
- c) Active Low: < 1V DC.

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

ESTOP Function

If an ESTOP switch is wired to the IB2-1 Controller Interface Board, customer-furnished system ground applied to terminal DI8+ activates the ESTOP function. The ESTOP function shuts down and locks out the converters.

When the ESTOP signal is removed, converters will remain off. To restart the converters: one at a time remove a converter, wait 30 seconds or more (until the LEDs on the converter extinguish), then re-insert the converter. Alternatively, to restart the converters the input sources can be switched off and then back on after the LEDs on the converters have extinguished.

Programmable Relay Outputs

The IB2 provides eight (8) programmable alarm relays with dry Form-C contacts. Connect up to eight (8) relay outputs to the IB2. Refer to Figure 6.6 for terminal locations and Table 6.2 for pin-out information.



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

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

Relay Ratings: Refer to the following.

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

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

Temperature Probes



NOTE! Each temperature probe consists of two or three pieces that plug together to make a complete probe. See SAG584641000 for part numbers and descriptions.

Up to two (2) temperature probes can be connected to the temperature ports located on the IB2. Refer to Figure 6.6 for temperature port locations.

The temperature probes can be programmed to monitor ambient temperature and/or battery temperature. The battery functions associated with the temperature probes are not used with this converter system since the converters are not to be used for battery charging.

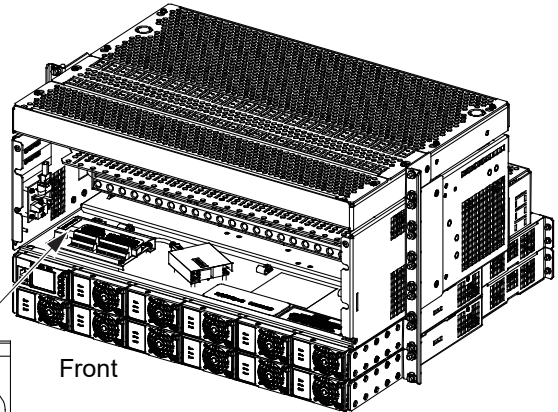
The temperature sensor end of the probe contains a tab with a 5/16" clearance hole for mounting.

A temperature probe programmed to monitor ambient temperature should be mounted in a convenient location, away from direct sources of heat or cold.

Figure 6.6 IB2 (Controller Interface Board) Connections

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

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



Front

Front door removed in illustration for clarity only.

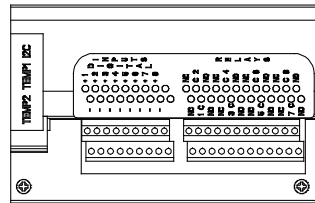
IB2 (Controller Interface Board)

J3-J9:

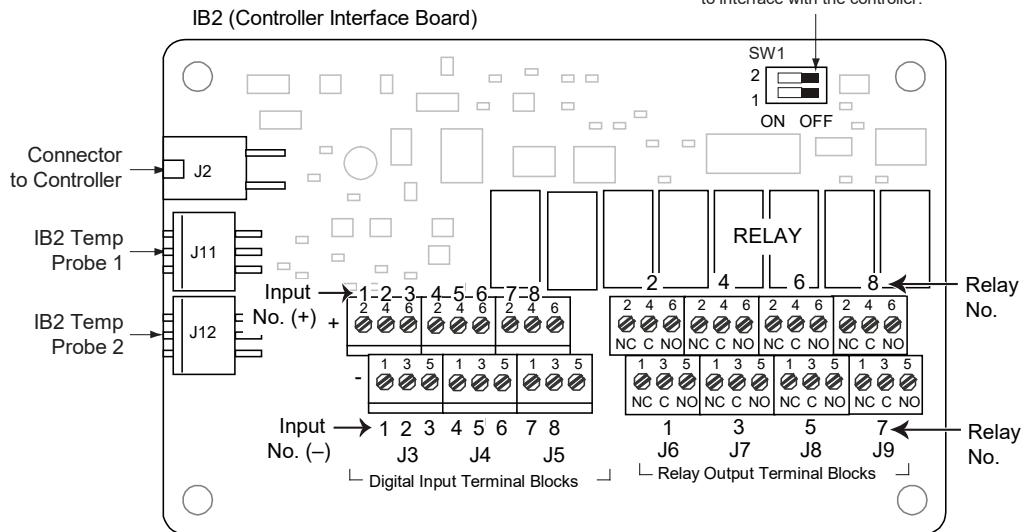
Wire Size Capacity: 16 AWG to 26 AWG.

Wire Strip Length: 0.20 inch.

Recommended Torque: 2.2 in-lbs.



Switch settings must be in this position to interface with the controller.



Schematic Diagram of IB2 (Controller Interface Board)

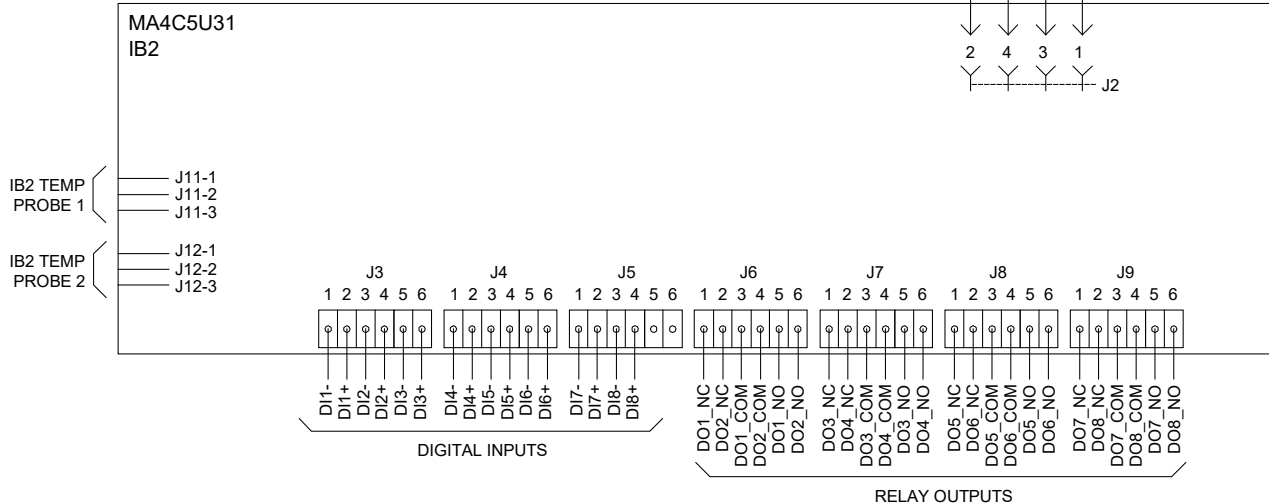


Table 6.1 Programmable Digital Inputs – IB2

Programmable Digital Input	IB2 Pin No.		Factory Wiring	Default 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	-	-58 VDC	
--	J5-5		not used	not used
--	J5-6			



NOTE! -58V is factory wired to the Digital Input #8 (-) terminal for your convenience and function predefined for ESTOP. Customer-furnished system ground applied to terminal Digital Input #8 (+) activates the ESTOP function. See “ESTOP Function” on page 23.

Table 6.2 Programmable Relay Outputs – IB2

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



NOTE! -The controller's 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 controller's remaining 7 relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific relay labeling.

6.7.3 Connecting a device or system to the NCU can bus

A supporting device or system may be connected to the NCU CAN Port located on the system interface circuit card. Refer to Figure 6.5 for location. Refer to Table 6.3 for pin-outs. Refer also to the external device's or system's instruction manual.

General Procedure

1. Remove the CAN termination plug from the CAN Port connector (see Figure 6.5 for location). Connect the device or system to the NCU Controller's CAN port. Refer to Table 6.3 for pinouts. Ensure that the last device on the controller's CAN bus has a CAN termination plug. Refer also to the external device's or system's instruction manual.
2. Reboot the Controller

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

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

Optional SM-Temp Module Procedure

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

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

1. Remove the CAN termination plug from the CAN Port connector (see Figure 6.5 for location). Connect the SM-Temp Module CAN bus to the CAN Port connector using separately ordered SM-Temp CAN bus interface cable (P/N 562868). Refer to Table 6.3 for pinouts. Ensure the last SM-Temp Module (or if only one) has a CAN termination strap as shown in the SM-Temp Module Instructions (UM547490).

Table 6.3 CAN Port Connections

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

6.8 NCU Controller Ethernet Connection

6.8.1 General

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

6.8.2 NCU front panel ethernet port

An RJ-45 10BaseT jack is provided on the front of the controller for connecting a computer directly to the NCU. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 6.7 for location and Table 6.4 for pin outs. Refer to the NCU Instructions (UM1M830BNA) for operational details. Default address: 192.168.100.100.



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



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

Figure 6.7 NCU Ethernet Port (to connect a computer directly to the NCU)

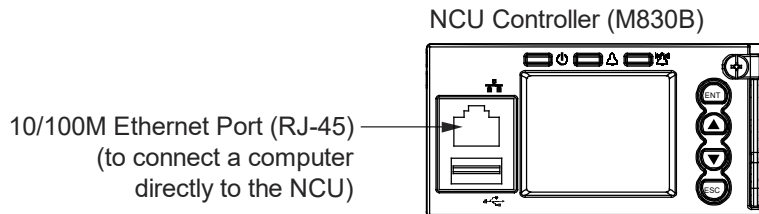


Table 6.4 RJ-45 Ethernet Port Pin Configuration

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

6.8.3 IB4 board ethernet port

An RJ-45 10BaseT jack is provided on the IB4 board for connection into a customer's network. Use this Ethernet port to connect the NCU to your Local Area Network (LAN). This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 6.8 for IB4 board location. Refer to Figure 6.8 for Ethernet port location and Table 6.4 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.

Ethernet Cable Routing Requirement: When connecting an ethernet cable to the IB4 board, the cable's routing must be to the right on the power system. For EMI compliance, the cable must NOT loop back to the input side of the IB4 board.



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 metallicly connected to the interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Revision 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallicly to OSP wiring.

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

Default IB4 Ethernet Port Parameters

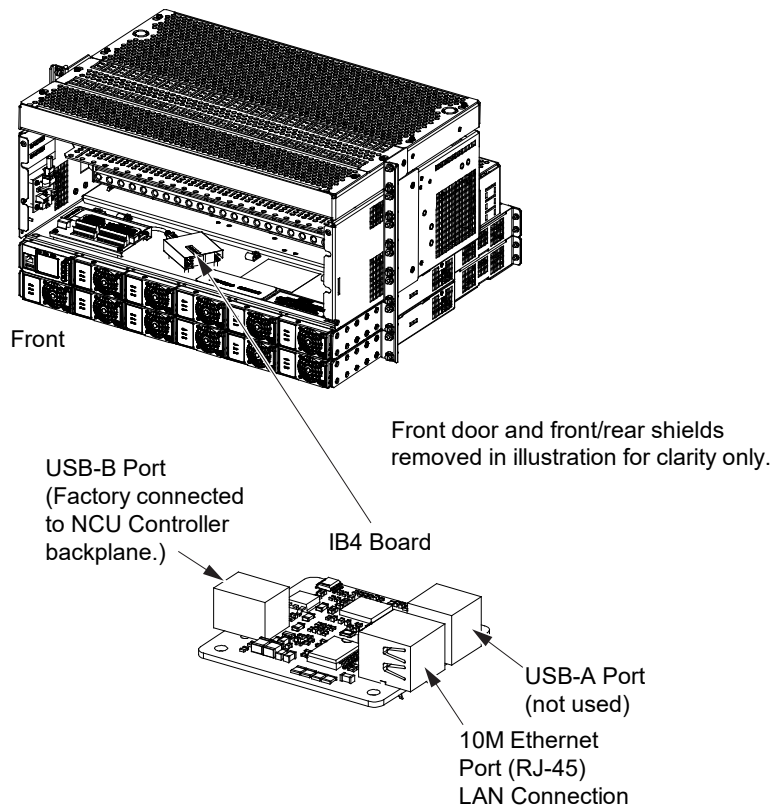
IPv4

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

IPv6

IPv6 Address: 20fa:fffd:ffc:ffb:ffa:ff9:fff8:fff7
IPv6 Prefix: 0
IPv6 Gateway: 20fa:1:ffe:fff:ffe:ffd:fff:ffe

Figure 6.8 IB4 Board Ethernet Port (to connect Local Area Network [LAN])



6.9 Load Connections



WARNING! Observe proper polarity when making load connections.

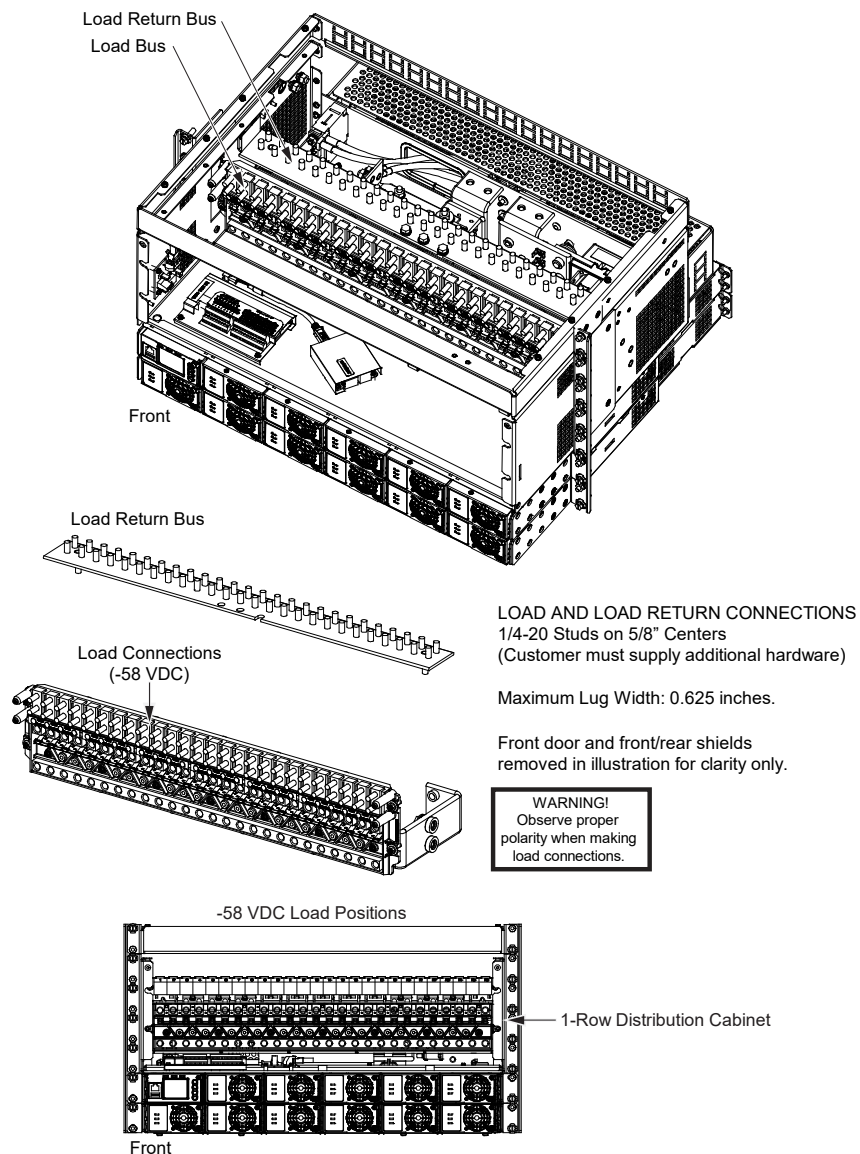
6.9.1 Recommended torque

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

6.9.2 Load and load return connections in a List 01, List 02, List AL, and List CL distribution cabinet

Load leads are connected to the individual load busbars located on the distribution panel (refer to Figure 6.9). Load return leads are connected to the return busbar located at the top of the distribution cabinet (refer to Figure 6.9).

Figure 6.9 Load and Load Return Connections in a List 01, List 02, List AL, and List CL Distribution Cabinet



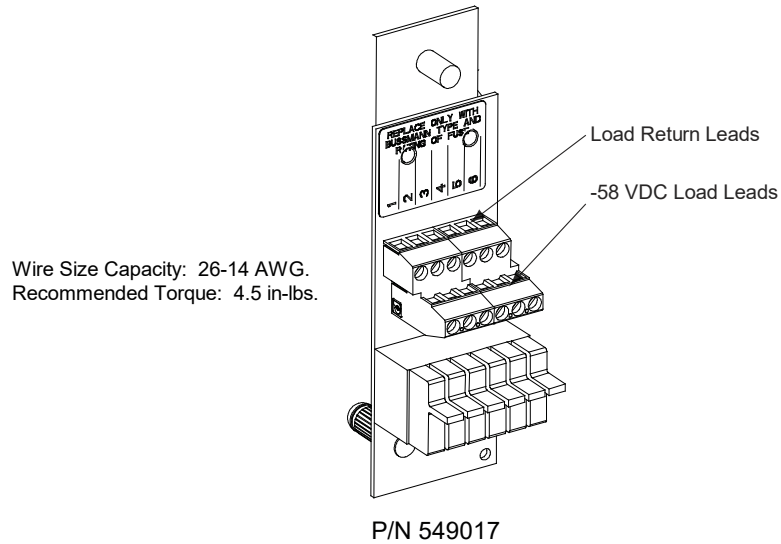
6.9.3 Load connections to an optional bullet nose 6-position GMT distribution fuse block, P/N 549017



WARNING! Observe proper polarity when making load connections.

If an optional “Bullet Nose 6-Position GMT Distribution Fuse Block” is furnished, refer to Figure 6.10 for load connection details and recommended torque.

Figure 6.10 Load Connections to an Optional Bullet Nose 6-Position GMT Distribution Fuse Block, P/N 549017



6.9.4 Load and load return connections in a List 03 and List 04 distribution cabinet

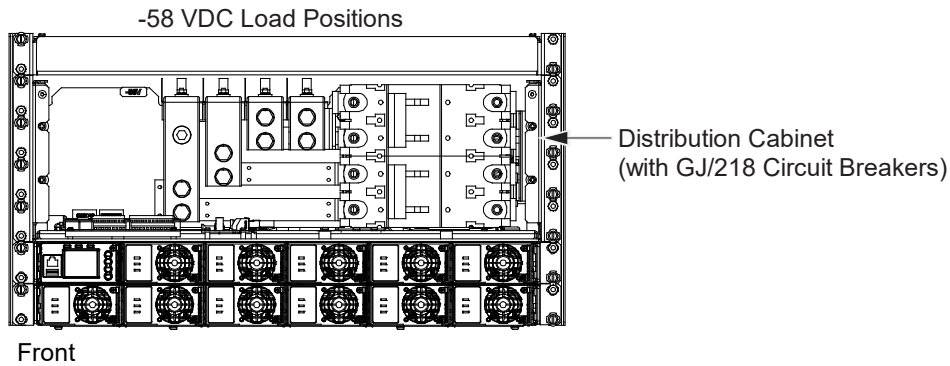
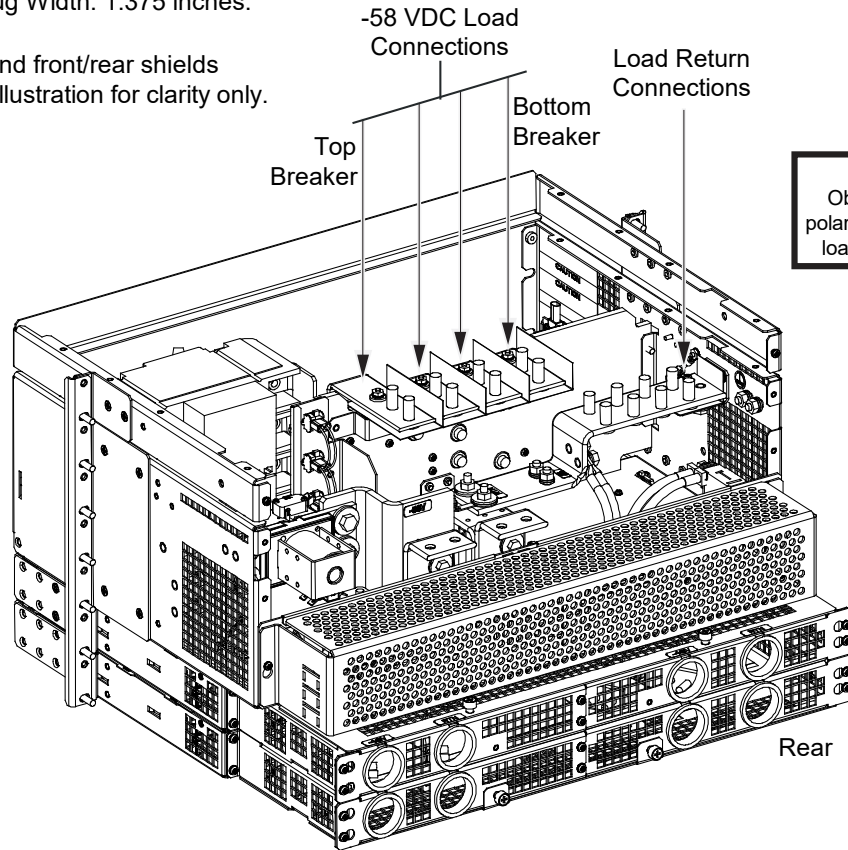
Load leads are connected to the individual load busbars located on the distribution panel (refer to Figure 6.11). Load return leads are connected to the return busbar located at the top of the distribution cabinet (refer to Figure 6.11).

Figure 6.11 Load and Load Return Connections in a List 03 and List 04 Distribution Cabinet

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

Maximum Lug Width: 1.375 inches.

Front door and front/rear shields removed in illustration for clarity only.



7 Installing Converter Modules

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



NOTE! Each converter locks into a converter module mounting shelf by means of a latch located on the bottom of the module. The latch and converter handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract. See Figure 7.1.



CAUTION! This converter contains Double pole/Neutral fusing; parts of the equipment that remain energized might represent a hazard during servicing after operation of the fuse.

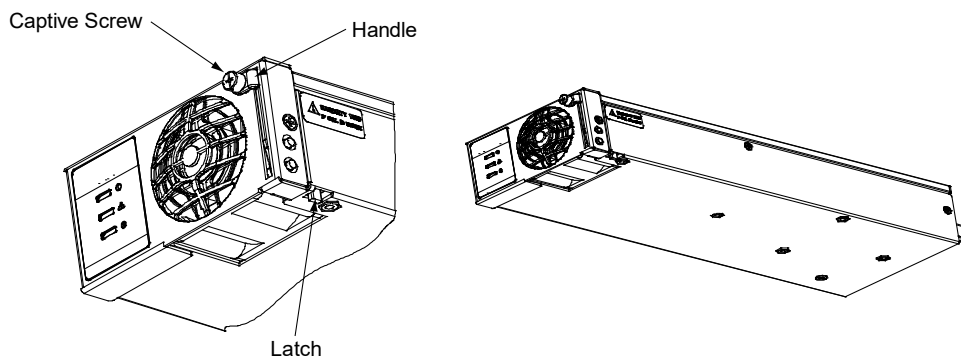


WARNING! To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing a converter. NEVER hold the handle in the closed position when installing a converter into a shelf.

Procedure

1. Unpack the converter module.
2. Remove the silicon rubber cover from the output port of the converter module and read the label.
3. If present, remove blank cover panels from the module mounting positions into which converter modules are to be installed.
4. Place the converter module into an unoccupied mounting slot without sliding it in completely.
5. Loosen the captive screw on the converter module's handle. Pull the handle down out from the converter module's front panel (this will also retract the latch mechanism). See Figure 7.1.
6. Push the converter module completely into the shelf.
7. Push the handle up into the converter module's front panel. This will lock the converter module securely to the shelf. Tighten the captive screw on the handle.
8. Repeat the above steps for each converter module being installed in the system.
9. After the converter modules are physically installed in the mounting shelf(s), they are ready for operation within 60 seconds after power is supplied to them.
10. Certain functions (i.e. converter current limit, converter addressing) may require adjustment when adding or replacing a converter. Refer to the NCU Controller manual (UM1M830BNA) for detailed instructions.

Figure 7.1 Installing Converter Modules



8 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.

8.1 Initial Startup Preparation

- Ensure that all blocks (except the last one) in the “Installation Acceptance Checklist” on page 3 have been checked.
- Ensure that converter module mounting positions are filled by a converter module or a blank panel as required.
- Verify all converter modules and the controller are fully seated, latched, and the latch handle screws secured.
- Refer to the separate NCU User Manual (UM1M830BNA) supplied with your system for complete controller operating information.
- Refer to the configuration drawing (C-drawing) supplied with your system documentation for factory settings of adjustable parameters.

8.2 Initially Starting the System

Procedure

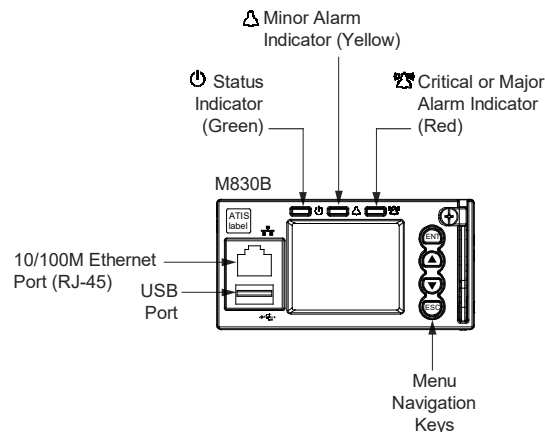
1. Apply DC input power to the system by closing ALL external DC disconnects or protective devices that supply DC power to the system.
2. Converter modules automatically start.
3. Open the distribution cabinet’s front door by loosening the captive fasteners.
4. Place each distribution circuit breaker to the ON position.

8.3 NCU Controller Initialization

Refer to the NCU User Manual (UM1M830BNA) for detailed instructions.

Refer to Figure 8.1 for locations of the NCU local indicators and navigation keys.

Figure 8.1 NCU Local Indicators and Navigation Keys



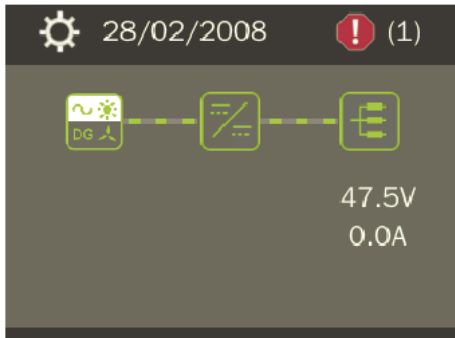
Procedure






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

1. After the NCU is powered on, the display shows the “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.

Main Menu

Date and time are alternately displayed. Green - No Alarm The number in () indicates the total number of alarms.
 Red - Alarm



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 converter module related information.
	DC	View DC equipments related information.

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.

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.

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

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

6. Refer to the following procedures to verify and set the NCU controller as required for your application.

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

Refer to the NCU User Manual (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.



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

Verifying the Configuration File

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

Procedure

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

Checking Basic System Settings

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



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

Procedure

1. **To Select a Sub-Menu:**
Press the UP and DOWN keys to highlight the desired sub-menu. Press the ENT key to enter the selected sub-menu.
2. **To Select a User:**
To select a User, use the UP and DOWN keys to move the cursor to the Select User field. Press ENT. Use the UP and DOWN keys to select a User previously programmed into the NCU. Press ENT to select the User. Note that only Users programmed into the NCU are shown. Users are programmed via the Web Interface. The default User is admin.
3. **To Enter a Password:**
If a password screen opens, a password must be entered to allow the User to make adjustments. To enter a password, use the UP and DOWN keys to move the cursor to the Enter Password field. Press ENT. Use the UP and DOWN keys to choose a character. Press ENT to accept and move to the next character. Continue this process until all characters are entered. Press ENT again to accept the password. The default password is 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 8.1 shows the menu navigation for some basic settings. Refer to the separate NCU Manual (UM1M830BNA) supplied with your power system for complete Local Display menus.

Table 8.1 NCU Basic Settings Menu Navigation

Parameter	Menu Navigation
Date	Main Menu / Settings Icon / Sys Settings / Date.
Time	Main Menu / Settings Icon / Sys Settings / Time.
IP Communications Parameters (IP address, subnet mask address, gateway address)	Main Menu / Settings Icon / Comm Settings / enter parameters.
Converter Output Voltage	Main Menu / Settings Icon / Other Settings / Conv Volt Set.
Converter Current Limit	Web Menu Navigation Only: Settings Menu / "DC/DC" Converter Tab / Current Limit and Current Limit Point.
HVSD Limit	Web Menu Navigation Only: Settings Menu / "DC/DC" Converter Tab / HVSD (set to enabled) then set HVSD Limit.
Over Voltage Alarm 1	Main Menu / Settings Icon / Conv Settings / Over Voltage 1.
Over Voltage Alarm 2	Main Menu / Settings Icon / Conv Settings / Over Voltage 2.
Under Voltage Alarm 1	Main Menu / Settings Icon / Conv Settings / Under Voltage 1.
Under Voltage Alarm 2	Main Menu / Settings Icon / Conv Settings / Under Voltage 2.

Configuring the NCU Identification of the Converters

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

Local Menu Navigation:

None.

Web Menu Navigation:

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

NCU Alarm Relay Check







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

8.5 Checking System Status

Procedure

1. Observe the status of the indicators located on the controller and converters. If the system is operating normally, the status of these is as shown in Table 8.2.

Table 8.2 Status and Alarm Indicators

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

8.6 Final Steps

Procedure

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



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

2. Close the distribution cabinet's front door and secure by tightening the captive fasteners.
3. Verify all converter modules and the controller are fully seated, latched, and the latch handle screws secured.
4. Verify there are no external alarms, and the local indicators are as shown in Table 8.2.

9 Operating Procedures

9.1 Controller and Converters

9.1.1 General

For operation instructions on these units, refer to the following documents.

- NCU Controller Instructions (UM1M830BNA)
- Converter Instructions (UM1C48582000P3)

9.1.2 Controller and converters local controls and indicators

Refer to the controller and converter instructions for descriptions of the local controls and indicators located on these units.

10 Maintenance

10.1 System Maintenance Procedures

It is recommended to perform the maintenance procedures listed in Table 10.1 every 6-months to ensure continual system operation.

Table 10.1 Maintenance Procedures to be Performed at 6-Month Intervals

Procedure	Referenced In
Check ventilation openings for obstructions such as dust, papers, manuals, etc.	--
Inspect and tighten all installer's connections.	"Making Electrical Connections" on page 15.

10.2 Adding a Converter Module to an Empty Converter Module Mounting Position

To increase system current capacity, a converter module can easily be added to an existing empty converter module mounting position. Refer to "Installing Converter Modules" on page 34 for a converter module installation procedure.

10.3 Installing a Field Expansion Converter Module Mounting Shelf (584641000 List 10)



DANGER! Adhere to the "Important Safety Instructions" on page vi.



CAUTION! During this procedure, the converters in the bottom shelf will be disconnected from the system output bus and should be de-energized or removed from the shelf before beginning the procedure.

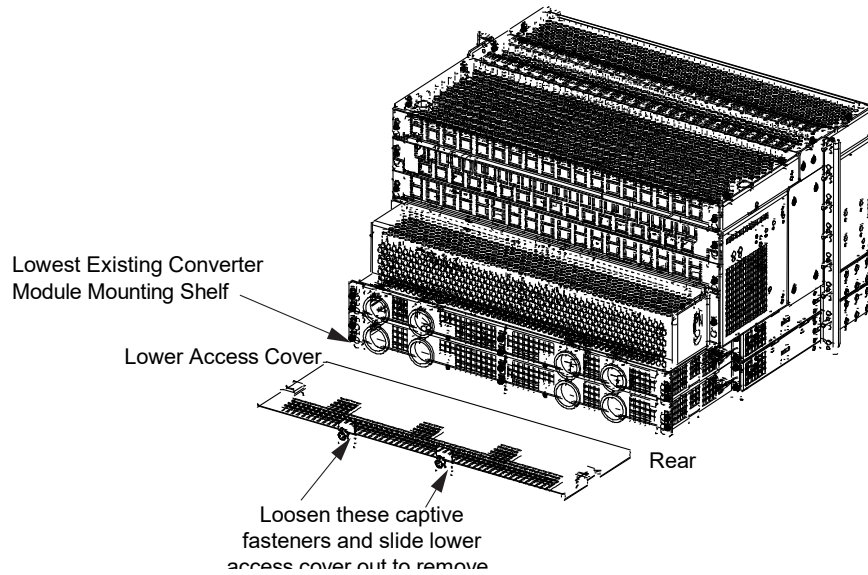
Procedure



NOTE! Refer to Figure 10.1 to Figure 10.15 as this procedure is performed.

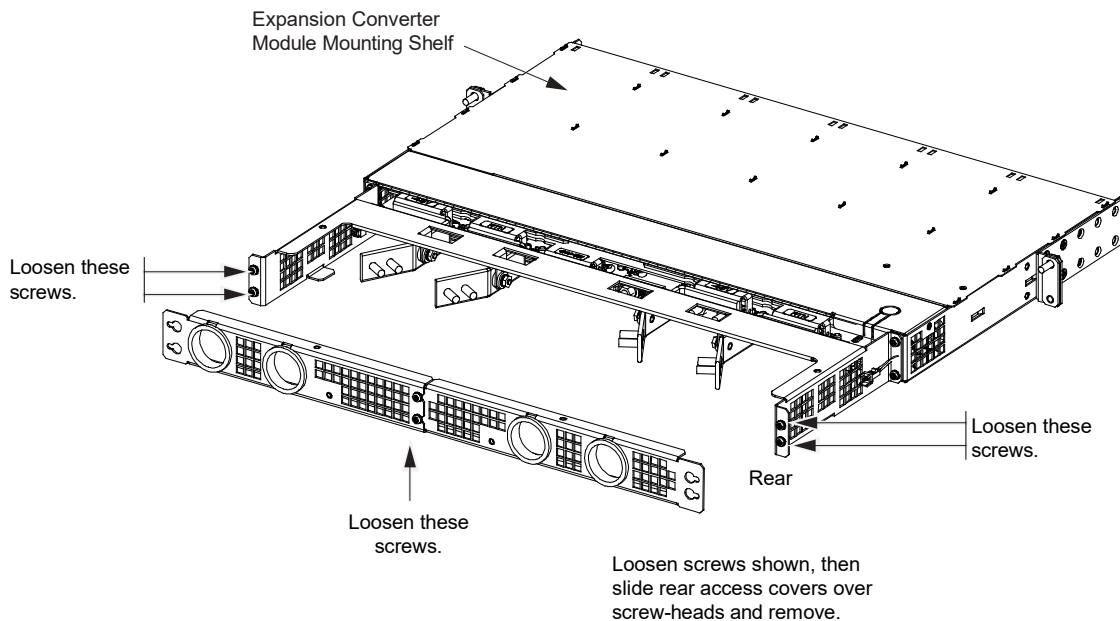
1. From the lowest existing converter module mounting shelf:
 - Remove the lower access cover by loosening the two (2) captive fasteners shown in Figure 10.1. Then remove the cover by sliding it out from the shelf. Set the lower access cover aside for later re-installation.

Figure 10.1 Removing Lower Access Cover



2. From the expansion converter module mounting shelf(s):
 - Remove the rear access covers by loosening (but do not remove) the six (6) screws shown in Figure 10.2. Remove the rear access covers and set aside for later re-installation.

Figure 10.2 Removing Rear Access Cover

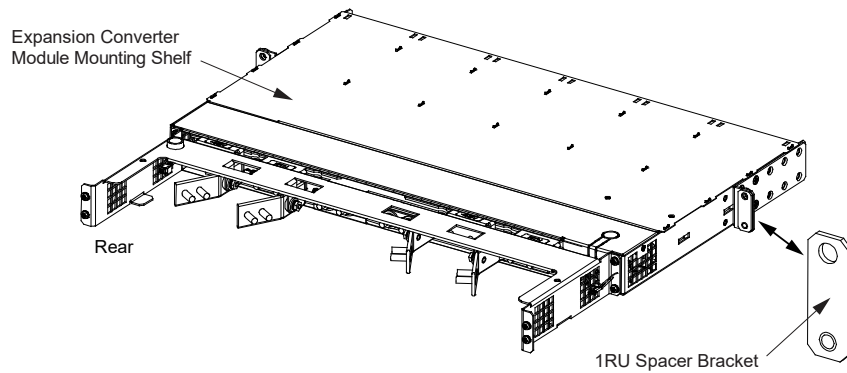


3. On the expansion converter module mounting shelf(s), ensure the mounting angles are set to match the front projection of the base power system (5" or 6").
4. On the expansion converter module mounting shelf(s), verify the 1RU spacer brackets (1 each side) are vertically aligned to the rear of the shelf mounting angles using one (1) #10-32 keps nut (per side). Re-align if required. Torque to 23 in-lbs. See Figure 10.3.



NOTE! The spacers ensure the rear busbar part mating surfaces are depth-wise aligned.

Figure 10.3 Verifying 1RU Spacer Brackets

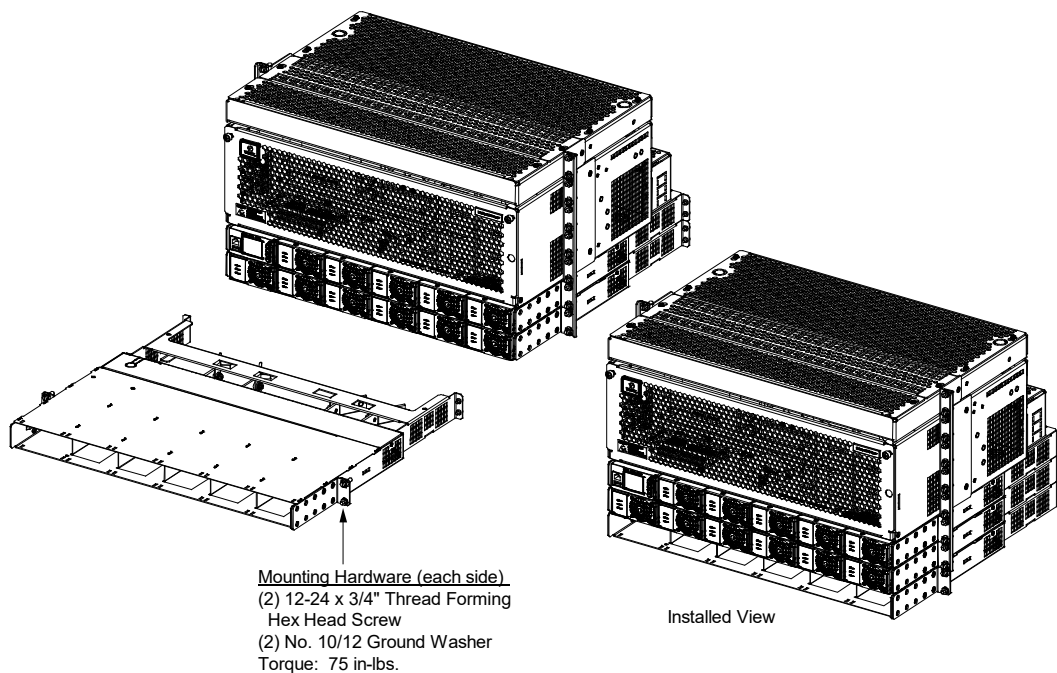


5. Install one (1) or two (2) expansion converter module mounting shelf directly below the system's bottom-most converter module mounting shelf in the rack as shown in Figure 10.4. Use the mounting hardware provided with the expansion converter module mounting shelf(s). Torque hardware as indicate in Figure 10.4.



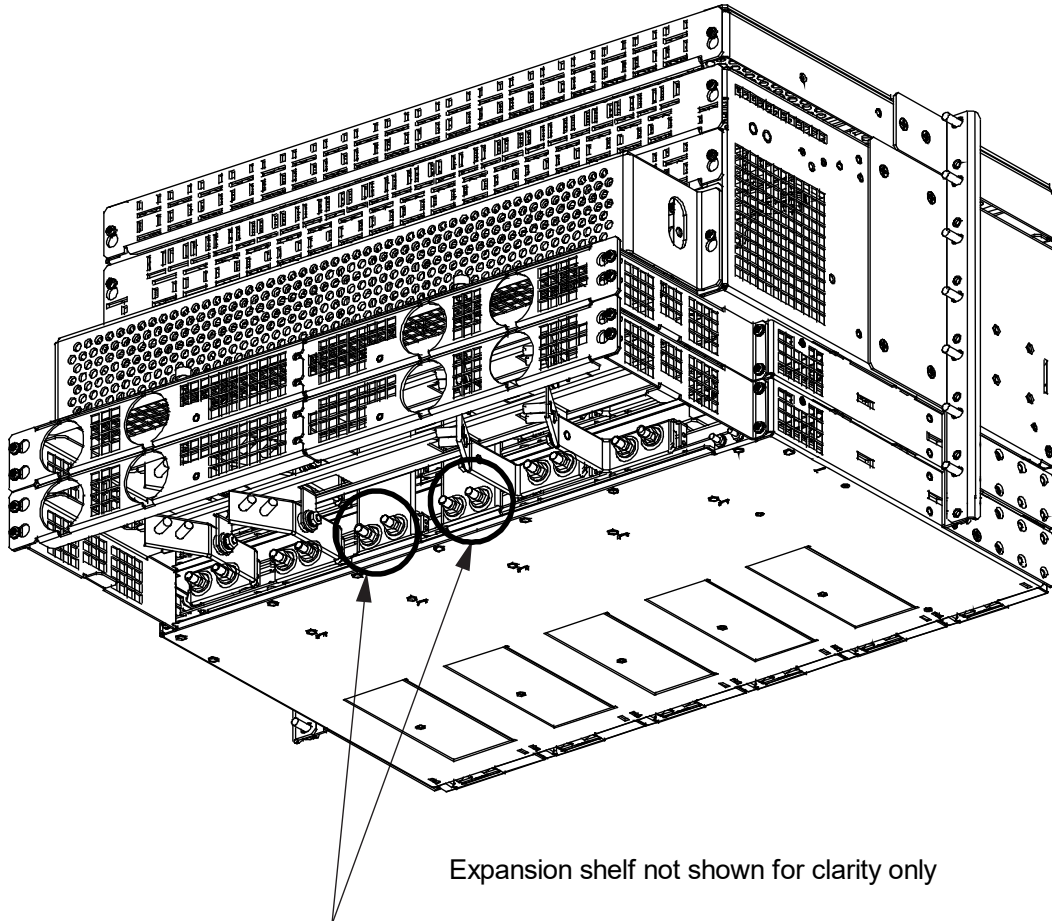
NOTE! Install (orient) the ground washers so the teeth dig into the mounting angles for a secure ground connection.

Figure 10.4 Mounting Expansion Shelf



6. From the lowest existing converter module mounting shelf:
 - Locate the lower set of hardware securing the -58V and Return output busbars to the converter module mounting shelf backplane board as shown in Figure 10.5. Remove and save quantity four (4) each of M6 hex nuts, Belleville washers, and flat washers.

Figure 10.5 Removing Busbar Hardware from Existing Converter Shelf



Remove this hardware.

7. Locate the two (2) guards P/N 60110026 provided loose with the expansion shelf. Fold each guard P/N 60110026 into a C-shape. Then wrap each around one of the support bracket's horizontal surfaces as shown in Figure 10.6.
8. Locate the four (4) guards P/N 60110602 provided loose with the expansion shelf. Fold each guard P/N 60110602 into an L-shape. Then hook each onto one of the support bracket's vertical flanges as show in Figure 10.6.
9. Locate guard P/N 60110621 provided loose with the expansion shelf. Fold guard P/N 60110621 as shown in Figure 10.7. Then place it over the -58V bus threaded studs as show in Figure 10.7. Press down on the guard so the studs pass through the holes in the guard.

Figure 10.6 Installing Guards P/N 60110026 and 60110602

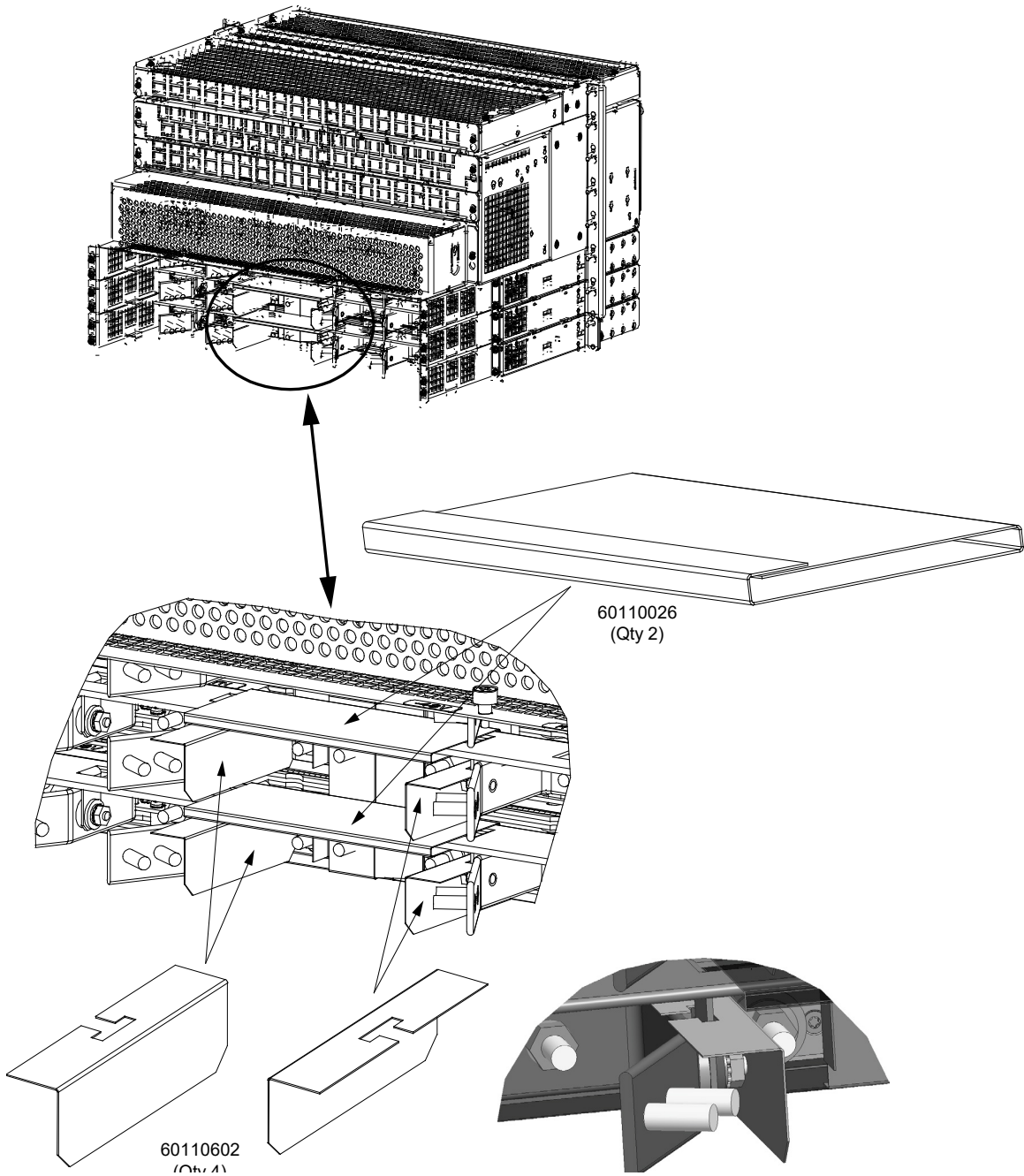
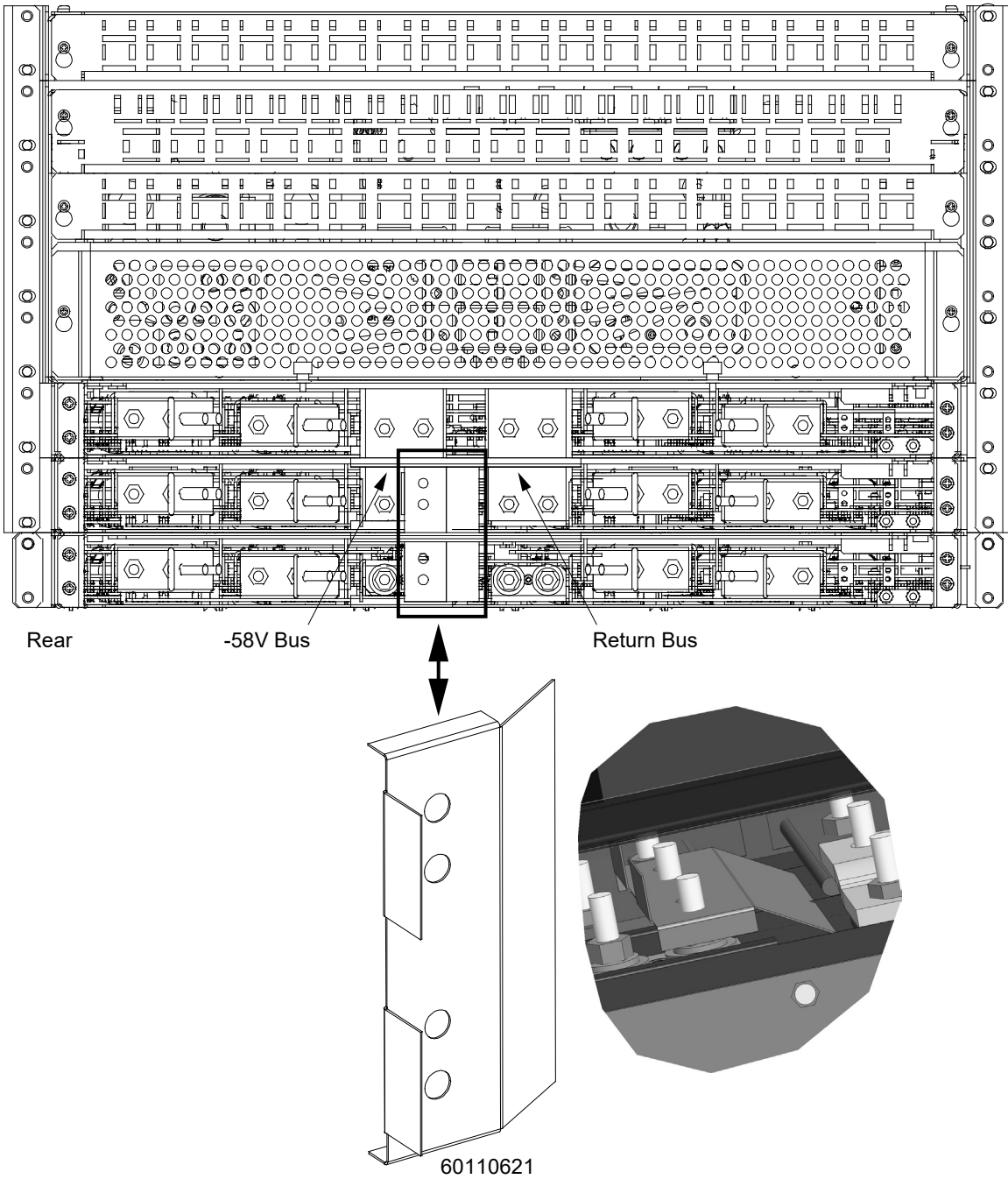


Figure 10.7 Installing Guard P/N 60110621 on -58V Bus Side





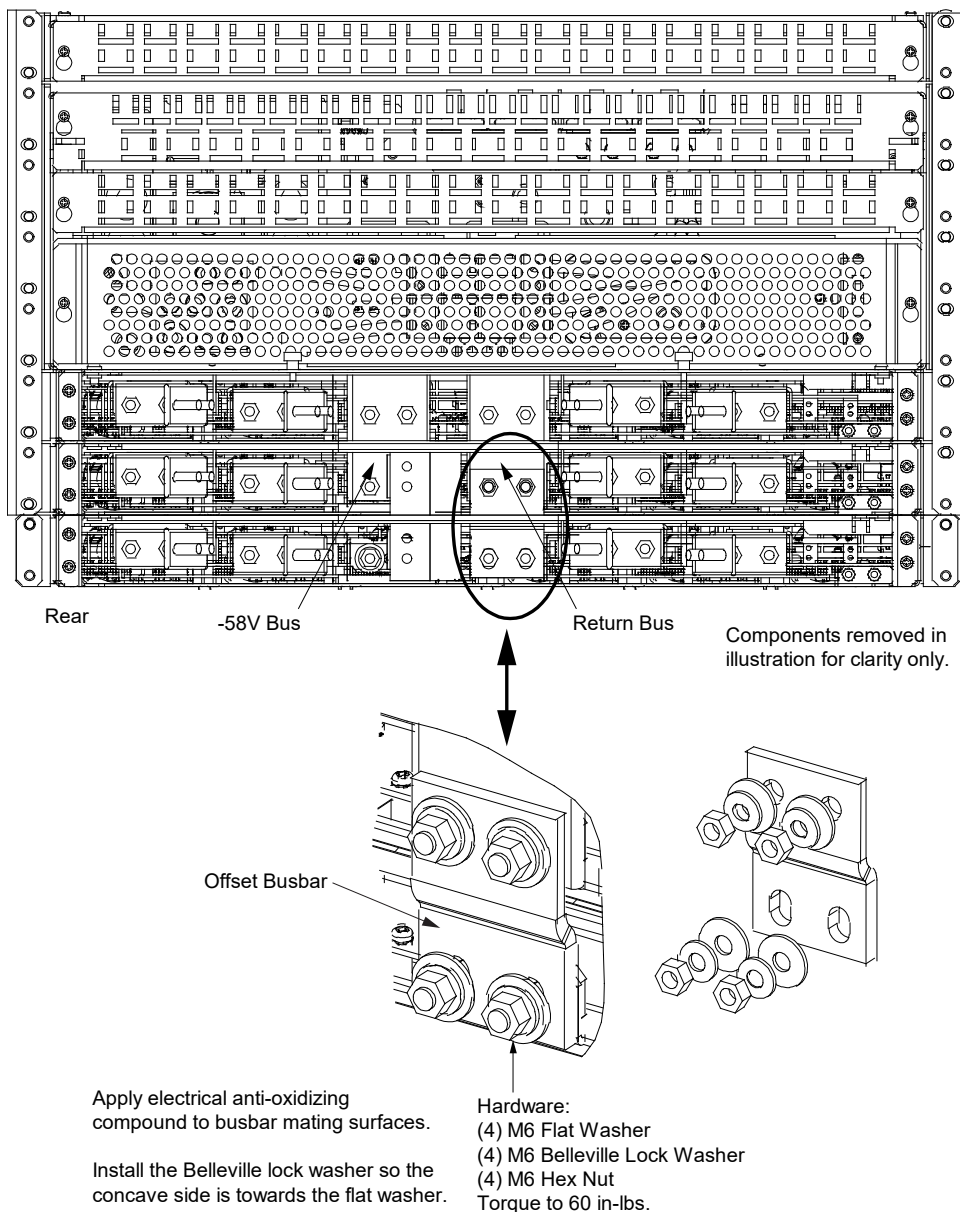
NOTE! Apply electrical anti-oxidizing compound to busbar mating surfaces before performing the next step.

10. Install one of the offset busbars provided with the expansion converter module mounting shelf between the return bus on the existing bottom-most converter module mounting shelf and the return bus on the expansion converter module mounting shelf. Secure the busbar to the expansion converter module mounting shelf with the hardware provided with the expansion converter module mounting shelf. Secure the busbar to the system's bottom-most converter module mounting shelf with the hardware previously removed. See Figure 10.8. Torque hardware as indicate in Figure 10.8. If a second expansion converter module mounting shelf is being installed, repeat this step for the second expansion converter module mounting shelf.



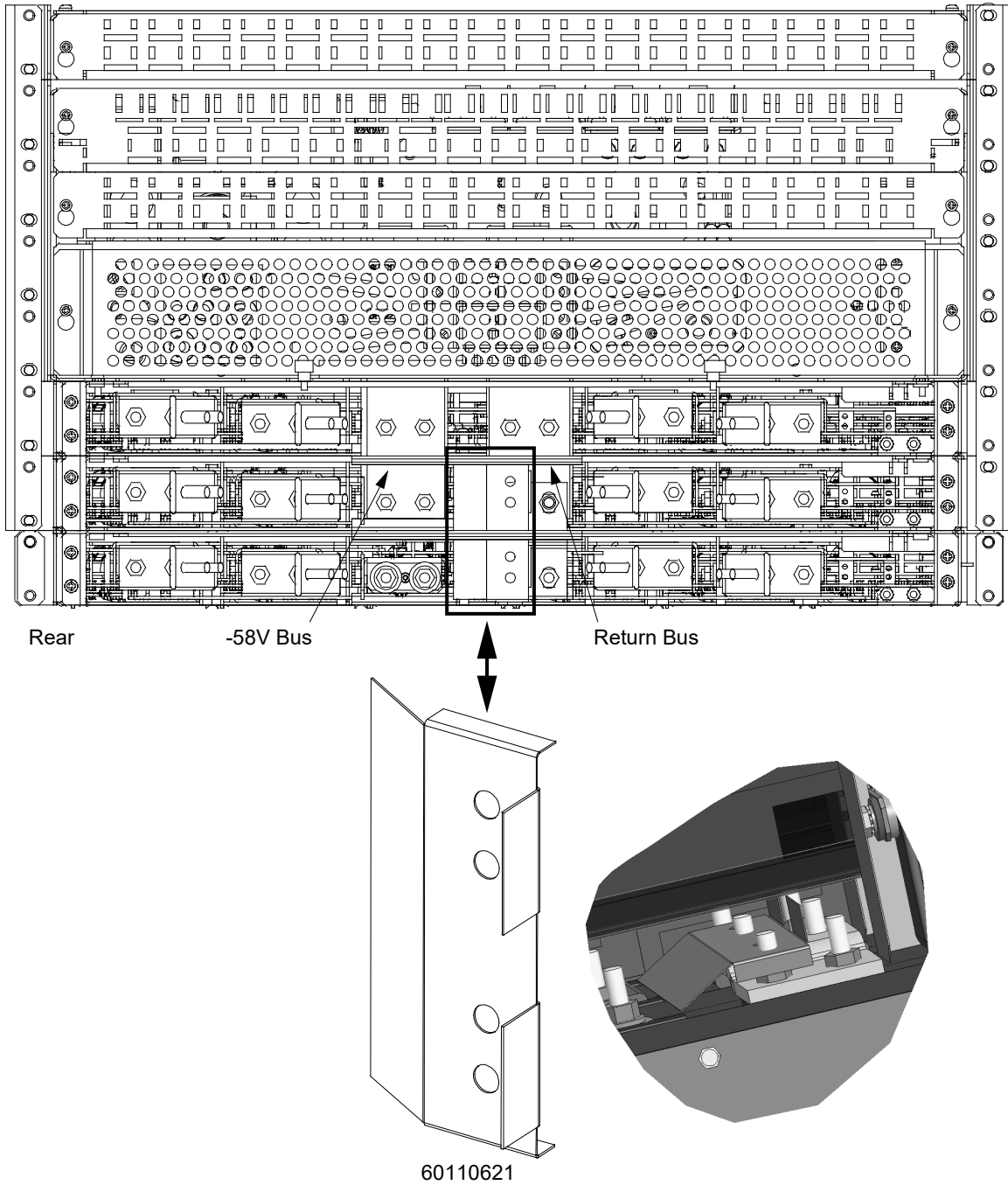
NOTE! Busbar slots mate to expansion converter module mounting shelf(s).

Figure 10.8 Installing Offset Busbar, Return Bus



11. Move guard 60110621 from the -58V bus side to the return bus side oriented as shown in Figure 10.9.

Figure 10.9 Installing Guard P/N 60110621 on Return Bus Side





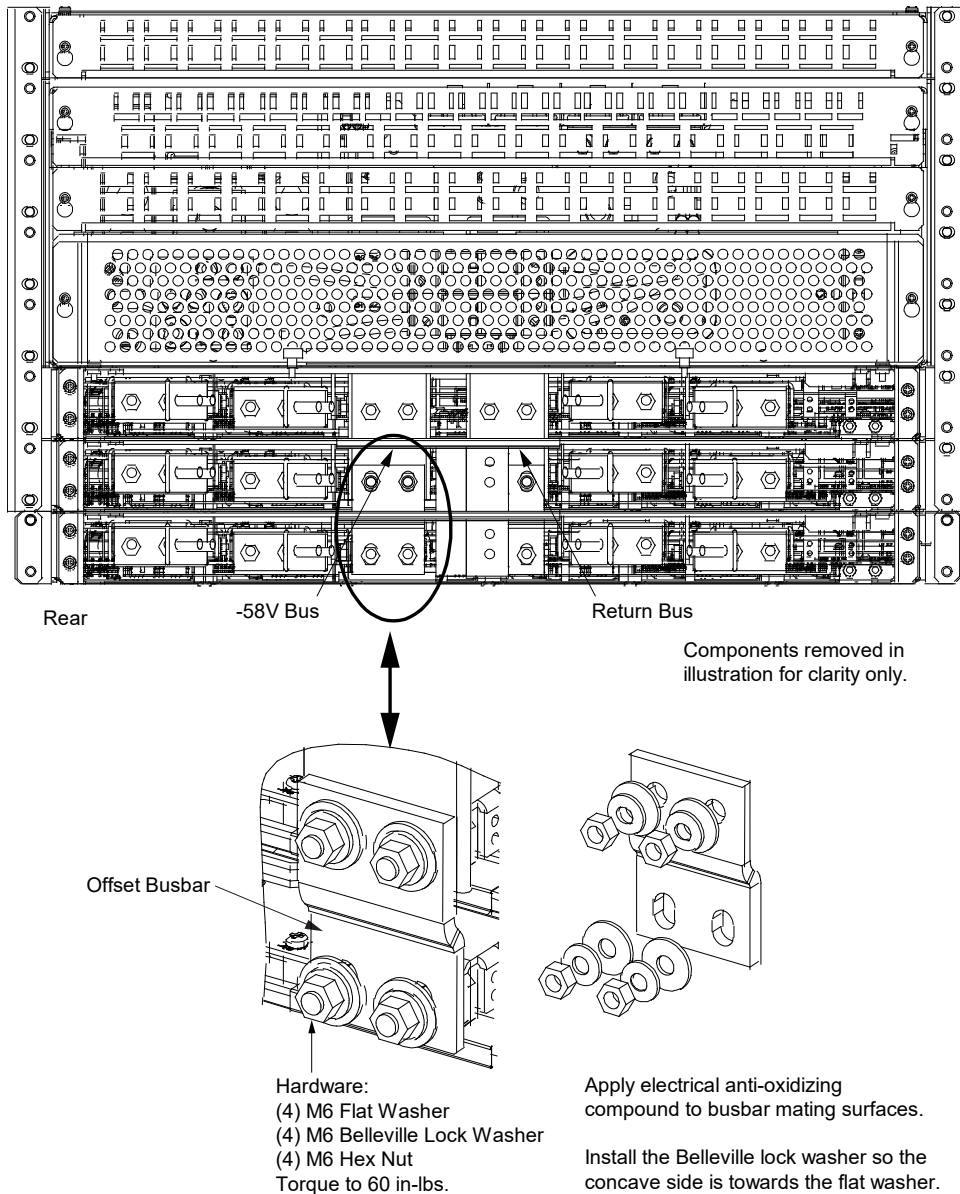
NOTE! Apply electrical anti-oxidizing compound to busbar mating surfaces before performing the next step.

12. Install the remainder offset busbar provided with the expansion converter module mounting shelf between the -58V bus on the existing bottom-most converter module mounting shelf and the -58V bus on the expansion converter module mounting shelf. Secure the busbar to the expansion converter module mounting shelf with the hardware provided with the expansion converter module mounting shelf. Secure the busbar to the system's bottom-most converter module mounting shelf with the hardware previously removed. See Figure 10.10. Torque hardware as indicate in Figure 10.10. If a second expansion converter module mounting shelf is being installed, repeat this step for the second expansion converter module mounting shelf.



NOTE! Busbar slots mate to expansion converter module mounting shelf(s).

Figure 10.10 Installing Offset Busbar, -58V Bus



13. Remove all seven (7) guards.
14. If One Expansion Converter Module Mounting Shelf Installed: For CAN bus cabling, disconnect the cable coming from the distribution cabinet from the connector on the bottom-most existing converter module mounting shelf and connect this cable to the same connector on the expansion converter module mounting shelf. See Figure 10.11.

Connect the open connector on the bottom-most existing converter module mounting shelf to the open connector on the expansion converter module mounting shelf. See Figure 10.11.

15. If Two Expansion Converter Module Mounting Shelves Installed: For CAN bus cabling, disconnect the cable coming from the distribution cabinet from the connector on the bottom-most existing converter module mounting shelf and connect this cable to the same connector on the bottom-most expansion converter module mounting shelf. See Figure 10.12.

Connect the remaining open connectors on the expansion converter module mounting shelves as shown in Figure 10.12.

Figure 10.11 Installing a Field Expansion Converter Module Mounting Shelf, CAN Connections One Expansion Shelf

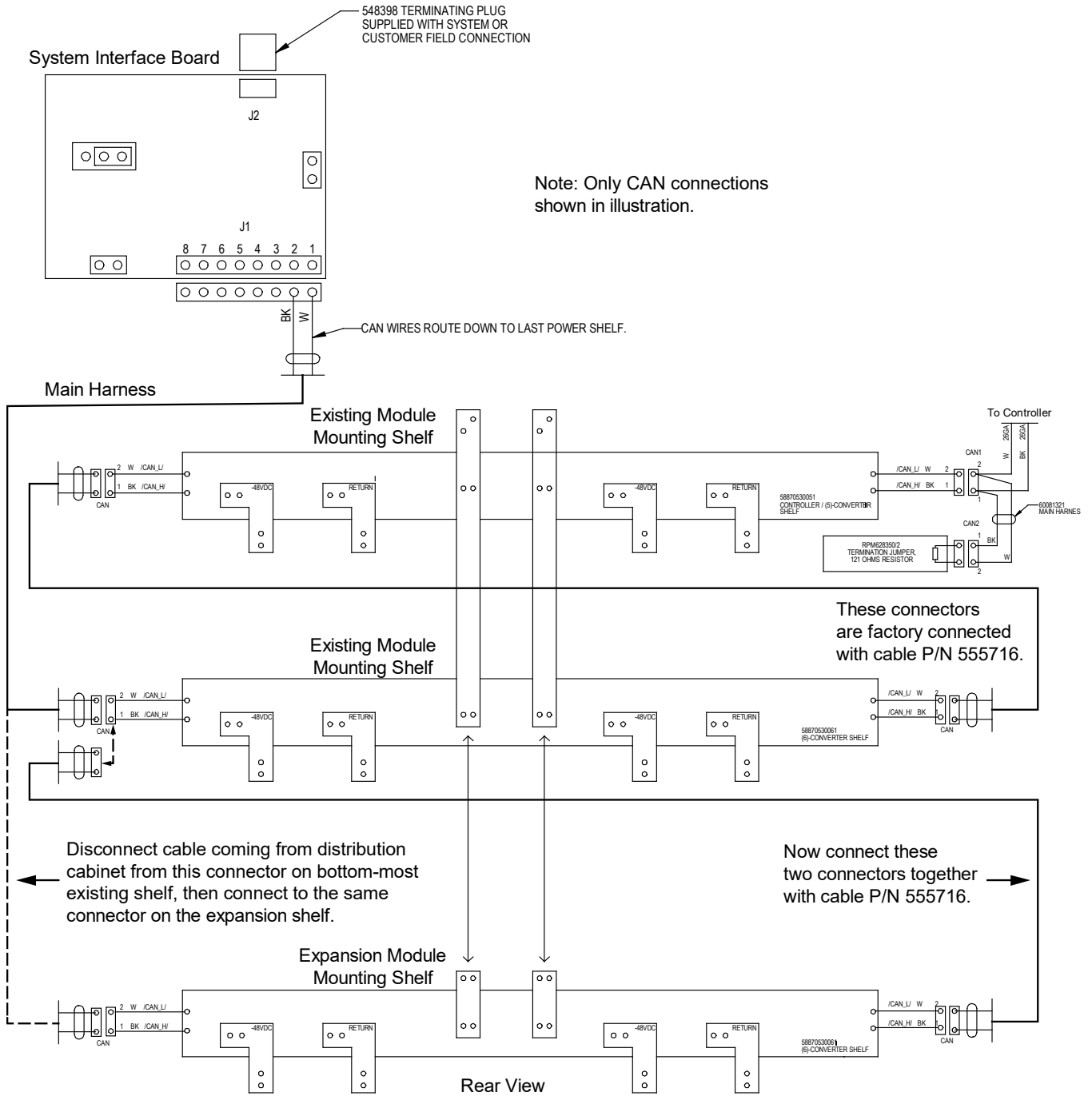
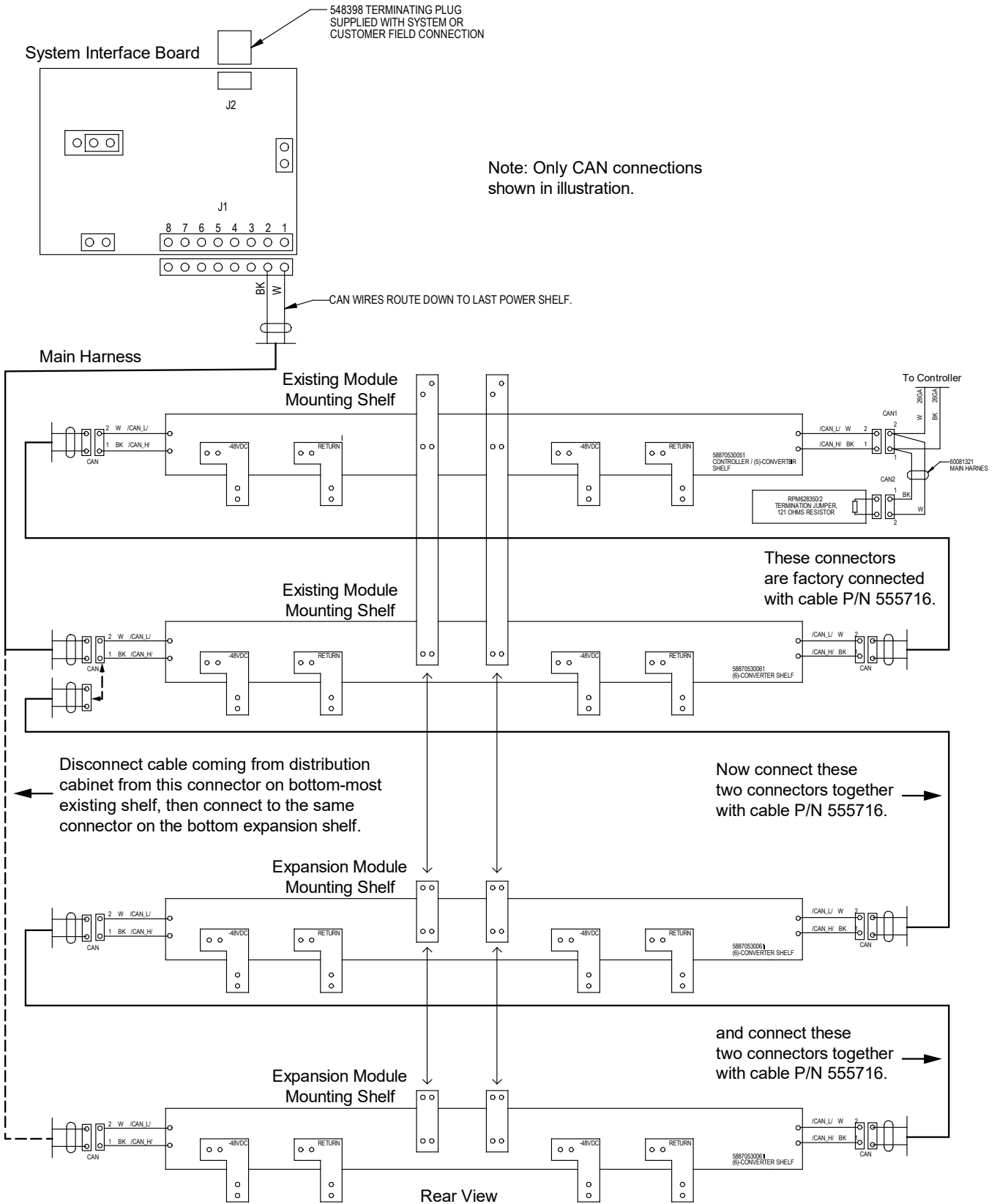
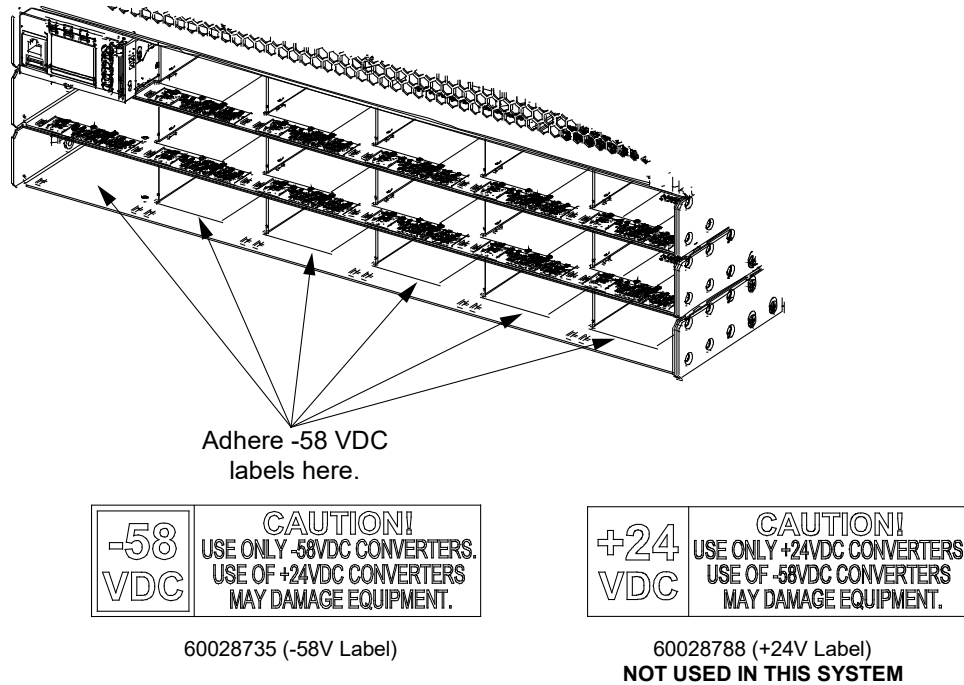


Figure 10.12 Installing a Field Expansion Converter Module Mounting Shelf, CAN Connections Two Expansion Shelf



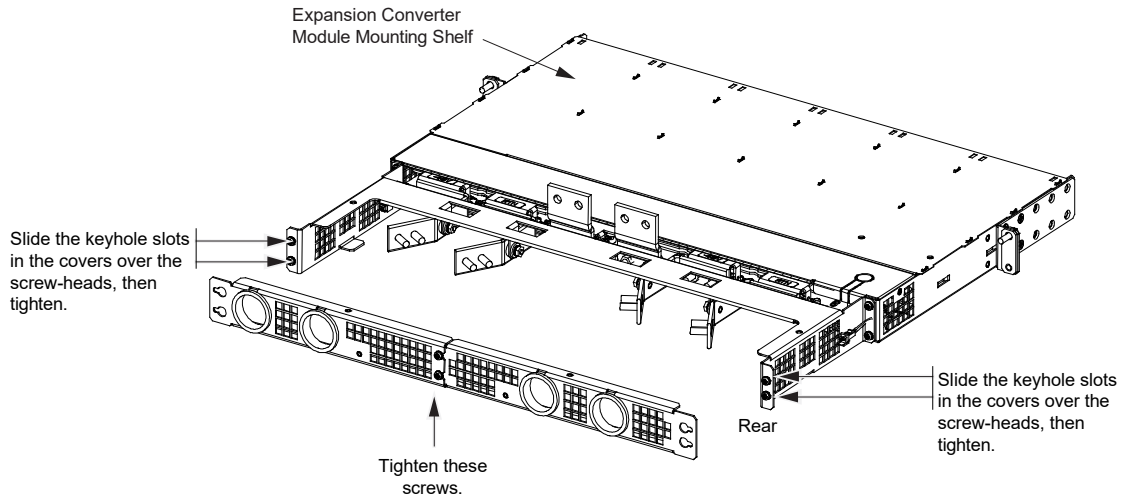
16. Apply the -58V labels provided to all converter mounting slots of the expansion shelf as shown in Figure 10.13. Note that the 584641000 List 10 shelf is used both in the Spec. No. 584641000 and the 584631000. Two sets of labels are provided (-58V and +24V). **The +24V label is not used in this system.** A sample of this labeling is provided in Figure 10.13.

Figure 10.13 Converter Module Voltage and Polarity Labels



17. Refer to “Nominal -48 VDC Input Connections” on page 19 and connect DC input power to the expansion converter module mounting shelf(s).
18. Refer to “Installing Converter Modules” on page 34 and install converter modules into the expansion converter module mounting shelf(s) as required. Install blank cover panels over unused converter module mounting positions.
19. Replace the rear access covers to the expansion converter module mounting shelf(s) by orienting the access covers over their mounted position and sliding the keyhole slots in the covers over the screw-heads, as shown in Figure 10.14. Tighten the screws to 18 in-lbs.
 - Note: Feed 1 rear bracket has narrow spacing on right-side keyhole slots.
 - Note: Feed 2 rear bracket has wide spacing on left-side keyhole slots.

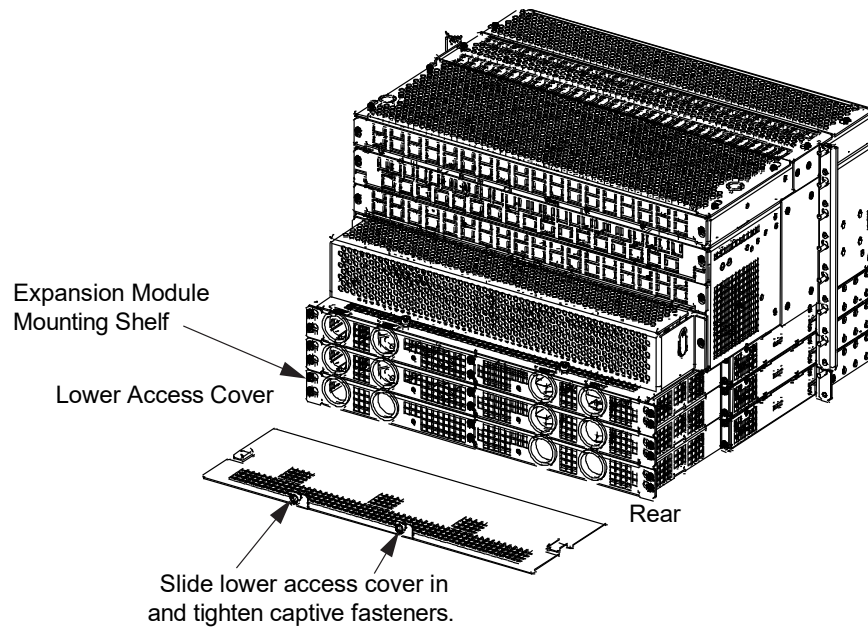
Figure 10.14 Installing a Field Expansion Converter Module Mounting Shelf, Replacing Rear Access Cover



Replace the rear access covers to the expansion module mounting shelf by orienting the access covers over their mounted position and slide the keyhole slots in the covers over the screw-heads.

20. Attach the lower access cover removed from the bottom-most shelf in the original system configuration to the bottom of the bottom-most expansion converter module mounting shelf. Do this by sliding the access cover in so that the tabs on the access cover slide on top of the corresponding tabs on the converter module mounting shelf, as shown in Figure 10.15. Secure by tightening the two (2) captive fasteners.

Figure 10.15 Installing a Field Expansion Converter Module Mounting Shelf, Replacing Lower Access Cover



10.4 Installing a Field Expansion DC Distribution Cabinet (584641000 List AL and List CL)



DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

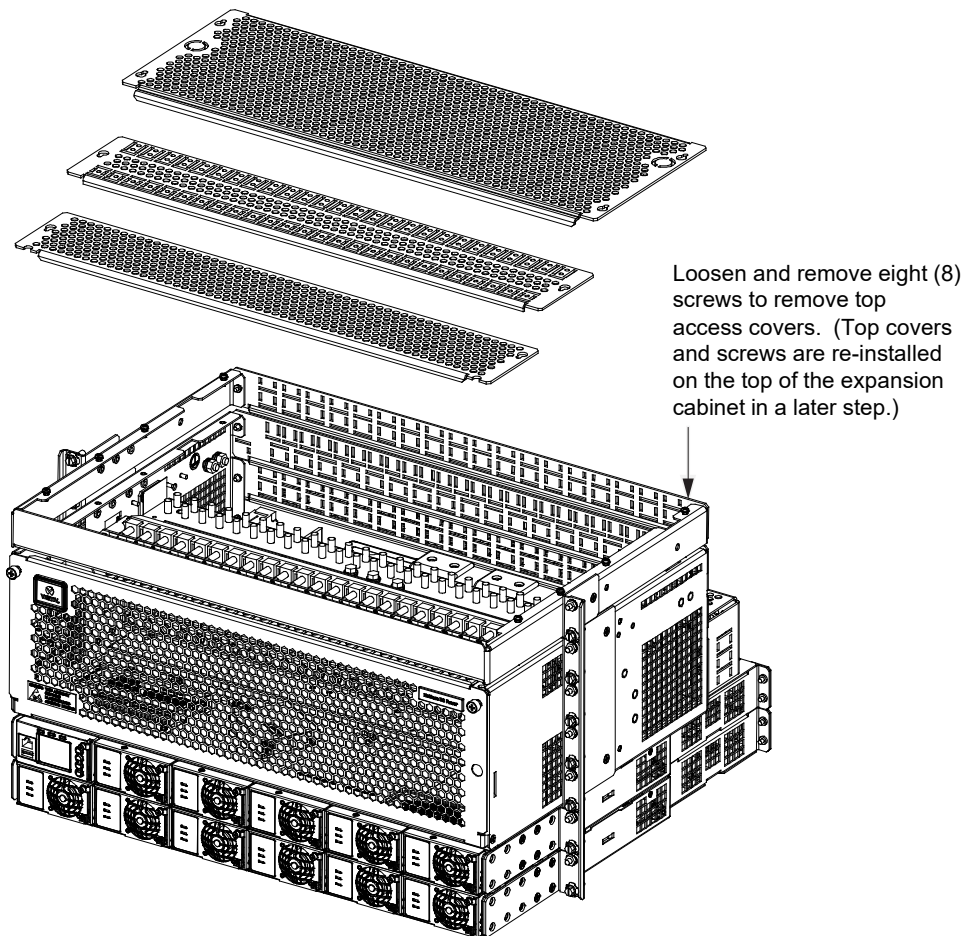
Procedure



NOTE! Refer to Figure 10.16 to Figure 10.20 as this procedure is performed.

1. Remove the existing DC distribution cabinet’s three (3) top access covers by removing the eight (8) screws shown in Figure 10.16. Carefully remove the screws making sure they do not drop inside the distribution cabinet. Set aside the top access covers and hardware for later re-installation onto the top of the expansion DC distribution cabinet.

Figure 10.16 Installing a Field Expansion DC Distribution Cabinet, Remove Top Panels



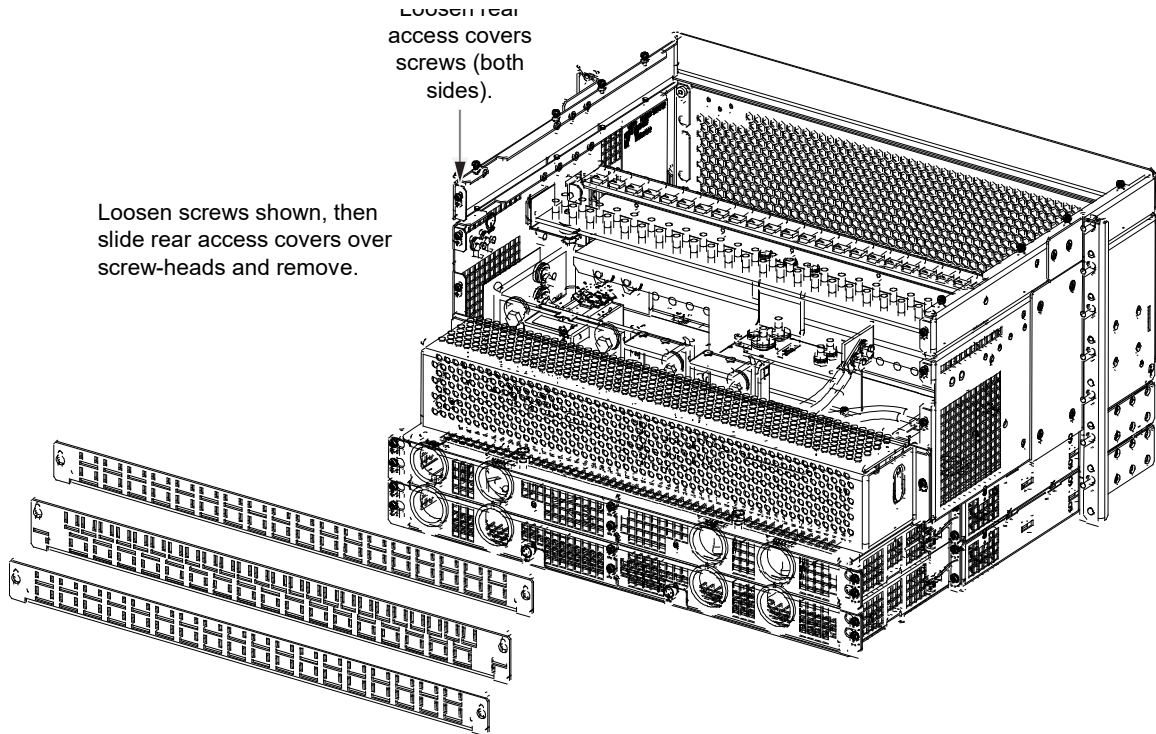
2. Remove the existing DC distribution cabinet’s upper two (2) rear access covers by loosening (but do not remove) the four (4) screws shown in Figure 10.17. Remove the upper access covers and set aside for later re-installation.

Remove the expansion DC distribution cabinet’s upper two (2) rear access covers in the same way and set aside for later re-installation.

- Remove the 1RU wiring space panel's rear cover on the existing DC distribution cabinet by loosening (but do not remove) the two (2) screws shown in Figure 10.17. Remove the rear access cover and set aside for later re-installation.

Remove the 1RU wiring space panel's rear cover on the expansion DC distribution cabinet in the same way and set aside for later re-installation.

Figure 10.17 Installing a Field Expansion DC Distribution Cabinet, Remove Rear Panels

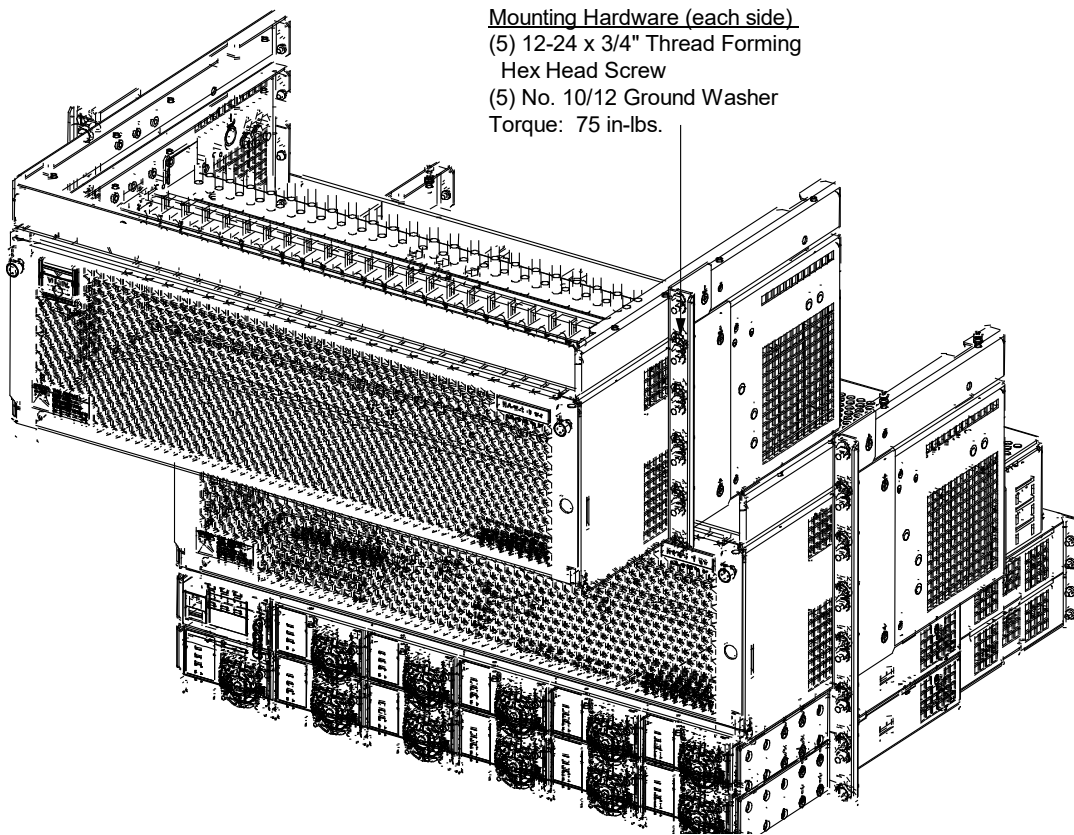


- Install one (1) expansion DC distribution cabinet directly above the existing system in the rack as shown in Figure 10.18. Customer must provide mounting hardware.



NOTE! Install (orient) the ground washers so the teeth dig into the mounting angles for a secure ground connection.

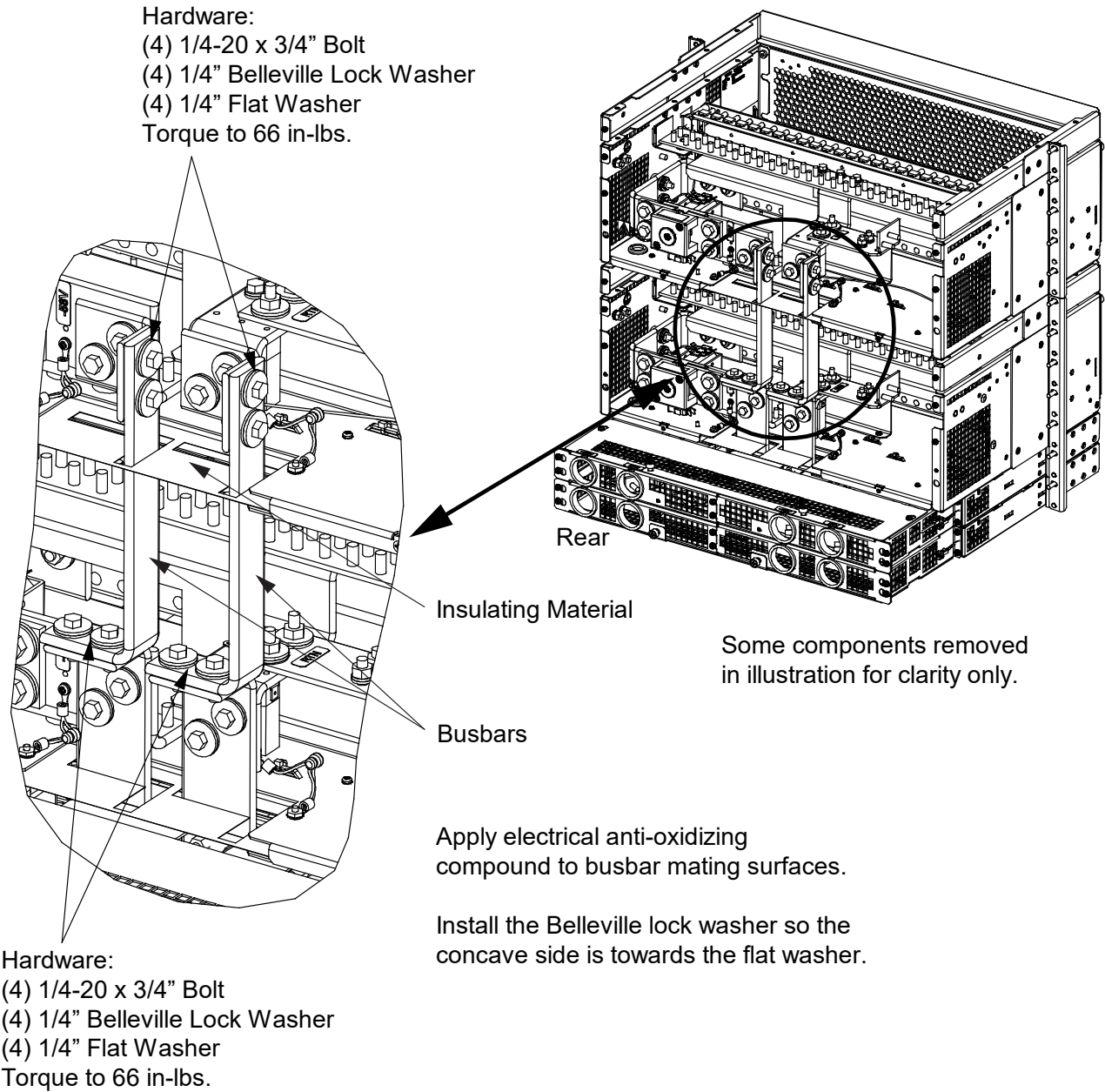
Figure 10.18 Installing a Field Expansion DC Distribution Cabinet, Install Cabinet



NOTE! Apply electrical anti-oxidizing compound to busbar mating surfaces before performing the next step.

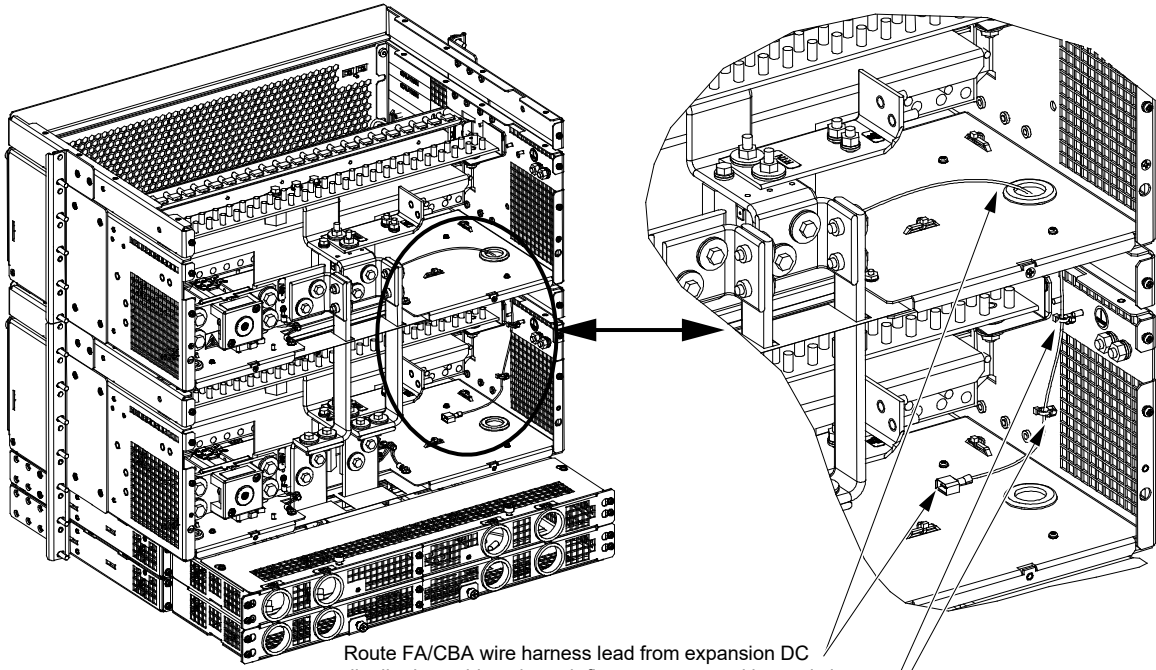
5. Install the busbars provided with the expansion DC distribution cabinet between the -58V and return busbars on the existing DC distribution cabinet and the -58V and return busbars on the expansion DC distribution cabinet. To install, slide the busbars up from the existing DC distribution cabinet through slit in gasket in the expansion DC distribution cabinet. See Figure 10.19. Hardware provided with the expansion DC distribution cabinet. Torque hardware as indicate in Figure 10.19.

Figure 10.19 Installing a Field Expansion DCs Distribution Cabinet, Install Busbars



6. Route FA/CBA wire harness lead from expansion DC distribution cabinet through floor grommet and into existing DC distribution cabinet. Connect to faston connector in existing DC distribution cabinet labeled "SYSFA_ROW2". See Figure 10.20.
7. Install cable tie mounts to wall in existing DC distribution cabinet. Dress alarm cable along wall and secure to cable tie mounts with provided cable ties. See Figure 10.20.

Figure 10.20 Installing a Field Expansion DC Distribution Cabinet, Routing FA/CBA Wire Harness



Route FA/CBA wire harness lead from expansion DC distribution cabinet through floor grommet and into existing DC distribution cabinet. Connect to faston connector in existing DC distribution cabinet labeled "SYSFA_ROW2".

Some components removed in illustration for clarity only.

Install cable tie mounts to wall in existing DC distribution cabinet. Dress alarm cable along wall and secure to cable tie mounts with provided cable ties.

8. Replace the rear access covers to the existing and expansion DC distribution cabinets and 1 RU wiring panels by orienting the access covers over their mounted position and sliding the keyhole slots in the covers over the screw-heads, as shown in Figure 10.17. Tighten the screws to 9.6 in-lbs.
9. Secure the top access covers that were removed from the existing DC distribution cabinet to the expansion DC distribution cabinet by orienting the access covers over their mounted position and sliding the keyhole slots in the covers over the screw-heads, as shown in Figure 10.16. Tighten the screws to 9.6 in-lbs.
10. Refer to "Installing Circuit Breakers and Fuses" on page 7 and install distribution devices into the expansion DC distribution cabinet.
11. Refer to "Load Connections" on page 31 and connect load leads to the expansion DC distribution cabinet.

10.5 Field Installation of Load Disconnect Contactor Remote Driver Jumper (P/N 60067965)

Included with Spec. No. 58464100002, 58464100004, and 584641000CL is a load disconnect contactor remote driver jumper (P/N 60067965). This jumper allows the load disconnect contactor circuit in a Spec. No. 58464100002, 58464100004, and 584641000CL to be controlled by a remote Vertiv™ NetSure™ -48 VDC power system.



DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

Procedure



NOTE! Refer to Figure 10.21 to Figure 10.23 as this procedure is performed.



NOTE! When the remote -48 VDC power system is a Vertiv™ NetSure™ 512, jumper P/N 60031372 must be ordered separately. This jumper is to be field installed to the main wire harness (P/N 555358) in the Vertiv™ NetSure™ 512 power system.

1. Vertiv™ NetSure™ 512 -48 VDC Power System: Connect jumper P/N 60031372 to the LVD faston-connectors in the Vertiv™ NetSure™ 512 -48 VDC Power System. Connect jumper (60067965) to jumper (60031372). See Figure 10.21.
2. Vertiv™ NetSure™ 5100 -48 VDC Power System: Connect jumper P/N 60067965 to the 4-position LVD connector in the Vertiv™ NetSure™ 5100 -48 VDC Power System. See Figure 10.22.
3. Vertiv™ NetSure™ 7100 -48 VDC Power System: Connect jumper P/N 60067965 to the 4-position LVD connector in the Vertiv™ NetSure™ 7100 -48 VDC Power System. See Figure 10.23.

Figure 10.21 -48 VDC Power System Connection, Spec. No. 582137000

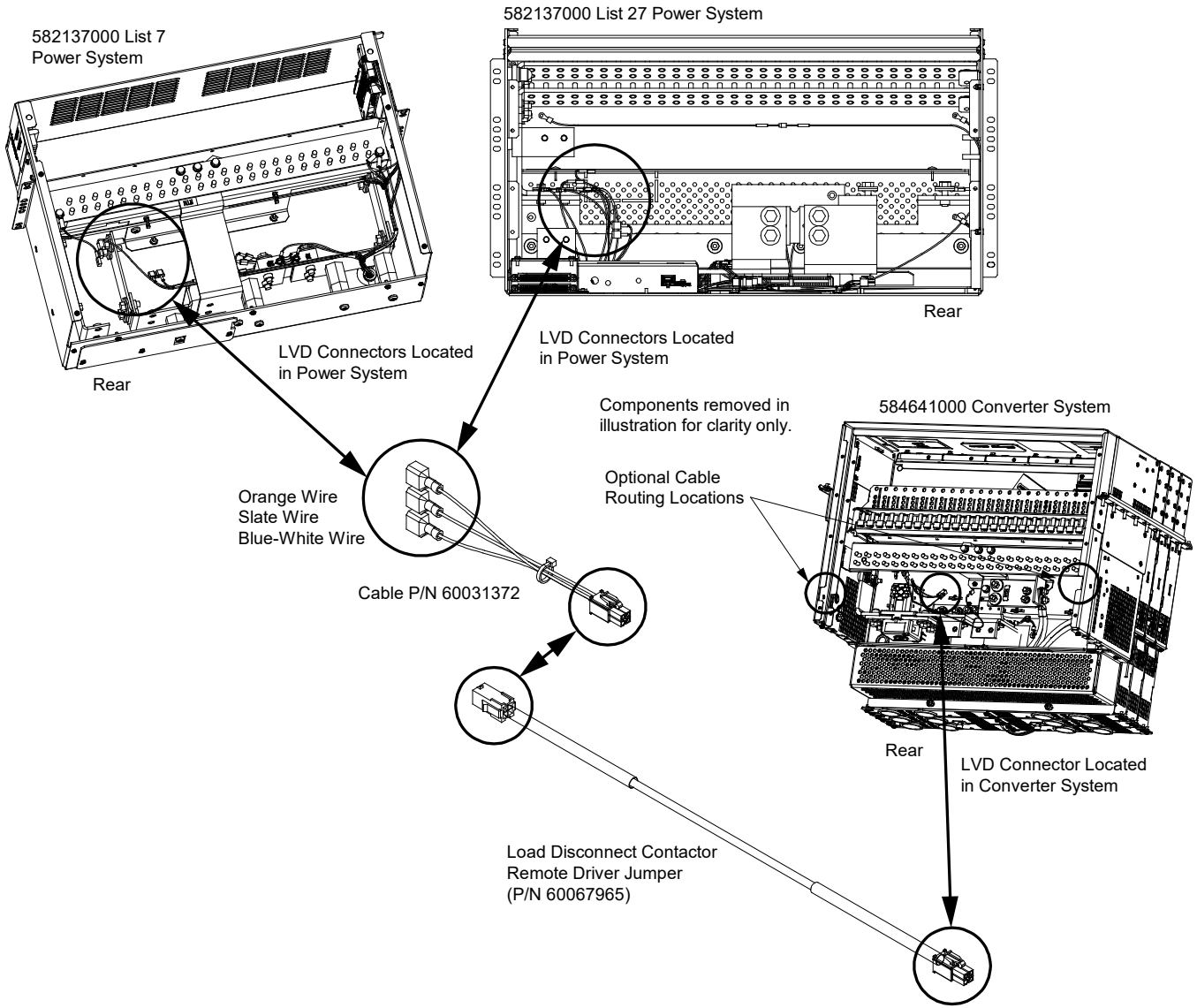


Figure 10.22 -48 VDC Power System Connection, Spec. No. 582137100

582137100 Power System

584641000 Converter System

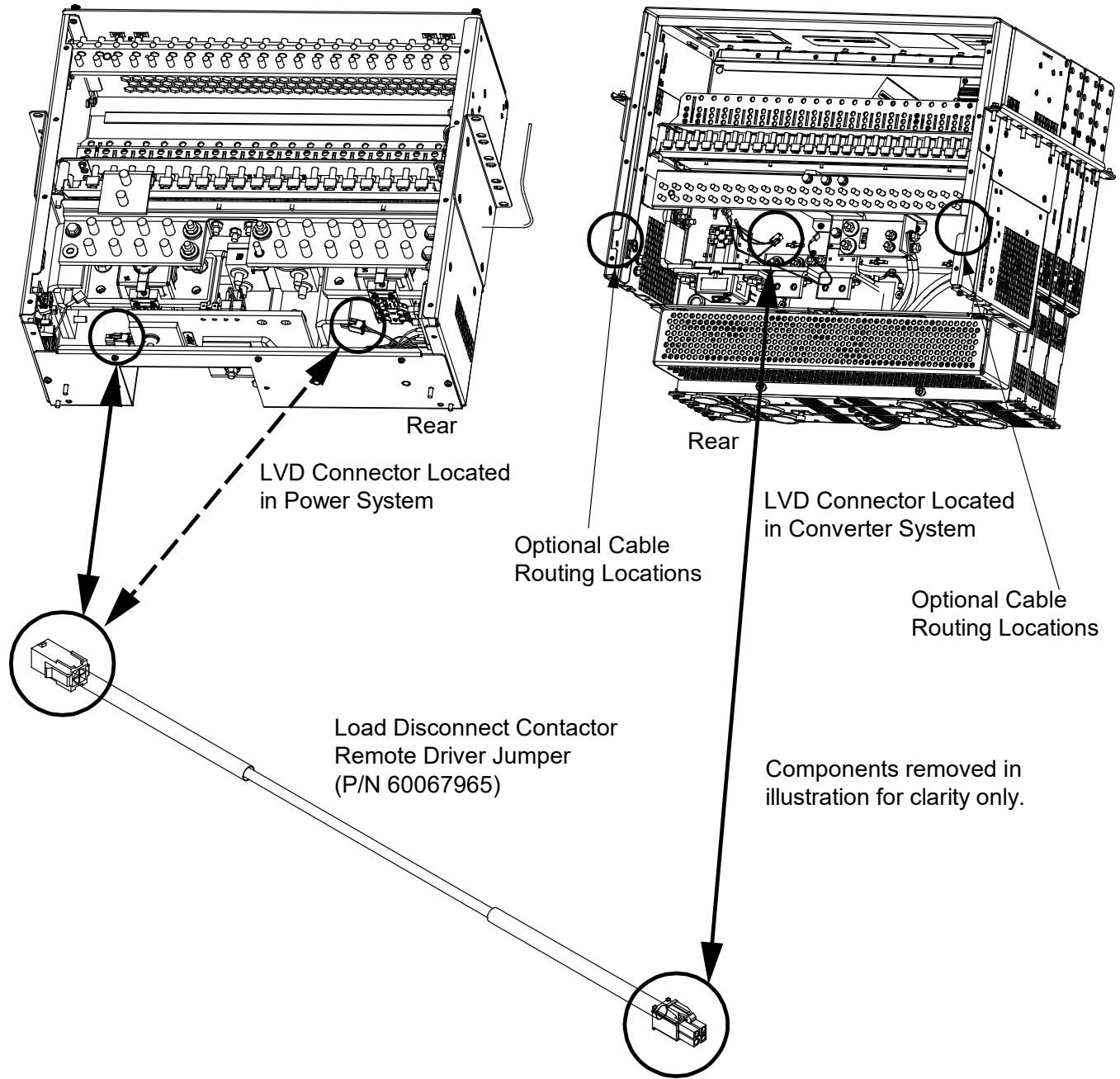
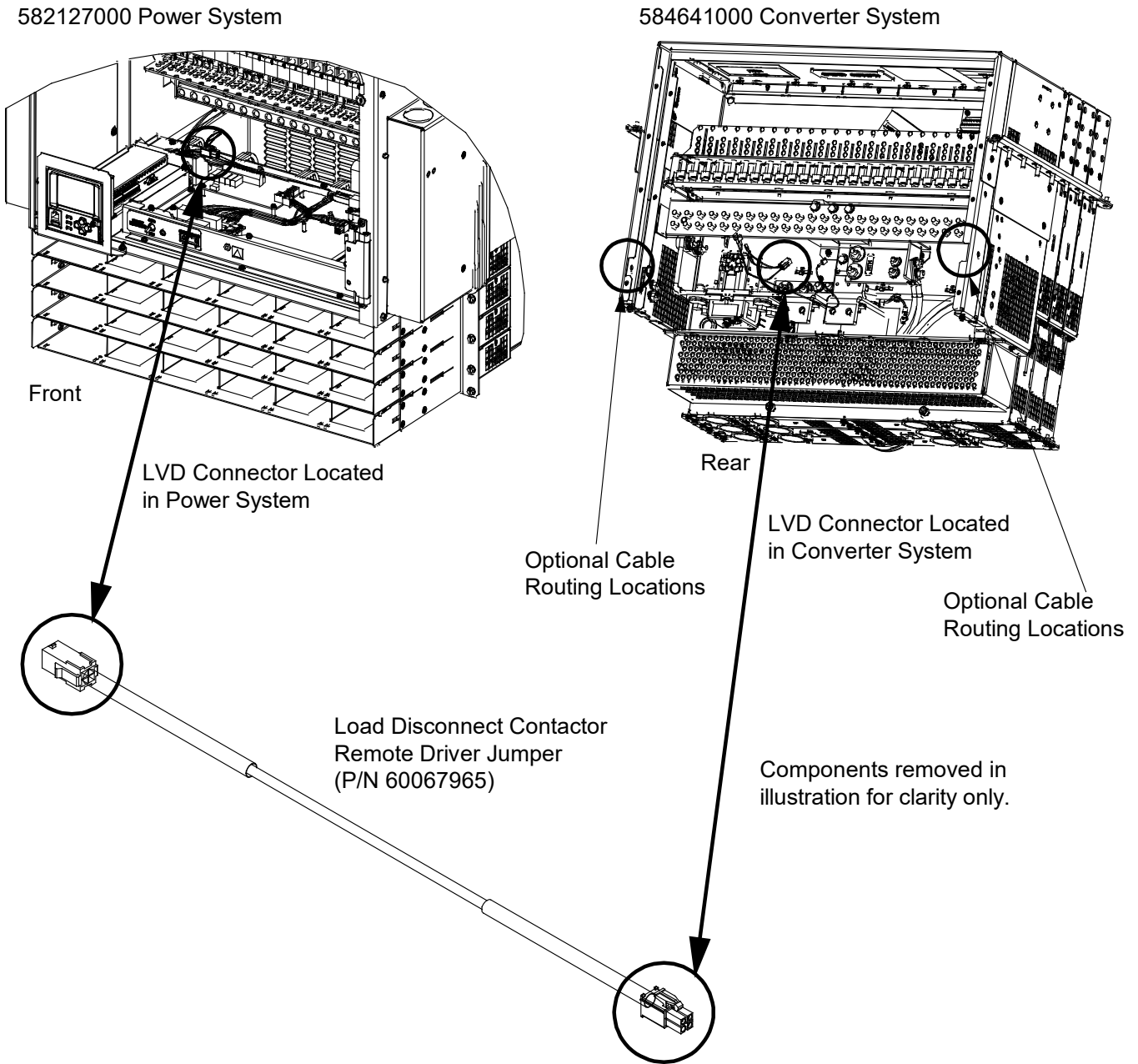
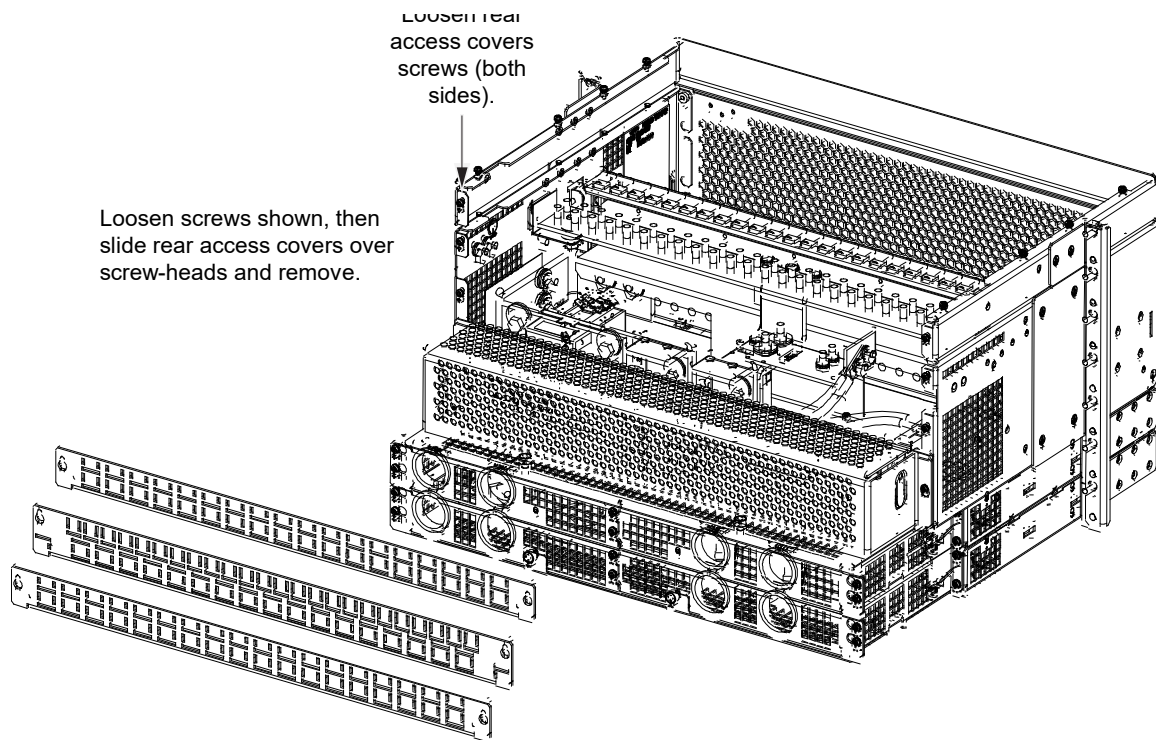


Figure 10.23 -48 VDC Power System Connection, Spec. No. 582127000



4. Route jumper P/N 60067965 from the -48V source power system to the DC-DC converter system.
5. Remove the DC-DC converter system's DC distribution cabinet's upper two (2) rear access covers by loosening (but do not remove) the four (4) screws shown in Figure 10.24. Remove the upper access covers and set aside for later re-installation.
6. Remove the DC-DC converter system's 1RU wiring space panel's rear cover by loosening (but do not remove) the two (2) screws shown in Figure 10.24. Remove the rear access cover and set aside for later re-installation.

Figure 10.24 Remove Rear Panels from DC-DC Converter System



7. Route jumper P/N 60067965 to 4-position load disconnect contactor connector (part of contactor control wire harness). Coil excess jumper P/N 60067965 length in a secure location. See Figure 10.21, Figure 10.22, or Figure 10.23.
8. Replace the rear access covers to the -48 VDC power system's DC distribution cabinets and 1 RU wiring panels by orienting the access covers over their mounted position and sliding the keyhole slots in the covers over the screw-heads, as shown in Figure 10.24. Tighten the screws to 9.6 in-lbs.

10.6 Field Installation of Load Disconnect Contactor Kit, P/N 60082562

Load disconnect contactor kit P/N 60082562 provides a load disconnect contactor (P/N 545468DCP), a load disconnect contactor wiring harness jumper (P/N RPM2300003/1), and a load disconnect contactor remote driver jumper (P/N 60067965).



DANGER! Adhere to the “Important Safety Instructions” starting on page vi.



DANGER! The system must be powered down before performing this procedure.

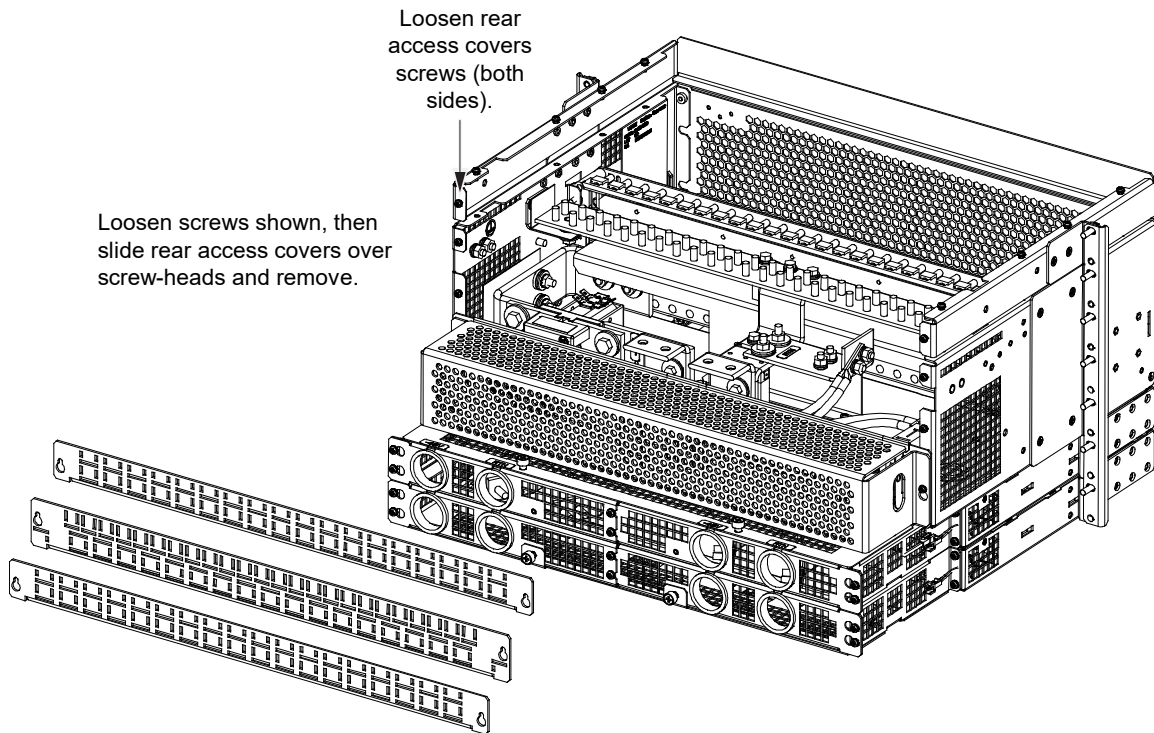
Procedure



NOTE! Refer to Figure 10.25 to Figure 10.27 as this procedure is performed.

1. Remove the DC-DC converter system’s DC distribution cabinet’s upper two (2) rear access covers by loosening (but do not remove) the four (4) screws shown in Figure 10.25. Remove the upper access covers and set aside for later re-installation.
2. Remove the DC-DC converter system’s 1RU wiring space panel’s rear cover by loosening (but do not remove) the two (2) screws shown in Figure 10.25. Remove the rear access cover and set aside for later re-installation.

Figure 10.25 Remove Rear Panels from DC-DC Converter System



3. Remove contactor bypass busbar. See Figure 10.26. Store busbar for possible later reuse if contactor is removed.
4. Assemble the load disconnect contactor wiring harness jumper (P/N RPM2300003/1) to the contactor. See Figure 10.27.
5. Install the contactor. See Figure 10.26.

Figure 10.26 Installing Load Disconnect Contactor

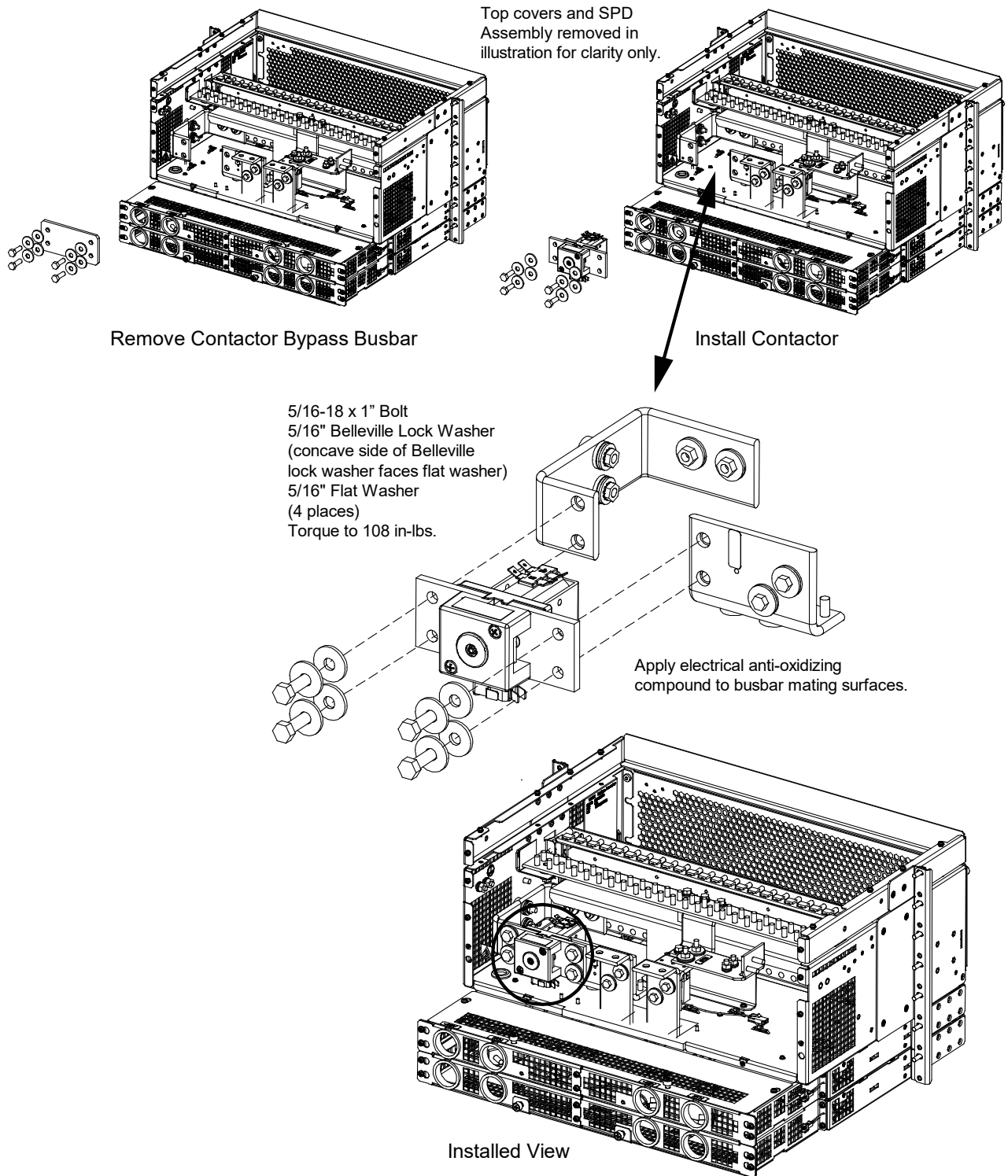
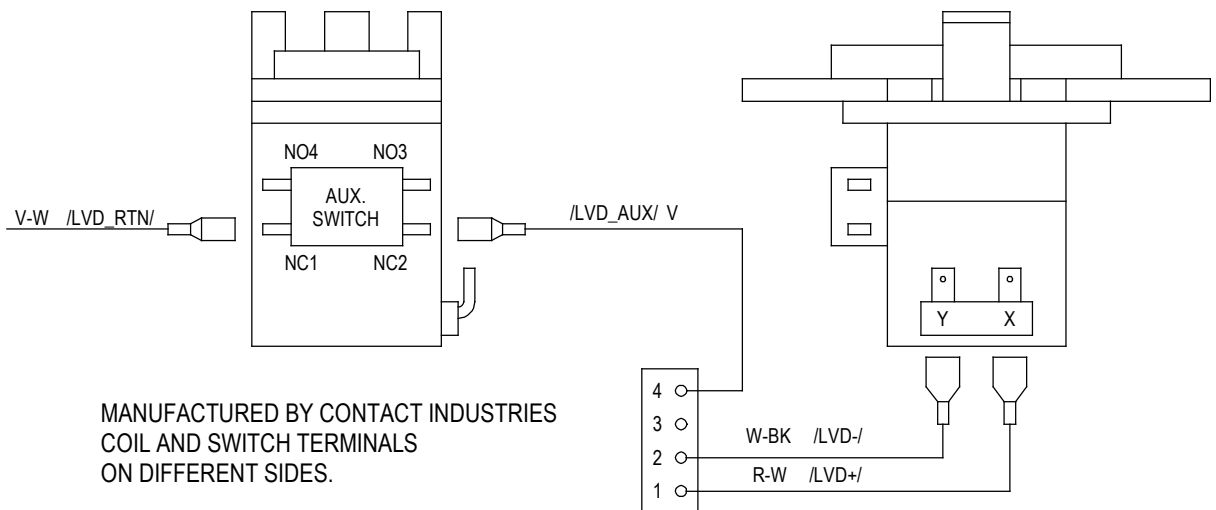
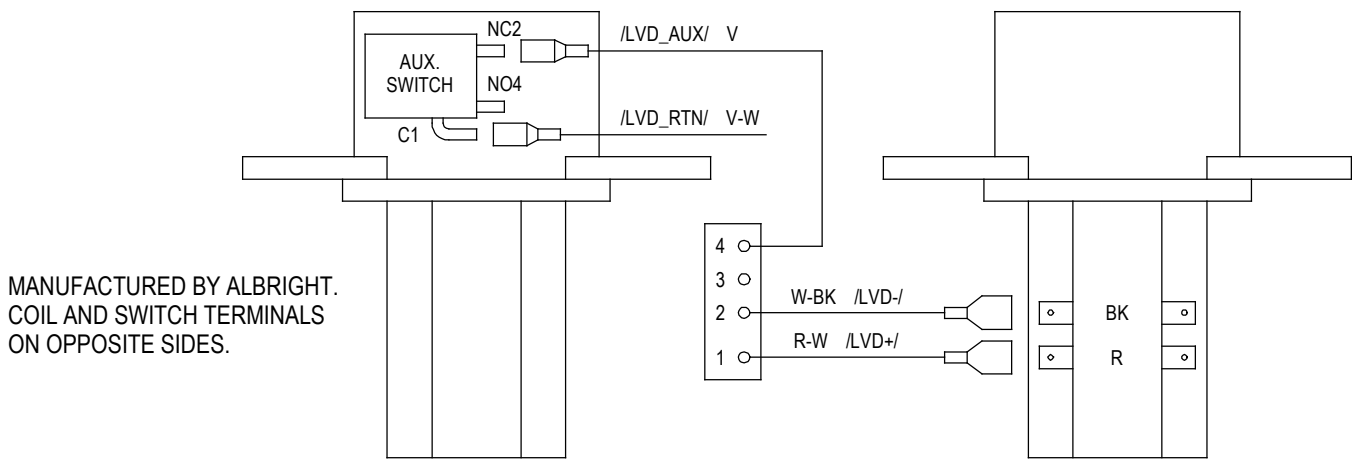
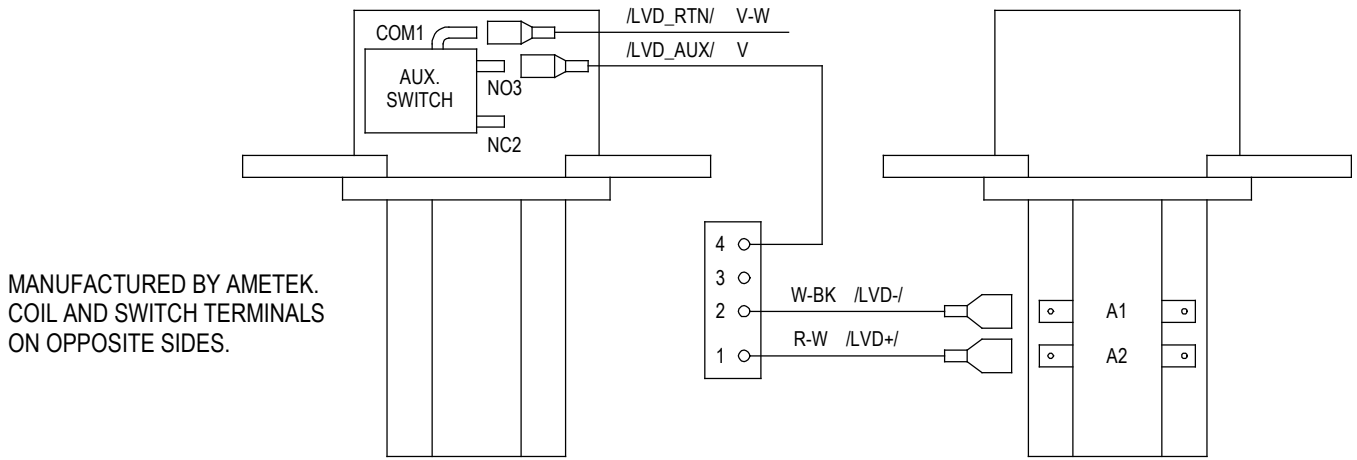


Figure 10.27 Contactor Wiring

LOAD DISCONNECT CONTACTOR CONTROL WIRING



6. Refer to “Field Installation of Load Disconnect Contactor Remote Driver Jumper (P/N 60067965)” on page 59 and install the load disconnect contactor remote driver jumper (P/N 60067965).
7. Replace the rear access covers to the -48 VDC power system’s DC distribution cabinets and 1 RU wiring panels by orienting the access covers over their mounted position and sliding the keyhole slots in the covers over the screw-heads, as shown in Figure 10.25. Tighten the screws to 9.6 in-lbs.

11 Troubleshooting and Repair

11.1 Contact Information

Refer to Section 4.154 (provided with your customer documentation) for support contact information.

11.2 Controller and Converters

For troubleshooting and repair instructions on these units, refer to the following documents.

- NCU Controller Instructions (UM1M830BNA)
- Converter Instructions (UM1C48582000P3)

11.3 Controller Configuration

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

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

11.4 System Troubleshooting Information

This system is designed for ease in troubleshooting and repair. The various indicators as described in “Controller and converters local controls and indicators” on page 40 and in the controller and converter instructions are designed to isolate failure to a specific element. Once the faulty element has been identified, refer to “Replacement Information” on page 68 and “Replacement Procedures” on page 68.

Troubleshooting Alarm Conditions on the Controller

The controller displays alarm conditions as listed in the “Resolving Alarms” section of the controller’s User Manual. Programmable external alarm relays are also available. Refer to “IB2 (controller interface board) connections” on page 23 and the configuration drawing (C-drawing) supplied with your system documentation for your alarm relay configurations.

The controller’s *Active Alarm* and *Alarm History* submenus allow the User to view alarm details. Refer to the NCU Controller Instructions (UM1M830BNA) to access these menus.

Checking the Controller’s Current Limit Point after Adding or Removing a Converter Module

If a converter module is added to the power system, the system current limit point will automatically increase by the percentage each existing converter was set to provide prior to the addition.

If a converter module is removed from the system (and the Conv Comm Fail alarm is reset), the current limit point will remain unchanged unless the capacity of the remaining converters is not sufficient to maintain the present current limit point. If that happens, the current limit point will automatically increase to the maximum (121% of the remaining converters).

It is recommended that the current limit point be checked whenever a converter module is added to or removed from the power system.

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

Refer to the NCU Instructions (UM1M830BNA) for a procedure.

Clearing a Converter Communications Fail Alarm after Removing a Converter

If a converter module is removed from the system, a converter communications failure alarm is generated. If the converter module will not be replaced, the alarm should be cleared. Refer to the NCU Controller Instructions (UM1M830BNA) for a procedure.

Clearing a Converter Lost Alarm

If the controller resets while a converter communications fail alarm is active, the converter communications fail alarm is replaced with an converter lost alarm. Refer to the NCU Controller Instructions (UM1M830BNA) for a procedure to clear the alarm.

11.5 Replacement Information

Replacement Assemblies

When a trouble symptom is localized to a faulty converter module, controller, or system circuit card; that particular device or circuit card should be replaced in its entirety. No attempt should be made to troubleshoot or repair individual components on any converter module, controller, or circuit card. Refer to SAG584641000 (System Application Guide) for replacement part numbers.

11.6 Replacement Procedures



DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

11.6.1 Replacing a converter module

Refer to the Converter Instructions (UM1C48582000P3) for a converter module replacement procedure. Refer also to “System Troubleshooting Information” on page 67.

The converter module being replaced is assigned by the controller the lowest available identification number. If desired, you can change the identification number. Refer to the NCU Controller Instructions (UM1M830BNA) for a procedure.

11.6.2 Replacing the NCU controller

Refer to the NCU Controller Instructions (UM1M830BNA) for a controller replacement procedure.

11.6.3 Replacing a distribution device

General

Replace distribution devices with the same type and rating. Refer to System Application Guide SAG584641000 for part numbers.

Distribution Fuse “Alarm Fuse” Replacement

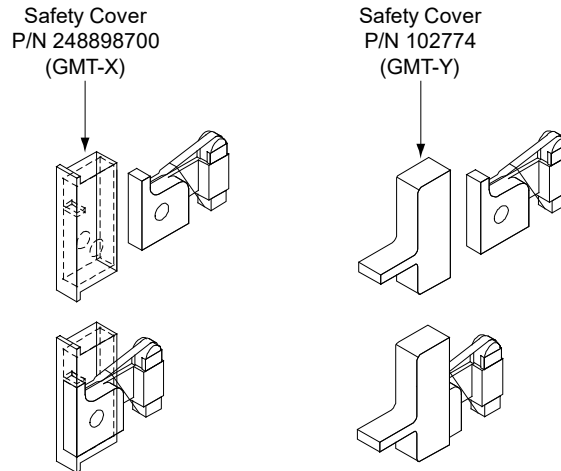
If a distribution fuse opens, the associated alarm fuse opens. Replace the distribution fuse before replacing the alarm fuse.

Procedure

1. An alarm fuse is removed by pulling it straight out of the fuseholder. If the alarm fuse is located in a modular fuse carrier, hold the fuse carrier in place with your thumb while pulling on the alarm fuse to prevent the entire carrier from inadvertently being pulled out.

- Safety fuse covers are provided for all Bussmann GMT type fuses installed in the system. These covers snap onto the fuses and provide protection from exposed electrical terminations when a fuse opens. Ensure that the safety fuse cover is installed after replacing a fuse. Refer to Figure 11.1 for installation details.

Figure 11.1 Installation of Safety Fuse Covers



Replacing a TPS/TLS Fuse

Procedure



NOTE! Refer to Figure 11.2 as this procedure is performed.

- Open the distribution cabinet's front door by loosening the captive fasteners.
- Remove the fuse carrier from the mounted fuseholder body by pulling it straight out.
- Remove the open fuse from the fuse carrier and replace it with the same type and rating.
- Replace the alarm fuse located in the front of the fuse carrier with the same type and rating. Ensure that a plastic safety cover is installed on the alarm fuse.
- Push the fuse carrier securely back into the mounted fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
- Verify no Fuse Alarms are active.
- Close the distribution cabinet's front door and secure by tightening the captive fasteners.

Replacing a Bullet Nose Fuseholder

Procedure

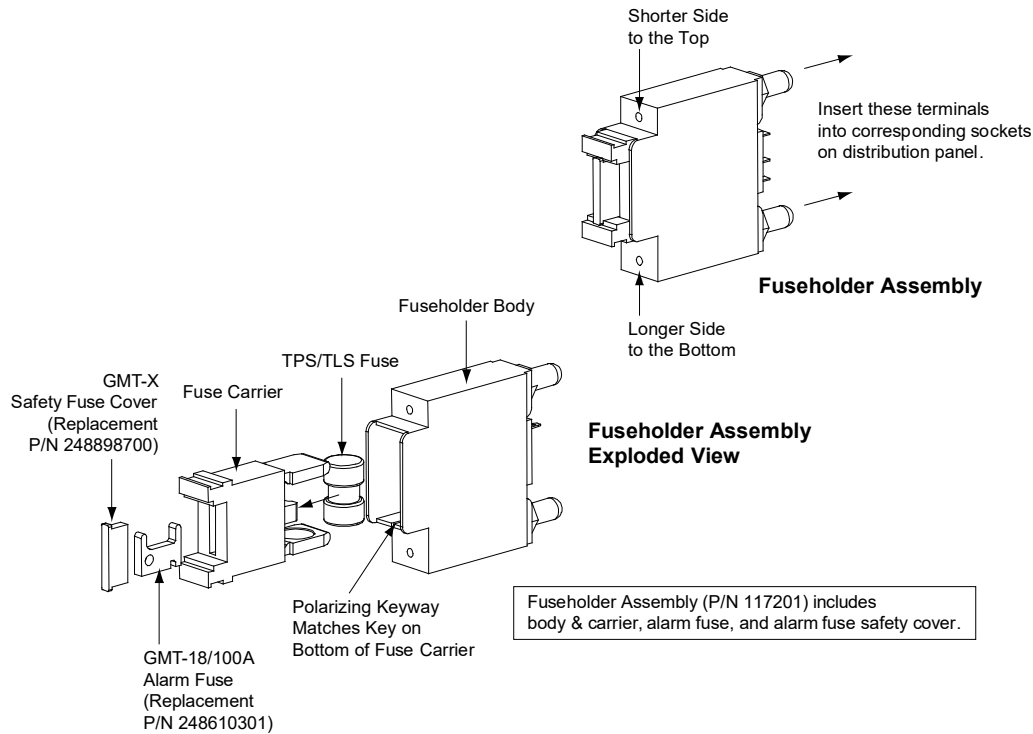


NOTE! Refer to Figure 11.2 as this procedure is performed.

- Open the distribution cabinet's front door by loosening the captive fasteners.
- Remove the fuse carrier from the mounted fuseholder body by pulling it straight out. Hold the fuseholder body while you pull the fuse carrier from the body.

3. Gently rock the defective fuseholder up and down while pulling firmly outward until the fuseholder is free from the distribution panel.
4. Orient the fuseholder as shown in Figure 11.2. 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.
5. Push the fuse carrier securely back into the mounted fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
6. Verify no Fuse Alarms are active.
7. Close the distribution cabinet's front door and secure by tightening the captive fasteners.

Figure 11.2 Replacing a TPS/TLS Fuseholder and/or Fuse



Replacing a Bullet Nose Circuit Breaker

Procedure

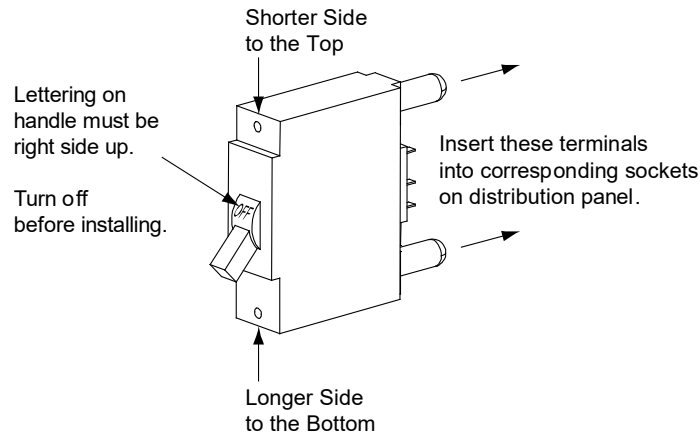


NOTE! Refer to Figure 11.3 as this procedure is performed.

1. Open the distribution cabinet's front door by loosening the captive fasteners.
2. Operate the defective circuit breaker to the OFF position.
3. Gently rock the defective circuit breaker up and down while pulling firmly outward until the breaker is free from the distribution panel.
4. Ensure that the circuit breaker is in the OFF position and is of the correct rating.

5. Orient the circuit breaker as shown in Figure 11.3. 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.
6. Operate the replacement circuit breaker to the ON position.
7. Verify no Circuit Breaker Alarms are active.
8. Close the distribution cabinet's front door and secure by tightening the captive fasteners.

Figure 11.3 Replacing a Bullet Nose Circuit Breaker



Replacing a GJ/218 Circuit Breaker

Procedure



NOTE! Refer to Figure 11.4 as this procedure is performed.

1. Open the distribution cabinet's front door by loosening the captive fasteners.
2. Operate the defective circuit breaker to the OFF position.



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

3. Remove the hardware securing the circuit breaker to the distribution panel and partially remove the circuit breaker.
4. Record each alarm wire located on the back of the circuit breaker (color and location on circuit breaker). Wiring diagrams are provided in Figure 11.4. Carefully disconnect the alarm wiring from the back of the circuit breaker, ensuring the exposed end does not contact any energized circuit.
5. Ensure that the replacement 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. Re-attach the alarm wiring to the back of the circuit breaker as recorded above. Wiring diagrams are provided in Figure 11.4.



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

6. Install the replacement circuit breaker into its mounting position and secure with the hardware previously removed. Torque hardware as indicate in Figure 11.4.

7. Transfer the circuit breaker guard from the old circuit breaker to the new circuit breaker.
8. Operate the replacement circuit breaker to the ON position.
9. Verify no Circuit Breaker Alarms are active.
10. Close the distribution cabinet's front door and secure by tightening the captive fasteners.

Figure 11.4 Replacing a GJ/218 Circuit Breaker (1-Pole) (cont'd on next page)

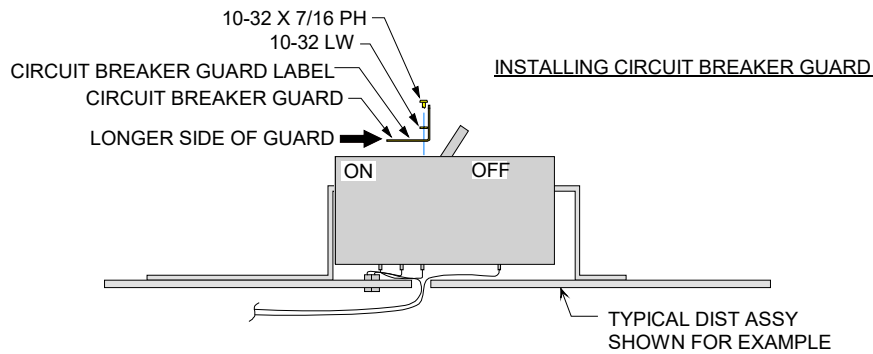
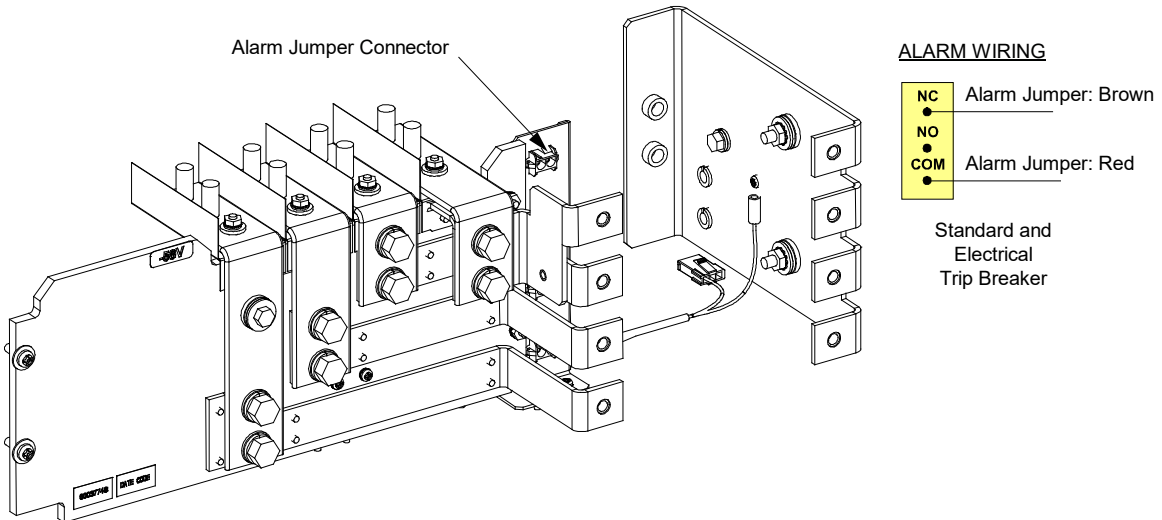
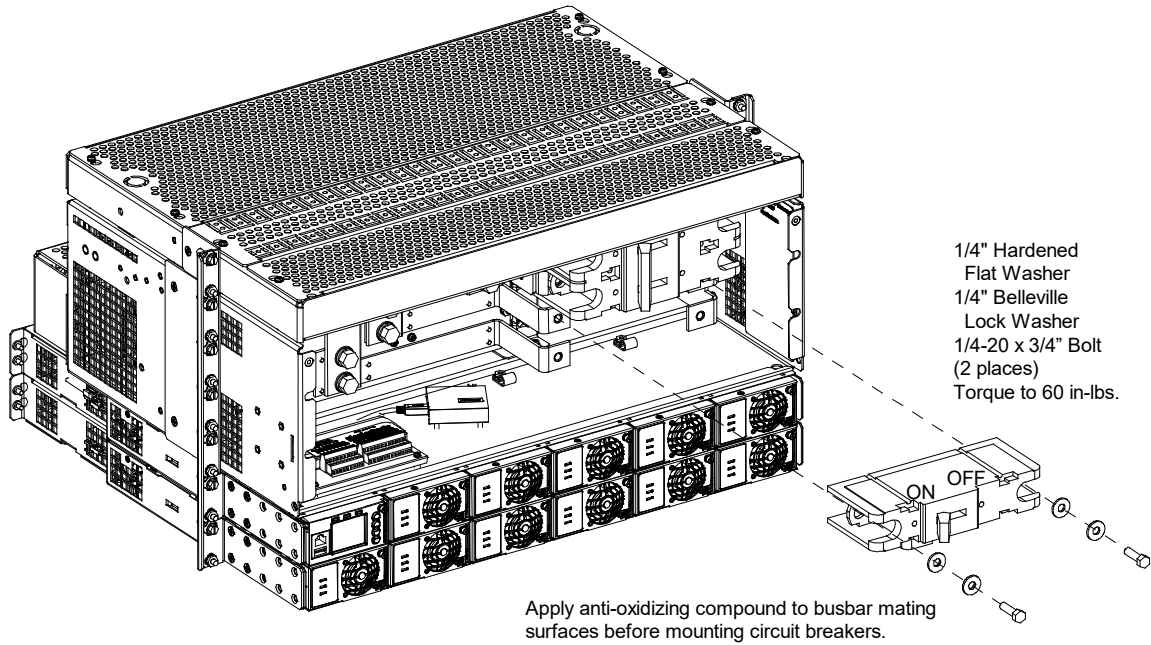
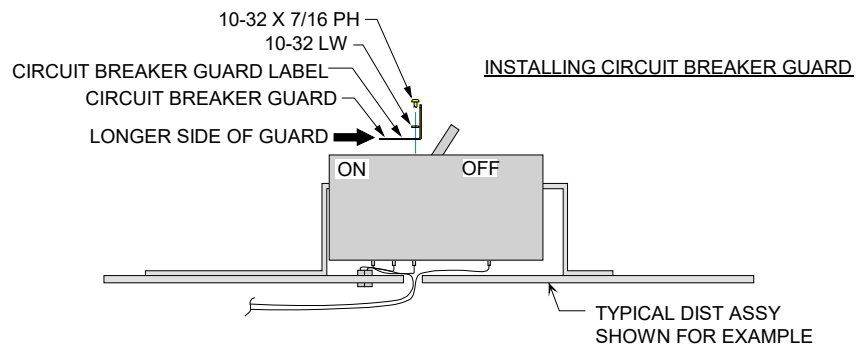
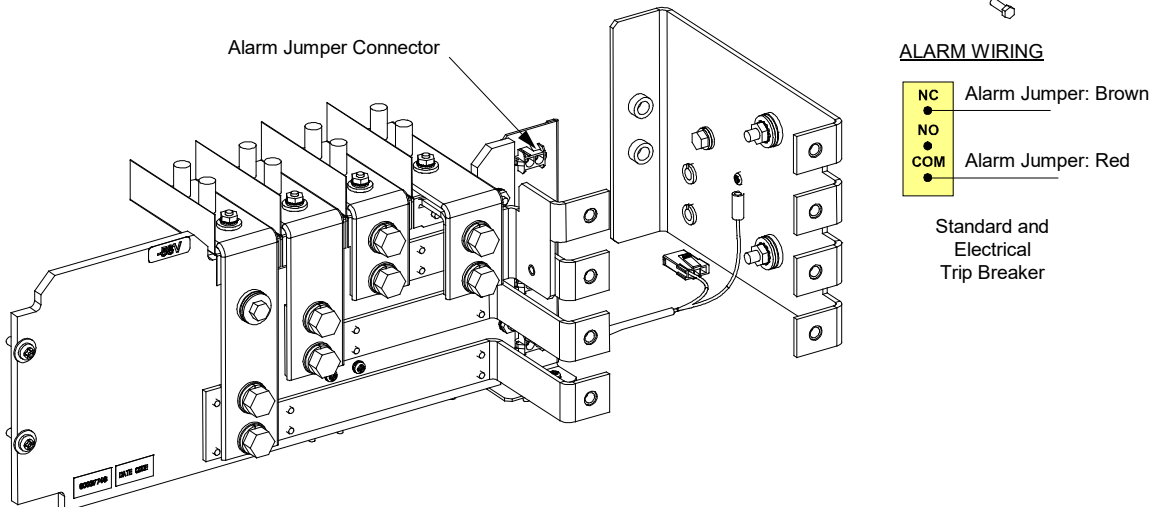
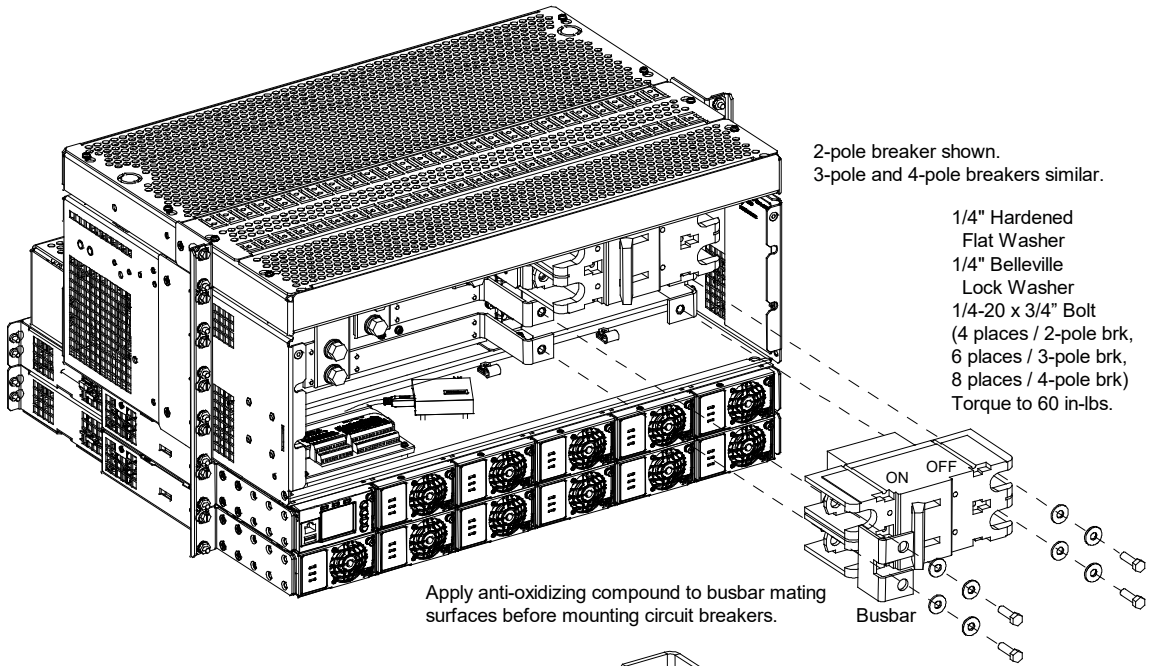


Figure 11.4 Replacing a GJ/218 Circuit Breaker (2-Pole, 3-Pole, 4-Pole) (cont'd from previous page)



11.6.4 Circuit card replacement procedures



ALERT! Circuit cards used in this system contain static-sensitive devices. Refer to Section 4154 (provided with your customer documentation) for “Static Warning” information.

General

The following circuit card replacement procedures can be performed with the system operating.



CAUTION! When performing any step in these procedures that requires removal or installation of hardware, use caution to ensure no hardware is dropped and left inside the cabinet; otherwise, service interruption or equipment damage may occur.



NOTE! When performing any step in these procedures that requires removal of existing hardware, retain all hardware for use in subsequent steps.

System Interface Circuit Card Replacement

Procedure



NOTE! Refer to Figure 11.5 for circuit card location. Refer also to Figure 11.5 as this procedure is performed.

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



DANGER! Performing the next steps exposes service personnel to exposed terminations inside the system shelf. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

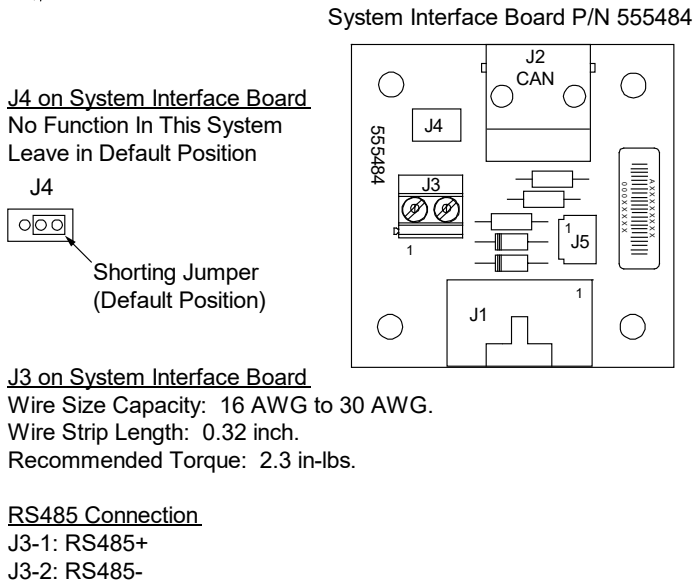
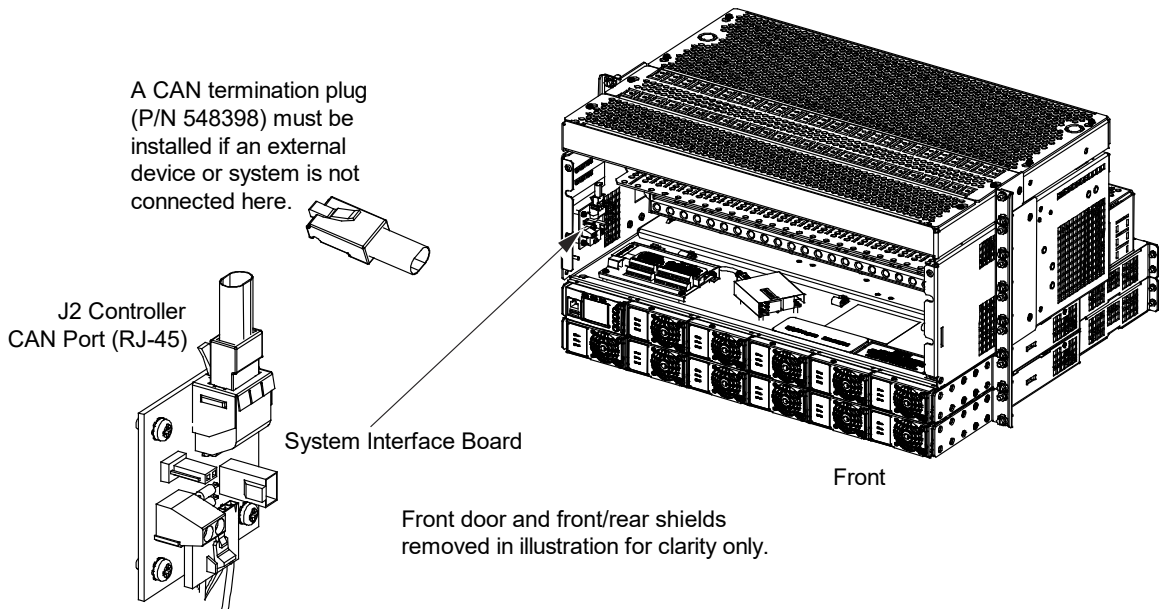


ALERT! Damage to the circuit card may result if the next step is not followed.

2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Open the distribution cabinet's front door by loosening the captive fasteners.
4. Carefully label any wires connected to the customer connection terminal block on the circuit card. These wires must be connected to the same terminals on the replacement circuit card. Refer to Figure 11.5.
5. Carefully label the connectors plugged into the circuit card. These connectors must be plugged into the same connectors on the replacement circuit card.
6. Remove the external wiring from the customer connection terminal block. DO NOT allow the bare wire end to contact any grounded or energized object. Isolate the wire end with electrical tape. Repeat for each wire to be removed.
7. Unplug all connectors plugged into the circuit card.
8. Remove the screws securing the circuit card and remove the circuit card from the distribution cabinet.
9. In this step, ensure you do not intermix the old and replacement circuit cards. Set the shorting jumper on the replacement circuit card to match the location on the old circuit card. Jumper settings are documented in the “Jumper Settings on the System Interface Board” on page 13.
10. Orient the replacement circuit card over its mounting position inside the distribution cabinet, and secure with the screws removed from the old circuit card.
11. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.

12. Reconnect the external wiring to the correct terminals on the customer connection terminal block. First remove the electrical tape that was applied to the bare wire end in a previous step. DO NOT allow the bare wire end to contact any grounded or energized object. After securing the wire, gently tug on the wire to ensure that it cannot be pulled out of the terminal block. Repeat for each wire to be reconnected.
13. Close the distribution cabinet's front door and secure by tightening the captive fasteners.
14. Remove the grounding wrist strap.
15. Enable the external alarms or notify appropriate personnel that this procedure is finished.
16. Ensure that there are no local or remote alarms active on the system.

Figure 11.5 System Interface Board Replacement



IB2 (Controller Interface Board) Replacement

Procedure



NOTE! Refer to Figure 11.6 for circuit card location. Refer also to Figure 11.6 as this procedure is performed.

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



DANGER! Performing the next steps exposes service personnel to exposed terminations inside the system shelf. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.



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

2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Open the distribution cabinet's front door by loosening the captive fasteners.
4. Carefully label the wires connected to the customer connection terminal blocks on the circuit card. These wires must be connected to the same terminals on the replacement circuit card. Refer to Figure 11.6.
5. Carefully label the connectors plugged into the circuit card. These connectors must be plugged into the same connectors on the replacement circuit card. Refer to Figure 11.6.



DANGER! In the next step, external alarm wiring may be energized from an external source. DO NOT allow bare wire ends to contact any grounded or energized object.

6. Remove the external wiring from the customer connection terminal blocks. DO NOT allow the bare wire end to contact any grounded or energized object. Isolate the wire end with electrical tape. Repeat for each wire to be removed.
7. Unplug all connectors plugged into the circuit card.
8. Remove the circuit card (and shield) from the distribution cabinet by removing the screws securing it to the cabinet. Refer to Figure 11.6.
9. In this step, ensure you do not intermix the old and replacement circuit cards. Set the switch on the replacement circuit card to the same setting as the old circuit card. Switch settings are documented in the "Switch Settings on the IB2 (Controller Interface Board)" on page 14.
10. Secure the replacement circuit card (and shield) to the distribution cabinet. Refer to Figure 11.6.
11. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.

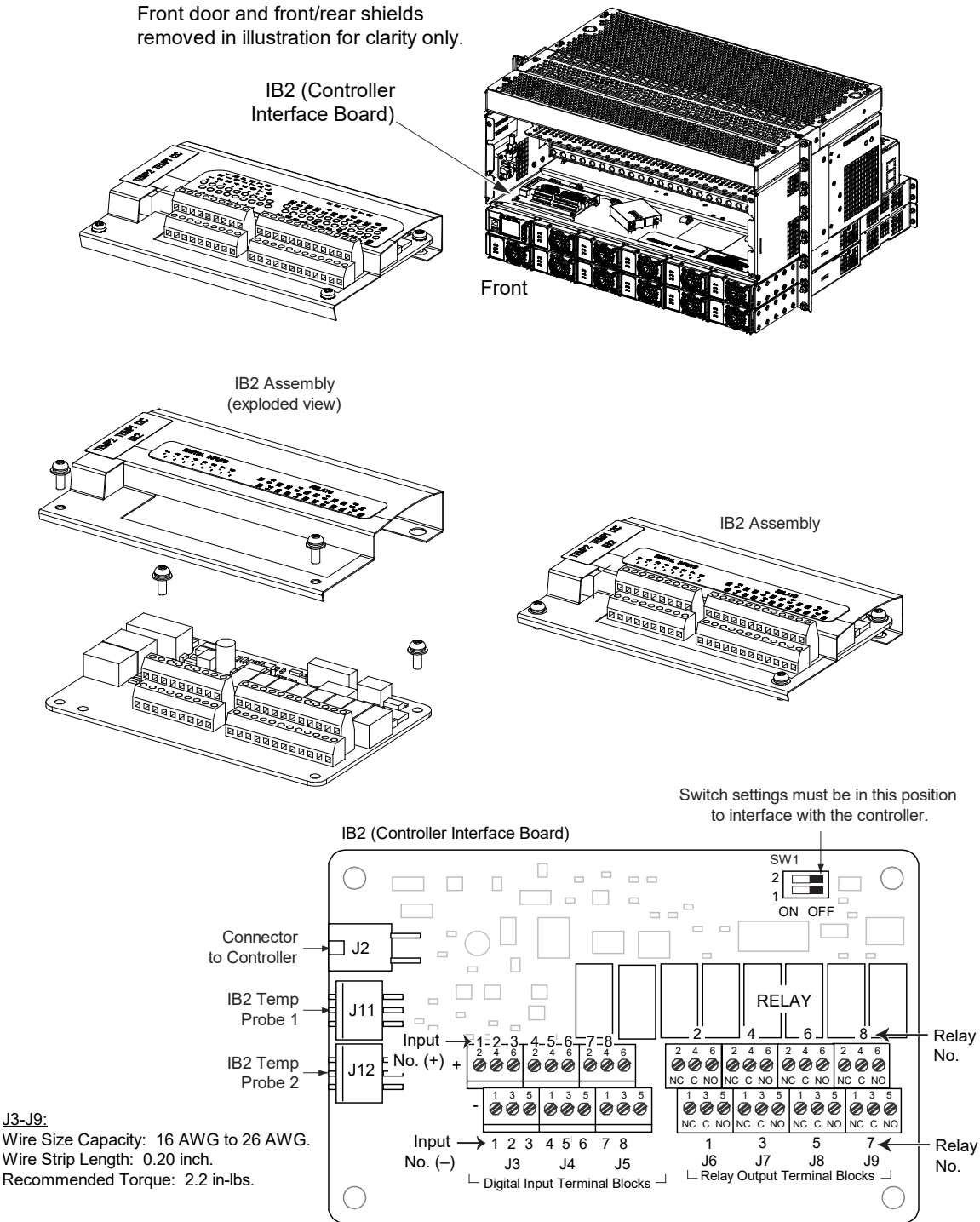


DANGER! In the next step, external alarm wiring may be energized from an external source. DO NOT allow bare wire ends to contact any grounded or energized object.

12. Reconnect the external wiring to the correct terminals on the customer connection terminal block. First remove the electrical tape that was applied to the bare wire end in a previous step. DO NOT allow the bare wire end to contact any grounded or energized object. After securing the wire, gently tug on the wire to ensure that it cannot be pulled out of the terminal block. Repeat for each wire to be reconnected.
13. Close the distribution cabinet's front door and secure by tightening the captive fasteners.
14. Remove the grounding wrist strap.

15. Enable the external alarms or notify appropriate personnel that this procedure is finished.
16. Ensure that there are no local or remote alarms active on the system.

Figure 11.6 IB2 (Controller Interface Board) Replacement



IB4 (Controller Ethernet Port) Board Replacement

Procedure



NOTE! Refer to Figure 11.7 for circuit card location. Refer also to Figure 11.7 as this procedure is performed.

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



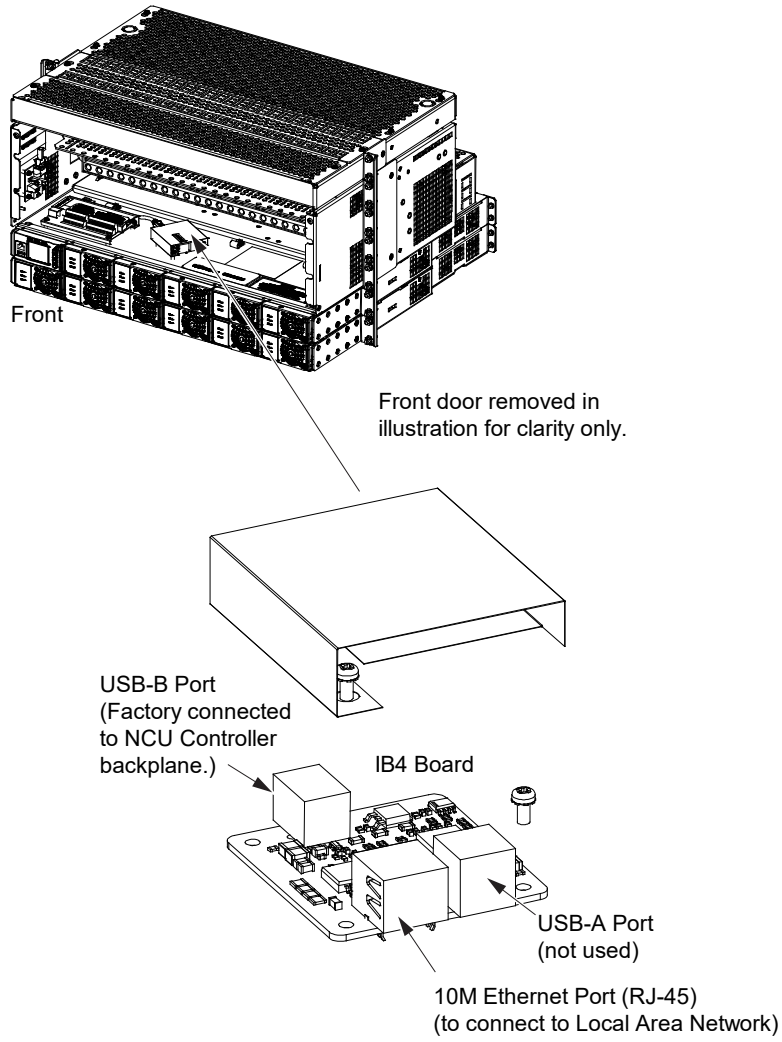
DANGER! Performing the next steps exposes service personnel to exposed terminations inside the system shelf. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.



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

2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Open the distribution cabinet's front door by loosening the captive fasteners.
4. Loosen the captive fastener securing the latch mechanism to the front of the NCU. Pull the latch mechanism away from the NCU (this will retract the latch mechanism located on the bottom of the NCU). This unlocks the NCU from the shelf. Slide the NCU partially out from the shelf.
5. Carefully label the connectors plugged into the IB4 board. These connectors must be plugged into the same connectors on the replacement circuit card. Refer to Figure 11.7.
6. Unplug all connectors plugged into the IB4 board.
7. Remove the IB4 board (and shield) from the distribution cabinet by removing the screws securing it to the cabinet. Refer to Figure 11.7.
8. Orient the replacement IB4 board over its mounting position, and secure with the screws removed from the old circuit card. Refer to Figure 11.7.
9. Plug all connectors removed from the old circuit card into the same position on the replacement IB4 board.
10. Slide the NCU completely into its mounting position. Push the latch mechanism into the front panel of the NCU, and secure by tightening the captive fastener. This locks the NCU securely to the shelf.
11. To verify that the IB4 board is functioning, from the Main Menu on the local display, press the ESC button, then down arrow and verify the IP address 192.168.100.100 is displayed.
12. Close the distribution cabinet's front door and secure by tightening the captive fasteners.
13. Remove the grounding wrist strap.
14. Enable the external alarms or notify appropriate personnel that this procedure is finished.
15. Ensure that there are no local or remote alarms active on the system.

Figure 11.7 IB4 (NCU Controller Second Ethernet Port Board) Replacement



11.6.5 Replacing a load disconnect contactor (if equipped)



DANGER! All sources of DC power must be completely disconnected from this system before performing this procedure. Use a voltmeter to verify no DC voltage is present on the system busbars before proceeding.



NOTE! In the following procedure, before making busbar-to-busbar connections, apply a thin coating of electrical anti-oxidizing compound to the mating surfaces of the busbars.

Procedure



NOTE! Refer to Figure 11.8 as this procedure is performed.

Removing the Contactor

1. Verify all DC power sources are disconnected from the system.
2. Remove the access covers from the rear of the system as required to gain tool access to the contactor to be replaced.
3. Disconnect the wiring to the contactor by unplugging the quick disconnects.
4. Note the orientation of the contactor to ensure the replacement is installed the same way. Unbolt the contactor (4-places) and remove. Save all hardware.

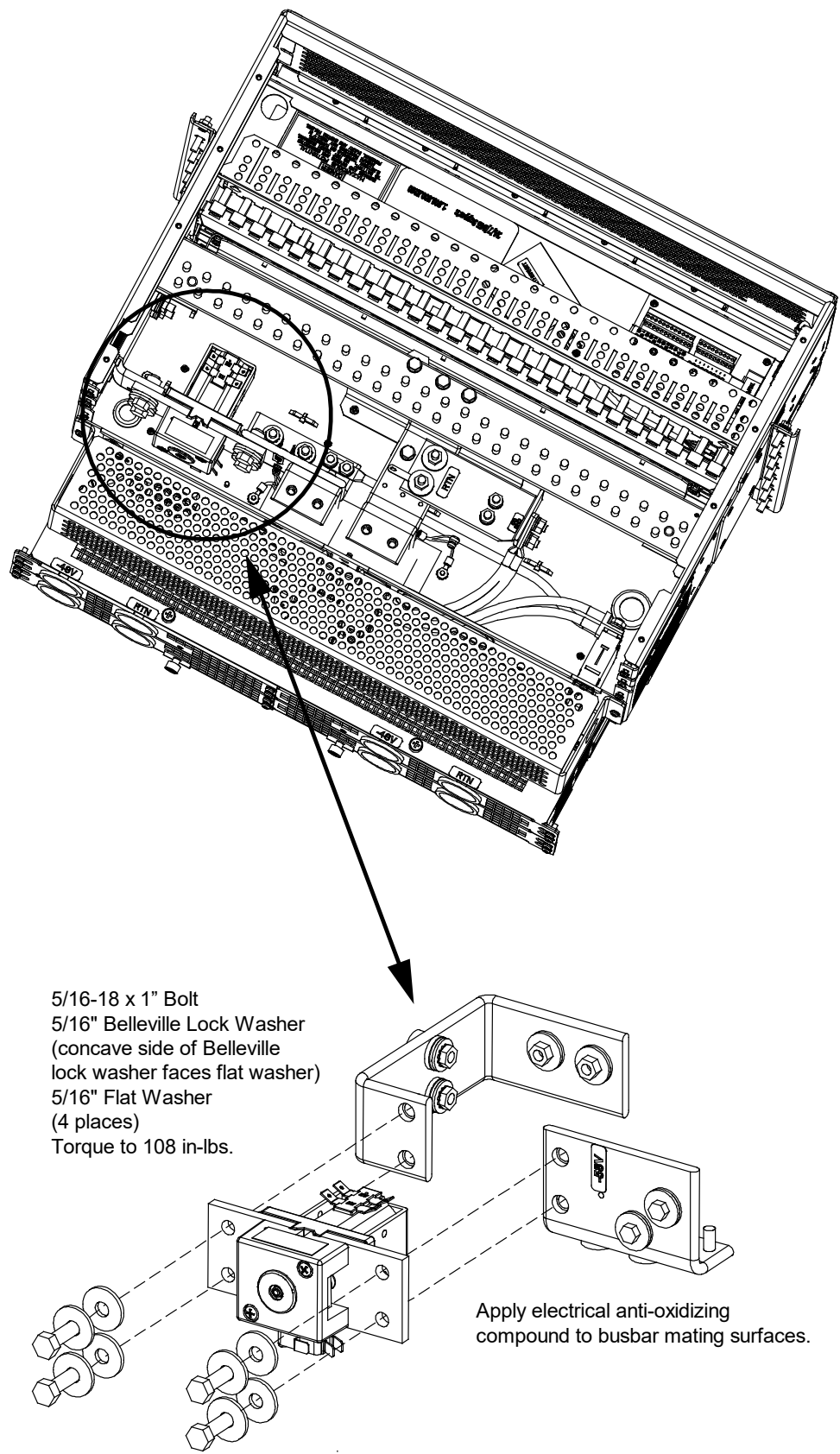
Installing the Replacement Contactor

1. Position the replacement contactor oriented the same way as the old.
2. Secure the contactor with the hardware removed above. Refer to Figure 11.8 for hardware build-up and recommended torque.
3. Replace the wiring to the contactor by plugging-in the quick disconnects. Refer to Figure 10.27 on page 66.
4. Reinstall the rear access covers as required.

Restarting the Power System

1. Reconnect the DC power sources to the system.
2. Start the system. Refer to the separate “Initially Starting, Configuring, and Checking System Operation” on page 35 for a startup procedure.
3. Verify no alarms are active.

Figure 11.8 Replacing a Load Disconnect Contactor (if equipped)



11.6.6 Replacing an SPD (Surge Protection Device)

The system is equipped with two (2) SPD (Surge Protection Device) Assemblies mounted on the rear of the system. Refer to Figure 11.9. Each SPD (Surge Protection Device) Assembly consists of a mounting base and two (2) plug-in SPD modules. The individual SPD plug-in modules can be replaced, as well as the entire base assembly.

SPD Plug-In Module (P/N 10035033) Replacement

Perform the following steps to replace an SPD plug-in module. It is recommended to replace both SPD plug-in modules connected to the same point/polarity, even if only one shows a fault.

Procedure



NOTE! Refer to Figure 11.9 as this procedure is performed.

1. Remove the SPD rear access cover by loosening but not removing the two (2) screws securing it to the system shelf. Remove the SPD rear access cover. Set the SPD rear access cover aside for later re-installation.
2. Check the status indicators on the SPD plug-in modules. If the color of a status indicator has changed from green to red, then that SPD plug-in module is damaged.
3. Locate and turn OFF the circuit breaker (CB1) connected to the SPD Assembly being replaced. See Figure 11.9.
4. Locate the defective SPD plug-in module.
5. Using a small flat-blade screwdriver, pop-out the defective SPD plug-in module from the mounting base. See Figure 11.9.
6. Orient the replacement SPD plug-in module over its mounting position and press it into place. See Figure 11.9.
7. Repeat the above steps for any other SPD plug-in module being replaced.
8. Locate and turn ON the circuit breaker (CB1) connected to the SPD Assembly. See Figure 11.9.
9. Verify there are no alarms being generated by the system.
10. Replace the SPD rear access cover by orienting the access cover over its mounted position and sliding the keyhole slots in the cover over the screw-heads. Tighten the screws to 9.6 in-lbs.

SPD Base with Plug-In Modules (P/N 10034885) Replacement

Check SPD mounting base. If the mounting base is damaged, then replace the complete SPD Assembly (mounting base and plug-in modules).

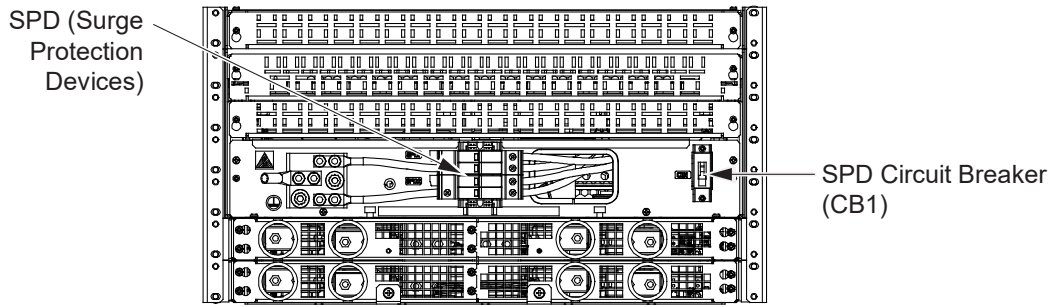
Procedure



NOTE! Refer to Figure 11.9 as this procedure is performed.

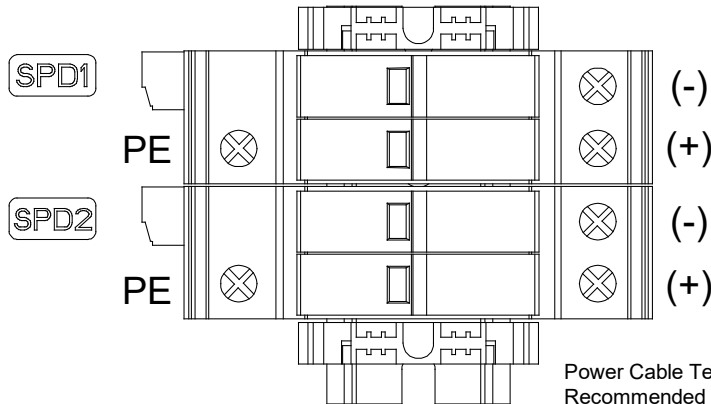
1. Remove the SPD rear access cover by loosening but not removing the two (2) screws securing it to the system shelf. Remove the SPD rear access cover. Set the SPD rear access cover aside for later re-installation.
2. Locate the defective SPD Assembly.
3. Locate and turn OFF the circuit breaker (CB1) connected to the SPD Assembly to be replaced. See Figure 11.9.
4. If not already done, label the power cables (“+”, “-”, and “earth ground”) connected to the defective SPD Assembly.
5. Disconnect the power cables from the “+”, “-”, and “earth ground” terminals of the defective SPD Assembly.
6. Remove the 3-position alarm terminal block half from the defective SPD Assembly. Do not remove the wires from the 3-position alarm terminal block.
7. Using a small flat-blade screwdriver, slide the clip securing the defective SPD Assembly to the DIN rail. Remove the defective SPD Assembly from the DIN rail.
8. Remove the 3-position alarm terminal block half from the replacement SPD Assembly. This will not be used and may be saved.
9. Orient the replacement SPD Assembly on the DIN rail by sliding the fix end into the DIN rail. Using a small flat-blade screwdriver, slide the clip on the other end of the SPD Assembly and snap the SPD Assembly to the DIN rail.
10. Reinsert the existing alarm wiring 3-position terminal block into the replacement SPD Assembly.
11. Reconnect the power cables (“+”, “-”, and “earth ground”) (with wire end ferrules) to the replacement SPD Assembly. The recommended torque is 30 in-lbs.
12. Locate and turn ON the circuit breaker (CB1) connected to the SPD Assembly. See Figure 11.9.
13. Replace the SPD rear access cover by orienting the access cover over its mounted position and sliding the keyhole slots in the cover over the screw-heads. Tighten the screws to 9.6 in-lbs.
14. Verify there are no alarms being generated by the system.

Figure 11.9 SPD Replacement (P/N 10035033 Plug-In Module or P/N 10034885 Mounting Base and Plug-In Modules)



Rear

Rear SPD cover removed in illustration for clarity only.

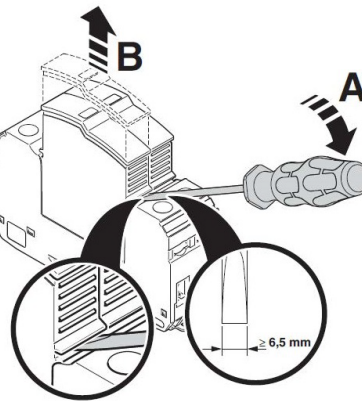


Power Cable Terminals
Recommended Torque: 30 in-lbs.
Alarm Contacts Terminals
Recommended Torque: 2.2 in-lbs.

Snap-Out DC SPD
(Surge Protection
Device) Modules

3-Position Alarm
Terminal Block

SPD Side View



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