



# NetSure™ 5100 Series -48 VDC Power System

## User Manual

Specification Number: 582137100

Model Number: 5100

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### **Technical Support Site**

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

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

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## Admonishments Used in this Document



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



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



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



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



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



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



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

# **Important Safety Instructions**

## **Safety Admonishments Definitions**

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

## **Safety and Regulatory Statements**

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

## **Déclarations de Sécurité et de Réglementation**

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

# 1 Customer Documentation Package

This document (UM582137100) provides *User Instructions* for -48 VDC Power System Model Vertiv™ NetSure™ 5100, Spec. No. 582137100.

The complete Customer Documentation Package consists of...

## **-48 VDC Power System Installation Manual**

- Power System Installation Instructions: IM582137100

## **NCU Controller User Manual**

- NCU Controller User Instructions: UM1M830BNA

## **USB Drive with All Customer Documentation**

- Power System Installation Instructions: IM582137100
- Power System User Instructions: UM582137100
- Power System “System Application Guide”: SAG582137100
- Inverter System “System Application Guide”: SAG584130100
- Module Mounting Assembly Power Data Sheet: PD588705300
- NCU Controller User Instructions: UM1M830BNA
- Rectifier Instructions: UM1R482000E3
- Solar Converter Instructions: UM1S482000E3
- -48 VDC to +24 VDC Converter Instructions: UM1C48241500
- -48 VDC to -58 VDC Converter Instructions: UM1C48582000P3
- Inverter Instructions: UM1I1201000
- Engineering Drawings
- Also provided on the USB drive is a controller configuration drawing and the controller configuration files loaded into the controller as shipped.

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

## 2 System Description

The Power Distribution Center...

- List 20, 25 (One Row Distribution Cabinet) is rated...  
-48 VDC; 400 A at 40 °C.  
-48 VDC; 300 A at 65 °C.
- List 27 (One Row Distribution Cabinet) is rated...  
Charge Ratings:  
-48 VDC; 600 A and +24 VDC; 63 A at 40 °C.  
-48 VDC; 525 A and +24 VDC; 50 A at 65 °C.  
Discharge Ratings:  
-48 VDC; 771 A at 40 °C.  
-48 VDC; 600 A at 65 °C.
- List 21 (Two Row Distribution Cabinet) is rated...  
-48 VDC; 600 A (400 A maximum per row) at 40 °C.  
-48 VDC; 400 A (300 A maximum per row) at 65 °C.
- List 26 (Two Row Distribution Cabinet) is rated...  
-48 VDC; 600 A (400 A maximum per row) and +24 VDC; 400 A or -58 VDC (max.); 340 A (max.) at 40 °C.  
-48 VDC; 400 A (300 A maximum per row) and +24 VDC; 300 A or -58 VDC (max.); 270 A (max.) at 65°C.

The Vertiv™ NetSure™ 5100 DC Power System is an integrated power system containing rectifiers (-48 VDC output), optional solar converters (-48 VDC output), optional converters (+24 VDC output), optional converters (-58 VDC output), optional inverter system (120 VAC output), intelligent control, metering, monitoring, and distribution. This power system is available in configurations for 19" and 23" rack mounting.

This power system is designed to power a load while charging a positive grounded battery. This power system is capable of operating in a batteryless installation or off battery for maintenance purposes. The power system is designed for operation with the positive output grounded.

This system consists of the following components.

### **DC Distribution Cabinet**

The system always includes a distribution cabinet, which provides DC distribution through fuses and/or circuit breakers. The distribution cabinet is factory mounted in the relay rack specified when ordered. Different sizes of distribution cabinets are available to accept from one (1) to two (2) distribution panels. A variety of distribution panels are available that provide load distribution, battery distribution, and dual voltage load distribution for use with -48 VDC to +24 VDC converters and -48 VDC to -58 VDC converters. These distribution panels are configured to accept bullet nose type circuit breakers and TPS/TLS fuseholders. The distribution cabinet may be equipped with low voltage load disconnect (LVLD) and/or low voltage battery disconnect (LVBD) (depending on available configuration options).

### **Controller**

NCU (NetSure Control Unit) Controller: The NCU controller provides power system control (including optional low voltage battery disconnect (LVBD) and low voltage load disconnect (LVLD) control), rectifier control (including a charge control function), solar converter control, -48 VDC to +24 VDC converter control, -48 VDC to -58 VDC converter control, -48 VDC to 120 VAC inverter control, metering functions, monitoring functions, and local/remote alarm functions. The controller also supports rectifier temperature compensation if the system is equipped with a temperature probe(s). Temperature probe(s) may also be designated to monitor ambient temperature and/or battery temperature. The controller also provides data acquisition, system alarm management, and advanced battery and energy 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 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.

### **Module Mounting Assembly**

The system contains one (1) to five (5) module mounting assemblies (depending on system configuration, see SAG582137100), which may house rectifier modules, optional solar converter modules, optional -48 VDC to +24 VDC converter modules, optional -48 VDC to -58 VDC converter modules, and a controller (depending on configuration, see PD588705300). Refer to PD588705300 for additional information.

### **Rectifier Modules**

The system contains rectifier modules, which provide load power, battery float current, and battery recharge current during normal operating conditions. Refer to the Rectifier Instructions (UM1R482000E3) for more information.

### **Optional Solar Converter Modules**

The system may contain solar converter modules (depending on configuration, see SAG582137100), which provide load power, battery float current, and battery recharge current during solar conditions. Refer to the Solar Converter Instructions (UM1S482000E3) for more information.

### **Optional -48 VDC to +24 VDC Converter Modules**

Where +24 VDC load power is also required, converter modules are available (depending on configuration, see SAG582137100). These converters operate from the main -48 VDC system bus to provide +24 VDC load power. Refer to the Converter Instructions (UM1C48241500) for more information.

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

Where -58 VDC load power is also required, converter modules are available. These converters operate from the main -48 VDC system bus to provide -58 VDC load power. Refer to the Converter Instructions (UM1C48582000P3) for more information.

### **Optional Inverter System**

#### 120 VAC @ up to 12 kVA Inverter System

The system contains one or more inverter module mounting shelves and AC distribution.

The inverter system can be set to operate in one of the three input power modes, AC Input Power Mode, DC Input Power Mode, and DC Only Input Power Mode.

- In the AC Input Power Mode, each inverter module operates with the commercial AC input to supply 120 VAC power to the loads. In the event commercial AC power fails or becomes abnormal, the inverter modules immediately transfer operation with the 48 VDC input to power to the inverters.
- In the DC Input Power Mode, each inverter module operates with the 48 VDC input to supply 120 VAC power to the loads. In the event DC power fails or becomes abnormal or an inverter module fails, the inverter module immediately transfers operation with the commercial 120 VAC input to power to the inverters.
- In the DC Only Input Power Mode, each inverter module operates with the 48 VDC input to supply 120 VAC power to the loads. In the event DC power fails or becomes abnormal or an inverter module fails, the inverter module shuts off.

The inverter system contains an EPO (Emergency Power Off) function. Connection points for a normally closed external EPO switch are provided on the customer interface board. If an external EPO switch is wired to the customer interface board, activating the switch to open the circuit activates the EPO function. The EPO function shuts down and locks out the inverters. When the EPO switch is returned to normal (closed loop), the inverters remain off. The inverters will restart when the AC and DC power inputs are removed and restored after 30 seconds or more (until the LEDs on the modules extinguish) (depending on the synchronizing time with the system). (Note that there is an EPO shorting link factory installed that can be replaced with a customer provided switch.)

This inverter system consists of the following components. Note the ratings are not only determined by the maximum number of inverters the system can be provided with, but also the rating of the AC distribution panel. The overall system rating cannot exceed the AC distribution panel rating.

- **Inverter Module Mounting Shelf(s)**  
The inverter system consists of one or more inverter module mounting shelves, depending on power rating. The inverter module mounting shelves house the inverter modules.
- **Inverter Modules**  
The inverter system contains 1 kVA/1 kW inverter modules (1 kVA at 40 °C and 0.5 kVA at 65 °C), supplying 120 VAC power from a commercial AC power source or from a 48 VDC input. Refer to the Inverter Instructions (UM111201000) for more information.
- **AC Load Distribution Shelf**  
The inverter system consists of one or more AC load distribution shelves, depending on power rating. A choice of a bulk output AC load distribution shelf or a NEMA receptacle output AC load distribution shelf is provided.

## 3 Operating Procedures

### 3.1 Rectifiers, Solar Converters, -48 VDC to +24 VDC Converters, -48 VDC to -58 VDC Converters, Inverters, and Controller

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

- Rectifier Instructions (UM1R482000E3)
- Solar Converter Instructions (UM1S482000E3)
- -48 VDC to +24 VDC Converter Instructions (UM1C48241500)
- -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3)
- Inverter Instructions (UM111201000)
- NCU Controller Instructions (UM1M830BNA)



**NOTE!** The controller's default "User Name" is "admin" and the default "Password" is "640275".

### 3.2 Solar Mode

#### Description

You have the option to set the system for solar mode (RECT-SOLAR or SOLAR) or to disable solar mode.

**RECT-SOLAR:** If you have both rectifiers and solar converters in the system, set Solar Mode to "RECT-SOLAR". Also set the "Float Charge Voltage (Solar)" parameter to the desired float setting. The parameter "Float Charge Voltage (Rect)" setting **MUST** be set 0.3 V lower than the "Float Charge Voltage (Solar)" parameter setting for solar converters to operate properly.

**SOLAR:** If you have only solar converters in the system, set Solar Mode to "SOLAR". Also set the "Float Charge Voltage (Solar)" parameter to the desired float setting.

#### Enabling Solar Mode

##### **Local Menu Navigation:**

None.

**Web Menu Navigation:**

Settings / System Tab / Solar Mode / set to “SOLAR” or “RECT-SOLAR” or “Disabled”.



**NOTE!** When solar converters are all installed prior to applying power and starting system, the NCU will NOT communicate with solar converters until SOLAR MODE is enabled.

### 3.3 ESTOP Function

If an ESTOP switch is wired to the IB2-1 Controller Interface Board, customer-furnished system ground applied to terminal DI8+ activates the ESTOP function. The ESTOP function shuts down and locks out the rectifiers and solar converters, shuts down and locks out the optional -48 VDC to +24 VDC converters or optional -48 VDC to -58 VDC converters, shuts down and locks out the inverters (if equipped with optional inverter system), and opens the optional low voltage disconnect (LVD) contactors (battery and load type). If the system has battery connected and does not contain a battery LVD or the controller power option is set to Battery Pwr (jumper J4 on the system interface board is set to Battery Pwr), the controller will remain operational. If the system does not contain battery or load LVD(s) and has battery connected, the loads will be sustained by the battery voltage.

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

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



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

### 3.4 EPO (Emergency Power Off) Function (If Equipped with Optional Inverter System)

The inverter system contains an EPO (Emergency Power Off) function. Connection points for a normally closed external EPO switch are provided on the customer interface board. If an external EPO switch is wired to the customer interface board, activating the switch to open the circuit activates the EPO function. The EPO function shuts down and locks out the inverters. When the EPO switch is returned to normal (closed loop), the inverters remain off. The inverters will restart when the AC and DC power inputs are removed and restored after 30 seconds or more (until the LEDs on the modules extinguish) (depending on the synchronizing time with the system). (Note that there is an EPO shorting link factory installed that can be replaced with a customer provided switch.)



**NOTE!** If a customer-furnished method to disconnect the AC and DC power inputs to the system is not provided, the inverters will stay locked OFF until the input power is recycled. If the EPO switch is returned to normal (closed loop) without recycling the input power, the inverters will remain off and have a local alarm visible on the module. The EPO alarm from the controller will extinguish. The controller will not issue an alarm for this condition.



**NOTE!** This inverter system EPO feature is in addition to the ESTOP feature described above. If this EPO is not wired, the inverter system will still respond to the ESTOP feature.

### 3.5 Controller Battery Charge Current Limit Feature

**Functionality:** After a failure of the input source (commercial AC or DC) or when some battery cells are permanently damaged, the current to the batteries can be quite extensive. To avoid overheating or further damages to the battery, the controller can be programmed to limit the battery current to a preset level by limiting the charging voltage of the rectifiers and solar converters. Should the battery current still exceed a higher preset value, an alarm is issued.

The controller limits the current going to the batteries based on the “Battery Current Limit” set point which is a percentage of the battery capacity in C10. For example, 0.1C10 would mean 10% of the battery capacity. If the C10 capacity of a battery is 100 amp-hr, the battery recharge current limiting setpoint is 0.1C10; therefore, the recharge current is limited to 10 A.

Refer to the NCU Controller Instructions (UM1M830BNA) to program this feature. Battery charge current is limited to the value set in the controller, as long as battery voltage is above 47 VDC.

### 3.6 Local Controls and Indicators

#### **General**

Refer to the Controller, Rectifier, Solar Converter, -48 VDC to +24 VDC Converter or -48 VDC to -58 VDC Converter, and Inverter Instructions for descriptions of the local controls and indicators located on these units.

#### **Optional Critical Alarm Indicator**

The system may be equipped with an optional critical alarm indicator which illuminates if the NCU controller issues a critical alarm. Refer to Figure 3.1.

#### **List KG GMT Load Distribution Fuse Panel**

Refer to Figure 3.2 for indicator locations.

**PWR A and PWR B Indicators:** These indicators illuminate (green) to indicate power is supplied to the A and B sides of the panel, respectively.



**NOTE!** The split (A/B) input bus option provided on this panel is strapped for a single input in this power system.

**FUSE ALARM Indicator:** This indicator illuminates (red) to indicate a load distribution fuse is open. The open fuse also provides a mechanical indicator visible through the fuse safety cover.

#### **Optional Transient Voltage Surge Suppressor (TVSS) Device**

An optional Transient Voltage Surge Suppressor (TVSS) device contains an indicator which illuminates when the circuit activates to suppress voltages. See Figure 3.3.

Figure 3.1 Optional Critical Alarm Indicator

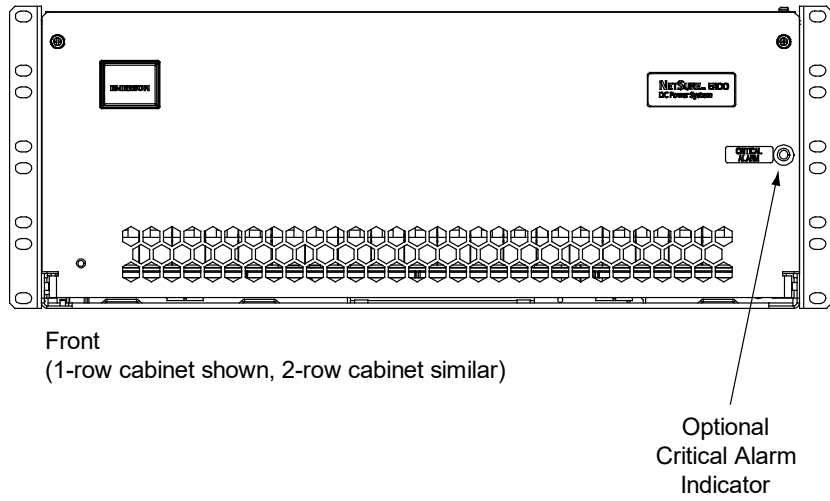


Figure 3.2 Indicator Locations (List KG)

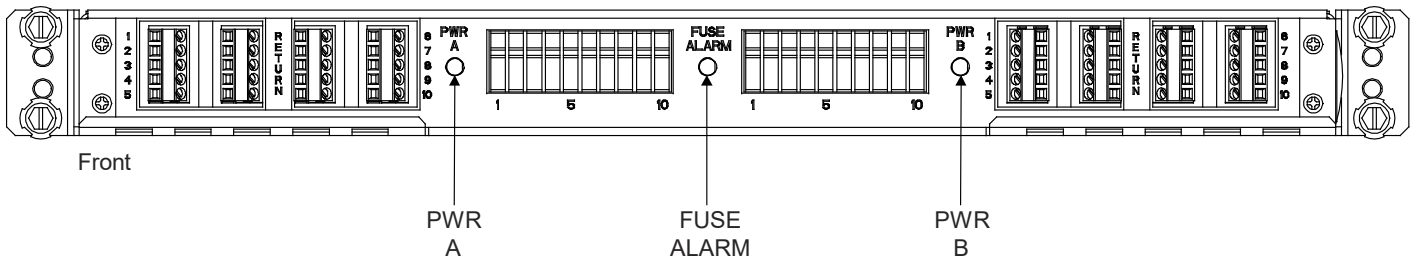
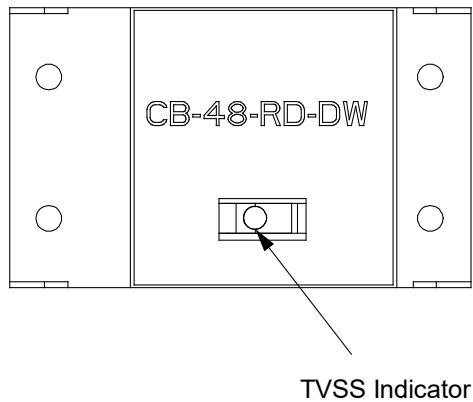


Figure 3.3 Optional Transient Voltage Surge Suppressor (TVSS) Device Indicator



### AC Load Distribution Disconnect Circuit Breakers (if equipped with Optional Inverter System)

The distribution shelf(s) contains front panel AC load distribution disconnect circuit breakers. For the NEMA output AC load distribution shelf, there is a circuit breaker for each outlet. For the bulk output AC load distribution shelf, there is a circuit breaker for each bulk output. See Figure 3.4.

Figure 3.4 AC Load Distribution Disconnect Circuit Breakers (cont'd on next page)

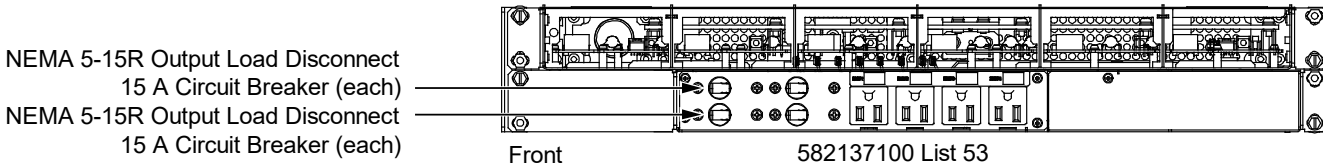
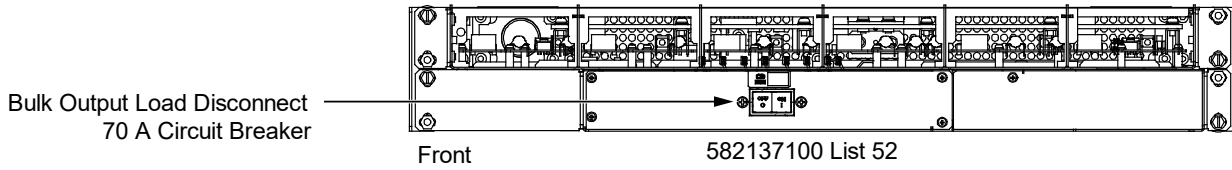
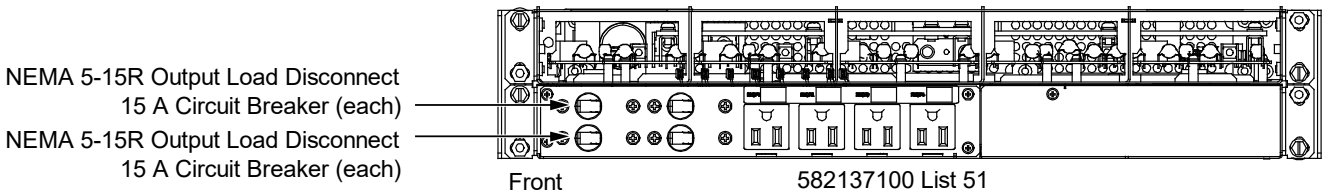
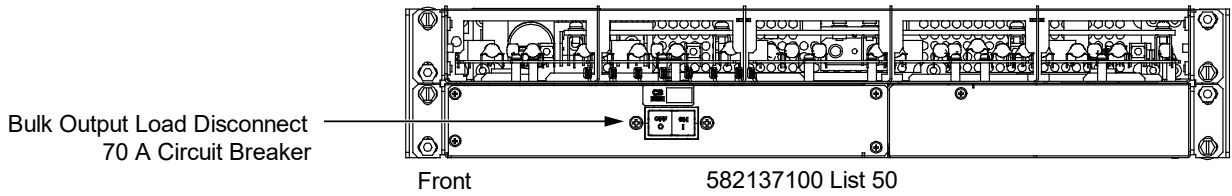
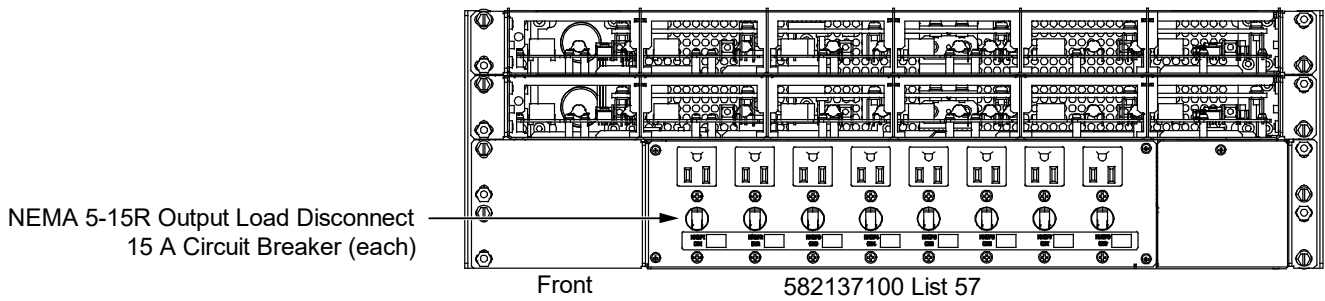
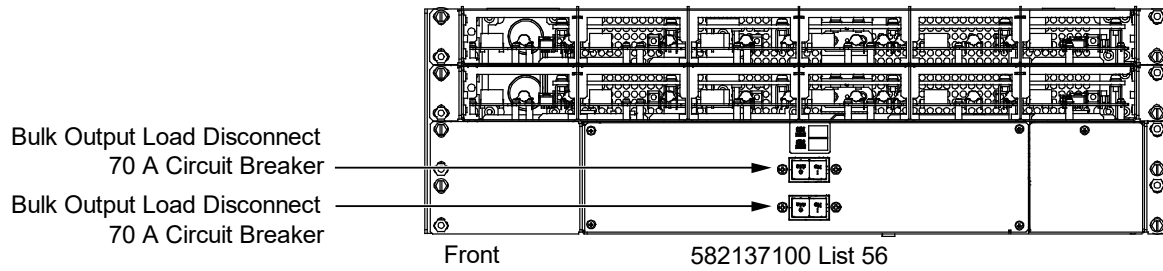
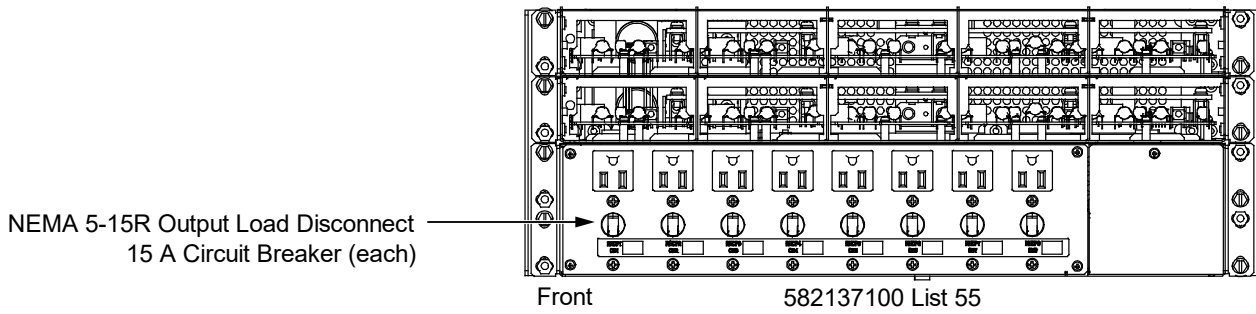
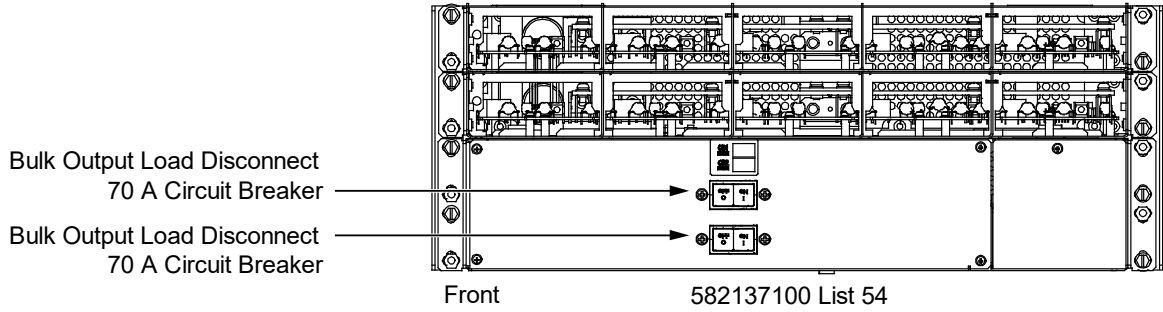


Figure 3.4 AC Load Distribution Disconnect Circuit Breakers (cont'd from previous page)



### 3.7 List 60 Hybrid Connection Cabinet

The hybrid connection cabinet provides four (4) circuit breaker positions up to 600 A and one (1) circuit breaker position up to 400 A for -48 VDC alternate energy sources.

The hybrid connection cabinet includes an SM-DU for monitoring of the circuit breakers internal shunts.

#### **Hybrid Connection Cabinet Circuit Breaker Shunt Ratings**

See Table 3.1.

**Table 3.1 Hybrid Connection Cabinet Circuit Breaker Shunt Ratings**

Circuit Breaker Size	Shunt Current Rating	Shunt Voltage Rating
100 A	100 A	25 mV
125 A	125 A	25 mV
150 A	150 A	25 mV
175 A	175 A	25 mV
200 A	200 A	25 mV
225 A	225 A	25 mV
250 A	250 A	25 mV
300 A	300 A	25 mV
350 A	350 A	25 mV
400 A	400 A	25 mV
600 A	600 A	25 mV

#### **SM-DU Parameter Settings**

- Shunt # Set As (Not Used, General, Load, Battery)
  - a) Not Used: Indicates this shunt input is not used.
  - b) General: Indicates the measurement of the shunt will be displayed and will not be added to Total DC Load or Total Battery Load.
  - c) Load: Indicates the measurement of the shunt will be displayed and added to the Total DC Load.
  - d) Battery: Indicates the measurement of the shunt will be displayed and added to the Total Battery Load and used with Battery Management.
- Shunt # Current (Rating of Shunt.)
- Shunt # Voltage (Rating of Shunt.)
- Current # Break Value (Device Rating.)
- Current # High Current Limit (% of Current # Breaker Value.)
- Current # Very High Current Limit (% of Current # Breaker Value.)



### SM-DU Circuit Card Indicators

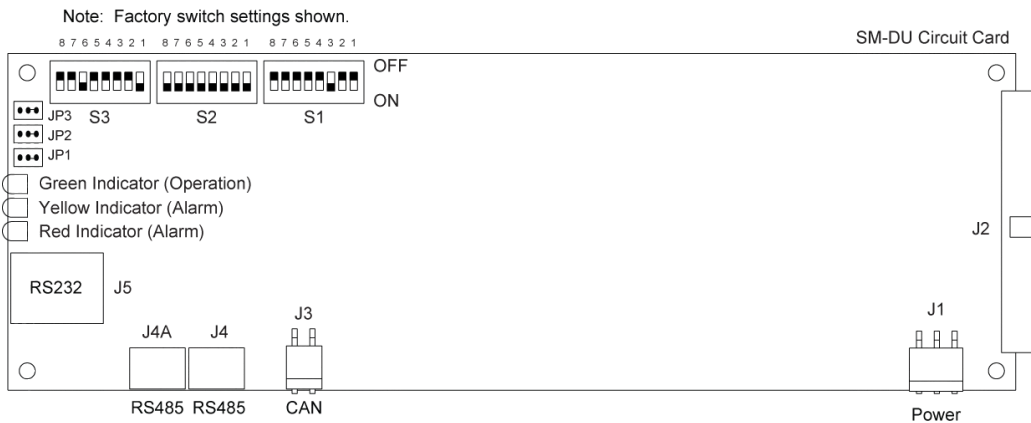
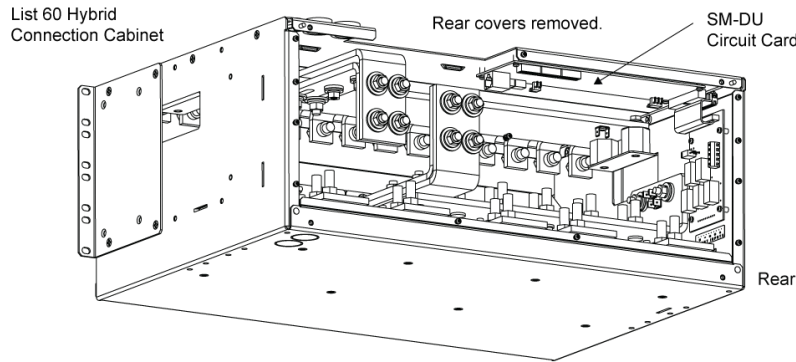
The SM-DU is used in a List 60 Hybrid Connection Cabinet. The SM-DU monitors the internal shunts in the cabinet.

There are three (3) status and alarm indicators located on the SM-DU. The functions of these indicators are as shown in Table 3.2. Refer to Figure 3.5 for location.

**Table 3.2 SM-DU Indicators**

Indicator	Normal State	Fault State	Fault Cause
Operation (Green)	On	Off	SM-DU is non-operational.
		Flashing	A 1/3Hz flashing indicates the SM-DU is being identified by the Controller. A 1Hz flashing indicates a communication failure.
Alarm (Yellow)	Off	On	A minor alarm.
Alarm (Red)	Off	On	A critical or major alarm.

**Figure 3.5 SM-DU Circuit Card in a List 60 Hybrid Connection Cabinet**



## 4 Maintenance

### 4.1 System Maintenance Procedures

It is recommended to perform the maintenance procedures listed in Table 4.1 every 6-months to ensure continual system operation.

**Table 4.1 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.	IM582137100

### 4.2 Adding a Module to an Existing Module Mounting Assembly

To increase system current capacity, a rectifier or solar converter module can easily be added to an existing module mounting assembly that contains an empty rectifier module or solar converter module mounting position. Likewise, to increase subsystem capacity, a -48 VDC to +24 VDC converter module can be added to a module mounting assembly that contains an empty -48 VDC to +24 VDC converter module mounting position. Also, a -48 VDC to -58 VDC DC-DC converter module can be added to a module mounting shelf that contains an empty -48 VDC to -58 VDC converter module mounting position.

Rectifier, solar converter, optional -48 VDC to +24 VDC converter modules, and optional -48 VDC to -58 VDC converter modules can be inserted or removed with power applied (hot swappable).

#### Procedure



**NOTE!** Each module locks into the module mounting assembly by means of a latch located on the bottom of the module.

The latch and module handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract. See Figure 4.3, Figure 4.4, or Figure 4.5.



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



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



**ALERT!** The -48 VDC to +24 VDC converter modules must only be installed in a system position that accepts a +24V DC-DC converter. Refer to labeling on the system's module mounting shelf. A sample of this labeling is provided in Figure 4.1.

**Figure 4.1 Sample Module Mounting Shelf Labeling**

-48 OR +24 VDC	<b>CAUTION! USE ONLY -48VDC OUTPUT RECTIFIERS OR +24VDC OUTPUT CONVERTERS. USE OF -58VDC OUTPUT CONVERTERS MAY DAMAGE EQUIPMENT.</b>
-------------------------	--



**ALERT!** The -48 VDC to -58 VDC converter modules must only be installed in a system position that accepts a -58V DC-DC converter. Refer to labeling on the system's module mounting shelf. A sample of this labeling is provided in Figure 4.2.

**Figure 4.2 Sample Module Mounting Shelf Labeling**



1. Unpack the modules.
2. Note the model number located on the front of each module. Model numbers starting with the letter “R” are rectifier modules. Model numbers starting with the letter “C” are converter modules. Model numbers starting with the letter “S” are solar converter modules.
3. Place the module into an unoccupied mounting position without sliding it in completely. Each module mounting assembly may house rectifier modules, optional solar converter modules, optional -48 VDC to +24 VDC converter modules, optional -48 VDC to -58 VDC converter modules, and a controller (depending on configuration).



**NOTE!** Refer to the module position identification label located either on the inside of the distribution cabinet door (rack mounted systems) or inside the OSP cabinet when no door is furnished for acceptable rectifier, solar converter, and -48 VDC to +24 VDC converter or -48 VDC to -58 VDC converter module mounting positions in the specific module mounting assembly(s) contained in your system. See Figure 4.6.



**NOTE!** See PD588705300 for additional acceptable module position details.



**NOTE!** For systems using an AC feed option where each feed connects to two (2) slots in the shelf (List 46 or Molex connected cords) and -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters are being used (List 26 two row distribution panel or List 27 single row distribution panel) in the plant, the following module restrictions apply for factory installed shelves 2 through 5:

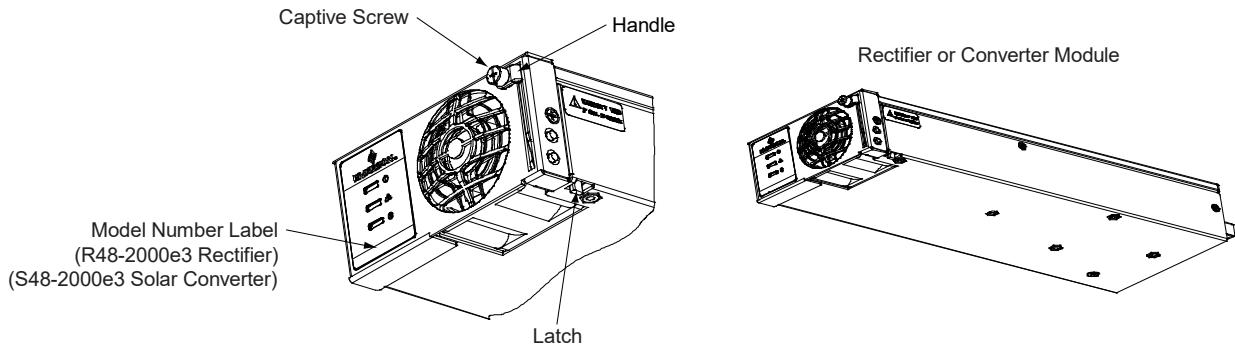
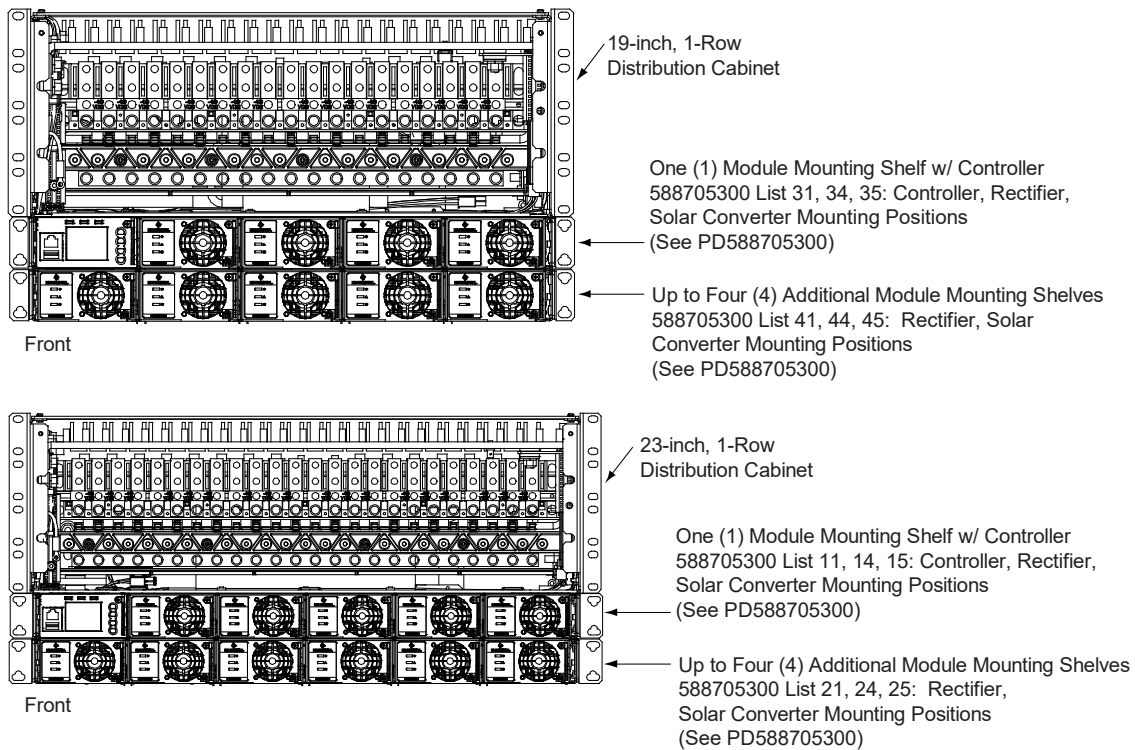
- Rectifiers can be in any or all six (6) positions if three (3) AC inputs provided.
  - +24V or -58V converters can be in the right three (3) positions (positions 4, 5 and 6).
  - Rectifiers can be in any position which has AC power that is not taken up with a converter.
  - One (1) Solar converter can be installed in the shelf, position 1 or 2.
  - Three (3) solar converters can be installed in the shelf, positions 1 or 2, positions 3 or 4 and positions 5 or 6 if the -48V to +24V or -48V to -58V bus bar is not installed to the shelf above.
4. Loosen the captive screw on the module's handle. Pull the handle down out from the module's front panel (this will also retract the latch mechanism). See Figure 4.3, Figure 4.4, or Figure 4.5.
  5. Push the module completely into the module mounting assembly.
  6. Push the handle up into the module's front panel. This will lock the module securely to the module mounting assembly. Tighten the captive screw on the handle.
  7. Repeat the above steps for each module being installed in the system.

8. After the modules are physically installed in the mounting module mounting assembly(s), they are ready for operation immediately after power is supplied to them.

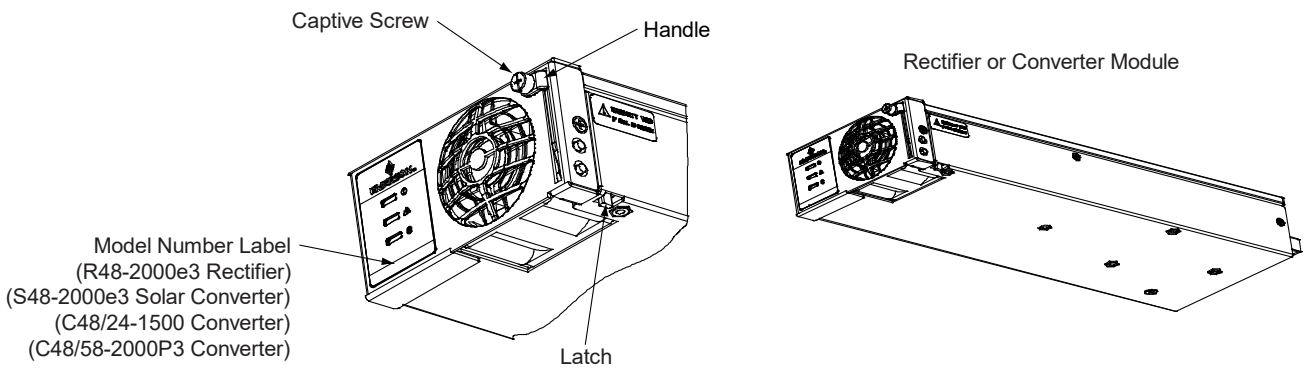
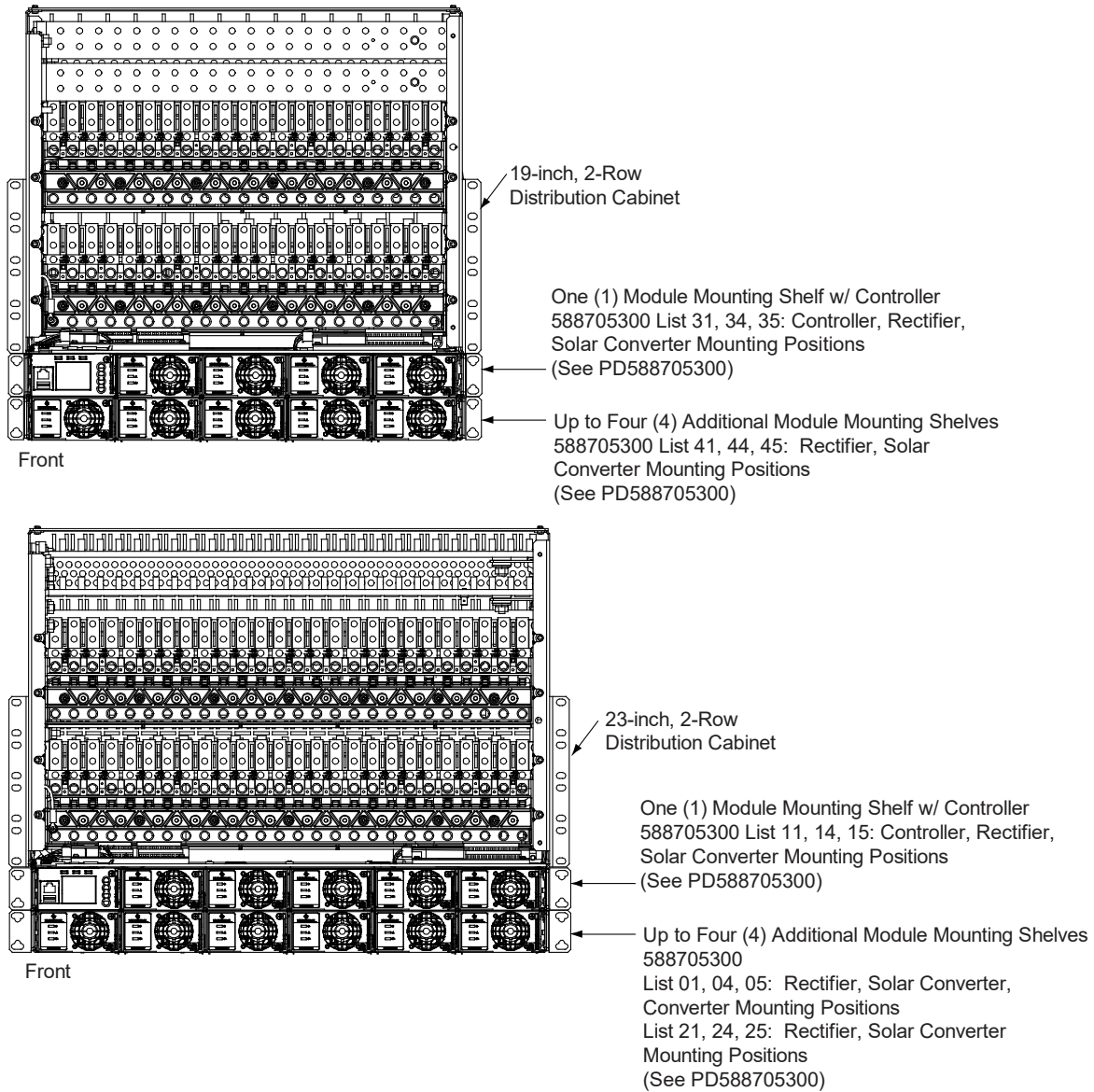
**NOTE!** It is recommended that the current limit point be checked whenever a rectifier, -48 VDC to +24 VDC converter, or -48 VDC to -58 VDC converter is added to or removed from the power system. Refer to “Checking the Controller’s Current Limit Point after Adding or Removing a Rectifier, -48 VDC to +24 VDC Converter Module, or -48 VDC to -58 VDC Converter Module” on page 39.

**NOTE!** The rectifier, solar converter, -48 VDC to +24 VDC converter module, or -48 VDC to -58 VDC converter module being replaced is assigned by the NCU the lowest available identification number. If desired, you can change the identification number, see “Configuring the NCU Identification of Rectifiers”, “Configuring the NCU Identification of Solar Converters”, or “Configuring the NCU Identification of -48 VDC to +24 VDC Converters or -48 VDC to -58 VDC Converters” in the separate Power System Installation Manual (IM582137100).

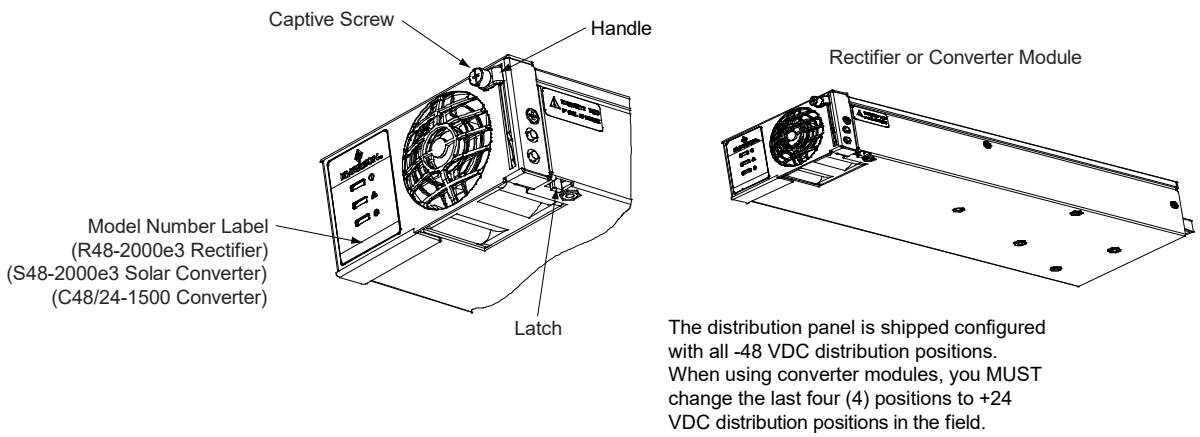
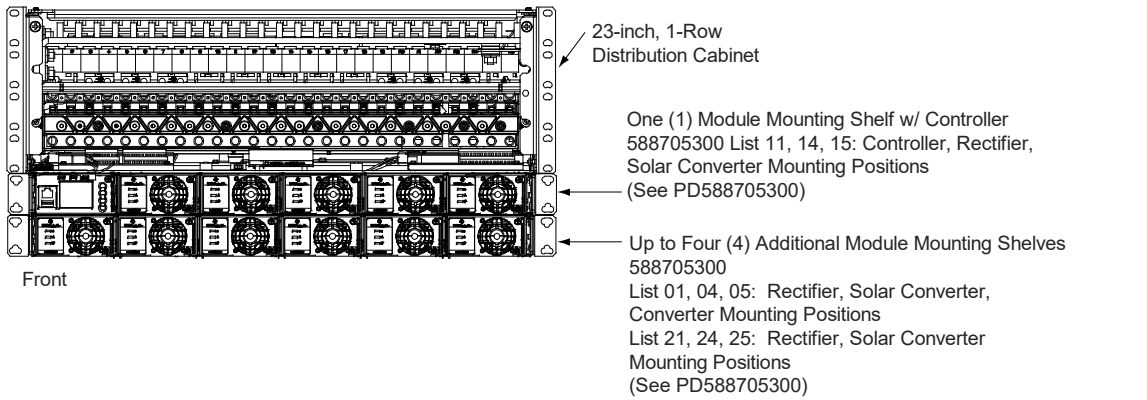
**Figure 4.3 Installing Rectifier and Solar Converter Modules (List 20, 25)**



**Figure 4.4** Installing Rectifier, Solar Converter, and -48 VDC to +24 VDC Converter Modules or -48 VDC to -58 VDC Converter Modules (List 21, 26)

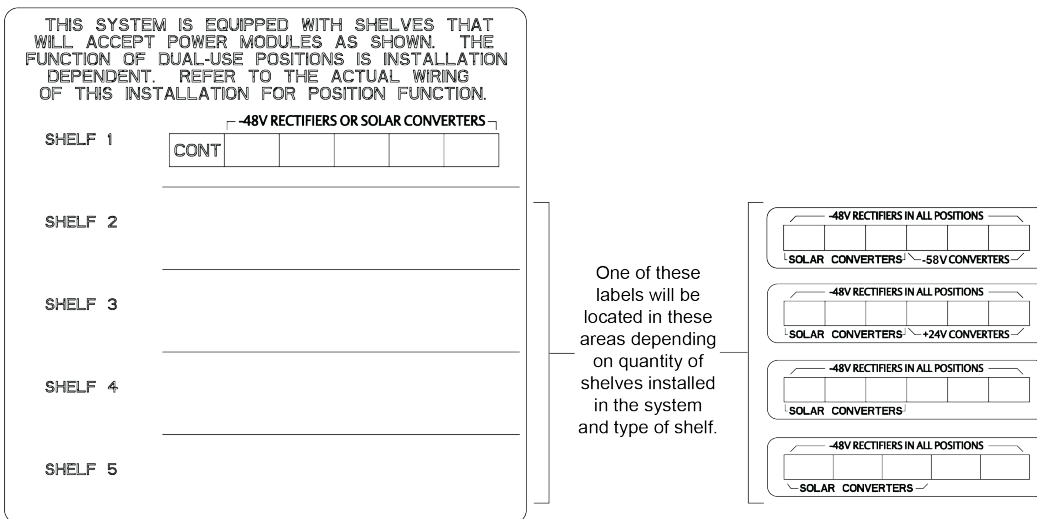


**Figure 4.5 Installing Rectifier and -48 VDC to +24 VDC Converter Modules (List 27)**



**Figure 4.6 Module Position Identification Label**

The label depicted below is located either on the inside of the distribution cabinet door (rack mounted systems) or inside the OSP cabinet when no door is furnished. As the system is being wired for module inputs, write the type of module to be placed in each module mounting position in the space provided on the label. Write R for rectifier, C for converter, and S for solar converter.



### 4.3 Installing a Field Expansion Module Mounting Assembly



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



**NOTE!** Discard the ship loose mounting angles as they are not used for this system. The mounting angles attached to the shelf can be used for either 5" projection or flush mounting.



**NOTE!** Field expansion shelf is not available if the system is equipped with a List 60, 61, or the inverter system.



**NOTE!** Refer to Figure 4.8 and Figure 4.9 as this procedure is performed.



**NOTE!** When installing in a data cabinet, refer also to “Installing Field Expansion Module Mounting Assembly Spacer Kit, P/N 560075” on page 22.

#### **Procedure**

1. When installing in a data cabinet equipped with 4-post flush mounting kit for data cabinets P/N 559801, refer first to “Installing Field Expansion Module Mounting Assembly Spacer Kit, P/N 560075” on page 22.
2. Remove the busbar rear shield from the module mounting assemblies in the rack. Remove the bottom panel from the busbar rear shield by gently bending the panel until it snaps from the busbar rear shield.
3. Remove the hardware from the lowest module mounting assembly’s -48V, return, and +24V or -58V (if present) busbars.
4. Install the expansion module mounting assembly directly below the bottom-most module mounting assembly in the rack. Use the mounting hardware provided with the expansion module mounting assembly.

Hardware build-up is:

12-24 x 3/4" screw and flat washer,

(1) set per side.

12-24 x 3/4" screw and ground washer,

(1) set per side.



**NOTE!** Install the ground washers so the teeth make contact with the metal on the mounting angles. Torque all screws to 65 in-lbs.

5. Remove the busbar rear shield from the expansion module mounting assembly.



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

6. Install the busbars provided with the expansion module mounting assembly between the studs on the expansion module mounting assembly and the studs on the module mounting assembly above it. Secure these busbars to the expansion module mounting assembly with the hardware provided with the expansion module mounting assembly. Secure these busbars to the module mounting assembly above the expansion module mounting assembly with the hardware previously removed. Torque to 60 in-lbs.

Hardware build-up for these connections are:

M6 Nut,

M6 Belleville lock washer,

M6 flat washer.

7. Disconnect the CAN cable coming from the distribution cabinet from the connector on the bottom-most existing module mounting assembly and connect this cable to the same connector on the expansion module mounting assembly.
8. Connect the open CAN connector on the bottom-most existing module mounting assembly to the open connector on the expansion module mounting assembly.
9. Re-install the rear busbar shield previously removed from the existing module mounting assembly. Re-install the rear busbar shield previously removed from the expansion module mounting assembly.
10. As an expansion shelf is installed, adhere the label furnished with the shelf to the bottom open shelf position on the label shown in Figure 4.10. This label is located either on the inside of the distribution cabinet door (rack mounted systems) or inside the OSP cabinet when no door is furnished.
11. Refer to the Power System Installation Instructions (IM582137100) and connect input power to the expansion module mounting assembly.



**NOTE!** *The List 36 expansion shelf has a Molex input feed where each feed connects to two (2) slots in the shelf. The following module restrictions apply:*

- Rectifiers can be in any or all six (6) positions if three (3) AC inputs provided.
- +24V or -58V converters can be in the right three (3) positions (positions 4, 5 and 6).
- Rectifiers can be in any position which has AC power that is not taken up with a converter.
- One (1) Solar converter can be installed in the shelf, position 1 or 2.
- Three (3) solar converters can be installed in the shelf, positions 1 or 2, positions 3 or 4 and positions 5 or 6 if the -48V to +24V or -48V to -58V bus bar is not installed to the shelf above.



**NOTE!** *Locate the module position identification label either on the inside of the distribution cabinet door (rack mounted systems) or inside the OSP cabinet when no door is furnished. As the shelf is being wired for module inputs, write the type of module to be placed in each module mounting position in the space provided on the label. Write R for rectifier, C for converter, and S for solar converter. See Figure 4.6.*

12. Refer to the Power System Installation Instructions (IM582137100) and install rectifier, solar converter, -48 VDC to +24 VDC converter and/or -48 VDC to -58 VDC converter modules into the expansion module mounting assembly as required.



**NOTE!** *Refer to the module position identification label located either on the inside of the distribution cabinet door (rack mounted systems) or inside the OSP cabinet when no door is furnished for acceptable rectifier, solar converter, -48 VDC to +24 VDC converter and -48 VDC to -58 VDC converter module mounting positions in the specific module mounting assembly(s) contained in your system. See Figure 4.6.*



**NOTE!** *See PD588705300 for additional acceptable module position details and the NOTE in step 11.*



**NOTE!** *When installing in a data cabinet, refer also to "Installing Field Expansion Module Mounting Assembly Spacer Kit, P/N 560075" on page 22.*



13. **For List 26 only:**

For List 33, two sets of converter polarity caution labels are provided loose. Based on the converter output voltage, apply the correct label to right three converter slots of the expansion shelf: “-48 VDC OR +24 VDC” label (P/N 60037065) for use with +24 VDC converters; “-48 VDC OR -58 VDC” label (P/N 60037064) for use with -58 VDC converters. A sample of this labeling is provided in Figure 4.7.

**Figure 4.7 Caution Labels**

60037065 (-48VDC OR +24VDC Label)



60037064 (-48VDC OR -58VDC Label)

**Figure 4.8** Installing a Field Expansion Module Mounting Assembly

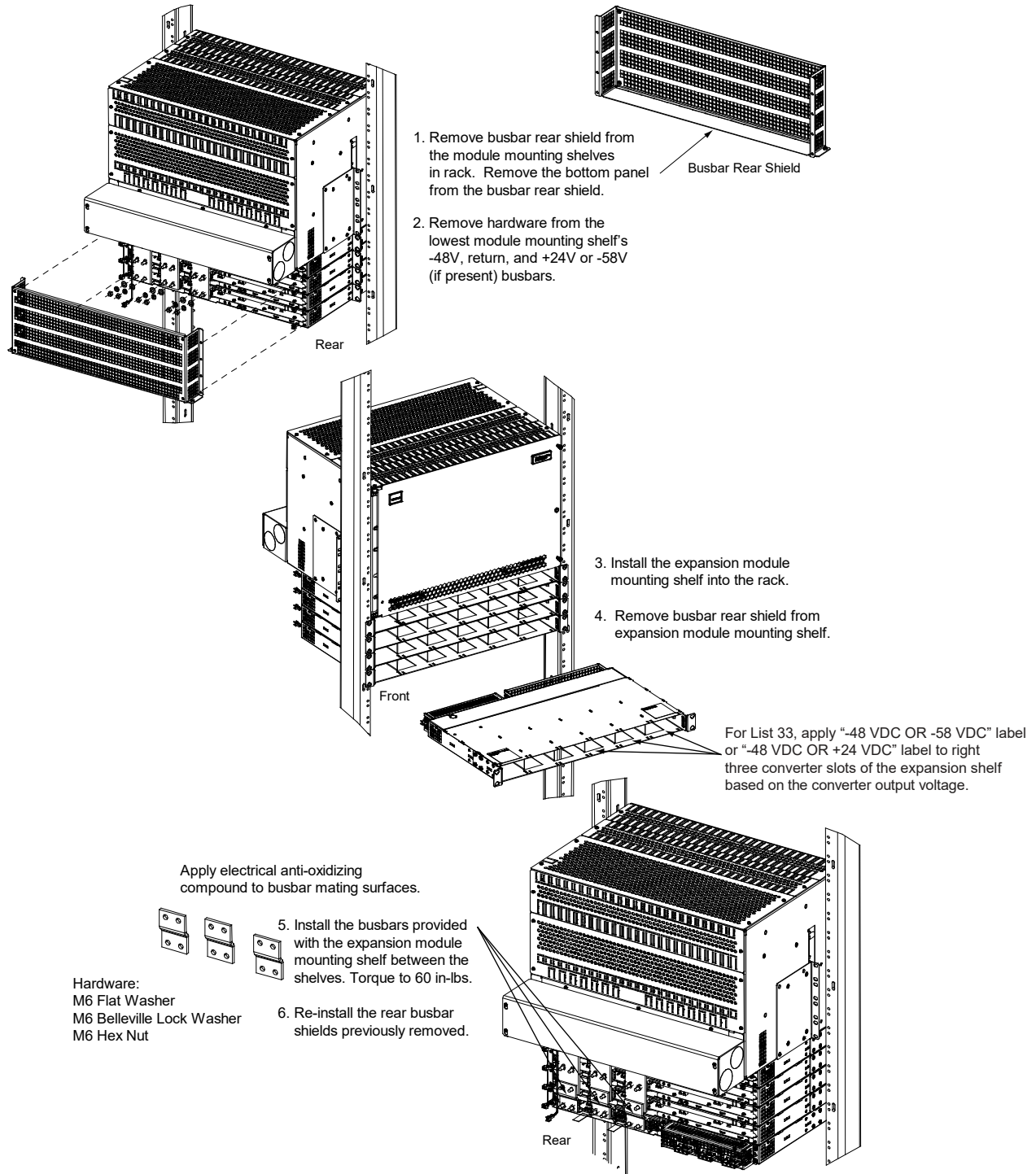
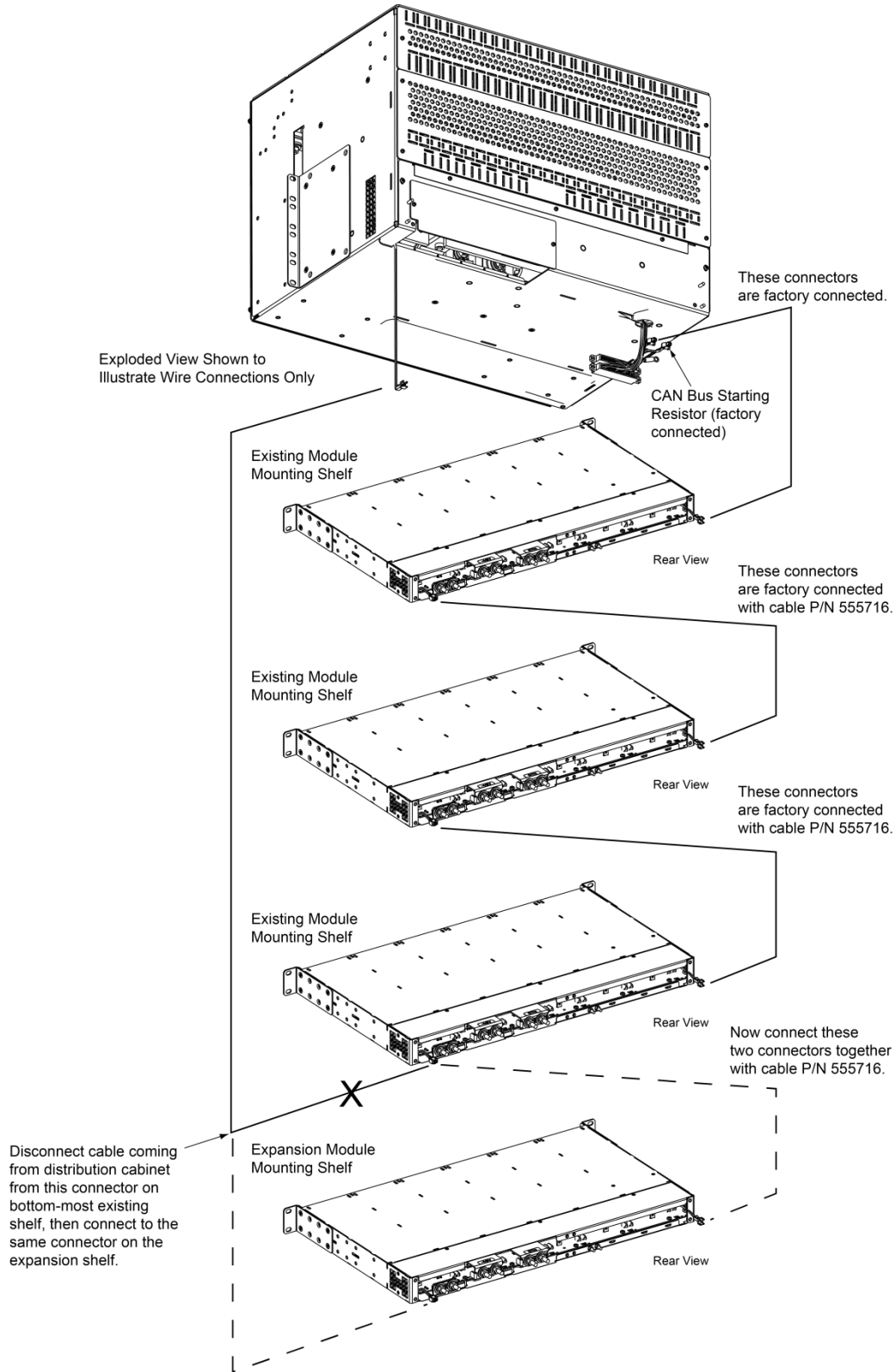
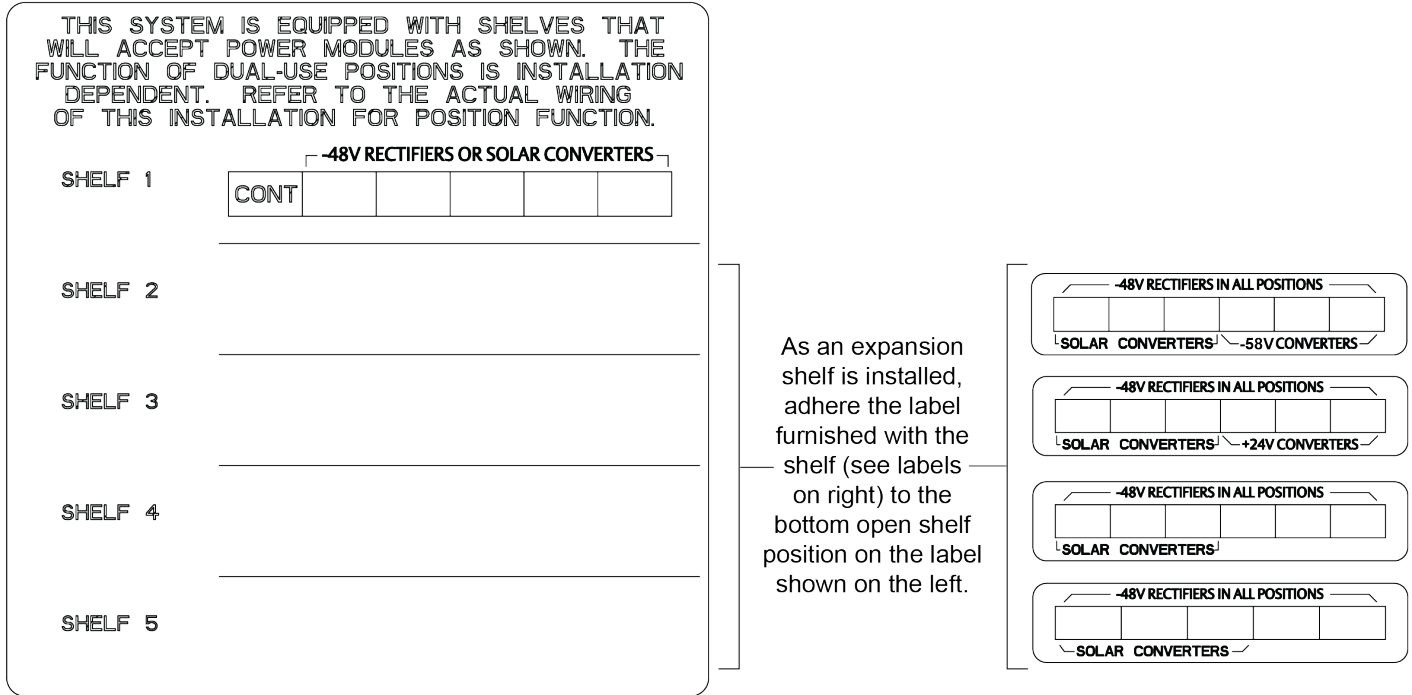


Figure 4.9 Installing a Field Expansion Module Mounting Assembly - Controller CAN Bus



**Figure 4.10 Install Module Position Identification Label**

The label depicted below is located either on the inside of the distribution cabinet door (rack mounted systems) or inside the OSP cabinet when no door is furnished.



## 4.4 Installing Field Expansion Module Mounting Assembly Spacer Kit, P/N 560075

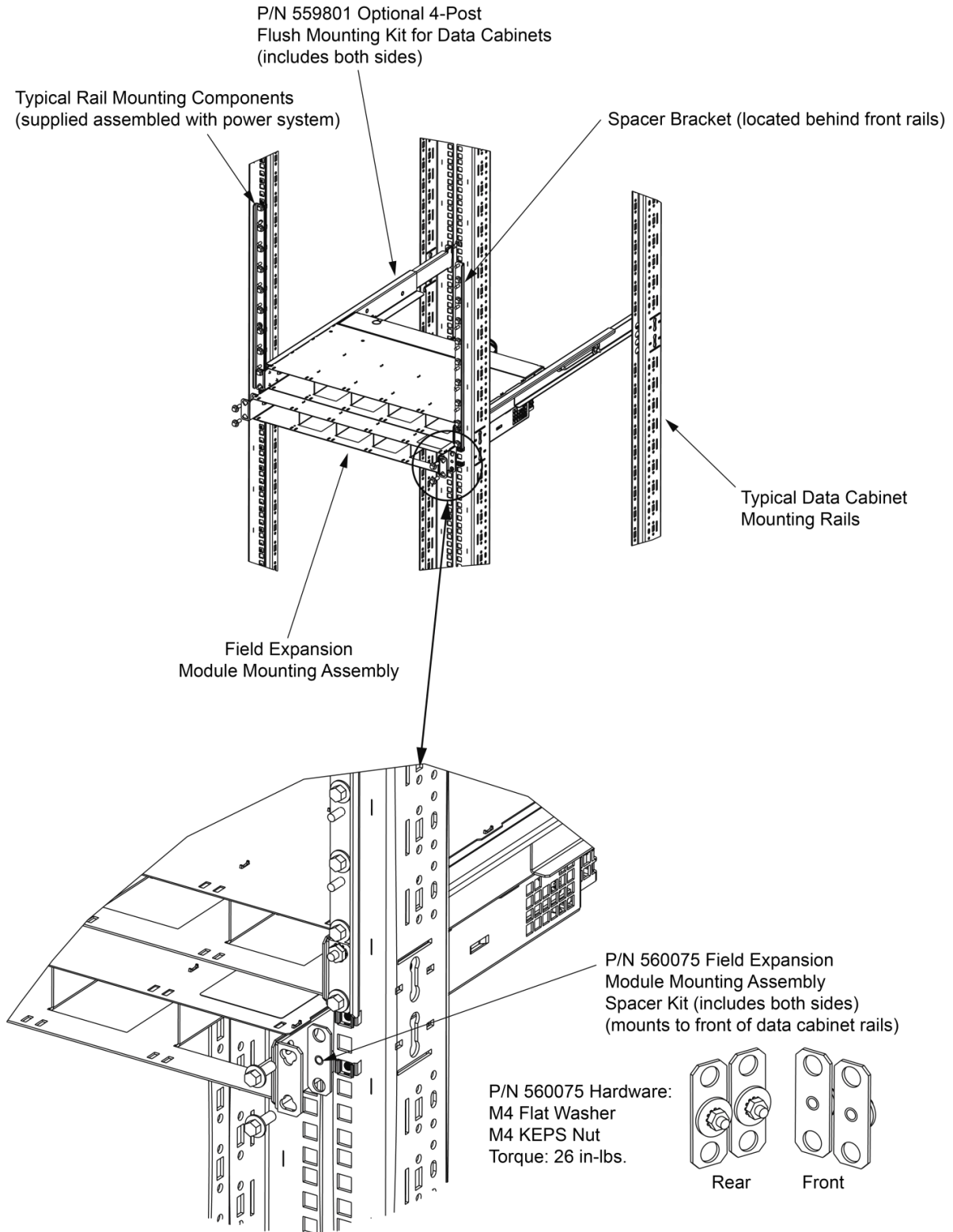
Provided with List 34, 36 field expansion module mounting assemblies is spacer kit (P/N 560075) for use with the 4-post flush mounting kit for data cabinets. Mounts to the outside front surfaces of the data cabinet's front vertical rails.

**NOTE!** Installation instructions for the 4-post flush mounting kit for data cabinets is provided in the Installation Instructions (IM582137100).

### Procedure

1. See Figure 4.11 for an assembly illustration. Must be assembled prior to installation of expansion module mounting assemblies.
2. Assemble spacer kit to outside front surface of data cabinet front vertical rails using M4 flat washer and M4 Keps nut. Torque = 26 in-lbs.

Figure 4.11 Installing Field Expansion Module Mounting Assembly Spacer Kit, P/N 560075



## 4.5 Adding an Inverter Module to an Existing Inverter Module Mounting Assembly

To increase system current capacity, an inverter module can easily be added to an existing inverter module mounting assembly that contains an empty inverter module mounting position.

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



**NOTE!** Each inverter module locks into the module mounting shelf by means of a latch located on the bottom of the inverter module. The latch and inverter module handle are interactive. Pushing the handle up into the inverter module's front panel causes the latch to extend to the locking position; pulling the handle down out from the inverter module's front panel causes the latch to retract. See Figure 4.12

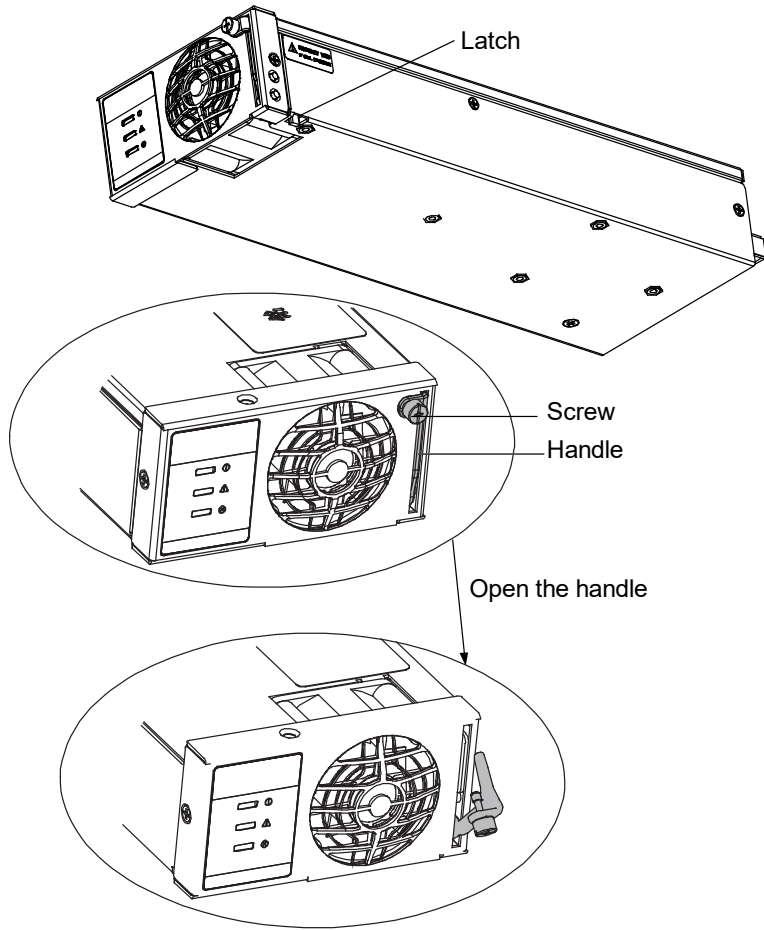


**WARNING!** To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing an inverter module. NEVER hold the handle in the closed position when installing an inverter module into a shelf.

### **Procedure**

1. Unpack the inverter modules.
2. If present, remove blank cover panels from the module mounting positions into which inverter modules are to be installed.
3. Place the inverter module into an unoccupied mounting position without sliding it in completely.
4. Loosen the captive screw on the inverter module's handle. Pull the handle down out from the inverter module's front panel (this will also retract the latch mechanism). See Figure 4.12.
5. Push the inverter module completely into the shelf.
6. Push the handle up into the inverter module's front panel. This will lock the inverter module securely to the shelf. Tighten the captive screw on the handle.
7. Repeat the above steps for each inverter module being installed in the system.
8. After the inverter modules are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

Figure 4.12 Installing Inverter Modules



## 4.6 Reconfiguring a Dual Voltage Distribution Panel (List DA, DB, DC, DD, DE, FA, FB, FC, FD, FE)

Perform the following procedure to reconfigure a dual voltage distribution panel (List DA, DB, DC, DD, DE, FA, FB, FC, FD, FE) to move distribution positions from one voltage to the other.



**DANGER!** Performing this procedure exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.



**NOTE!** Save all removed hardware. Hardware will be re-used.



**NOTE!** Refer to Figure 4.13 through Figure 4.18 as this procedure is performed.

### **Procedure**

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position or open the system's enclosure door.
2. Remove the shield from the front of the distribution panel by loosening the screws securing it and lifting it up and out. Refer to Figure 4.13.
3. Locate the place in the distribution panel where the voltages switch from one level to another. List DA-DE panels have a gap in position at this location.
4. Remove the shorting busbar, FA alarm strap, and FA shorting strap from the rear of the distribution panel for the positions to be reconfigured. Refer to Figure 4.14.
5. Remove the screws from the front plastic panel to remove the device busbar for the positions to be reconfigured. Move the device busbar over one position and re-secure with the screws just removed. Refer to Figure 4.15.



**NOTE!** No need to move the device busbar for the List FA-FE panels.

6. Replace the shorting busbar over one position and re-secure as shown in Figure 4.16. Replace the FA alarm strap over one position and reposition the FA shorting strap as shown in Figure 4.16. Secure these as shown in Figure 4.16.
7. Remove the polarity label plug buttons as shown in Figure 4.17.
8. Remove the polarity label then turn over the label to show the other polarity as shown in Figure 4.17.
9. Reposition the load lug as shown in Figure 4.17.



**NOTE!** No need to move the load lug busbar on List FA-FE panels.

10. Replace the polarity label and the plug buttons with the proper polarity visible.
11. Install the shield onto the front of the distribution panel. Refer to Figure 4.13.
12. Close the distribution cabinet's front door and turn the latch clockwise or close the system's enclosure door.
13. Ensure that there are no local or remote alarms active on the system.



Figure 4.13 Removing/Installing Distribution Panel Shield

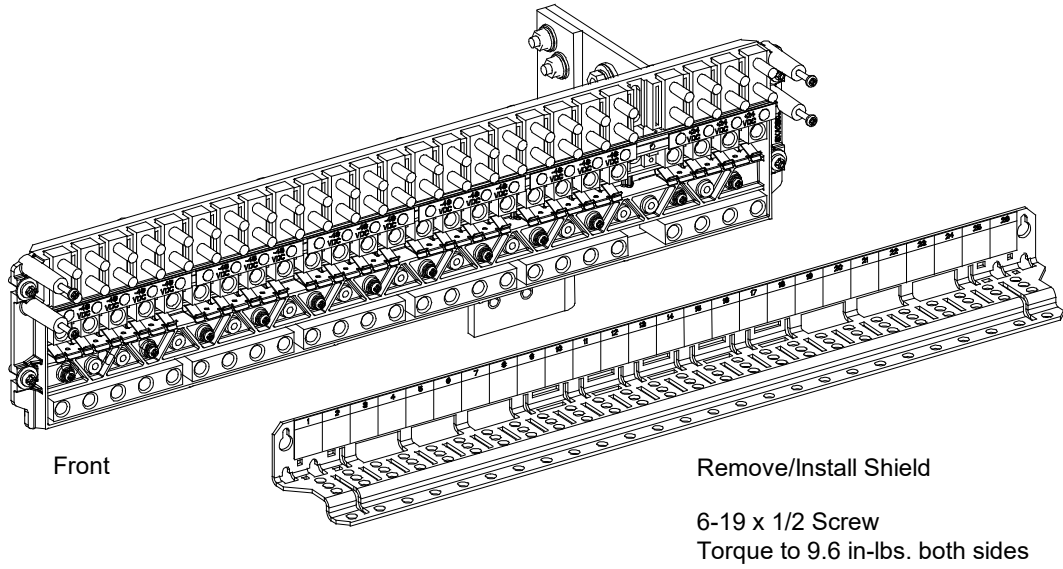
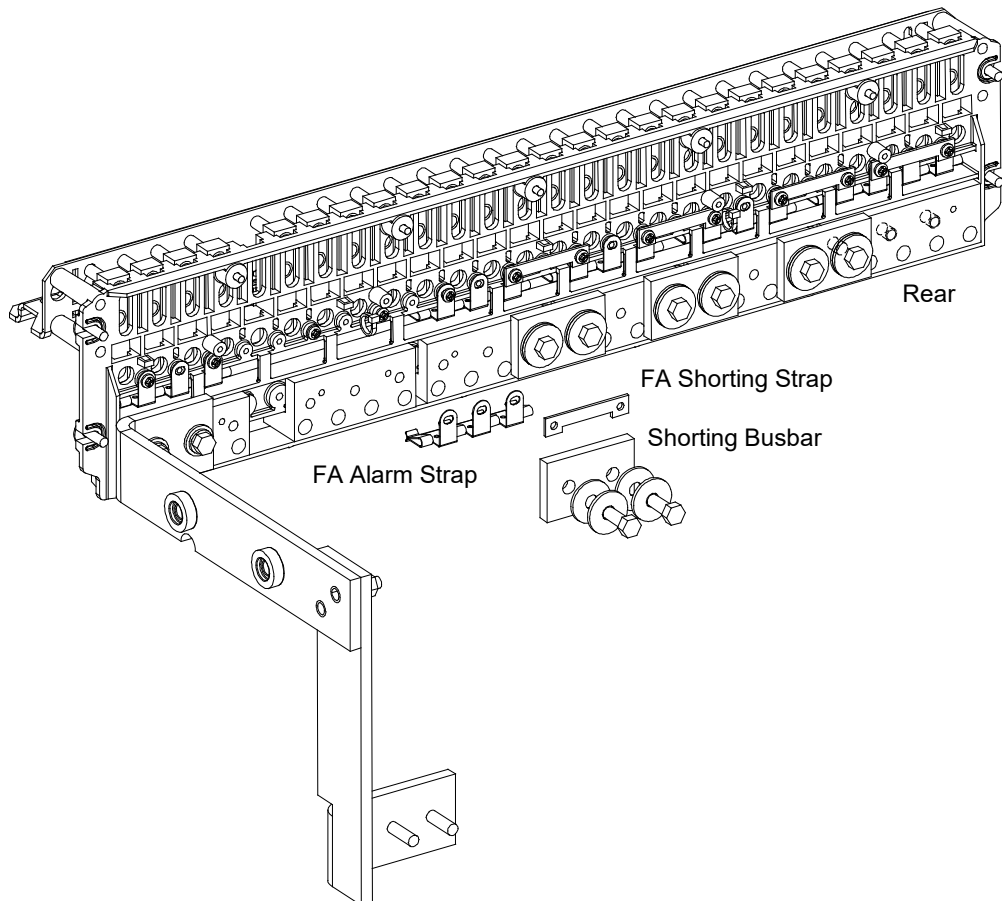


Figure 4.14 Removing Shorting Busbar, FA Alarm Strap, and FA Shorting Strap



**Figure 4.15 Moving Distribution Device Busbar Over One Position**

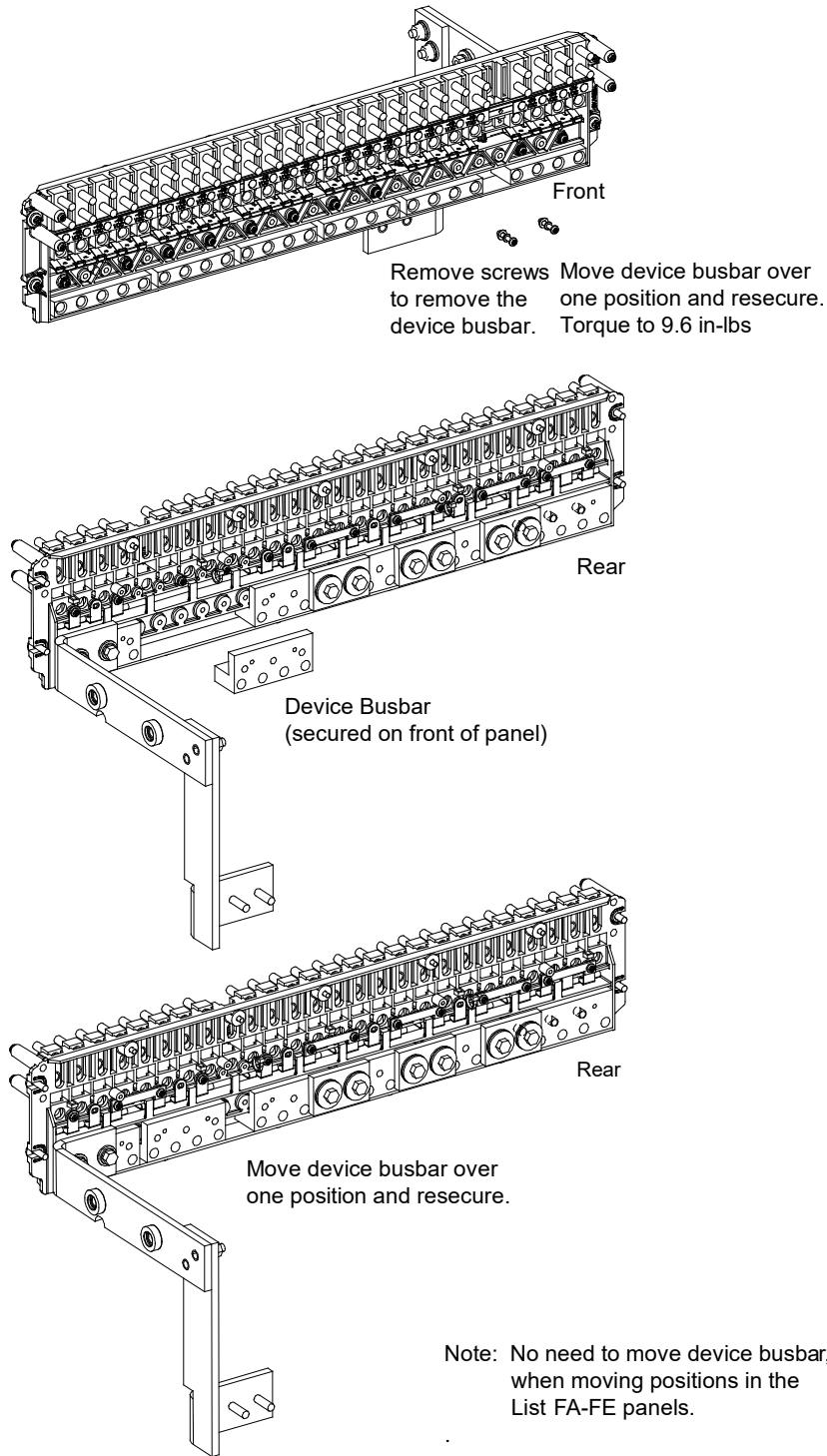


Figure 4.16 Replacing Shorting Busbar, FA Alarm Strap, and FA Shorting Strap

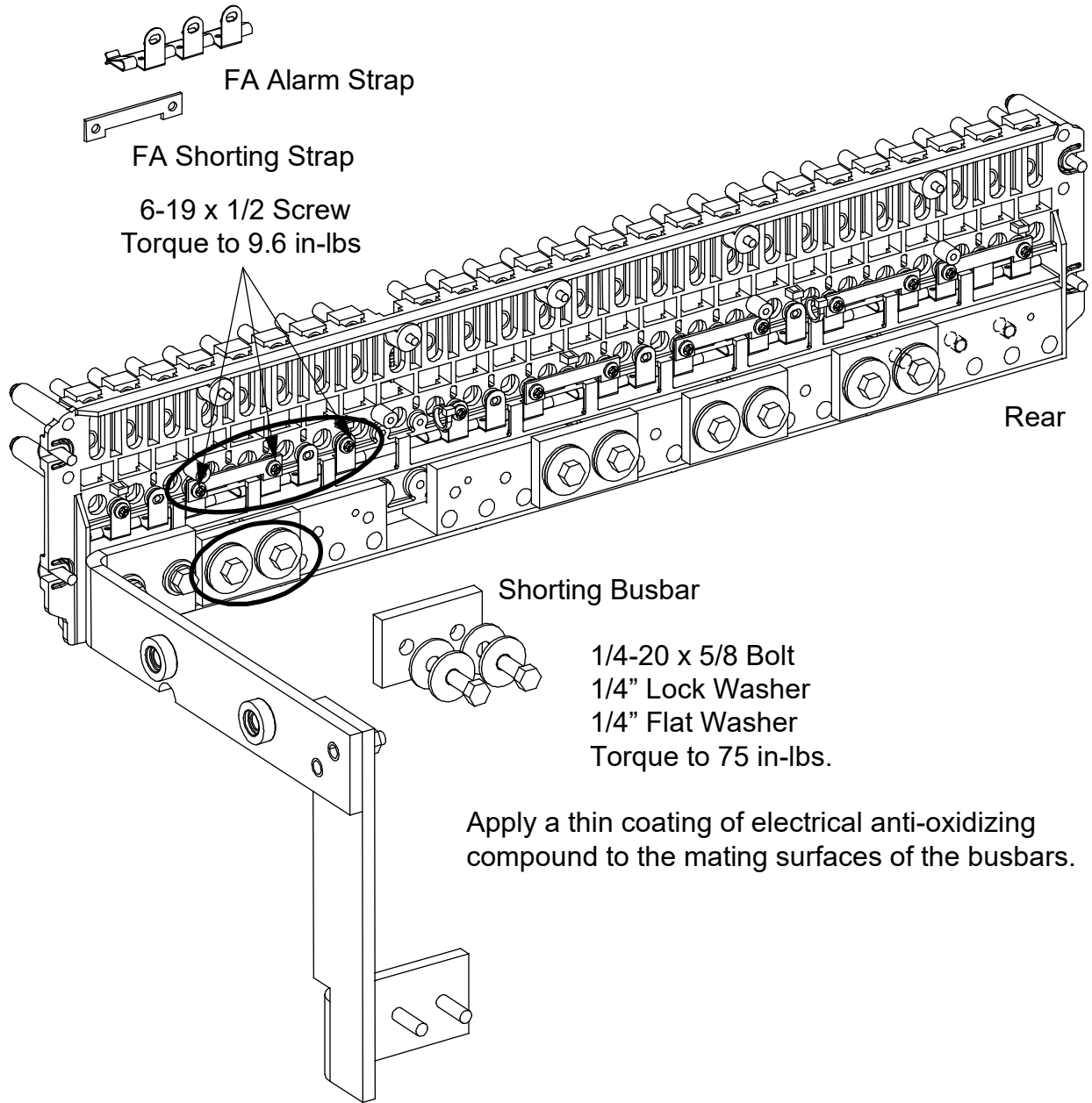
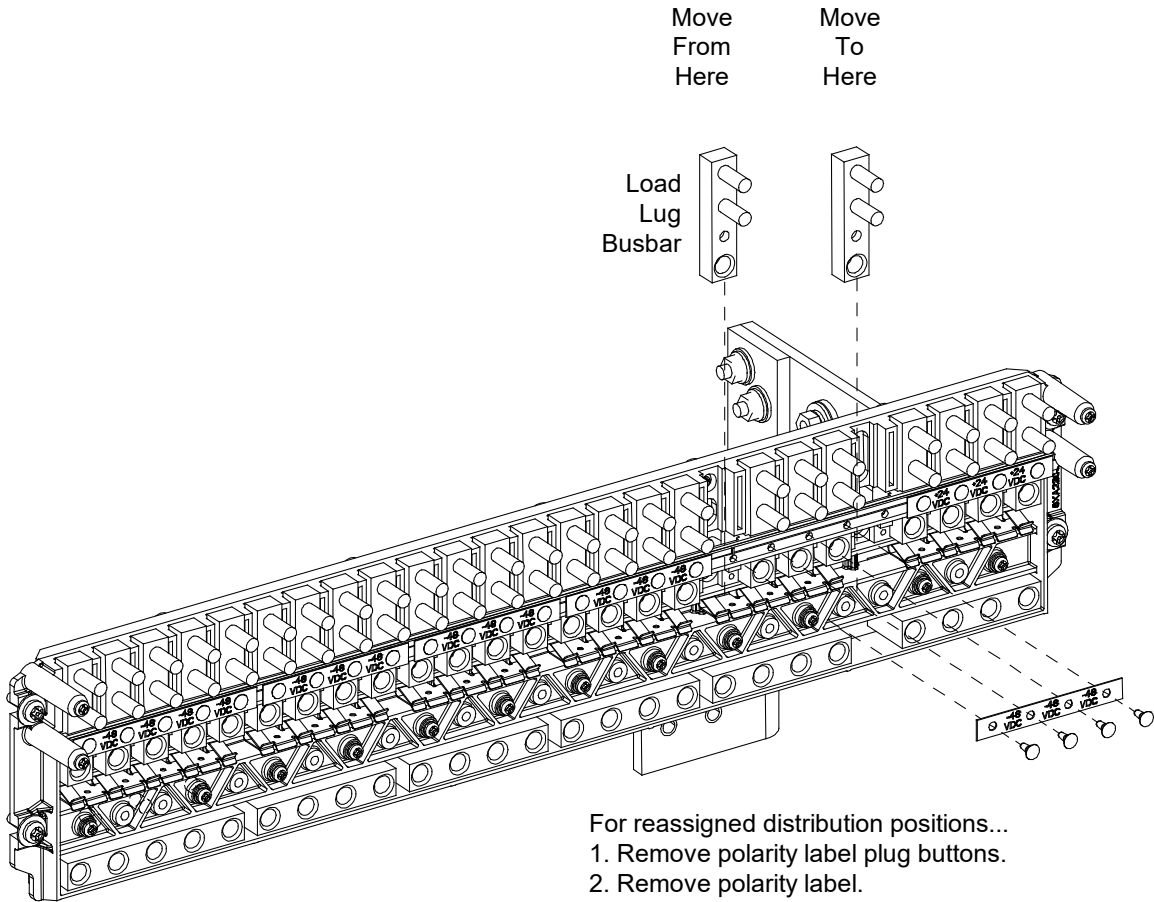
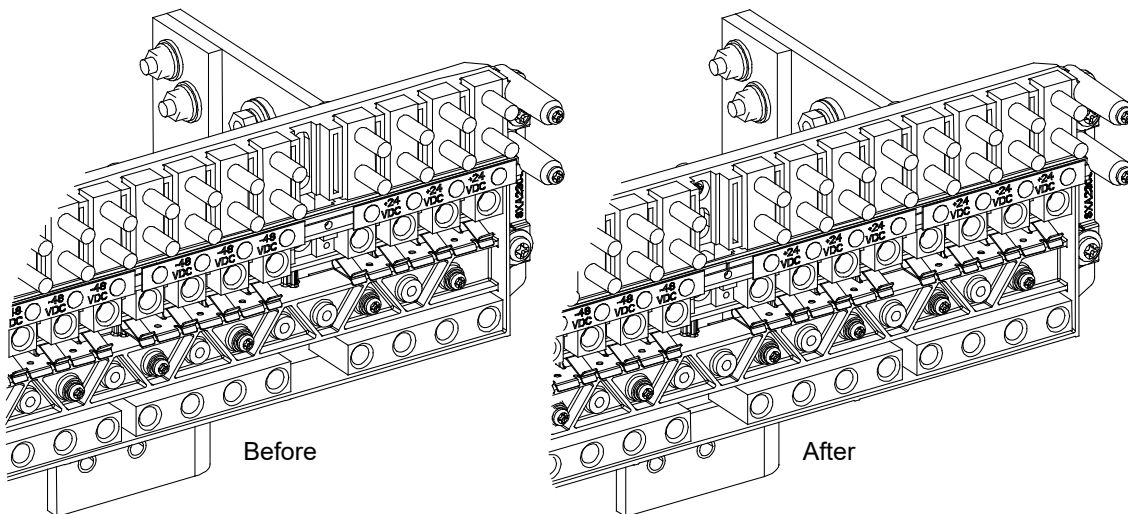


Figure 4.17 Reworking Polarity Label and Swap Load Lug Busbar



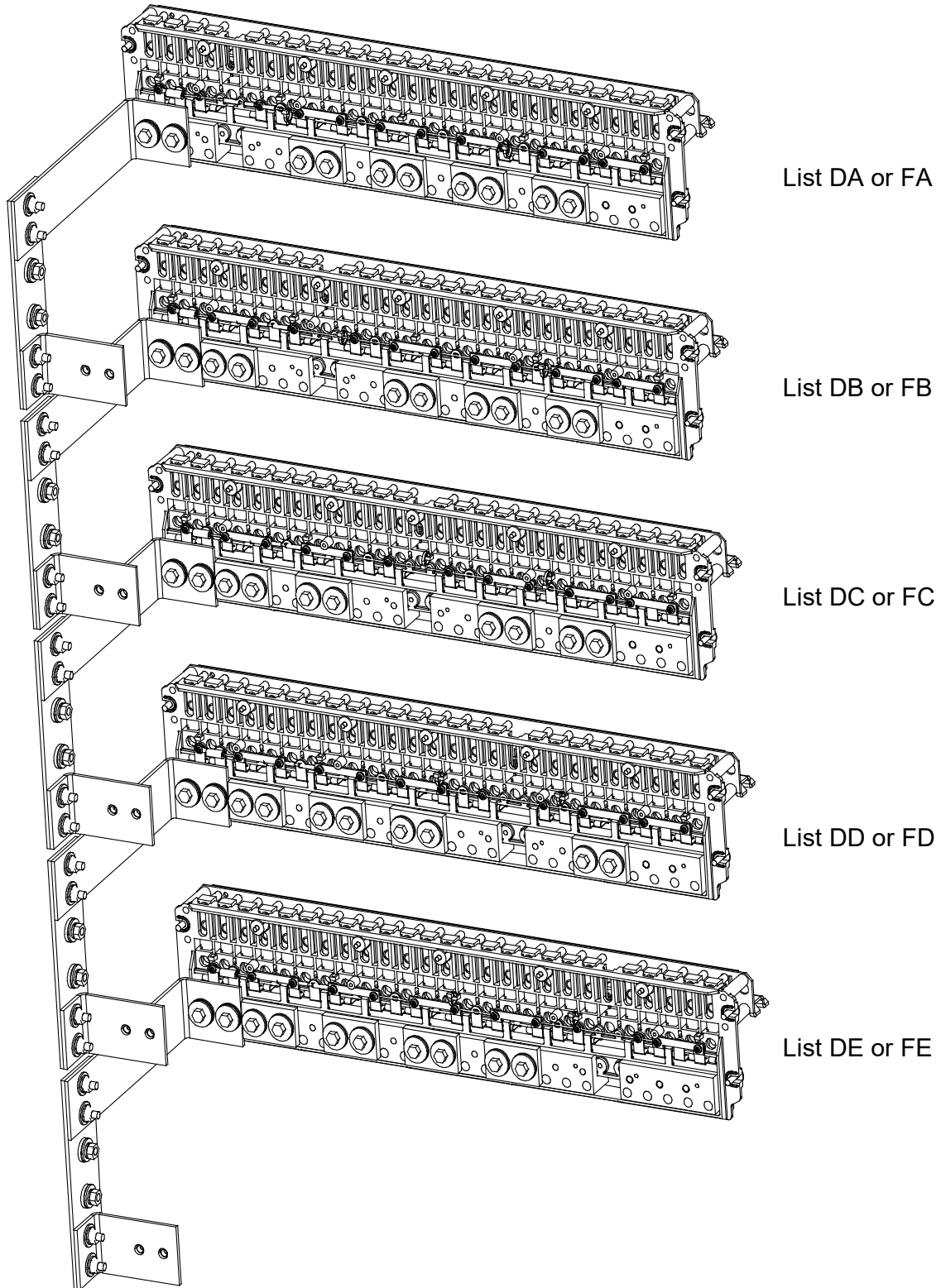
For reassigned distribution positions...

1. Remove polarity label plug buttons.
2. Remove polarity label.
3. Turn over polarity label so other polarity shows.
4. Replace polarity label.
5. Replace polarity label plug buttons.



Note: No need to move the load lug busbar, when reconfiguring the number of positions of the -48V/-58V panel.

Figure 4.18 Reworking the Distribution Panel



Note: List DA-List DE panels shown. No open positions on List FA-FE panels.

## 4.7 Reconfiguring the Distribution Voltage on Positions 23 to 26 of a List DF Distribution Panel installed in a List 27 Distribution Cabinet

Perform the following procedure to reconfigure the distribution voltage on positions 23 to 26 of a List DF distribution panel installed in a List 27 distribution cabinet (to move distribution positions from one voltage to the other).



**DANGER!** Performing this procedure exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.



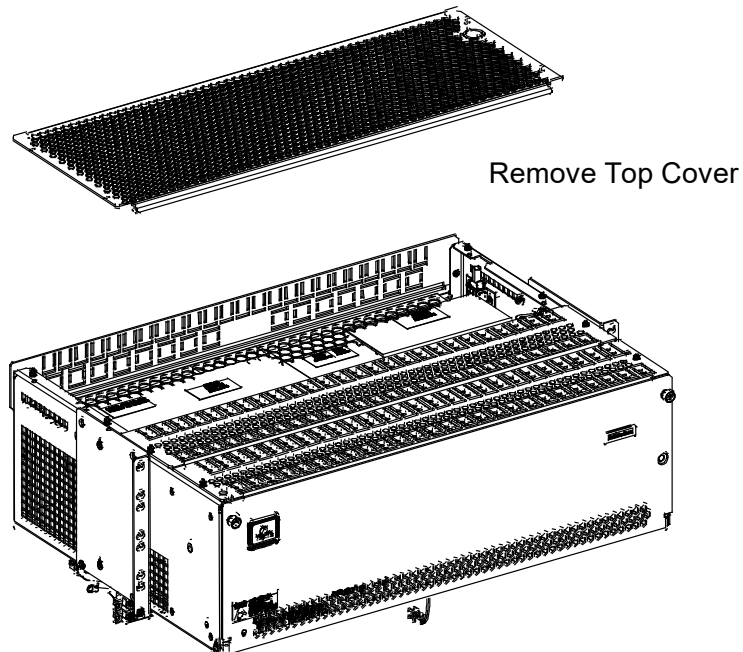
**NOTE!** Save all removed hardware. Hardware will be re-used.

### Procedure

This procedure is written changing from -48 VDC distribution to +24 VDC distribution on positions 23 to 26. Reverse the procedure to go from +24 VDC distribution to -48 VDC distribution.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position or open the system's enclosure door.
2. Remove the top cover from the distribution cabinet.

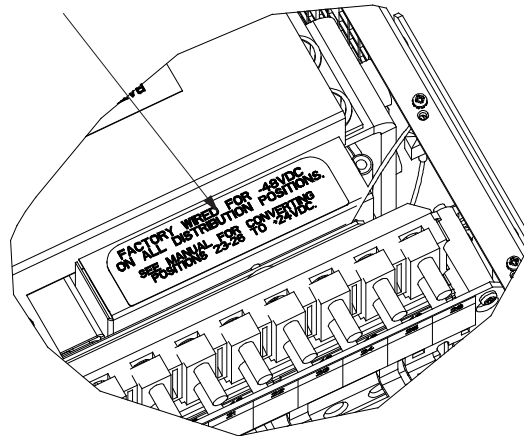
**Figure 4.19** Removing the Distribution Cabinet Top Cover



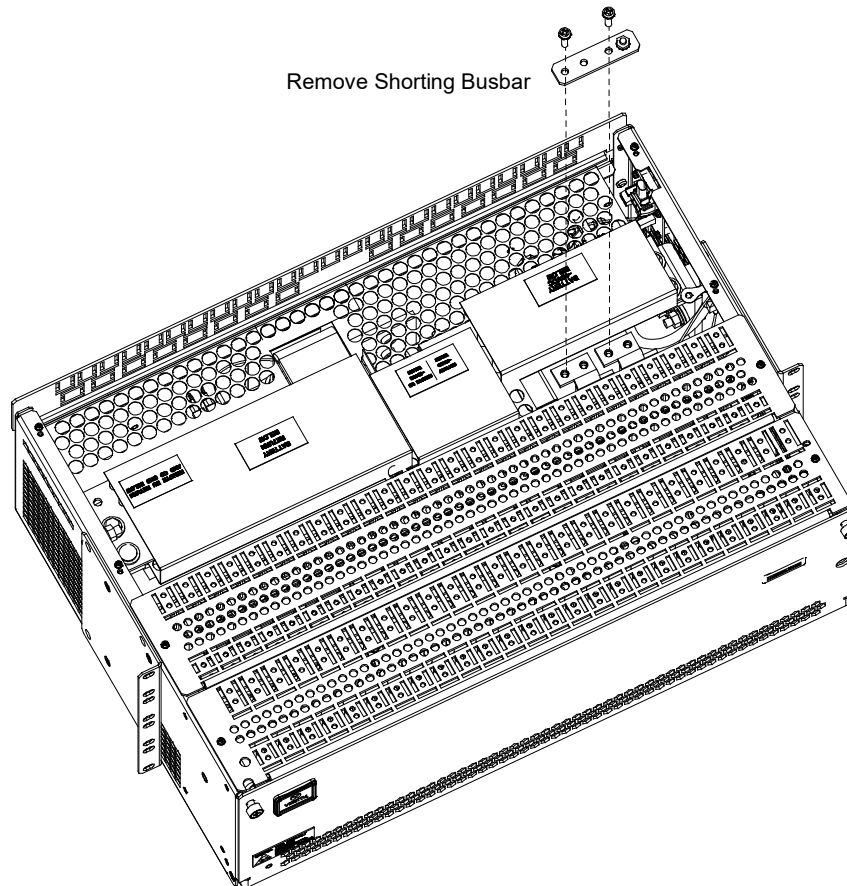
3. Locate the shorting busbar shield in the area below the distribution cabinet top cover just removed.
4. Bend the top flap of the shorting busbar shield up to access the shorting busbar.

**Figure 4.20 Bending Shorting Busbar Shield Top Flap**

Bend Over Top Flap  
To Access Shorting Busbar

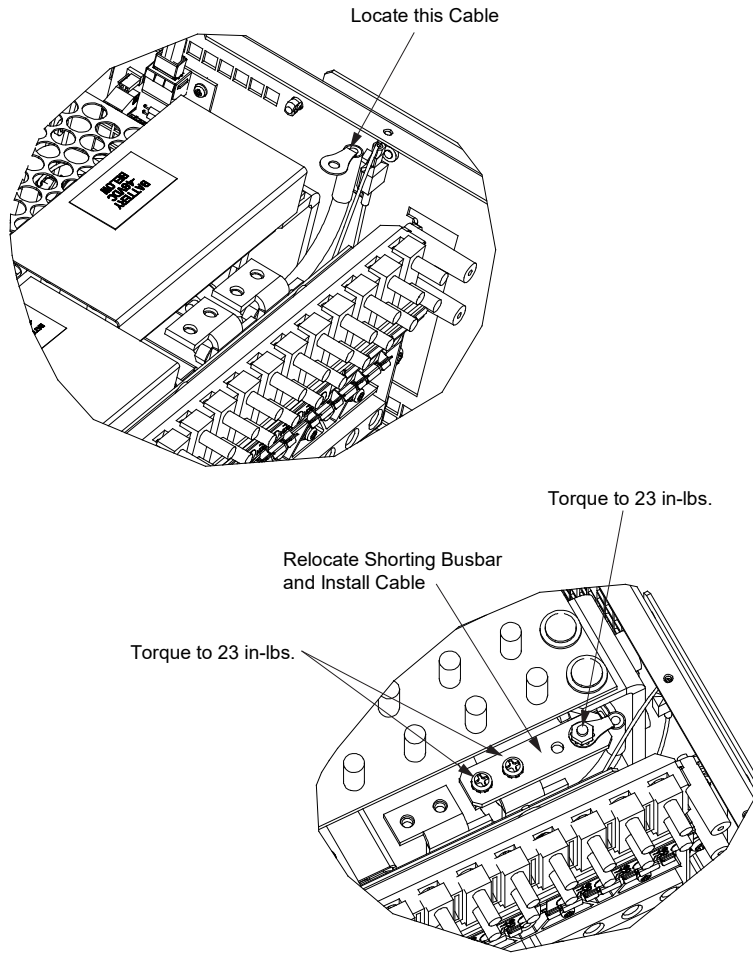


5. Remove the shorting busbar.

**Figure 4.21 Removing the Shorting Busbar**

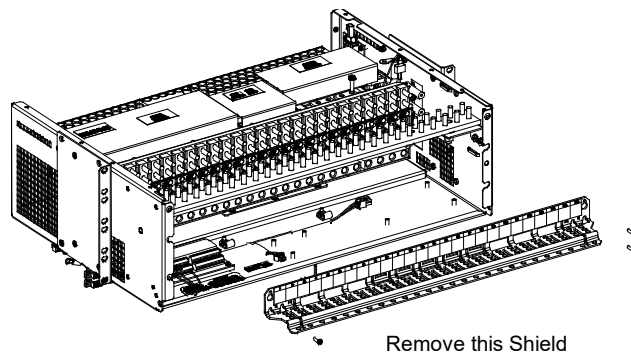
6. Relocate the shorting busbar just removed in the position shown in Figure 4.22. Torque as indicated in the illustration.
7. Locate the heavy cable secured to the side of the distribution cabinet. Connect this cable to the relocated shorting busbar. See Figure 4.22. Torque as indicated in the illustration.

**Figure 4.22 Relocating Shorting Busbar and Connecting Cable**



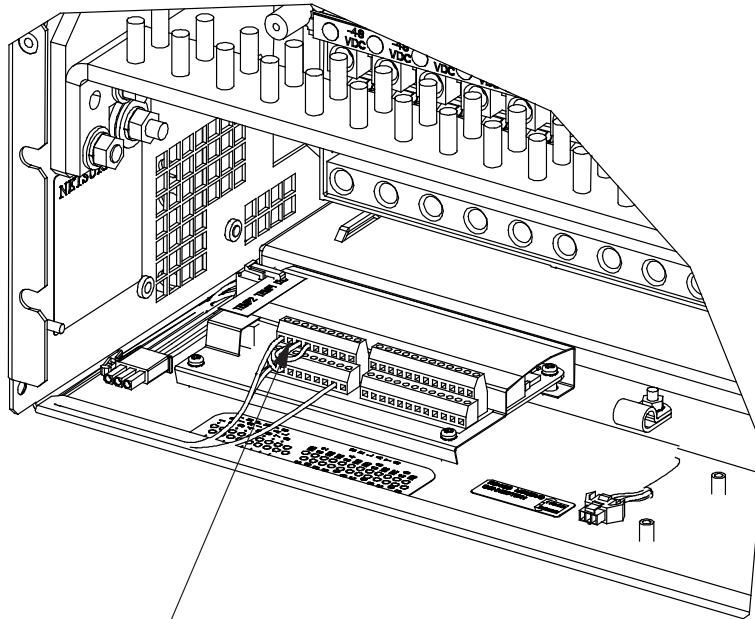
8. Remove the shield from the distribution panel.

**Figure 4.23 Removing Distribution Panel Shield**



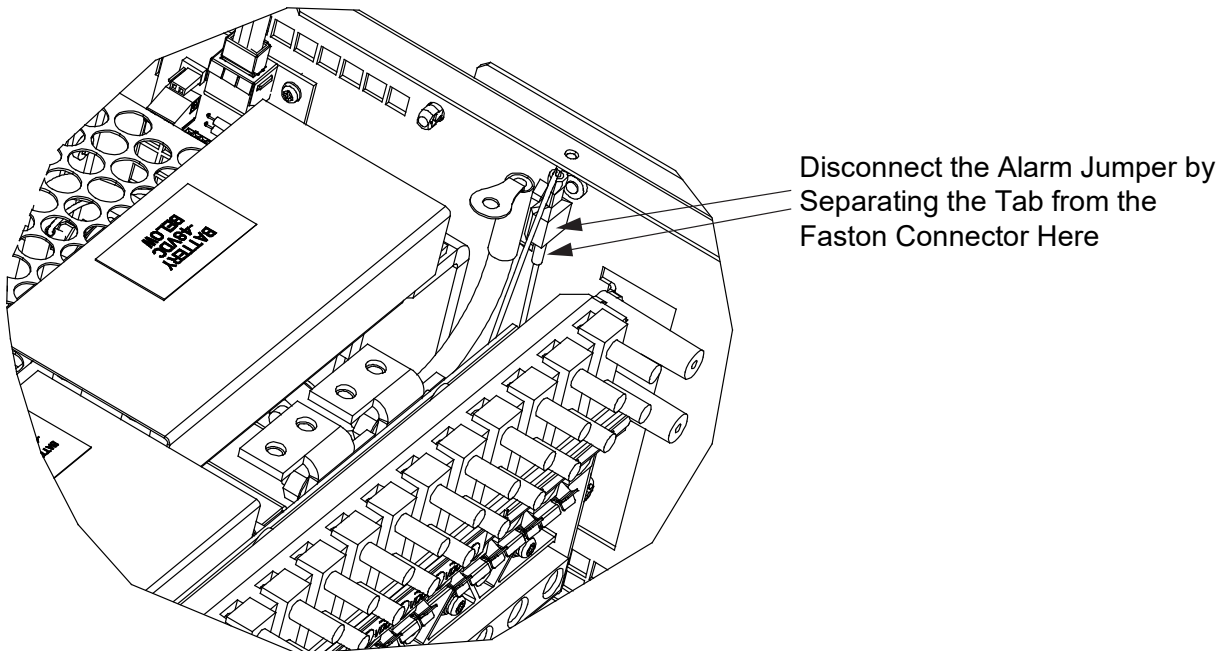
9. Locate the violet wire stored near the IB2 card inside the distribution cabinet. Connect this wire to Digital Input 2+ (DI2+) on the IB2.



**Figure 4.24 Connecting Violet Wire to IB2 DI2+**

Locate violet wire in this area.  
Connect to “Digital Input 2+” (DI2+) on the IB2.

10. Locate the faston connector secured to the inside side wall of the distribution cabinet (see Figure 4.25). Disconnect the wire with the tab from the faston connector. Insulate and tie back

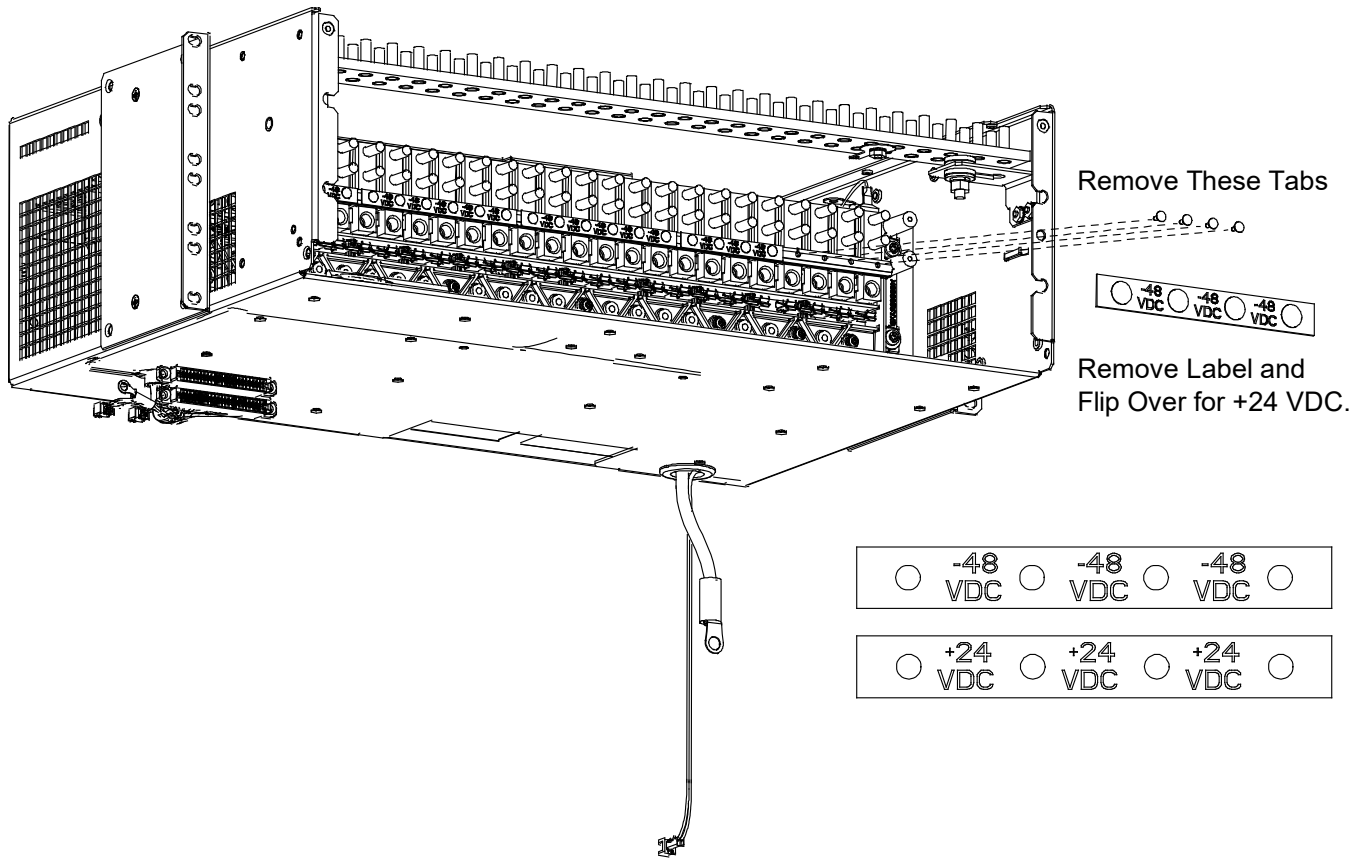
**Figure 4.25 Disconnecting Alarm Jumper**

Disconnect the Alarm Jumper by  
Separating the Tab from the  
Faston Connector Here

11. Remove the voltage/polarity label plug buttons for positions 23 through 26 of the distribution panel as shown in Figure 4.26.
12. Remove the voltage/polarity label for positions 23 through 26 of the distribution panel, then turn over the label to show other polarity.

13. Re-secure with the plug buttons just removed.

**Figure 4.26 Flipping Voltage Label Over**



14. Reinstall the shield to the distribution panel.
15. Bend the top flap of the shorting busbar shield back to the down position.
16. Replace the top cover to the distribution cabinet.
17. Ensure that there are no local or remote alarms active on the system.
18. Close the distribution cabinet's front door and turn the latch clockwise or close the system's enclosure door.

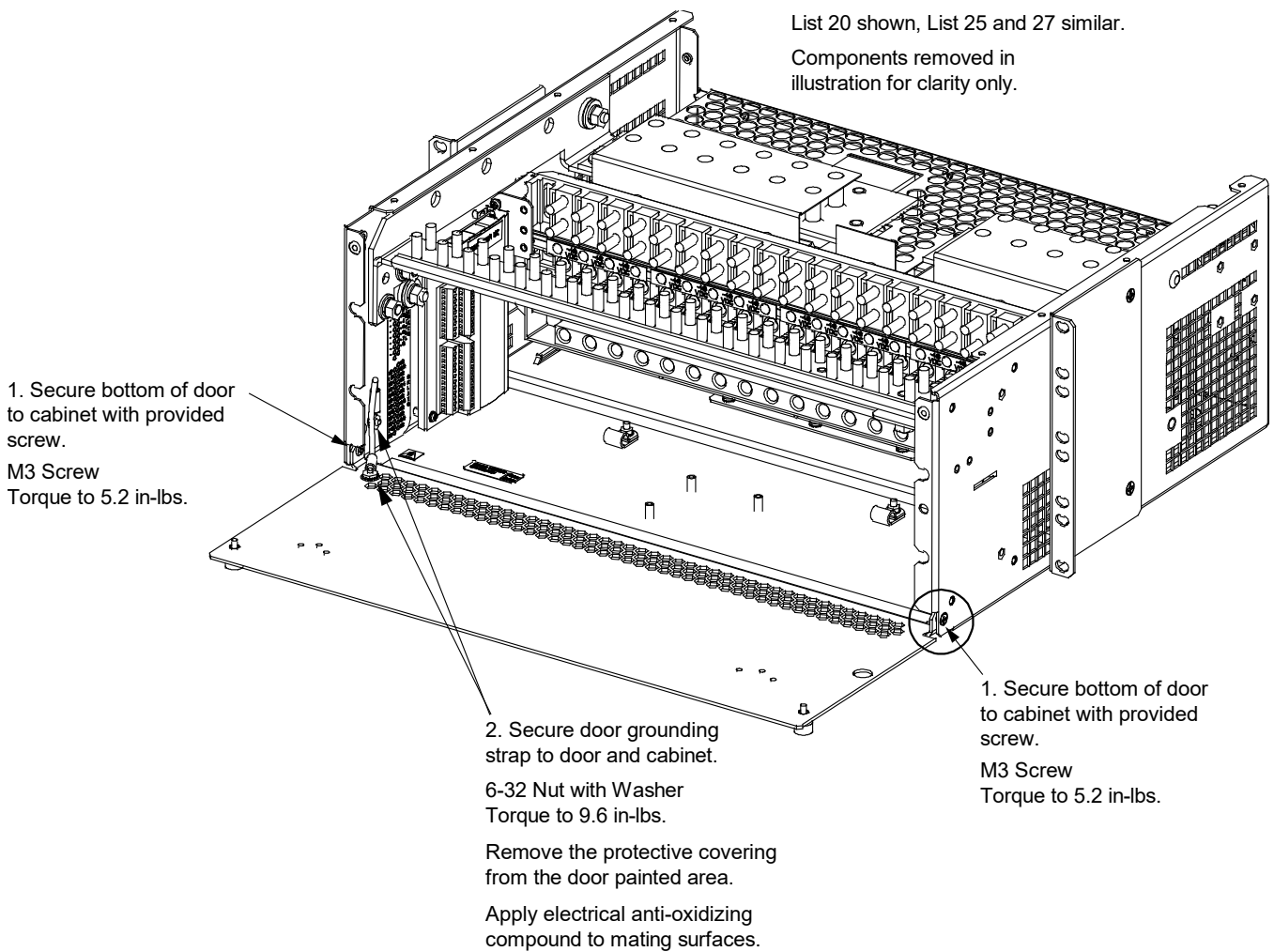
## 4.8 Installing a Front Door Kit

Perform the following procedure to install a front door kit P/N 10010293, 10010294, 10010295, or 10010296.

### Procedure

1. Refer to Figure 4.27 or Figure 4.28 to install the front door kit. After securing the door grounding cable, ensure that when the door is closed the ground cable is not pinched.

**Figure 4.27** Installing Door Kit P/N 10010292 or 10010294



**Figure 4.28** Installing Door Kit P/N 10010293 or 10010295

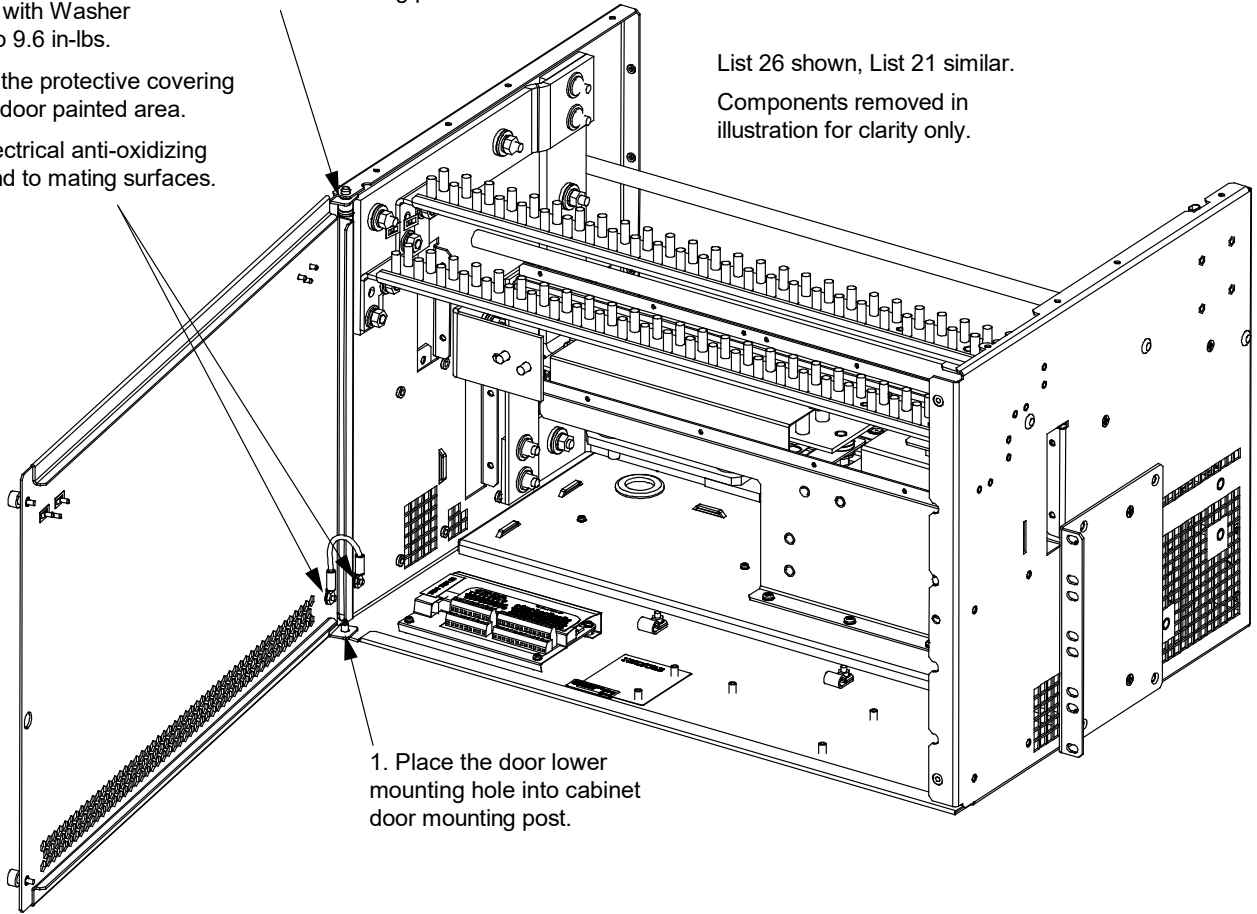
3. Secure door grounding strap to door and cabinet.  
6-32 Nut with Washer  
Torque to 9.6 in-lbs.

Remove the protective covering from the door painted area.

Apply electrical anti-oxidizing compound to mating surfaces.

2. Place the door upper spring loaded fastener into cabinet door mounting post.

List 26 shown, List 21 similar.  
Components removed in illustration for clarity only.



## 5 Troubleshooting and Repair

### 5.1 Contact Information

Refer to Section 4.15.4 (provided with your customer documentation) for support contact information.

### 5.2 Controller, Rectifiers, Solar Converters, Optional -48 VDC to +24 VDC Converters, Optional -48 VDC to -58 VDC Converters, and Optional Inverters

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

- NCU Controller Instructions (UM1M830BNA)
- Rectifier Instructions (UM1R482000E3)
- Solar Converter Instructions (UM1S482000E3)
- -48 VDC to +24 VDC Converter Instructions (UM1C48241500)
- -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3)
- Inverter Instructions (UM1I1201000)

### 5.3 Controller Configuration

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



**NOTE!** 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.

### 5.4 System Troubleshooting Information

This system is designed for ease in troubleshooting and repair. The various indicators as described in “Local Controls and Indicators” on page 6 and in the controller, rectifier, solar converter, -48 VDC to +24 VDC converter, and -48 VDC to -58 VDC converter instructions are designed to isolate failure to a specific element. Once the faulty element has been identified, refer to “Replacement Information” on page 4.1 and “Replacement Procedures” on page 4.1.

#### **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 the System Installation Instructions (IM582137100) and the configuration drawing (C-drawing) supplied with your power 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 Instructions (UM1M830BNA) to access these menus.

#### **Checking the Controller’s Current Limit Point after Adding or Removing a Rectifier, -48 VDC to +24 VDC Converter Module, or -48 VDC to -58 VDC Converter Module**

If a rectifier, -48 VDC to +24 VDC converter module, or -48 VDC to -58 VDC converter module is added; the respective current limit point in amps will automatically increase to maintain the same percentage. For example, if the current limit was set to 100% of combined capacity and a module is added, the new current limit setpoint will be 100% of the combined capacity including the new module.

If a rectifier, -48 VDC to +24 VDC converter, or -48 VDC to -58 VDC converter module is removed from the system (and the Rect Comm Fail or Conv Comm Fail alarm is cleared); the respective current limit point will remain unchanged unless the capacity of the remaining rectifiers, -48 VDC to +24 VDC converters, or -48 VDC to -58 VDC converters is not sufficient to maintain this current limit point. If that happens, the current limit point will automatically decrease to the maximum (121% of the remaining rectifiers or 116% of the remaining -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters).

It is recommended that the current limit point be checked whenever a rectifier, -48 VDC to +24 VDC converter module, or -48 VDC to -58 VDC converter module is added to or removed from the power system.

When setting total rectifier or total -48 VDC to +24 VDC converter or -48 VDC to -58 VDC 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 rectifiers and the current limit is set to 150 amps then each rectifier has a current limit set point of 30 amps. If one or more rectifiers or -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters are removed or fails, it will take several seconds for the individual set points to the remaining rectifiers or -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters to be reset. In the example given, if one rectifier is removed the current limit set point will drop to 120 amps (30 amps times four remaining rectifiers) until the controller can send updated set points to the remaining rectifiers. This takes a couple communication cycles (several seconds) after which each rectifier would have a new set point of 37.5 amps for a total of 150 amps. The total current limit of the rectifiers and -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters should not be set such that the loss of the redundant rectifiers or -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters will cause this temporary set point to drop below the actual maximum expected load. If batteries are used on the rectifier output, the batteries should support the load until the current limit set points can be re-established due to loss of a rectifier.

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

### **Clearing a Rectifier Communications Fail Alarm after Removing a Rectifier**

If a rectifier module is removed from the system, a rectifier communications failure alarm is generated. If the rectifier module will not be replaced, the alarm should be cleared.

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

### **Clearing a Solar Converter Communications Fail Alarm after Removing a Solar Converter**

If a solar converter module is removed from the system, a solar converter communications failure alarm is generated. If the solar converter module will not be replaced, the alarm should be cleared.

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

### **Clearing a -48 VDC to +24 VDC Converter or -48 VDC to -58 VDC Converter Communications Fail Alarm after Removing a -48 VDC to +24 VDC Converter or -48 VDC to -58 VDC Converter**

If a -48 VDC to +24 VDC or a -48 VDC to -58 VDC 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 Instructions (UM1M830BNA) for a procedure.

### **Clearing an Inverter Communications Fail Alarm after Removing an Inverter**

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

### **Clearing a Rectifier Lost Alarm**

If the controller resets while a rectifier communications fail alarm is active, the rectifier communications fail alarm is replaced with a rectifier lost alarm.

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

### **Clearing a Solar Converter Lost Alarm**

If the controller resets while a solar converter communications fail alarm is active, the solar converter communications fail alarm is replaced with a solar converter lost alarm.

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

### **Clearing a -48 VDC to +24 VDC Converter or -48 VDC to -58 VDC Converter Lost Alarm**

If the controller resets while a -48 VDC to +24 VDC converter or -48 VDC to -58 VDC converter communications fail alarm is active, the converter communications fail alarm is replaced with a converter lost alarm.

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

### **Clearing an Inverter Lost Alarm**

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

## **5.5 Replacement Information**

### **Replacement Assemblies**

When a trouble symptom is localized to a faulty rectifier module, solar converter module, -48 VDC to +24 VDC converter module, -48 VDC to -58 VDC converter module, 120 VAC inverter 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 rectifier module, solar converter module, -48 VDC to +24 VDC converter module, -48 VDC to -58 VDC converter module, 120 VAC inverter module, controller, or circuit card. Refer to SAG582137100 (System Application Guide) for replacement part numbers.

## **5.6 Replacement Procedures**



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

### **5.6.1 Replacing a Rectifier, Solar Converter, Optional -48 VDC to +24 VDC Converter, or Optional -48 VDC to -58 VDC Converter, and Inverter**

Refer to the Rectifier Instructions (UM1R482000E3), Solar Converter Instructions (UM1S482000E3), -48 VDC to +24 VDC Converter Instructions (UM1C48241500) or -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3), and inverter instructions (UM1I1201000) for a rectifier, solar converter, -48 VDC to +24 VDC converter module or -48 VDC to -58 VDC converter module, and inverter module replacement procedure. Refer also to “System Troubleshooting Information” on page 39.

The rectifier, solar converter, -48 VDC to +24 VDC converter module or -48 VDC to -58 VDC converter module, or inverter module being replaced is assigned by the NCU the lowest available identification number. If desired, you can change the identification number, see “Configuring the NCU Identification of Rectifiers”, “Configuring the NCU Identification of Solar Converters”, “Configuring the NCU Identification of -48 VDC to +24 VDC Converters or -48 VDC to -58 VDC Converters, and configuring the NCU Identification of Inverters” in the separate Power System Installation Manual (IM582137100).

### **5.6.2 Replacing the NCU Controller**

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

### **5.6.3 Replacing a Distribution Device**

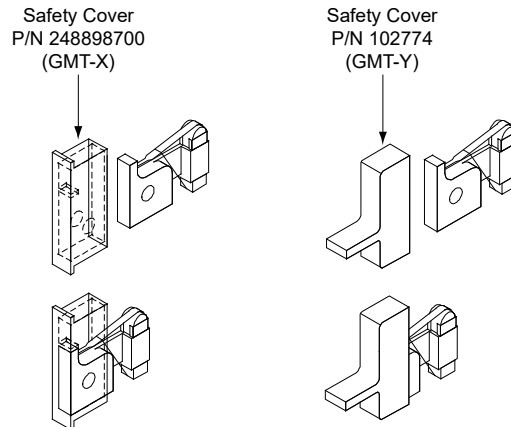
Replace distribution devices with the same type and rating. Refer to System Application Guide SAG582137100 for part numbers.

#### **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**

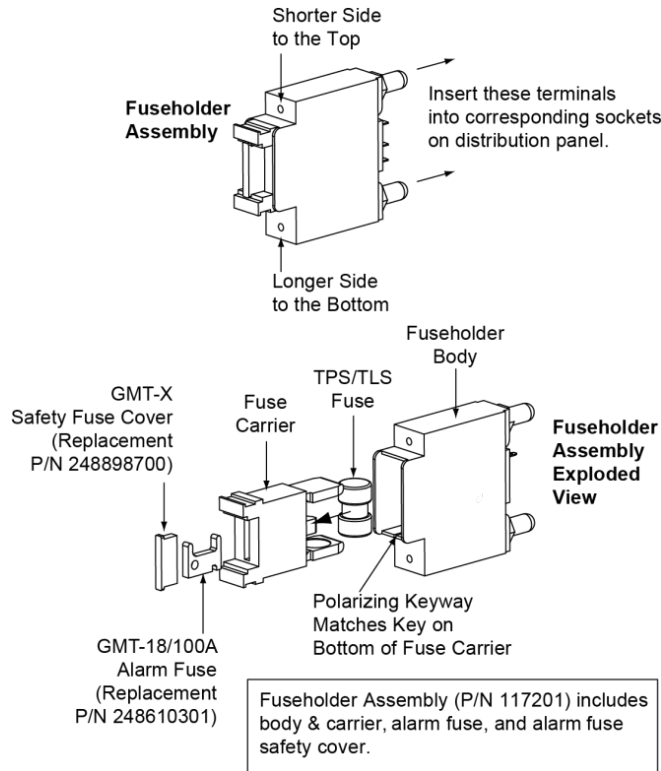
1. An alarm fuse is removed by pulling it straight out of the fuseholder. If the alarm fuse is located in a modular fuse carrier, hold the fuse carrier in place with your thumb while pulling on the alarm fuse to prevent the entire carrier from inadvertently being pulled out.
2. Safety fuse covers are 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. Insure that the safety fuse cover is installed after replacing a fuse. Refer to Figure 5.1 for installation details.

**Figure 5.1 Installation of Safety Fuse Covers****Replacing a TPS/TLS Fuse****Procedure**

**NOTE!** Refer to Figure 5.2 as this procedure is performed.

1. Remove the fuse carrier from the mounted fuseholder body by pulling it straight out.
2. Remove the open fuse from the fuse carrier and replace it with the same type and rating.
3. 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.
4. 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.
5. Verify no Fuse Alarms are active.



**Figure 5.2 Replacing a TPS/TLS Fuseholder and/or Fuse**

## Replacing a Bullet Nose Fuseholder

### Procedure



**NOTE!** Refer to Figure 5.2 as this procedure is performed.

1. 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.
2. Gently rock the defective fuseholder up and down while pulling firmly outward until the fuseholder is free from the distribution panel.
3. Orient the fuseholder as shown in Figure 5.2. 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.
4. 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.
5. Verify no Fuse Alarms are active.

## Replacing a Bullet Nose Circuit Breaker

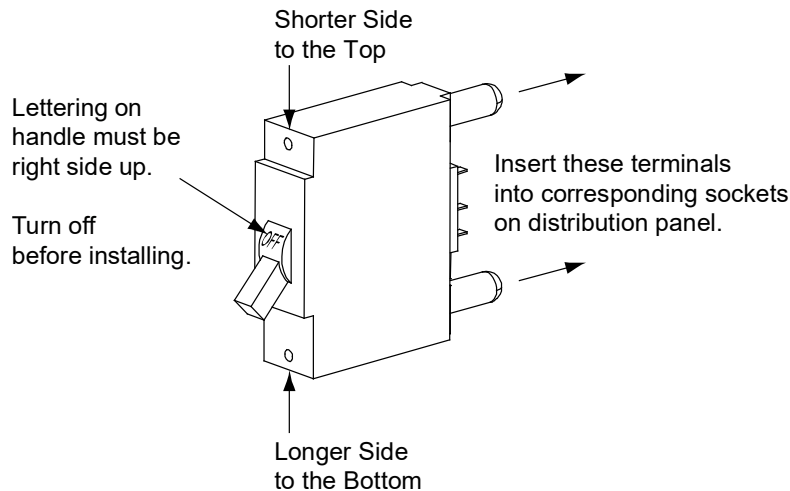
### Procedure



**NOTE!** Refer to Figure 5.3 as this procedure is performed.

1. Operate the defective circuit breaker to the OFF position.
2. Gently rock the defective circuit breaker up and down while pulling firmly outward until the breaker is free from the distribution panel.
3. Ensure that the replacement circuit breaker is in the OFF position, and is of the correct rating.
4. Orient the circuit breaker as shown in Figure 5.3. 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.
5. Operate the replacement circuit breaker to the ON position.
6. Verify no Circuit Breaker Alarms are active.

**Figure 5.3** Replacing a Bullet Nose Circuit Breaker

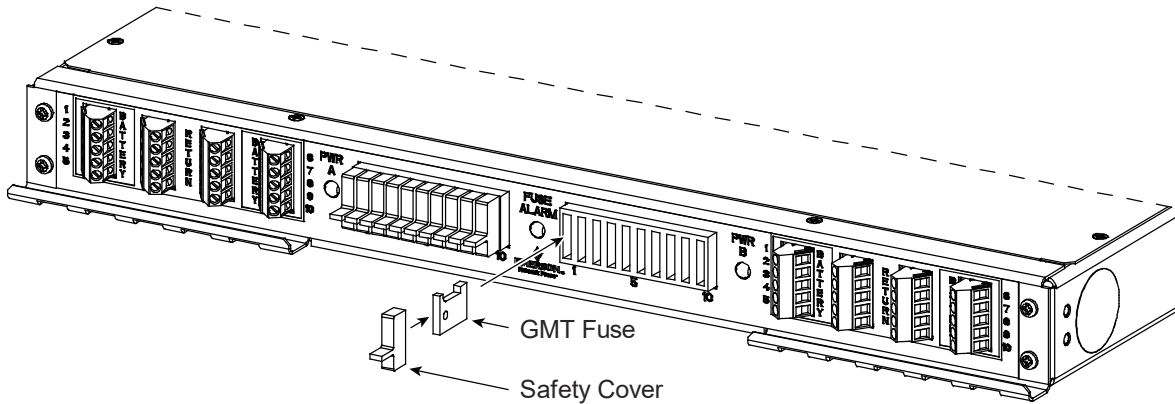


## Replacing a GMT Distribution Fuse in a List KG

### Procedure

1. Refer to Figure 5.4 and replace the fuse. Ensure a safety fuse cover is installed on the replacement fuse, as shown in Figure 5.1.
2. Verify no Fuse Alarms are active.

Figure 5.4 GMT Distribution Fuse Replacement (List KG)



### 5.6.4 Circuit Card Replacement Procedures



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



**ALERT!** Circuit cards used in this system contain static-sensitive devices. Read the “Static Warning” found in Section 4154 (provided with your system documentation) before performing any of the following procedures.

#### **General**

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

#### **Circuit Card Locations**

Refer to Figure 5.5, Figure 5.6, or Figure 5.7.

Figure 5.5 List 20, 25 Circuit Card Locations (1-Row Distribution Cabinet)

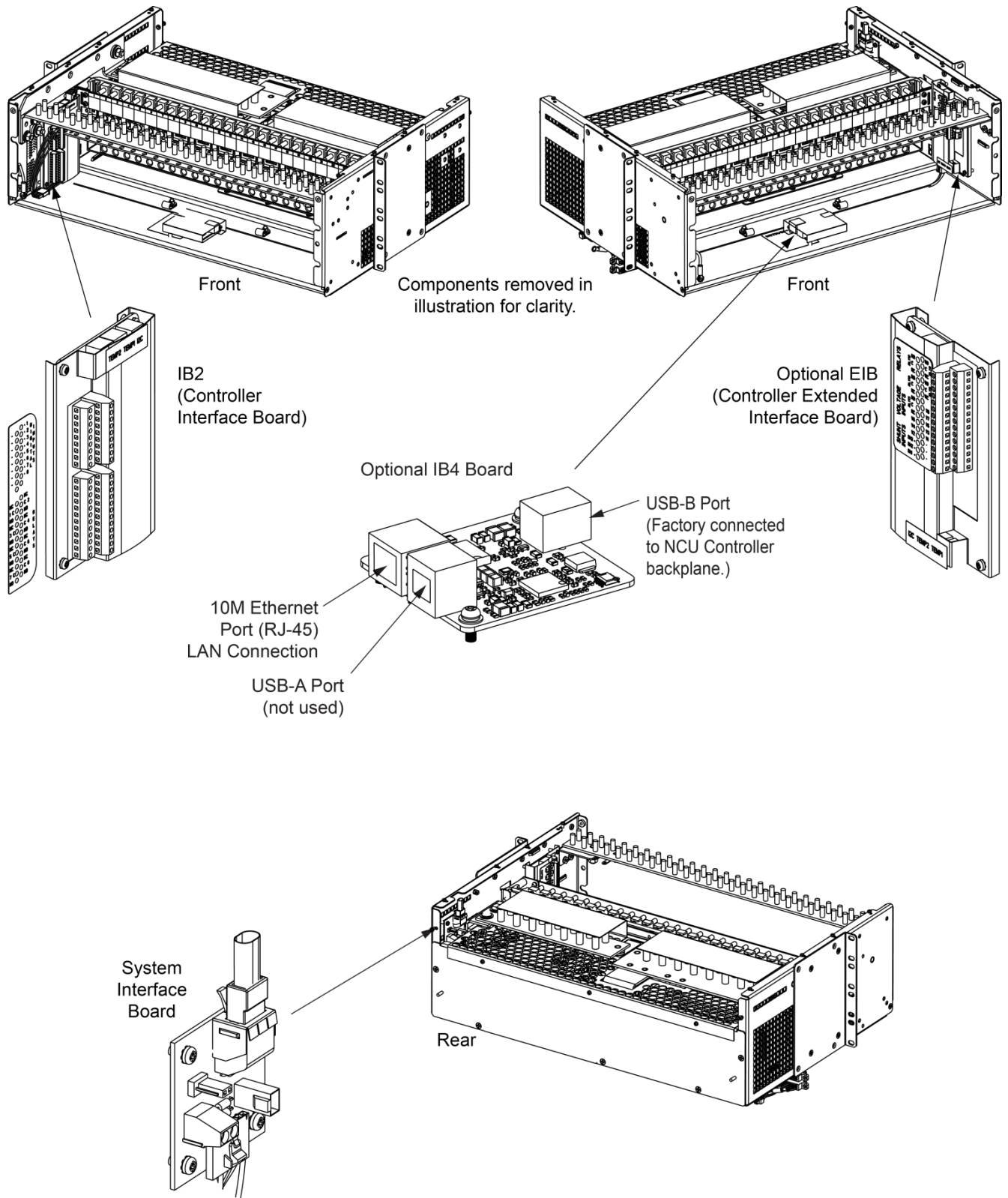


Figure 5.6 List 21, 26 Circuit Card Locations (2-Row Distribution Cabinet)

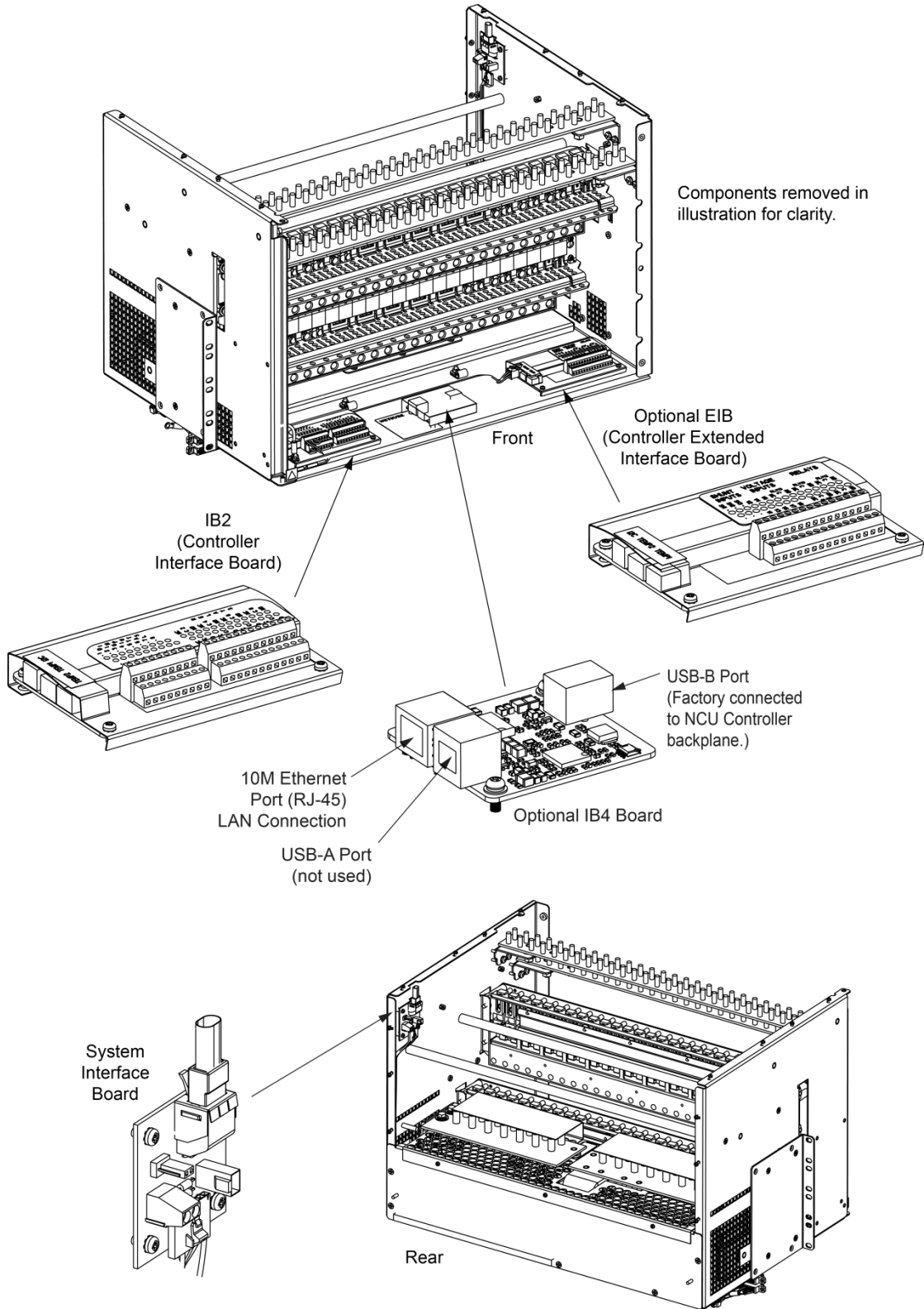
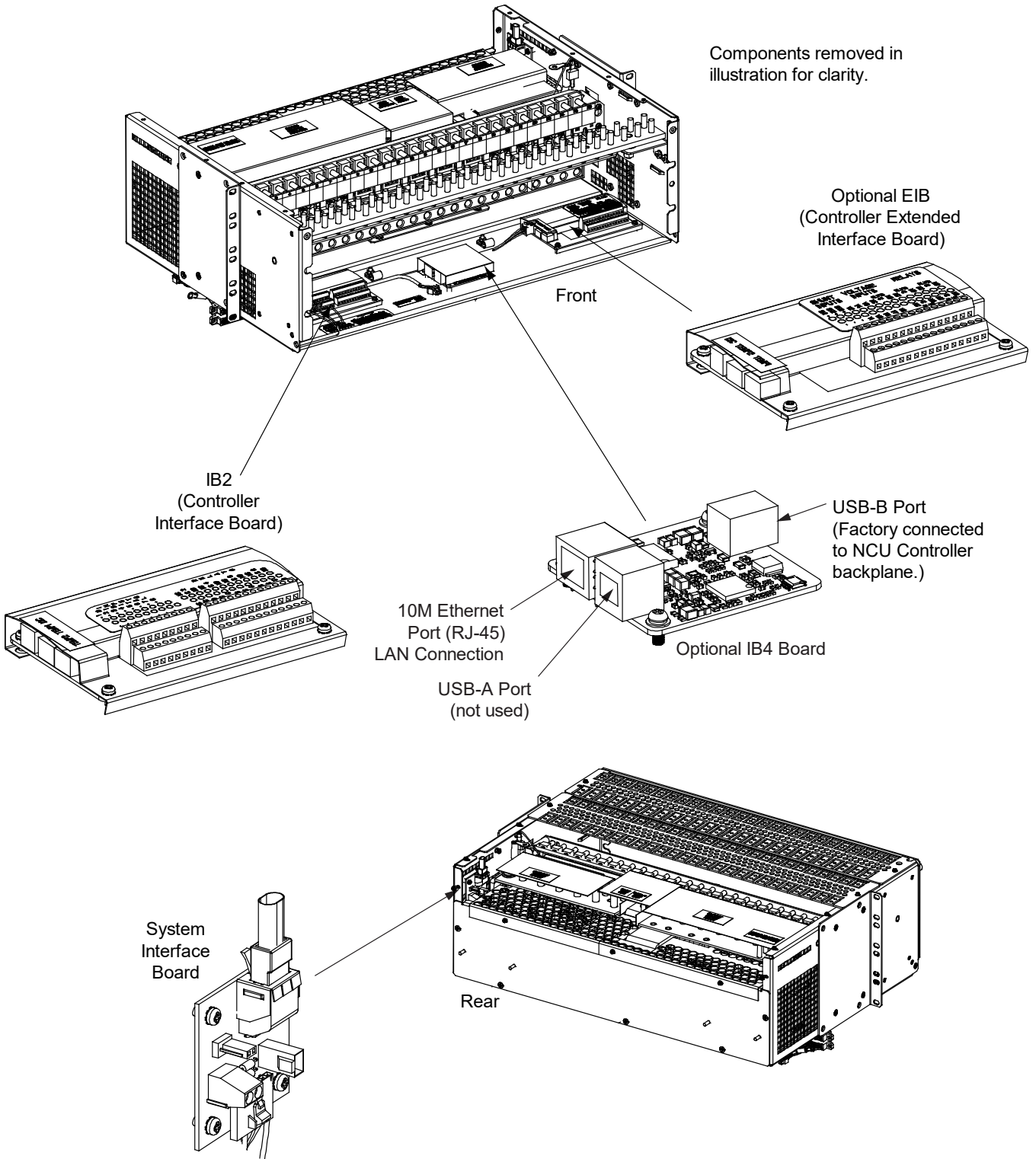


Figure 5.7 List 27 Circuit Card Locations (1-Row Distribution Cabinet)



## Replacing a System Interface Circuit Card

### Procedure



**NOTE!** Refer to Figure 5.8 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 battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

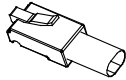


**WARNING!** Damage to the circuit card may result if the next step is not followed.

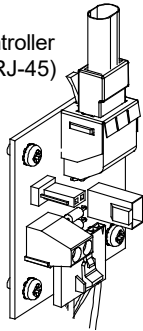
2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Remove the rear covers to access the circuit card mounting screws. Refer to Figure 5.8 for circuit card location.
4. Carefully label any wires connected to the customer connection terminal block on the circuit card. These wires must be connected to the same terminals on the replacement circuit card. Refer to Figure 5.8.
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 5.8.
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 “Setting Jumper and Switch Options” section of the Power System Installation Instructions (IM582137100).
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. Reinstall the rear covers.
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 5.8 Replacing a System Interface Circuit Card**

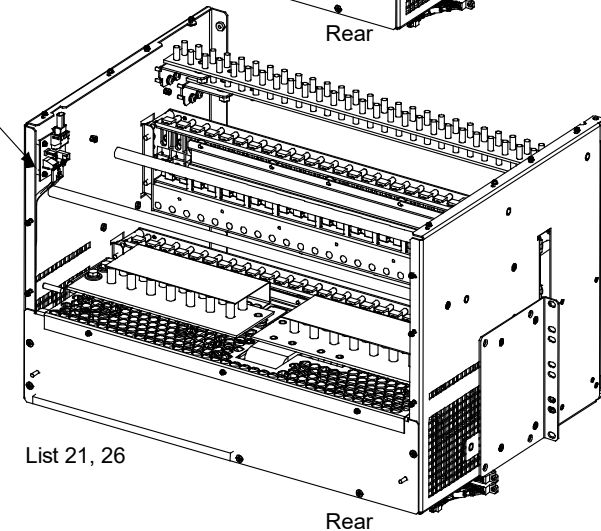
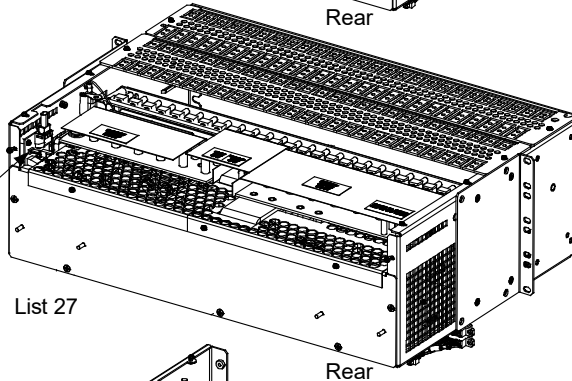
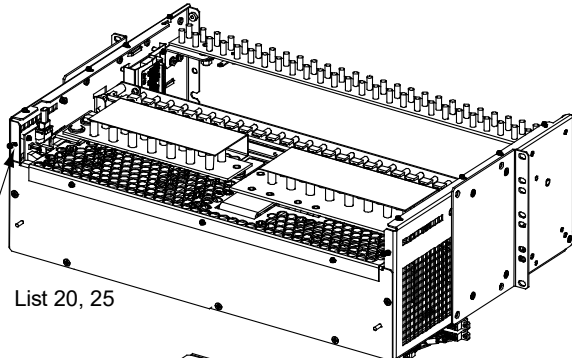
A CAN termination plug (P/N 548398) must be installed if an external device or system is not connected here.



J2 Controller CAN Port (RJ-45)



System Interface Board



**J4 on System Interface Board**

Selects to power controller from "Battery Power" or not if a battery LVD contactor is furnished.

No  
Battery Battery  
Pwr Pwr



Shorting Jumper

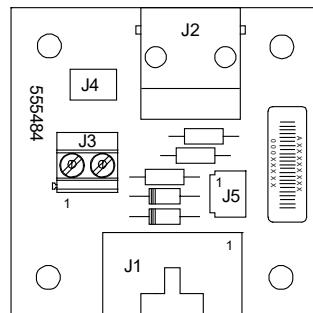
**J3 on System Interface Board**

Wire Size Capacity: 16 AWG to 30 AWG.  
Wire Strip Length: 0.32 inch.  
Recommended Torque: 2.3 in-lbs.

**RS485 Connection**

J3-1: RS485+  
J3-2: RS485-

System Interface Board P/N 555484





## Replacing the IB2 (Controller Interface Board) or Optional EIB (Controller Extended Interface Board)

### Procedure



**NOTE!** Refer to Figure 5.5, Figure 5.6, or Figure 5.7 for circuit card locations. Refer to Figure 5.9 or Figure 5.10 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 battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.



**WARNING!** 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.
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 5.9 or Figure 5.10.
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 5.9 or Figure 5.10.



**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. See Figure 5.9 or Figure 5.10.
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 "Setting Jumper and Switch Options" section of the Power System Installation Instructions (IM582137100).
10. Secure the replacement circuit card (and shield) to the distribution cabinet. See Figure 5.9 or Figure 5.10.
11. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.

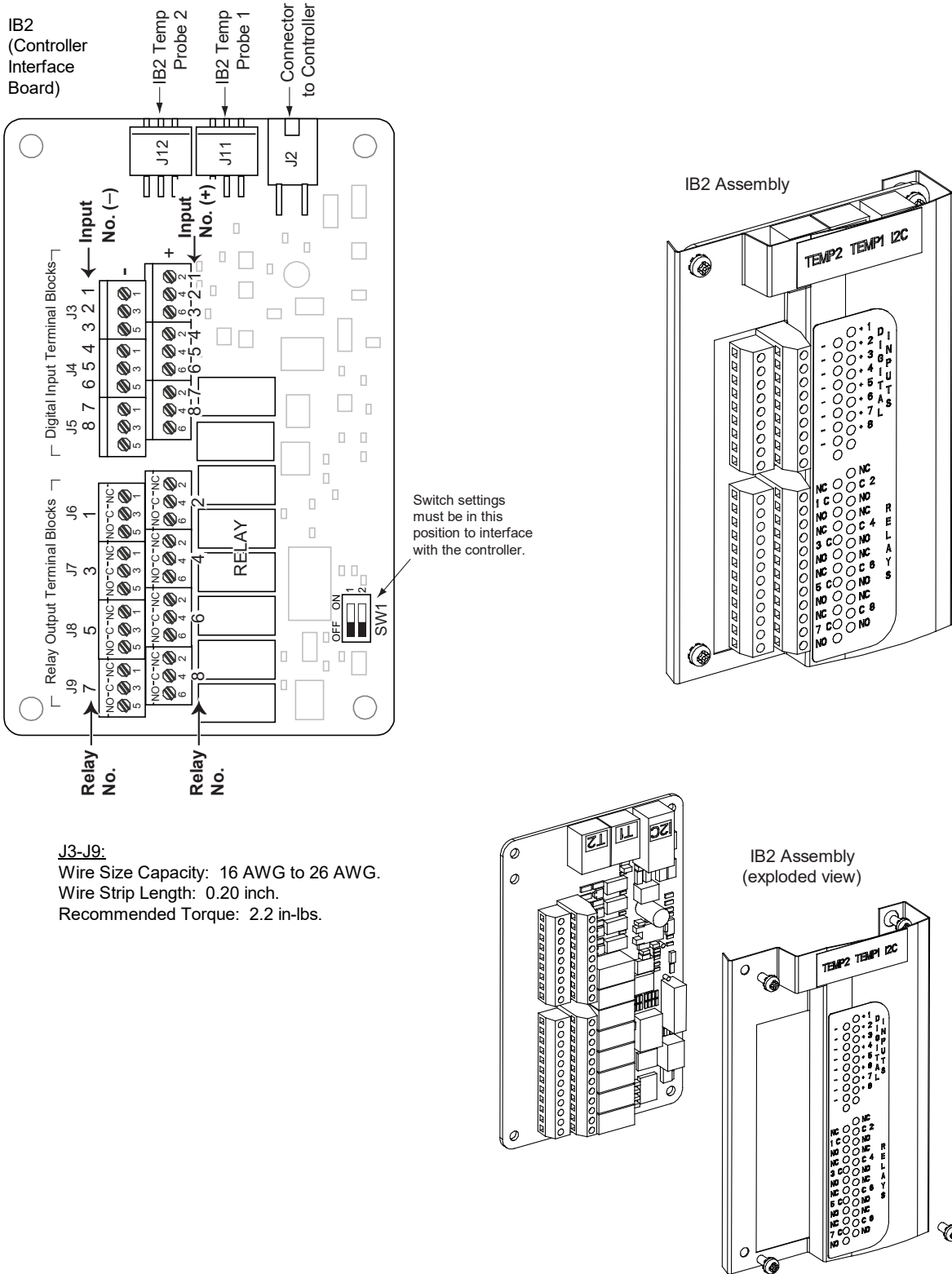


**DANGER!** In the next step, external alarm wiring may be energized from an external source. DO NOT allow bare wire ends to contact any grounded or energized object.

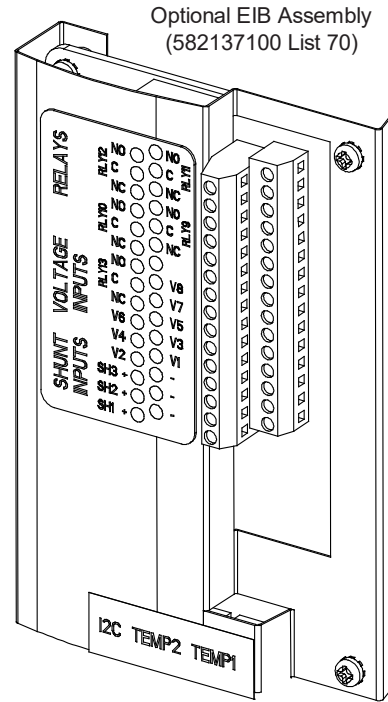
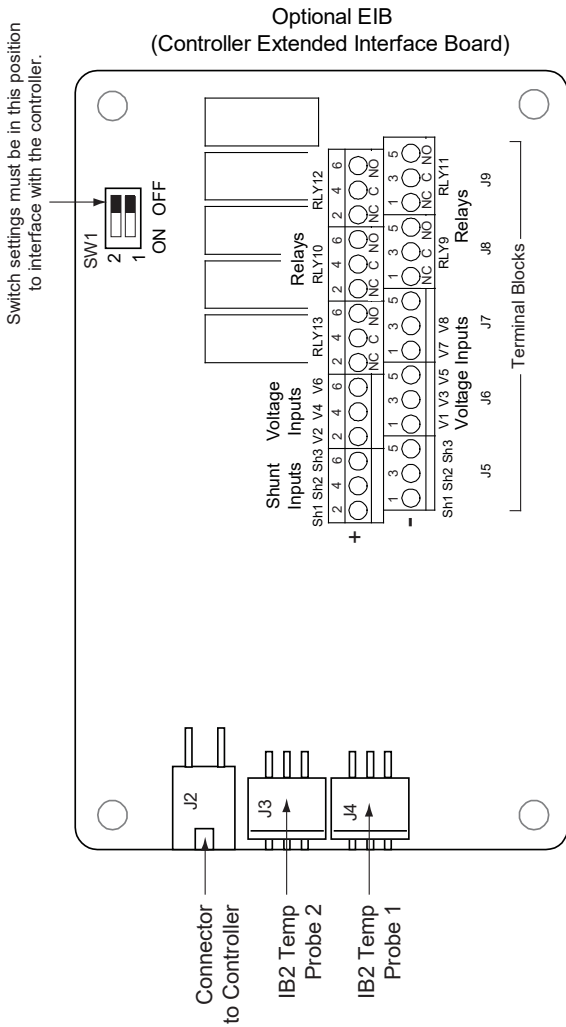
12. Reconnect the external wiring to the correct terminals on the customer connection terminal block. First remove the electrical tape that was applied to the bare wire end in a previous step. DO NOT allow the bare wire end to contact any grounded or energized object. After securing the wire, gently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

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.

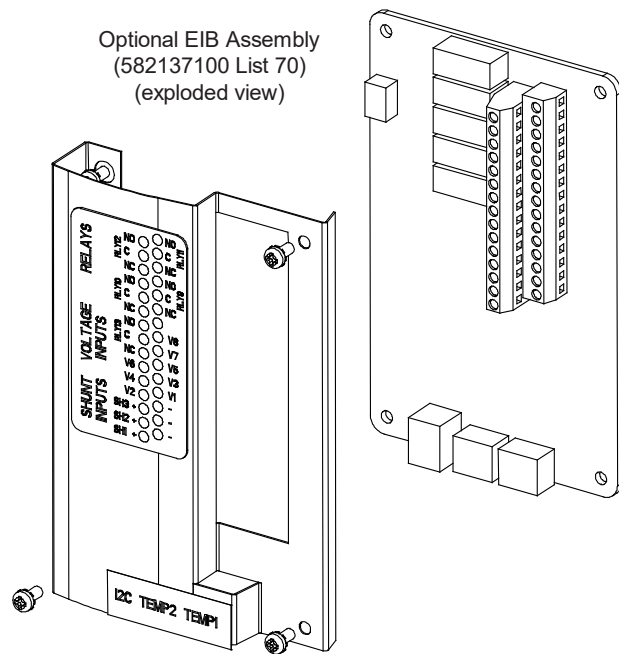
**Figure 5.9 Replacing an IB2 (Controller Interface Board) Circuit Card**



**Figure 5.10** Replacing an EIB (Controller Extended Interface Board) Circuit Card



Optional EIB Assembly  
(582137100 List 70)  
(exploded view)



**J5-J9**

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

## Replacing the Optional IB4 Board

### Procedure



**NOTE!** Refer to Figure 5.5, Figure 5.6, or Figure 5.7 for circuit card locations. Refer to Figure 5.11 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 battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

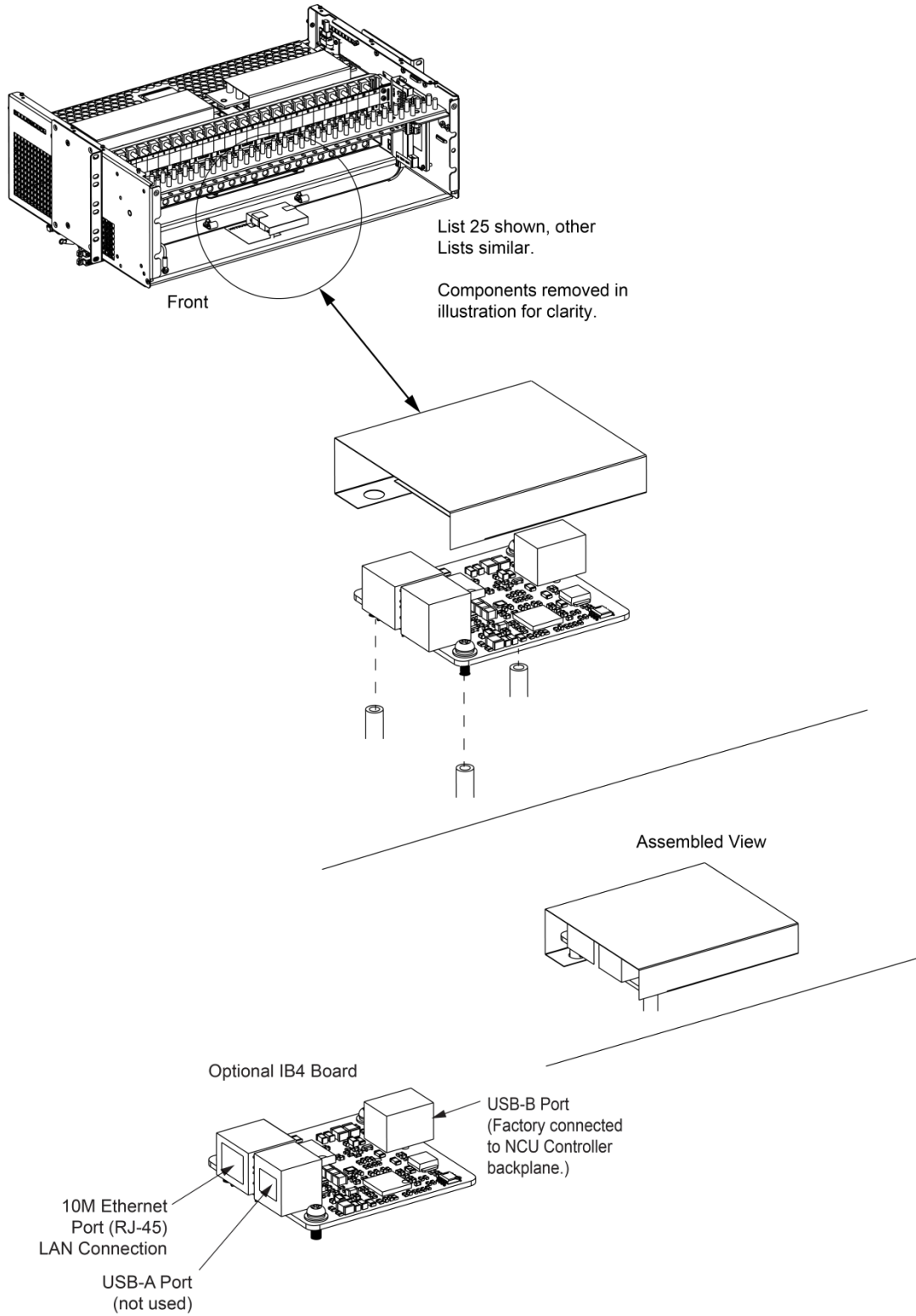
2. Open the distribution cabinet's front door.



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

3. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
4. 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 circuit card. These connectors must be plugged into the same connectors on the replacement circuit card.
6. Unplug all connectors plugged into the circuit card.
7. Remove the circuit card (and shield) from the distribution cabinet by removing the screws securing it to the cabinet. See Figure 5.11.
8. Secure the replacement circuit card (and shield) to the distribution cabinet. See Figure 5.11.
9. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.
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. Remove the grounding wrist strap.
12. Close the distribution cabinet's front door.
13. 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.
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 5.11 Replacing an Optional IB4 Board



## **Replacing an SM-DU Circuit Card in a List 60 Hybrid Connection Cabinet**

### **Procedure**



**NOTE!** Refer to Figure 5.12 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.



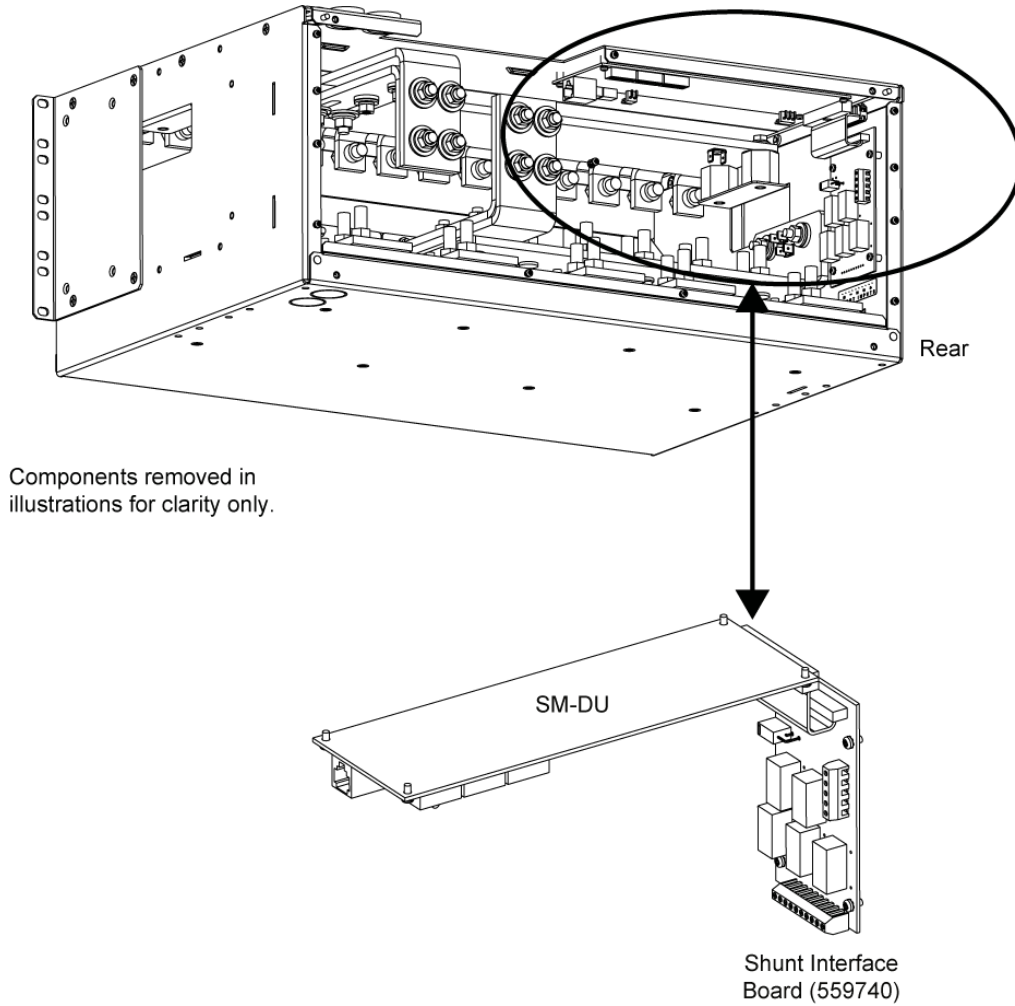
**DANGER!** Performing the next steps exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.



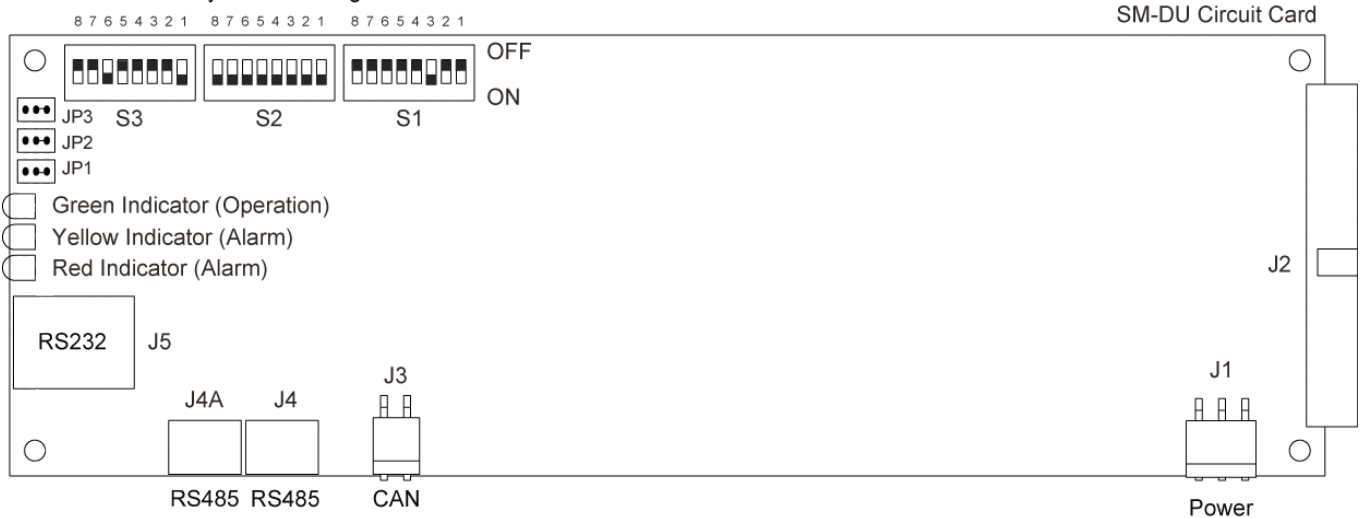
**WARNING!** Damage to the circuit card may result if the next step is not followed.

2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Remove the rear covers to access the circuit card mounting screws. See Figure 5.12.
4. Unplug all connectors plugged into the circuit card.
5. Remove the screws securing the circuit card and remove the circuit card from the cabinet.
6. In this step, ensure you do not intermix the old and replacement circuit cards. Set the switches on the replacement circuit card to the same setting as the old circuit card. Switch settings are documented in the “Setting Jumper and Switch Options” section of the Power System Installation Instructions (IM582137100).
7. Orient the replacement circuit card over its mounting position inside the cabinet, and secure with the screws removed from the old circuit card.
8. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.
9. Reinstall the rear covers.
10. Remove the grounding wrist strap.
11. Temporarily remove then re-insert the controller. Wait for the controller to initialize.
12. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
13. Ensure that there are no local or remote alarms active on the system.

**Figure 5.12** Replacing an SM-DU Circuit Card in a List 60 Hybrid Connection Cabinet



Note: Factory switch settings shown.



## 5.6.5 Replacing a Distribution Panel in a List 20, 25 Distribution Cabinet



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



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

### **Procedure**



**NOTE!** Refer to Figure 5.13 as this procedure is performed.

### **Removing the Distribution Panel**

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.
2. Open the distribution cabinet’s front door or remove the front access panel (as required).
3. Remove the distribution panel cover.
4. Disconnect all system load and battery wiring from the circuit breaker/fuse positions on the distribution panel.
5. Refer to “Replacing the IB2 (Controller Interface Board) or Optional EIB (Controller Extended Interface Board)” on page 51 and remove the IB2 and EIB assemblies.
6. Disconnect the alarm wiring from the distribution panel. See Figure 5.13.
7. Remove the hardware securing the system load distribution device busbar to the panel. See Figure 5.13.
8. Remove the hardware securing the battery disconnect device busbar to the panel (if present). See Figure 5.13.
9. Remove the hardware securing the distribution panel to the distribution cabinet. Some hardware is located behind the lug terminal busbars which requires the lug terminal busbars to be removed first. Remove the distribution panel from the distribution cabinet. See Figure 5.13.

### **Installing the Distribution Panel**



**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.

1. Orient the replacement distribution panel into distribution cabinet, checking to ensure no wires are pinched. Replace the hardware securing the distribution panel to the distribution cabinet. Refer to Figure 5.13 for hardware build-up and torque.
2. Replace the hardware securing the system load distribution device busbar to the distribution panel. Refer to Figure 5.13 for hardware build-up and torque.
3. Replace the hardware securing the battery disconnect device busbar to the distribution panel (if present). Refer to Figure 5.13 for hardware build-up and torque.
4. Reconnect the alarm wiring to the distribution panel. See Figure 5.13.
5. Refer to “Replacing the IB2 (Controller Interface Board) or Optional EIB (Controller Extended Interface Board)” on page 51 and replace the IB2 and EIB assemblies.
6. Reconnect the load distribution and battery wiring to the circuit breaker/fuse positions on the distribution panel.

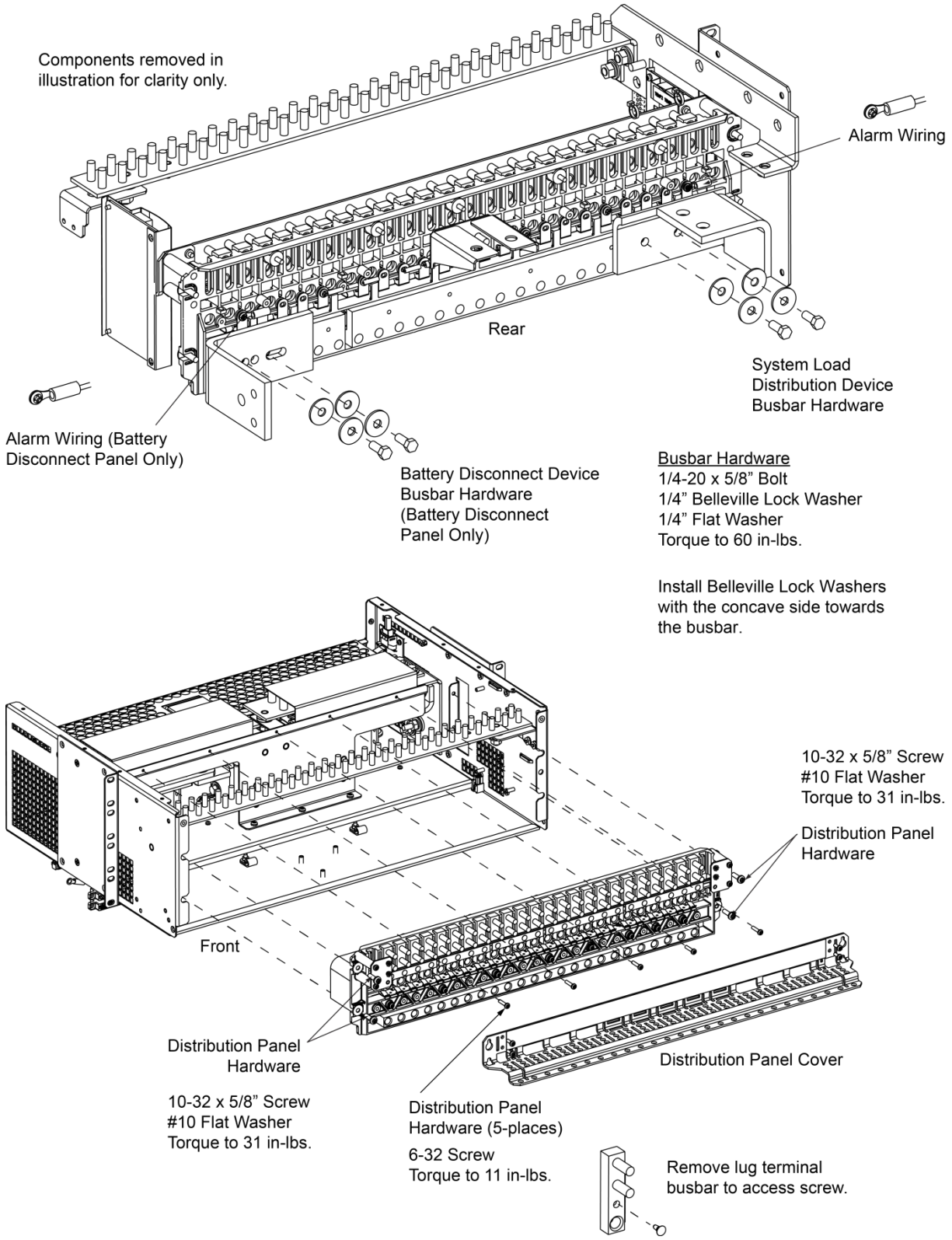


7. Transfer the plug-in circuit breakers or fuses from the old distribution panel to the replacement distribution panel.
8. Replace the distribution panel cover.
9. Close the front door or replace the front access panel (as required) removed above.

#### **Restarting the Power System**

1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582137100) for a startup procedure.
3. Close the distribution cabinet's front door.
4. Verify no alarms are active.

**Figure 5.13 Replacing a Distribution Panel in a List 20, 25 Distribution Cabinet**



## 5.6.6 Replacing a Distribution Panel in a List 21, 26 Distribution Cabinet



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



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

### **Procedure**



**NOTE!** Refer to Figure 5.14 as this procedure is performed.

### **Removing the Distribution Panel**

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.
2. Open the distribution cabinet's front door or remove the front access panel (as required).
3. Remove the distribution panel cover.
4. Disconnect all system load, sub-system load, and battery wiring from the circuit breaker/fuse positions on the distribution panel.
5. Disconnect the alarm wiring from the distribution panel. See Figure 5.14.
6. Remove the hardware securing the system load distribution device busbar to the panel. See Figure 5.14.
7. Remove the hardware securing the sub-system load distribution device busbar to the panel (if present). See Figure 5.14.
8. Remove the hardware securing the battery disconnect device busbar to the panel (if present). See Figure 5.14.
9. Remove the hardware securing the distribution panel to the distribution cabinet. Some hardware is located behind the lug terminal busbars which requires the lug terminal busbars to be removed first. Remove the distribution panel from the distribution cabinet. See Figure 5.14.

### **Installing the Distribution Panel**



**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.

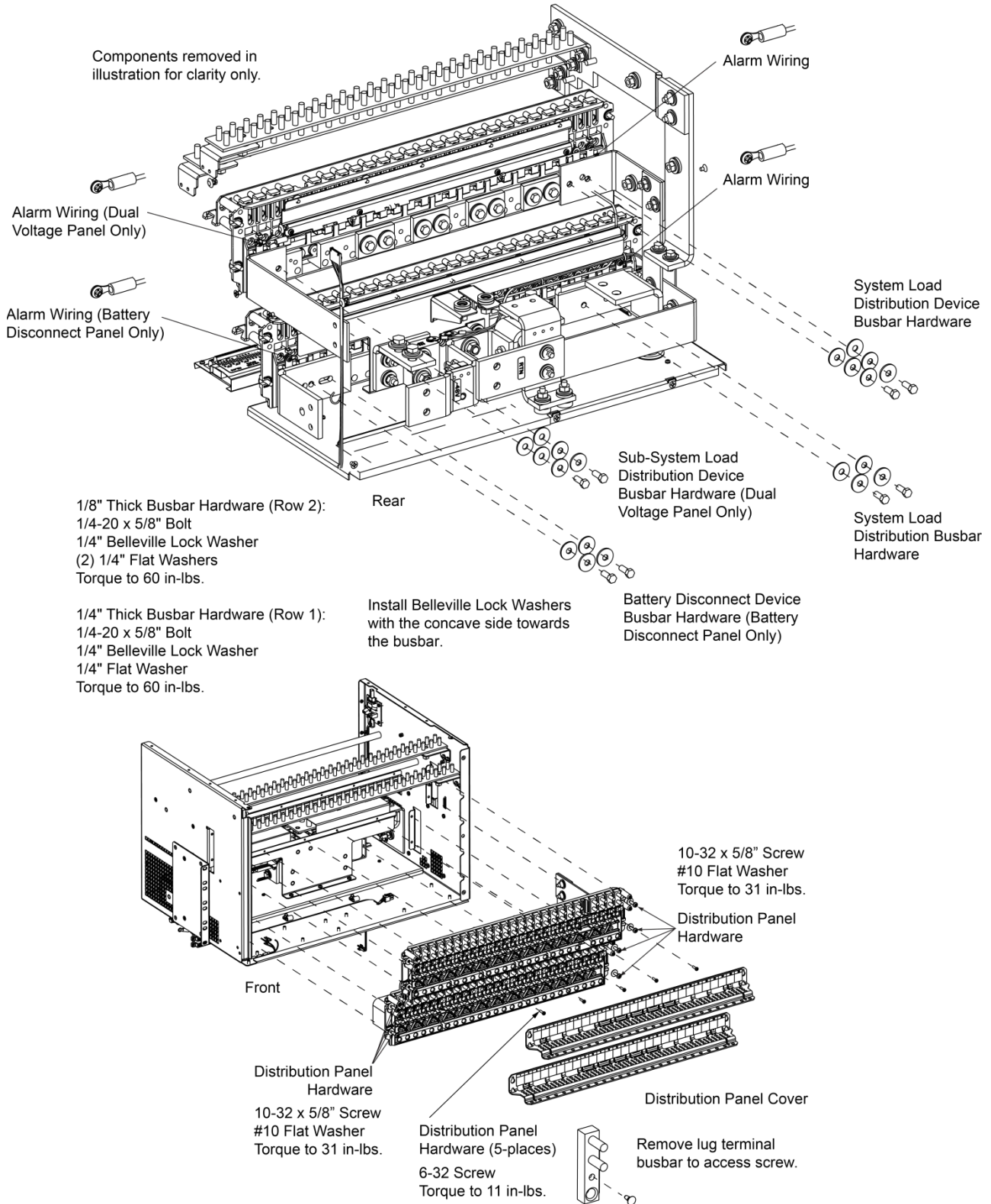
1. Orient the replacement distribution panel into distribution cabinet, checking to ensure no wires are pinched. Replace the hardware securing the distribution panel to the distribution cabinet. Refer to Figure 5.14 for hardware build-up and torque.
2. Replace the hardware securing the system load distribution device busbar to the distribution panel. Refer to Figure 5.14 for hardware build-up and torque.
3. Replace the hardware securing the sub-system load distribution device busbar to the distribution panel (if present). Refer to Figure 5.14 for hardware build-up and torque.
4. Replace the hardware securing the battery disconnect device busbar to the distribution panel (if present). Refer to Figure 5.14 for hardware build-up and torque.
5. Reconnect the alarm wiring to the distribution panel. See Figure 5.14.

6. Reconnect the system load, sub-system load, and battery wiring to the circuit breaker/fuse positions on the distribution panel.
7. Transfer the plug-in circuit breakers or fuses from the old distribution panel to the replacement distribution panel.
8. Replace the distribution panel cover.
9. Close the front door or replace the front access panel (as required) removed above.

#### **Restarting the Power System**

1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582137100) for a startup procedure.
3. Close the distribution cabinet's front door.
4. Verify no alarms are active.

**Figure 5.14 Replacing a Distribution Panel in a List 21, 26 Distribution Cabinet**



## 5.6.7 Replacing a Battery or Load Disconnect Contactor in a List 20, 25 Distribution Cabinet



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



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

### **Procedure**



**NOTE!** Refer to Figure 5.15 and Figure 5.16 as this procedure is performed.

### **Removing the Contactor**

1. Verify all AC and DC power sources are disconnected from the power system.
2. Remove the rear top shield.
3. Remove the top rear shield.
4. Remove the battery and battery return busbar assemblies. See Figure 5.15.
5. Remove the shield below the battery and battery return busbar assemblies. See Figure 5.15.
6. Disconnect the wiring to the contactor by unplugging the quick disconnects.
7. Note the orientation of the contactor to ensure the replacement is installed the same way. Unbolt the contactor (4-places) and remove.

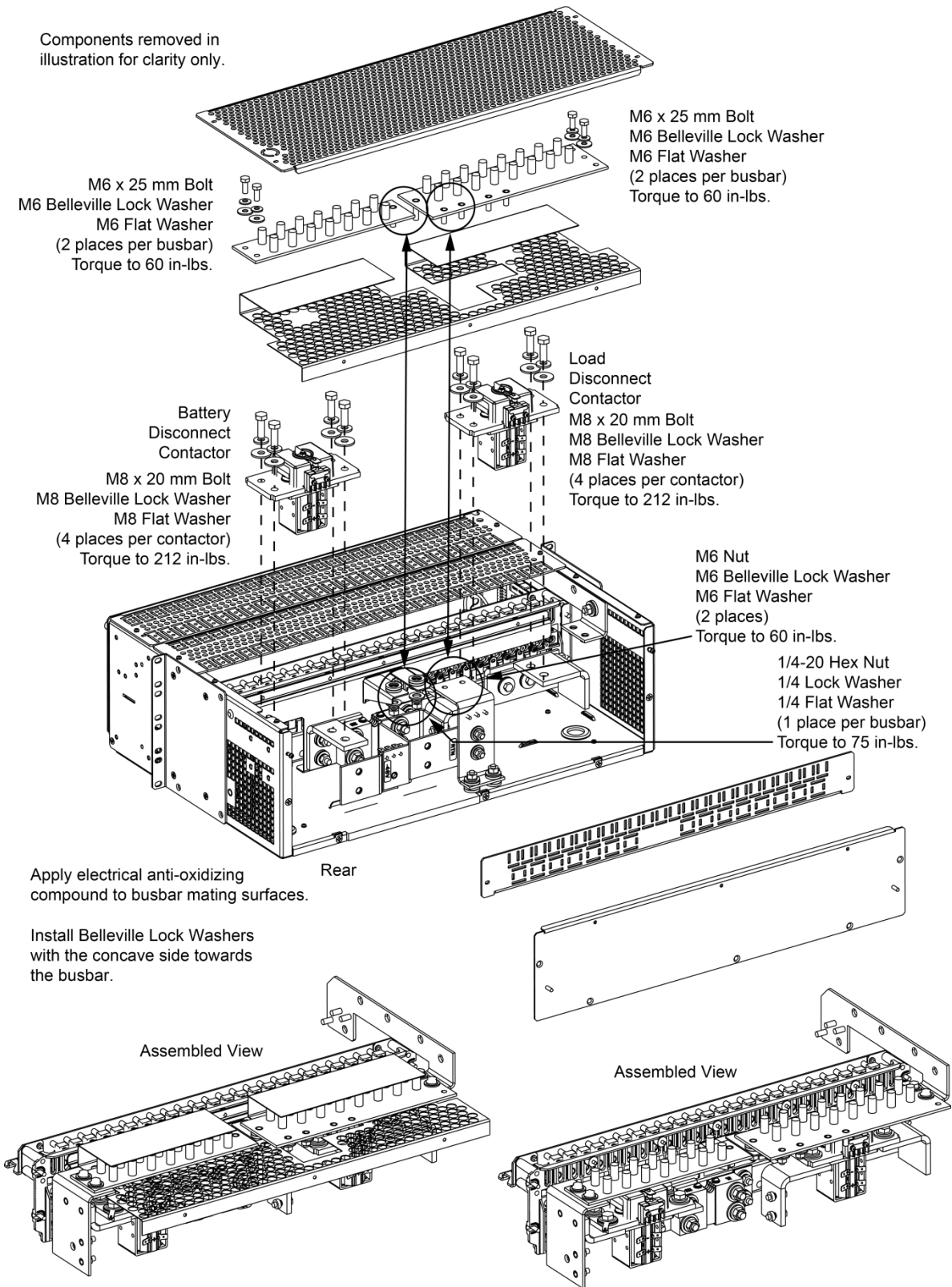
### **Installing the Replacement Contactor**

1. Position the replacement contactor oriented the same way as the old.
2. Secure the contactor with the hardware removed above. Refer to Figure 5.15 for hardware build-up and recommended torque.
3. Replace the wiring to the contactor by plugging-in the quick disconnects. Refer to Figure 5.15 and Figure 5.16.
4. Replace the shield below the battery and battery return busbar assemblies. See Figure 5.15.
5. Replace the battery and battery return busbar assemblies. See Figure 5.15 for hardware build-up and recommended torque.
6. Replace the top rear shield.
7. Replace the rear top shield.

### **Restarting the Power System**

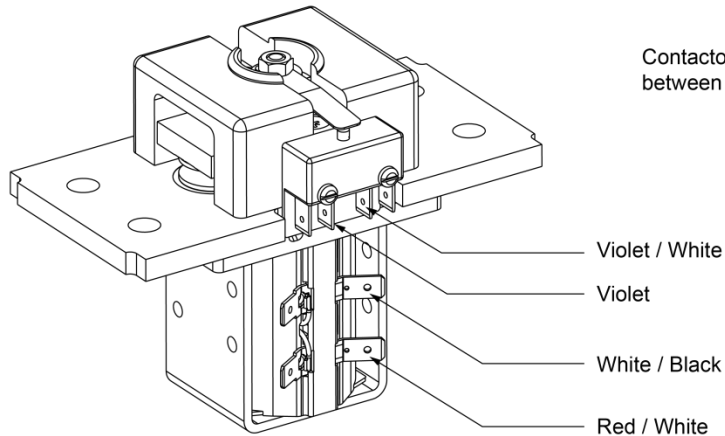
1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582137100) for a startup procedure.
3. Verify no alarms are active.

**Figure 5.15** Replacing a Battery or Load Disconnect Contactor in a List 20, 25 Distribution Cabinet

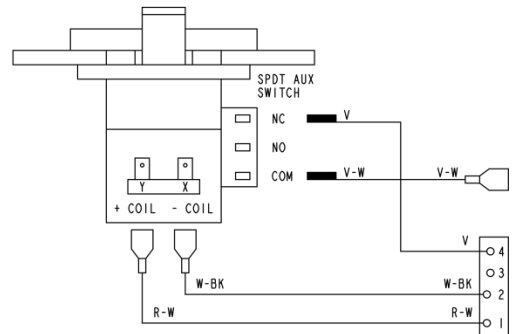
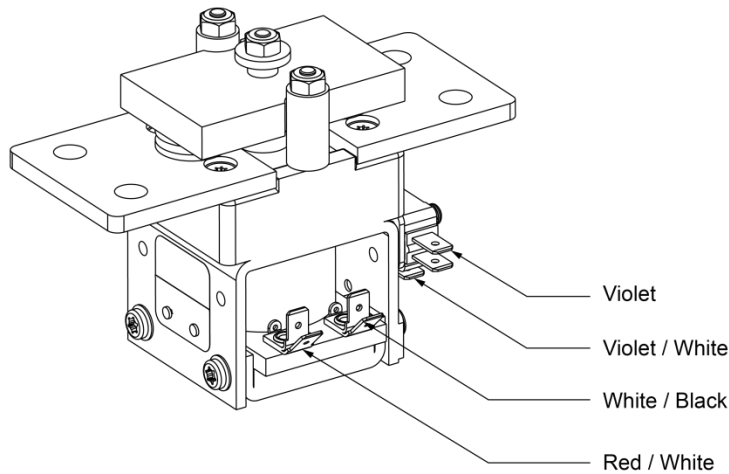
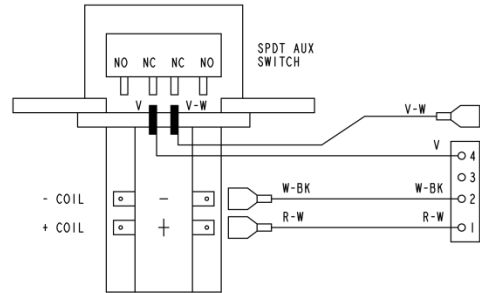
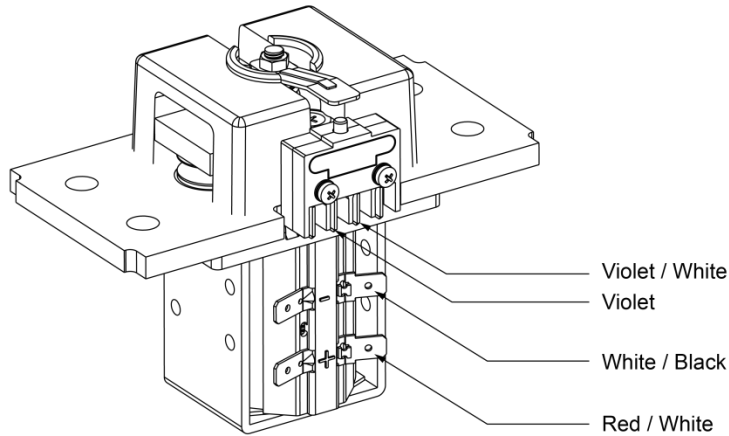
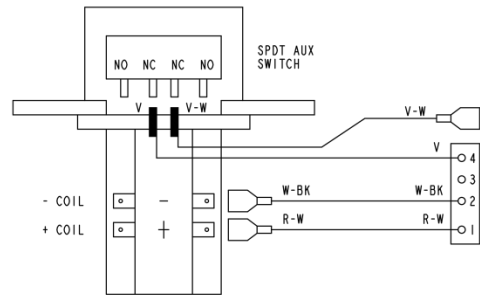


**Figure 5.16 Battery or Load Disconnect Contactor Wiring**

**Load and Battery Disconnect Contactors**



Contactor styles vary between manufacturer's.





## 5.6.8 Replacing a Battery or Load Disconnect Contactor in a List 21, 26 Distribution Cabinet



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



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

### **Procedure**



**NOTE!** Refer to Figure 5.17 and Figure 5.16 as this procedure is performed.

### **Removing the Contactor**

1. Verify all AC and DC power sources are disconnected from the power system.
2. Remove the rear shields.
3. Remove the top rear shield.
4. Remove the battery and battery return busbar assemblies. See Figure 5.17.
5. Remove the shield below the battery and battery return busbar assemblies. See Figure 5.17.
6. Disconnect the wiring to the contactor by unplugging the quick disconnects.
7. Note the orientation of the contactor to ensure the replacement is installed the same way. Unbolt the contactor (4-places) and remove.

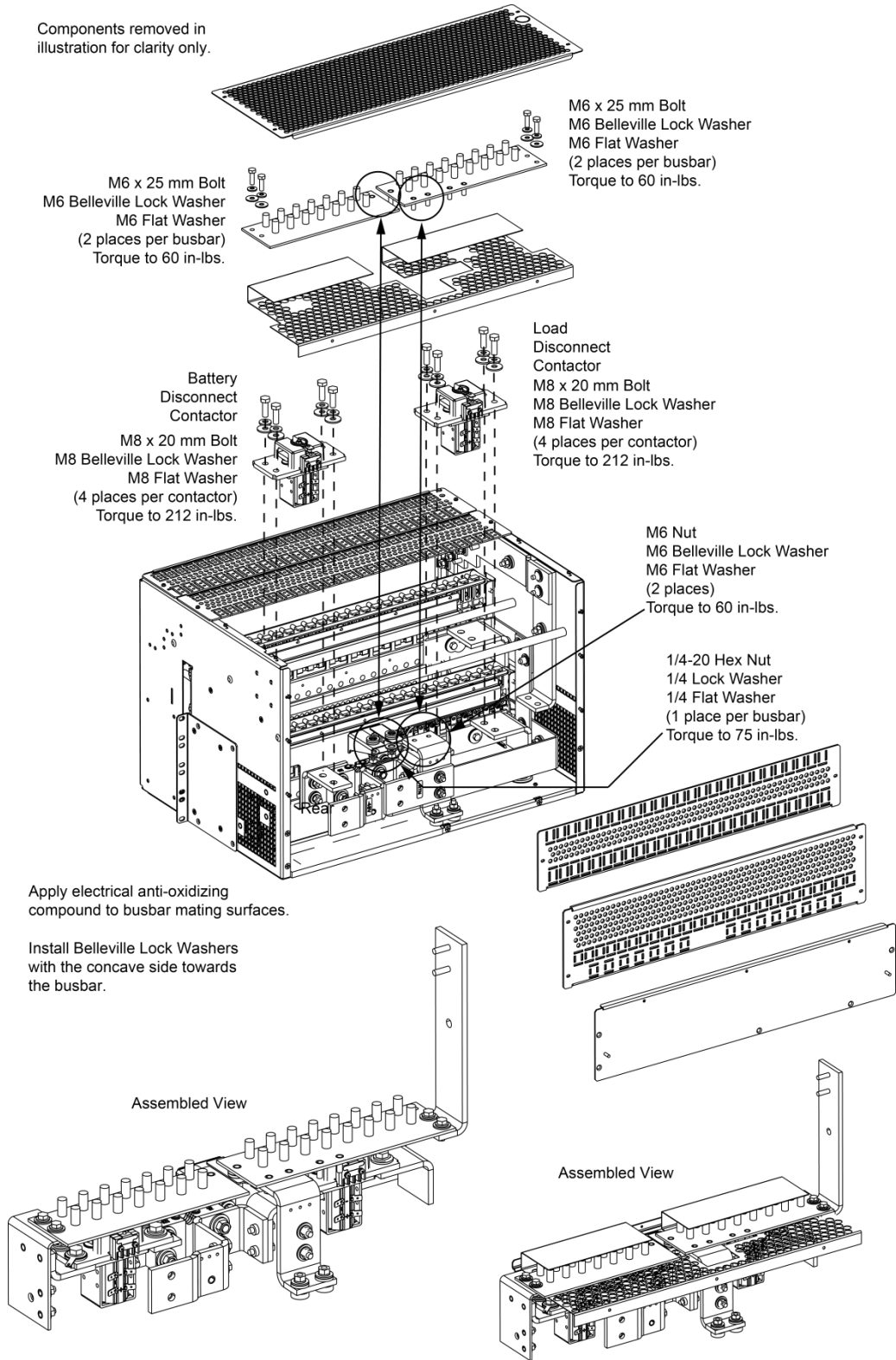
### **Installing the Replacement Contactor**

1. Position the replacement contactor oriented the same way as the old.
2. Secure the contactor with the hardware removed above. Refer to Figure 5.17 for hardware build-up and recommended torque.
3. Replace the wiring to the contactor by plugging-in the quick disconnects. Refer to Figure 5.17 and Figure 5.16.
4. Replace the shield below the battery and battery return busbar assemblies. See Figure 5.17.
5. Replace the battery and battery return busbar assemblies. See Figure 5.17 for hardware build-up and recommended torque.
6. Replace the top rear shield.
7. Replace the rear shields.

### **Restarting the Power System**

1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582137100) for a startup procedure.
3. Verify no alarms are active.

**Figure 5.17** Replacing a Battery or Load Disconnect Contactor in a List 21, 26 Distribution Cabinet



## 5.6.9 Replacing an SPD (Surge Protection Device) (if furnished)

The power system may be equipped with either one (1) or two (2) SPD (Surge Protection Device) assemblies mounted external to the power system. Refer to “SPD Replacement for Power Systems with Two (2) SPD Assemblies Per Output Voltage Circuit” for systems equipped with two (2) SPD assemblies per output voltage circuit. Refer to “SPD Replacement for Power Systems with One (1) SPD Assembly Per Output Voltage Circuit” for systems equipped with only one (1) SPD assembly per output voltage circuit. Each SPD (Surge Protection Device) assembly consists of a mounting base and either two (2) or four (4) plug-in SPD modules. The individual SPD plug-in modules can be replaced, as well as the entire base assembly.

### **SPD Replacement for Power Systems with Two (2) SPD Assemblies Per Output Voltage Circuit**

For systems equipped with two (2) SPD assemblies per output voltage circuit, each SPD assembly consists of a mounting base and two (2) plug-in SPD modules. Refer to Figure 5.18 and Figure 5.19. 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. Refer to Figure 5.18 and Figure 5.19 as this procedure is performed.

#### **Procedure**

1. 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.
2. Locate and turn OFF the circuit breaker connected to the SPD assembly being replaced.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
3. Locate the defective SPD plug-in module.
4. Using a small flat-blade screwdriver, pop-out the defective SPD plug-in module from the mounting base. See Figure 5.18 or Figure 5.19.
5. Orient the replacement SPD plug-in module over its mounting position and press it into place. See Figure 5.18 or Figure 5.19.
6. Repeat the above steps for any other SPD plug-in module being replaced.
7. Locate and turn ON the circuit breaker connected to the SPD assembly.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
8. Verify there are no alarms being generated by the system.

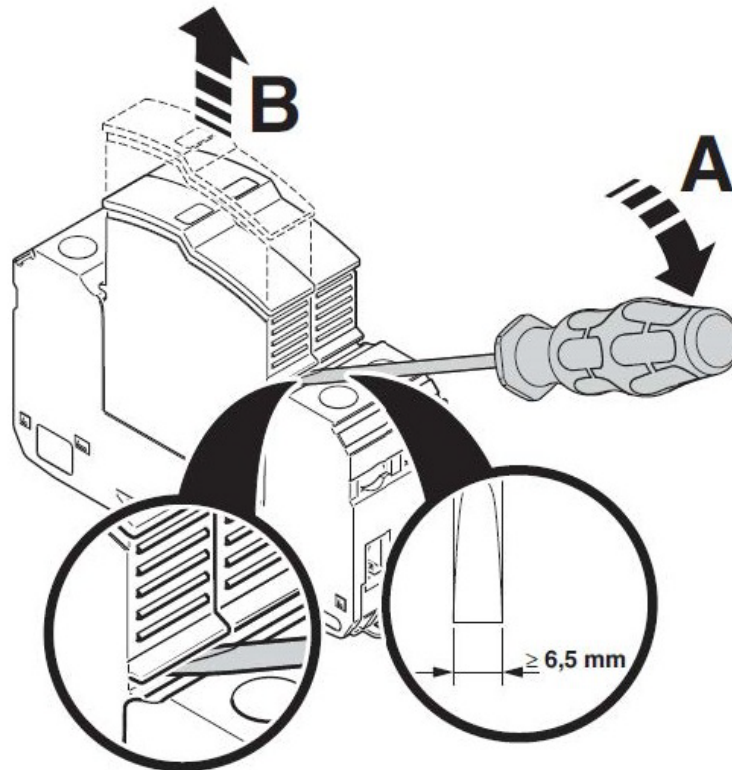
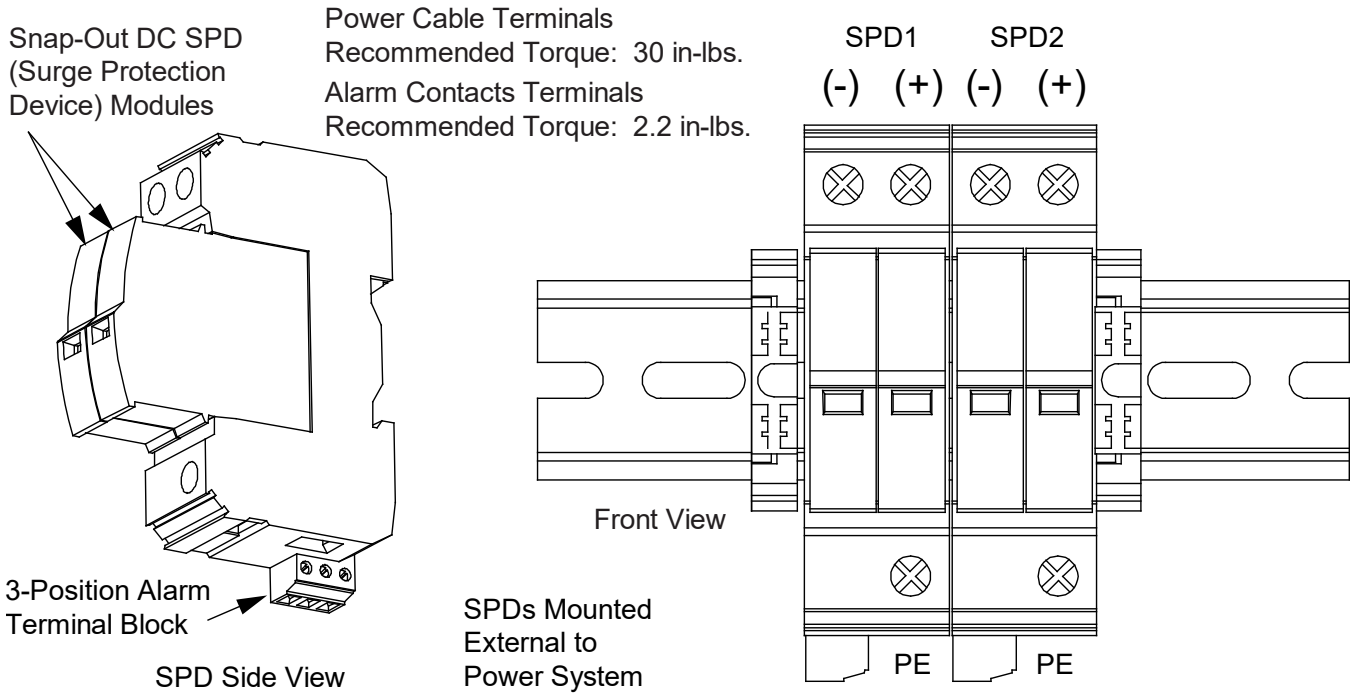
## **SPD Base with Plug-In Modules (P/N 10034885) Replacement**

Check SPD mounting base. If the mounting base is damaged, then replace the complete SPD assembly (mounting base and plug-in modules). Refer to Figure 5.18 and Figure 5.19 as this procedure is performed.

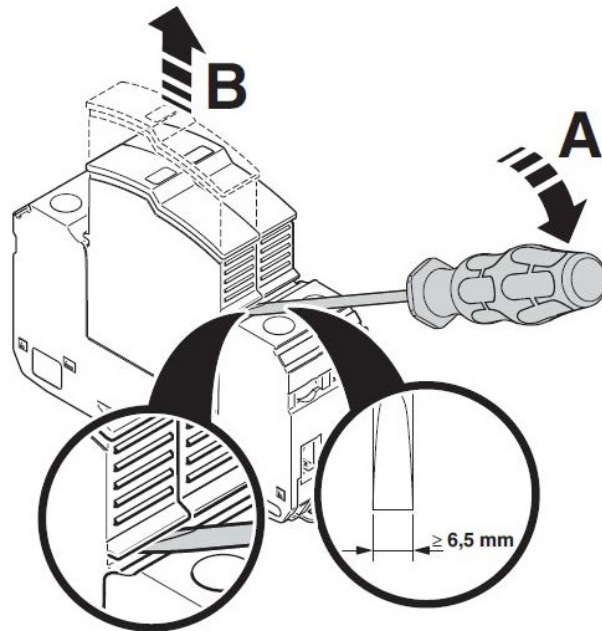
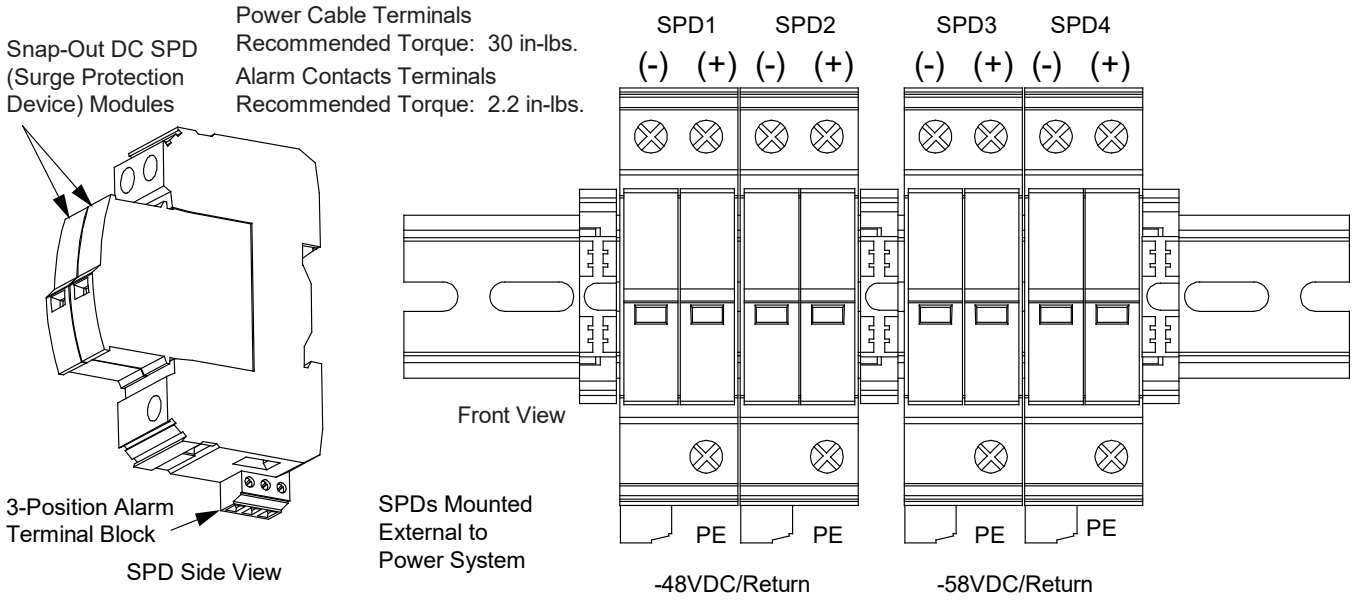
### **Procedure**

1. Locate the defective SPD assembly.
2. Locate and turn OFF the circuit breaker connected to the SPD assembly to be replaced.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
3. If not already done, label the power cables (“+”, “-”, and “earth ground”) connected to the defective SPD assembly.
4. Disconnect the power cables from the “+”, “-”, and “earth ground” terminals of the defective SPD assembly.
5. 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.
6. 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.
7. Remove the 3-position alarm terminal block half from the replacement SPD assembly. This will not be used and may be saved.
8. 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.
9. Reinsert the existing alarm wiring 3-position terminal block into the replacement SPD assembly.
10. Reconnect the power cables (“+”, “-”, and “earth ground”) (with wire end ferrules) to the replacement SPD assembly. The recommended torque is 30 in-lbs.
11. Locate and turn ON the circuit breaker connected to the SPD assembly.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
12. Verify there are no alarms being generated by the system.

Figure 5.18 SPD Replacement (P/N 10035033 Plug-In Module or P/N 10034885 Mounting Base and Plug-In Modules)  
(582137100ZZ028)



**Figure 5.19 SPD Replacement (P/N 10035033 Plug-In Module or P/N 10034885 Mounting Base and Plug-In Modules) (582137100500)**



## **SPD Replacement for Power Systems with One (1) SPD Assembly Per Output Voltage Circuit**

For systems equipped with one (1) SPD assembly per output voltage circuit, each SPD assembly consists of a mounting base and either two (2) (Bourns Version) or four (4) (Phoenix Contact Version) plug-in SPD modules. Refer to Figure 5.20 and Figure 5.21 for Phoenix Contact Version SPDs. Refer to Figure 5.22 and Figure 5.23 for Bourns Version SPDs. The individual SPD plug-in modules can be replaced, as well as the entire base assembly.

### **SPD Plug-In Module – Phoenix Contact Version (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. Refer to Figure 5.20 and Figure 5.21 as this procedure is performed.

#### **Procedure**

1. 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.
2. Locate and turn OFF the circuit breaker connected to the SPD assembly being replaced.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
3. Locate the defective SPD plug-in module.
4. Using a small flat-blade screwdriver, pop-out the defective SPD plug-in module from the mounting base. See Figure 5.20 or Figure 5.21.
5. Orient the replacement SPD plug-in module over its mounting position and press it into place. See Figure 5.20 or Figure 5.21.
6. Repeat the above steps for any other SPD plug-in module being replaced.
7. Locate and turn ON the circuit breaker connected to the SPD assembly.
8. 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
9. 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
10. Verify there are no alarms being generated by the system.

### **SPD Base with Plug-In Modules – Phoenix Contact Version (P/N 10060979) Replacement**

Check SPD mounting base. If the mounting base is damaged, then replace the complete SPD assembly (mounting base and plug-in modules). Refer to Figure 5.20 and Figure 5.21 as this procedure is performed.

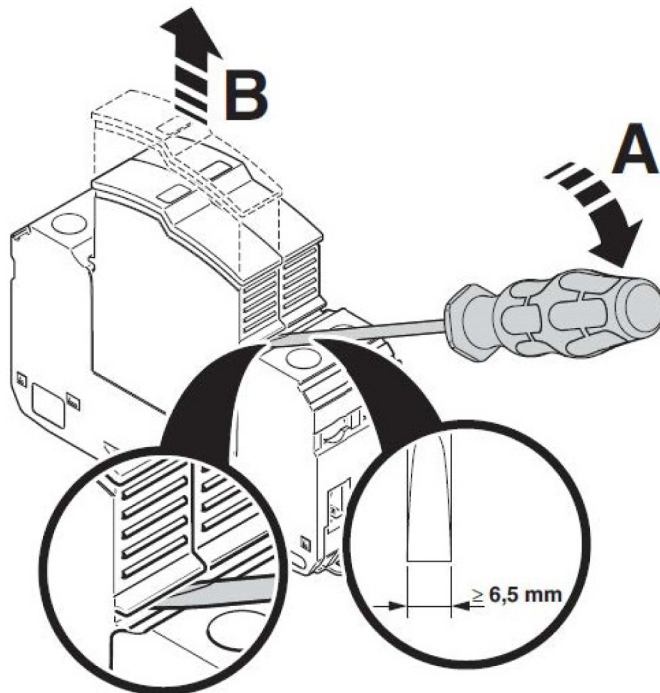
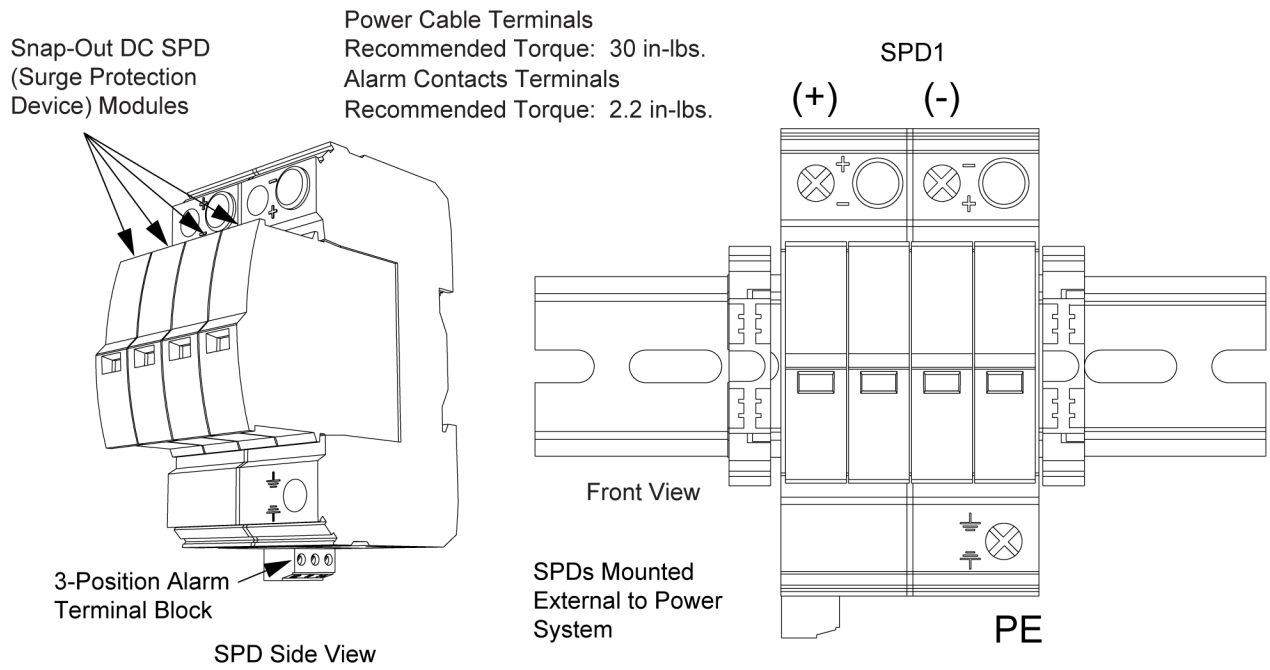
#### **Procedure**

1. Locate the defective SPD assembly.
2. Locate and turn OFF the circuit breaker connected to the SPD assembly to be replaced.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
3. If not already done, label the power cables (“+”, “-”, and “earth ground”) connected to the defective SPD assembly.
4. Disconnect the power cables from the “+”, “-”, and “earth ground” terminals of the defective SPD assembly.

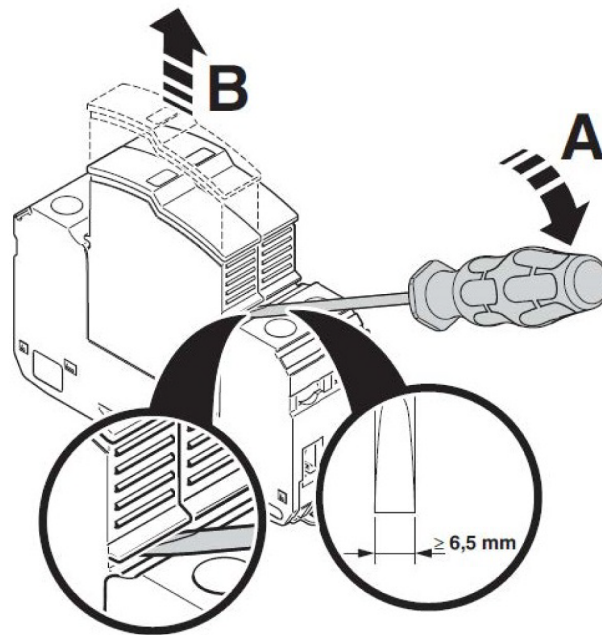
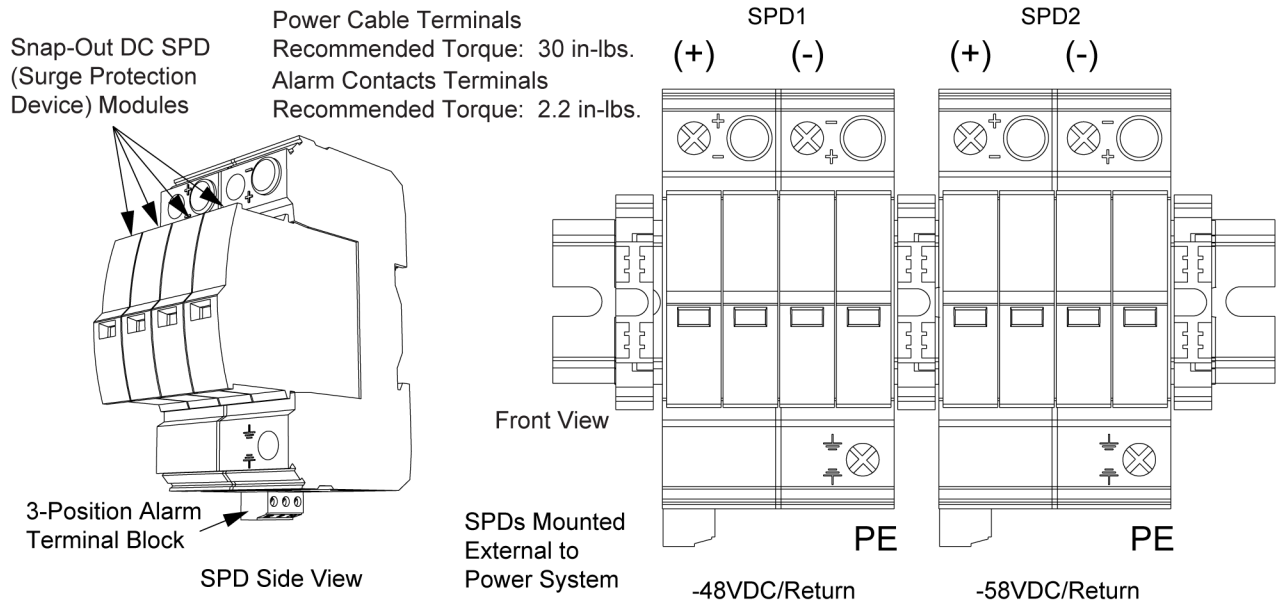
5. Remove the 3-position alarm terminal block half from the defective SPD assembly. Do not remove the wires from the 3-position alarm terminal block.
6. Using a small flat-blade screwdriver, slide the clip securing the defective SPD assembly to the DIN rail. Remove the defective SPD Assembly from the DIN rail.
7. Remove the 3-position alarm terminal block half from the replacement SPD assembly. This will not be used and may be saved.
8. 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.
9. Reinsert the existing alarm wiring 3-position terminal block into the replacement SPD assembly.
10. Reconnect the power cables (“+”, “-”, and “earth ground”) (with wire end ferrules) to the replacement SPD assembly. The recommended torque is 30 in-lbs.
11. Locate and turn ON the circuit breaker connected to the SPD assembly.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
12. Verify there are no alarms being generated by the system.



Figure 5.20 SPD Replacement – Phoenix Contact Version (P/N 10035033 Plug-In Module or P/N 10060979 Mounting Base and Plug-In Modules) (582137100ZZ028)



**Figure 5.21 SPD Replacement – Phoenix Contact Version (P/N 10035033 Plug-In Module or P/N 10060979 Mounting Base and Plug-In Modules) (582137100500)**



**SPD Plug-In Module – Bourns Version (P/N 10071911) 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. Refer to Figure 5.22 and Figure 5.23 as this procedure is performed.

**Procedure**

1. 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.
2. Locate and turn OFF the circuit breaker connected to the SPD assembly being replaced.
3. 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
4. 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
5. Locate the defective SPD plug-in module.
6. Using a small flat-blade screwdriver, pop-out the defective SPD plug-in module from the mounting base. See Figure 5.22 or Figure 5.23.
7. Orient the replacement SPD plug-in module over its mounting position and press it into place. See Figure 5.22 or Figure 5.23.
8. Repeat the above steps for any other SPD plug-in module being replaced.
9. Locate and turn ON the circuit breaker connected to the SPD assembly.
10. 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
11. 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
12. Verify there are no alarms being generated by the system.

## **SPD Base with Plug-In Modules – Bourns Version (P/N 10060979) Replacement**

Check SPD mounting base. If the mounting base is damaged, then replace the complete SPD assembly (mounting base and plug-in modules). Refer to Figure 5.22 and Figure 5.23 as this procedure is performed.

### **Procedure**

1. Locate the defective SPD assembly.
2. Locate and turn OFF the circuit breaker connected to the SPD assembly to be replaced.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
3. If not already done, label the power cables (“+”, “-”, and “earth ground”) connected to the defective SPD assembly.
4. Disconnect the power cables from the “+”, “-”, and “earth ground” terminals of the defective SPD assembly.
5. 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.
6. 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.
7. Remove the 3-position alarm terminal block half from the replacement SPD assembly. This will not be used and may be saved.
8. 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.
9. Reinsert the existing alarm wiring 3-position terminal block into the replacement SPD assembly.
10. Reconnect the power cables (“+”, “-”, and “earth ground”) (with wire end ferrules) to the replacement SPD assembly. The recommended torque is 30 in-lbs.
11. Locate and turn ON the circuit breaker connected to the SPD assembly.
  - 582137100ZZ028 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus).
  - 582137100 List 500 typically located in Row 2 (Top Row) of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
12. Verify there are no alarms being generated by the system.

Figure 5.22 SPD Replacement – Bourns Version (P/N 10071911 Plug-In Module or P/N 10060979 Mounting Base and Plug-In Modules) (582137100ZZ028)

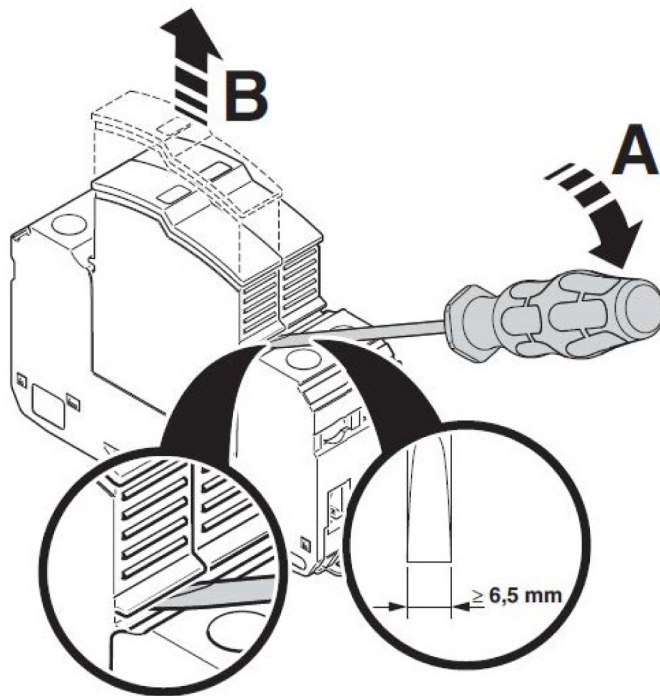
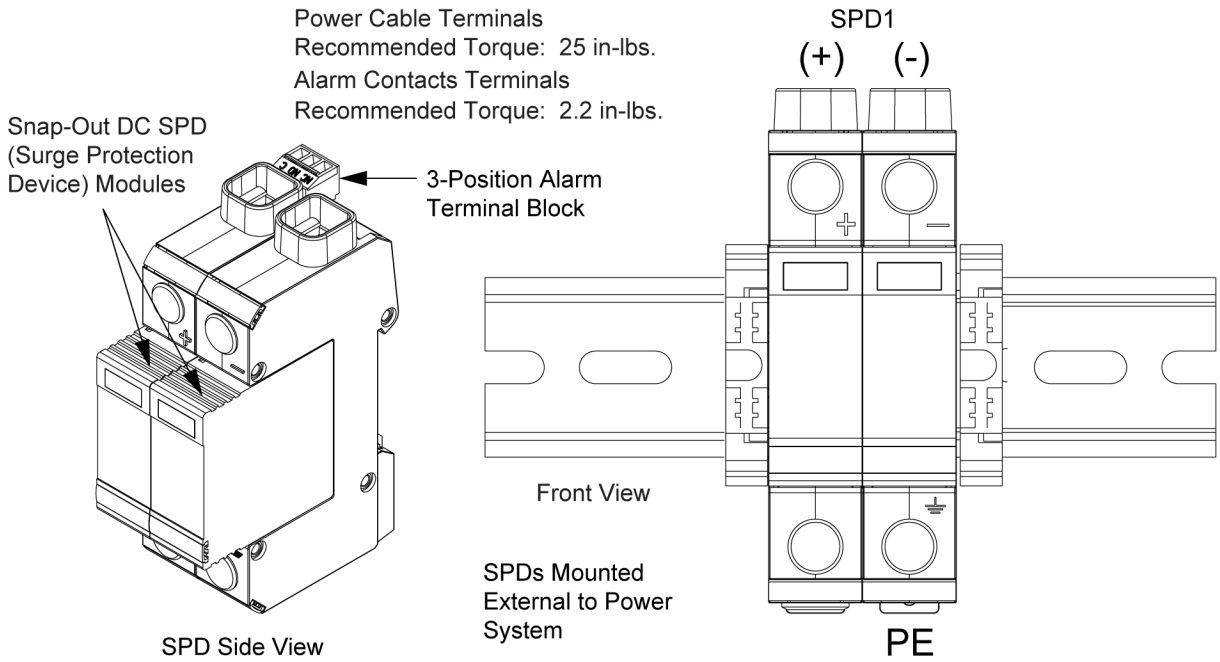
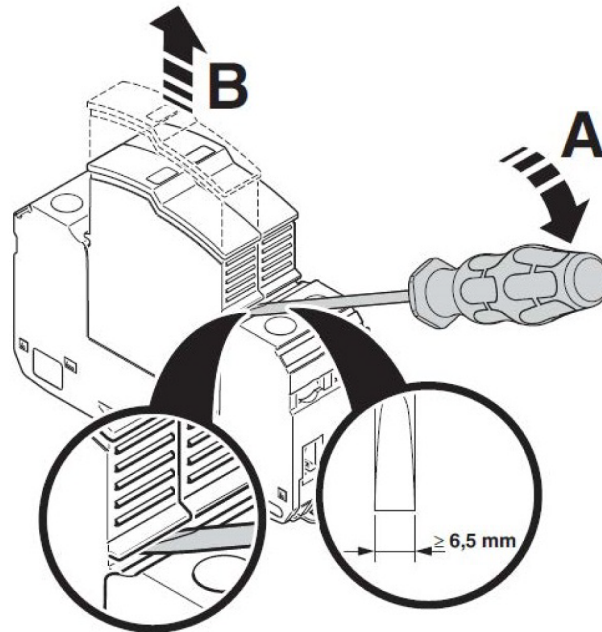
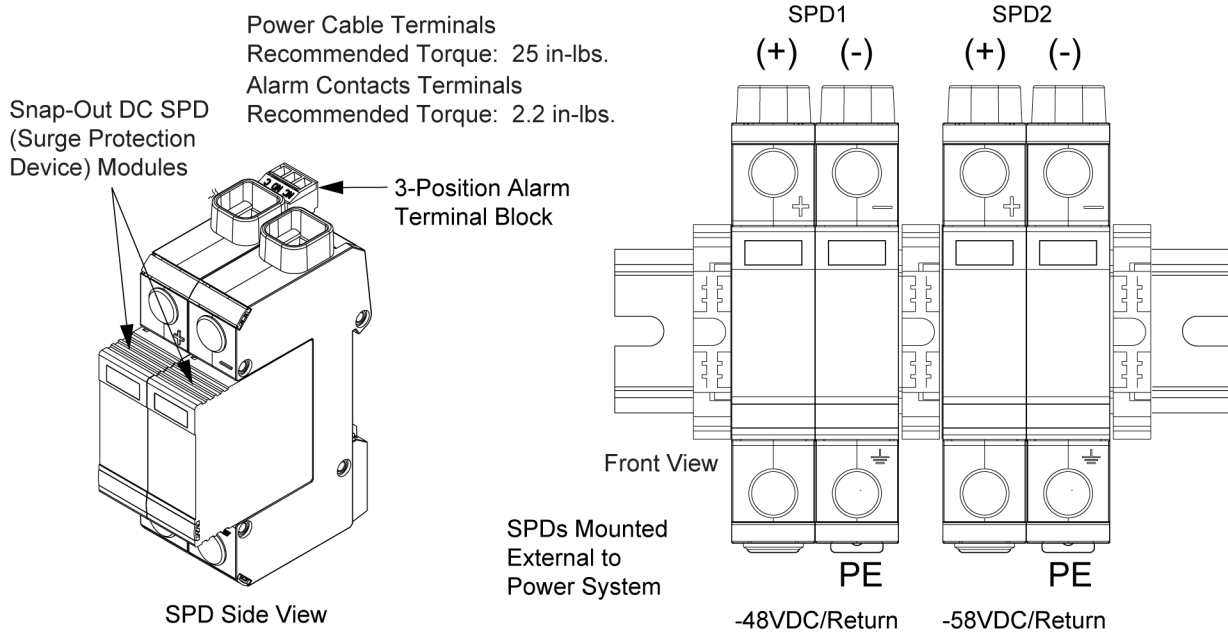


Figure 5.23 SPD Replacement – Bourns Version (P/N 10071911 Plug-In Module or P/N 10060979 Mounting Base and Plug-In Modules) (582137100500)



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