



NetSure™ 7100 Series -48 VDC Power System

User Manual

Specification Number: 582127000

Model Number: 7100

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Technical Support Site

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

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

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Admonishments Used in this Document



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



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



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



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



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



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



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

Important Safety Instructions

Safety Admonishments Definitions

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

Safety and Regulatory Statements

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

Déclarations de Sécurité et de Réglementation

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

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1 Customer Documentation Package

This document (UM582127000) provides *User Instructions* for Vertiv™ NetSure™ -48 VDC Power System Model 7100, Spec. No. 582127000.



NOTE! 582127000 List 100, 101, 102, 203, 500, 501, 502, 503, 600, 601, 900, and 901 are specific configurations of 582127000. Separate *User Instructions* and *Installation Instructions* are provided with these power systems. For 582127000 List 100, 101, 102, 203, 500, 501, 502, and 503; do not use these instructions. Refer to IM582127000100 and UM582127000100 for instructions. For 582127000 List 600, 601, 900, 901; do not use these instructions. Refer to IM582127000900 and UM582127000900 for instructions.

The complete Customer Documentation Package consists of...

-48 VDC Power System Installation Manual

- Power System Installation Instructions: IM582127000

NCU Controller User Manual

- NCU Controller User Instructions: UM1M830BNA

USB Drive with All Customer Documentation

- Power System Quick Start Guide: QS582127000
- Power System Installation Instructions: IM582127000
- Power System Installation Instructions: IM582127000100 (instructions for List 100, 101, 102, 203, 500, 501, 502, and 503)
- Power System User Instructions: UM582127000
- Power System User Instructions: UM582127000100 (instructions for List 100, 101, 102, 203, 500, 501, 502, and 503)
- NCU Controller User Instructions: UM1M830BNA
- Rectifier Instructions: UM1R483500e
- Rectifier Instructions: UM1R483500e3
- Rectifier Instructions: UM1R482000e3
- -48 VDC to +24 VDC Converter Instructions: UM1C48241500
- -48 VDC to -58 VDC Converter Instructions: UM1C48582000P3
- Inverter Instructions: UM1I1201000
- Power System "System Application Guide": SAG582127000
- Inverter System "System Application Guide": SAG584130100
- NCU Controller 2nd Ethernet Port Add-On Kit Instructions: IM559252
- NCU Controller 2nd Ethernet Port Retrofit Kit Instructions: IM559251
- Engineering Drawings
- Also provided on the USB drive is a controller configuration drawing and the controller configuration files loaded into the controller as shipped.

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

2 System Description

-48 VDC @ up to 12000 Amperes Power System

The Vertiv™ NetSure™ 7100 DC Power System is an integrated power system containing -48 VDC rectifiers, optional -48 VDC to +24 VDC converters, optional -48 VDC to -58 VDC converters, optional inverter system, intelligent control, metering, monitoring, and distribution.

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.

Distribution Cabinet

The system always includes a minimum of one distribution cabinet, which provides DC distribution through fuses and/or circuit breakers. The distribution cabinet is factory mounted in a relay rack, on shipping brackets, or in an enclosure as specified when ordered.

Four different sizes of distribution cabinets are available to accept from one (1) to four (4) 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 or -48 VDC to -58 VDC converters. These distribution panels are configured to accept either bullet nose type circuit breakers and TPS/TLS fuseholders, TPH fuses, TPL-B fuses, or GJ/218 circuit breakers. A bulk output panel is also available.

The distribution cabinet may be equipped with low voltage load disconnect (LVLD), low voltage battery disconnect (LVBD), and manual battery disconnect.

Controller

NCU (NetSure Control Unit): The 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), converter control, 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 (Spec. No. 588705000)

The system may contain one or more Spec. No. 588705000 module mounting assemblies, each of which houses up to six (6) 3500 watt rectifier modules or six (6) 3500 watt converter modules. Refer to System Application Guide SAG582127000 for more information.

- **Rectifier Modules (for use in Spec. No. 588705000)**

The system may contain 3500 watt rectifier modules; which provide load power, battery float current, and battery recharge current during normal operating conditions. Refer to the Rectifier Instructions (UM1R483500e) for more information.

Module Mounting Assembly (Spec. No. 588705300)

The system may contain one or more Spec. No. 588705300 module mounting assemblies, each of which houses 2000 watt rectifier modules, optional +24 VDC, 1500 watt DC-DC converter modules, and optional 1600W average (2000W peak) DC-DC converter modules. Refer to System Application Guide SAG582127000 for more information.

- **Rectifier Modules (for use in Spec. No. 588705300)**

The system contains 2000 watt 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 -48 VDC to +24 VDC Converter Modules (for use in Spec. No. 588705300)**

Where +24 VDC load power is also required, 1500 watt DC-DC converter modules are available. Refer to the Converter Instructions (UM1C48241500) for more information.

- **Optional -48 VDC to -58 VDC Converter Modules (for use in Spec. No. 588705300)**

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.

Module Mounting Assembly (Spec. No. 588705400)

The system may contain one or more Spec. No. 588705400 module mounting assemblies, each of which houses up to six (6) 3500 watt rectifier modules. Refer to System Application Guide SAG582127000 for more information.

- **Rectifier Modules (for use in Spec. No. 588705400)**

The system contains 3500 watt rectifier modules; which provide load power, battery float current, and battery recharge current during normal operating conditions. Refer to the Rectifier Instructions (UM1R483500e3) for more information.

Module Mounting Assembly (Spec. No. 588705500)

The system may contain one or more Spec. No. 588705500 module mounting assemblies, each of which houses up to six (6) 4000 watt rectifier modules. Refer to System Application Guide SAG582127000 for more information.

- **Rectifier Modules (for use in Spec. No. 588705500)**

The system contains 4000 watt rectifier modules; which provide load power, battery float current, and battery recharge current during normal operating conditions. Refer to the Rectifier Instructions (UM1R483500e) for more information.

Optional Inverter System120 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 Input Only 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 Input Only 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 output AC load distribution shelf is provided.

3 Operating Procedures

3.1 Rectifiers, Converters, Inverters, and Controller

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

- Rectifier Instructions (UM1R483500e or UM1R482000e3 or UM1R483500e3)
- -48 VDC to +24 VDC Converter Instructions (UM1C48241500)
- -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3)
- Inverter Instructions (UM1I1201000)
- NCU Controller Instructions (UM1M830BNA)



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

3.2 ESTOP Function

If an ESTOP switch is wired to the IB2-1 Controller Interface Board, customer-furnished system ground applied to terminal D18+ activates the ESTOP function. The ESTOP function shuts down and locks out the rectifiers, shuts down and locks out the optional -48 VDC to +24 VDC converters, or 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 J8 on the system interface board is set to Battery Pwr), the controller will remain operational. If the system does not contain battery or load LVD(s) and has battery connected, the loads will be sustained by the battery voltage.

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

For Systems Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will remain open. Rectifiers, 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 will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). When the rectifiers restart, LVD contactors (battery and load type) will close 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.

3.3 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.

3.4 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/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.

Refer to the NCU 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.

3.5 Local Controls and Indicators

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

If the system is installed in an enclosure, an enclosure mounted LED kit is available which provides a factory installed LED located at the top of the enclosure visible from the front with the door closed. This LED illuminates red if a major or critical alarm activates.

Refer to the next section for descriptions of the local controls and indicators located on the circuit cards installed in the distribution cabinet.

Circuit Card Locations

Refer to Figure 3.1.

Figure 3.1 Circuit Card Locations (Main Bay)

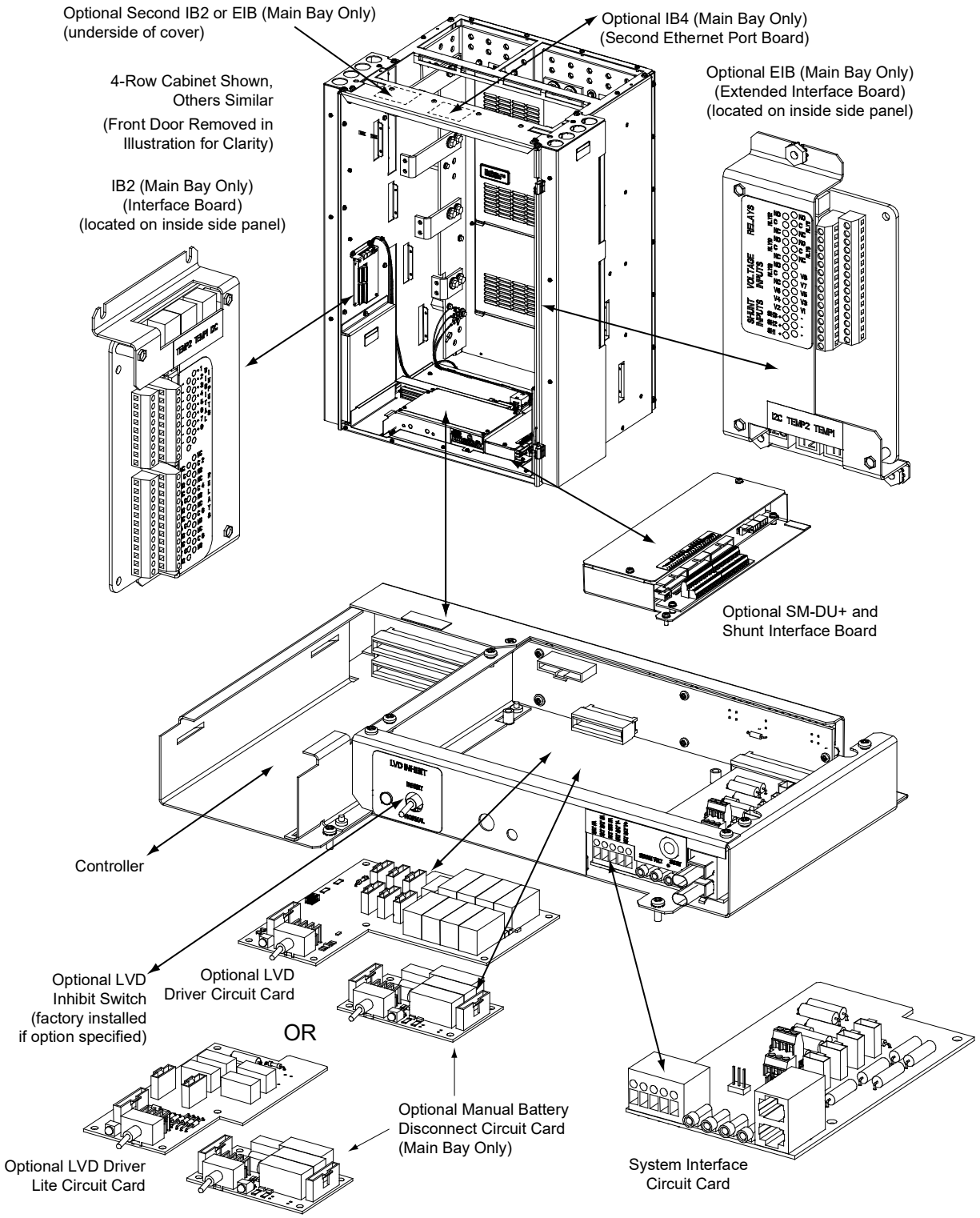
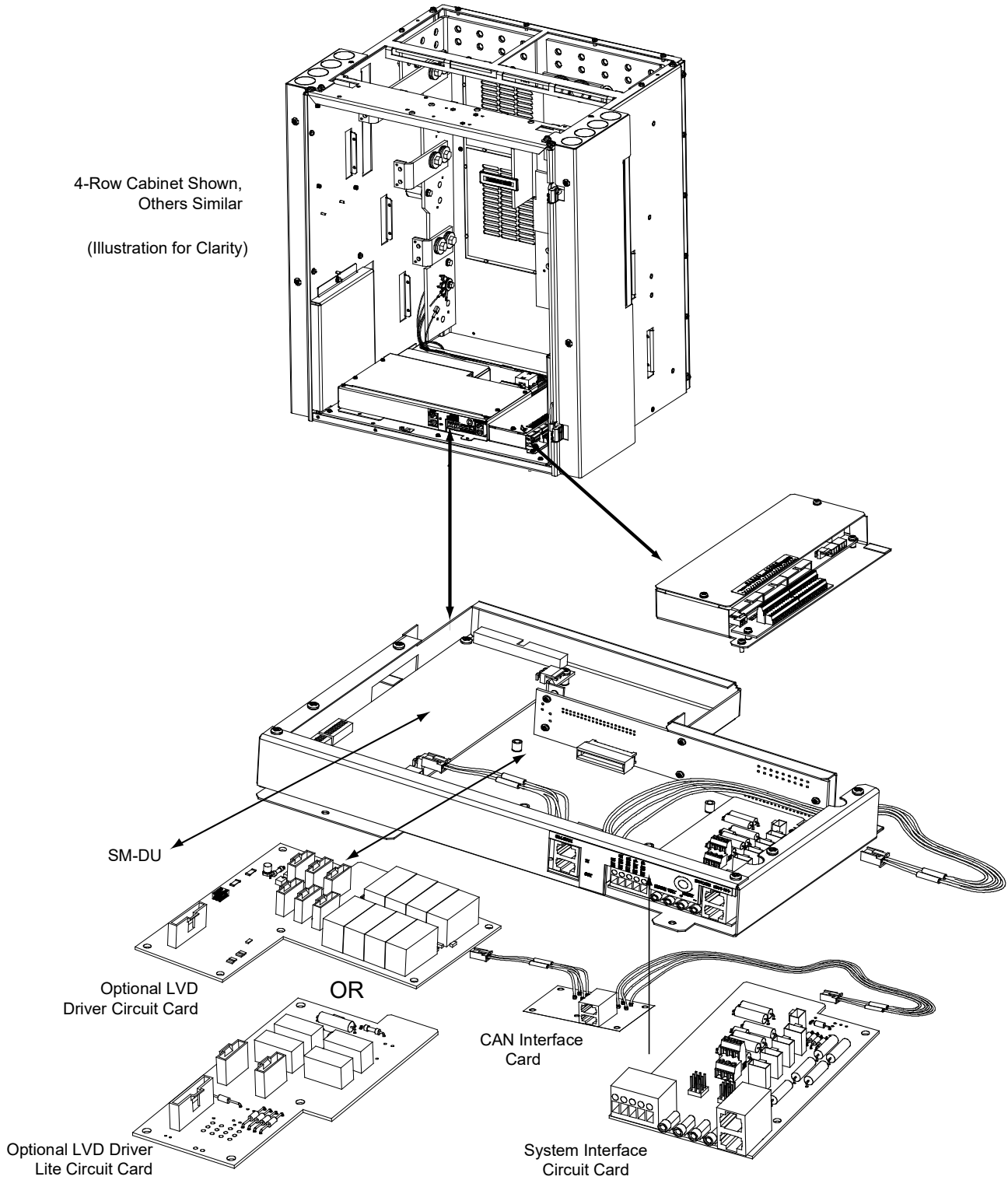


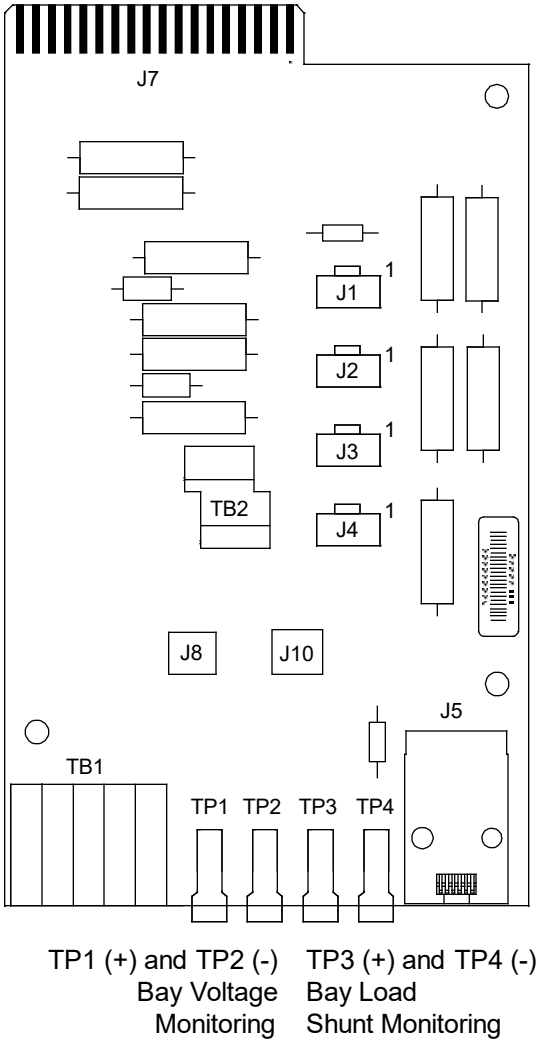
Figure 3.1 Circuit Card Locations (Supplementary Bay)



System Interface Circuit Card

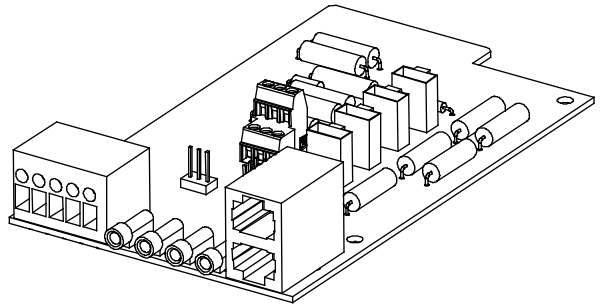
The system interface circuit card contains test points to externally monitor bay voltage and bay load. Refer to Figure 3.2.

Figure 3.2 System Interface Circuit Card



Bay Load Shunt Scale

- List 21, 1-Row Cabinet
800A / 25mV
32A per mV
- List 22, 2-Row Cabinet
2000A / 25mV
80A per mV
- List 23, 3-Row Cabinet
2500A / 25mV
100A per mV
- List 24, 4-Row Cabinet
2500A / 25mV
100A per mV



Optional LVD Driver Circuit Card

The optional LVD driver circuit card installed in the main bay contains an LVD inhibit switch and indicator. Refer to Figure 3.3. LVD driver circuit cards are required for 2-, 3-, or 4-row distribution cabinets that contain three or more LVD contactors (LVBD and/or LVLD); or if the distribution cabinet is equipped with an LVBD contactor rated 1200A or higher.



CAUTION! If the switch is returned to the ON (normal) position when low voltage disconnect alarms are active, a low voltage disconnection will occur.



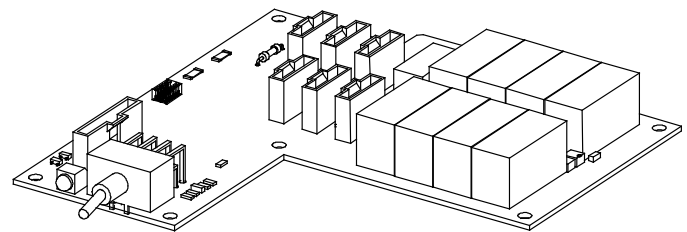
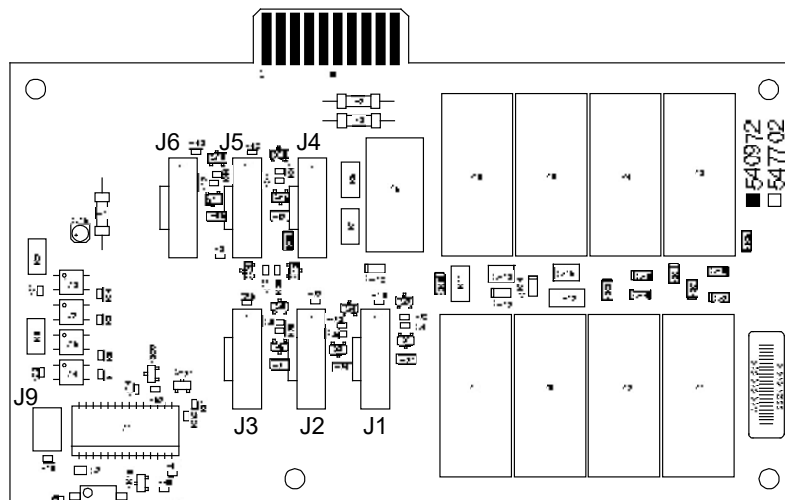
WARNING! While the LVD inhibit switch is in the OFF (inhibit) position, a low voltage disconnection will not occur if battery or load voltage decreases below the low voltage disconnect setpoint. For maximum battery protection, this switch should NOT be left in the OFF (inhibit) position.



ALERT! Do not hold the LVD inhibit switch in the up position for more than 3 seconds to avoid damaging the contactor.

Figure 3.3 Optional LVD Driver Circuit Card

Main Bay



LVD Inhibit
Active Indicator

Illuminates when the low voltage disconnect circuit has been disabled through the use of the LVD Inhibit switch.

Switch and indicator located on circuit card installed in Main Bay only.

Momentary UP / Middle / Down

Momentary UP Position: Closes all LVD Contactors (inhibit mode).

Middle Position: OFF (Controller DOES NOT control LVD's) (inhibit mode).

DOWN Position: ON (Controller controls LVD's).

Note: The UP position will not close the LVBD contactor if the battery is manually disconnected using the Manual Battery Disconnect Switch.

Optional LVD Driver Lite Circuit Card

The optional LVD driver lite circuit card installed in the main bay contains an LVD inhibit switch and indicator. Refer to Figure 3.4. LVD driver lite circuit cards are required for distribution cabinets that contain two LVLD contactors or one LVLD contactor and one LVBD contactor. LVBD contactor must be rated at 600A or lower.



CAUTION! If the switch is returned to the ON (normal) position when low voltage disconnect alarms are active, a low voltage disconnection will occur.

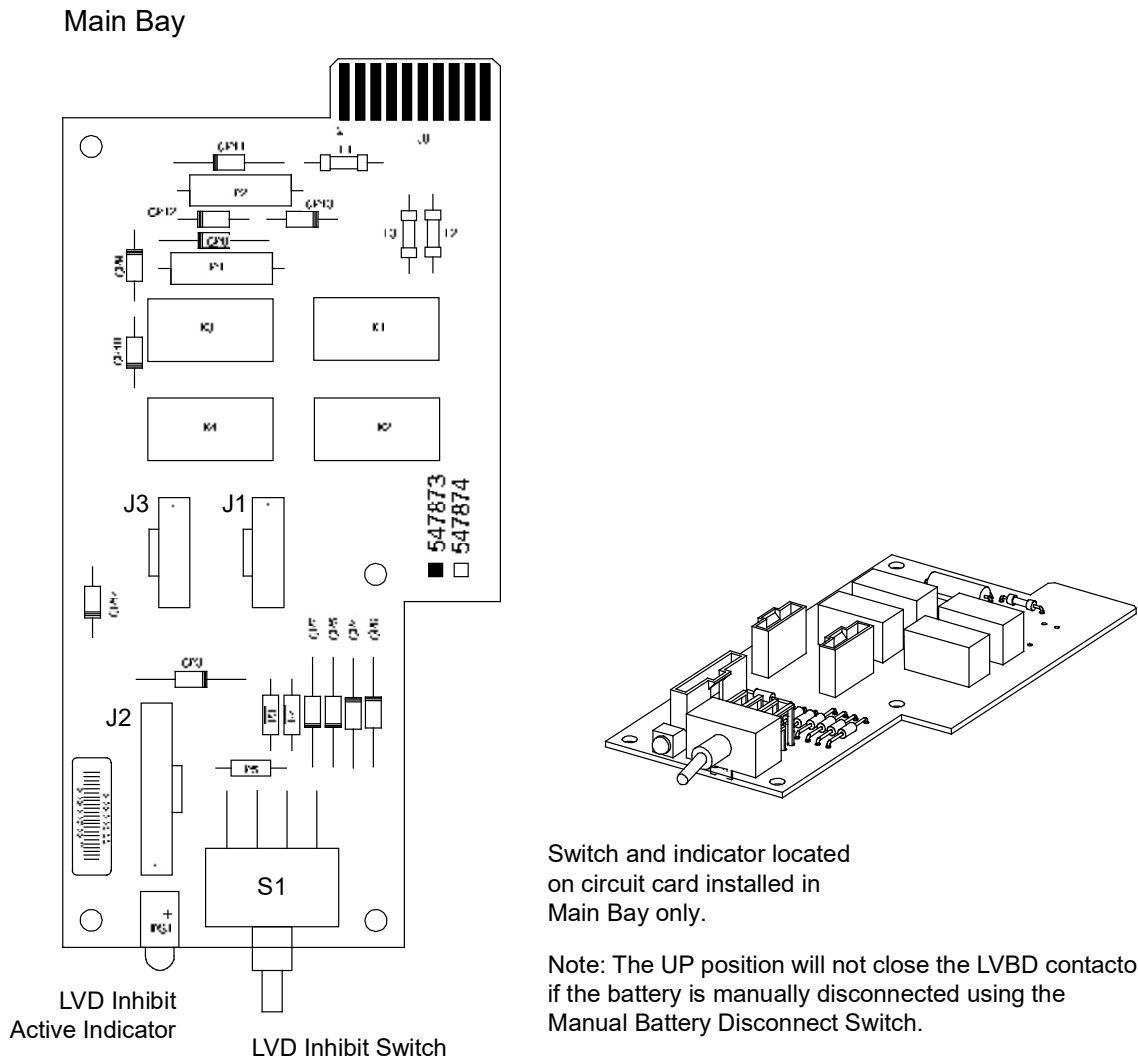


WARNING! While the LVD inhibit switch is in the OFF (inhibit) position, a low voltage disconnection will not occur if battery or load voltage decreases below the low voltage disconnect setpoint. For maximum battery protection, this switch should NOT be left in the OFF (inhibit) position.



ALERT! Do not hold the LVD inhibit switch in the up position for more than 3 seconds to avoid damaging the contactor.

Figure 3.4 Optional LVD Driver Lite Circuit Card



Illuminates when the low voltage disconnect circuit has been disabled through the use of the LVD Inhibit switch.

Momentary UP / Middle / Down

- Momentary UP Position: Closes all LVD Contactors (inhibit mode).
- Middle Position: OFF (Controller DOES NOT control LVD's) (inhibit mode).
- DOWN Position: ON (Controller controls LVD's).

Optional Manual Battery Disconnect Circuit Card (Main Bay Only)

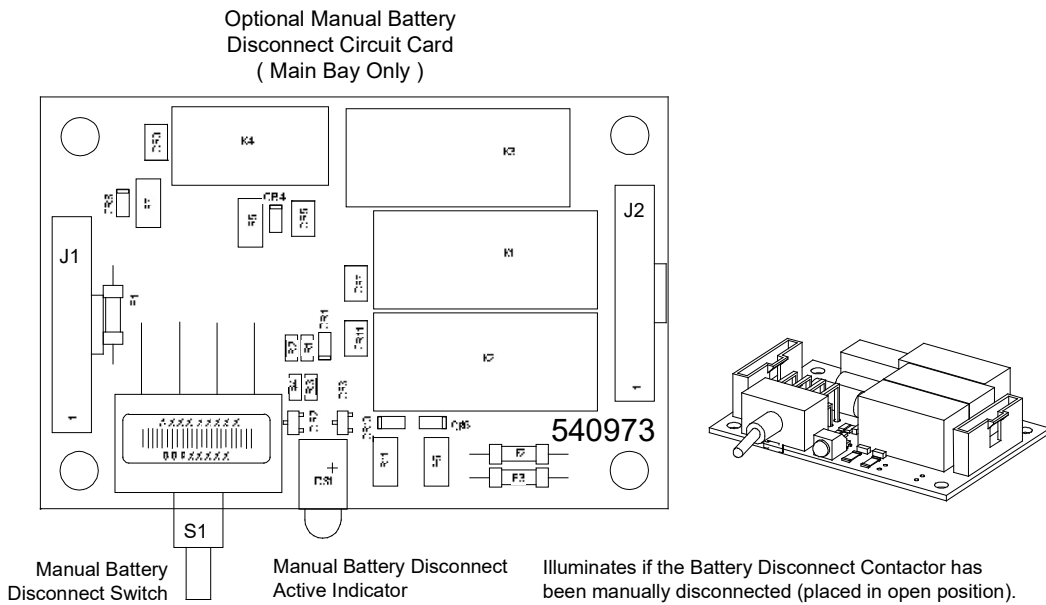
The optional manual battery disconnect circuit card contains a manual battery disconnect switch and indicator. Refer to Figure 3.5.

NOTE! If this option is to be used as a Maintenance Battery Disconnect only, at least one rectifier requires to be active and providing voltage to the system for proper operation.

ALERT! Do not hold the MBD switch (S1) in the up position for more than 3 seconds to avoid damaging the contactor.

ALERT! When using switch, after either pushing up or down let switch return to the center position for 3 seconds before pushing switch in the opposite direction to avoid damaging the contactor.

Figure 3.5 Optional Manual Battery Disconnect Circuit Card



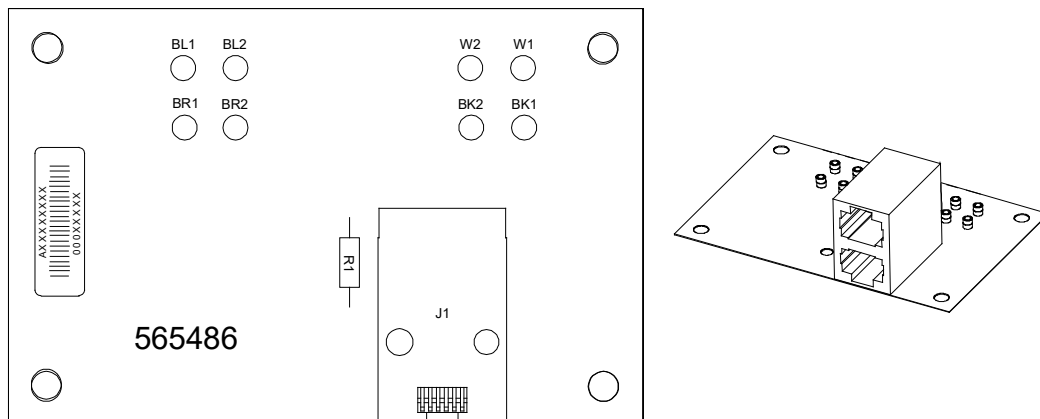
Momentary UP / Middle / Momentary Down

Momentary UP Position: Closes (latches in close position) the Battery Disconnect Contactor.

Middle Position: Normal Operation.

Momentary DOWN Position: Opens (latches in open position) the Battery Disconnect Contactor.
Momentarily place switch in the UP position to close the contactor.

CAN Interface Board
(Supplementary Bay Only)



SM-DU Circuit Card

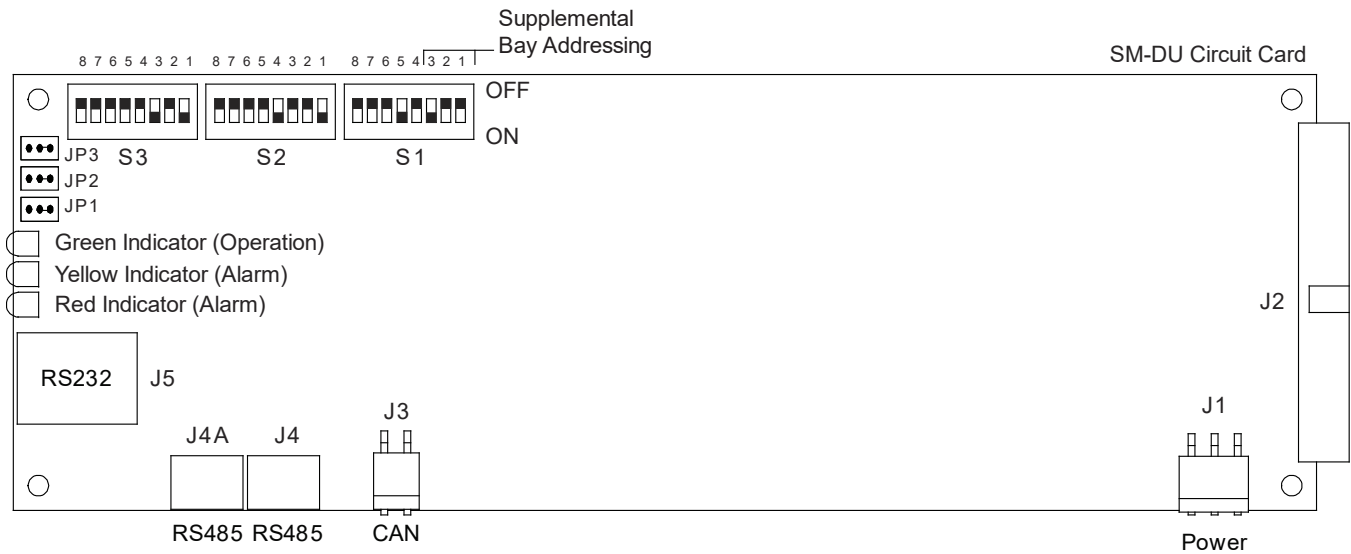
The SM-DU is used in supplemental bays in place of a controller. The SM-DU monitors the bay and reports to the controller. The controller sends commands to the SM-DU to fulfill battery management and load control functions according to the received data.

There are three (3) status and alarm indicators located on the SM-DU. The functions of these indicators (from top to bottom as shown in the illustration) are as shown in Table 3.1. Refer to Figure 3.6 for location.

Table 3.1 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.

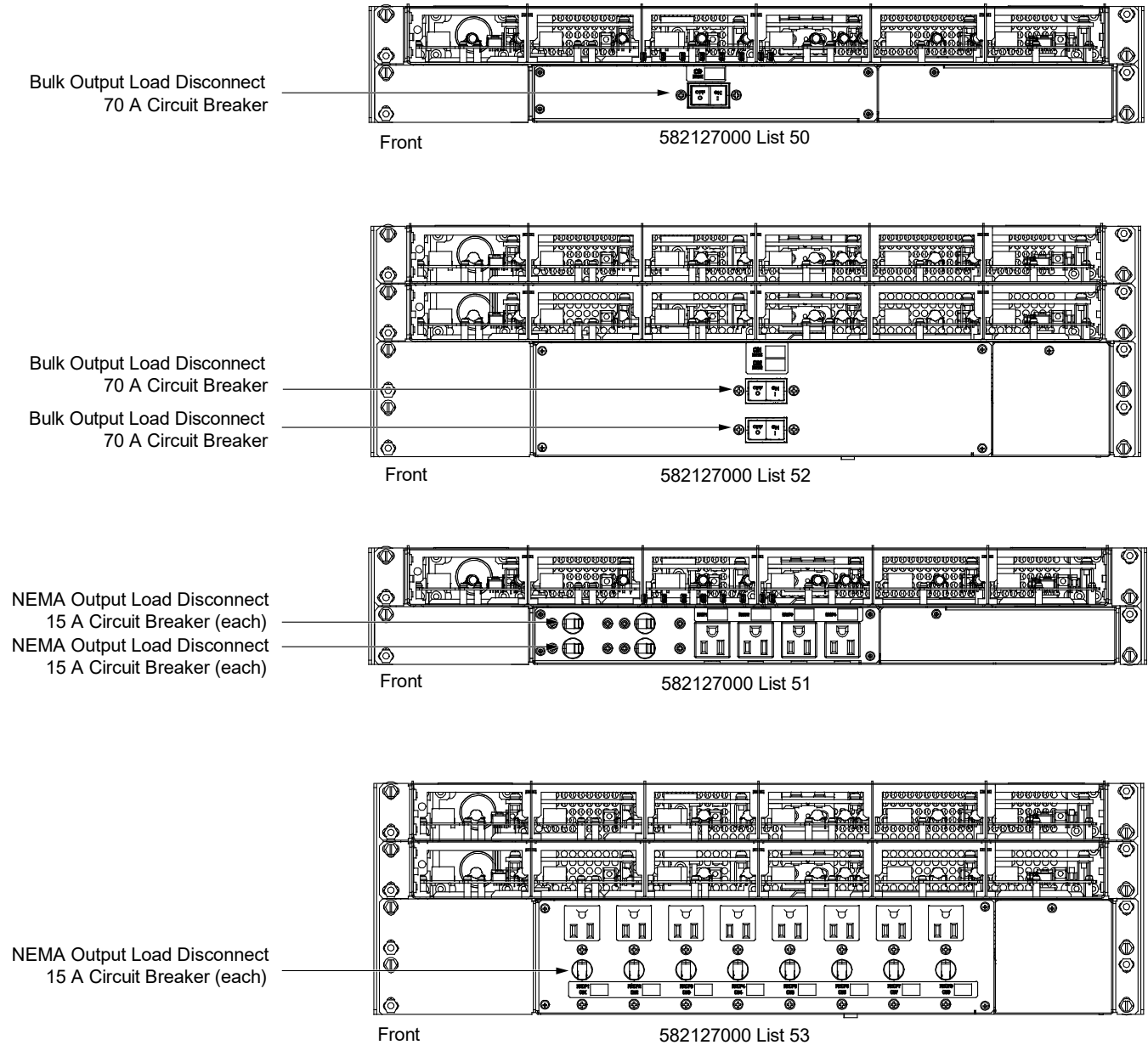
Figure 3.6 SM-DU Circuit Card



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 3.7.

Figure 3.7 AC Load Distribution Disconnect Circuit Breakers



3.6 Procedures when the System is Installed in an Enclosure

3.6.1 Removing the Enclosure Rear Panels

Procedure

1. Loosen the fasteners on the rear panel, then remove the panel. Refer to Figure 3.8.
2. For reassembly, note the location of the large holes in two corners of the panels. Orient the panels as shown in Figure 3.8.

3.6.2 Removing the Enclosure Side Panels

Procedure

1. Loosen the fasteners on the side panel, then remove the panel. Refer to Figure 3.8.

3.6.3 AC Input Conduit Options

Procedure

1. Two types of conduit plates are available. Select and install the conduit plate appropriate for your application. Refer to Figure 3.9.

Figure 3.8 Removing System Enclosure Side and Rear Panels

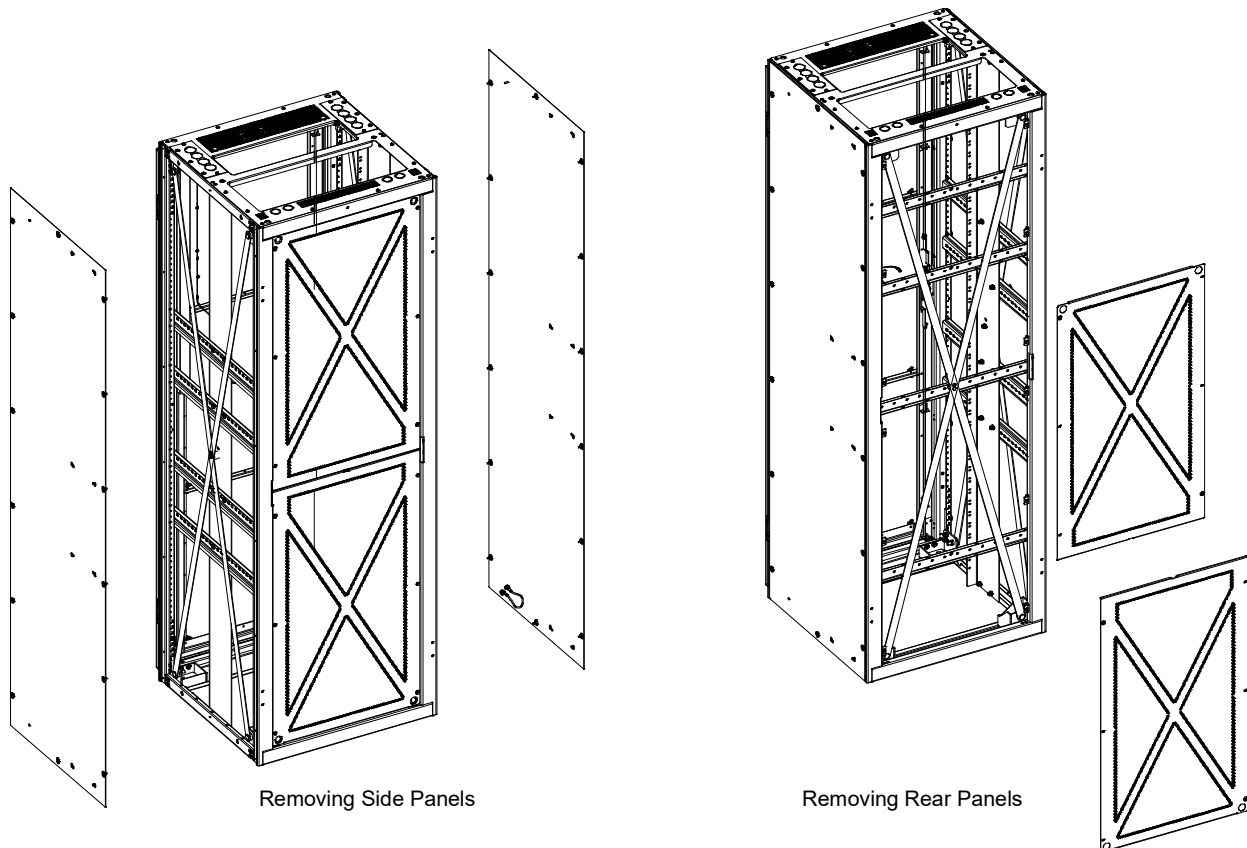
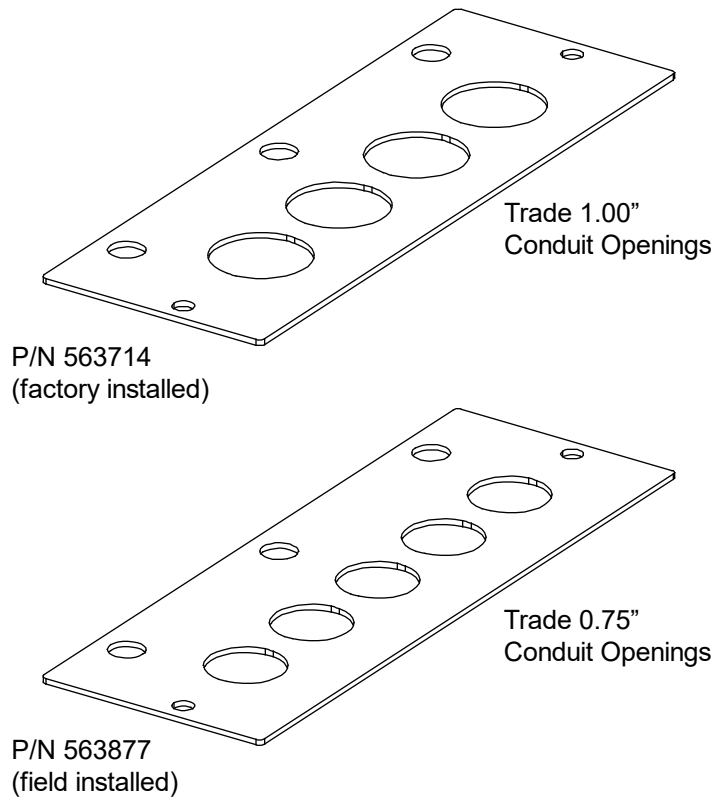


Figure 3.9 AC Input Conduit Plates



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.	IM582127000, "Making Electrical Connections" section.

4.2 Adding a Rectifier Module to an Existing Spec. No. 588705000, 588705400, or 588705500 Module Mounting Assembly

To increase system current capacity, a rectifier module can easily be added to an existing Spec. No. 588705000, 588705400, or 588705500 module mounting assembly that contains an empty rectifier module mounting position.

It is recommended that the current limit point be checked whenever a rectifier module is added to or removed from a 588705000, 588705400, or 588705500 module mounting assembly in the power system. Refer to "Checking the Controller's Current Limit Point after Adding or Removing a Rectifier Module or Converter Module" on page 57.

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

- For rectifier module installation instructions in a 588705000 and 588705500 shelf, refer to Rectifier Instructions (UM1R483500e).
- For rectifier module installation instructions in a 588705400 shelf, refer to Rectifier Instructions (UM1R483500e3).

4.3 Adding a Rectifier or Converter Module to an Existing Spec. No. 588705300 Module Mounting Assembly

To increase system current capacity, a rectifier module can easily be added to an existing Spec. No. 588705300 module mounting assembly that contains an empty rectifier module mounting position. Likewise, to increase subsystem capacity a -48 VDC to +24 VDC DC-DC converter module can be added to a Spec. No. 588705300 module mounting assembly that contains an empty -48 VDC to +24 VDC converter module mounting position. 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 and converter modules can be inserted or removed with power applied (hot swappable).

Rectifiers modules can be installed in any mounting position of each module mounting assembly. Converters modules can be installed in any of the three far right mounting positions of each module mounting assembly (as viewed from the front). See Figure 4.3. See Alerts below for restrictions.



NOTE! Each rectifier and converter module locks into the module mounting assembly by means of a latch located on the bottom of the module. The latch and module handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract. See Figure 4.3.



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

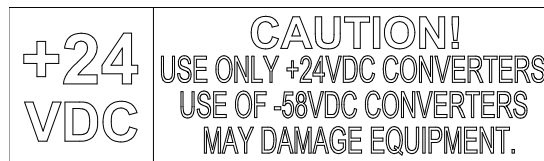


ALERT! The system can either have +24V DC-DC converters installed or -58V DC-DC converters installed. The system cannot have both types of converters installed at the same time.



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

Figure 4.1 Sample Module Mounting Shelf Labeling



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

Figure 4.2 Sample Module Mounting Shelf Labeling



Procedure

1. Unpack the modules.
2. Note the model number located on the front of each module. Model numbers starting with the letter "R" are rectifier modules. Model numbers starting with the letter "C" are converter modules.

3. Place the module into an unoccupied mounting position without sliding it in completely. Rectifiers modules can be installed in any mounting position of each module mounting assembly. Converters modules can be installed in any of the three far right mounting positions of each module mounting assembly (as viewed from the front). See Figure 4.3.
4. Loosen the captive screw on the module's handle. Pull the handle down out from the module's front panel (this will also retract the latch mechanism). See Figure 4.3.
5. Push the module completely into the shelf.
6. Push the handle up into the module's front panel. This will lock the module securely to the shelf. Tighten the captive screw on the handle.
7. Repeat the above steps for each module being installed in the system.
8. After the modules are physically installed in the module mounting assembly(s), they are ready for operation immediately after power is supplied to them.

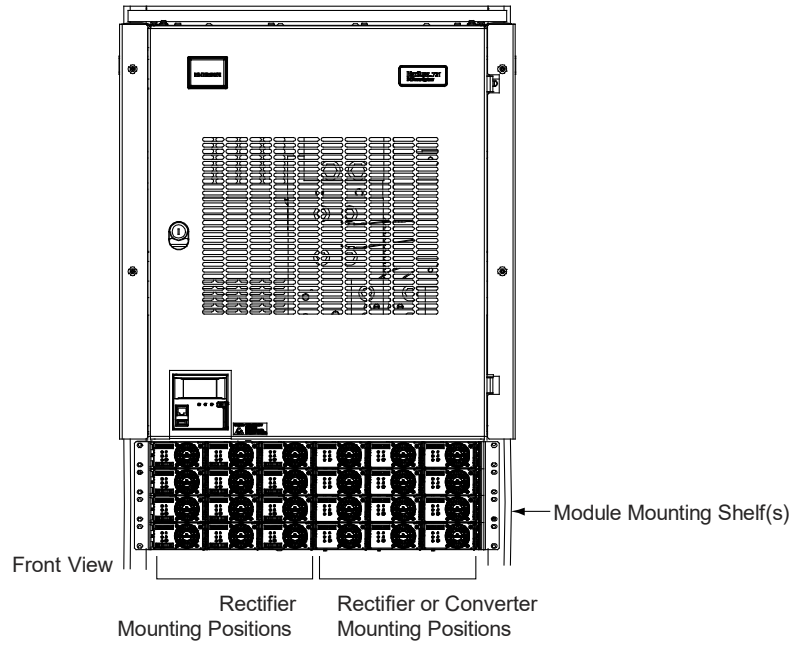


NOTE! It is recommended that the current limit point be checked whenever a rectifier is added to or removed from the power system. Refer "Checking the Controller's Current Limit Point after Adding or Removing a Rectifier Module or Converter Module" on page 57.

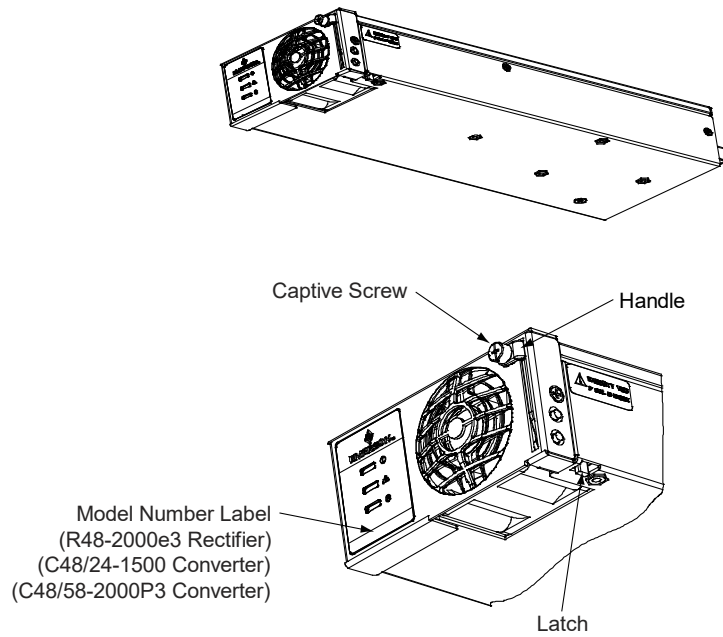


NOTE! The rectifier or converter being added is assigned by the controller the lowest available identification number. If desired, you can change the identification number. Refer to the NCU Instructions (UM1M830BNA) for a procedure.

Figure 4.3 Installing Rectifier and Converter Modules in a Spec. No. 588705300 Module Mounting Assembly



Rectifier or Converter Module



4.4 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705000 or 588705500 in a System Installed in a Relay Rack or an Enclosure



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



NOTE! Refer to Figure 4.4 and Figure 4.5 as this procedure is performed. A system installed in a relay rack is shown in the illustrations. The procedure for a system installed in an enclosure is the same except as noted in the following procedure steps.

Procedure

1. If the system is installed in an enclosure, refer to “Removing the Enclosure Rear Panels” on page 15 and remove the enclosure rear panels.
2. Install the expansion module mounting assembly directly below the bottom-most module mounting assembly in the rack or enclosure. Use the mounting hardware provided in the expansion busbar kit.

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.

3. On the rear of the expansion module mounting assembly, remove the rear shield that covers the output busbars. For a system installed in a relay rack, on the bottom-most module mounting assembly in the rack, remove the rear shield that covers the output busbars



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

4. Secure the existing shelf's busbars to the expansion shelf's mating busbars with the supplied interconnect busbars and hardware.

Hardware build-up for these connections are:

- 1/4-20 x 1" bolt,
- 1/4" Belleville lock washer,
- 1/4" flat washer.

Install the Belleville lock washer so the concave side is towards the busbar. Torque all connections to 60 in-lbs.

If installing a second expansion module mounting assembly, 1/4-20 nuts (included) are required in lieu of the 1/4-20 x 1" bolts (see Figure 4.4).

5. Disconnect the cable coming from the distribution cabinet from the bottom connector on the bottom-most existing module mounting assembly.
6. Connect the bottom connector on the bottom-most existing module mounting assembly to the top connector on the expansion module mounting assembly.
7. Connect the cable disconnected in step 4 (coming from distribution cabinet) to the bottom connector on expansion module mounting assembly.

8. For a system installed in a relay rack, replace the rear covers onto the expansion module mounting assembly and the module mounting assembly installed directly above it.
9. Refer to the Power System Installation Instructions (IM582127000) and connect AC input power to the expansion module mounting assembly.
10. For a system mounted in an enclosure, replace the rear covers.
11. Refer to the Rectifier Instructions and install rectifier modules into the expansion module mounting assembly as required.

Figure 4.4 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705000 or 588705500 (cont'd on next page)

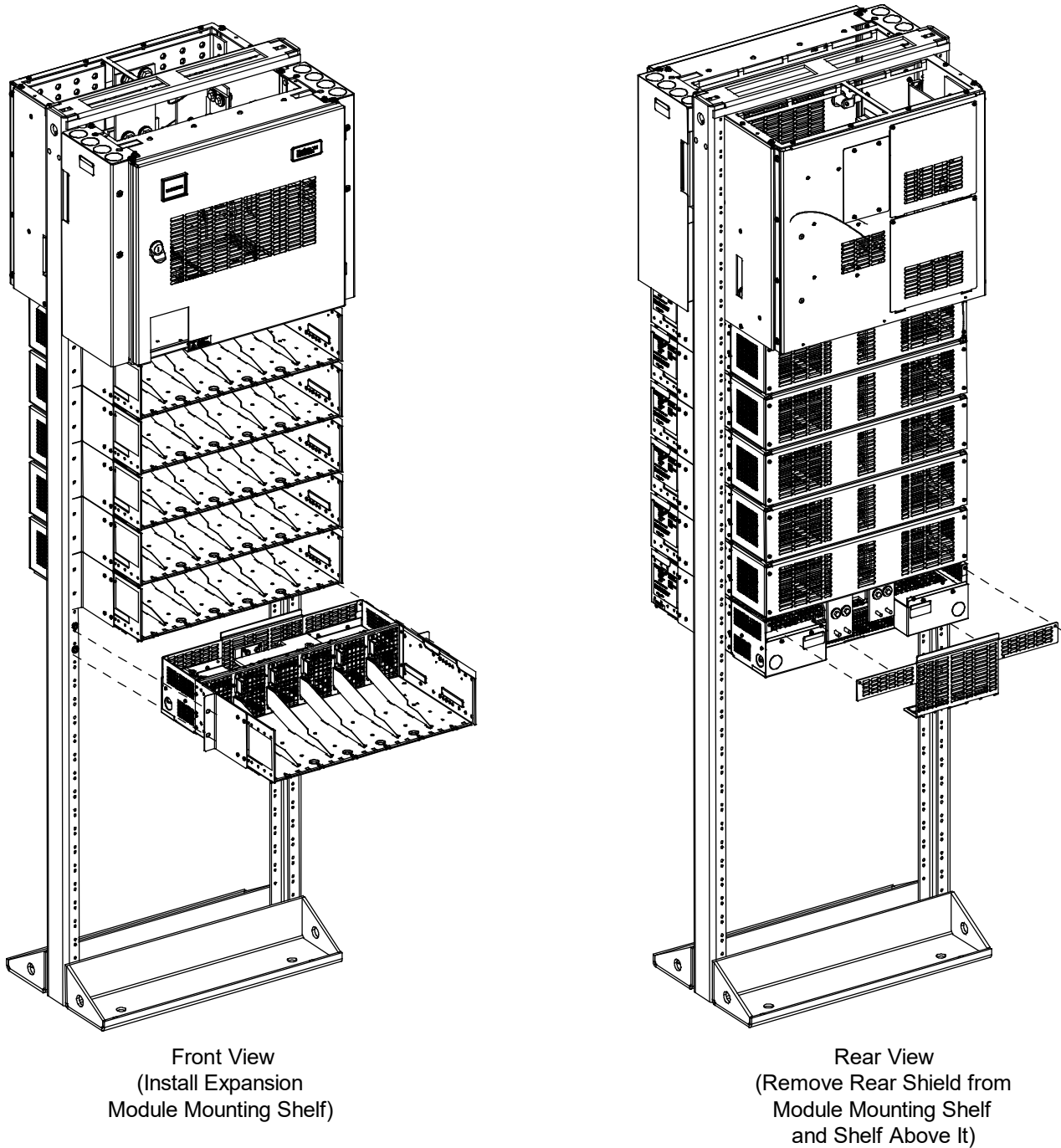


Figure 4.4 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705000 or 588705500 (cont'd from previous page)

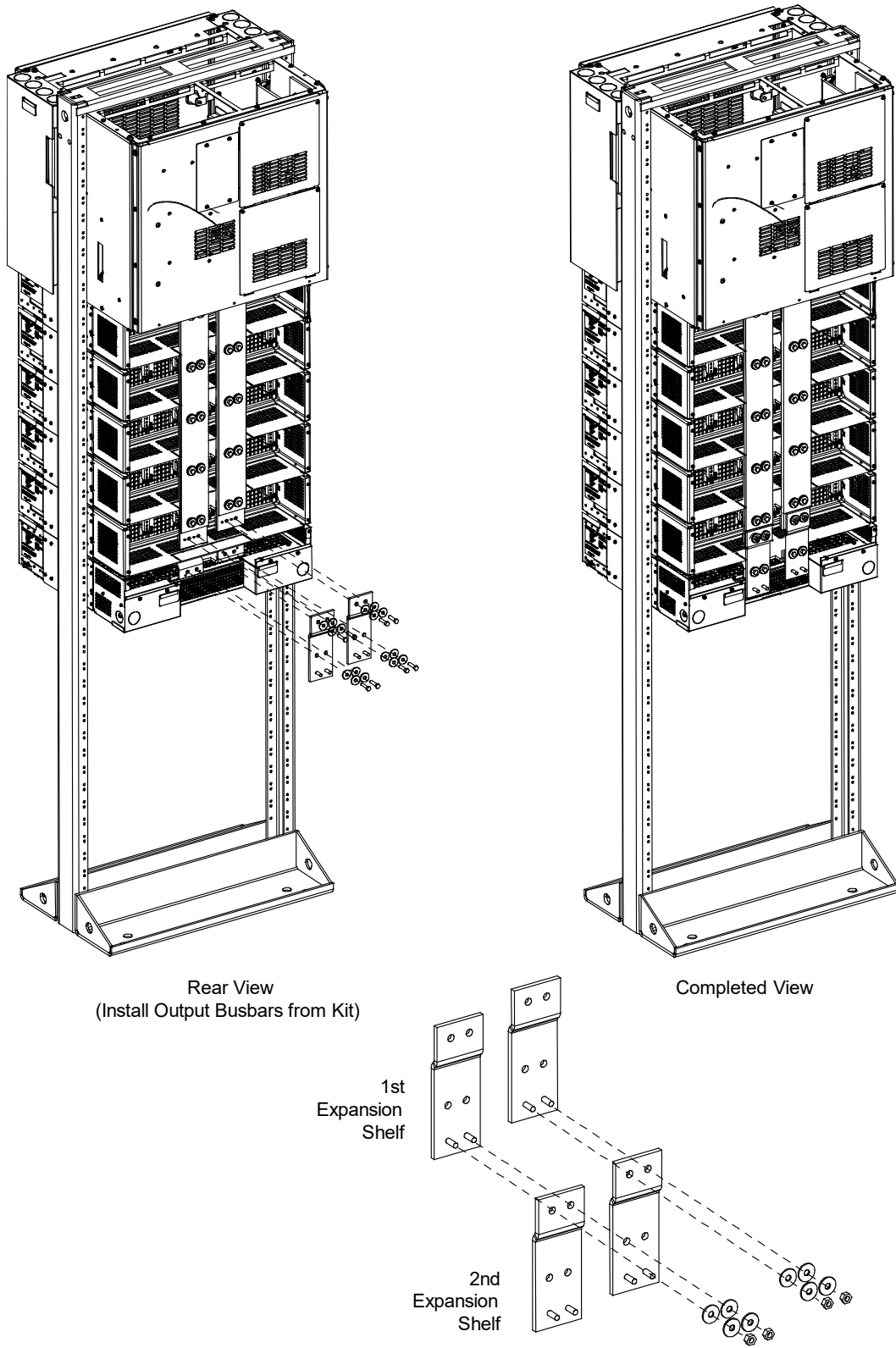
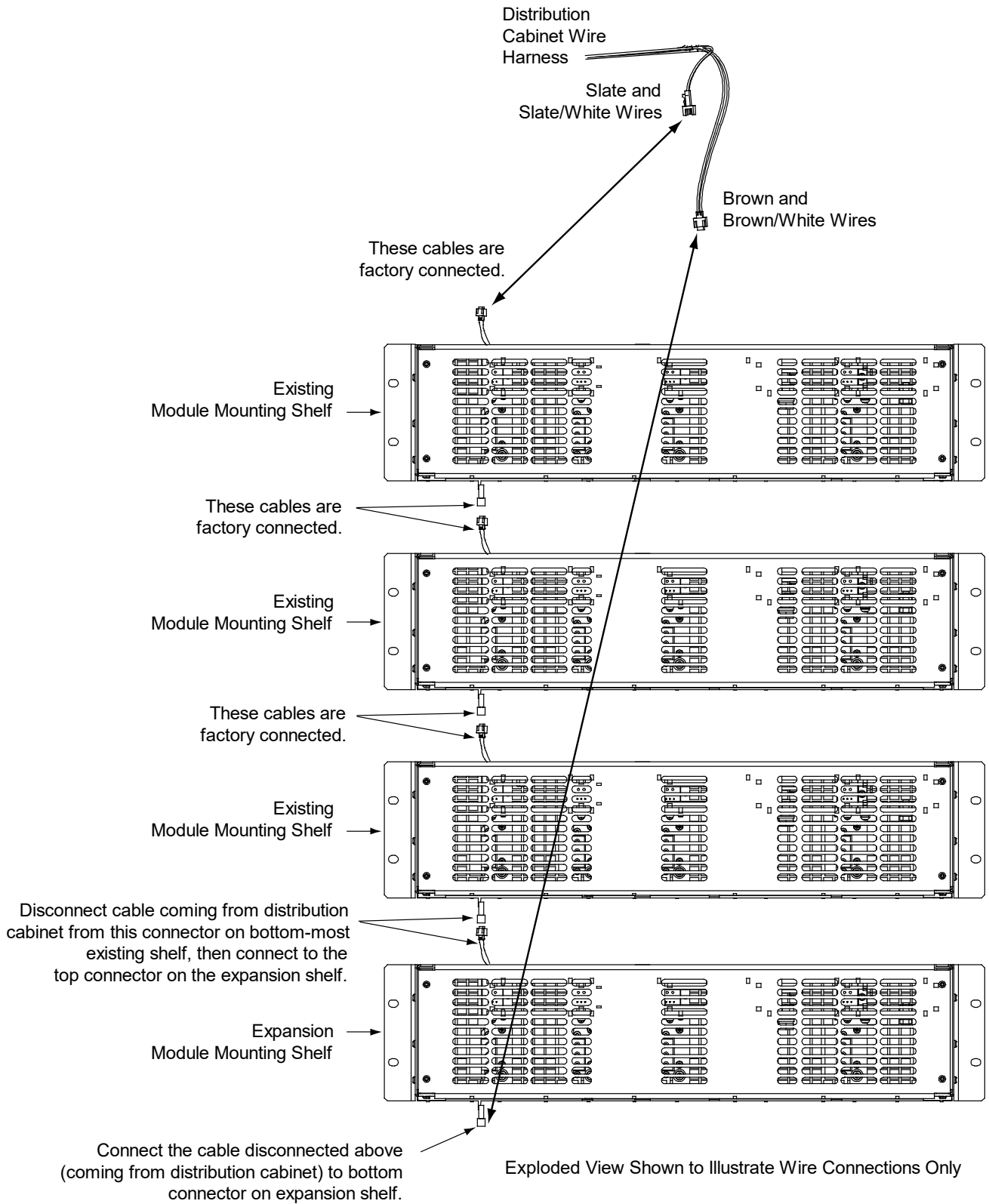


Figure 4.5 Controller CAN Bus, Module Mounting Assembly Spec. No. 588705000 or 588705500



4.5 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705300 in a System Installed in a Relay Rack



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



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



NOTE! Refer to Figure 4.7 and Figure 4.8 as this procedure is performed.

Procedure

1. Remove the busbar rear shield from the existing module mounting assemblies. Remove the cut-out panel from the busbar rear shield by gently bending the panel until it snaps from the busbar rear shield.
2. Remove the hardware from the lowest module mounting assembly's -48V, return, and +24V or -58V (if present) busbars.
 - a) Remove the mounting angles attached to the shelf and replace with P/N 555768. Place the mounting angle in position as shown in Figure 4.7.
3. 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.

4. 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.

5. Install the busbars provided with the expansion module mounting assembly between the studs on the expansion module mounting assembly and the studs on the shelf 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 shelf 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.

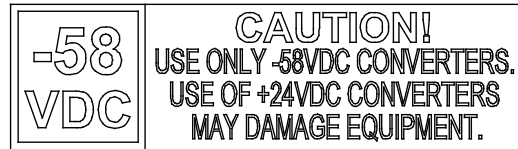
6. Disconnect the cable coming from the distribution cabinet from the connector on the bottom-most existing module mounting assembly and connect this cable to the same connector on the expansion module mounting assembly.
7. Connect the open connector on the bottom-most existing module mounting assembly to the open connector on the expansion module mounting assembly.
8. 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.

9. Refer to the Power System Installation Instructions (IM582127000) and connect AC input power to the expansion module mounting assembly.
10. Refer to the Power System Installation Instructions (IM582127000) and install rectifier and converter modules into the expansion module mounting assembly as required.
11. 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: +24V label 60028788 for use with +24VDC converters; -58V label 60028735 for use with -58VDC converters. A sample of this labeling is provided in Figure 4.6.

Figure 4.6 Caution Labels



60028788 (+24V Label)



60028735 (-58V Label)

Figure 4.7 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705300

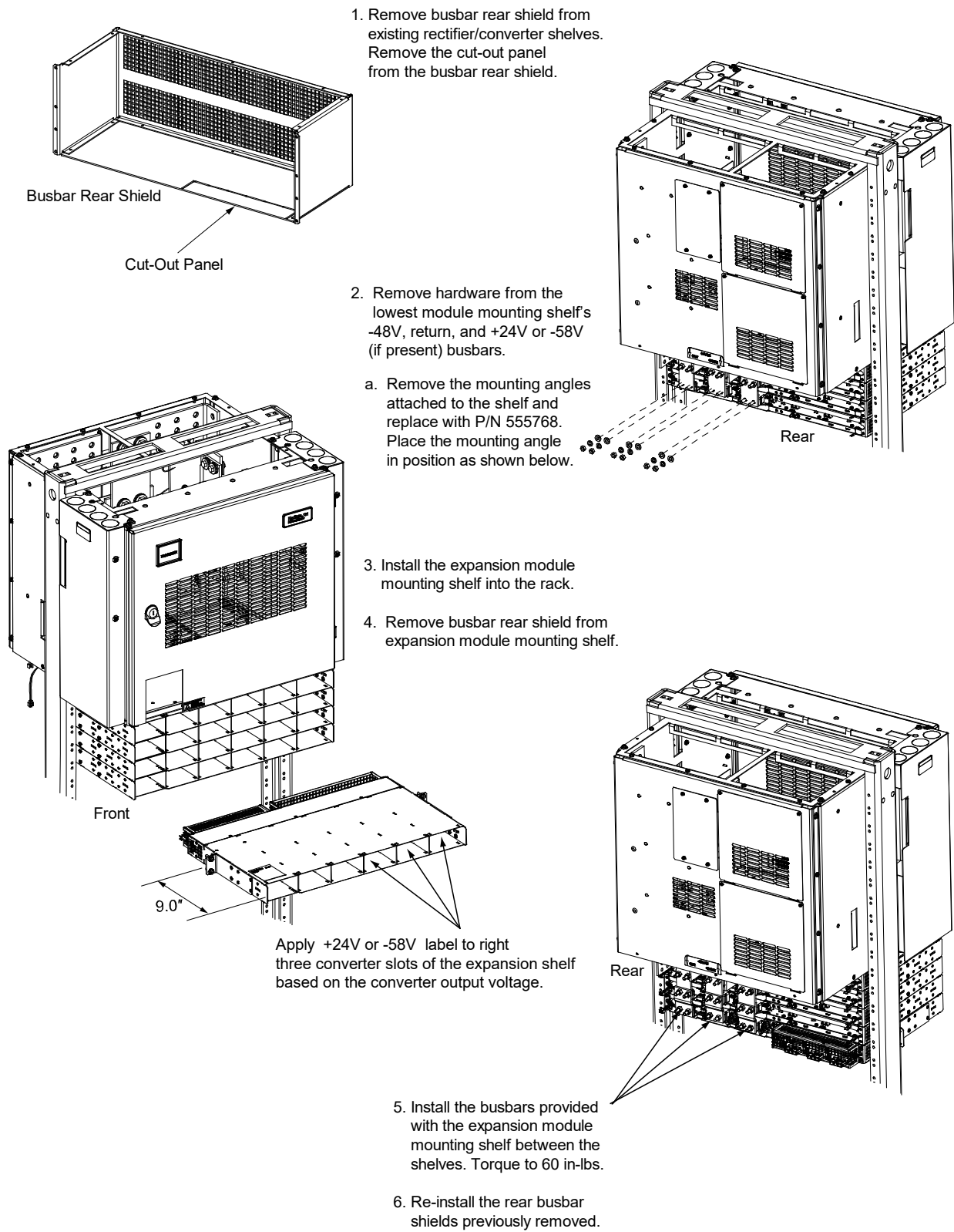
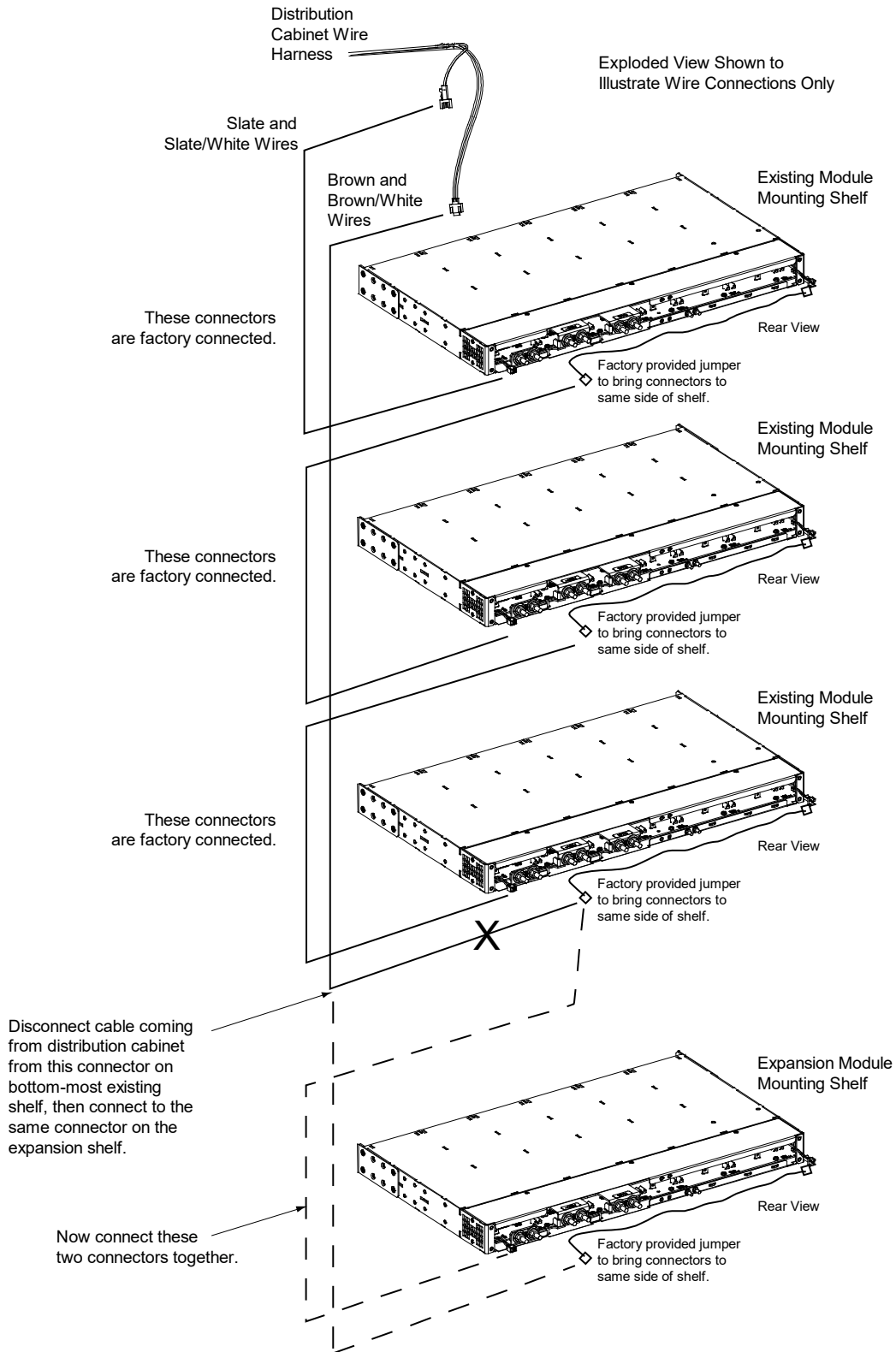


Figure 4.8 Controller CAN Bus, Module Mounting Assembly Spec. No. 588705300



4.6 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400 in a System Installed in a Relay Rack or an Enclosure



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



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



NOTE! Field expansion shelf is not available if the system is equipped with the inverter system.



NOTE! Refer to Figure 4.9 and Figure 4.10 as this procedure is performed. A system installed in a relay rack is shown in the illustrations. The procedure for a system installed in an enclosure is the same except as noted in the following procedure steps.



NOTE! Apply electrical anti-oxidizing compound to busbar mating surfaces.

Procedure

1. If the system is installed in an enclosure, refer to “Removing the Enclosure Rear Panels” on page 15 and remove the enclosure rear panels.
2. For a system installed in a relay rack, remove the busbar rear shield from the existing module mounting assemblies.
3. For a system installed in a relay rack, remove the cut-out panel from the busbar rear shield.
4. Prepare the expansion module mounting assembly by installing the “L” shaped busbars onto the expansion module mounting assembly as shown in Figure 4.9.
5. 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, (2) each side.

10/12 ground washer, (2) each 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.

6. Remove the hardware from the lowest module mounting assembly's -48V and return busbars.
7. Install the busbars provided with the expansion module mounting assembly between the busbars on the expansion module mounting assembly and the busbars 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. Refer to Figure 4.9 for assembly details. Torque as shown in Figure 4.9.
8. Refer to Figure 4.10 and make the CAN bus connections.
9. For a system installed in a relay rack, re-install the rear busbar shield previously removed from the existing module mounting assembly.

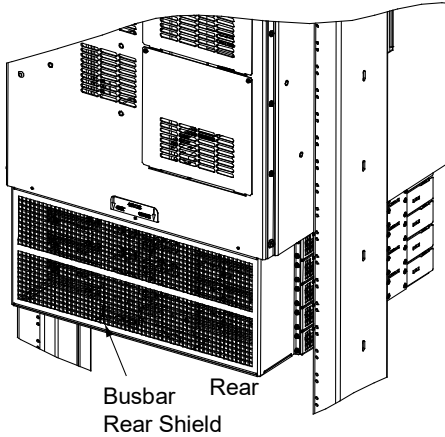


NOTE! To add a second expansion module mounting assembly, repeat this procedure. Note that for a system installed in a relay rack, the lower section of the center rear shield on the first expansion module mounting assembly needs to be removed from the rear section of the shield.

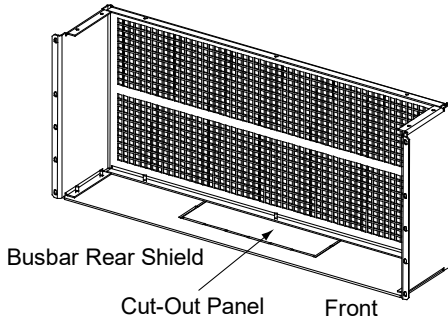
10. Refer to the Power System Installation Instructions (IM582127000) and connect AC input power to the expansion module mounting assembly.
11. For a system mounted in an enclosure, replace the rear covers.
12. Refer to the Power System Installation Instructions (IM582127000) and install rectifier modules into the expansion module mounting assembly as required.

Figure 4.9 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400
(cont'd on next page)

1. Remove busbar rear shield from existing module mounting assemblies.

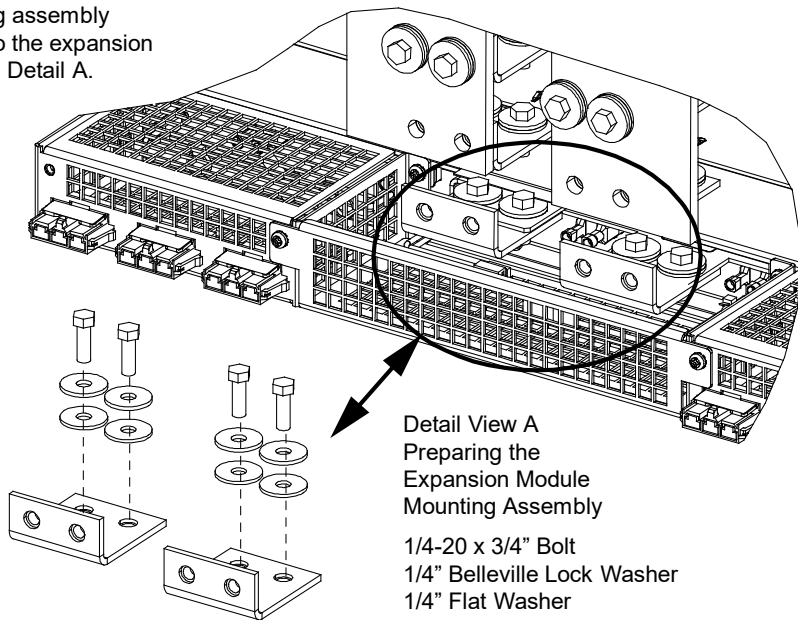


2. Remove the cut-out panel from the busbar rear shield.



3. Prepare the expansion module mounting assembly by installing the “L” shaped busbars onto the expansion module mounting assembly as shown in Detail A.

Apply electrical anti-oxidizing compound to busbar mating surfaces.



4. Install the expansion module mounting assembly into the rack.

10/12 Ground Washer (2 each side)
12-24 x 3/4” Screw (2 each side)
Torque to 65 in-lbs.

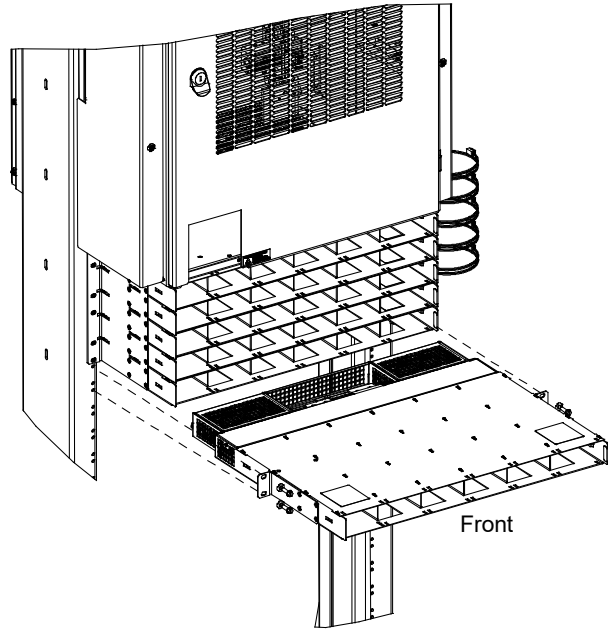
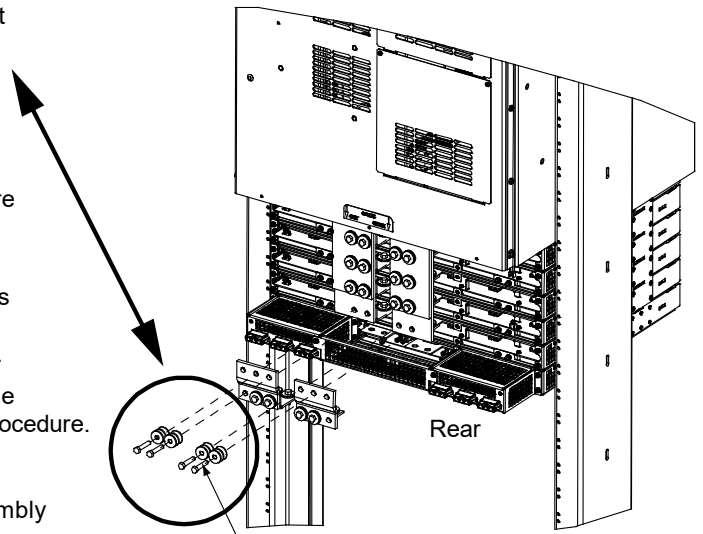


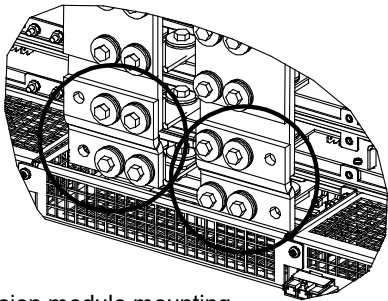
Figure 4.9 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400
(cont'd from previous page)

5. Remove hardware from the lowest module mounting assembly's -48V and return busbars.
6. Install the busbars provided with the expansion module mounting assembly between the assemblies, using the hardware removed in the above step. See Detail B.
7. After making CAN bus connections (see next page), re-install the rear busbar shield previously removed.
8. To add a second expansion module mounting assembly, repeat this procedure. Note that the lower section of the center rear shield on the first expansion module mounting assembly needs to be removed from the rear section of the shield. See Detail C.

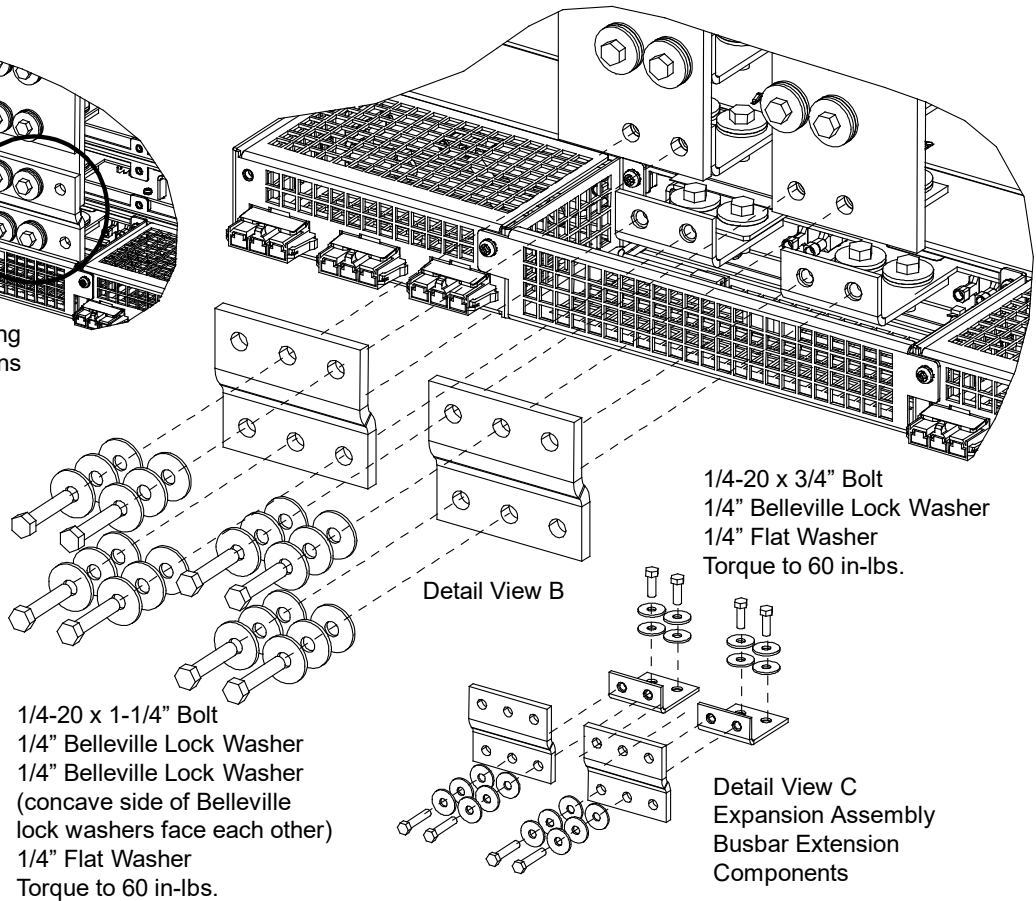


Remove this hardware from the lowest module mounting assembly and re-use it to add the busbar extensions for the expansion module mounting assembly.

Apply electrical anti-oxidizing compound to busbar mating surfaces.



Expansion module mounting assembly busbar extensions installed view.

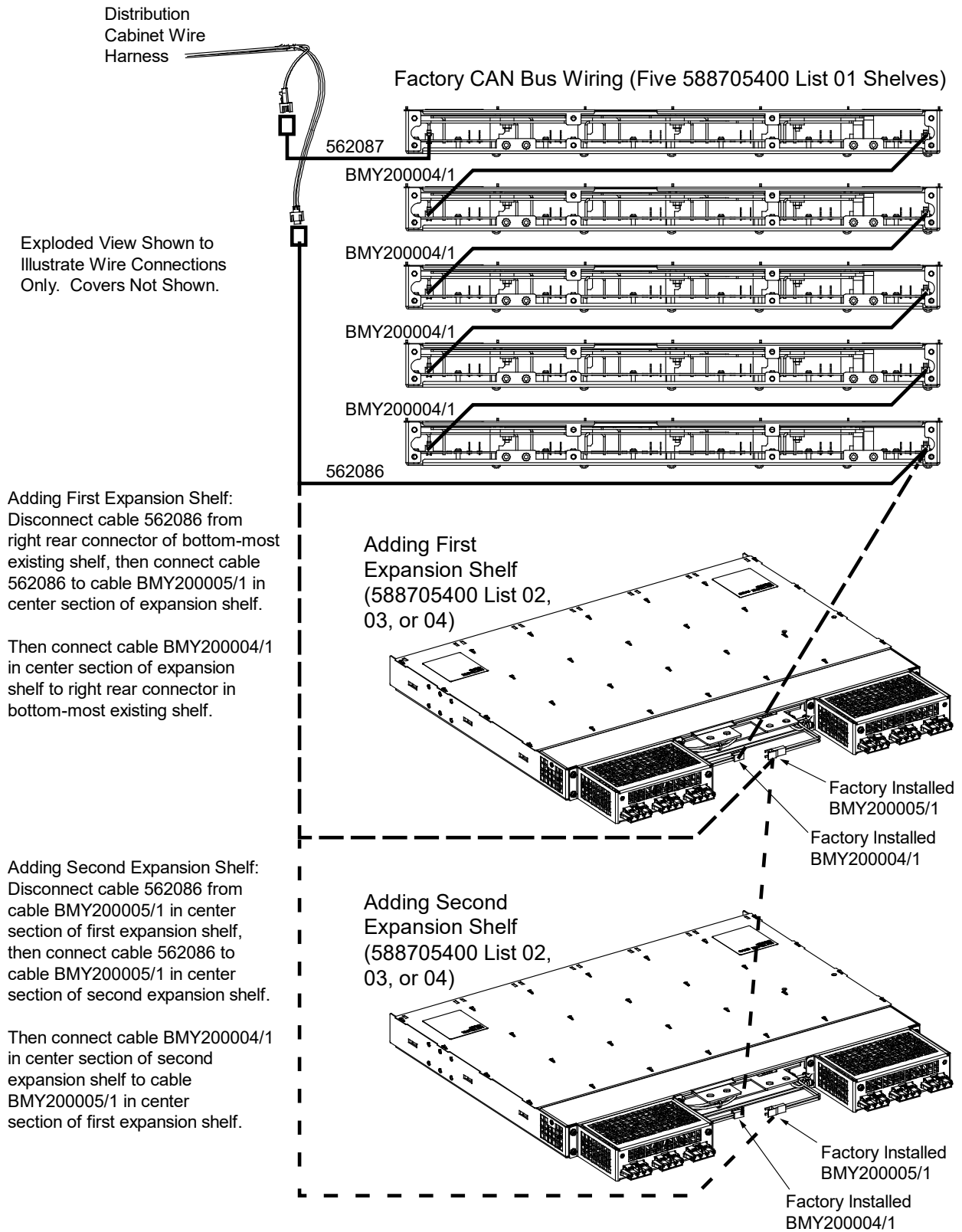


1/4-20 x 1-1/4" Bolt
1/4" Belleville Lock Washer
1/4" Belleville Lock Washer
(concave side of Belleville lock washers face each other)
1/4" Flat Washer
Torque to 60 in-lbs.

1/4-20 x 3/4" Bolt
1/4" Belleville Lock Washer
1/4" Flat Washer
Torque to 60 in-lbs.

Detail View C
Expansion Assembly
Busbar Extension
Components

Figure 4.10 Controller CAN Bus, Module Mounting Assembly Spec. No. 588705400



4.7 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400 in a System Installed with 588705000 or 588705500 in a Relay Rack or an Enclosure



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



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



NOTE! List 37A must be used for the first expansion shelf installation beneath a 588705000 or 588705500 shelf. List 37 must be used for the second expansion shelf installation.



NOTE! Field expansion shelf is not available if the system is equipped with the inverter system.



NOTE! Refer to Figure 4.11 and Figure 4.12 as this procedure is performed. A system installed in a relay rack is shown in the illustrations. The procedure for a system installed in an enclosure is the same except as noted in the following procedure steps.



NOTE! Apply electrical anti-oxidizing compound to busbar mating surfaces.

Procedure

1. If the system is installed in an enclosure, refer to “Removing the Enclosure Rear Panels” on page 15 and remove the enclosure rear panels.
2. For a system installed in a relay rack, remove the busbar rear shield from the existing module mounting assemblies. Discard the busbar rear shield of the lowest existing module mounting assembly. Save the busbar rear shield of the other existing module mounting assemblies for later reuse.
3. Prepare the expansion module mounting assembly by installing the “L” shaped busbars onto the expansion module mounting assembly as shown in Figure 4.11.
4. Install the mounting angles to the expansion module mounting assembly as shown in Figure 4.11.
5. 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, (2) each side.

10/12 ground washer, (2) each side.



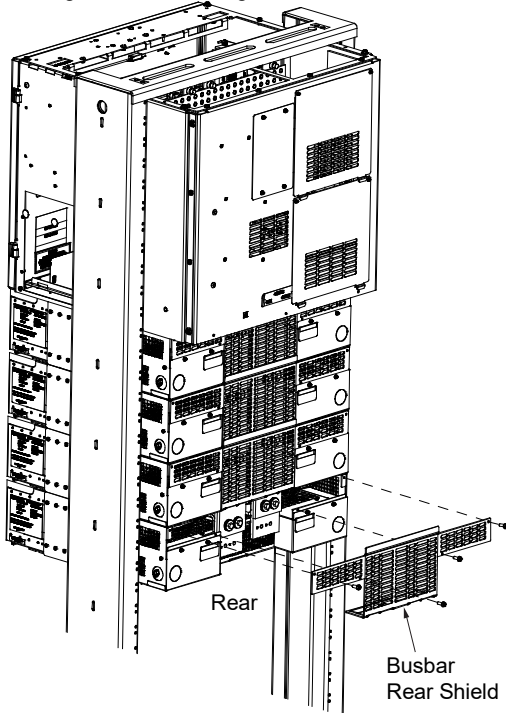
NOTE! Install the ground washers so the teeth make contact with the metal on the mounting angles. Torque all screws to 65 in-lbs.

6. Install the busbars provided with the expansion module mounting assembly between the busbars on the expansion module mounting assembly and the busbars 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. Torque as shown in Figure 4.11.
7. Refer to Figure 4.12 and make the CAN bus connections.

8. For a system installed in a relay rack, install the rear busbar shield provided with the module mounting assembly field expansion kit on the lowest existing module mounting assembly. Re-install the rear busbar shield previously removed from the other existing module mounting assembly.
9. Refer to the Power System Installation Instructions (IM582127000) and connect AC input power to the expansion module mounting assembly.
10. For a system mounted in an enclosure, replace the rear covers.
11. Refer to the Power System Installation Instructions (IM582127000) and install rectifier modules into the expansion module mounting assembly as required.

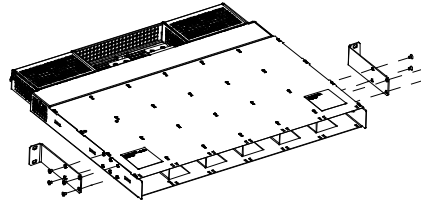
Figure 4.11 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400 (cont'd on next page)

1. Remove the busbar rear shield from the existing module mounting assemblies. Discard the busbar rear shield of the lowest existing module mounting assembly. Save the busbar rear shield of the other existing module mounting assemblies for later reuse.



3. Install the mounting angles to the expansion module mounting assembly.

M4 x 6mm Screw (4 each side)



4. Install the expansion module mounting assembly into the rack.

10/12 Ground Washer (2 each side)
12-24 x 3/4" Screw (2 each side)
Torque to 65 in-lbs.

2. Prepare the expansion module mounting assembly by installing the "L" shaped busbars onto the expansion module mounting assembly as shown in Detail A.

Apply electrical anti-oxidizing compound to busbar mating surfaces.

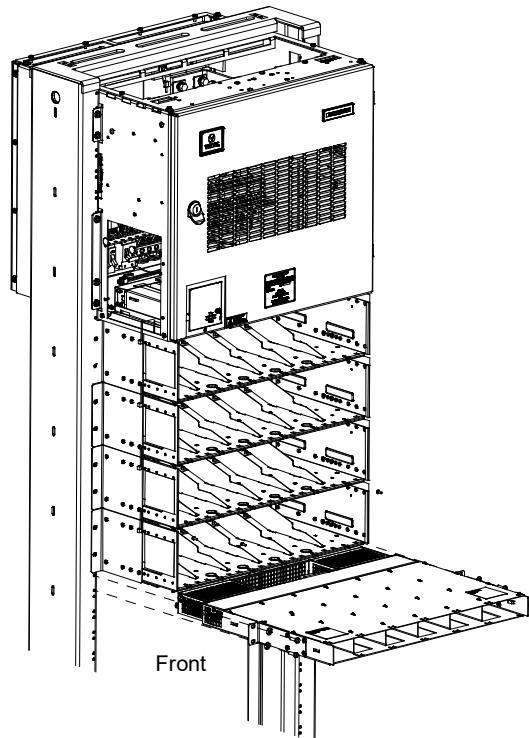
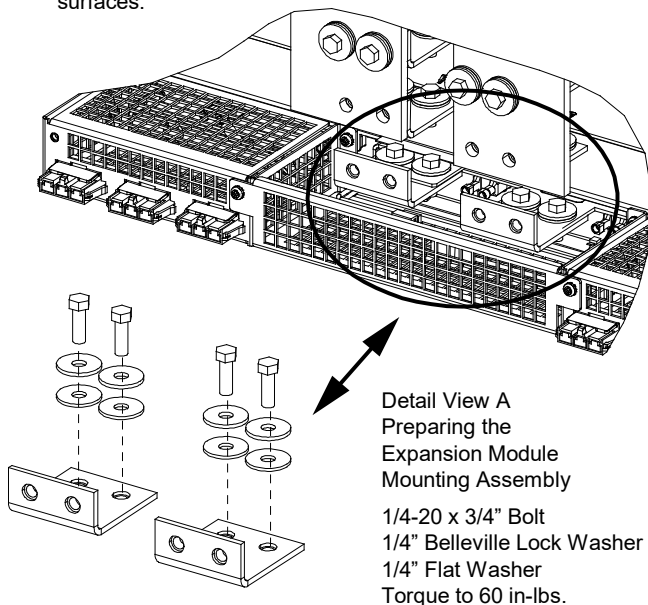


Figure 4.11 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400 (cont'd from previous page)

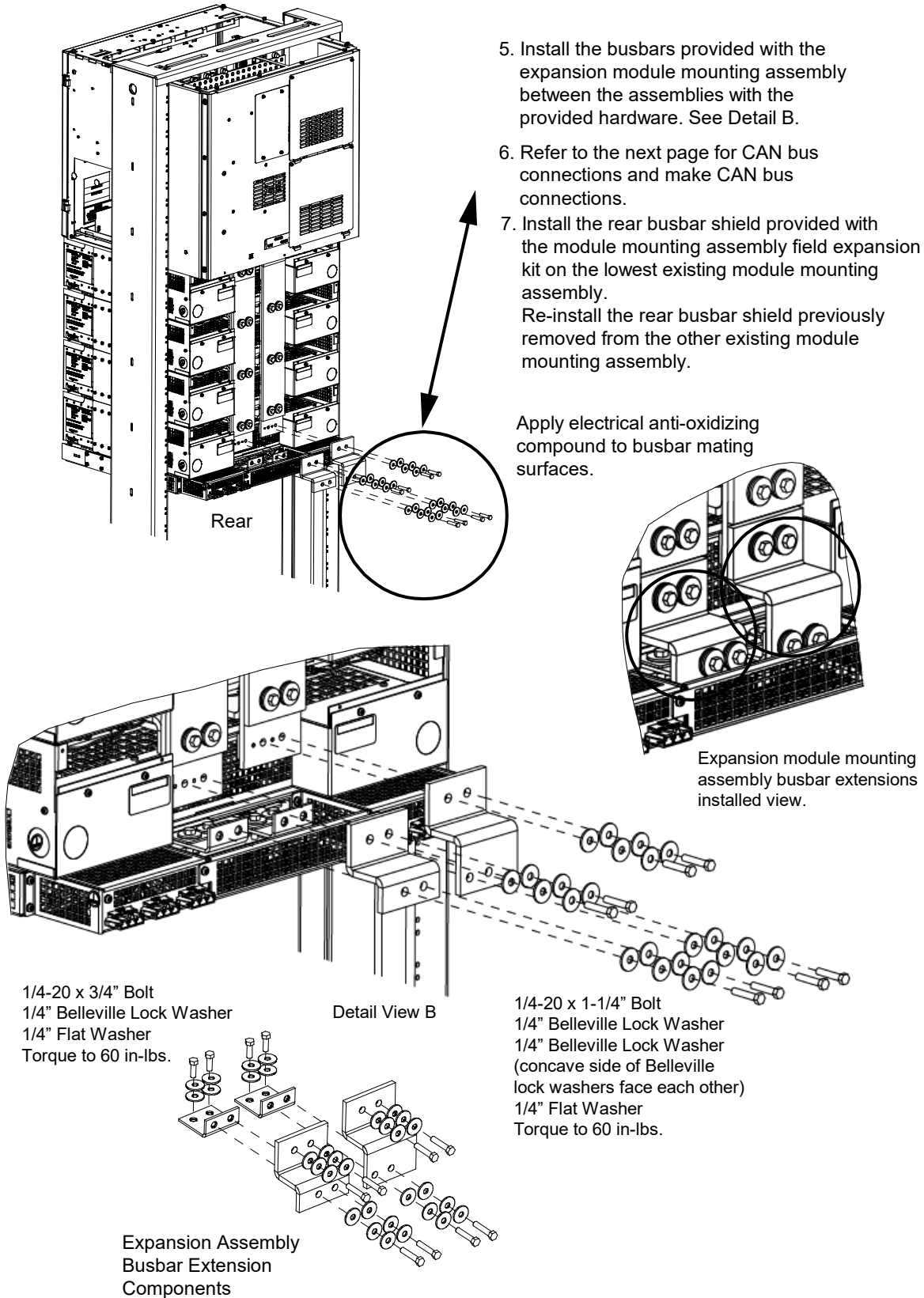
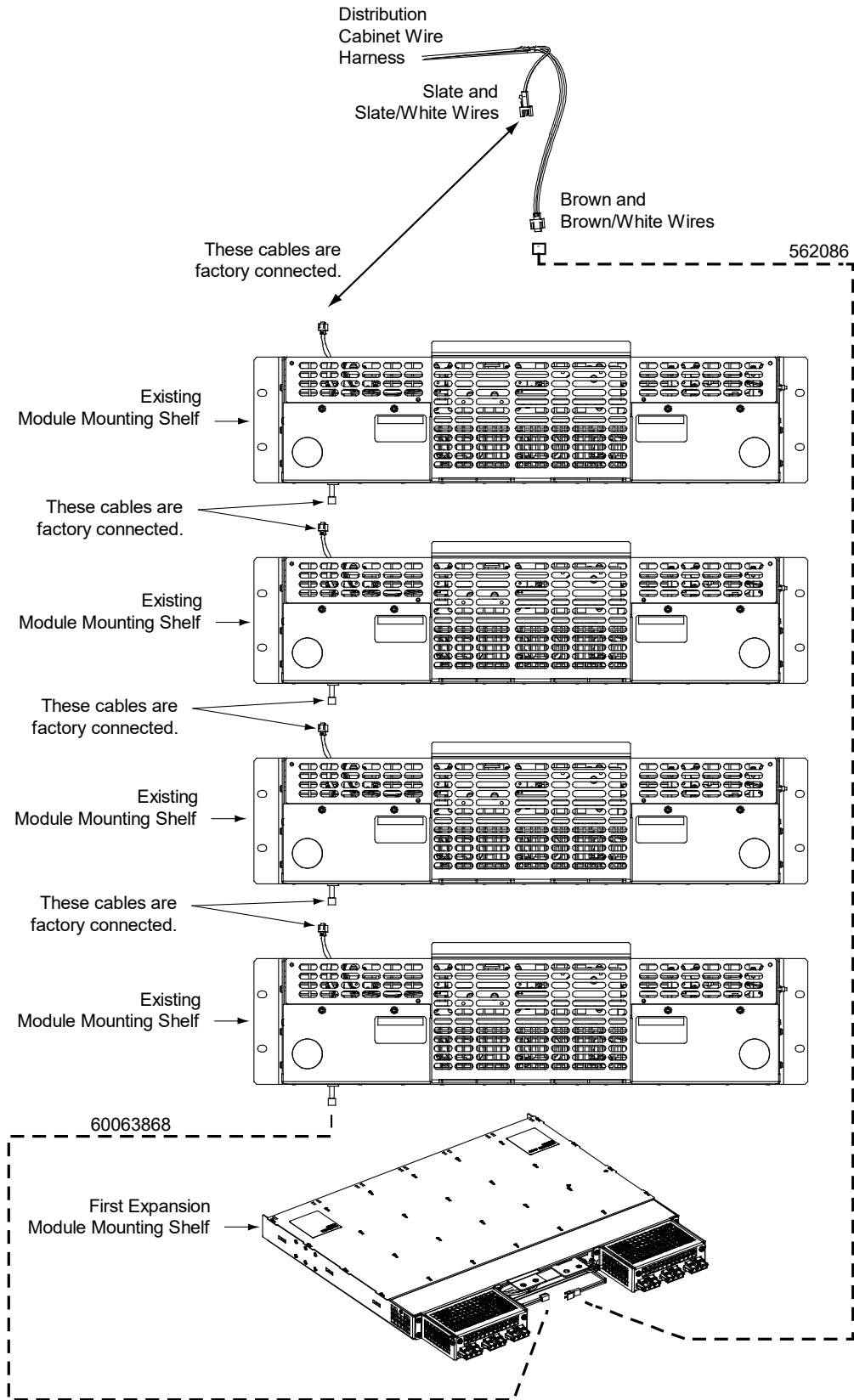


Figure 4.12 Controller CAN Bus, Module Mounting Assembly Spec. No. 588705000 or 588705500 and 588705400



If installing the second expansion module assembly, perform the below steps.

Procedure

1. If the system is installed in an enclosure, refer to “Removing the Enclosure Rear Panels” on page 15 and remove the enclosure rear panels.
2. For a system installed in a relay rack, remove the busbar rear shield from the existing module mounting assemblies.
3. Prepare the expansion module mounting assembly by installing the “L” shaped busbars onto the expansion module mounting assembly as shown in Figure 4.13.
4. Install the mounting angles to the expansion module mounting assembly as shown in Figure 4.13.
5. 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, (2) each side.

10/12 ground washer, (2) each side.

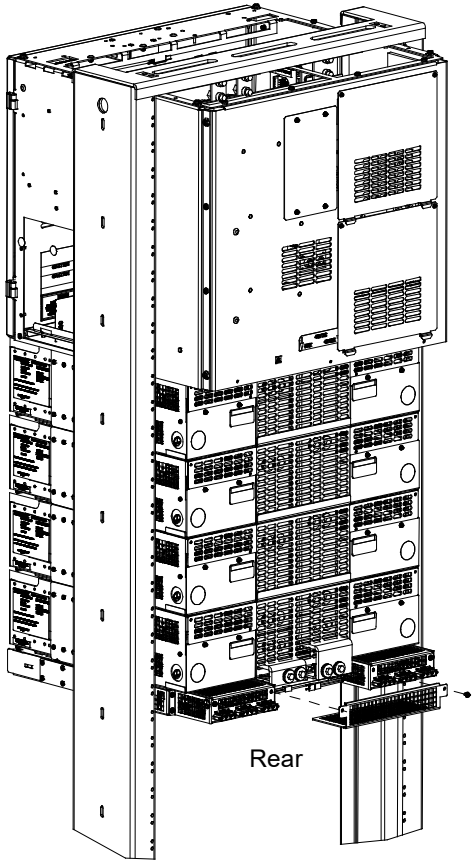


NOTE! Install the ground washers so the teeth make contact with the metal on the mounting angles. Torque all screws to 65 in-lbs.

6. Remove the hardware from the lowest module mounting assembly. See Figure 4.13.
7. Install the busbars provided with the expansion module mounting assembly between the busbars on the expansion module mounting assembly and the busbars 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 as shown in Figure 4.13.
8. Refer to Figure 4.14 and make the CAN bus connections.
9. Remove the lower section of the rear shield of the first expansion module mounting assembly from the rear section of the shield.
10. For a system installed in a relay rack, re-install the rear busbar shield previously removed from the existing module mounting assembly.
11. Refer to the Power System Installation Instructions (IM582127000) and connect AC input power to the expansion module mounting assembly.
12. For a system mounted in an enclosure, replace the rear covers.
13. Refer to the Power System Installation Instructions (IM582127000) and install rectifier modules into the expansion module mounting assembly as required.

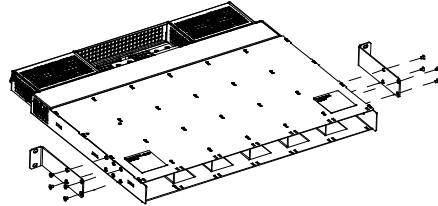
Figure 4.13 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400 (cont'd on next page)

1. Remove busbar rear shield from existing module mounting assemblies.



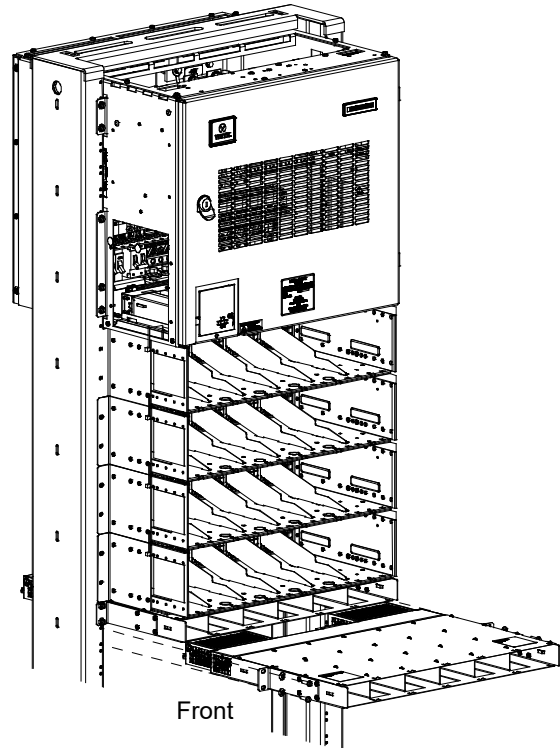
3. Install the mounting angles to the expansion module mounting assembly.

M4 x 6mm Screw (4 each side)



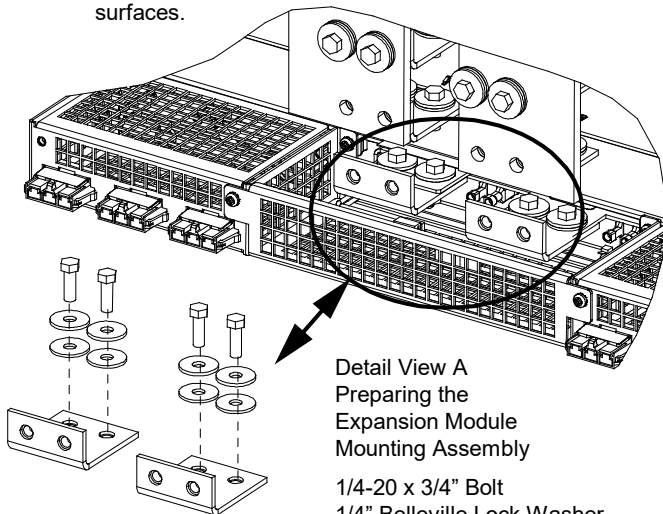
4. Install the expansion module mounting assembly into the rack.

10/12 Ground Washer (2 each side)
12-24 x 3/4" Screw (2 each side)
Torque to 65 in-lbs.



2. Prepare the expansion module mounting assembly by installing the "L" shaped busbars onto the expansion module mounting assembly as shown in Detail A.

Apply electrical anti-oxidizing compound to busbar mating surfaces.



Detail View A
Preparing the
Expansion Module
Mounting Assembly

1/4-20 x 3/4" Bolt
1/4" Belleville Lock Washer
1/4" Flat Washer
Torque to 60 in-lbs.

Figure 4.13 Installing a Field Expansion Module Mounting Assembly Spec. No. 588705400 (cont'd from previous page)

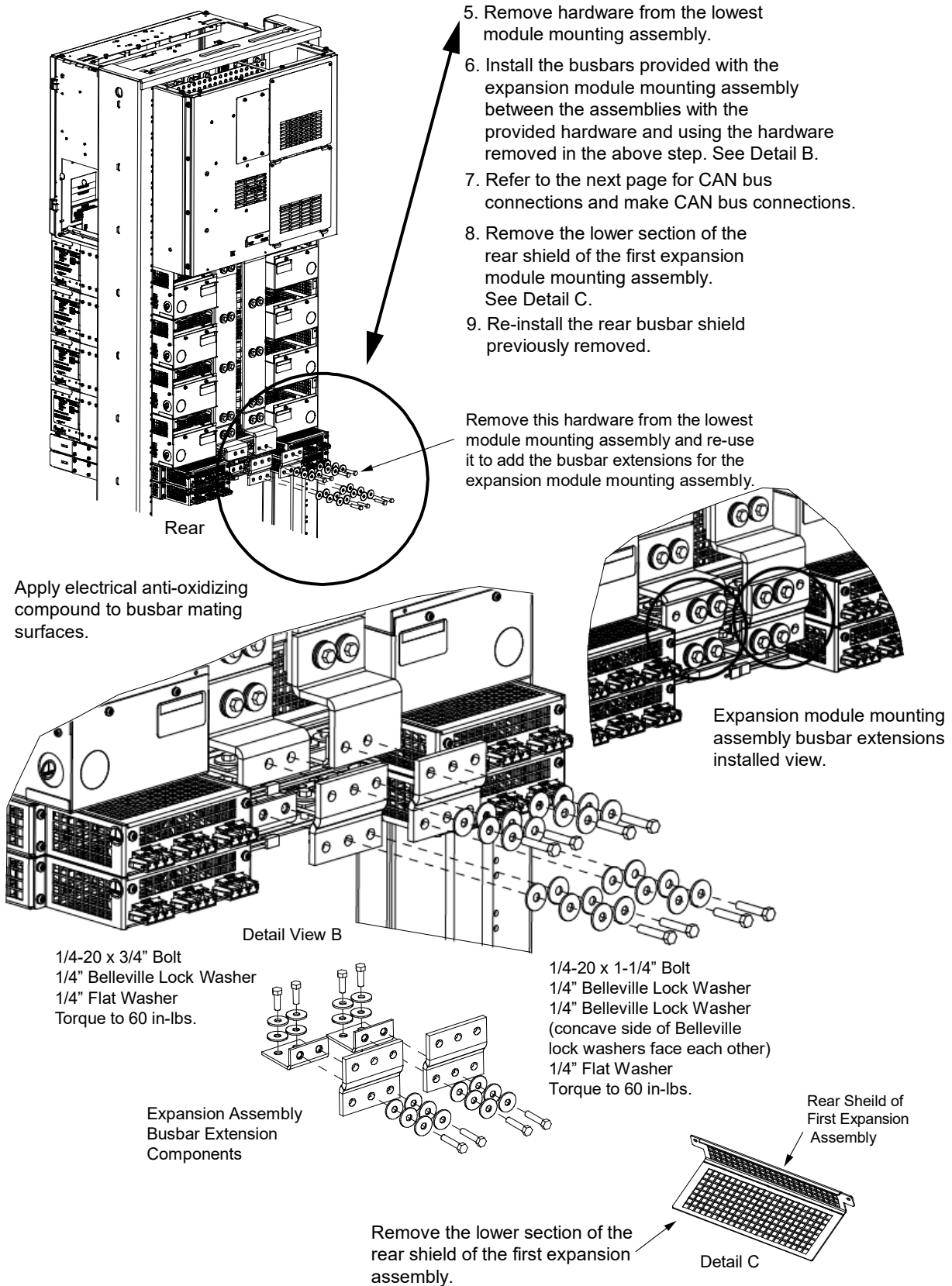
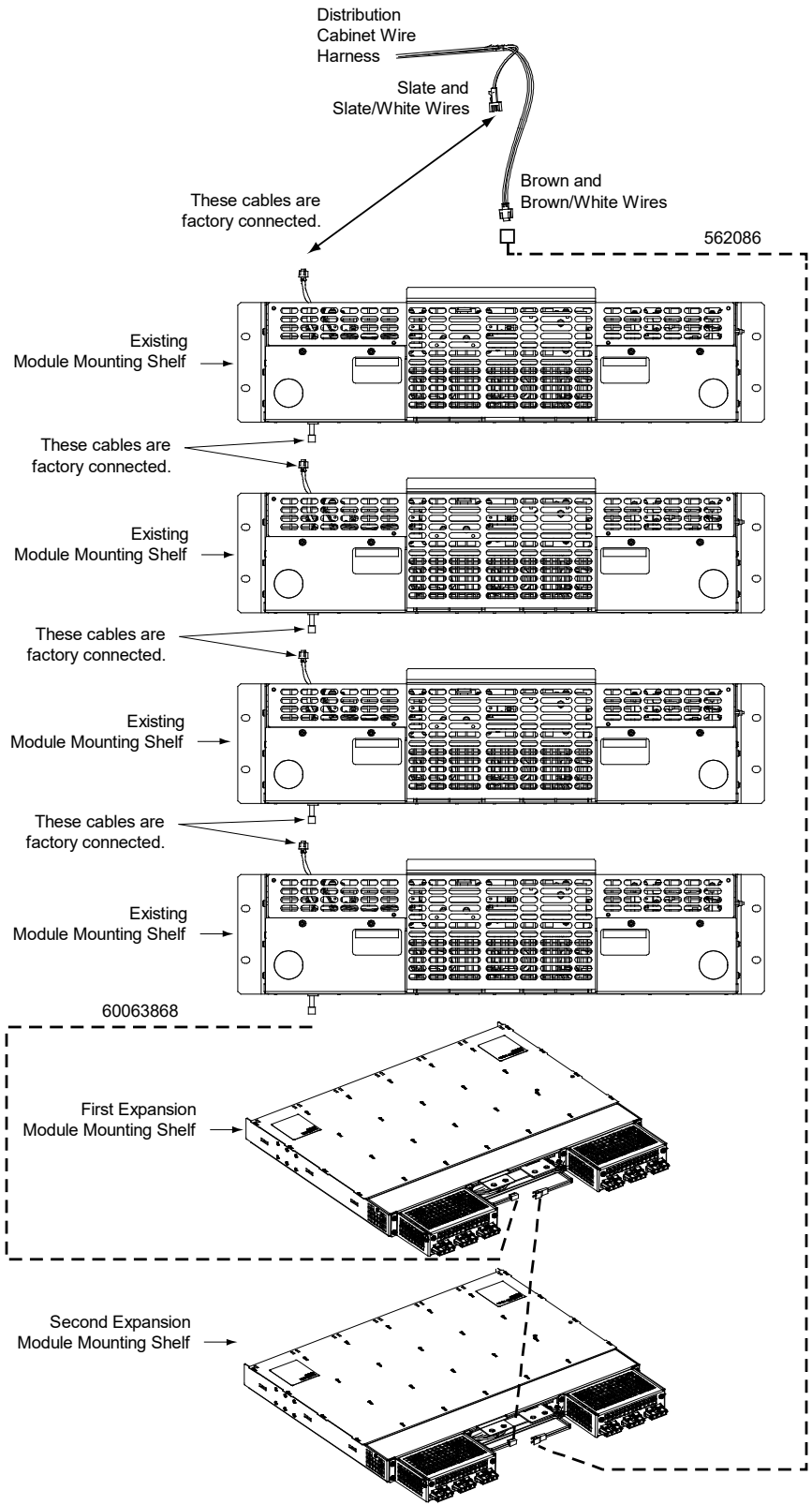


Figure 4.14 Controller CAN Bus, Module Mounting Assembly Spec. No. 588705000 or 588705500 and 588705400



4.8 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 4.15.

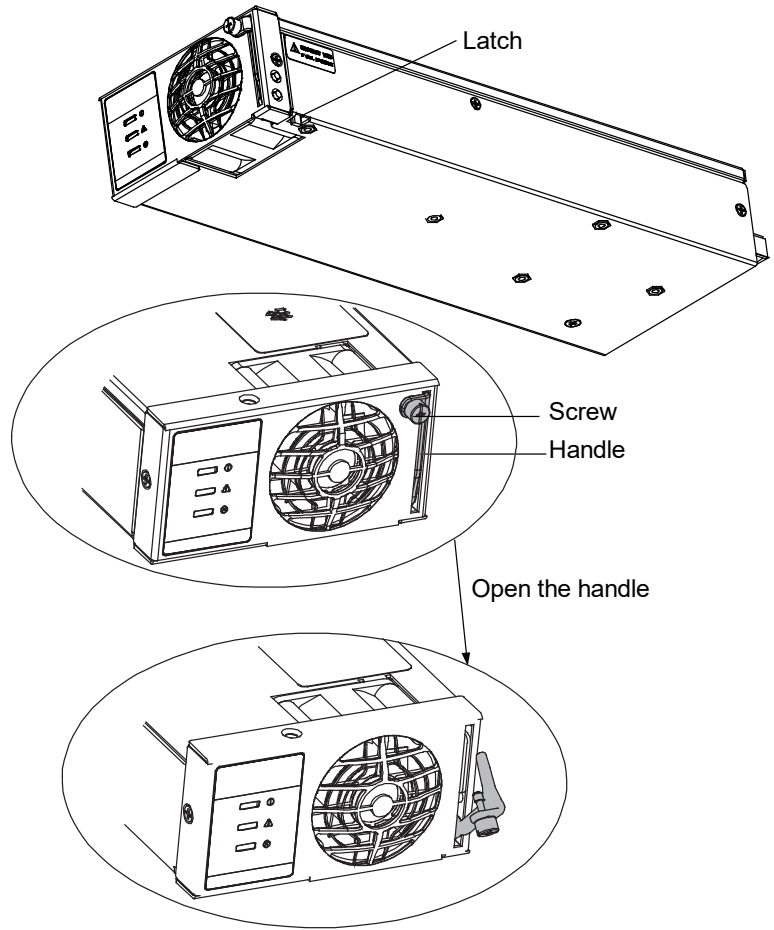


WARNING! To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing an inverter module. NEVER hold the handle in the closed position when installing an inverter module into a shelf.

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 4.15.
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 4.15 Installing Inverter Modules



4.9 Reconfiguring a Dual Voltage Distribution Panel (List DE, DF, DG, DH, DJ, DK, FE, FF, FG, FH, FJ, FK)

Perform the following procedure to reconfigure a dual voltage distribution panel (List DE, DF, DG, DH, DJ, DK, FE, FF, FG, FH, FJ, FK) 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.

Removing the Distribution Panel

Procedure

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 by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
3. Remove the plastic shield covering the circuit breakers and/or fuseholders on the distribution panel to be removed by loosening the screws holding the shield and sliding the shield upwards.
4. Record circuit breaker and/or fuse positions and sizes.
5. Remove circuit breakers and/or fuseholders.
6. Label the load leads.
7. Disconnect and insulate all load leads from the circuit breaker and/or fuse positions.
8. Disconnect and insulate all load return leads from the ground busbar.
9. Refer to Figure 4.16 and remove the hardware securing the +24V or -58V jumper leads. Insulate and tie back these leads.
10. Refer to Figure 4.16 and locate the in-line FA/CBA connector located near the back of the distribution panel. Separate the connector halves.
11. Refer to Figure 4.16 and remove the hardware securing the distribution panel's ground busbar to the distribution cabinet's busbar.
12. Refer to Figure 4.16 and remove the hardware securing the distribution panel's system load distribution busbar to the distribution cabinet's busbar.
13. Refer to Figure 4.16 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the distribution panel from the distribution cabinet.

Reworking the Distribution Panel

You can reconfigure the distribution panel to swap -48V distribution positions for +24V or -58V distribution positions, and vice versa, in groups of four. The resulting assembly can have following positions. See Table 4.2.

Table 4.2 Positions

Positions	
(0) -48V	(26) +24V or -58V
(6) -48V	(20) +24V or -58V
(10) -48V	(16) +24V or -58V
(14) -48V	(12) +24V or -58V
(18) -48V	(8) +24V or -58V
(22) -48V	(4) +24V or -58V
(26) -48V	(0) +24V or -58V

You do this by moving the shorting bus and CBA/FA alarm strap. Refer to Figure 4.17 to reconfigure the distribution panel.

Note that for a List DE and FE distribution panel, you must also move the subsystem input power busbar as shown in Figure 4.17.

Note that if you reconfigure a distribution panel for all subsystem voltage (List DK and FK) or all system voltage, you must also move the extra CBA/FA alarm strap stored on the far left (as viewed from the rear) to the far right position (as shown in Figure 4.17).

Note that if you reconfigure a distribution panel for all subsystem voltage (List DK and FK), you must disconnect and insulate the system CBA/FA lead (as shown in Figure 4.17).

Note that if you reconfigure a distribution panel for all system voltage, you must disconnect and insulate the subsystem CBA/FA lead (as shown in Figure 4.17).

Note that if the panel is re-configured for all subsystem positions (List DK and FK), the distribution cabinet's load side busbar must be removed since it is not to be connected to the distribution panel and will cause interference. Note that the busbar that is removed should be retained in the event that the panel is re-configured at a later date to revert back to a panel with some subsystem positions.

Figure 4.16 Removing/Installing the Distribution Panel

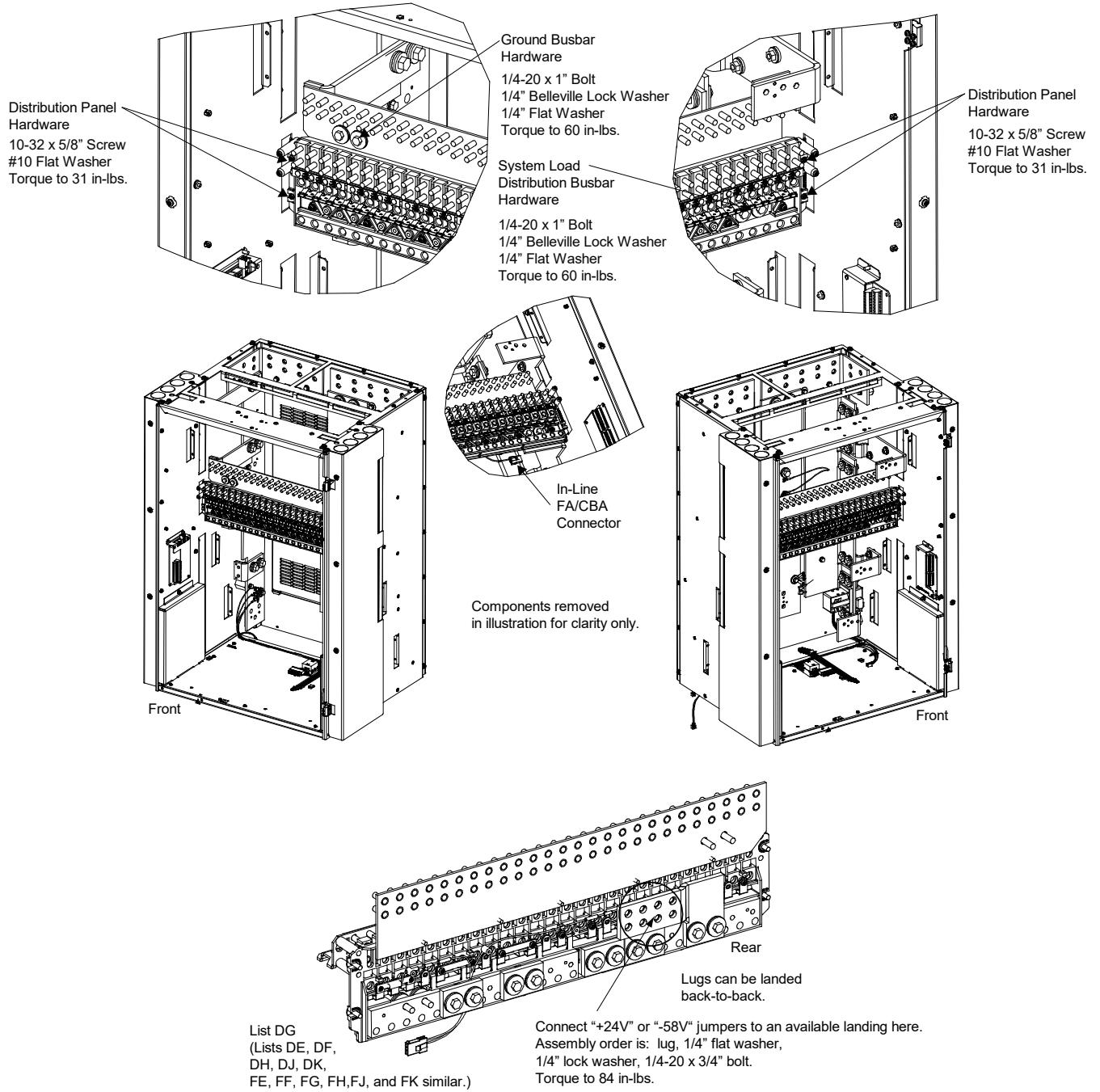


Figure 4.17 Reworking the Distribution Panel (cont'd on next page)

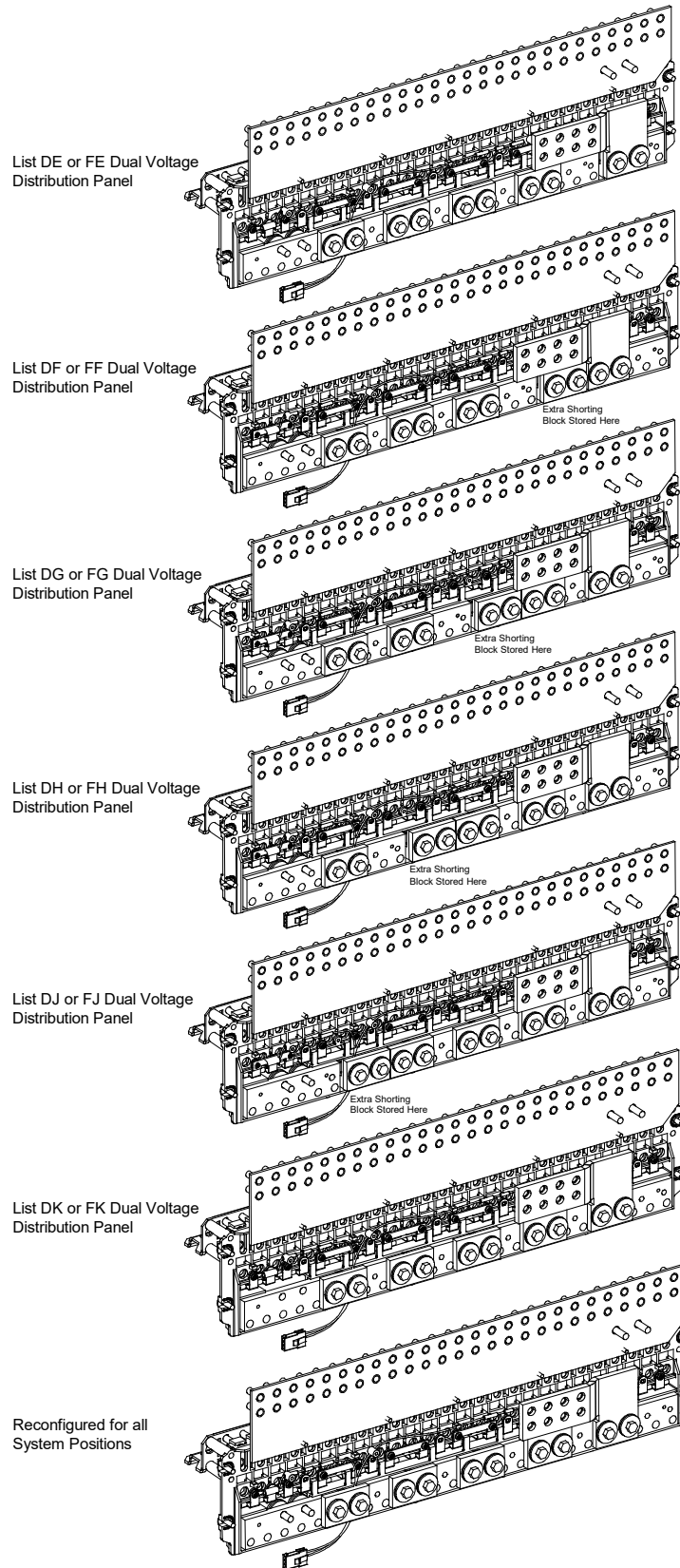


Figure 4.17 Reworking the Distribution Panel (cont'd from previous page, cont'd on next page)

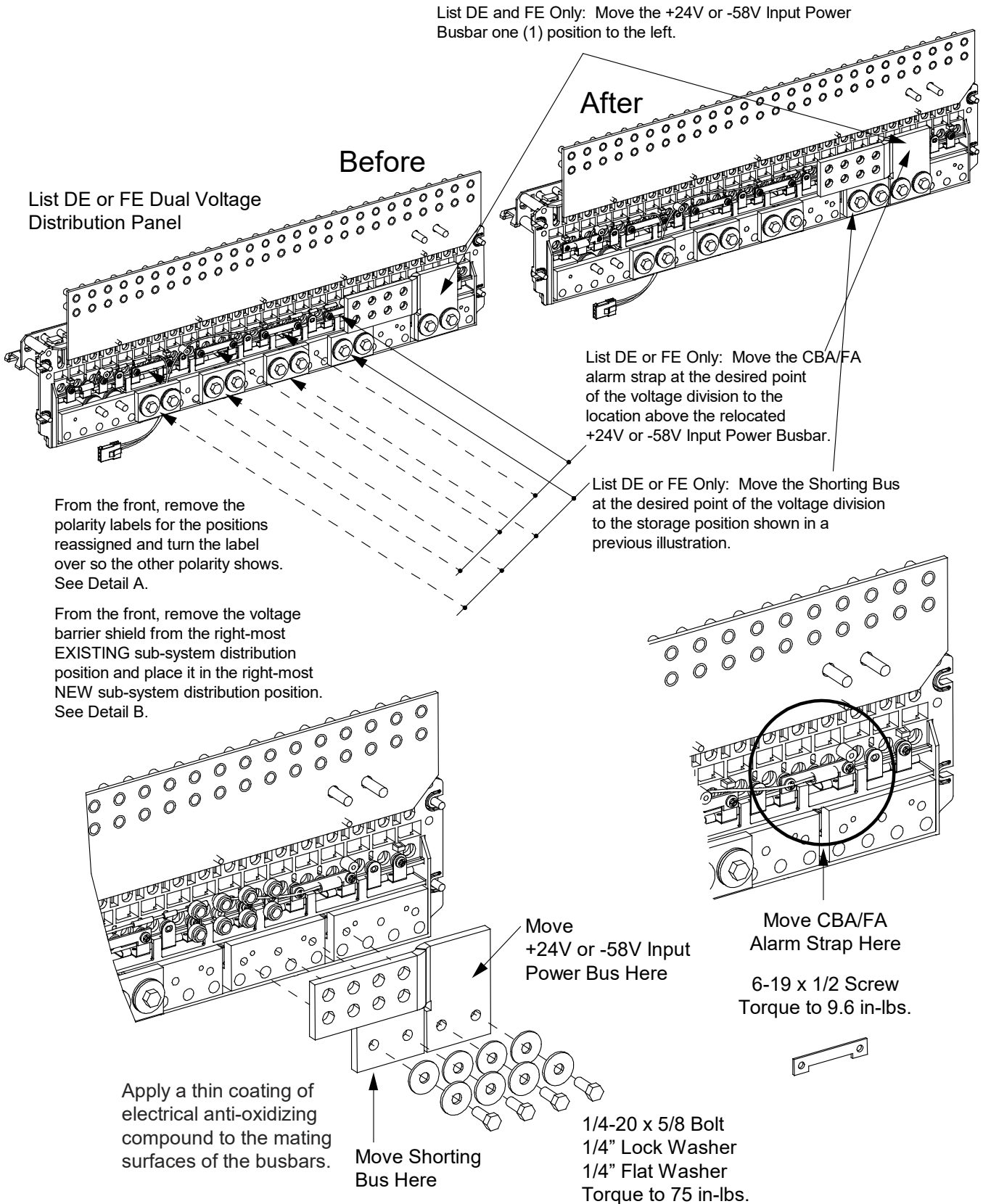


Figure 4.17 Reworking the Distribution Panel (cont'd from previous page, cont'd on next page)

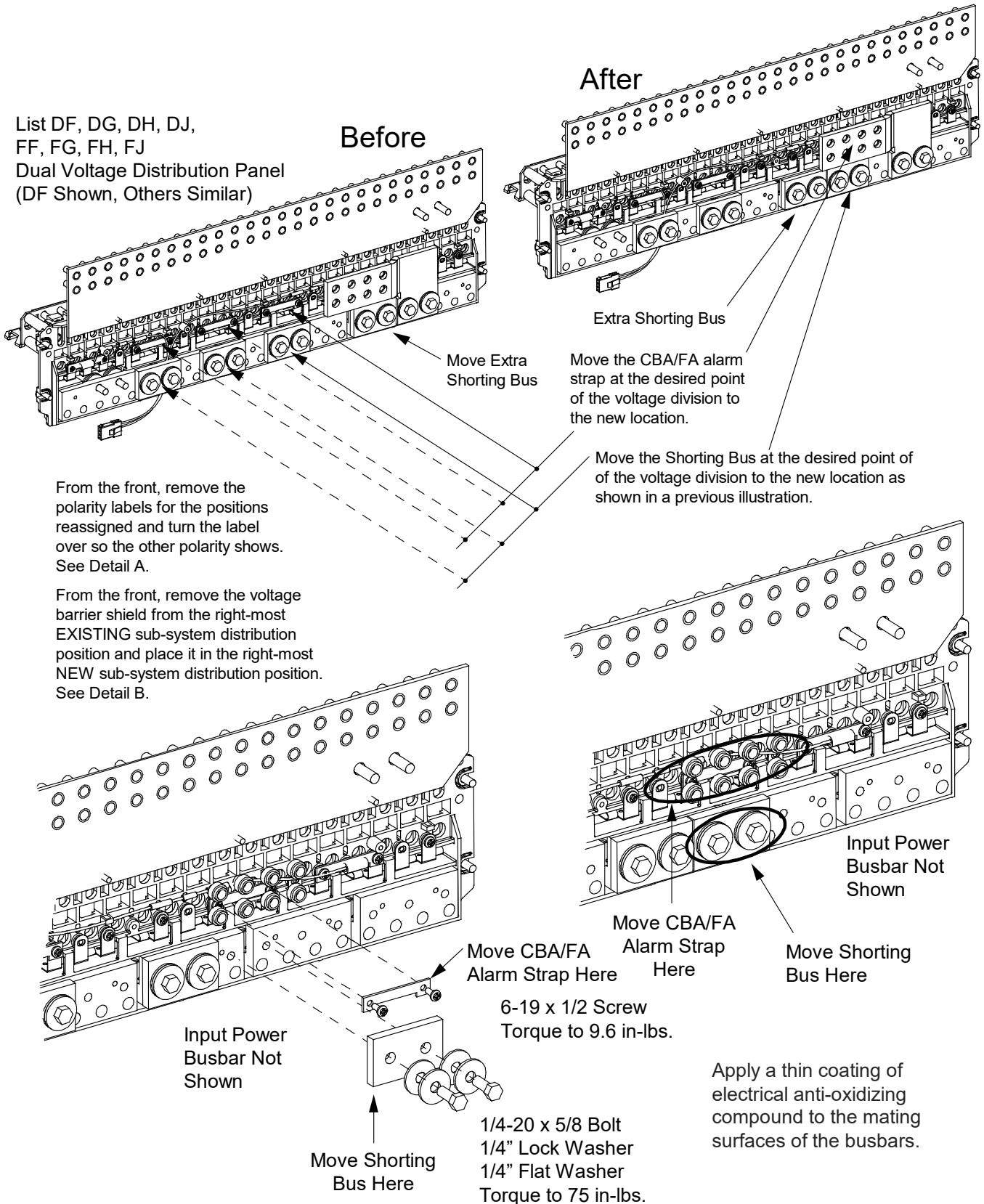
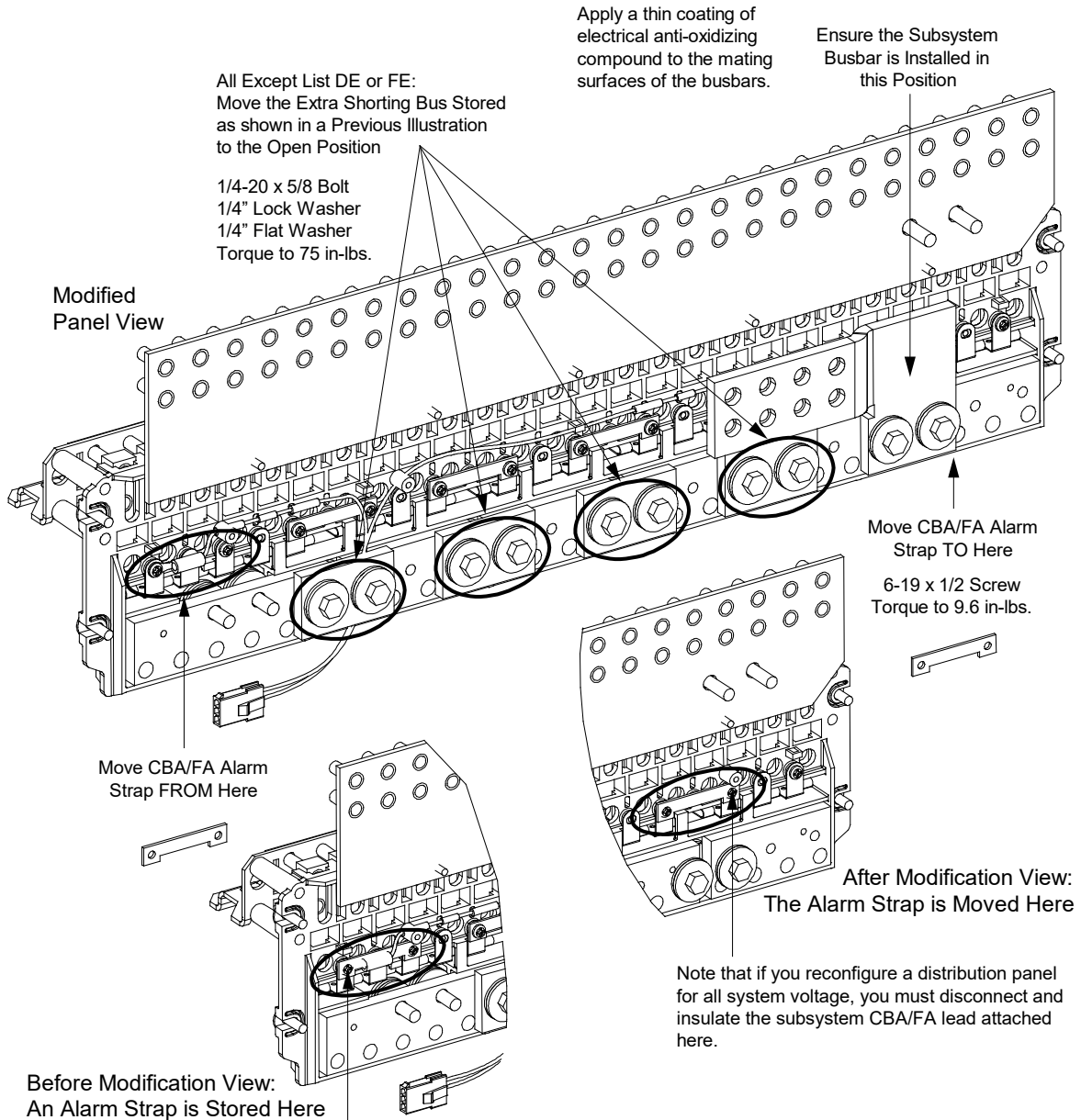


Figure 4.17 Reworking the Distribution Panel (cont'd from previous page, cont'd on next page)

Distribution Panel Reconfigured
for All Subsystem (List DK or FK) or
All System Positions

From the front, remove the polarity labels for the positions reassigned and turn the label over so the other polarity shows. See Detail A.

From the front, remove the voltage barrier shield. See Detail B.



All Except List DE or FE:
Move the Extra Shorting Bus Stored
as shown in a Previous Illustration
to the Open Position

1/4-20 x 5/8 Bolt
1/4" Lock Washer
1/4" Flat Washer
Torque to 75 in-lbs.

Apply a thin coating of
electrical anti-oxidizing
compound to the mating
surfaces of the busbars.

Ensure the Subsystem
Busbar is Installed in
this Position

Move CBA/FA Alarm
Strap TO Here
6-19 x 1/2 Screw
Torque to 9.6 in-lbs.

Move CBA/FA Alarm
Strap FROM Here

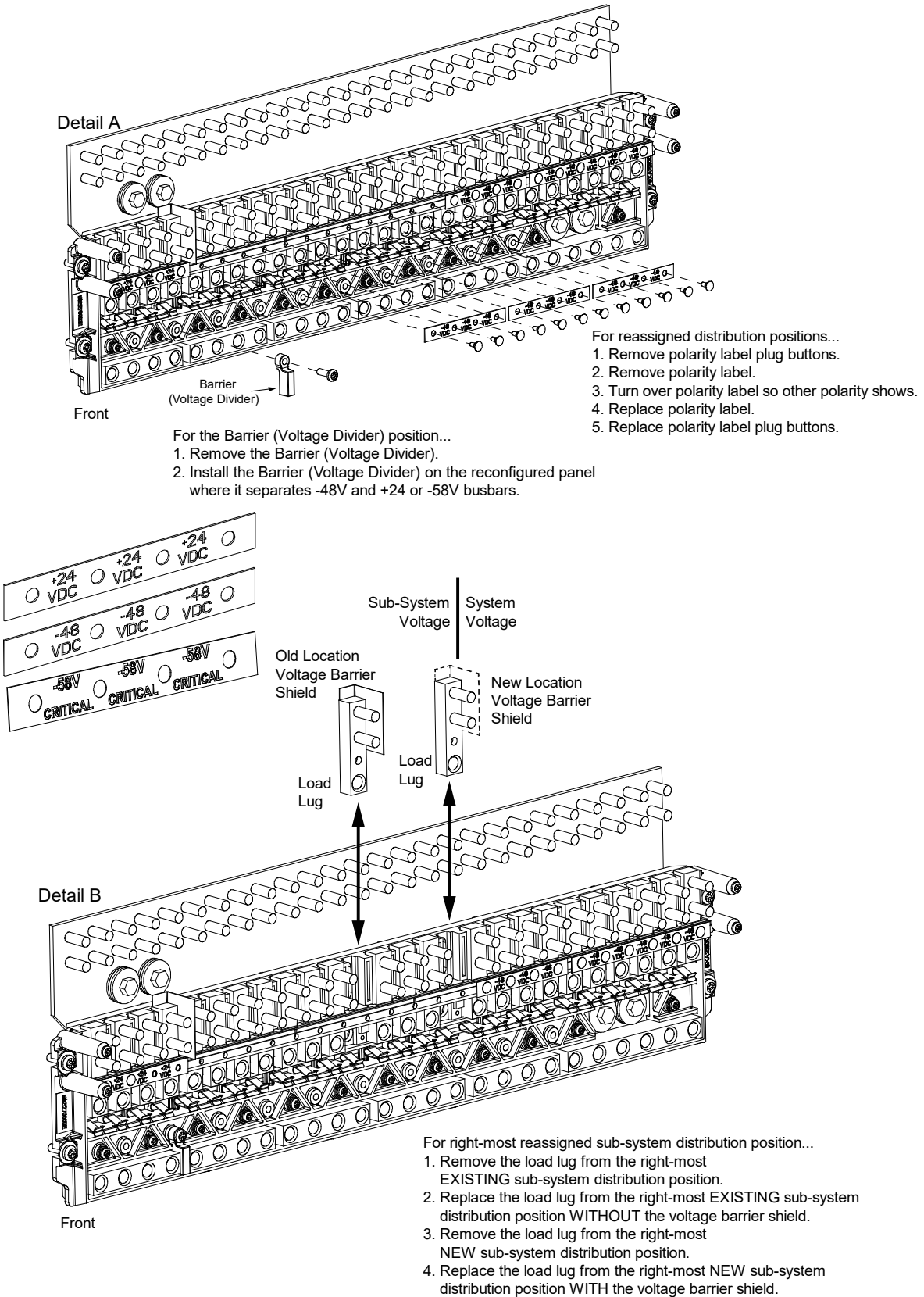
After Modification View:
The Alarm Strap is Moved Here

Before Modification View:
An Alarm Strap is Stored Here

Note that if you reconfigure a distribution panel
for all system voltage, you must disconnect and
insulate the subsystem CBA/FA lead attached
here.

Note that if you reconfigure a distribution panel
for all subsystem voltage (List DK or FK), you
must disconnect and insulate the system
CBA/FA lead attached here.

Figure 4.17 Reworking the Distribution Panel (cont'd from previous page)



Replacing 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.

Procedure



NOTE! If the panel is re-configured for all subsystem positions (List DK), the distribution cabinet's load side busbar must be removed since it is not to be connected to the distribution panel and will cause interference. Note that the busbar that is removed should be retained in the event that the panel is re-configured at a later date to revert back to a panel with some subsystem positions.

1. If the panel is re-configured for all subsystem positions, remove the distribution cabinet's load side busbar. Save this busbar and hardware for future use.
2. Orient the distribution panel into the distribution cabinet, checking to ensure no wires are pinched. Replace the hardware securing the distribution panel to the distribution cabinet. Refer to Figure 4.16 for hardware build-up. Torque as indicated in Figure 4.16.
3. Reconnect the +24V or -58V jumper leads. Refer to Figure 4.16 for hardware build-up. Torque as indicated in Figure 4.16. **For a panel re-configured to all -48V positions, the +24V or -58V jumper leads MUST not be used. They should be retained at the site for future use if necessary.**
4. In all except panels re-configured for all subsystem positions (List DK or FK), replace the hardware securing the distribution panel's system load distribution busbar to the distribution cabinet's busbar. Refer to Figure 4.16 for hardware build-up. Torque as indicated in Figure 4.16.
5. Replace the hardware securing the distribution panel's ground busbar to the distribution cabinet's busbar. Torque as indicated in Figure 4.16.
6. Plug the in-line FA/CBA connector located near the back of the distribution panel into the mating connector half in the distribution cabinet. Refer to Figure 4.16.



WARNING! In the next step, observe correct polarity; otherwise equipment damage will result.

7. Reconnect the load return leads to the ground busbar.
8. Reconnect the load leads to the circuit breaker and/or fuse positions.
9. Replace the circuit breakers and/or fuseholders.
10. Replace the plastic shield covering the circuit breakers and/or fuseholders on the distribution panel.
11. Verify no circuit breaker/fuse alarms are active.
12. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.
13. Ensure that there are no local or remote alarms active on the system.

4.10 Changing the Controller's LVD Control Level for a Contactor

The controller has two available LVD control levels (LVD1 and LVD2). The level used to control a contactor is determined by which connector on the LVD circuit card its control leads are plugged into. To change the LVD control level for a contactor, simply switch which LVD connector it is plugged into (if an open connector is available) on the LVD circuit card. Refer to Figure 5.20 and Figure 5.21 for connector location and function.



NOTE! DO NOT change a Low Voltage Load Disconnect contactor to LVD Control Level 2 (LVD2) if the system is furnished with a Low Voltage Battery Disconnect contactor.

4.11 Adding a Supplemental Bay in the Field

Refer to the Power System Installation Instructions (IM582127000) for procedures detailing mounting and wiring of the supplemental bay.

Supplied with the supplemental bay is a USB drive which contains the product documentation along with a document file that provides a listing of the SM-DU and optional SM-DU+ settings required for that particular supplemental bay. See Table 4.3 and Table 4.4 for samples of the information provided in the file. Refer to this document file (chart) and program the SM-DU and optional (if furnished) SM-DU+ settings in the controller with the specific values listed in the chart. Refer to the NCU Instructions (UM1M830BNA) for programming details. There are also labels located near the SM-DU and SM-DU+ in the supplemental bay that detail the controller's settings for this bay.

The controller must be rebooted after connection of the supplemental bay to configure the SMDU and SMDU+ (if equipped) in the supplemental bay into the controller.

Reboot the Controller

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

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

Once the controller has been programmed for the newly installed supplemental bay, refer to the NCU Instructions (UM1M830BNA) and save a copy of the "SettingParam.tar" file.

Table 4.3 Sample Supplemental Bay SM-DU Programmable Parameter Chart

Device	Parameter	Factory Setting	Setting for this Bay
SM-DU Shunt 1 Load	Full Scale Current (A)	2500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU Shunt 2 Battery	Full Scale Current (A)	2500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU LVD	LVD1	Enabled	Refer to USB Drive
	LVD2	Enabled	Refer to USB Drive

Table 4.4 Sample Supplemental Bay Optional SM-DU+ Programmable Parameter Chart (cont'd on next page)

Device	Parameter	Factory Setting	Setting for this Bay
SM-DU+ Shunt 1	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 2	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 3	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 4	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 5	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 6	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 7	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 8	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 9	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 10	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 11	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 12	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 13	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 14	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 15	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive

Table 4.4 Sample Supplemental Bay Optional SM-DU+ Programmable Parameter Chart (cont'd from previous page)

Device	Parameter	Factory Setting	Setting for this Bay
SM-DU+ Shunt 16	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 17	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 18	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 19	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 20	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 21	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 22	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 23	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 24	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive
SM-DU+ Shunt 25	Full Scale Current (A)	500	Refer to USB Drive
	Full Scale Voltage (mV)	25	Refer to USB Drive

4.12 Installing Optional Second IB2 (Controller Interface Board) or Optional Second EIB (Controller Extended Interface Board)

Refer to the procedure in the Installation Manual (IM582127000).

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, Converters, and Optional Inverters

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

- NCU Controller Instructions (UM1M830BNA)
- Rectifier Instructions (UM1R483500e or UM1R482000e3 or UM1R483500e3)
- -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 and Rectifier Instructions are designed to isolate failure to a specific element. Once the faulty element has been identified, refer to “Replacement Information” on page 58 and “

Replacement Procedures” on page 59.

Troubleshooting Alarm Conditions on the Controller

The controller displays alarm conditions as listed in the “Available Alarms” or “Resolving Alarms” section of the controller’s User Manual. Programmable external alarm relays are also available. Refer to the System Installation Instructions (IM582127000) 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 Module or Converter Module

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

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

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

When setting total rectifier or total converter current limit, the set point to each unit is the total set point divided by the number of units. For example, if the system contains five 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 converters are removed or fail it will take several seconds for the individual set points to the remaining rectifiers or 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 converters should not be set such that the loss of the redundant rectifiers or 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 Converter Communications Fail Alarm after Removing a Converter

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

Refer to the NCU 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 Converter Lost Alarm

If the controller resets while a 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, converter module, controller, or system circuit card; that particular device or circuit card should be replaced in its entirety. No attempt should be made to troubleshoot or repair individual components

on any rectifier module, converter module, Inverter module, controller, or circuit card. Refer to SAG582127000 (System Application Guide) for replacement part numbers.

Replacement Cables

Refer to SAG582127000 (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 Module (in a Spec. No. 588705000 Module Mounting Assembly)

Refer to the Rectifier Instructions (UM1R483500e) for a rectifier module replacement procedure. Refer also to “System Troubleshooting Information” on page 57.

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

5.6.2 Replacing a Rectifier or Converter Module (in a Spec. No. 588705300 Module Mounting Assembly)

Refer to the Rectifier User Instructions (UM1R482000e3), -48 VDC to +24 VDC Converter User Instructions (UM1C48241500), or -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3) for a rectifier and converter module replacement procedure. Refer also to “System Troubleshooting Information” on page 57.

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

5.6.3 Replacing a Rectifier Module (in a Spec. No. 588705400 Module Mounting Assembly)

Refer to the Rectifier User Instructions (UM1R483500e3) for a rectifier module replacement procedure. Refer also to “System Troubleshooting Information” on page 57.

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

5.6.4 Replacing a Rectifier Module (in a Spec. No. 588705500 Module Mounting Assembly)

Refer to the Rectifier User Instructions (UM1R483500e) for a rectifier module replacement procedure. Refer also to “System Troubleshooting Information” on page 57.

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

5.6.5 Replacing an inverter module

Refer to the Inverter Instructions (UM1I1201000) for an inverter module replacement procedure. Refer also to “System Troubleshooting Information” on page 57.

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

5.6.6 Replacing the Controller

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

5.6.7 Replacing a Distribution Device

General

Replace distribution devices with the same type and rating. Refer to System Application Guide SAG582127000 for part numbers.

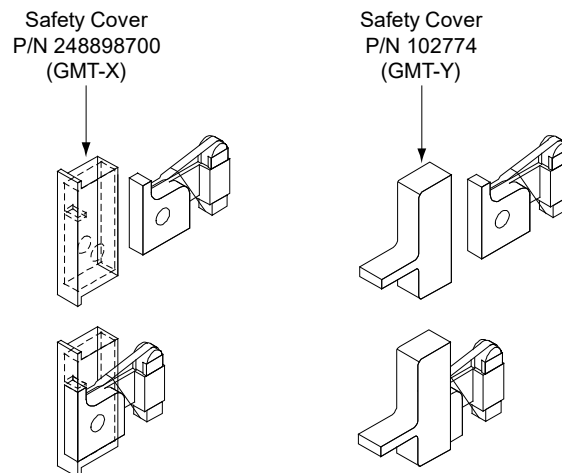
Distribution Fuse “Alarm Fuse” Replacement

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. Ensure 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. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the fuse carrier from the mounted fuseholder body by pulling it straight out.
3. Remove the open fuse from the fuse carrier and replace it with the same type and rating.
4. 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.

5. Push the fuse carrier securely back into the mounted fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
6. Verify no Fuse Alarms are active.
7. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Replacing a Bullet Nose Fuseholder

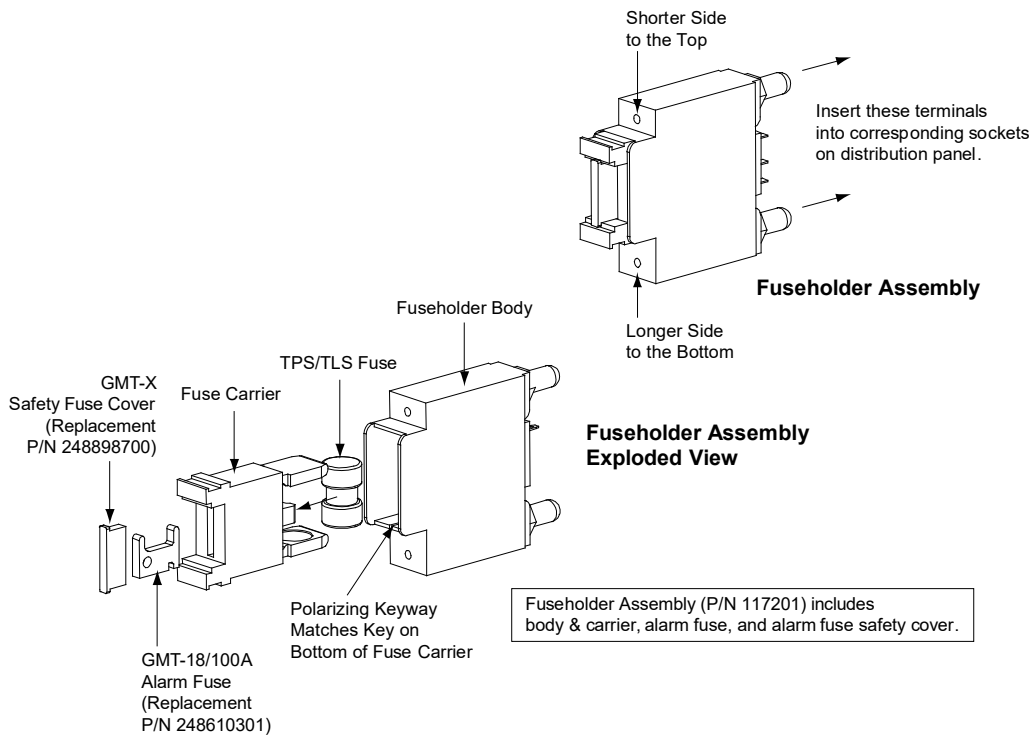
Procedure



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

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the fuse carrier from the mounted fuseholder body by pulling it straight out. Hold the fuseholder body while you pull the fuse carrier from the body.
3. Gently rock the defective fuseholder up and down while pulling firmly outward until the fuseholder is free from the distribution panel.
4. Orient the fuseholder as shown in Figure 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.
5. Push the fuse carrier securely back into the mounted fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
6. Verify no Fuse Alarms are active.
7. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

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



Replacing a Bullet Nose Circuit Breaker

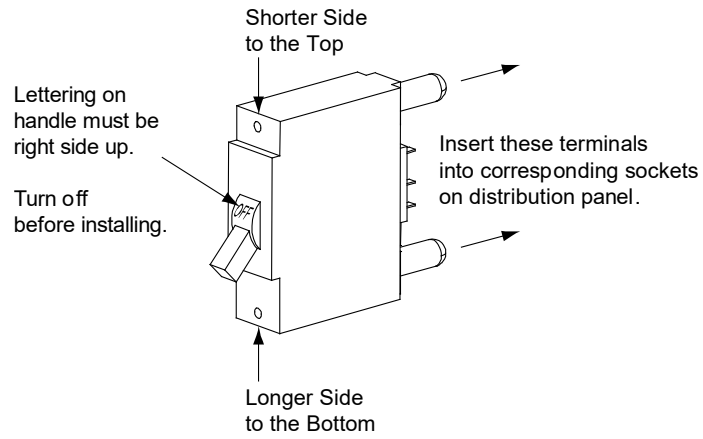
Procedure



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

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Operate the defective circuit breaker to the OFF position.
3. Gently rock the defective circuit breaker up and down while pulling firmly outward until the breaker is free from the distribution panel.
4. Ensure that the circuit breaker is in the OFF position, and is of the correct rating.
5. Orient the circuit breaker as shown in Figure 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.
6. Operate the replacement circuit breaker to the ON position.
7. Verify no Circuit Breaker Alarms are active.
8. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.3 Replacing a Bullet Nose Circuit Breaker



Replacing a TPH Fuse

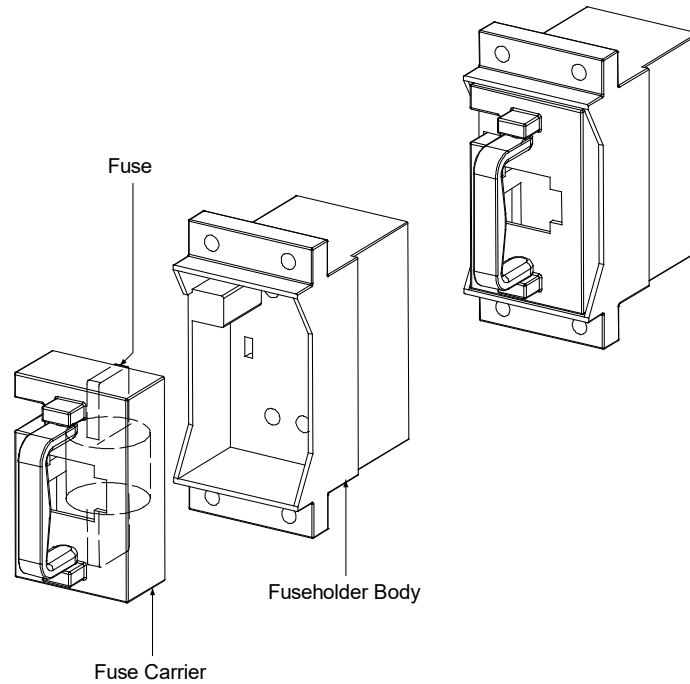
Procedure



NOTE! Refer to Figure 5.4 as this procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the fuse carrier from the mounted fuseholder body by grasping its handle and pulling straight out.
3. Remove the open fuse from the fuse carrier and replace it with the same type and rating.
4. Push the fuse carrier securely back into the mounted fuseholder body.
5. On the distribution panel, locate the open alarm fuse associated with the TPH fuse being replaced. Replace the alarm fuse with the same type and rating. Ensure that a plastic safety cover is installed on the alarm fuse.
6. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.4 Replacing a TPH Fuse



Replacing a TPL-B Fuse

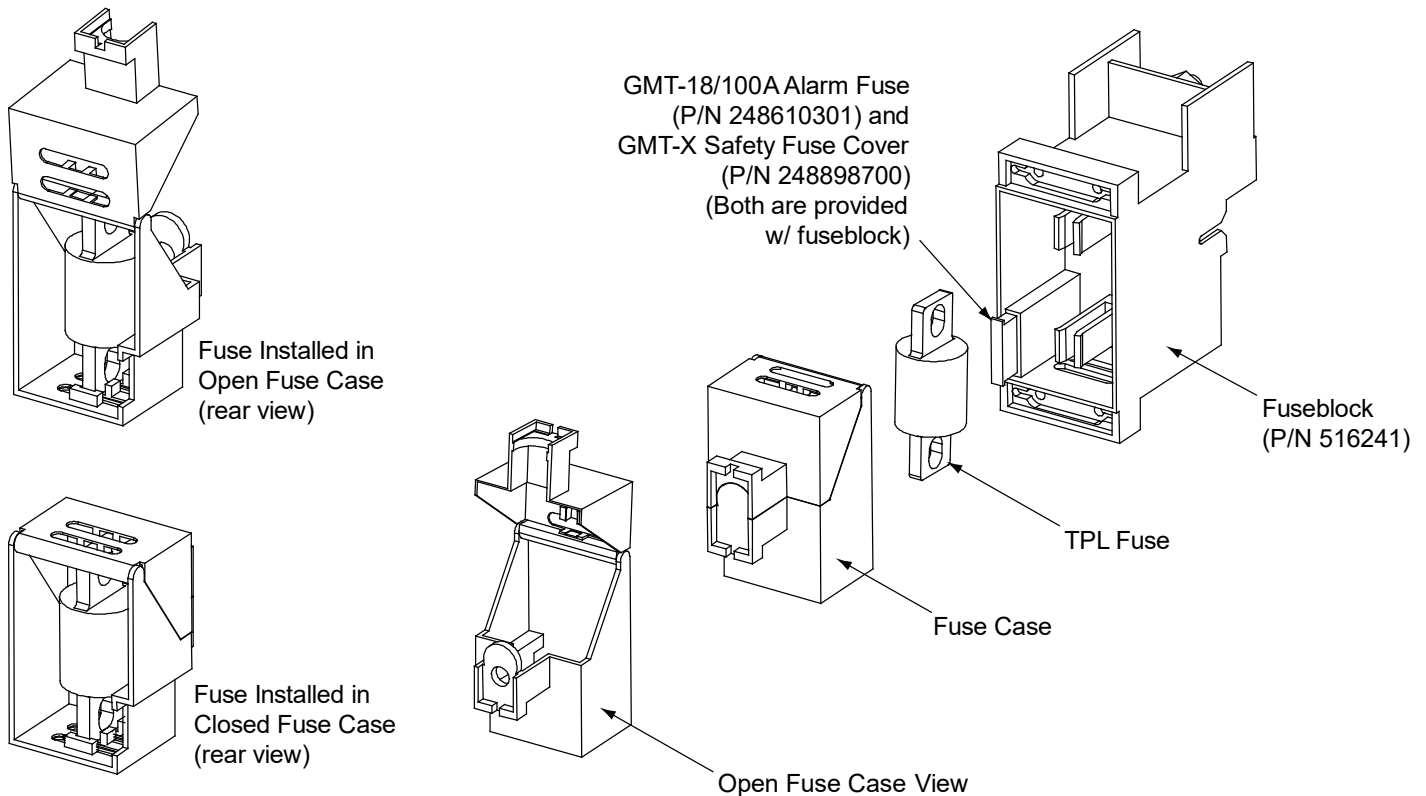
Procedure



NOTE! Refer to Figure 5.5 as this procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the fuse case from the mounted fuse block by grasping its handle and pulling it straight out.
3. Open the fuse case.
4. Remove the open fuse from the fuse case and replace it with the same type and rating.
5. Close the fuse case.
6. Push the fuse case securely back into the mounted fuse block.
7. Replace the alarm fuse located in the front of the TPL-B fuse block. Replace only with a fuse of the same type and rating. Ensure that a plastic safety cover is installed on the alarm fuse.
8. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.5 Replacing a TPL-B Fuse



Replacing a GJ/218 Circuit Breaker

Procedure



NOTE! Refer to Figure 5.6 as this procedure is performed.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Operate the defective circuit breaker to the OFF position.



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

3. Remove the hardware securing the circuit breaker to the distribution panel and partially remove the circuit breaker.
4. Record each alarm wire located on the back of the circuit breaker (color and location on circuit breaker). Wiring diagrams are provided in Figure 5.6. Carefully disconnect the alarm wiring from the back of the circuit breaker, ensuring the exposed end does not contact any energized circuit.
5. **Shunted Breakers Only:** Record each shunt wire located on the back of the circuit breaker (color and location on circuit breaker). Wiring diagrams are provided in Figure 5.6. Carefully disconnect the shunt wiring from the back of the circuit breaker, ensuring the exposed end does not contact any energized circuit.
6. Ensure that the replacement circuit breaker is in the OFF position, and is of the correct rating and type (electrical trip/mechanical trip or electrical trip only). Orient the circuit breaker over its mounting location. Re-attach the alarm wiring and shunt wiring (if applicable) to the back of the circuit breaker as recorded above. Wiring diagrams are provided in Figure 5.6.

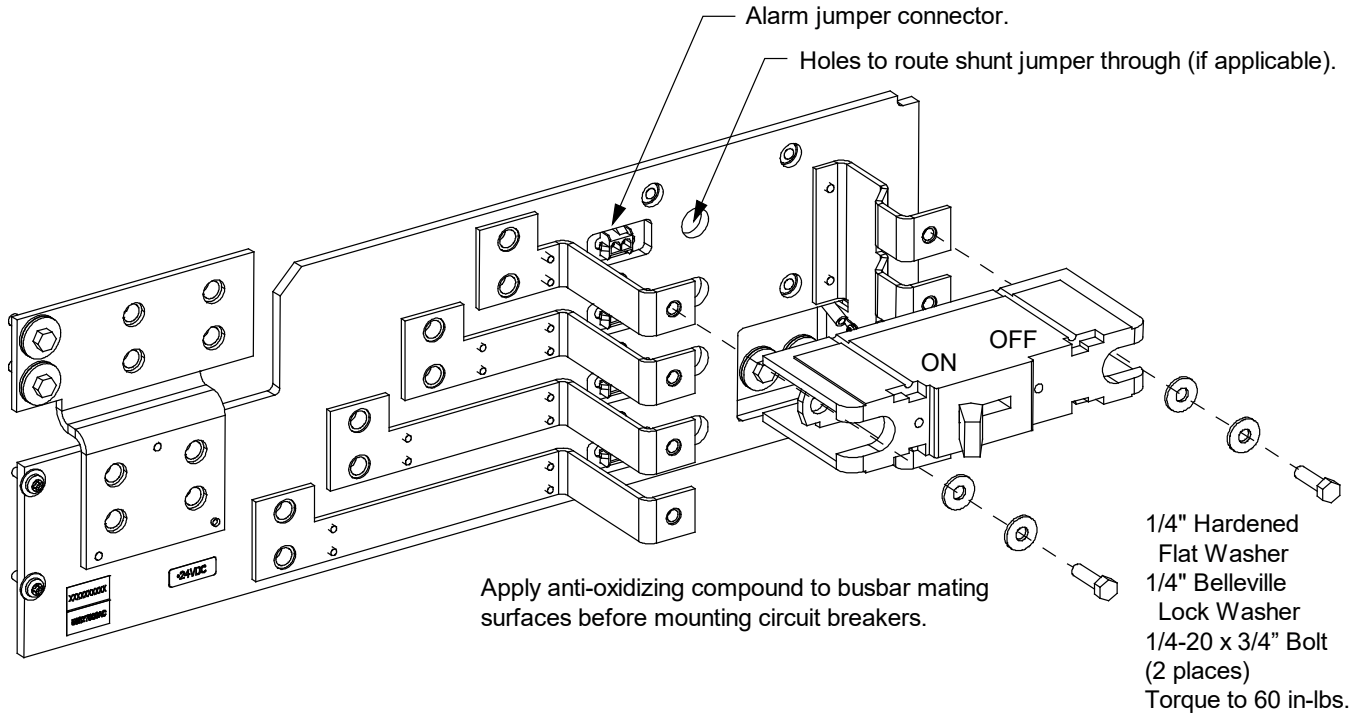


DANGER! The bolts being installed in the following step may be at system potential. Use insulated tools.

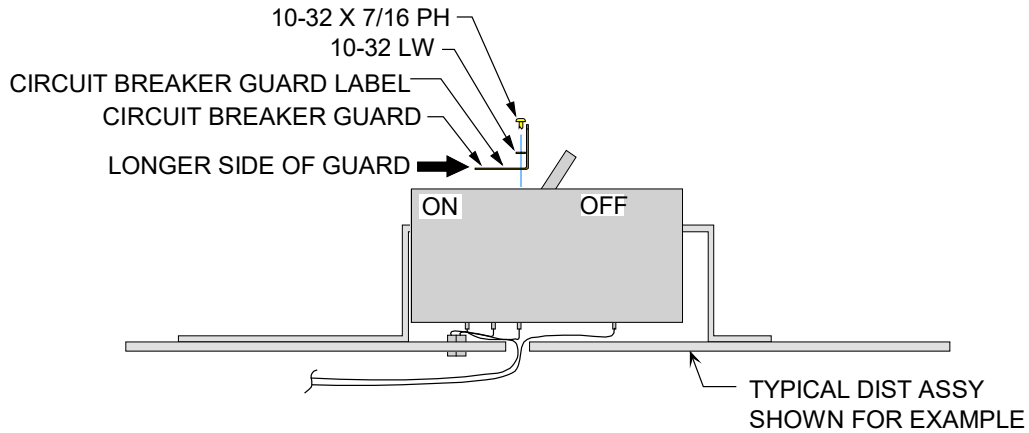
7. Install the replacement circuit breaker into its mounting position and secure with the hardware previously removed. Torque to 60 in-lbs.
8. Transfer the circuit breaker guard from the old circuit breaker to the new circuit breaker.
9. Operate the replacement circuit breaker to the ON position.
10. Verify no Circuit Breaker Alarms are active.
11. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.6 Replacing a GJ/218 Circuit Breaker (1-Pole) (Lists AC, AD, BC, BD) (cont'd on next page)

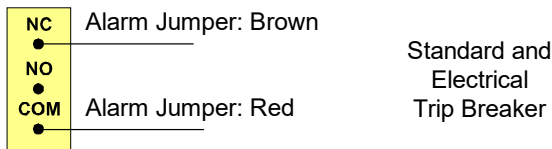
INSTALLING CIRCUIT BREAKER



INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS W/OUT SHUNTS)



ALARM WIRING (BREAKERS WITH SHUNTS)

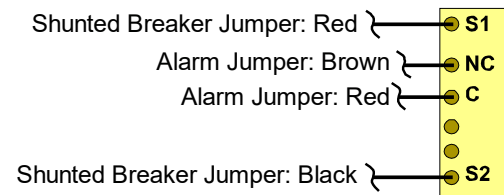
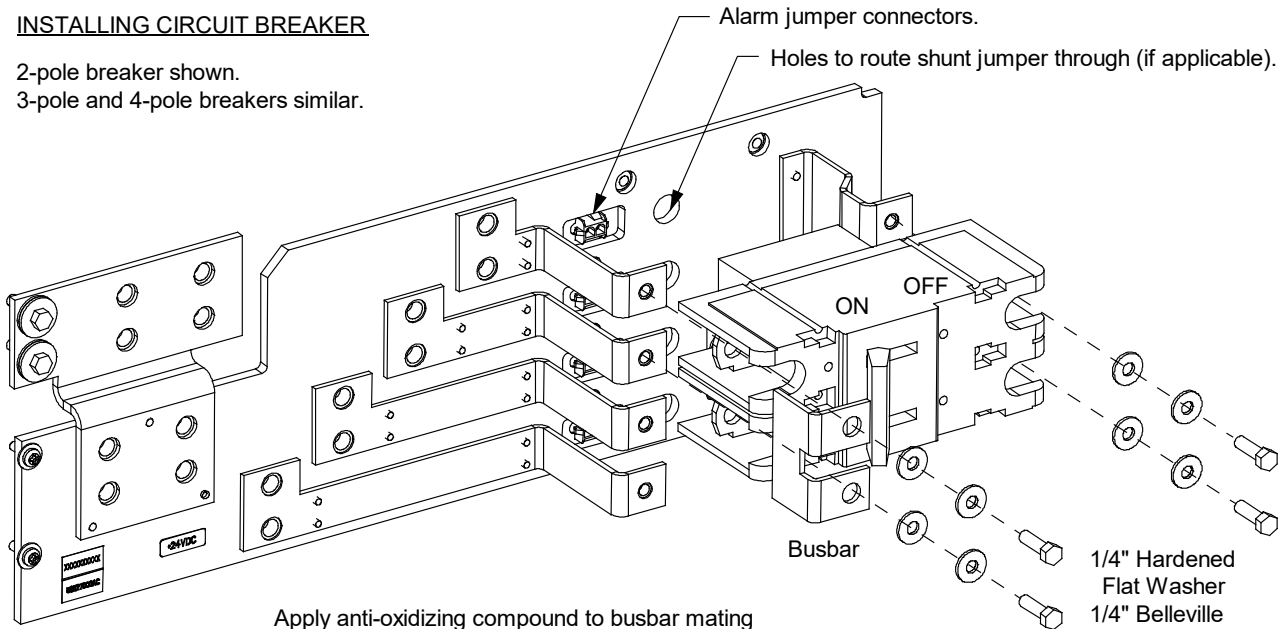


Figure 5.6 Replacing a GJ/218 Circuit Breaker (2-Pole, 3-Pole, 4-Pole) (Lists AC, AD, BC, BD) (cont'd from previous page, cont'd on next page)

INSTALLING CIRCUIT BREAKER

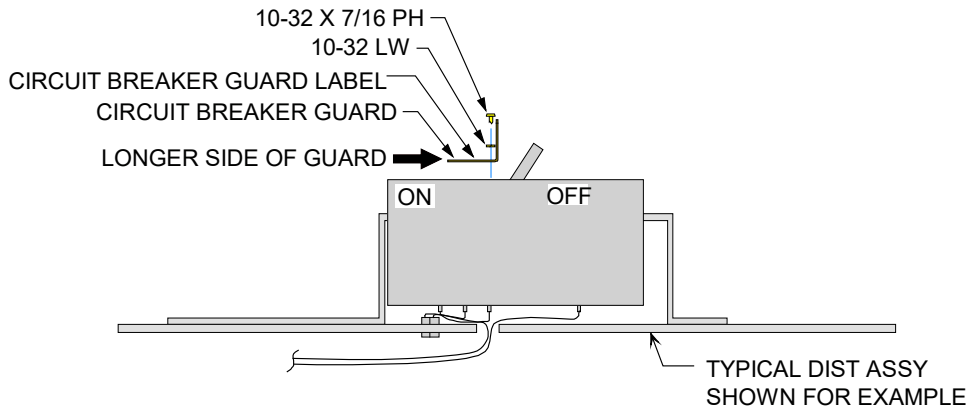
2-pole breaker shown.
3-pole and 4-pole breakers similar.



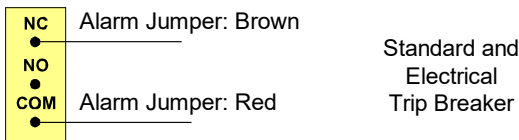
Apply anti-oxidizing compound to busbar mating surfaces before mounting circuit breakers.

- 1/4" Hardened Flat Washer
- 1/4" Belleville Lock Washer
- 1/4-20 x 3/4" Bolt
- (4 places / 2-pole brk, 6 places / 3-pole brk, 8 places / 4-pole brk)
- Torque to 60 in-lbs.

INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS W/OUT SHUNTS)



ALARM WIRING (BREAKERS WITH SHUNTS)

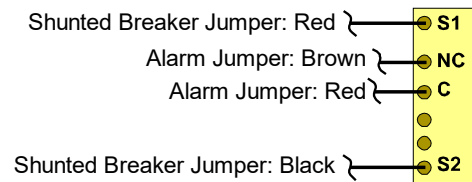
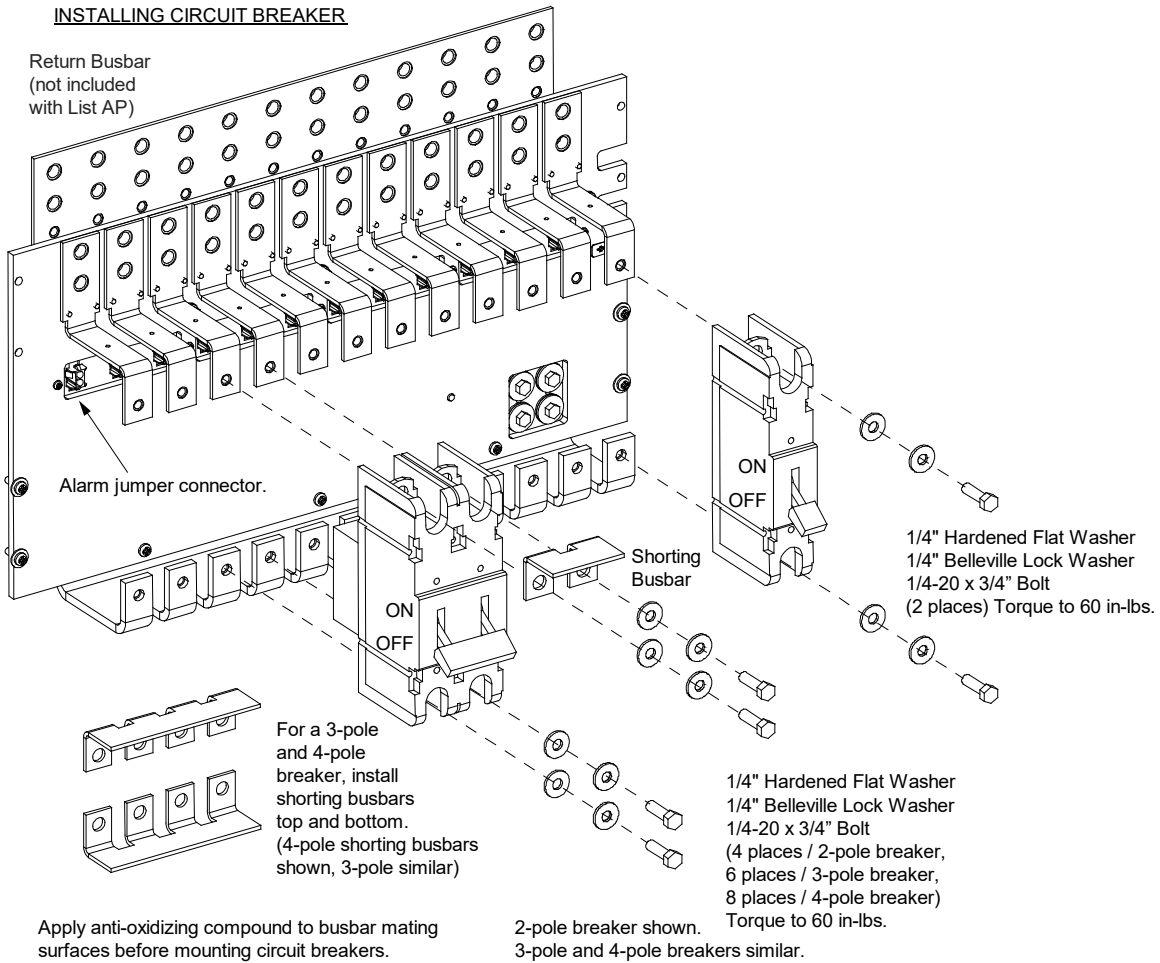
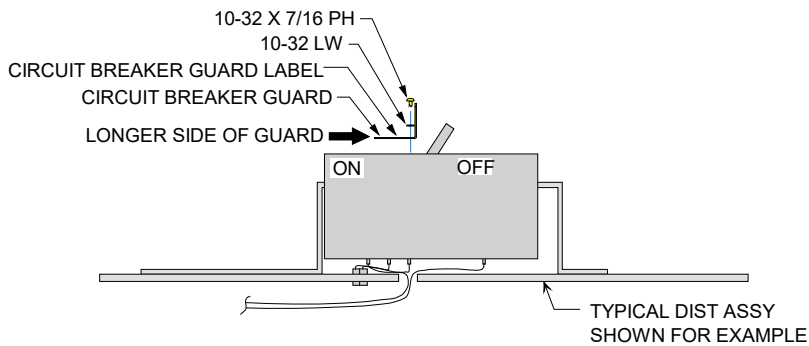


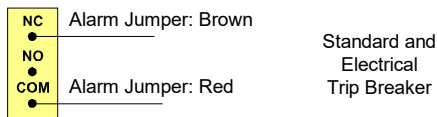
Figure 5.6 Replacing a GJ/218 Circuit Breaker (1-Pole, 2-Pole, 3-Pole, 4-Pole) (List AM and List AP) (cont'd from previous page)



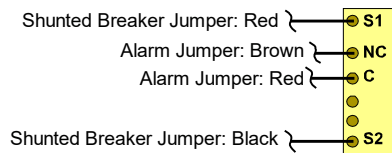
INSTALLING CIRCUIT BREAKER GUARD



ALARM WIRING (BREAKERS W/OUT SHUNTS)



ALARM WIRING (BREAKERS WITH SHUNTS)



5.6.8 Replacing a Distribution Panel (List AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, BA, BB, BC, BD, BF, and BH)



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.

Procedure



NOTE! List AC shown in illustration, other Lists similar.



NOTE! Refer to Figure 5.7 as this procedure is performed.

Removing the Distribution Panel

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the plastic shield covering the circuit breakers or fuseholders on the panel to be removed by loosening the screws holding the shield and sliding the shield upwards.
3. Disconnect and insulate all load or battery wiring from the circuit breaker or fuse positions.
4. On panels equipped with a ground busbar, remove all load return or battery return wiring from the ground busbar.
5. On panels equipped with shunts, label the shunt leads then remove them from the panel.
6. Locate the in-line FA/CBA connector located near the back of the panel, and separate the connector halves.
7. Refer to Figure 5.7 and remove the hardware securing the panel's Ground Busbar (if equipped) to the distribution cabinet's busbar.
8. **For load distribution panels**, refer to Figure 5.7 and remove the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar.
9. **For battery distribution panels**, refer to Figure 5.7 and remove the hardware securing the panel's Battery Busbar to the distribution cabinet's busbar.
10. **For dual voltage load distribution panels**, refer to Figure 5.7 and remove the hardware securing the +24V jumper leads.
11. Refer to Figure 5.7 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the panel from the distribution cabinet.

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 (10-32 x 5/8" bolt, #10 flat washer, 4-places).
2. **For dual voltage load distribution panels**, replace the hardware securing the +24V jumper leads (1/4-20 bolt, 1/4" lock washer, 1/4" flat washer. Torque to 84 in-lbs).
3. **For battery distribution panels**, replace the hardware securing the panel's Battery Busbar to the distribution cabinet's busbar (3/8-16 x 1-1/4" bolt, 3/8" Belleville lock washer, 3/8" hardened flat washer, 2-places. Torque to 180 in-lbs.)

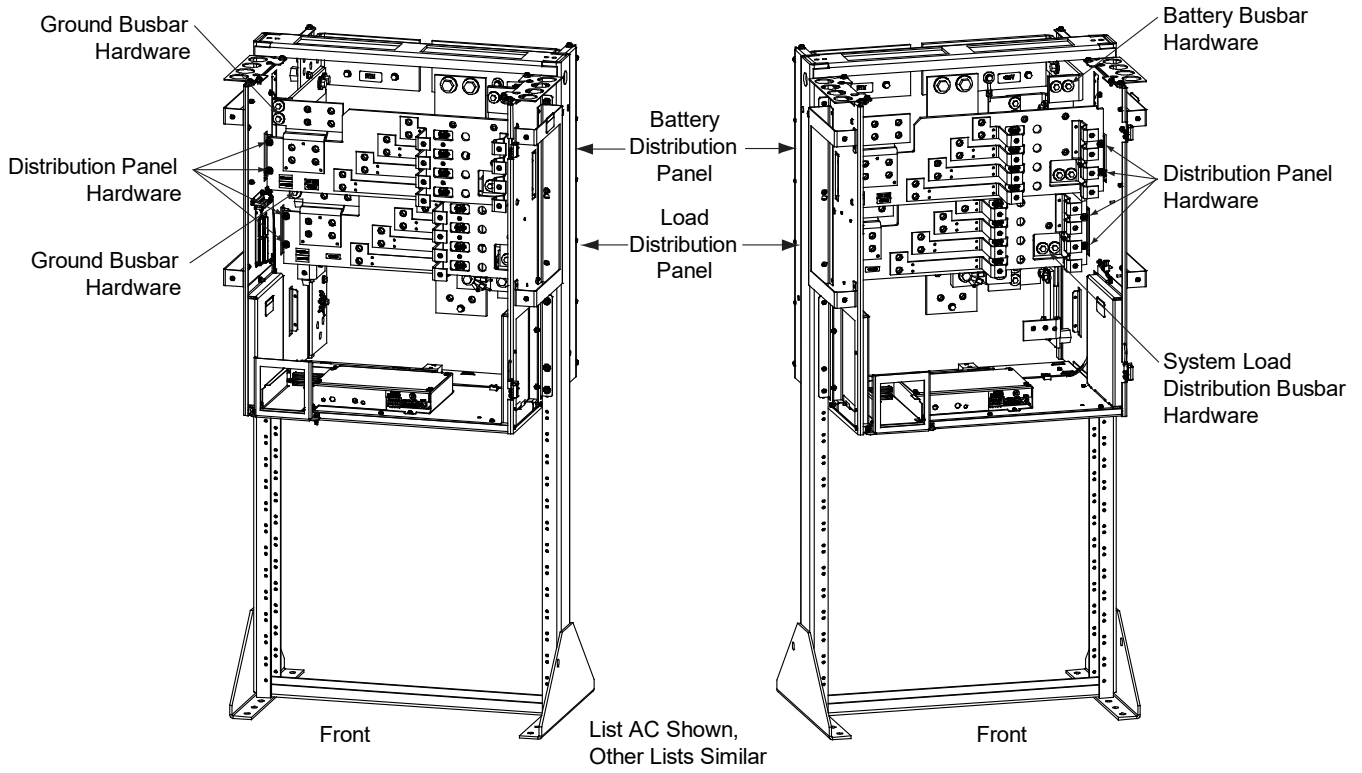
4. **For load distribution panels**, replace the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar (1/4-20 x 1" bolt, 1/4" Belleville lock washer, 1/4" Belleville lock washer (concave side of Belleville lock washers face each other), 1/4" hardened flat washer, 2-places. Torque to 60 in-lbs).
5. Replace the hardware securing the panel's Ground Busbar (if equipped) to the distribution cabinet's busbar (1/4-20 x 1" bolt, 1/4" Belleville lock washer, 1/4" Belleville lock washer (concave side of Belleville lock washers face each other), 1/4" hardened flat washer, 2-places. Torque to 60 in-lbs).
6. Locate the in-line FA/CBA connector located near the back of the panel, and plug it into the mating connector half in the distribution cabinet.
7. On panels equipped with shunts, reconnect the shunt leads.



WARNING! In the next step, observe correct polarity; otherwise equipment damage will result.

8. On panels equipped with a ground busbar, reconnect the load return or battery return wiring to the ground busbar.
9. Reconnect the load or battery wiring to the circuit breaker or fuse positions.
10. Transfer the plug-in circuit breakers or fuses from the old panel to the replacement panel.
11. Replace the plastic shield covering the circuit breakers or fuseholders on the replacement panel.
12. Verify no Circuit Breaker/Fuse Alarms are active.
13. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.7 Replacing a Distribution Panel (List AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, BA, BB, BC, BD, BF, and BH)



Components removed in illustrations for clarity only.

5.6.9 Replacing a Distribution Panel (List AL, AN, DE, DF, DG, DH, DJ, DK, FE, FF, FG, FH, FJ, FK)



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.

Procedure



NOTE! Refer to Figure 5.8 as this procedure is performed.

Removing the Distribution Panel

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the plastic shield covering the circuit breakers or fuseholders on the panel to be removed by loosening the screws holding the shield and sliding the shield upwards.
3. Disconnect and insulate all load wiring from the circuit breaker or fuse positions.
4. Remove all load return wiring from the ground busbar (if present).
5. Locate the in-line FA/CBA connector located near the back of the panel, and separate the connector halves.
6. Refer to Figure 5.8 and remove the hardware securing the panel's ground busbar (if present) to the distribution cabinet's busbar.
7. Refer to Figure 5.8 and remove the hardware securing the panel's system load distribution busbar to the distribution cabinet's busbar.
8. **For dual voltage load distribution panels**, refer to Figure 5.8 and remove the hardware securing the +24V or -58V jumper leads.
9. Refer to Figure 5.8 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the panel from the distribution cabinet.

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.

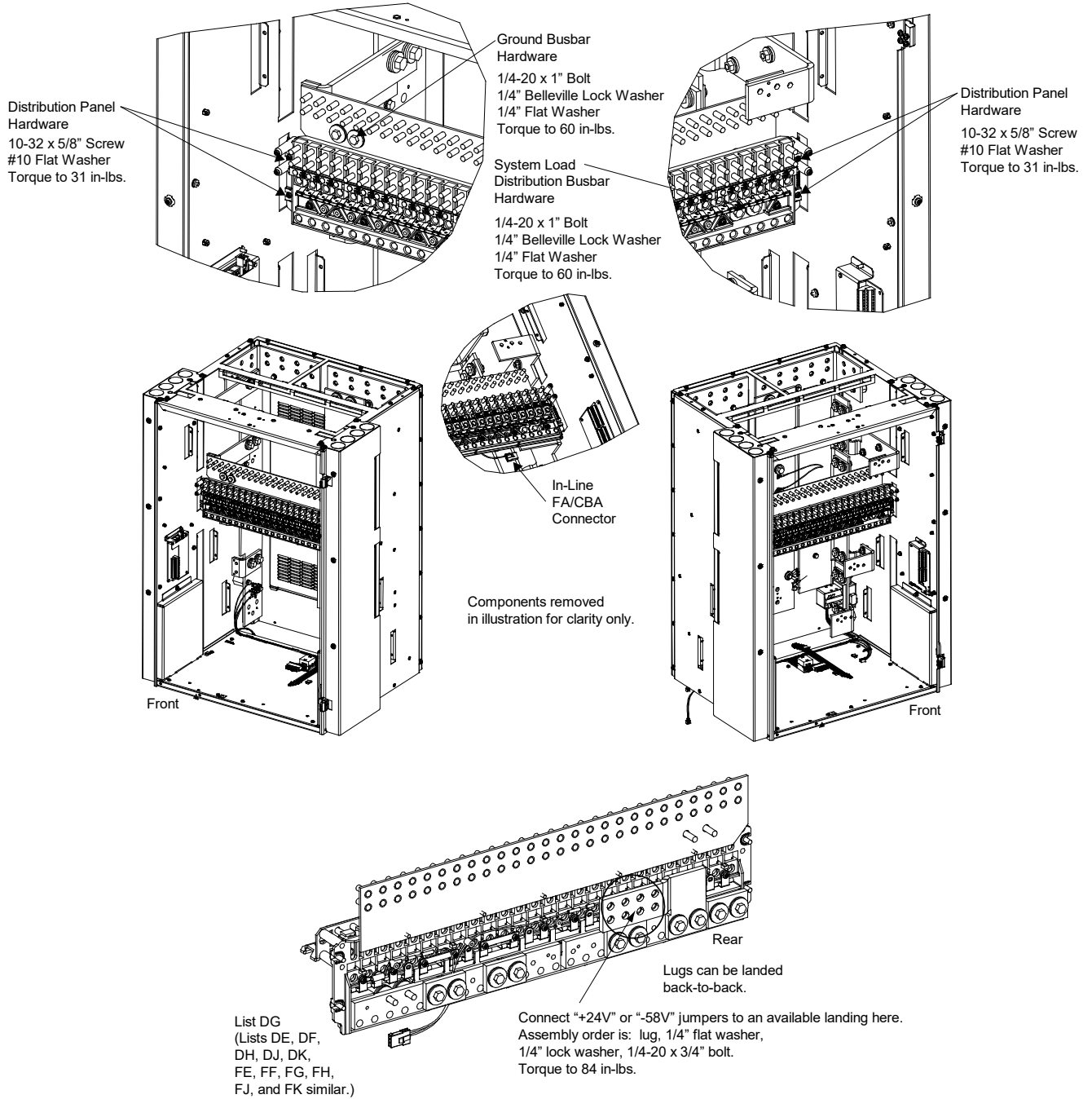
1. Orient the replacement distribution panel into distribution cabinet, checking to ensure no wires are pinched. Replace the hardware securing the distribution panel to the distribution cabinet. Torque per Figure 5.8.
2. **For dual voltage load distribution panels**, replace the hardware securing the +24V or -58V jumper leads. Torque per Figure 5.8.
3. Replace the hardware securing the panel's system load distribution busbar to the distribution cabinet's busbar. Torque per Figure 5.8.
4. Replace the hardware securing the panel's ground busbar (if present) to the distribution cabinet's busbar. Torque per Figure 5.8.
5. Locate the in-line FA/CBA connector located near the back of the panel, and plug it into the mating connector half in the distribution cabinet.



WARNING! In the next step, observe correct polarity; otherwise equipment damage will result.

6. Reconnect the load return wiring to the ground busbar (if present).
7. Reconnect the load wiring to the circuit breaker or fuse positions.
8. Transfer the plug-in circuit breakers or fuses from the old panel to the replacement panel.
9. Replace the plastic shield covering the circuit breakers or fuseholders on the replacement panel.
10. Verify no circuit breaker/fuse alarms are active.
11. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.8 Replacing a Distribution Panel (List AL, AN, DE, DF, DG, DH, DJ, DK, FE, FF, FG, FH, FJ, FK)



5.6.10 Replacing a Distribution Panel List AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, DA, DB, DC, DD, BA, BB, BC, BD, BE, BF, BG, or BH with a List AL, AN, DE, DF, DG, DH, DJ, or DK, FE, FF, FG, FH, FK



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.

Procedure

Removing the Existing Distribution Panel



NOTE! Refer to Figure 5.9.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the plastic shield covering the circuit breakers or fuseholders on the panel to be removed by loosening the screws holding the shield and sliding the shield upwards.
3. Disconnect and insulate all load or battery wiring from the circuit breaker or fuse positions.
4. On panels equipped with a ground busbar, remove all load return or battery return wiring from the ground busbar.
5. On panels equipped with shunts, label the shunt leads then remove them from the panel.
6. Locate the in-line FA/CBA connector located near the back of the panel, and separate the connector halves.
7. Refer to Figure 5.9 and remove the hardware securing the panel's Ground Busbar (if equipped) to the distribution cabinet's busbar.
8. **For load distribution panels**, refer to Figure 5.9 and remove the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar.
9. **For battery distribution panels**, refer to Figure 5.9 and remove the hardware securing the panel's Battery Busbar to the distribution cabinet's busbar.
10. **For dual voltage load distribution panels**, refer to Figure 5.9 and remove the hardware securing the +24V jumper leads.
11. Refer to Figure 5.9 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the panel from the distribution cabinet.

Replacing the Busbar



NOTE! Refer to Figure 5.10.



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. Perform the procedure in Figure 5.10.

Installing the New Distribution Panel



NOTE! Refer to Figure 5.11.



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. Remove the plastic shield covering the circuit breakers or fuseholders on the replacement panel by loosening the screws holding the shield and sliding the shield upwards.
2. **For dual voltage load distribution panels**, orient the replacement distribution panel into distribution cabinet. Secure the +24V jumper leads to the rear of the panel as shown in Figure 5.11. Torque per Figure 5.11.
3. Secure the replacement distribution panel to the distribution cabinet, ensuring no wires are pinched. Torque per Figure 5.11.
4. Replace the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar. Torque per Figure 5.11.
5. Replace the hardware securing the panel's Ground Busbar to the distribution cabinet's busbar. Torque per Figure 5.11.
6. Locate the in-line FA/CBA connector located near the back of the panel, and plug it into the mating connector half in the distribution cabinet.



WARNING! In the next step, observe correct polarity; otherwise equipment damage will result.

7. Refer to IM582127000 and connect load leads to the replacement panel.
8. Ensure appropriately sized circuit breakers or fuses are installed in the replacement panel.
9. Replace the plastic shield covering the circuit breakers or fuseholders on the replacement panel.
10. Verify no Circuit Breaker/Fuse Alarms are active.
11. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.9 Removing the Existing Distribution Panel

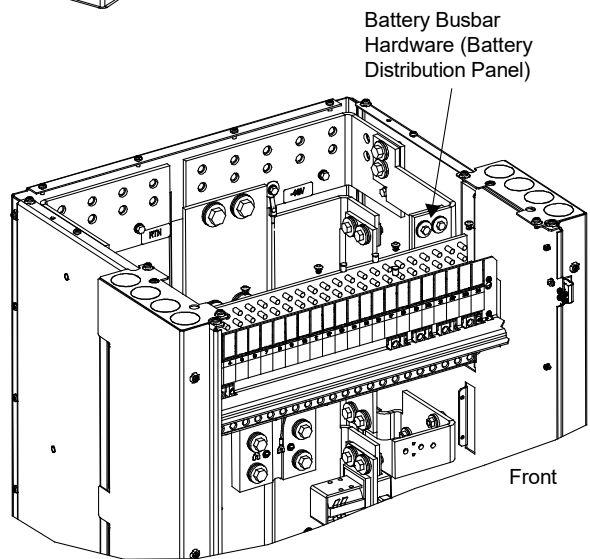
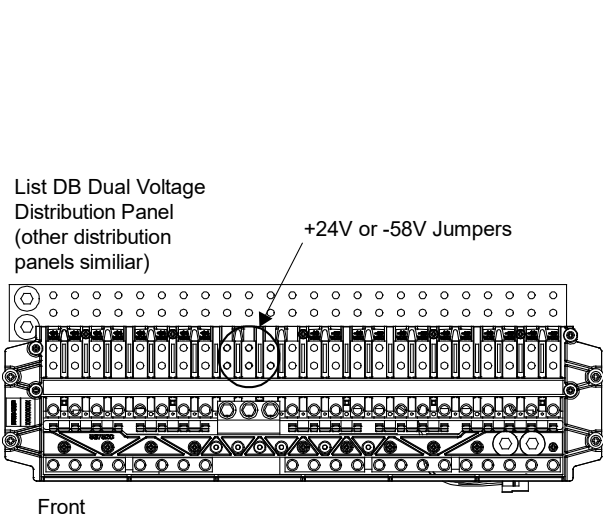
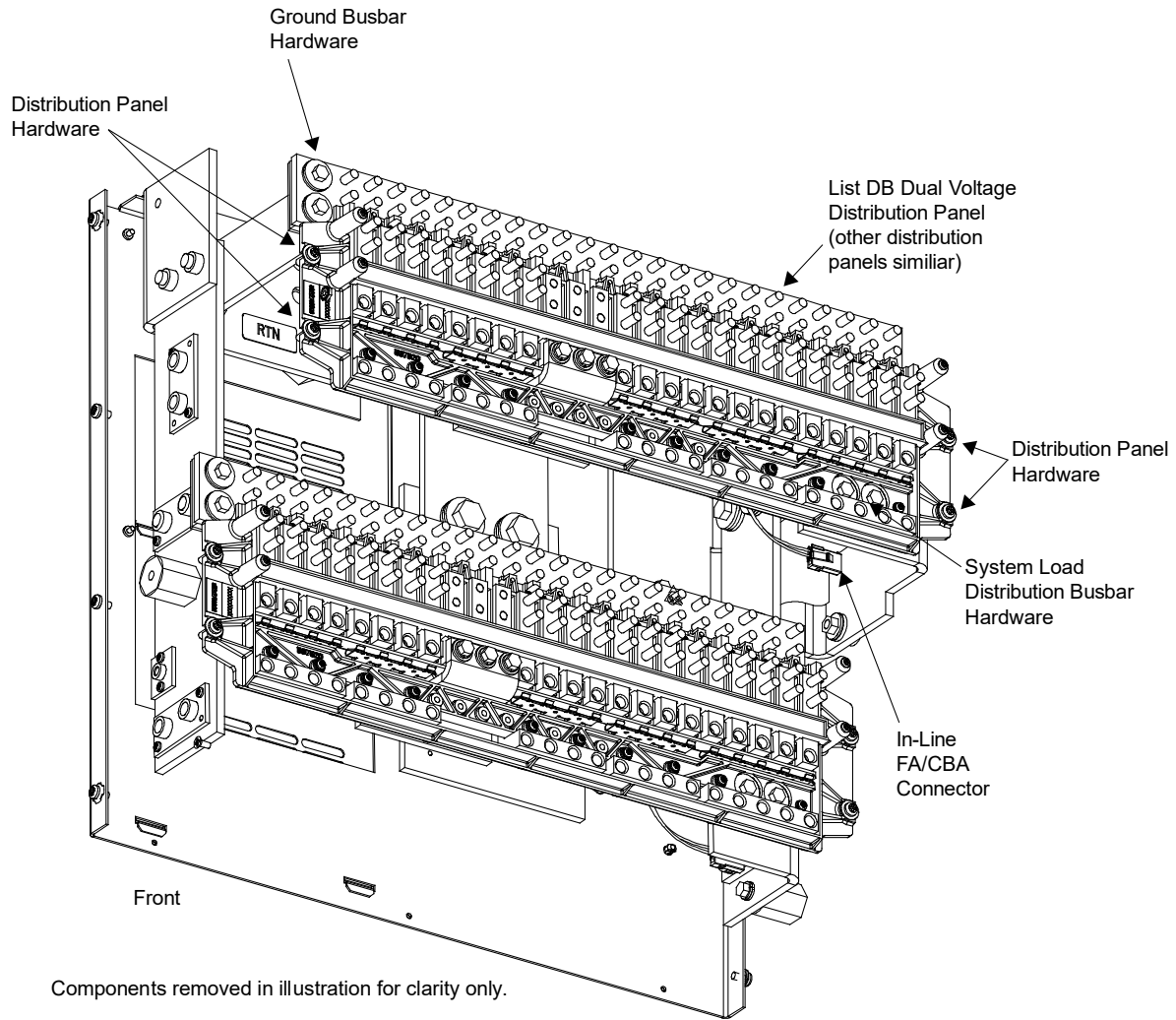
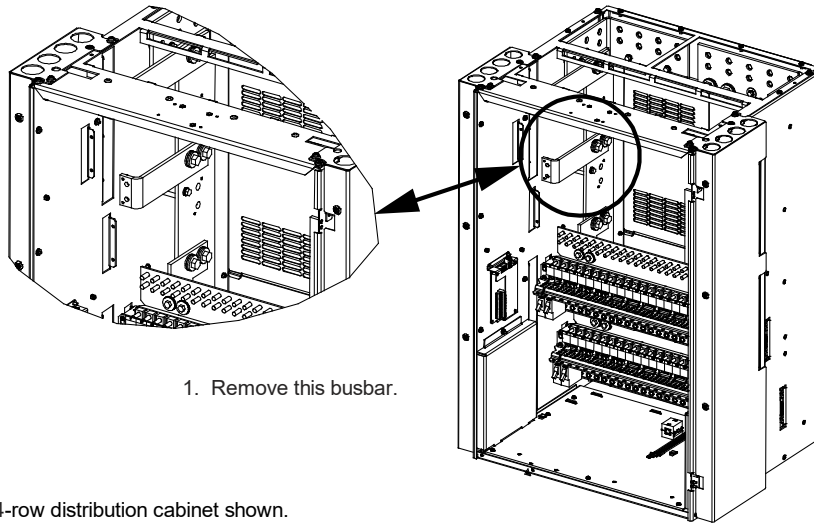


Figure 5.10 Replacing the Busbar



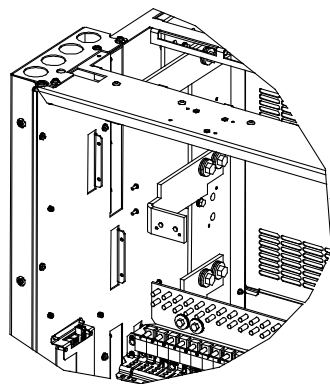
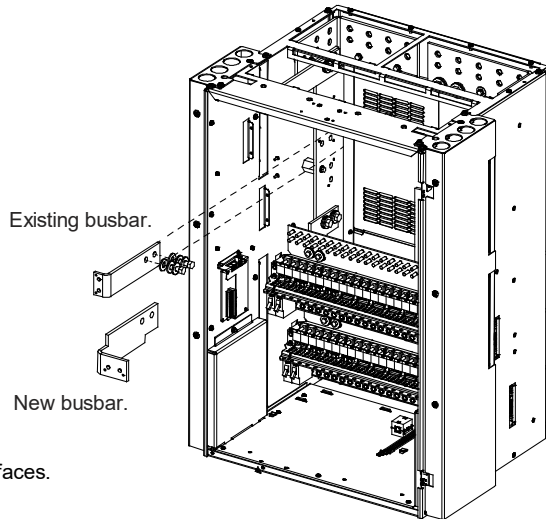
1. Remove this busbar.

4-row distribution cabinet shown.
1, 2, or 3-row cabinet similar.

2. Replace with new busbar.
See SAG582127000 for part number.

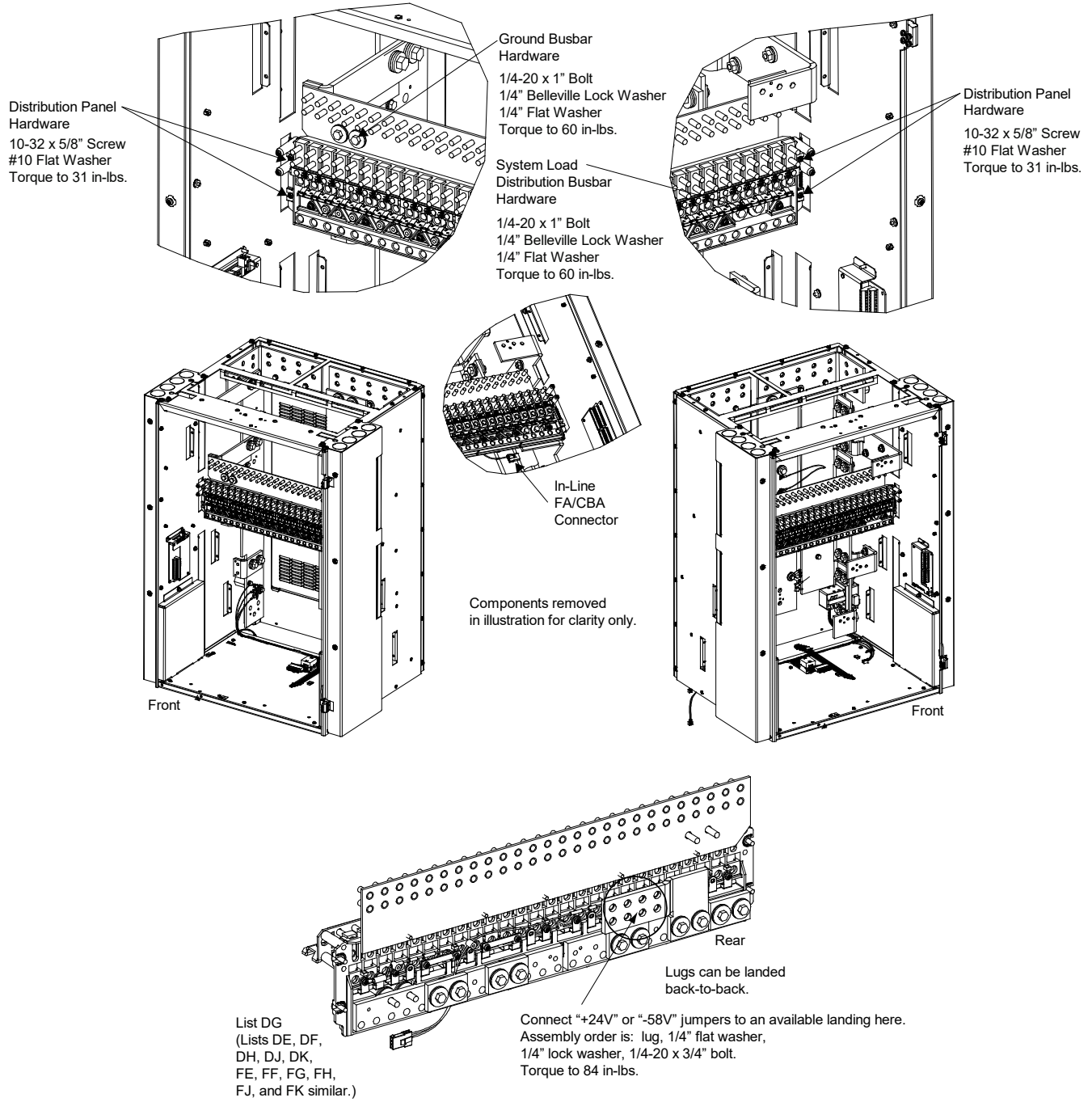
- 3/8-16 x 1-1/4" Bolt
- 3/8" Belleville Lock Washer
- 3/8" Belleville Lock Washer (concave side of Belleville Lock Washers face each other)
- 3/8" Hardened Flat Washer (2 places)
- Torque to 180 in-lbs.

Apply electrical anti-oxidizing compound to busbar mating surfaces.



3. New busbar installed view.

Figure 5.11 Installing the New Distribution Panel



5.6.11 Replacing a Distribution Panel (List AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, DA, DB, DC, DD, BA, BB, BC, BD, BE, BF, BG, or BH with AM or AP)



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.

Procedure



NOTE! Refer to Figure 5.12 as this procedure is performed.

Removing the Distribution Panel



NOTE! Refer to Figure 5.9.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.
2. Remove the plastic shield covering the circuit breakers or fuseholders on the panel to be removed by loosening the screws holding the shield and sliding the shield upwards.
3. Disconnect and insulate all load or battery wiring from the circuit breaker or fuse positions.
4. On panels equipped with a ground busbar, remove all load return or battery return wiring from the ground busbar.
5. On panels equipped with shunts, label the shunt leads then remove them from the panel.
6. Locate the in-line FA/CBA connector located near the back of the panel, and separate the connector halves.
7. Refer to Figure 5.9 and remove the hardware securing the panel's Ground Busbar (if equipped) to the distribution cabinet's busbar.
8. **For load distribution panels**, refer to Figure 5.9 and remove the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar.
9. **For battery distribution panels**, refer to Figure 5.9 and remove the hardware securing the panel's Battery Busbar to the distribution cabinet's busbar.
10. **For dual voltage load distribution panels**, refer to Figure 5.9 and remove the hardware securing the +24V jumper leads.
11. Refer to Figure 5.9 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the panel from the distribution cabinet.

Replacing the Busbar



NOTE! Refer to Figure 5.12.

1. Perform the procedure in Figure 5.12.

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 (10-32 x 5/8" bolt, #10 flat washer, 4-places).

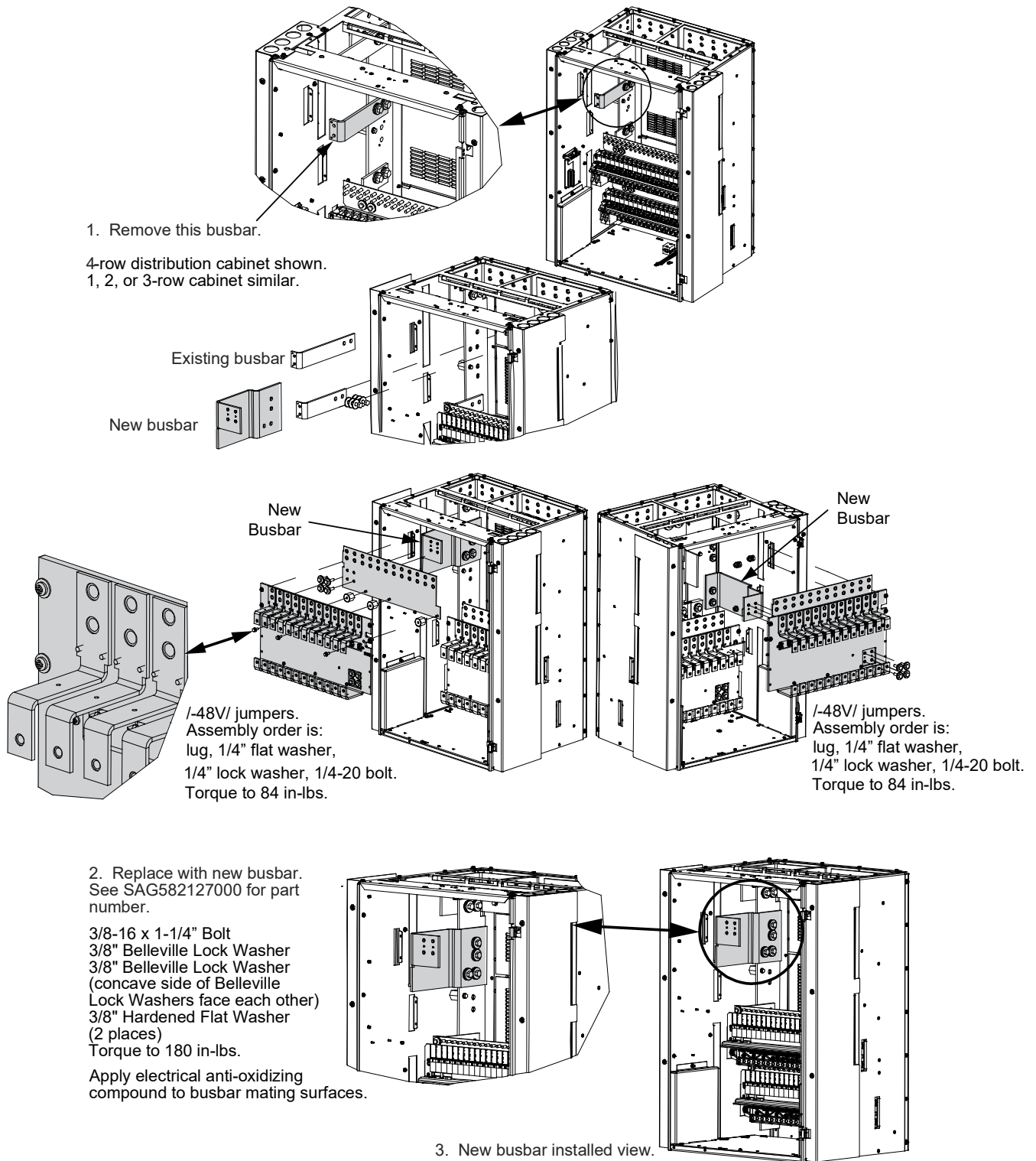
2. Replace the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar (1/4-20 x 1" bolt, 1/4" Belleville lock washer, 1/4" Belleville lock washer (concave side of Belleville lock washers face each other), 1/4" hardened flat washer, 4-places. Torque to 60 in-lbs).
3. Replace the hardware securing the panel's Ground Busbar (if equipped) to the distribution cabinet's busbar (1/4-20 x 1" bolt, 1/4" Belleville lock washer, 1/4" Belleville lock washer (concave side of Belleville lock washers face each other), 1/4" hardened flat washer, 4-places. Torque to 60 in-lbs).
4. Locate the in-line FA/CBA connector located near the back of the panel, and plug it into the mating connector half in the distribution cabinet.
5. On panels equipped with shunts, reconnect the shunt leads.



WARNING! In the next step, observe correct polarity; otherwise equipment damage will result.

6. On panels equipped with a ground busbar, reconnect the load return wiring to the ground busbar, if practical.
7. Reconnect the load wiring to the circuit breaker or fuse positions, if practical.
8. Transfer the circuit breakers from the old panel to the replacement panel.
9. Verify no Circuit Breaker/Fuse Alarms are active.
10. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.12 Replacing the Busbar



5.6.12 Replacing a Distribution Panel (List AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, DA, DB, DC, DD, BA, BB, BC, BD, BE, BF, BG, or BH with EA)



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.

Procedure



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

Removing the Distribution Panel



NOTE! Refer to Figure 5.9.

1. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack) or open the system's enclosure door.
2. Remove the plastic shield covering the circuit breakers or fuseholders on the panel to be removed by loosening the screws holding the shield and sliding the shield upwards.
3. Disconnect and insulate all load or battery wiring from the circuit breaker or fuse positions.
4. On panels equipped with a ground busbar, remove all load return or battery return wiring from the ground busbar.
5. On panels equipped with shunts, label the shunt leads then remove them from the panel.
6. Locate the in-line FA/CBA connector located near the back of the panel and separate the connector halves.
7. Refer to Figure 5.9 and remove the hardware securing the panel's Ground Busbar (if equipped) to the distribution cabinet's busbar.
8. **For load distribution panels**, refer to Figure 5.9 and remove the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar.
9. **For battery distribution panels**, refer to Figure 5.9 and remove the hardware securing the panel's Battery Busbar to the distribution cabinet's busbar.
10. **For dual voltage load distribution panels**, refer to Figure 5.9 and remove the hardware securing the -48V jumper leads.
11. Refer to Figure 5.9 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the panel from the distribution cabinet.

Replacing the Busbar



NOTE! Refer to Figure 5.13.

1. Perform the procedure in 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 (10-32 x 5/8" bolt, #10 flat washer, 4-places).

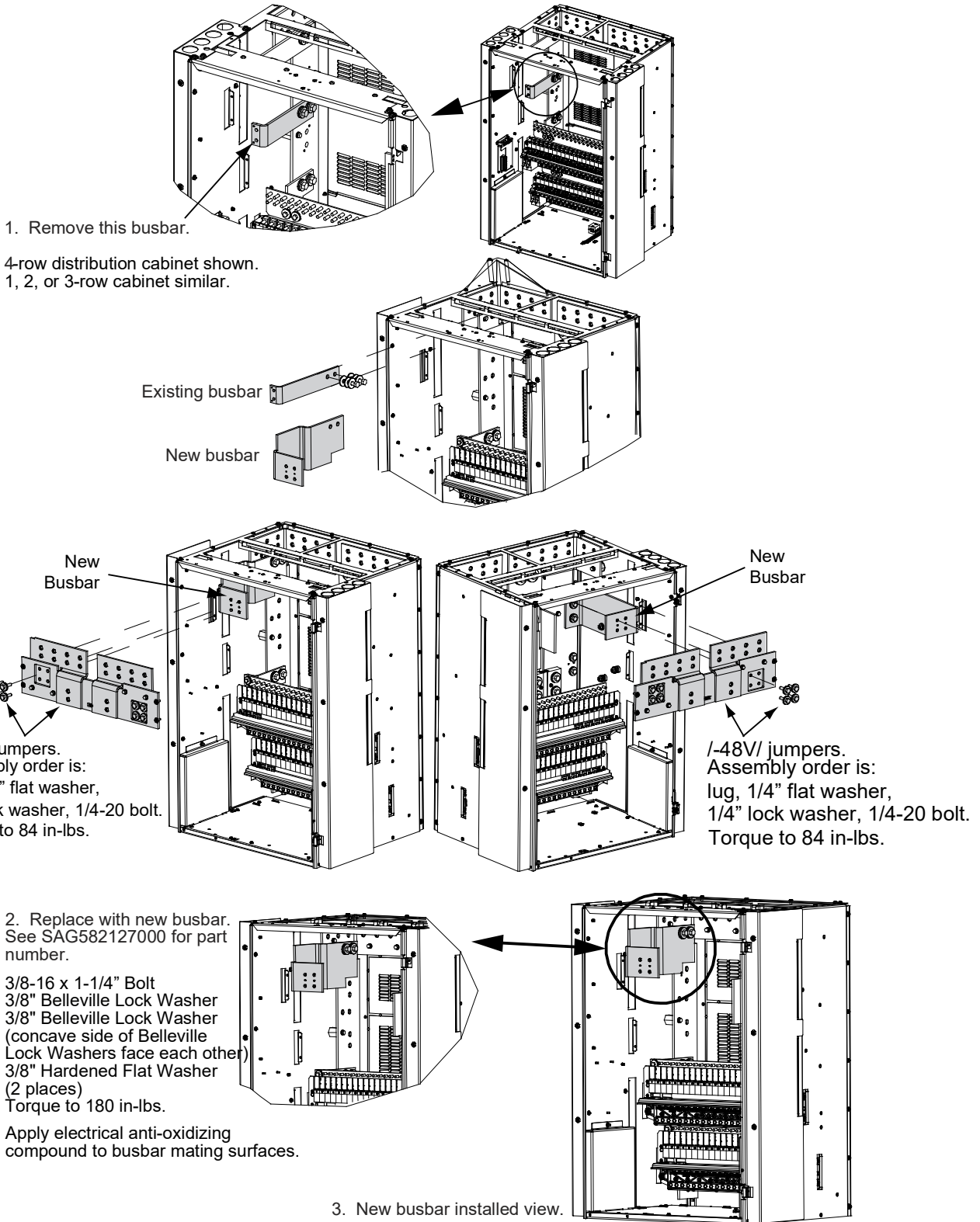
2. Replace the hardware securing the panel's System Load Distribution busbar to the distribution cabinet's busbar (1/4-20 x 1" bolt, 1/4" Belleville lock washer, 1/4" Belleville lock washer (concave side of Belleville lock washers face each other), 1/4" hardened flat washer, 4-places. Torque to 60 in-lbs).
3. Replace the hardware securing the panel's Ground Busbar (if equipped) to the distribution cabinet's busbar (1/4-20 x 1" bolt, 1/4" Belleville lock washer, 1/4" Belleville lock washer (concave side of Belleville lock washers face each other), 1/4" hardened flat washer, 4-places. Torque to 60 in-lbs).



WARNING! In the next step, observe correct polarity; otherwise equipment damage will result.

4. Reconnect the load return or battery return wiring to the ground busbar, if practical.
5. Reconnect the load wiring to the load busbar, if practical.
6. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.

Figure 5.13 Replacing the Busbar



5.6.13 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 4.154 (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.

Refer to Figure 3.1 for circuit card locations.



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



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

System Interface Circuit Card Replacement

Procedure

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 by turning the latch in the counterclockwise position (system’s in a relay rack) or open the system’s enclosure 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. Remove the top and front panels to access the circuit cards at the bottom of the distribution cabinet.
5. 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 5.14.
6. 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 5.14.



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

7. 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.
8. Unplug all connectors plugged into the circuit card.
9. Remove the screws securing the circuit card and remove the circuit card from the distribution cabinet.

10. In this step, ensure you do not intermix the old and replacement circuit cards. Set the shorting jumpers on the replacement circuit card to match the locations on the old circuit card. Jumper settings are documented in the “Setting Jumpers and Switch Options” section of the Power System Installation Instructions (IM582127000).
11. Slide the replacement circuit card into the mounting position inside the distribution cabinet, and secure with the screws removed from the old circuit card.
12. 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.

13. 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.
14. Remove the grounding wrist strap.
15. Reinstall the top and front panels that cover the circuit cards at the bottom of the distribution cabinet.
16. Close the distribution cabinet’s front door and turn the latch clockwise to secure the door (system’s in a relay rack) or close the system’s enclosure door.
17. Enable the external alarms or notify appropriate personnel that this procedure is finished.
18. Ensure that there are no local or remote alarms active on the system.

Figure 5.14 System Interface Circuit Card Connector Locations

(Main Bay Only)

* When an NCU configuration is furnished that enables NCU capability to receive status information sent from Fiamm SoNick [Sodium Nickel] batteries. Connect leads from the Fiamm SoNick batteries to the RS-485 terminals. Refer to the battery manufacturer documentation and the NCU controller manual UM1M830BNA for details.

TB2 (Main Bay Only)

RS485 Connection*

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

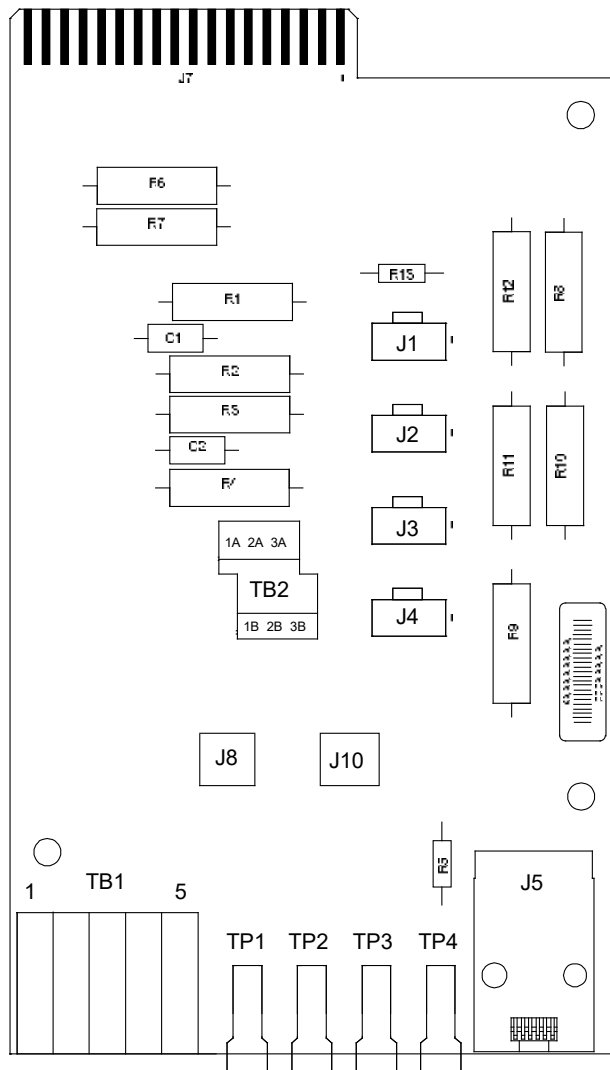
RS232 Connection

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

TB2 3A: Internally used by system.

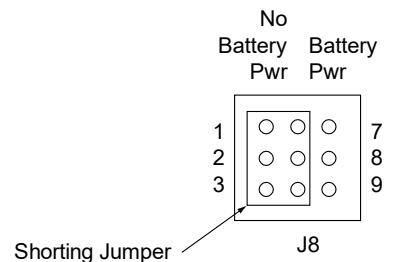
TB2

Wire Size Capacity: 16-26 AWG.
Recommended Torque: 2.0 in-lbs.

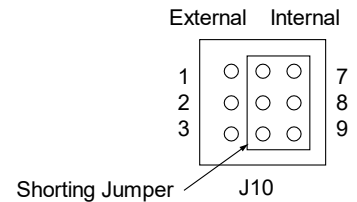


J1, J2, J3, J4
Distribution Panels FA Inputs

J8 (Main Bay Only)
Selects to power Controller from "Battery Power" or not.



J10 (Main Bay Only)
Battery Monitoring External / Internal (see TB1-4 and TB1-5 for external monitoring points)



J5
CAN2 (top)
CAN1 (bottom)

TB1-1: Battery Tray FA
TB1-2: External Battery FA
TB1-3: External System FA
TB1-4: External Battery Monitoring (-)
TB1-5: External Battery Monitoring (+)

TP1 (+) and TP2 (-)
Bay Voltage Monitoring

TP3 (+) and TP4 (-)
Bay Load Shunt Monitoring

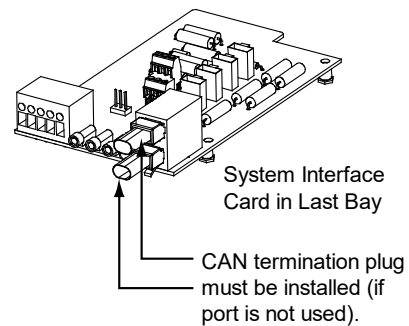
TB1

TB1-2, TB1-3, TB1-4, TB1-5 Main Bay Only.

Wire Size Capacity: 22-12 AWG.

Recommended Torque: 3.0 in-lbs.

FA Signals: System voltage applied to the terminal turns in an alarm.



SM-DU Circuit Card Replacement (Supplemental Bays Only)

Procedure

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.

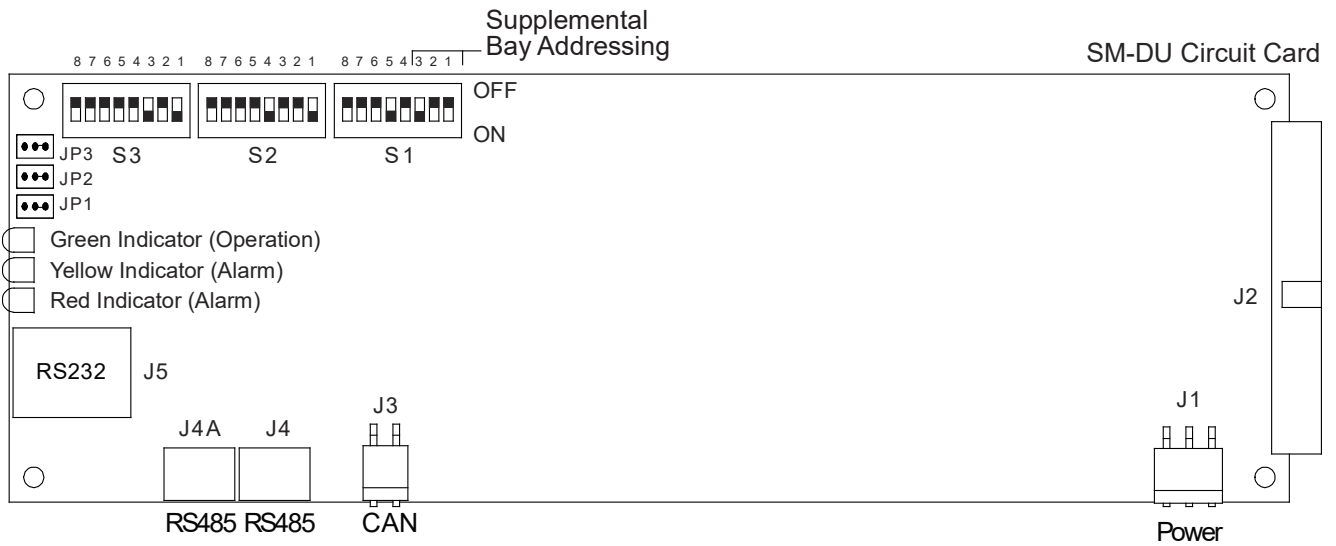
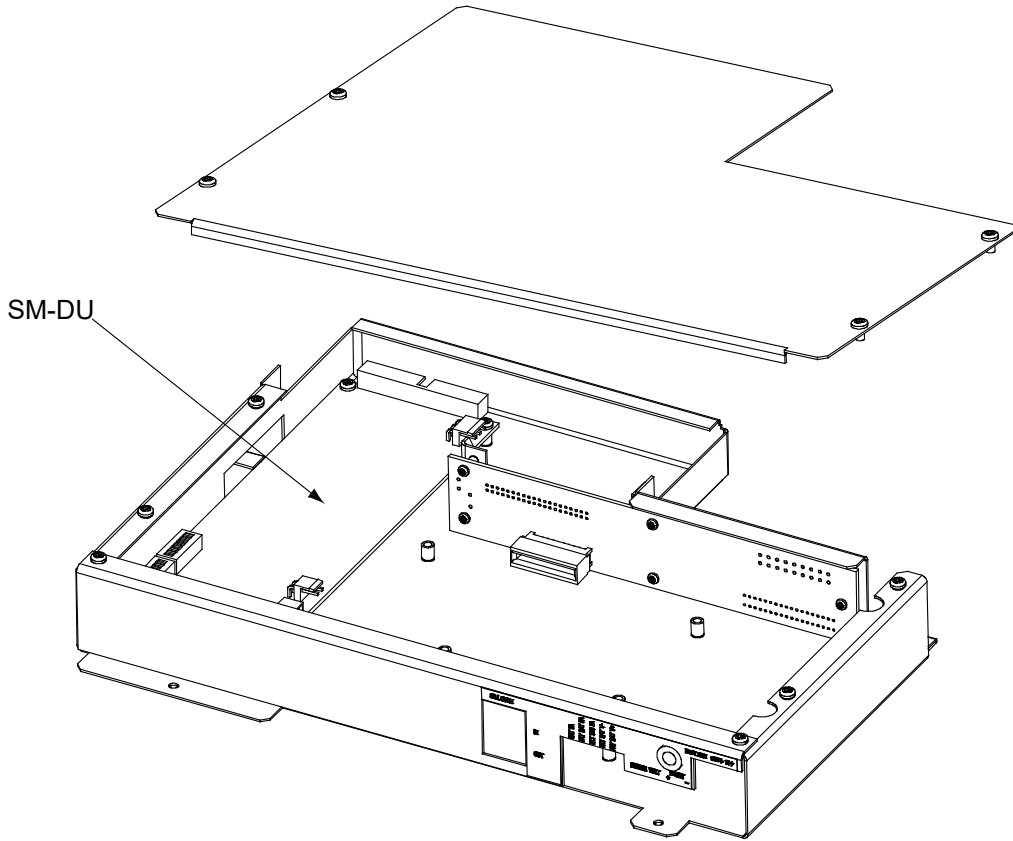
2. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack), or open the system's enclosure door.



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. Remove the top and front panels to access the circuit cards at the bottom of the distribution cabinet. See Figure 5.15.
5. Remove connectors J1, J2, and J3 from the circuit card.
6. Remove the screws securing the circuit card and remove the circuit card from the distribution cabinet.
7. 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 Jumpers and Switch Options" section of the Power System Installation Instructions (IM582127000).
8. Slide the replacement circuit card into the mounting position inside the distribution cabinet, and secure with the screws removed from the old circuit card.
9. Plug connectors J1, J2, and J3 into the circuit card.
10. Reinstall the top and front panels that cover the circuit cards at the bottom of the distribution cabinet.
11. Remove the grounding wrist strap.
12. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack), or close the system's enclosure door.
13. Reboot the Controller
Local Menu Navigation: At the Main Screen, press ENT and ESC at the same time to reset the NCU Controller.
Web Menu Navigation: Go to Advance Settings Menu / SW Maintenance Tab / Reboot Controller button.
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 5.15 SM-DU Circuit Card Replacement (Supplemental Bays Only)



IB2 (Controller Interface Board) and Optional EIB (Controller Extended Interface Board) Replacement (Main Bay Only)

Procedure

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 by turning the latch in the counterclockwise position (system's in a relay rack) or open the system's enclosure 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. 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 5.16 or Figure 5.17.
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 5.16 or Figure 5.17.



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 by removing the bracket the circuit card is mounted to. Remove the circuit card from the bracket.
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 Jumpers and Switch Options" section of the Power System Installation Instructions (IM582127000).
10. Secure the replacement circuit card to the bracket and re-install the circuit card and bracket into the distribution cabinet.
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 and turn the latch clockwise to secure the door (system's in a relay rack) or close the system's enclosure door.

15. Reboot the Controller

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

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

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

Figure 5.16 IB2 (Controller Interface Board) Connector Locations

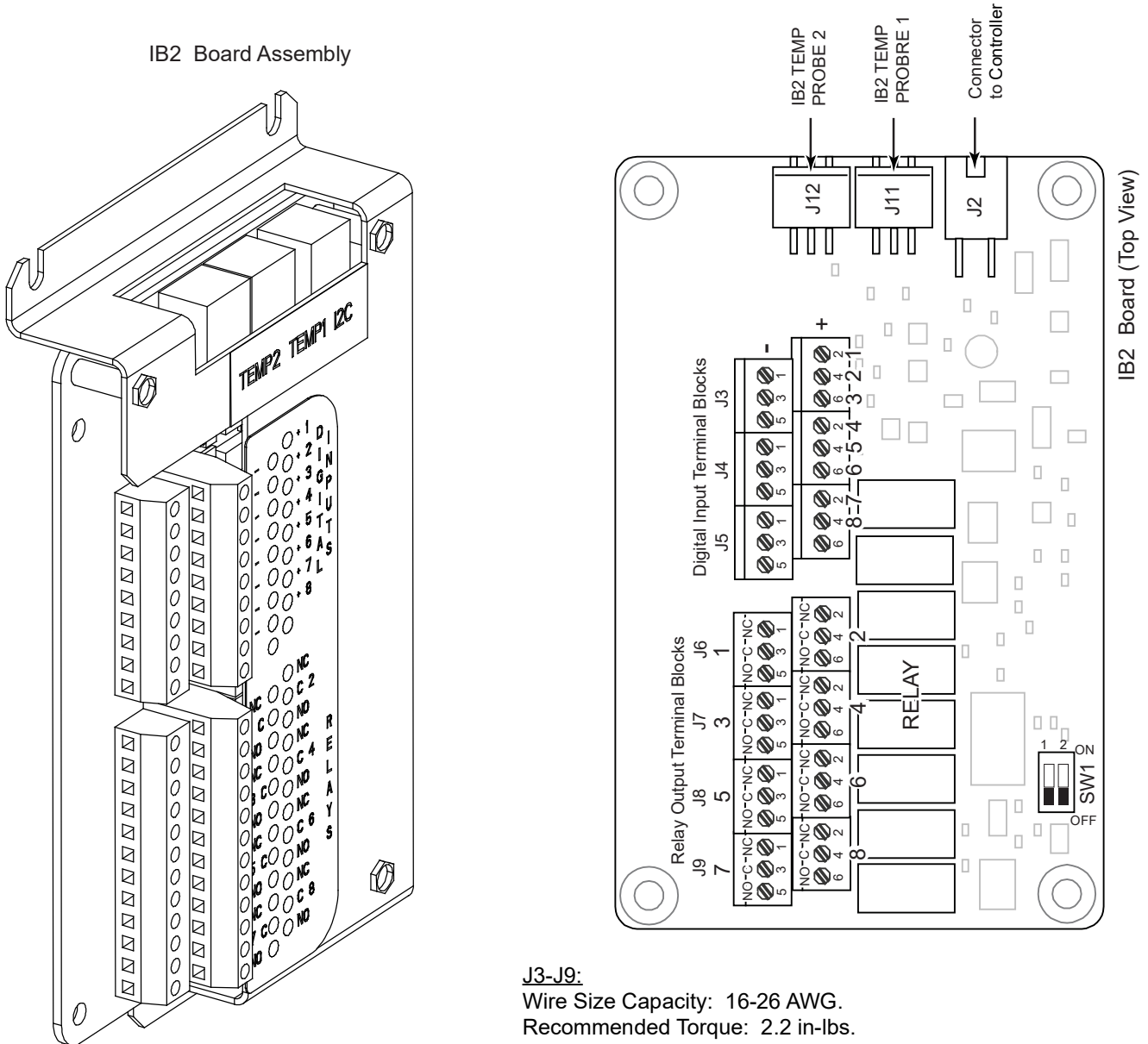
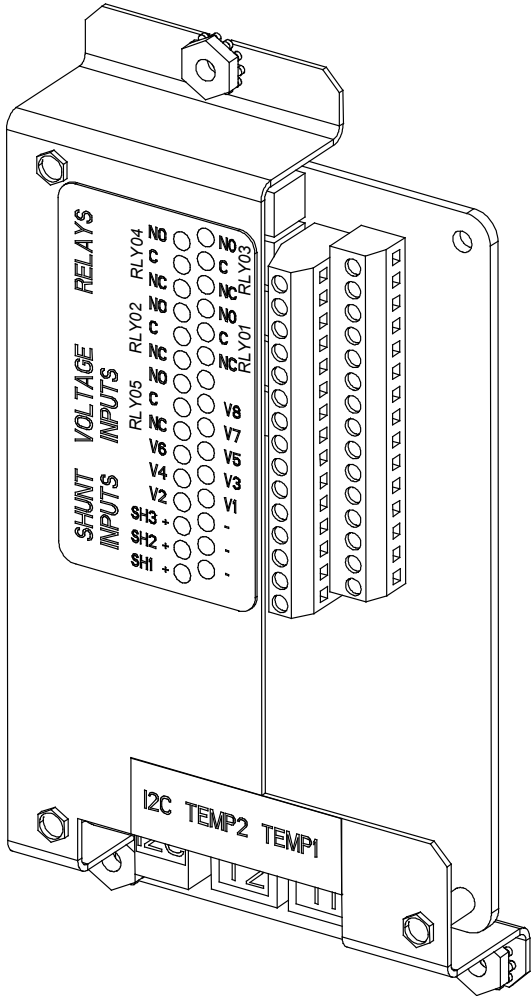
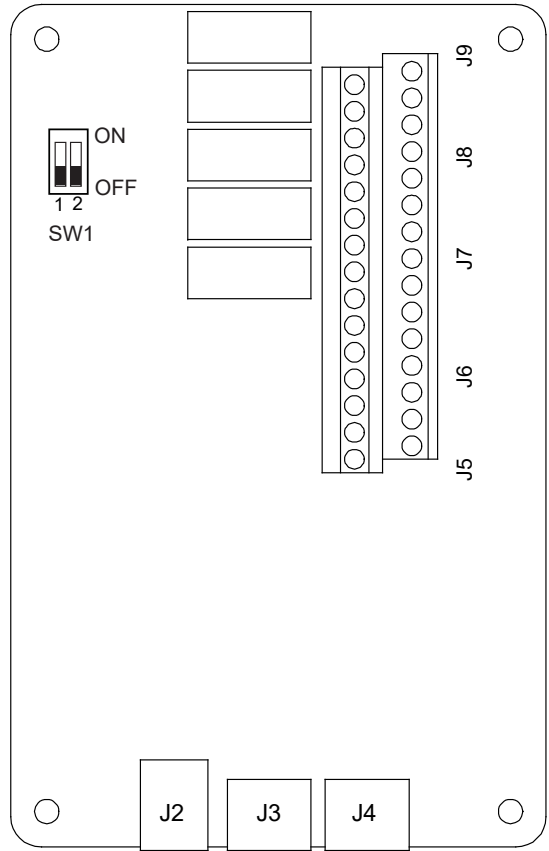


Figure 5.17 EIB (Controller Extended Interface Board) Connector Locations

Optional EIB Interface Board Assembly



Optional EIB Interface Board
(Top View)



J5-J9

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

SM-DU+ and Shunt Interface Assembly Replacement

Procedure

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 by turning the latch in the counterclockwise position (system's in a relay rack) or open the system's enclosure 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. Carefully label the wires connected to the shunt input terminal blocks on circuit card. These wires must be connected to the same terminals on the replacement circuit card. Refer to Figure 5.18.
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 5.18.



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 shunt input 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 screw securing the SM-DU+ and Shunt Interface Assembly to the bottom of the distribution cabinet and remove the assembly.
9. **SM-DU+:** 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 settings as the old circuit card. Switch settings are documented in the "Setting Jumpers and Switch Options" section of the Power System Installation Instructions (IM582127000).
10. Slide the replacement SM-DU+ and Shunt Interface Assembly into the mounting position inside the distribution cabinet, and secure with the screw removed from the old assembly.
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 shunt input terminal blocks. 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 and turn the latch clockwise to secure the door (system's in a relay rack) or close the system's enclosure door.

IB4 (NCU Controller Second Ethernet Port Board) Replacement (Main Bay Only)

Procedure

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.

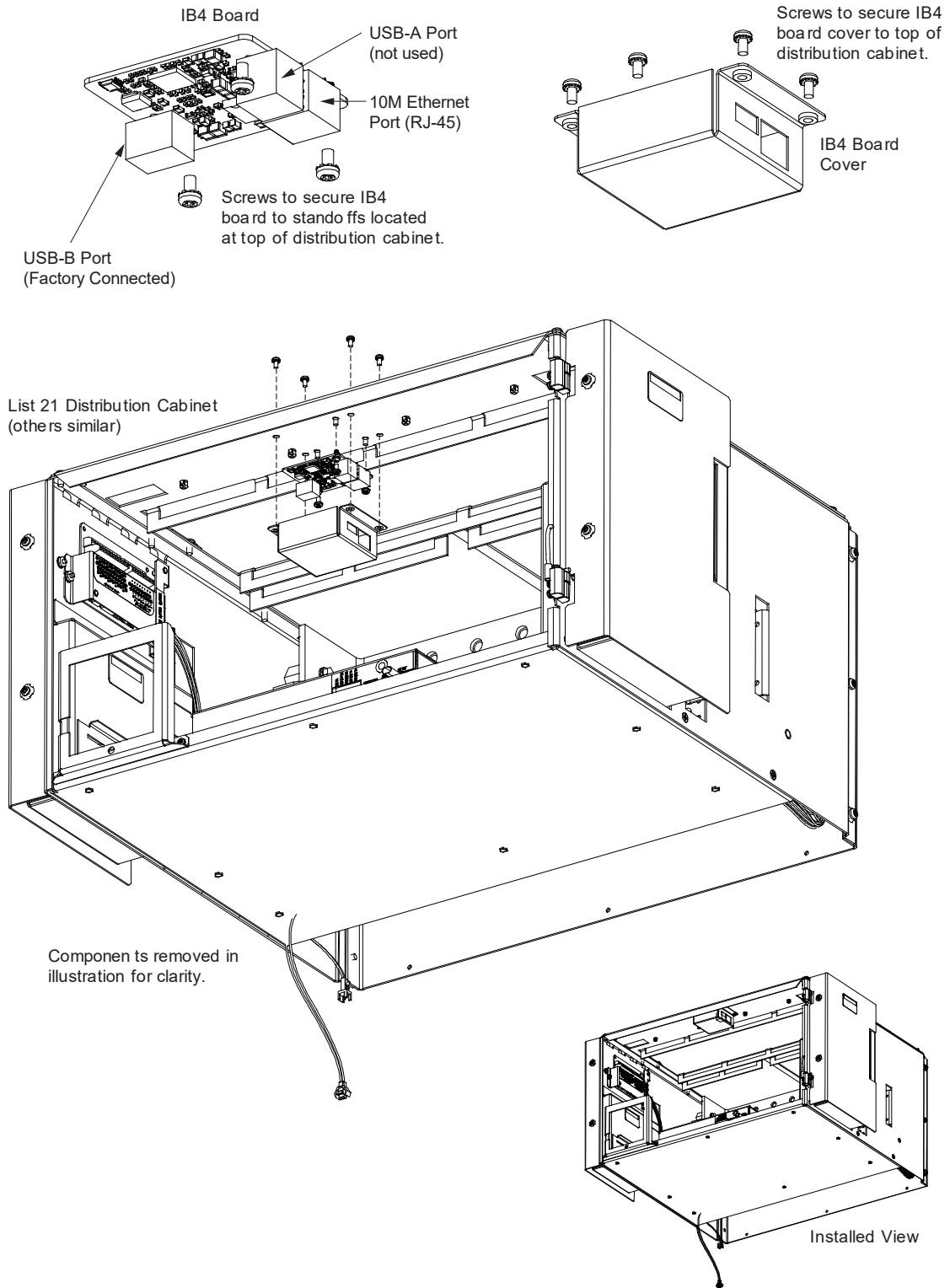
2. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack) or open the system's enclosure door.



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. Refer to Figure 5.19.
6. Unplug all connectors plugged into the circuit card.
7. Remove the circuit card shield from the distribution cabinet by removing the screws securing it to the cabinet. Refer to Figure 5.19.
8. Remove the circuit card from the distribution cabinet by removing the screws securing it to the cabinet. Refer to Figure 5.19.
9. Orient the replacement circuit card over its mounting position, and secure with the screws removed from the old circuit card. Refer to Figure 5.19.
10. Orient the circuit card shield over its mounting position, and secure with the screws previously removed. Refer to Figure 5.19.
11. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.
12. 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.
13. Remove the grounding wrist strap.
14. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack) or close the system's enclosure door.
15. 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.
16. Enable the external alarms or notify appropriate personnel that this procedure is finished.
17. Ensure that there are no local or remote alarms active on the system.

Figure 5.19 IB4 (NCU Controller Second Ethernet Port Board) Replacement



Optional LVD Driver and LVD Driver Lite Circuit Card Replacement

Procedure

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 by turning the latch in the counterclockwise position (system's in a relay rack) or open the system's enclosure door.

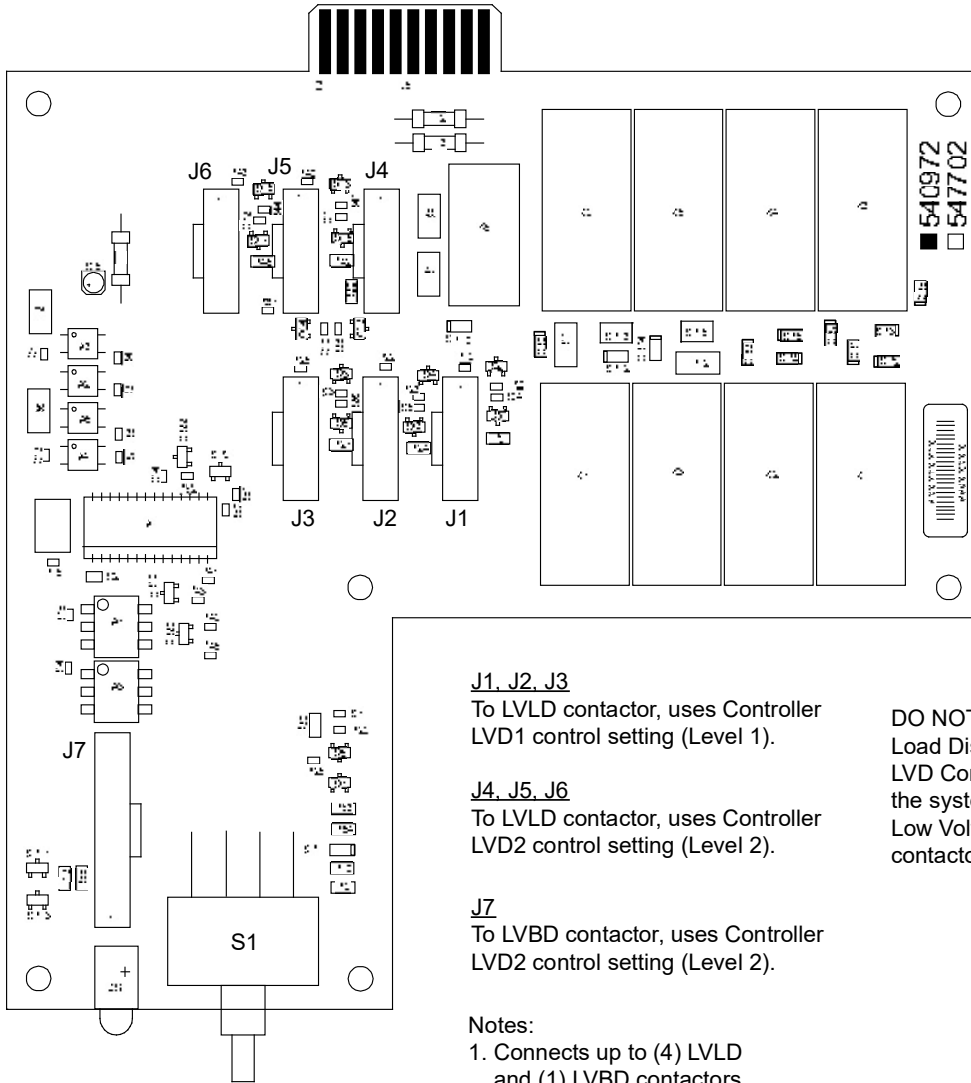
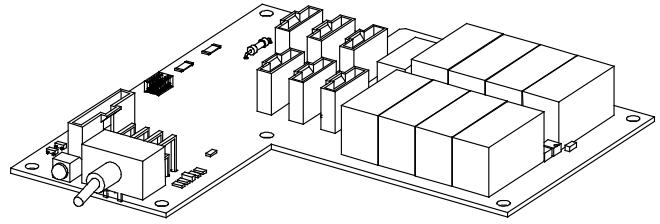


WARNING! Damage to the circuit card may result if the next step is not followed.

3. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
4. If any of the low voltage disconnect contactors is open and it is desired to be closed, push the LVD Inhibit Switch located on the circuit card installed in the main bay to the UP position momentarily and then leave the switch in the middle (OFF) position.
5. Remove the top and front panels to access the circuit cards at the bottom of the distribution cabinet.
6. 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 5.20 or Figure 5.21.
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. Slide the replacement circuit card into the mounting position inside the distribution cabinet, and secure with the screws removed from the old circuit card.
10. Ensure that the LVD Inhibit Switch is in the middle (OFF) position.
11. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.
12. Push the LVD Inhibit Switch to the down (ON) position.
13. Remove the grounding wrist strap.
14. Reinstall the top and front panels that cover the circuit cards at the bottom of the distribution cabinet.
15. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack) or close the system's enclosure door.
16. Enable the external alarms or notify appropriate personnel that this procedure is finished.
17. Ensure that there are no local or remote alarms active on the system.

Figure 5.20 Optional LVD Driver Circuit Card Connector Locations

Main Bay



J1, J2, J3

To LVLD contactor, uses Controller LVD1 control setting (Level 1).

J4, J5, J6

To LVLD contactor, uses Controller LVD2 control setting (Level 2).

J7

To LVBD contactor, uses Controller LVD2 control setting (Level 2).

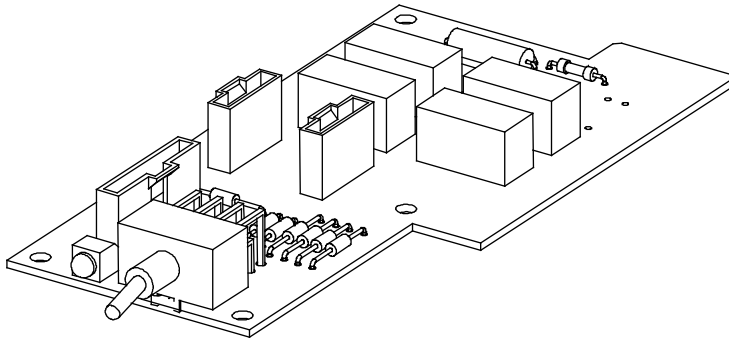
DO NOT change a Low Voltage Load Disconnect contactor to LVD Control Level 2 (LVD2) if the system is furnished with a Low Voltage Battery Disconnect contactor.

Notes:

1. Connects up to (4) LVLD and (1) LVBD contactors.
2. Switch and indicator located on circuit card installed in Main Bay only.

Figure 5.21 Optional LVD Driver Lite Circuit Card Connector Locations

Main Bay



DO NOT change a Low Voltage Load Disconnect contactor to LVD Control Level 2 (LVD2) if the system is furnished with a Low Voltage Battery Disconnect contactor.

J1

To LVLD contactor, uses Controller LVD1 control setting (Level 1).

J3

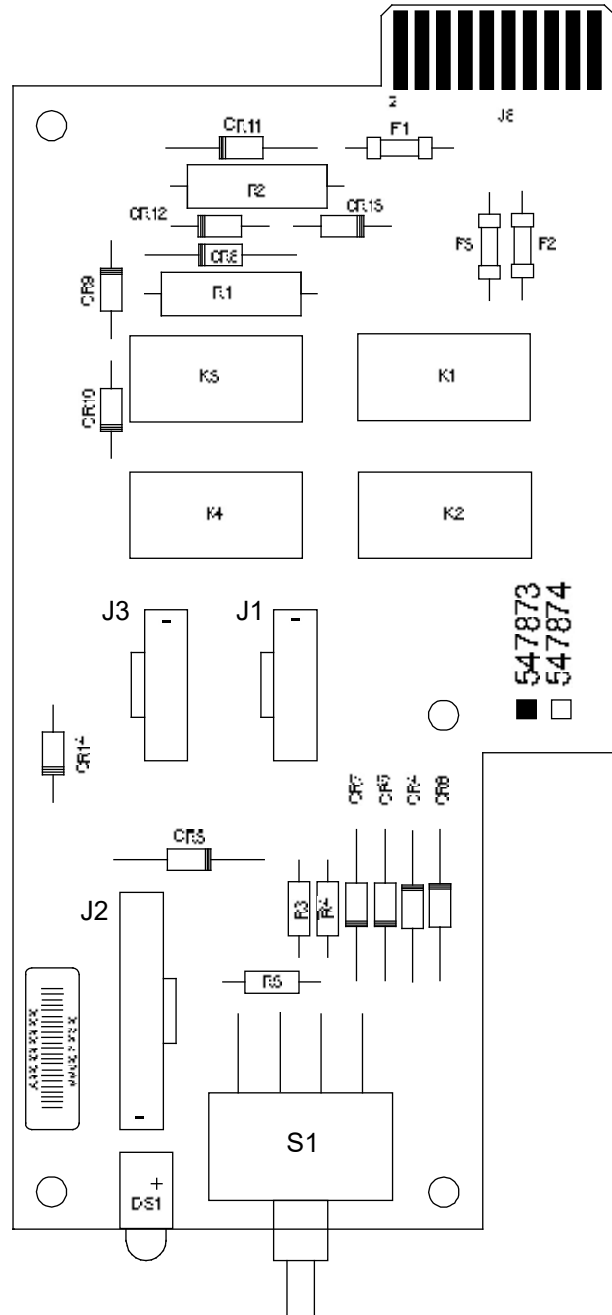
To LVLD contactor, uses Controller LVD2 control setting (Level 2).

J2

To LVBD contactor, uses Controller LVD2 control setting (Level 2).
Can only be used if it is contained in a List 21 (1-row) cabinet.

Notes:

1. Connects up to (2) LVD contactors rated at 600A or less.
2. Only one (1) contactor per level can be accommodated. J2 and J3 are on Level 2, only one (1) of these connectors can be used at a time.
3. Switch and indicator located on circuit card installed in Main Bay only.



Optional Manual Battery Disconnect Circuit Card Replacement

Procedure

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.

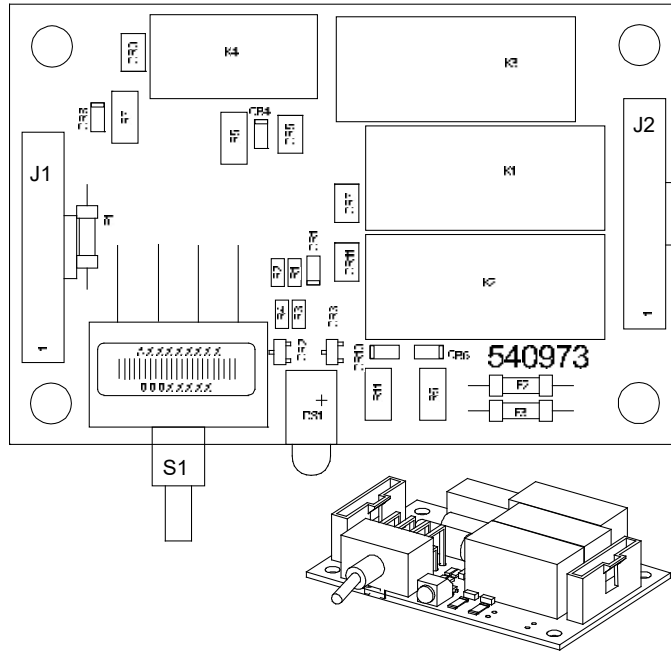
2. Open the distribution cabinet's front door by turning the latch in the counterclockwise position (system's in a relay rack) or open the system's enclosure door.



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. Remove the top and front panels to access the circuit cards at the bottom of the distribution cabinet.
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 5.22.
6. Unplug all connectors plugged into the circuit card.
7. Remove the screws securing the circuit card and remove the circuit card from the distribution cabinet.
8. Place the replacement circuit card into the mounting position inside the distribution cabinet, and secure with the screws removed from the old circuit card.
9. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.
10. Remove the grounding wrist strap.
11. Reinstall the top and front panels that cover the circuit cards at the bottom of the distribution cabinet.
12. Close the distribution cabinet's front door and turn the latch clockwise to secure the door (system's in a relay rack) or close the system's enclosure door.
13. Enable the external alarms or notify appropriate personnel that this procedure is finished.
14. Ensure that there are no local or remote alarms active on the system.

Figure 5.22 Optional Manual Battery Disconnect Circuit Card Connector Locations (Main Bay Only)



5.6.14 Replacing a Battery or Load Disconnect Contactor



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.



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

Procedure



NOTE! Refer to Figure 5.23, Figure 5.24, Figure 5.25, or Figure 5.26 as this procedure is performed. A system installed in a relay rack is shown in the illustrations. The procedure for a system installed in an enclosure is the same except as noted in the following procedure steps.

Removing the Contactor

1. Verify all AC and DC power sources are disconnected from the power system.
2. **For the 1-row distribution cabinet**, the contactor can be accessed from the top of the distribution cabinet. For the 2, 3, or 4-row distribution cabinet, the contactor can be accessed from the rear (and top) of the distribution cabinet.
3. **For the 2, 3, or 4-row distribution cabinet**, remove the distribution cabinet's rear access panel(s).
4. Disconnect the wiring to the contactor by unplugging the quick disconnects.
5. Note the orientation of the contactor to ensure the replacement is installed the same way. Unbolt the contactor (4-places) and remove. Save all hardware.

Installing the Replacement Contactor

1. Position the replacement contactor oriented the same way as the old.
2. Secure the contactor with the hardware removed above. Refer to Figure 5.23, Figure 5.24, Figure 5.25, or Figure 5.26 for hardware build-up and recommended torque.
3. Replace the wiring to the contactor by plugging-in the quick disconnects. Refer to Figure 5.23, Figure 5.24, Figure 5.25, or Figure 5.26.
4. For the 2, 3, or 4-row distribution cabinet, replace the distribution cabinet's rear access panel(s).

Restarting the Power System

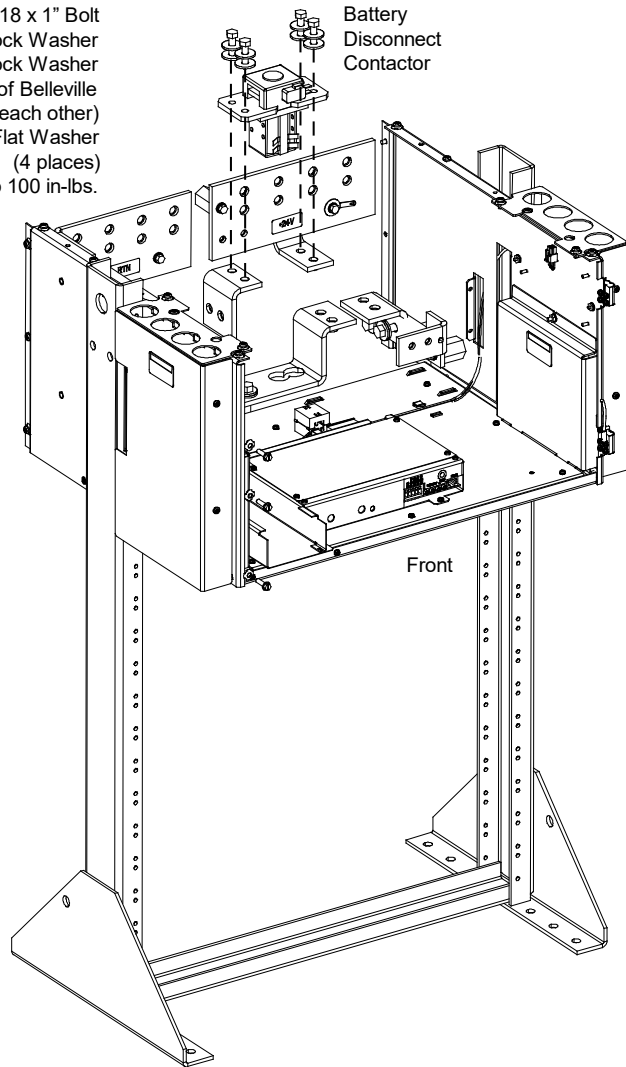
1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582127000) for a startup procedure.
3. Verify no alarms are active.

Figure 5.23 Replacing a Battery Disconnect Contactor in a 1-Row Distribution Cabinet

- 5/16-18 x 1" Bolt
- 5/16" Belleville Lock Washer
- 5/16" Belleville Lock Washer
(concave side of Belleville
Lock Washers face each other)
- 5/16" Hardened Flat Washer
(4 places)
- Torque to 100 in-lbs.

Apply electrical anti-oxidizing compound to busbar mating surfaces.

Components removed in illustration for clarity only.



Contactor styles vary between manufacturer's.

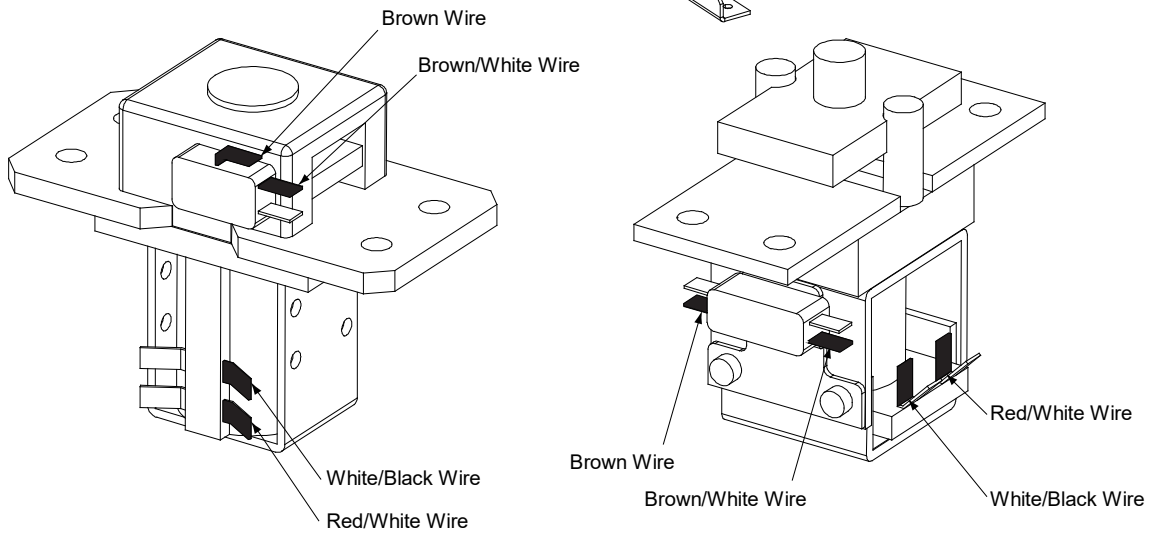


Figure 5.24 Replacing a Battery Disconnect Contactor in a 2, 3, or 4-Row Distribution Cabinet

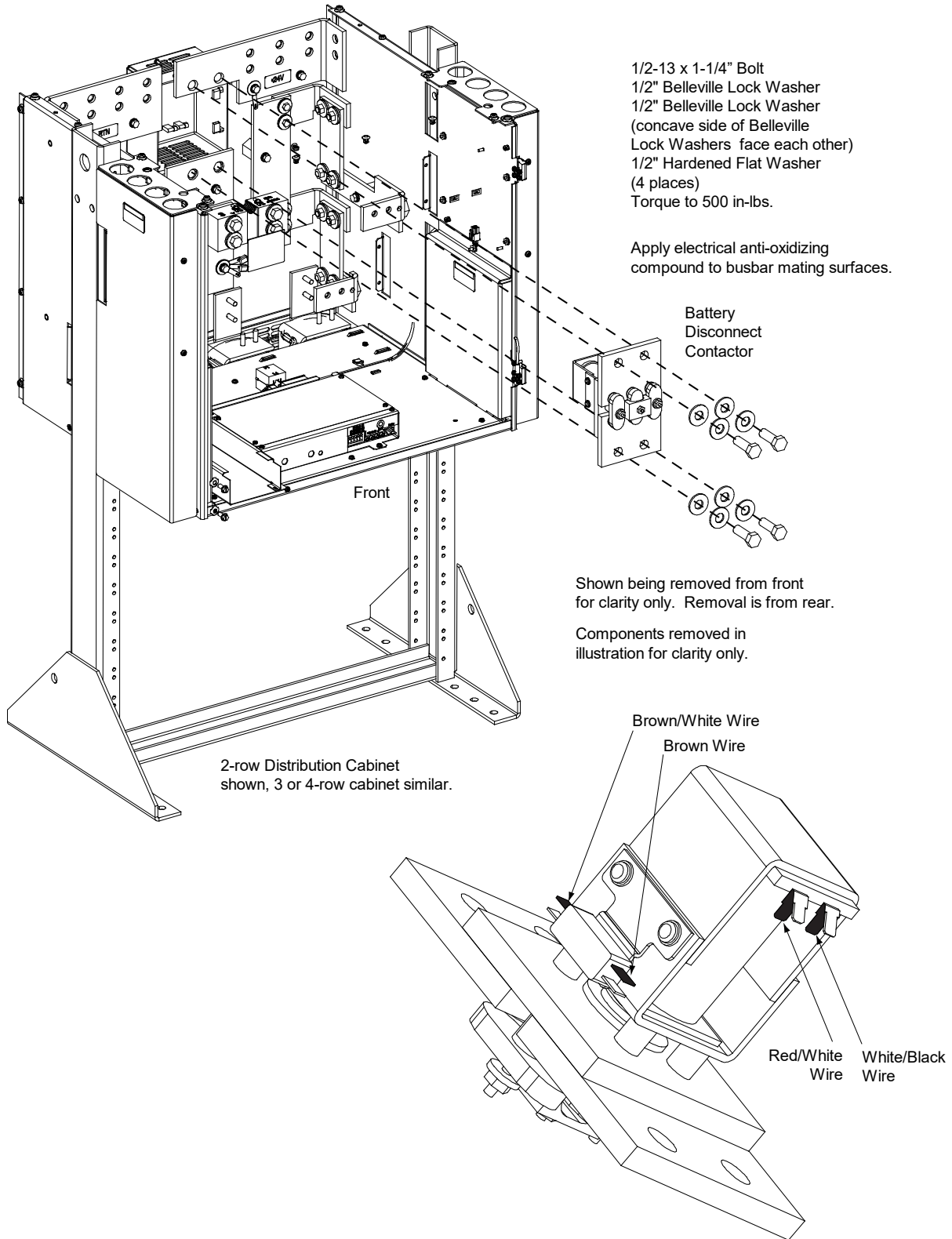


Figure 5.25 Replacing a Load Disconnect Contactor in a 1-Row Distribution Cabinet

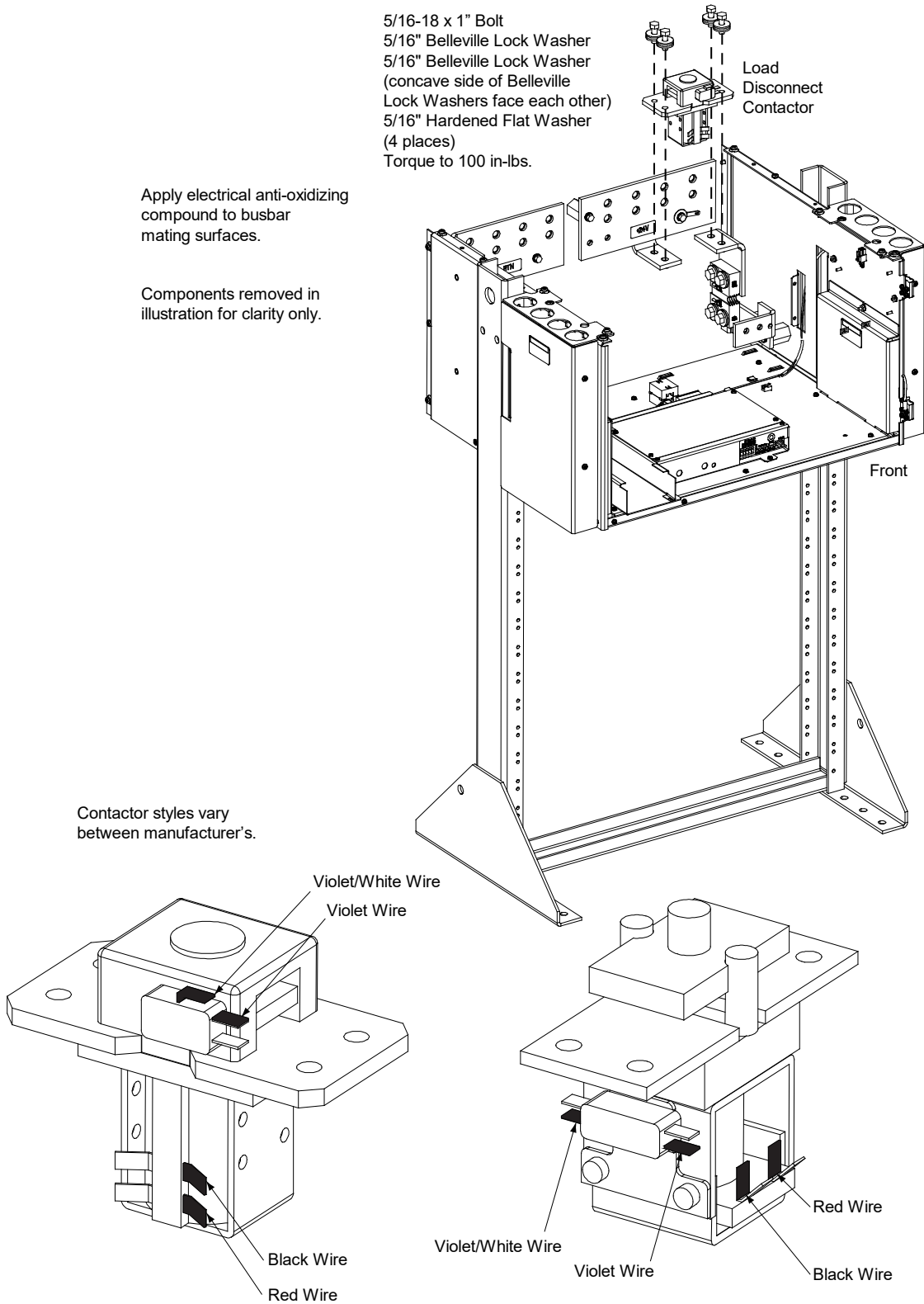
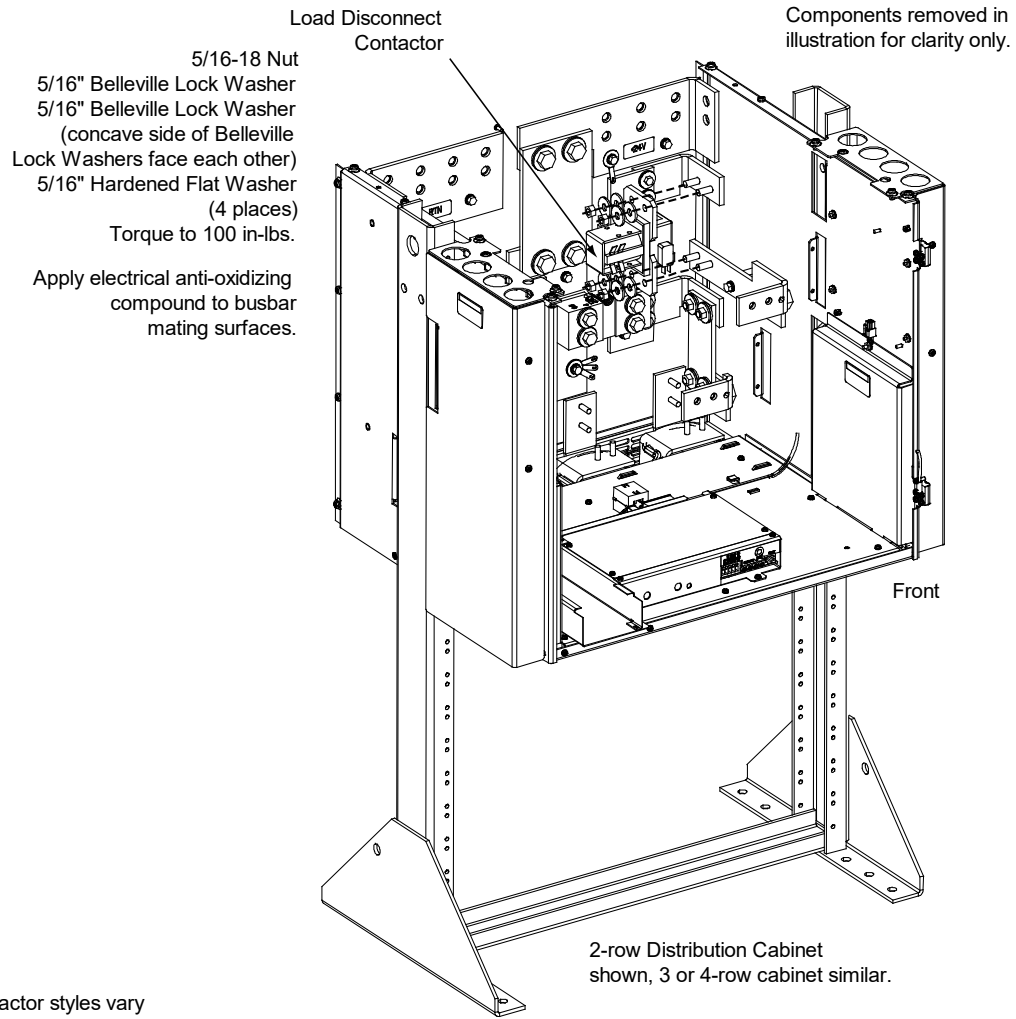
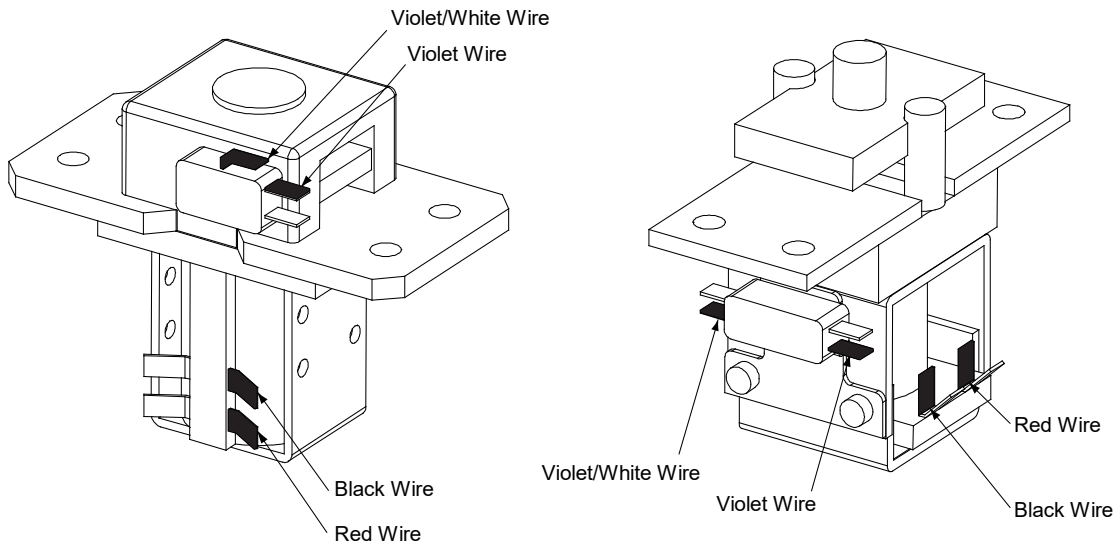


Figure 5.26 Replacing a Load Disconnect Contactor in a 2, 3, or 4-Row Distribution Cabinet



Contactor styles vary between manufacturer's.



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