



## Battery Disconnect Panel

Installation and User Manual (Section 5938), Revision G

Specification Number: 586400200

Model Number: LBD2000

+24 VDC or -48VDC

1000 to 2000 Amps per Circuit

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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

## General Safety



**DANGER!** YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.

Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:

- a) The tasks should be performed in the order indicated.
- b) Remove watches, rings, and other metal objects.
- c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present. Check for voltage with both AC and DC voltmeters prior to making contact.
- d) Wear eye protection.
- e) Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed.

## Voltages

### DC Output and Battery Voltages



**DANGER!** This system produces DC power and may have a battery source connected to it. Although the DC voltage is not hazardously high, the rectifiers and/or battery can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact an output terminal or battery terminal or exposed wire connected to an output terminal or battery terminal. NEVER allow a metal object, such as a tool, to contact more than one termination or battery terminal at a time, or to simultaneously contact a termination or battery terminal and a grounded object. Even a momentary short circuit can cause sparking, explosion, and injury.



**DANGER!** Follow local lockout/tagout procedures to ensure DC branch circuit protection devices remain de-energized during installation at loads, as required.

## Battery

Refer to the battery manufacturer documentation for specific battery safety instructions. The following are general guidelines.



**WARNING!** Correct polarity must be observed when connecting battery leads.



**WARNING!** Special safety precautions are required for procedures involving handling, installing, and servicing batteries. Observe all battery safety precautions in this manual and in the battery instruction manual. These precautions should be followed implicitly at all times.



**WARNING!** A battery can present a risk of electrical shock and high short circuit current. Servicing of batteries should be performed or supervised only by properly trained and qualified personnel knowledgeable about batteries and the required precautions.

The following precautions should be observed when working on batteries:

- Remove watches, rings, and other metal objects.
- Eye protection should be worn to prevent injury from accidental electrical arcs.
- Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed. Ensure that wrenches with more than one working end have only one end exposed.
- Do not lay tools or metal parts on top of batteries.
- Disconnect charging source prior to connecting or disconnecting battery terminals.
- Risk of explosion if battery is replaced with an incorrect type or if polarity is reversed. Recommended to replace batteries with the same manufacturer and type, or equivalent.
- Dispose of used batteries according to the instructions provided with the batteries. Do not dispose of batteries in a fire. They may explode.
- ALWAYS FOLLOW THE BATTERY MANUFACTURER'S RECOMMENDATIONS AND SAFETY INSTRUCTIONS.



**DANGER!** This equipment may be used in conjunction with lead-acid batteries. Working near lead-acid batteries is dangerous!

In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns.

- Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes, and is toxic.
- Batteries contain sulfuric acid.
- Batteries generate explosive gases during normal operation. Systems containing batteries should never be installed in an airtight room or space. Only install in a ventilated environment.
- Batteries are an energy source that can produce high amounts of electrical current.

FOR THESE REASONS, IT IS OF CRITICAL IMPORTANCE THAT YOU READ THESE INSTRUCTIONS AND FOLLOW THEM EXACTLY.

WHEN WORKING WITH LEAD-ACID BATTERIES:

- Follow the recommended PPE requirements per the SDS for the battery to be used.
- If battery acid enters your eye, immediately flush your eye with running cold water for at least 15 minutes. Get medical attention immediately.
- If battery acid contacts skin or clothing, wash immediately with soap and water.



**ALERT!** Performing maintenance and/or troubleshooting procedures may interrupt power to the loads, if battery reserve is not sufficient.

## Handling Equipment Containing Static Sensitive Components



**ALERT!** Installation or removal of equipment containing static sensitive components requires careful handling. Before handling any equipment containing static sensitive components, read and follow the instructions contained on the Static Warning Page.

## Maintenance and Replacement Procedures



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



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

## STATIC WARNING



This equipment contains static sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any equipment containing static sensitive components, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor. Some wrist straps have a built-in one megohm resistor; no external resistor is necessary. Read and follow wrist strap manufacturer's instructions outlining use of a specific wrist strap.
3. Do not touch traces or components on equipment containing static sensitive components. Handle equipment containing static sensitive components only by the edges that do not have connector pads.
4. After removing equipment containing static sensitive components, place the equipment only on conductive or anti-static material such as conductive foam, conductive plastic, or aluminum foil. Do not use ordinary Styrofoam™ or ordinary plastic.
5. Store and ship equipment containing static sensitive components only in static shielding containers.
6. If necessary to repair equipment containing static sensitive components, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.

## DESCRIPTION

This document provides installation and repair information for a Model LBD2000 Battery Disconnect Panel, Spec. No. 586400200.

The Model LBD2000 is a +24 or –48 volt Battery Disconnect Panel designed for mounting on a wall or in a 23” relay rack. The panel provides one battery disconnect fuse within the current range of 1000 to 2000 amperes.

Refer to System Application Guide SAG586400200 for a complete description and specifications.

## INSTALLATION

### Safety Statement



**DANGER!** Installation of this equipment should only be performed by a qualified installer following approved safety procedures.

This equipment is used in conjunction with batteries. Batteries are an energy source that can produce high amounts of electrical current. NEVER allow a metal object, such as a tool, to contact more than one termination at a time, or to simultaneously contact a termination and a grounded object, such as the metal case of the Battery Disconnect Panel. Even a momentary short circuit can cause an explosion resulting in injury. To avoid such short circuits and to avoid injury:

- Remove watches, bracelets and rings.
- Use only tools having insulated handles.
- If insulated tools are not available, completely cover tool handles with a minimum of three half-lapped layers of electrical tape.
- Ensure that wrenches with more than one working end have only one end exposed.
- Wear eye protection at all times.

### Removing the Front Access Door

The front access door can be removed from the Battery Disconnect Panel to aid in installation. To remove the door:

1. Open the door. To do so, unlock the door latch by turning screw in latch handle 1/4-turn counterclockwise. Then pull outward on the latch handle to release.
2. Remove the screw that secures the green or green/yellow door grounding wire to the cabinet. (This screw also prevents the door from being removed.)
3. Lift door upward to separate the hinge halves.

The front access door must be installed, and the door grounding wire reattached before operating the Battery Disconnect Panel.

### Mounting the Battery Disconnect Panel



**NOTE!** If the optional Battery Bank Installation Kit P/N P0915627 is used, refer to P0913485 for Installation Instructions. Installation Kit P/N P0915627 (includes Mounting Bracket Kit P/N 535140) allows the Battery Disconnect Panel to be installed on the top of a VRLA Battery Stack.

### Wall Mounting

Keyhole slots are provided in the rear panel for wall mounting. The keyholes accept 5/16-inch hardware. Refer to System Application Guide SAG586400200 for mounting hole locations.

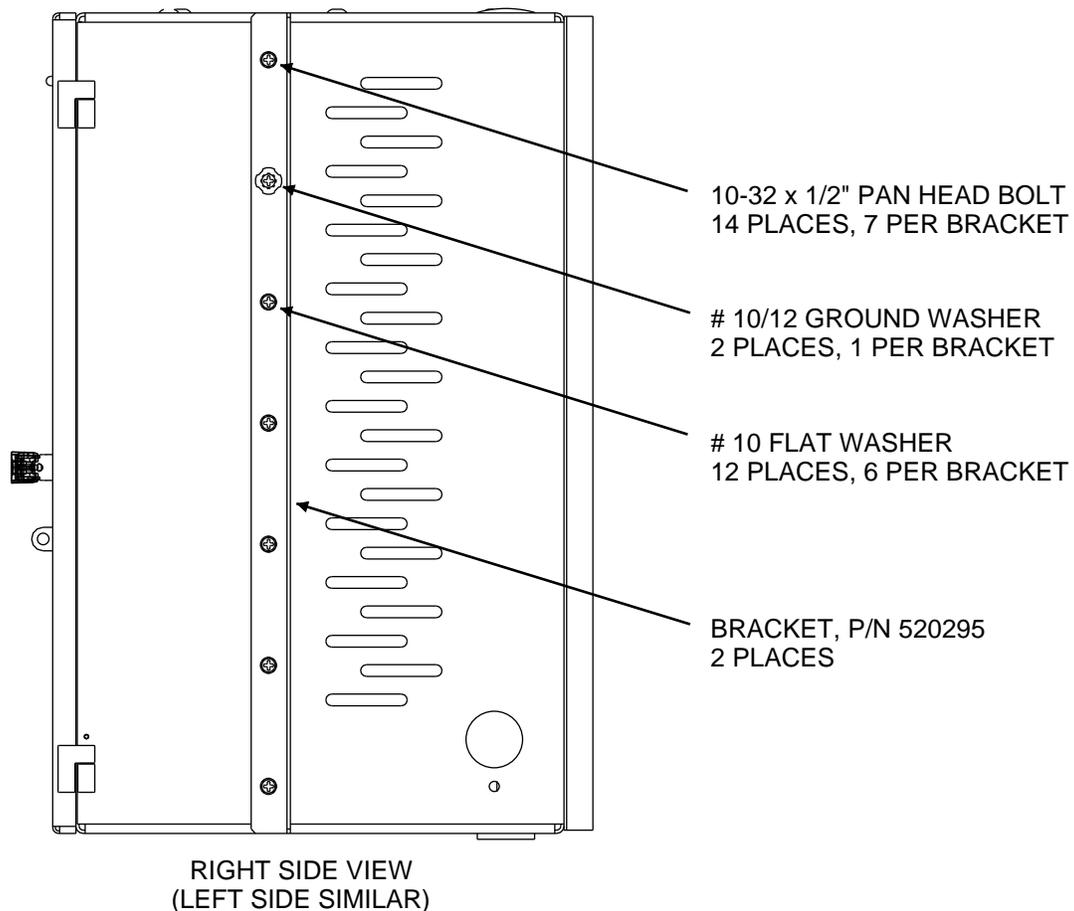
### Rack Mounting

When the furnished rack mounting angles are installed, the panel can be mounted in a standard 23" relay rack with 1-3/4" multiple drillings. Hardware is provided for installing the mounting angles on the cabinet sides. To install the angles, refer to **Figure 1**.

After the rack mounting angles are installed, use eight furnished 12-24 x 3/4" hex washer head thread forming screws to mount the Disconnect Panel in the relay rack.

**NOTE!** When mounting the panel in the relay rack, use one ground washer per side for proper connection to the rack grounding system.

**Figure 1:** Attaching Relay Rack Mounting Angles



## User Selections

 **NOTE!** If the Battery Disconnect Panel will not be used with a Vortex® or NETSURE™ Power System, the User Selections may be skipped.

### Shunt Monitoring (Shunt POD) Circuit Card

Each Battery Disconnect Panel is equipped with one Shunt Monitoring (Shunt POD) Circuit Cards, Part No. 501981. Each card enables the MCA in a specific Vortex or NETSURE Power System to monitor battery charge/discharge current. Switches on the Shunt POD have been factory-set. These switch settings should be verified.

To access the Shunt POD Circuit Card, open the front access door.

### Setting Shunt Capacity Selection Switches

Located on each Shunt POD circuit card 501981 are two switches. These switches allow the Shunt POD circuit card to be used with a variety of shunt sizes. The switches are factory set to match the shunt that is factory-connected to the circuit card. The following procedure is provided to check the factory setting, or to set the switches on a replacement Shunt POD.

#### Procedure:

1. Refer to **Figure 2** and locate Switches S1 and S2 on Shunt POD circuit card 501981.
2. Refer to **Table 1**, and set the switches to match the capacity of the 25mV. shunt connected to this circuit card.

 **NOTE!** Factory setting of these switches is as follows:

<b>Fuse Rating</b>	<b>Shunt Capacity</b>	<b>Switch S2 Section 3</b>	<b>Switch S1</b>
All fuses	2500A	Open	D

**Table 1:** Shunt POD Circuit Card Part No. 501981 Shunt Capacity Selection Switch Settings

Switch S2 Section 3 Position	Switch S1 Position	25mV. Shunt Capacity	50mV. Shunt Capacity	Switch S2 Section 3 Position	Switch S1 Position	25mV. Shunt Capacity	50mV. Shunt Capacity
Open	0	50A	100A	Closed	0	400A	800A
Open	1	100A	200A	Closed	1	650A	1300A
Open	2	150A	300A	Closed	2	1200A	2400A
Open	3	200A	400A	Closed	3	1250A	2500A
Open	4	250A	500A	Closed	4	1300A	2600A
Open	5	300A	600A	Closed	5	1600A	3200A
Open	6	400A	800A	Closed	6	2000A	4000A
Open	7	500A	1000A	Closed	7	2600A	5200A
Open	8	600A	1200A	Closed	8	3000A	6000A
Open	9	800A	1600A	Closed	9	3750A	7500A
Open	A	1000A	2000A	Closed	A	4000A	8000A
Open	B	1500A	3000A	Closed	B	5000A	10000A
Open	C	2000A	4000A	Closed	C	6000A	12000A
Open	D	2500A	5000A	Closed	D	7500A	15000A
Open	E	4000A	8000A	Closed	E	8000A	16000A
Open	F	5000A	10000A	Closed	F	10000A	20000A*

\* - Do not use this position.

### Setting Shunt POD Identification Switch

Located on each Shunt POD circuit card 501981 is a dual in-line package (DIP) switch. The settings of two individual sections of this DIP switch determine how the MCA identifies this Shunt POD (and the shunt connected to it). The Shunt POD can be identified as monitoring System load current, Subsystem load current, or Battery current. This switch is factory set. The following procedure is provided to check the factory setting, or to set the switch on a replacement Shunt POD.

 **NOTE!** Section 1 of switch S2 is not used in this assembly.

#### Procedure:

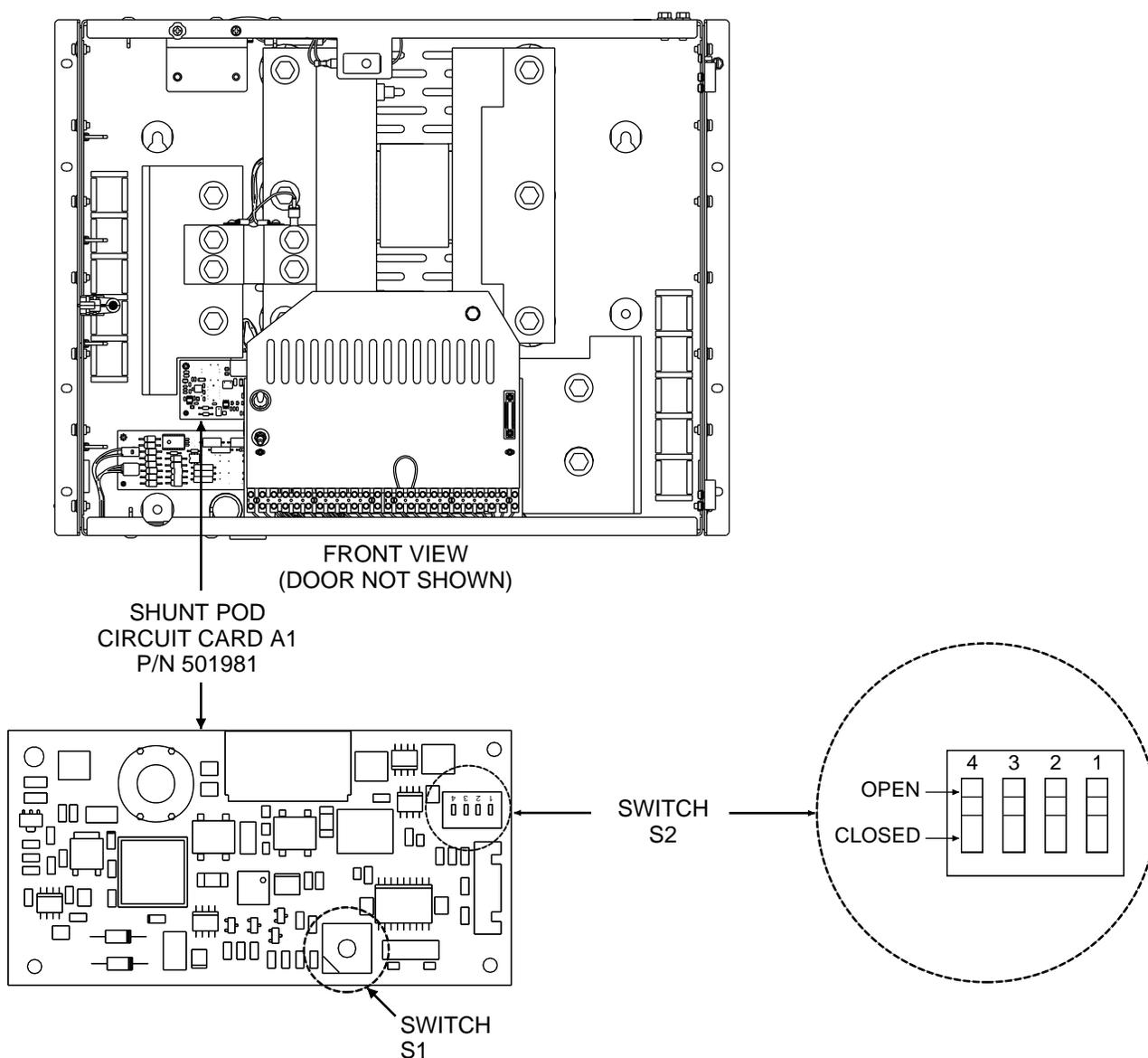
- 1) Refer to **Figure 2** and locate Switch S2 on Shunt POD circuit card 501981.
2. Refer to **Table 2** and set switch S2 for the type of shunt.

 **NOTE!** Factory setting of these switch sections is “- Battery Current” for Lists 1, and “+ Battery Current” for List 11.

**Table 2:** Shunt POD Circuit Card Part No. 501981 Shunt Type Identification Switch Settings

Switch S2		Shunt Type
Section 2	Section 4	
Open	Open	+ Battery Current
Open	Closed	- Battery Current
Closed	Open	System Load Current
Closed	Closed	Subsystem Load Current

**Figure 2:** Shunt POD Circuit Card Settings



## Electrical Connections



**DANGER!** Read the Safety Statement at the beginning of the INSTALLATION section. It is recommended that all electrical connections be made **without** DC power applied to the system. Connect cables to battery terminals last.



**ALERT!** This battery disconnect must be installed in the UNGROUNDED battery lead only.



**NOTE!** *Battery Return and Load Return wiring is external to this assembly.*

## Wiring Considerations

All wiring should follow the current edition of the National Electrical Code and applicable local codes. Use wiring with a minimum temperature rating of 90°C for all Load and Battery connections.

### Equipment Grounding Connection (Frame Ground)

For grounding requirements, refer to the National Electrical Code, applicable local codes, and your specific site requirements.

**Wall Mounting:** Two clearance holes for 1/4 20 hardware on 5/8-inch centers are provided for connection into a customer's grounding network. Refer to **Figure 4** for locations. Hardware is provided. Recommended torque is 84 in-lbs when standard flat washers and lock washers are used.

**Rack Mounting:** To ground the panel through the relay rack grounding system, use ground washers when mounting the panel in the relay rack.

**Mounting on a Battery Stack or Battery Stand:** Ground per site requirements. Either use ground washers on the mounting hardware or connect a separate ground conductor as described under Wall Mounting.

### Installing Optional Accessory Busbar Rear Extension Kit



**NOTE!** *If not installing the Optional Accessory Busbar Rear Extension Kit, skip this procedure.*

An accessory busbar kit is available for extending input and output busbars through the rear cabinet panel. This allows lug connections outside of the cabinet for rack mount applications. A plastic safety cover is included.



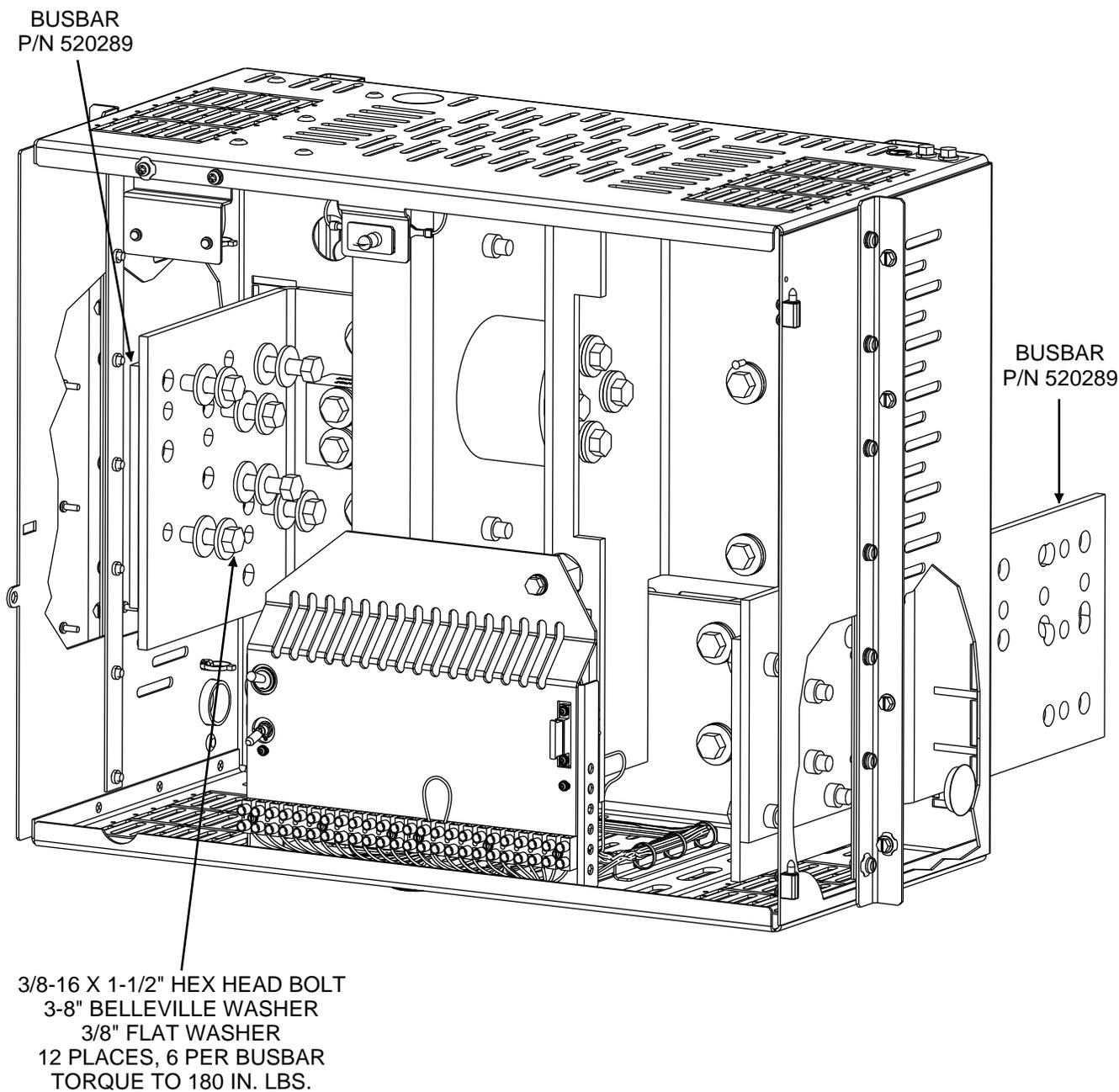
**NOTE!** *Apply electrical anti-oxidizing compound to busbar mating surfaces.*

If furnished, install the busbar extension plates as shown in **Figure 3A**. Remove cable cutouts in the rear panel. Use kit-furnished 3/8-16 bolts and washers. Recommended torque for 3/8-16 hardware is 180 in. lbs. when using Belleville washers, and 300 in. lbs. when using standard lock washers.

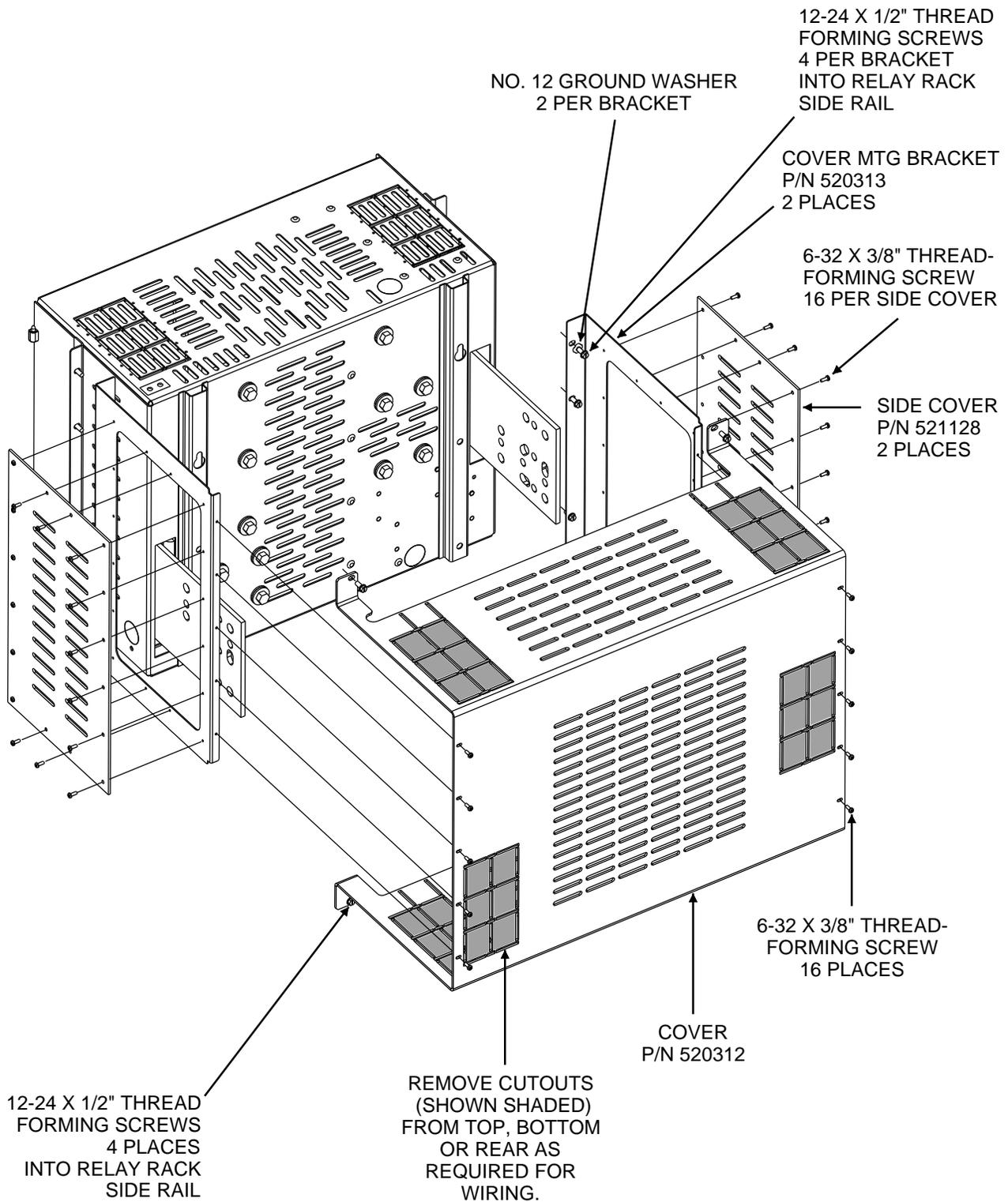
After all electrical connections have been made to the busbars, install the plastic busbar cover as shown in **Figure 3B**.

**Figure 3A:** Installing Optional Busbar Rear Extension Kit

**NOTE**  
 APPLY ELECTRICAL ANTI OXIDIZING  
 COMPOUND TO BUSBAR MATING  
 SURFACES BEFORE INSTALLING  
 HARDWARE.



**Figure 3B:** Installing Optional Busbar Rear Extension Kit



## Input (Battery) Connections



**DANGER!** Read the Safety Statement at the beginning of the INSTALLATION section. It is recommended that all electrical connections be made **without** DC power applied to the system. Connect cables to battery terminals last.

Refer to **Figure 4A**, or **Figure 4B** when making input (Battery) connections.

The Input (Battery) busbar allows top or bottom feed, and accommodates up to six lugs (back to back). If furnished, the optional rear extension busbar accommodates up to six lugs (back to back). Lugs and lug mounting hardware must be supplied by the installer. Refer to System Application Guide SAG586400200 and drawing 031110100 for lug information.

Input connections are located at the left-hand side of the Battery Disconnect Panel. Rectangular cutouts are provided, which allow wiring to enter the assembly through the top, bottom, or rear panel. After the required cutout is removed, a furnished piece of edge guard should be cut to length and installed on all edges of the opening(s).

Use customer furnished bolts, washers, and hex nuts to mount lugs. Refer to **Table 3** for recommended bolts and recommended torque.



**NOTE!** If making connections to the optional rear extension busbar, first route wiring through the appropriate cutouts in the plastic safety cover. After input and output connections are completed, slide cover into place and attach. Refer to **Figure 4B**.

**Table 3:** Input and Output Lug Bolt Requirements

Bolts for Input (Battery) and Output (Load) Lugs	Torque (In. Lbs.)
3/8-16 bolts on 1" centers. Customer to provide lugs, bolts & additional hardware. Bolt length: 1-1/2" for single lug; 2" for back to back lugs.	180 (Belleville lock washer) 300 (Standard flat & lock)
Clearance hole for 1/2-13 bolts on 1-3/4" centers. Customer to provide lugs, bolts & additional hardware. Bolt length: 1-1/2" for single lug; 2" for back to back lugs.	444 (Belleville lock washer) 720 (Standard flat & lock)

## Output (Load) Connections

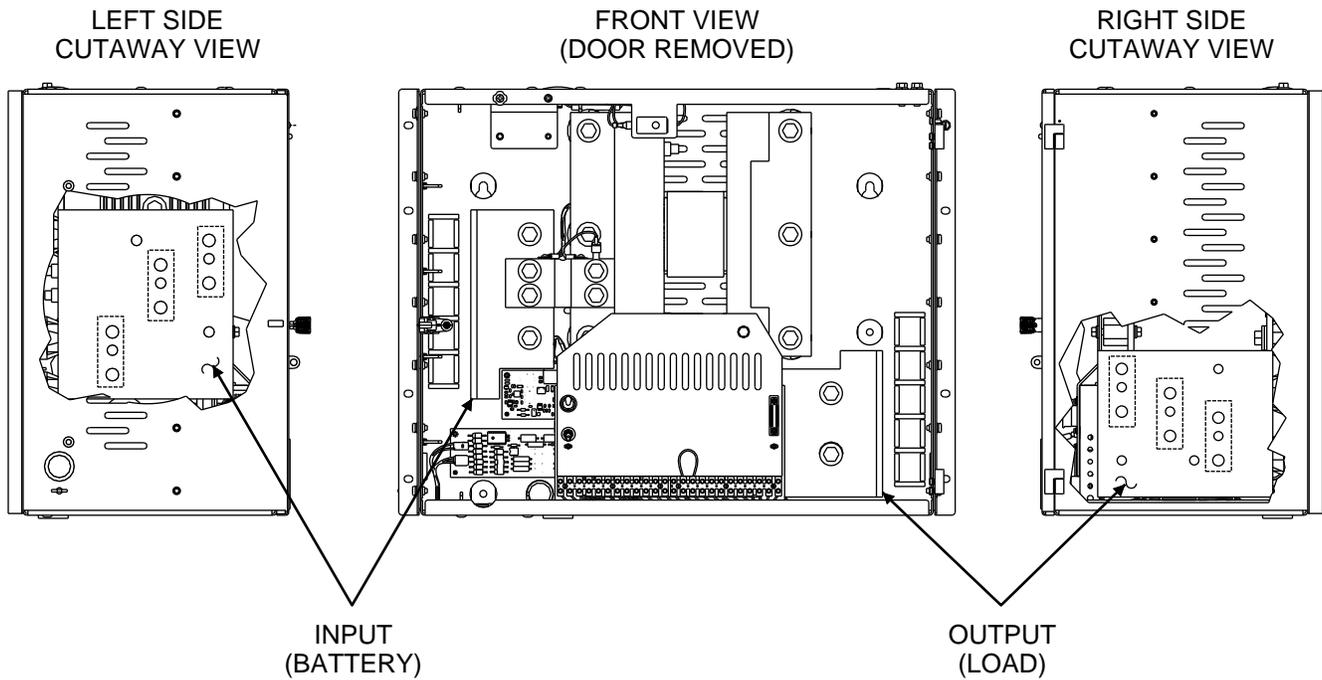
Refer to **Figure 4** when making output (Load) connections. The Output (Load) busbar allows top or bottom feed, and accommodates up to six lugs (back to back). If furnished, the optional rear extension busbar accommodates up to six lugs (back to back). Lugs must be supplied by the installer. Lug mounting hardware is furnished with the panel. Refer to System Application Guide SAG586400200 and drawing 031110100 for lug information.

Load connections are located at the right-hand side of the Battery Disconnect Panel. Rectangular cutouts are provided, which allow wiring to enter the assembly through the top, bottom, or rear panels. After the required cutout is removed, a furnished piece of edge guard should be cut to length and installed on all edges of the opening.

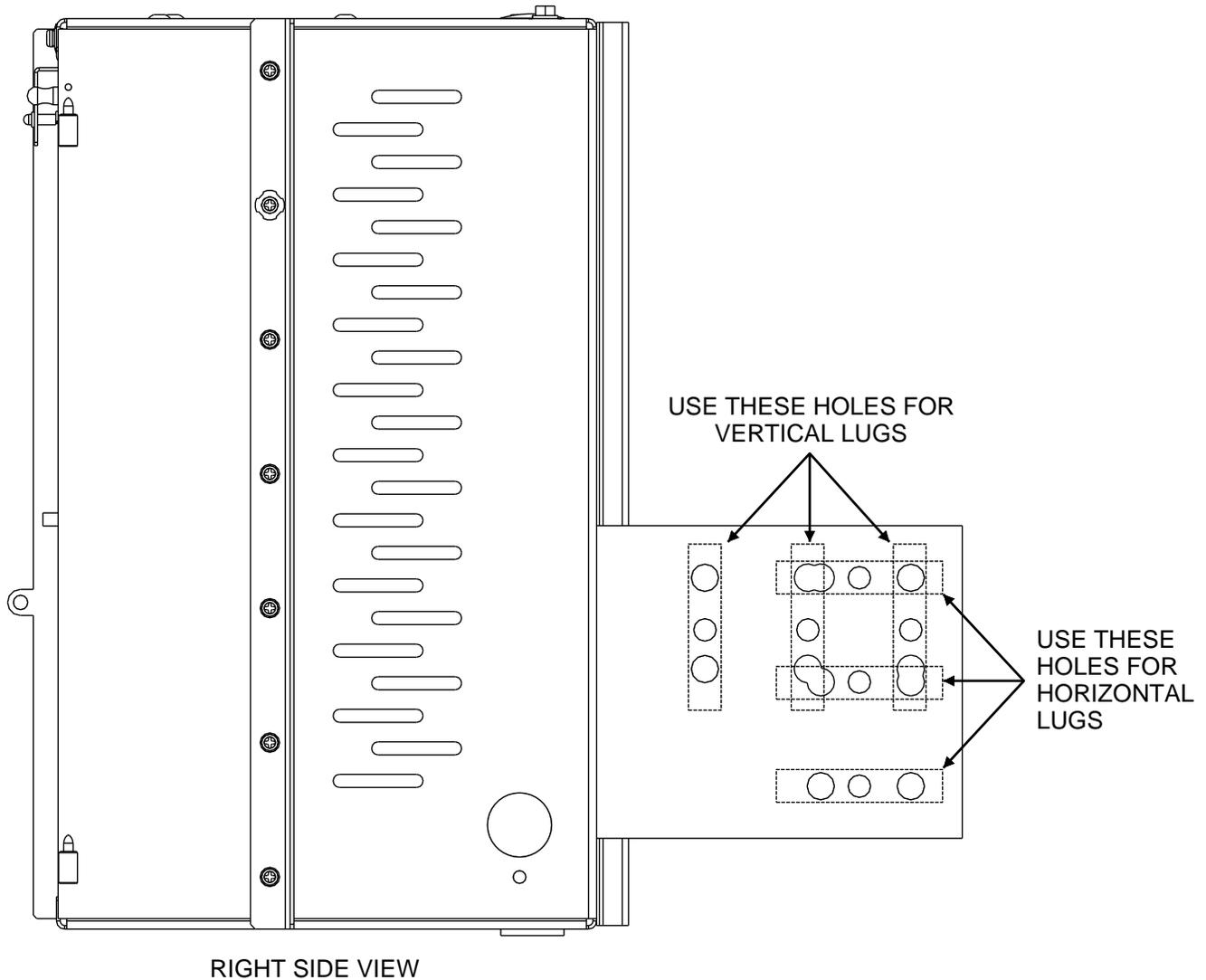
Use customer furnished bolts, washers, and hex nuts to mount lugs. Refer to **Table 3** for recommended bolts and recommended torque.

**NOTE!** If making connections to the optional rear extension busbar, first route wiring through the appropriate cutouts in the plastic safety cover. After input and output connections are completed, slide cover into place and attach. Refer to **Figure 3B**.

**Figure 4A:** Input and Output Connections



**Figure 4B:** Input and Output Connections with Optional Busbar Rear Extension Kit Installed (Input Busbar Shown; Output Busbar Similar.)



## External Alarm, Reference, and Control Connections

 **NOTE!** If making connections to the MCA of a Vortex or NETSURE Power System, see also the next section, “External Alarm, Reference, and Control Connections to a Vortex® or NETSURE™ Power System”.

External alarm, reference and control wiring should enter the cabinet through one of the circular openings available in the left side, right side, top, bottom, or rear panel. Each hole is sized to accept a 3/4" conduit fitting. If conduit is not required, apply a furnished edge guard to the opening before installing wires. Anchors for a plastic cable tie are provided to aid in wire routing, as shown in **Figure 5**.

Refer to **Figure 6** when making external alarm, reference and control connections. Screw-compression terminal blocks are provided. The terminal blocks accept 10-22 AWG wire. Strip approximately 1/4" of insulation from the end of the wire, then insert into the terminal block cavity, and tighten the screw. Recommended torque is 5 inch pounds.

 **ALERT!** Observe correct polarity when making the following connections. Reversing polarity may cause equipment damage.

1. **Controlled Battery Source (CBS):** Connect –BAT (List 1) or +BAT (List 11) to terminal 1 of terminal block TB2. Connect the Return (GND) lead to terminal 2 of TB2. Provide an external 1-1/3A fuse in the **ungrounded** lead.

 **NOTE!** An additional wire is also connected to terminal 2 of TB2. Ensure this lead is not removed.

2. **Fuse Alarm (FA):** In the event of an alarm condition, closed loop circuits will be provided between terminals 1 to 2, 4 to 5, and 7 to 8 of terminal block TB1, and open loop circuits will be provided between terminals 2 to 3, 5 to 6, and 8 to 9 of TB1.

 **NOTE!** Do not apply voltages higher than 42.4 volts AC (peak) or 60 volts DC.

3. **Door Alarm:** In the event of an alarm condition, a closed loop circuit will be provided between terminals 10 to 11 of terminal block TB1, and an open loop circuit will be provided between terminals 11 to 12 of TB1.

 **NOTE!** Do not apply voltages higher than 42.4 volts AC (peak) or 60 volts DC.

4. **Shunt POD Circuit Card:** For use with a compatible Vortex or NETSURE MCA only. The following connections should be made between the Shunt POD circuit card(s) and the MCA. Refer to **Figure 8**.
  - a) **DATA IN:** Connect terminal 6 of terminal block TB2 to the DATA OUT terminal of a previous Battery Disconnect Panel. If there is no previous Battery Disconnect Panel, make no connection to terminal 6.
  - b) **DATA OUT:** Connect terminal 7 of terminal block TB2 to the DATA IN terminal of the next Battery Disconnect Panel, or to the Vortex or NETSURE Power System MCA via the accessory Vortex or NETSURE Interface Cable.

5. **Emergency Power Off (EPO), Emergency Shutdown or Fire Alarm Disconnect:** Applying System Ground to terminal 5 of terminal block TB2 opens (releases) the contactor to disconnect battery from the system bus. System ground may be obtained at terminal 4 of TB2.

 **NOTE!** For applications in which a single-pole switch is used for Emergency Power Off (EPO), Emergency Shutdown or Fire Alarm Disconnect control of both the Battery Disconnect Panel and an associated Power System, a diode kit must be installed in series with the control lead of the Battery Disconnect Panel as follows:

- a) **List 1 (-48V System):** Install Part No. 534989 diode assembly as shown in **Figure 6B**. Check for correct diode polarity. Follow tool manufacturer's instructions when using crimp tool.
- b) **List 11 (+24V System):** Install Part No. 534993 diode assembly as shown in **Figure 6B**. Check for correct diode polarity. Follow tool manufacturer's instructions when using crimp tool.

6. **Shunt Output:** A signal that is proportional to shunt current is provided at terminals 8 (-) and 9 (+) of terminal block TB2.

 **NOTE!** The polarity shown is for Battery Discharge current in -48V systems and Battery Recharge current in +24V systems.

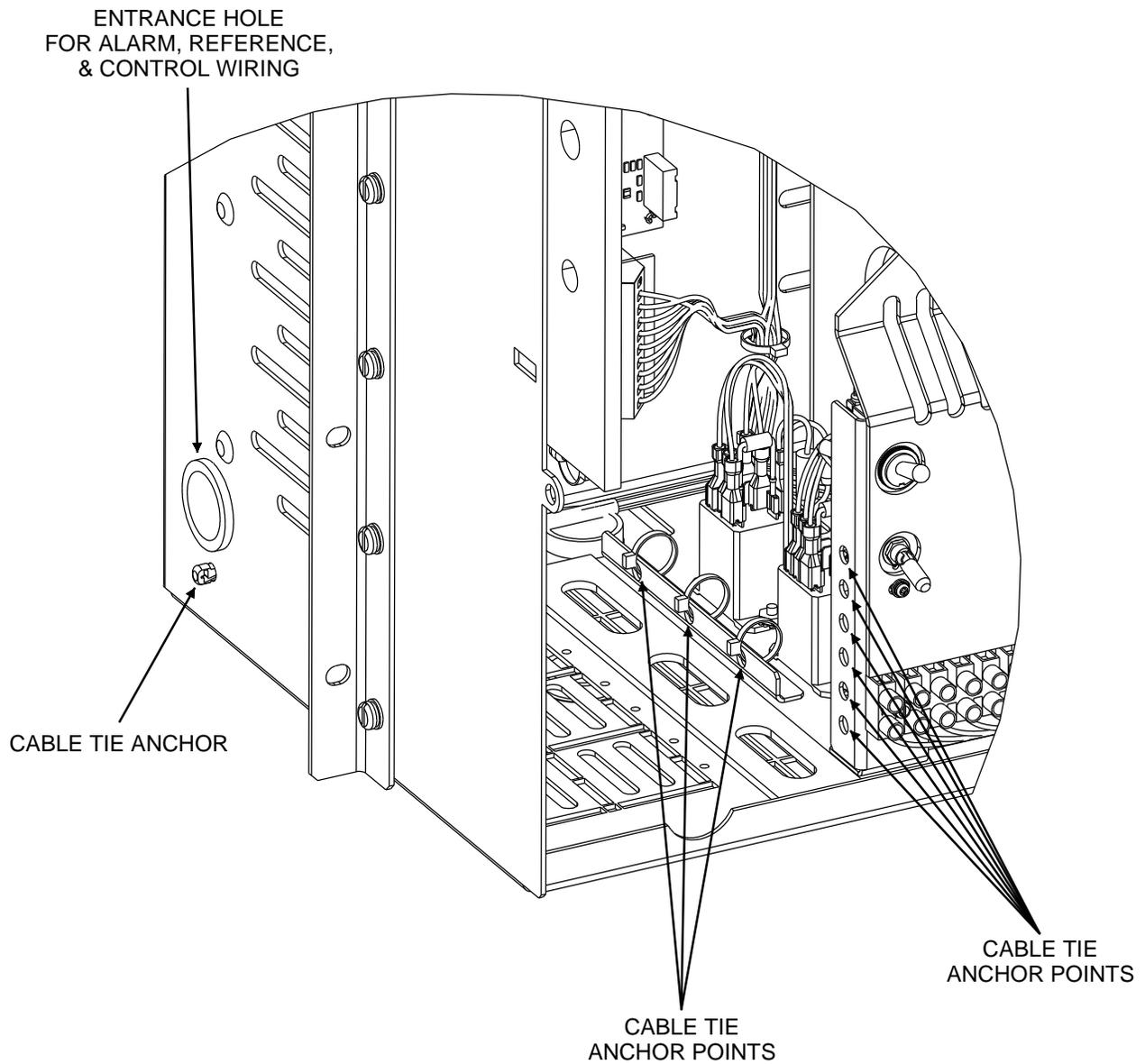
7. **Contact Control:** Applying System Ground to terminal 3 of terminal block TB2 closes (pulls in) the contactor to connect battery to the system bus (if Battery Disconnect switch S1 is in the NORMAL position). Removing System Ground from this terminal releases the contactor to disconnect battery from the system bus. System ground may be obtained at terminal 2 of TB2.

 **NOTE!** A jumper is factory connected between terminals 2 and 3 of TB2. If the Battery Disconnect is to be controlled by an external control device (such as LVD), remove the jumper, and replace with the external switch leads.

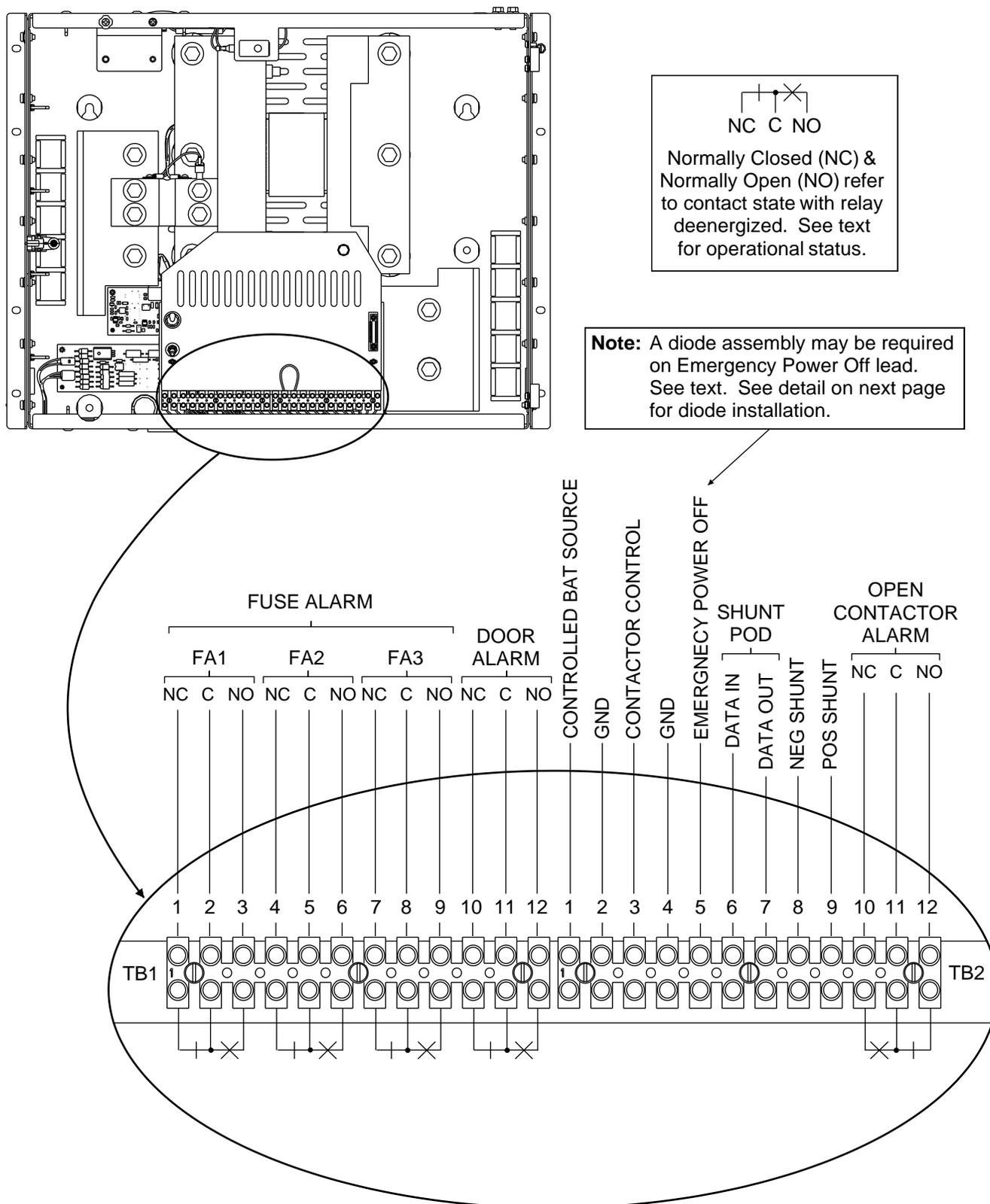
The Controlled Battery Source return lead is also connected to terminal 2 of TB2. Ensure this lead is not removed.

8. **Open Contactor Alarm:** When the contactor is energized (pulled in), contacts close between terminals 10 and 11 of terminal block TB2, and contacts open between terminals 11 and 12 of TB2. When the contactor is deenergized (released), contacts open between terminals 10 and 11 of terminal block TB2, and contacts close between terminals 11 and 12 of TB2.

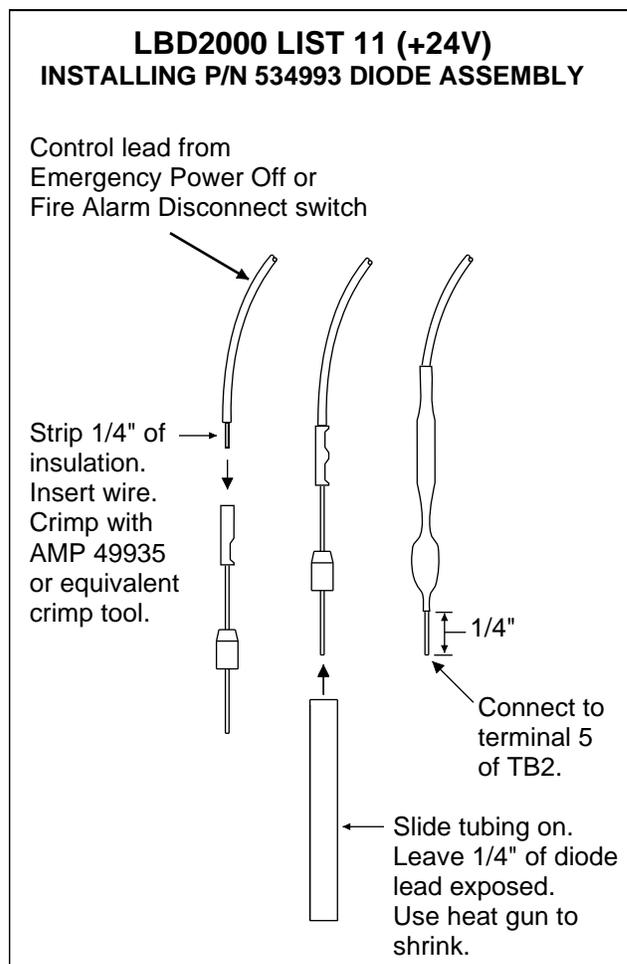
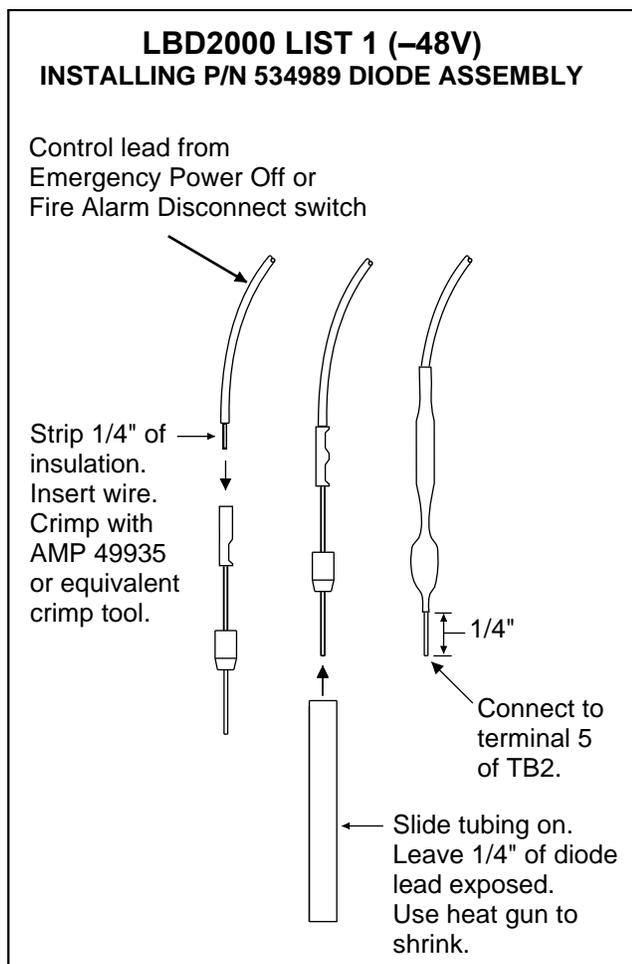
**Figure 5:** Alarm, Reference and Control Wiring Entrance and Cable Tie Anchor Locations  
(Left Side Shown—Right Side Similar)



**Figure 6A:** Alarm, Reference and Control Connections



**Figure 6B:** Detail Showing Installation of Diode Kit in Emergency Power Off Lead



## **External Alarm, Reference, and Control Connections to a Vortex® or NETSURE™ Power System**



**NOTE!** If the Battery Disconnect Panel will not be used with a Vortex® or NETSURE™ Power System, skip this section.

An accessory interface cable kit can be used to connect specific alarm, reference, and control leads of the Battery Disconnect Panel to the MCA of a Vortex or NETSURE Power System. Each kit consists of a cable and a resistor pigtail assembly. One end of the cable plugs into a connector in Power System. The un-terminated end of the cable connects to TB1 and TB2 in the Battery Disconnect Panel. Refer to System Application Guide SAG586400200 for kit ordering information. Refer to **Figure 7** for pin identification of the cable connector.

The following connections can be made between the Battery Disconnect Panel and the MCA of a Vortex or NETSURE Power System.

### **Spec.No. 581125000, 582125000 or 582126000 Power System**

1. Refer to **Figure 8A**.
2. **Shunt POD Data (J1 pin 14):** Connect the GREEN/WHITE lead of the kit-furnished harness to terminal 4 of TB2 in the Battery Disconnect Panel.
3. **System Fuse/Circuit Breaker Alarm (J1 pin 8):** To activate the System Fuse/Circuit Breaker Alarm circuit if a battery disconnect device opens:
  - a) Connect the RED/BLACK lead of the kit-furnished harness to terminal 1 of TB1 in the Battery Disconnect Panel.
  - b) Connect a kit-furnished resistor pigtail assembly between terminal 2 of TB1 and terminal 1 of TB2 in the Battery Disconnect Panel.



**NOTE!** Fused battery is also connected to terminal 1 of TB2, as described under External Alarm, Reference, and Control Connections. Ensure this lead is not removed.

- c) Make NO CONNECTION to terminal 3 of TB1 in the Battery Disconnect Panel.
4. **Emergency Power Off (EPO), Emergency Shutdown or Fire Alarm Disconnect (J1 pin 13):** To enable the power system's Emergency Power Off (EPO), Emergency Shutdown or Fire Alarm Disconnect circuit to open the Battery Disconnect contactor, connect the RED/WHITE lead of the kit-furnished harness to terminal 5 of TB2. Install a furnished diode assembly in the RED/WHITE lead being connected to terminal 5 of TB2 as follows:
  - a) **List 1 (-48V System):** Install Part No. 534989 diode assembly as shown in **Figure 6B**. Check for correct diode polarity. Follow tool manufacturer's instructions when using crimp tool.
  - b) **List 11 (+24V System):** Install Part No. 534993 diode assembly as shown in **Figure 6B**. Check for correct diode polarity. Follow tool manufacturer's instructions when using crimp tool.
5. If additional Battery Disconnect Panels are being installed, make connections from panel to panel as shown in **Figure 8A**. Installer is to provide wire.
6. After interface cable connections to the Battery Disconnect Panel are complete, connect the remaining end of the cable to connector J1, located in the Power System Main Bay (single-bay systems) or in the last Supplemental Bay (multiple-bay systems). J1 is located on the Interconnect/LVD Inhibit circuit card in the Distribution Cabinet. Refer to the documentation provides with the Power System for J1 access and location.

### **Spec. No. 582121900 Distribution Bay**

1. Refer to **Figure 8B**.
2. **Shunt POD Data:** Connect the RED lead of the kit-furnished harness to terminal 4 of TB2.
3. **System Fuse/Circuit Breaker Alarm:** To activate the System Fuse/Circuit Breaker Alarm circuit if a battery disconnect device opens:
  - a) Connect the BLACK lead of the kit-furnished harness to terminal 1 of TB1 in the Battery Disconnect Panel.
  - b) Connect a kit-furnished resistor pigtail assembly between terminal 2 of TB1 and terminal 1 of TB2 in the Battery Disconnect Panel.



**NOTE!** Fused battery is also connected to terminal 1 of TB2, as described under External Alarm, Reference, and Control Connections.

- c) Make NO CONNECTION to terminal 3 of TB1 in the Battery Disconnect Panel.
4. **Emergency Shutdown and Fire Alarm Disconnect:** Not applicable.
5. If additional Battery Disconnect Panels are being installed, make connections from panel to panel as shown in **Figure 8B**. Installer is to provide wire.
6. After interface cable connections to the Battery Disconnect Panel are complete, connect the remaining end of the cable to an available connector J3A or J2A in the Distribution Bay. Refer to the documentation provides with the Distribution Bay for J3A/J2A location.

### **Spec. No. 582121901 Distribution Bay**

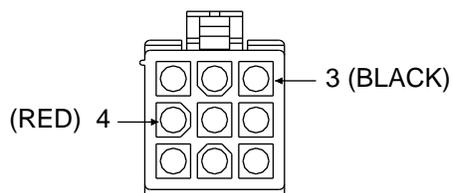
1. Refer to **Figure 8C**.
2. **Shunt POD Data (J3A/J2A pin 4):** Connect the ORANGE lead of the kit-furnished harness to terminal 4 of TB2.
3. **System Fuse/Circuit Breaker Alarm (J3A/J2A pin 7):** To activate the System Fuse/Circuit Breaker Alarm circuit if a battery disconnect device opens:
  - a) Connect the WHITE/BROWN lead of the kit-furnished harness to terminal 1 of TB1.
  - b) Connect a kit-furnished resistor pigtail assembly between terminal 2 of TB1 and terminal 1 of TB2.



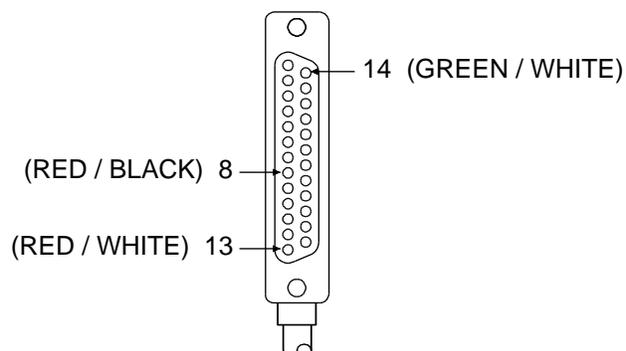
**NOTE!** Fused battery is also connected to terminal 1 of TB2, as described under External Alarm, Reference, and Control Connections.

- c) Make NO CONNECTION to terminal 3 of TB1.
4. **Emergency Shutdown and Fire Alarm Disconnect:** Not applicable.
5. If additional Battery Disconnect Panels are being installed, make connections from panel to panel as shown in **Figure 8C**. Installer is to provide wire.
6. After interface cable connections to the Battery Disconnect Panel are complete, connect the remaining end of the cable to an available connector J3A or J2A in the Distribution Bay. Refer to the documentation provides with the Distribution Bay for J3A/J2A location.

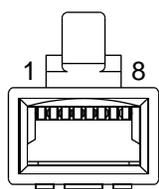
**Figure 7:** Vortex or NETSURE Interface Cable Pin Arrangement



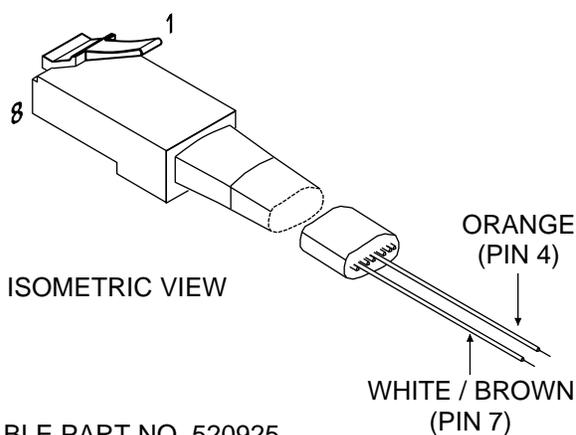
**PIN-SIDE VIEW**  
 CABLE PART NO. 540952  
 (P/O P/N 540951 KIT)  
 (MATES WITH JB IN SPEC. NO. 582121900 DISTRIBUTION BAY)



**PIN-SIDE VIEW**  
 CABLE PART NO. 520732  
 (P/O P/N 520983 KIT)  
 (MATES WITH J1 IN SPEC. NO. 581125000, 582125000 OR 582126000 MAIN BAY OR SUPPLEMENTAL BAY)

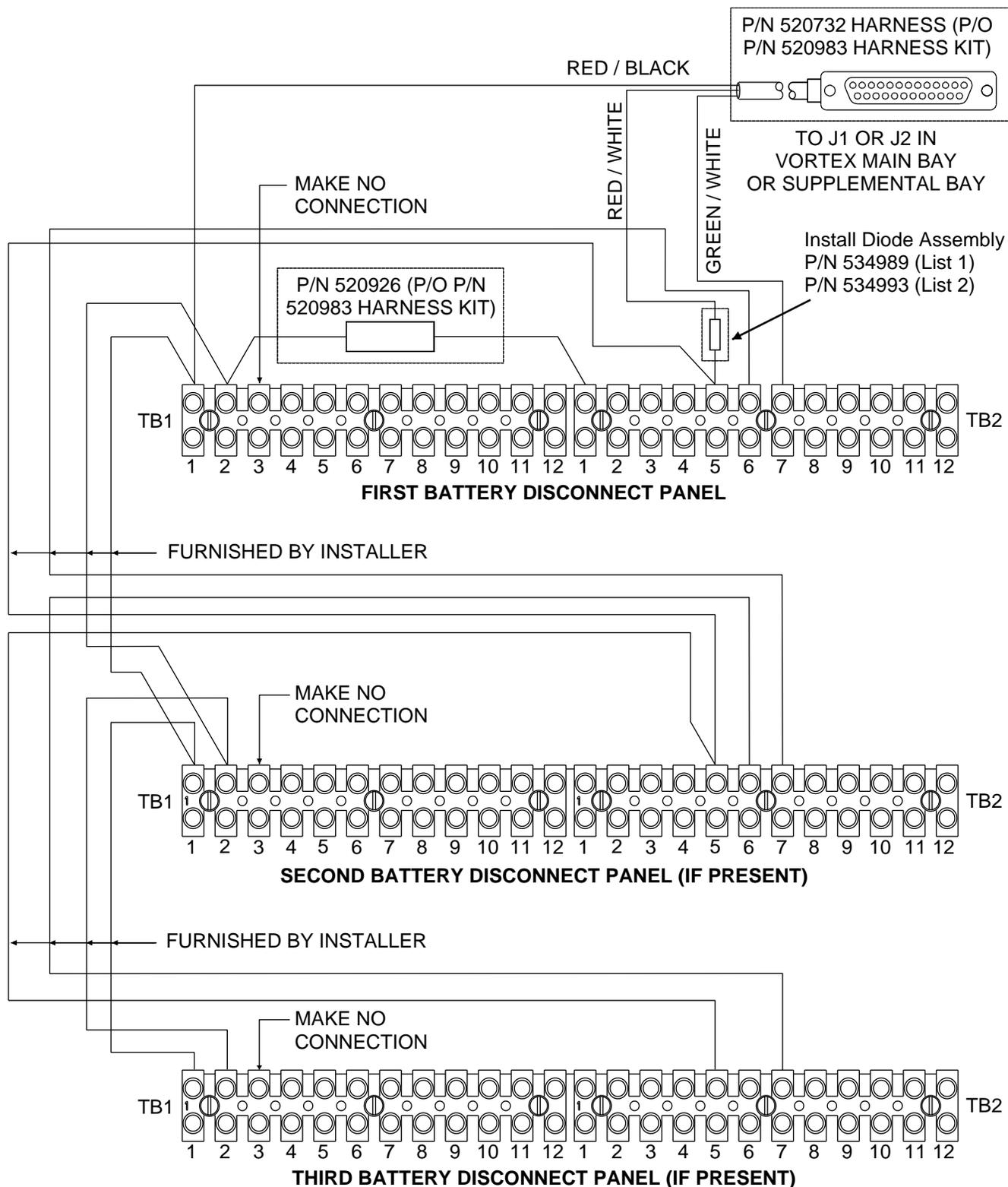


**PIN-SIDE VIEW**

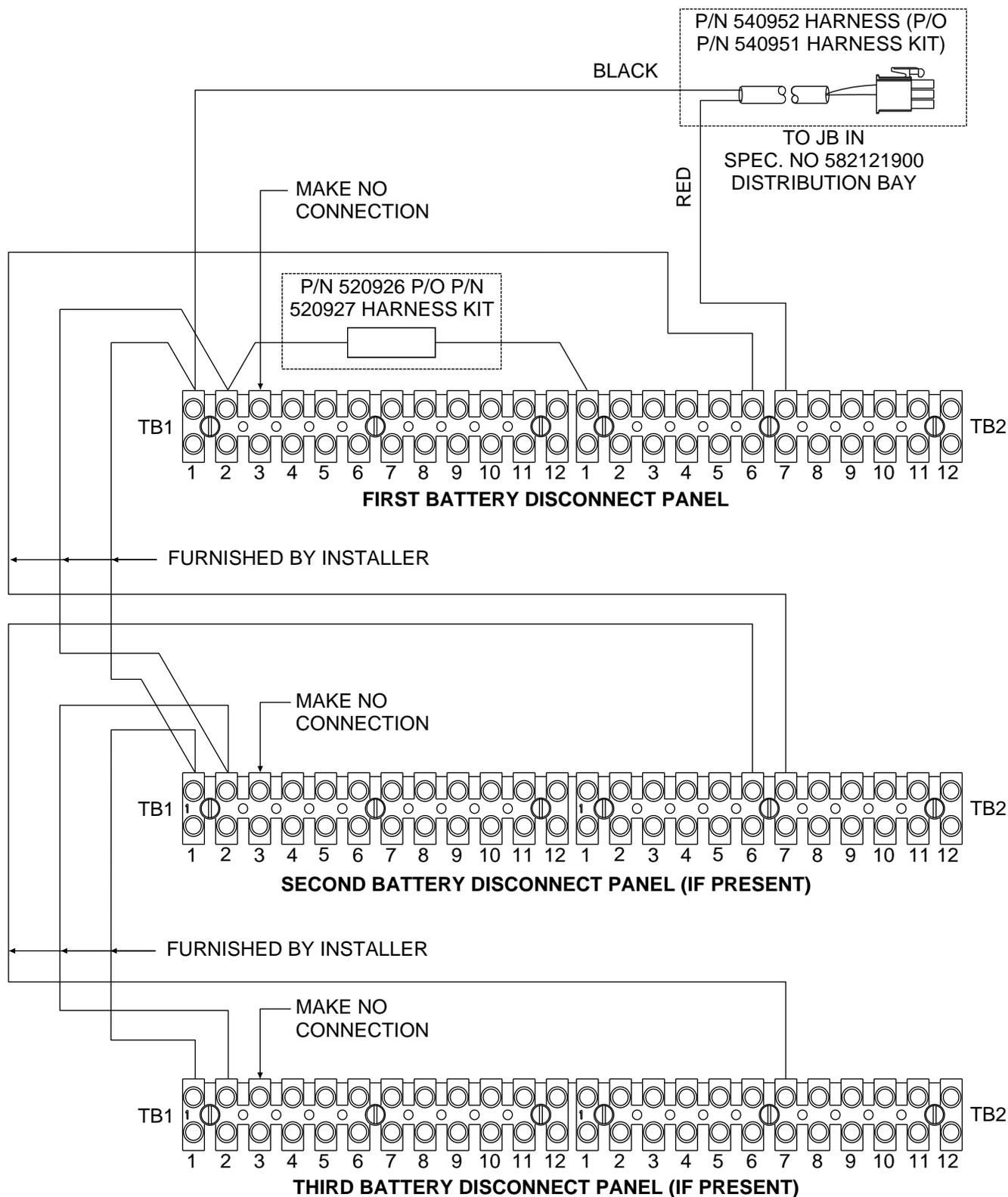


**ISOMETRIC VIEW**  
 CABLE PART NO. 520925  
 (P/O P/N 520927 KIT)  
 (MATES WITH J3A OR J2A IN VPS SPEC. NO. 582121901 DISTRIBUTION BAY)

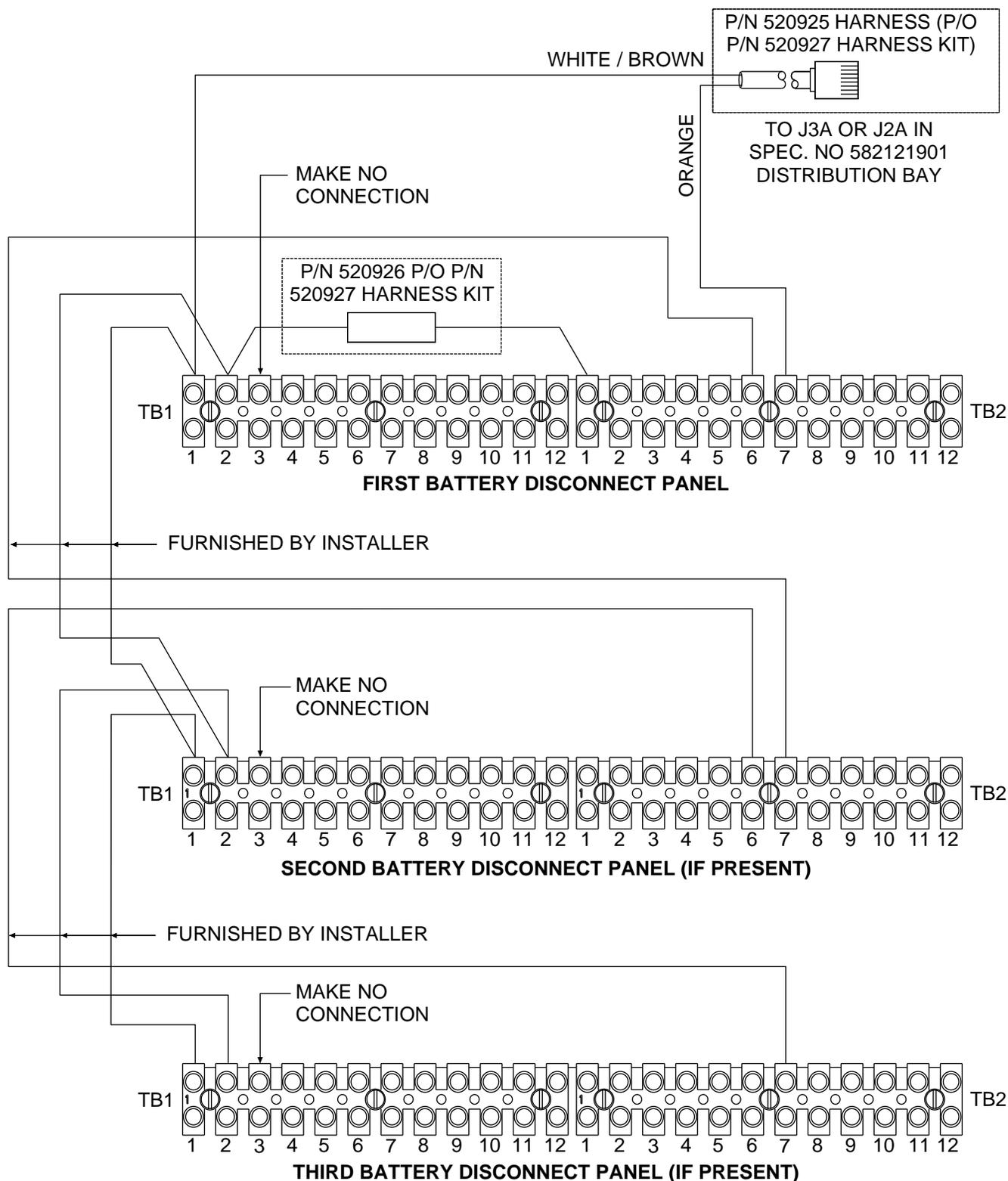
**Figure 8A:** Shunt POD Signal Interconnection with a Spec. No 581125000, 582125000 or 582126000 Main Bay or Supplemental Bay



**Figure 8B:** Shunt POD Signal Interconnection with a Spec. No 582121900 Distribution Bay



**Figure 8C:** Shunt POD Signal Interconnection with a Spec. No 582121901 Distribution Bay



## Initially Starting and Checking Operation

After all electrical connections have been made, perform the following procedures to start and verify Battery Disconnect Panel operation.

 **NOTE!** If the Battery Disconnect Panel is used in conjunction with a Vortex or NETSURE Power System, refer to the power system documentation for MCA checkout procedures.

### **Initial Startup**

1. If the front access door was removed prior to installing the Battery Disconnect Panel, reinstall the door now. Ensure the door ground wire is connected at both ends.
2. Ensure that a good alarm fuse is installed.
3. Verify the NORM/DISC (normal/disconnect) switch is in the NORM position.
4. Verify battery voltage is present at the input.
5. Verify the Controlled Battery Source (CBS) is connected and power is applied.

### **Checking Door Alarm (if connected)**

#### **Procedure:**

1. Close the front access door. Ensure the door is fully latched.
  - a) **Requirement:** External door alarm circuits are off.
2. Open the front access door.
  - a) **Requirement:** External door alarm circuits activate.
3. Pull the plunger of the door alarm switch fully out to a detent position.
  - a) **Requirement:** External door alarm circuits are off.

 **NOTE!** The alarm switch may be left in the “cutoff” position during the remainder of the checkout procedures. The switch will automatically return to normal operation when the door is closed.

### **Checking Contactor Alarm**

 **ALERT!** Battery will be disconnected from load during this procedure.

1. Place the NORM/DISC (normal/disconnect) switch is in the DISC position.
  - a) **Requirement:** Contactor opens (releases).
  - b) **Requirement:** CONTR ALARM indicator illuminates red.
  - c) **Requirement:** External Open Contactor alarms activate (if connected).
2. Place the NORM/DISC (normal/disconnect) switch is in the NORM position.
  - a) **Requirement:** Contactor closes (pulls in).
  - b) **Requirement:** CONTR ALARM indicator extinguishes.

- c) **Requirement:** External Open Contactor alarm resets (if connected).

### **Checking Fuse Alarm**

1. Remove the good alarm fuse from the fuseholder. Replace with a known open fuse.
  - a) **Requirement:** FUSE ALARM indicator illuminates red.
  - b) **Requirement:** External fuse alarm activate (if connected).
2. Remove the open alarm fuse. Replace with a good alarm fuse.
  - a) **Requirement:** FUSE ALARM indicator extinguishes.
  - b) **Requirement:** External fuse alarm resets (if connected).

### **Checking EPO (Emergency Power Off) Function**



**NOTE!** *This procedure may be skipped if the EPO function is not being used.*

1. Activate external EPO switch (applies ground to TB2 terminal 5).
  - a) **Requirement:** Contactor opens (releases).
  - b) **Requirement:** CONTR ALARM indicator illuminates red.
  - c) **Requirement:** External Open Contactor alarms activate (if connected).
2. Reset external EPO switch (removes ground from TB2 terminal 5).
  - a) **Requirement:** Contactor remains open (released).
  - b) **Requirement:** CONTR ALARM indicator remains illuminated red.
  - c) **Requirement:** External Open Contactor alarms remain activated (if connected).
3. Depress and release EPO RESET switch on Battery Disconnect Panel.
  - a) **Requirement:** Contactor closes (pulls in).
  - b) **Requirement:** CONTR ALARM indicator extinguishes.
  - c) **Requirement:** External Open Contactor alarm resets (if connected).

### **Final Steps**

Close the front access door. Ensure the door is latched. Lock the latch by turning screw in latch handle 1/4-turn clockwise.

Verify that there are no local or remote alarms active.

# OPERATION

## Controls and Indicators

Refer to **Figure 9**.

**CONTACTOR DISCONNECT Switch:** Placing this locking-type toggle switch in the NORM position closes the disconnect contactor if ground is present on the LVD Control terminal (TB2-3). Placing the switch in the DISC position causes the contactor to open (release).

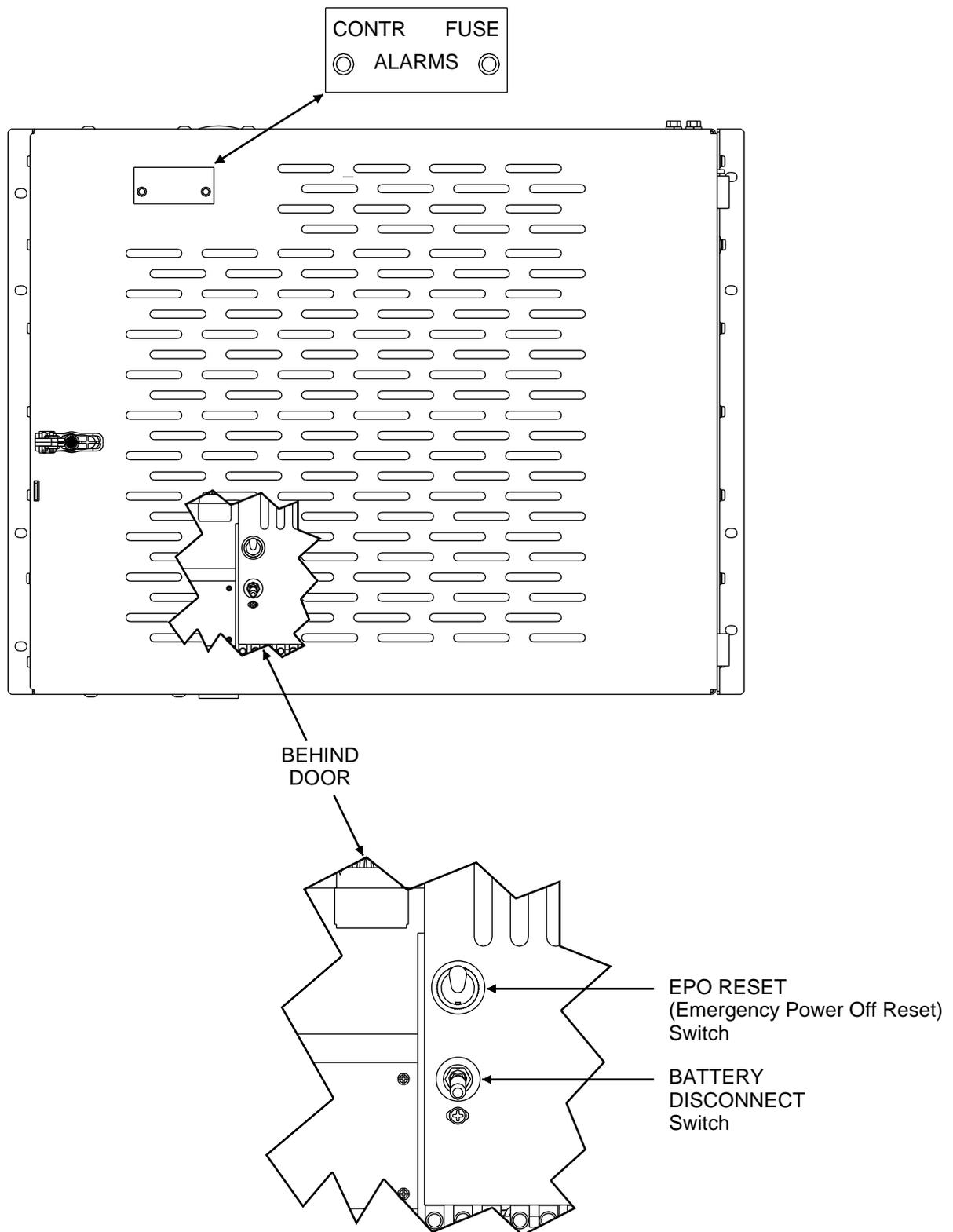
**EPO RESET (Emergency Power Off Reset) Switch:** Following application and removal of a ground signal at the EPO terminal, depressing and releasing this momentary toggle switch closes (pulls in) the contactor to reconnect battery to the load.

**FUSE ALARM Indicator:** This red LED illuminates to indicate the fuse has opened.

**CONTR ALARM Indicator:** This red LED illuminates to indicate that the contactor has opened (released).

 **NOTE!** *When the disconnect contactor is open and rectifier output has also been disabled, LEDs on the Battery Disconnect Panel will not illuminate.*

**Figure 9:** Controls and Indicators



# REPAIR PROCEDURES

## Safety Statement



**DANGER!** Installation of this equipment should only be performed by a qualified installer following approved safety procedures.

This equipment is used in conjunction with batteries. Batteries are an energy source that can produce high amounts of electrical current. NEVER allow a metal object, such as a tool, to contact more than one termination at a time, or to simultaneously contact a termination and a grounded object, such as the metal case of the Battery Disconnect Panel. Even a momentary short circuit can cause an explosion resulting in injury. To avoid such short circuits and to avoid injury:

- Remove watches, bracelets and rings.
- Use only tools having insulated handles.
- If insulated tools are not available, completely cover tool handles with a minimum of three half-lapped layers of electrical tape.
- Ensure that wrenches with more than one working end have only one end exposed.
- Wear eye protection at all times.

## Door Alarm Cutoff Feature

If a door alarm is connected to the Battery Disconnect Panel, the alarm may be inhibited during repair procedures by pulling the plunger on the door switch fully out to a detent position. The alarm switch will automatically return to normal operation when the door is closed.

## Replacing the Fuse

When replacing the fuse, it is recommended that the fuse mounting hardware also be replaced. Refer to System Application Guide SAG586400200 for part numbers for fuses and a fuse hardware kit.



**DANGER!** The fuse and all busbars are connected to battery. Read and follow the Safety Statement at the beginning of this Repair Procedures section.



**ALERT!** Perform the following steps in the order presented; otherwise damage to the replacement fuse may occur.



**ALERT!** The fuse uses 3/8-24 x 1" mounting bolts. **DO NOT SUBSTITUTE** or the fuse will be damaged. If new bolts are required, a hardware kit is available. Refer to System Application Guide SAG586400200 for kit part number.

### Procedure to Remove Fuse:



**NOTE!** Refer to **Figure 10** as this procedure is performed.

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system.
2. Open the front access door. To do so, unlock the door latch by turning screw in latch handle 1/4-turn counterclockwise. Then pull outward on the latch handle to release.

3. Place the CONTACTOR DISCONNECT switch in the DISC position. Verify that the contactor has opened (released).
4. Remove the contactor cover. To do so, remove the one (1) 1/4-20 x 1/2" screw and the two (2) 4-40 screws that secure it.
5. Loosen but do not remove two (2) 3/8-16 x 3/4" hex head bolts at the right side of the contactor.
6. Loosen but do not remove three (3) 3/8-16 x 3/4" hex head bolts on the Right Side Vertical Busbar.



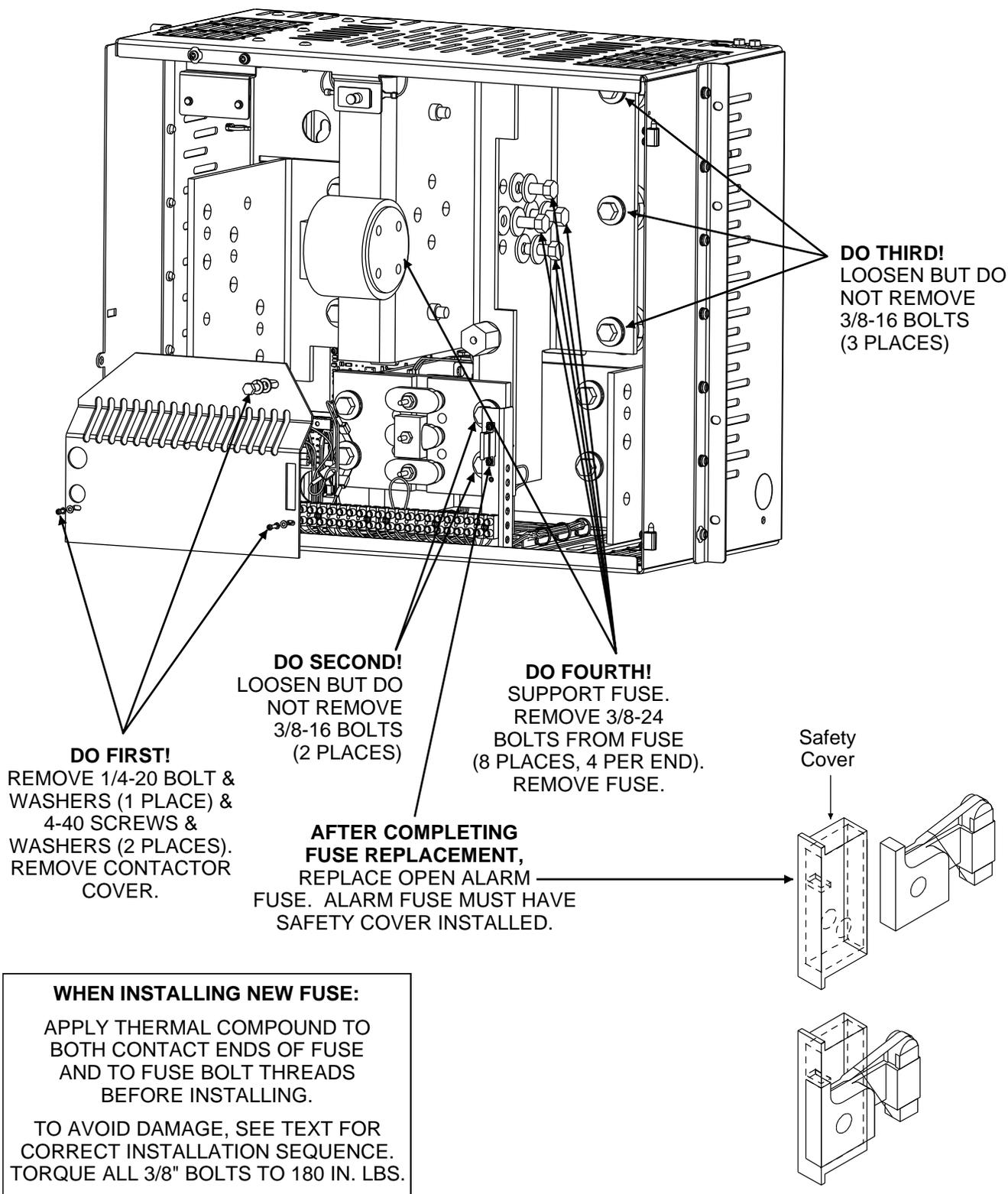
**ALERT!** In the next step, the fuse weighs approximately 4 pounds. **DO NOT** allow it to drop when removing the screws that hold it.

7. Remove four (4) 3/8-24 x 1" hex head screws at each side of the fuse. Remove the fuse.

#### **Procedure to Install Fuse**

1. Apply a thin coating of thermal compound to each end of the replacement fuse. Also apply thermal compound to the threads of the eight (8) 3/8-24 x 1" hex head screws that will secure the fuse.
2. Hold the replacement fuse in position and install the eight (8) 3/8-24 x 1" hex head screws and washers to secure it. Installation order is: bolt, Belleville washer, flat washer, busbar, fuse. Tighten screws FINGER TIGHT ONLY at this time.
3. Tighten the eight (8) 3/8-24 x 1" hex head screws that secure the fuse. Torque to 180 inch pounds.
4. Tighten the three (3) previously loosened 3/8-16 x 3/4" hex head bolts on the Right Side Vertical Busbar. Torque to 180 inch pounds.
5. Tighten the two (2) 3/8-16 x 3/4" hex head bolts on the right side of the contactor. Torque to 180 inch pounds.
6. Reinstall the contactor cover. Secure with the previously removed 1/4-20 x 1/2" and 4-40 screws.
7. Replace the alarm fuse. Ensure a safety cover is in place on the replacement fuse, as shown in the figure.
8. Place the CONTACTOR DISCONNECT switch in the NORM position. Verify that the contactor has closed (pulled in).
9. Close the cabinet front door. Ensure the door is latched. Lock the latch by turning screw in latch handle 1/4-turn clockwise.
10. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
11. Verify that there are no local or remote alarms active.

**Figure 10:** Replacing the Fuse



## Replacing the Contactor

Refer to System Application Guide SAG586400200 for part numbers.



**DANGER!** The fuse and all busbars are connected to battery. Read and follow the Safety Statement at the beginning of this Repair Procedures section.

Battery and all other sources of battery voltage must be completely disconnected from this Battery Disconnect Panel before replacing the contactor. Using a voltmeter, measure from the input busbar to system ground and from the output busbar to system ground. Verify no voltage is present.



**NOTE!** Refer to **Figure 11** as this procedure is performed.

### Procedure to Remove Contactor

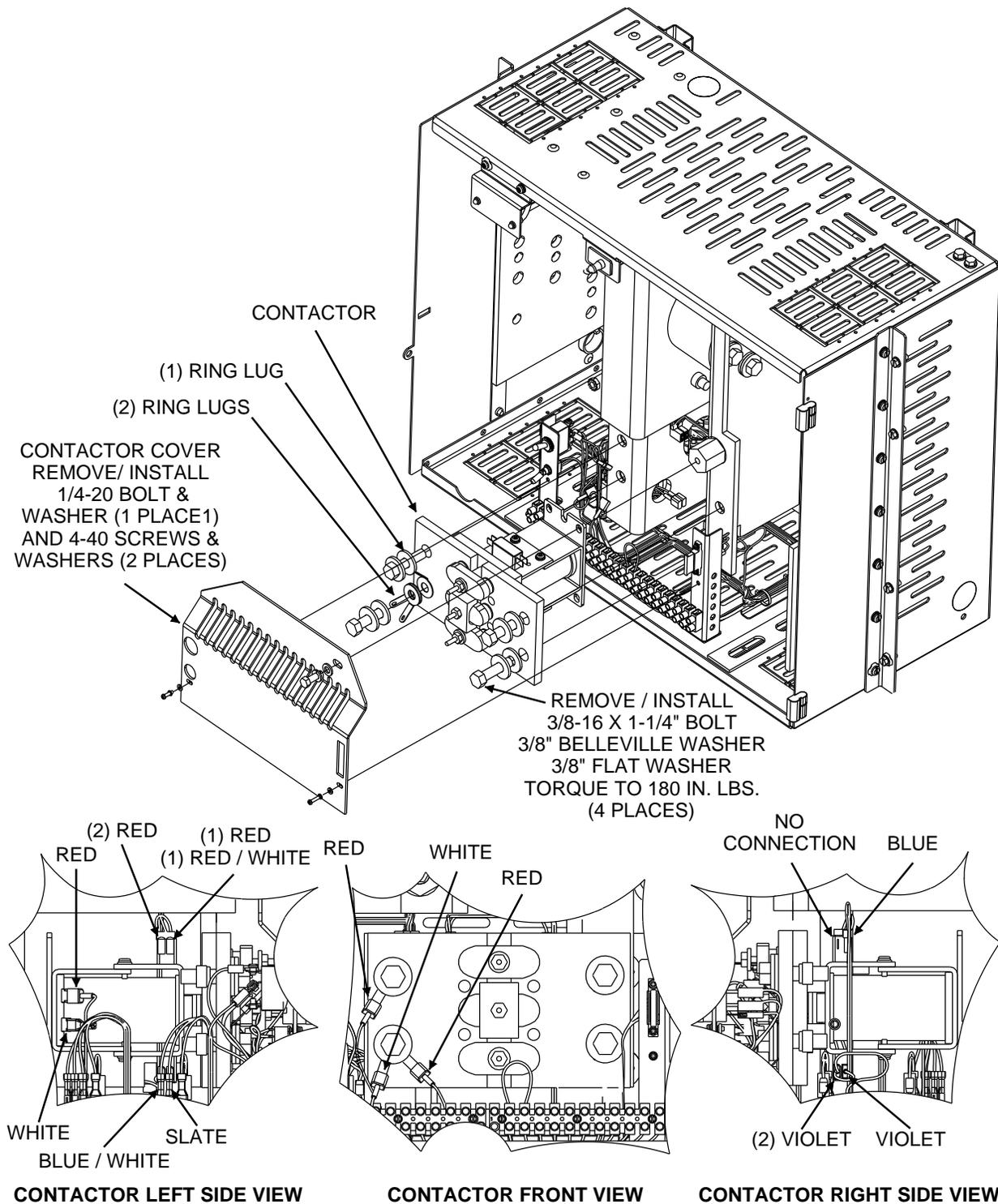
1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system.
2. Open the front access door. To do so, unlock the door latch by turning screw in latch handle 1/4-turn counterclockwise. Then pull outward on the latch handle to release.
3. Remove the contactor cover. To do so, remove the one (1) 1/4-20 x 1/2" screw and the two (2) 4-40 screws that secure it.
4. **Remove all sources of battery voltage from the Battery Disconnect Panel.** Use a voltmeter to verify no voltage is present on either side of the contactor before proceeding.
5. Disconnect all 22 AWG wires from the contactor as shown in the three details of **Figure 11**.
6. Remove four (4) 3/8-16 x 1-1/4" hex head bolts and associated washer from the contactor as shown in the figure. Retain the bolts, washers and ring lugs. Remove the contactor.

### Procedure to Install Contactor

1. Apply a thin coating of electrical anti-oxidizing compound to the mating surfaces of the busbars and contactor.
2. Place the contactor in position and secure with the four (4) 3/8-16 x 1-1/4" hex head bolts previously removed. Reinstall ring lugs on two of the bolts as shown in the figure. Tighten bolts to the recommended torque shown in the figure.
3. Reconnect all 22 AWG wires to the contactor as shown in the three details of **Figure 11**.
4. Reinstall the contactor cover. Secure with the previously removed 1/4-20 x 1/2" and 4-40 screws.
5. Reconnect battery voltage sources to the Battery Disconnect Panel.
6. Place the CONTACTOR DISCONNECT switch in the NORM position. Verify that the contactor has closed (pulled in).
7. Close the cabinet front door. Ensure the door is latched. Lock the latch by turning screw in latch handle 1/4-turn clockwise.

8. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
9. Verify that there are no local or remote alarms active.

**Figure 11:** Replacing the Contactor



## Replacing a Shunt POD Circuit Card (Part No. 501981)



**DANGER!** The fuse and all busbars are connected to battery. Read and follow the Safety Statement at the beginning of this Repair Procedures section.



**ALERT!** Circuit cards used in this equipment contain static-sensitive devices. Read the Static Warning page at the front of this manual before performing the following procedure.



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



**NOTE!** Refer to **Figure 12** as this procedure is performed.

### **Procedure:**

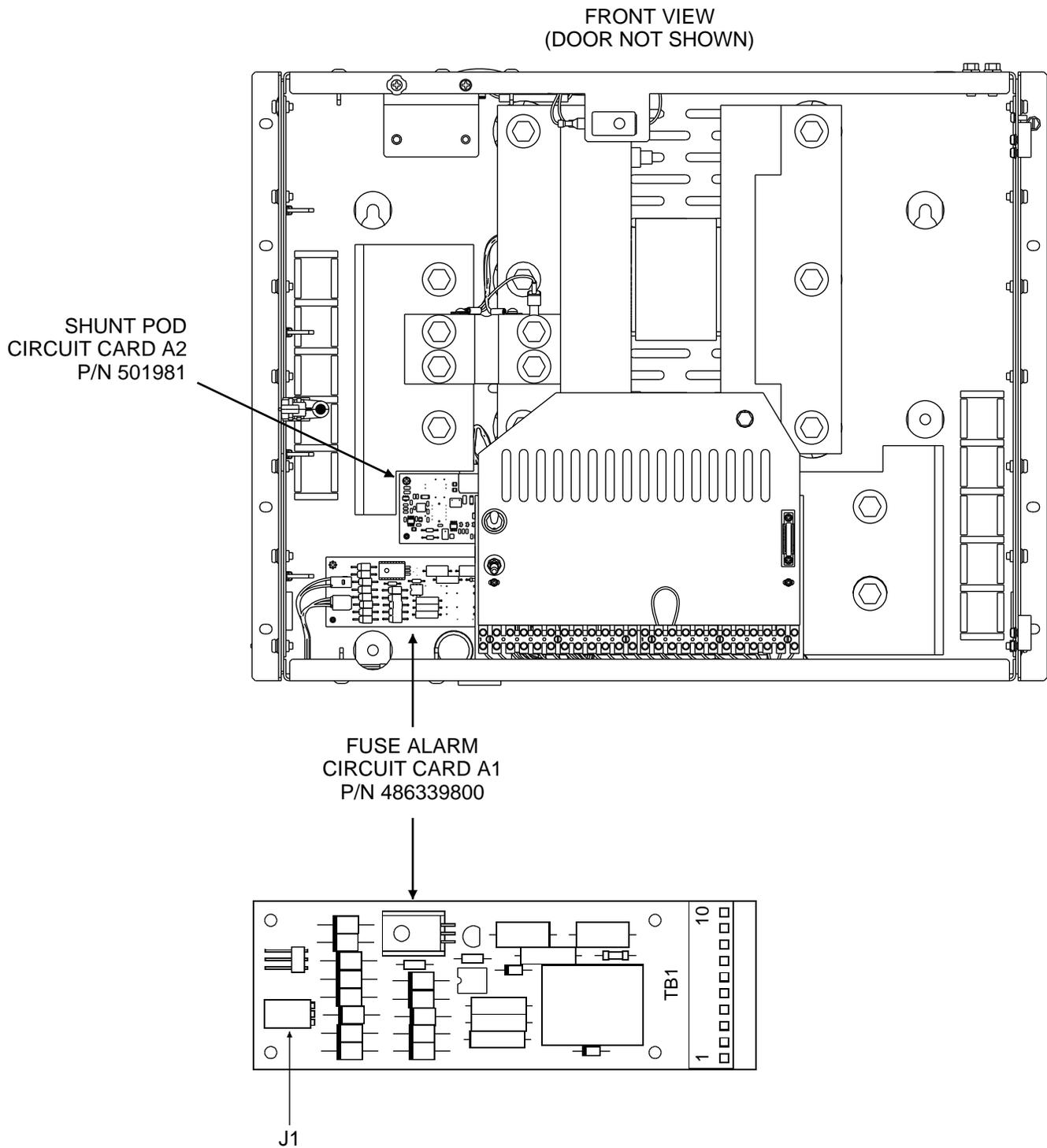
1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system.
2. Open the front access door. To do so, unlock the door latch by turning screw in latch handle 1/4-turn counterclockwise. Then pull outward on the latch handle to release.



**ALERT!** 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. Disconnect the mating plug from connector J1 on the circuit card.
5. Remove the screw that secures one corner of the circuit card. Carefully lift the circuit card from its three mounting posts. Remove the card from the cabinet.
6. Check the settings of switches S1 and S2 on the replacement circuit card, and adjust as necessary. See Setting User Selections in the Installation section of this document for a procedure.
7. Install the replacement circuit card into the location previously vacated. Carefully press card down over its three mounting posts. Install and tighten the one mounting screw.
8. Reconnect the mating plug to connector J1 on the circuit card. Insert fully to ensure the plug locks in place.
9. Remove the grounding wrist strap.
10. Close the cabinet front door. Ensure the door is latched. Lock the latch by turning screw in latch handle 1/4-turn clockwise.
11. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
12. Verify that there are no local or remote alarms active.

**Figure 12:** Replaceable Circuit Card Locations



## Replacing a Fuse Alarm Circuit Card (Part No. 486339800)



**DANGER!** The fuse and all busbars are connected to battery. Read and follow the Safety Statement at the beginning of this Repair Procedures section.



**ALERT!** Circuit cards used in this equipment contain static-sensitive devices. Read the Static Warning page at the front of this manual before performing the following procedure.



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



**NOTE!** Refer to **Figure 12** as this procedure is performed.

### **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.
2. Open the front access door. To do so, unlock the door latch by turning screw in latch handle 1/4-turn counterclockwise. Then pull outward on the latch handle to release.



**ALERT!** 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. Disconnect the mating plug from connector J1 on the circuit card.



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

5. Identify the wires connected to TB1 on the circuit card. These wires must be connected to the same terminals on the replacement circuit card.
6. READ AND UNDERSTAND THIS ENTIRE STEP BEFORE PROCEEDING. One wire at a time, disconnect external alarm wiring from terminal block TB1 on the circuit card. DO NOT allow bare wire end to contact any grounded or energized object. Isolate the wire end with electrical tape or sleeving. Repeat for each wire.
7. Remove the screw that secures one corner of the circuit card. Carefully lift the circuit card from its three mounting posts. Remove the card from the cabinet.
8. Install the replacement circuit card into the location previously vacated. Carefully press card down over its three mounting posts. Install and tighten the one mounting screw.
9. Reconnect the mating plug to connector J1 on the circuit card. Insert fully to ensure the plug locks in place.



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

10. READ AND UNDERSTAND THIS ENTIRE STEP BEFORE PROCEEDING. One wire at a time, reconnect external alarm wiring to terminal block TB1 on the circuit card. DO NOT allow bare wire end to contact any grounded or energized object.
11. Remove the grounding wrist strap.
12. Close the cabinet front door. Ensure the door is latched. Secure latch by turning screw in latch handle 1/4-turn clockwise.
13. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
14. Verify that there are no local or remote alarms active.

