

# Smart BDFB

Technical Guide 9400009-J0

Effective: 05/2018





# Alpha Breaker Distribution Fuse Bay Smart BDFB



**NOTE:**

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Equipment to be installed in restricted access areas by qualified technicians only.



**NOTE:**

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Photographs contained in this manual are for illustrative purposes only. These photographs may not match your installation.



**NOTE:**

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Operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are questions regarding the safe operation of this powering system, contact Alpha Technologies or your nearest Alpha representative.



**NOTE:**

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# 1. Safety


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**SAVE THESE INSTRUCTIONS:** This manual contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies or the nearest Alpha representative.


## 1.1 Safety Symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

The use of **ATTENTION** indicates specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.

 **NOTE:**  
**A NOTE provides additional information to help complete a specific task or procedure. Notes are designated with a checkmark, the word NOTE, and a rule beneath which the information appears**

 **CAUTION!**  
**CAUTION indicates safety information intended to PREVENT DAMAGE to material or equipment. Cautions are designated with a yellow warning triangle, the word CAUTION, and a rule beneath which the information appears.**

 **WARNING!**  
**WARNING presents safety information to PREVENT INJURY OR DEATH to personnel. Warnings are indicated by a shock hazard icon, the word WARNING, and a rule beneath which the information appears.**

 **HOT!**  
**The use of HOT presents safety information to PREVENT BURNS to the technician or user.**

## 1.2 General Warning and Cautions

 **WARNING!**  
**You must read and understand the following warnings before installing the enclosure and its component. Failure to do so could result in personal injury or death.**

- Read and follow all instructions included in this manual.
- Only trained personnel are qualified to install or replace this equipment and its components.
- Use proper lifting techniques whenever handling equipment, parts, or batteries.

## 1.3 Electrical Safety



### WARNING!

**Hazardous voltages are present at the input of power systems. The DC output from rectifiers and batteries, though not dangerous in voltage, has a high short-circuit current capacity that may cause severe burns and electrical arcing.**

Before working with any live battery or power system, follow these precautions:

- a. Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
- b. Wear safety glasses with side shields at all times during the installation.
- c. Use OSHA approved insulated hand tools. Do not rest tools on top of batteries.



### WARNING!

**Lethal voltages are present within the power system. Always assume that an electrical connection or conductor is energized. Check the circuit with a voltmeter with respect to the grounded portion of the enclosure (both AC and DC) before performing any installation or removal procedure.**

- Do not work alone under hazardous conditions.
- A licensed electrician is required to install permanently wired equipment. Input voltages can range up to 240 Vac. Ensure that the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.
- The enclosure which contains the DC or AC power system along with customer installed radios must remain locked at all times, except when authorized service personnel are present.
- Always assume electrical connections or conductors are live. Turn off all circuit breakers and double-check with a voltmeter before performing installation or maintenance.
- Place a warning label on the utility panel to warn emergency personnel that a reserve battery source is present which will power the loads in a power outage condition or if the AC disconnect breaker is turned off.
- At high ambient temperature conditions, the internal temperature can be hot so use caution when touching the equipment.

## 1.4 Battery Safety

- Never transport an enclosure with batteries installed. Batteries must ONLY be installed after the enclosure has been securely set in place at its permanent installation location. Transporting the unit with batteries installed may cause a short circuit, fire, explosion, and/or damage to the battery pack, enclosure and installed equipment.
- Servicing and connection of batteries must be performed by, or under the direct supervision of, personnel knowledgeable of batteries and the required safety precautions.
- Batteries contain or emit chemicals known to cause cancer and birth defects or other reproductive harm. Battery post terminals and related accessories contain lead and lead compounds. Wash your hands after handling batteries.



### WARNING!

**Follow battery manufacturer's safety recommendations when working around battery systems. Do not smoke or introduce an open flame when batteries (especially vented batteries) are charging. When charging, batteries vent hydrogen gas, which can explode.**

- Batteries are hazardous to the environment and should be disposed at a recycling facility. Consult the battery manufacturer for recommended local authorized recyclers.

## 2. Introduction

### 2.1 Scope of the Manual

This instruction manual explains the features, installation, interconnection and startup of the Alpha Breaker Distribution Fuse Bay (BDFB) high capacity distribution system. Images contained in this document are for illustrative purposes only and may not exactly match your installation.

### 2.2 Product Overview

Alpha's BDFB is a high capacity distribution system designed to be fed from a -48V power system, bringing power closer to the connected equipment and increasing the number of load distribution points. The system has been designed based on standard rear access for input feeder cable and secondary load cable terminations. It can be configured from a dual feed up to eight feeds, with each individual panel providing up to 20 secondary load positions.

Alpha's Smart BDFB provides a total system capacity of up to 5120A, divided into two banks (A and B). Each bank has four panels, enabling customers to obtain full utilization of the current (from the primary power plant).

Cable management bus kits provide additional options, while optimally designed buswork with 25mV current shunts are used to maximize efficiency and reduce costs. Each system includes a digital meter for monitoring the voltage, current and breaker trip status of each panel and system level alarms.

### 2.3 Product Features

- Secondary distribution solution for cell site, CO, MSC, data center and cable headend facilities
- Total system capacity of up to 5120A
- Flexible dual, quad, six or eight feed options with a maximum rating of 640A per feed
- Each panel consists of 20 secondary load positions
- Flexible circuit breaker and TPS fuse options
- Options for internal and external return
- Optional Ethernet to CAN communication.

A digital meter with the following features:

- Voltage, current and breaker status display for each channel
- Alarm for lost feed (under voltage), over current, and breaker trip on each individual panel
- System alarms for each alarm type, on any panel
- Audible alarm, top mounted LED, and dry contacts for each alarm

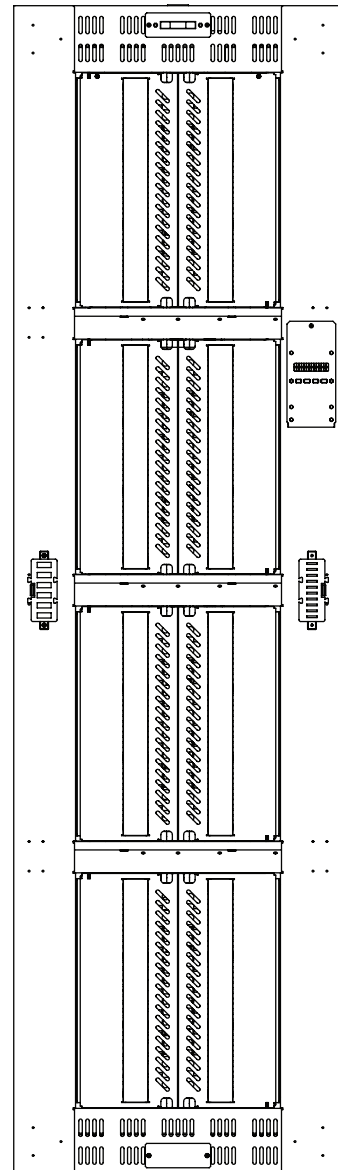


Figure 1 — BDFB, 8-feed secondary distribution system, 24"

# 3. Specifications

## 3.1 Product Specifications

Electrical	
<b>System Voltage:</b>	-48V
<b>Output Current per Load/Panel:</b>	640A max
<b>Number of Loads/Panels per bay:</b>	2, 4, 6 or 8
<b>Secondary Load Positions:</b>	20 positions per panel
<b>Over Current Protection:</b>	TPS/TLS Plug in bullet up to 125A
	Single pole LEL breaker up to 100A
	Double pole LEL breaker up to 200A
	Triple pole LEL breaker up to 300A
Distribution & Termination	
<b>Input Feed Cables</b>	
<b>Termination Details:</b>	3/8" dia. on 1" centers or 1/2" on 1/3/4" centers
<b>Secondary Load Cables</b>	
<b>Termination Details:</b>	1 pole are 1/4" dia. on 5/8" centers
	2 pole and 3 pole are 3/8" dia. on 1" centers
<b>Internal Ground Bar:</b>	1/4" dia. on 1" centers (lug adapters for 2 and 3 pole)
<b>External Ground Bar:</b>	20 x 1/4" dia. on 5/8" centers and 7 x 3/8" dia. on 1"centers
<b>GMT Fuse</b>	
<b>Termination Detail:</b>	.34 to 2.5 m <sup>2</sup> (14 to 22AWG)
Mechanical	
<b>Mounting:</b>	Standard box bay mounting options
<b>Dimensions:</b>	
<b>Standard Width Option</b>	
	<b>mm:</b> 2134H x 610W x 610D
	<b>inches:</b> 84H x 23.6W x 23.6D
<b>Extended Width Option</b>	
	<b>mm:</b> 2134H x 813W x 610D
	<b>inches:</b> 84H x 31.6W x 23.6D
Environmental	
<b>Temperature:</b>	0 to 40°C (32 to 104 F)
<b>Humidity:</b>	0 to 95% RH non-condensing
<b>Elevation:</b>	-500 to 2800m (-1640 to 9186ft)
System Level Alarm & Control	
<b>Control:</b>	Local monitoring of voltage per panel
	Local monitoring of current per feed
	Bay level breaker/fuse trip frame lamp indicator
<b>Panel Alarms:</b>	Feed present indicator (green LED)
	Breaker trip indicator (red LED)
<b>Alarm Relays (dry contacts):</b>	Over current alarm on any panel
	Loss of input feed alarm
	Fuse/breaker trip alarm
<b>Alarm Connections:</b>	1.5mm <sup>2</sup> (16 to 30AWG)
Agency Compliance	
<b>Safety:</b>	CSA C22.2 No. UL 60950-1-2nd Ed. UL 60950-1-2nd Ed. NEBS level 3 certification (pending)

## 3.2 Load Bus Arrangements

A load bus is defined as one or more panels protected by a single circuit breaker or fuse at the power plant. Cable from the power plant is terminated at the input connector and goes through an 800A rated shunt. For currents larger than 500 amps, two 750 kcmil feeder cables are required per shunt.

The 640A maximum capacity per load bus applies even if multiple fuse panels are connected together.



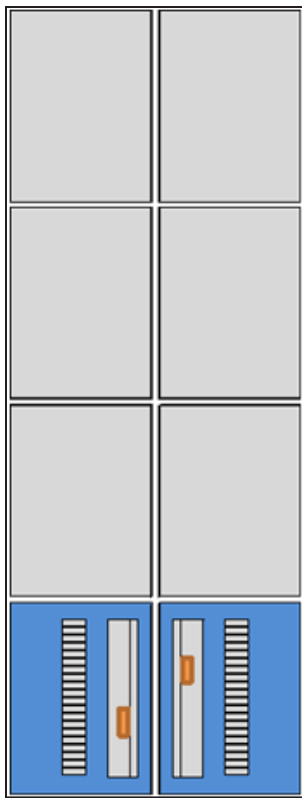
### NOTE:

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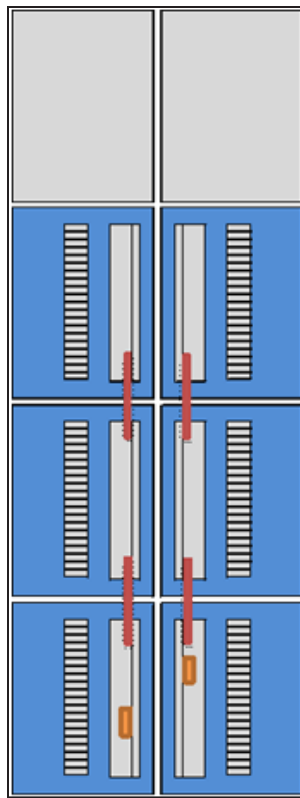
**If changes are made to the load bus the BDFB's Monitor Interface must be reconfigured to the new arrangements so that the correct currents are monitored and displayed.**

#### 3.2.1 BDFB System Configurations

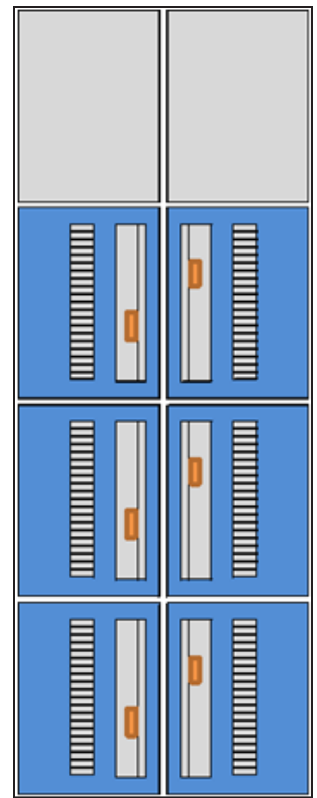
The enclosure can be configured for two, four, six or eight loads. In two or four load configurations, a bus bar/link kit connects the panels together vertically. The BDFB comes factory configured for top feed.



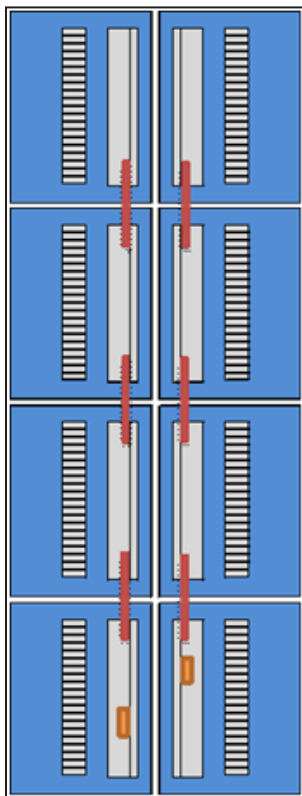
2 panel, 2 load



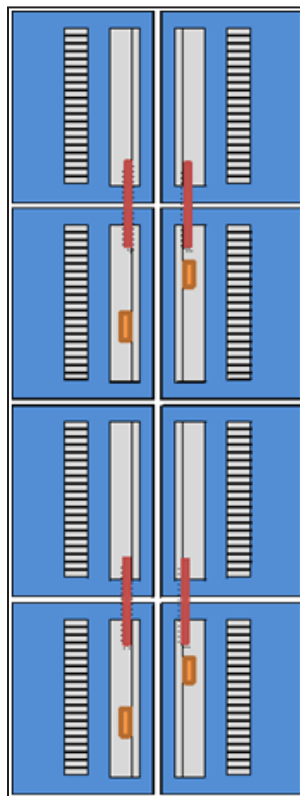
6 panel, 2 load



6 panel, 6 load




8 panel, 2 load



8 panel, 4 load

**Legend**

 = Shunt


 = Link bar

Figure 2 — BDFB load bus arrangements

### 3.2.2 Shunt Assembly and Link Bar

The BDFB load bus arrangements are factory configured, but they can be changed in the field while the system is operating live. The load bus details are installed at either the top or the bottom panels. These may be unbolted and moved if required.

The basic procedure for

- Linking two panels is to install a link bar between the panels, and then remove one shunt feed.
- Separating two panels is to add a shunt bus kit to the panel to be separated, connect the feed and then remove the link bar between panels.

See the section on Installing / Changing the load shunt bus kit on page 52 for detailed instructions on these procedures.

Figure 3 shows a detailed view of the shunt bus assembly on the top panel and a second panel connected to it via a link bar.

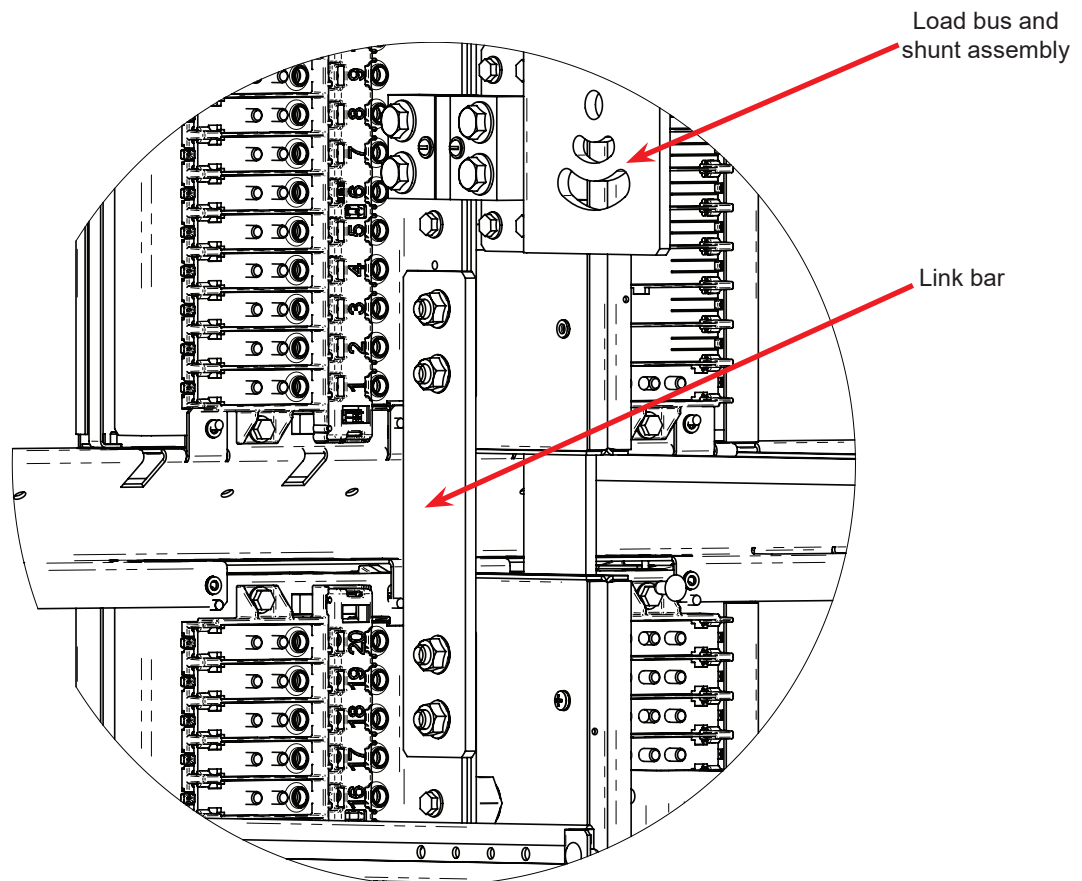


Figure 3 — Detailed view of load bus arrangement

### 3.3 Distribution Panels

Each 20-position distribution panel accepts bullet-style circuit breakers and fuse holders. Single-pole through 100A, two-pole through 200A, three-pole through 300A and fuses through 125A.

 **NOTE:**

1. Breakers in the distribution panels rated 100A and greater shall have one empty space above and below for use in an operating ambient of 40°C.
2. Breakers in the distribution panels rated 125A and greater shall have one empty space above and below for use in an operating ambient of 35°C.

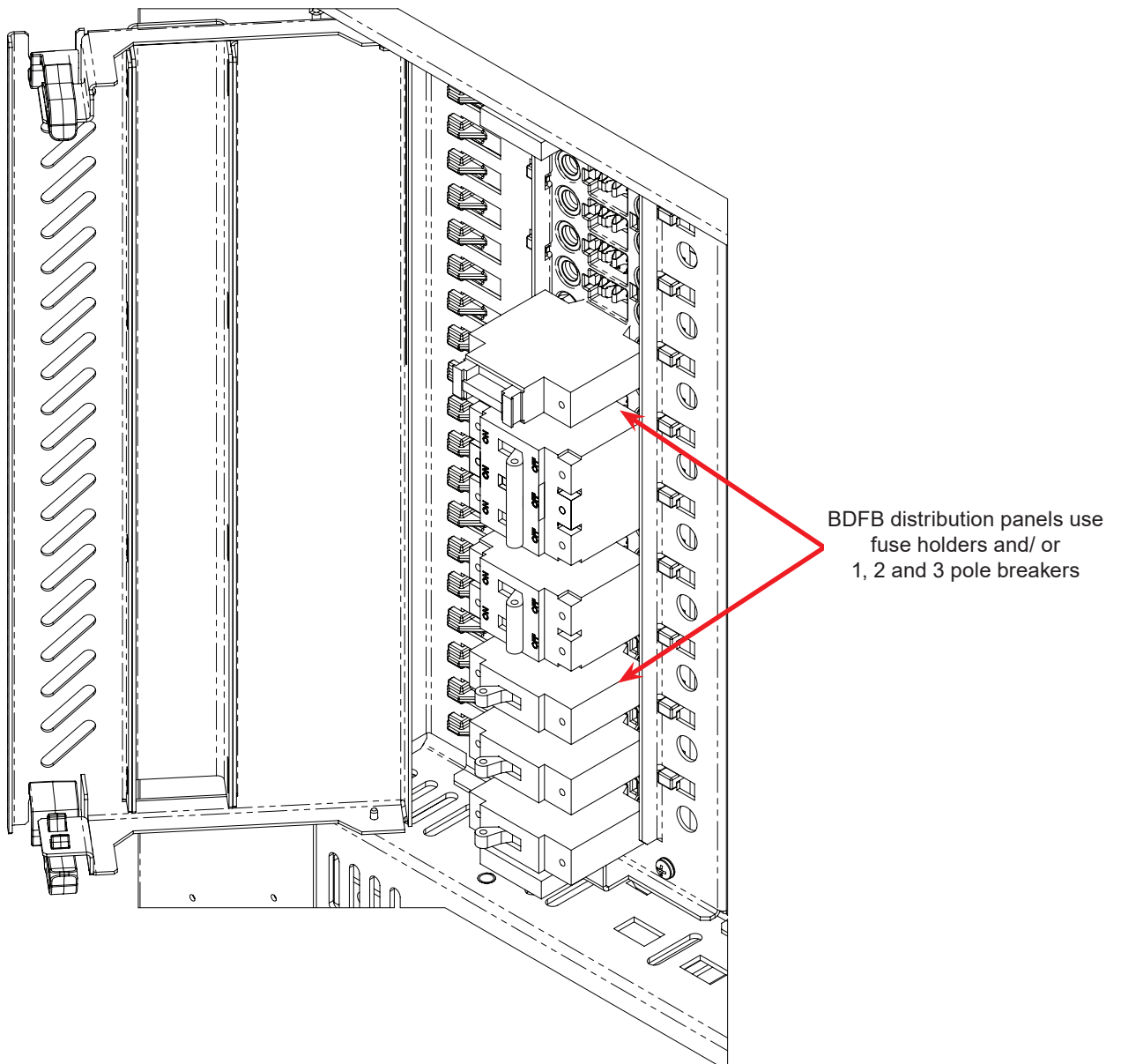


Figure 4 — Breaker / fuse holder distribution



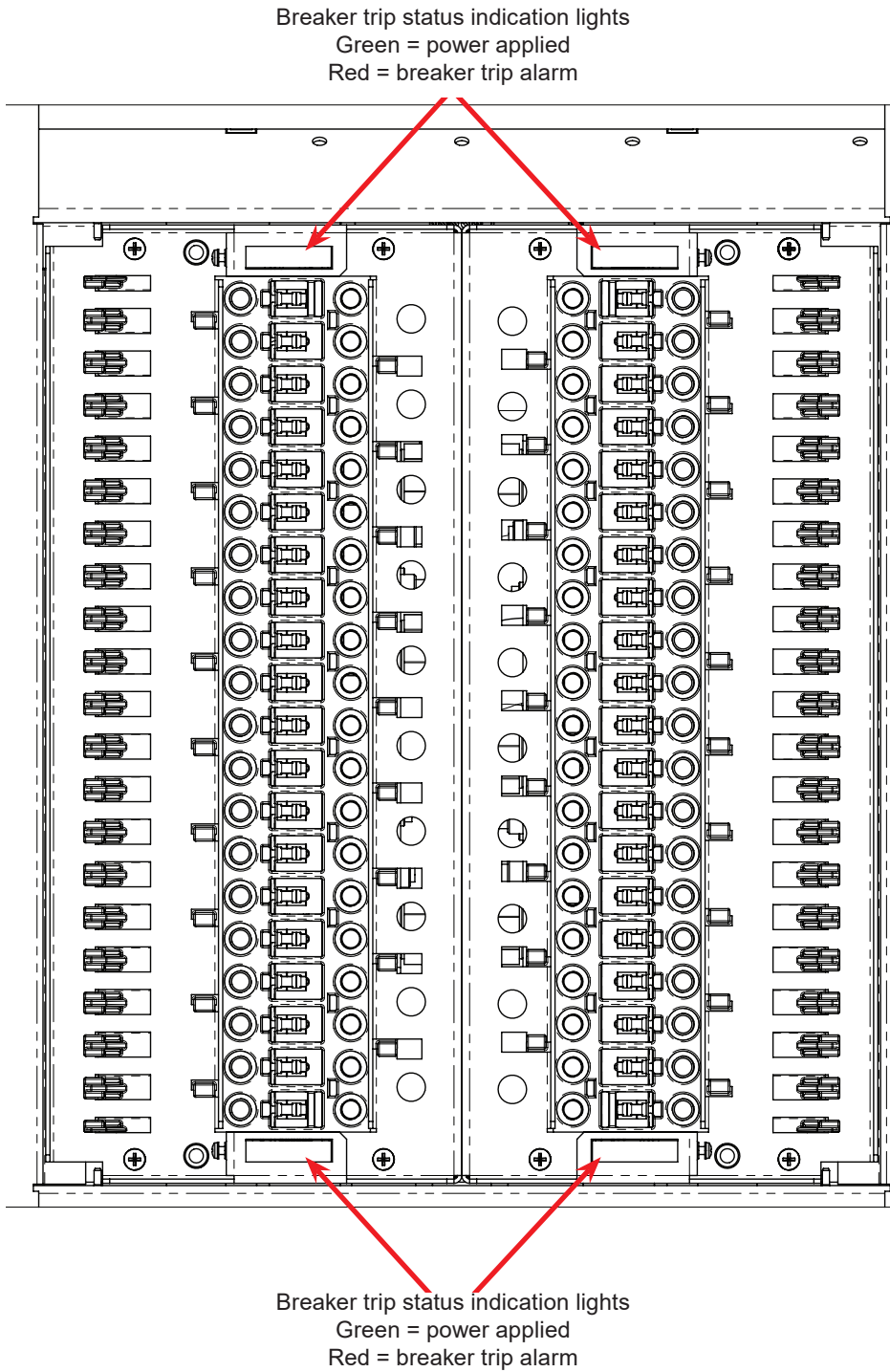


Figure 5 — Front view breaker distribution panels, left and right banks shown

# 4. Installation

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## 4.1 Pre-Installation Preparation

### 4.1.1 Site Selection

- Avoid areas that may be subjected to hot air exhaust from nearby equipment.
- Provide adequate space for safe access for installation and maintenance personnel.
  - Rear: 3ft (1m)
  - Front: 3ft (1m)
  - Top and bottom: clearance required for load cable entry

### 4.1.2 Floor Plan Layout

Consider the following before selecting a location:

- Structure of building able to support the additional weight
- Enough space to meet requirements for access
- Adequate space to do the install
- Check and record distances to the load; minimize input cable length where possible
- Understand the full load on the DC system
- Window for working hours and other similar restrictions
- How much and what kind of prep work can be done in advance
  - Reinforce floors
  - Install cable racks
  - Run wiring
  - Minimize cable lengths (cost)
  - Minimize cable flow and congestion

### 4.1.3 Installation Component Requirements

**Not Supplied:** External DC conduit, cable and fittings

### 4.1.4 Tools and Equipment








Insulated tools are essential. Use the following list as a guide:

- Electric drill with hammer action
- Digital voltmeter equipped with test leads
- Various crimping tools and dies to match lugs used in installation
- Torque wrench: 1/4" drive, 0-150 in-lb for battery post connections
- Torque wrench: 3/8" drive, 0-100 ft-lb for system connections
- Insulating canvases as required (2' x 2', 1' x 1', 3' x 3', etc.)
- Cutters and wire strippers (#14 to #22 AWG) [2.5 – 34 mm<sup>2</sup>]
- Insulated hand tools listed as follows:
  - Combination wrenches
  - Ratchet and socket set
  - Various screwdrivers
  - Electricians knife and cable cutters

### 4.1.5 Packing Materials

Alpha is committed to providing products and services that meet our customers' needs and expectations in a sustainable manner, while complying with all relevant regulatory requirements. As such Alpha strives to follow our quality and environmental objectives from product supply and development through to the packaging for our products. Rectifiers and batteries are shipped on individual pallets and are packaged according to the manufacturer's guidelines.

Almost all of Alpha's packaging material is from sustainable resources and or is recyclable. See the following table for the material and its environmental codes.

 <b>20</b> PAP/PCB	 <b>01</b> PET	 <b>04</b> PE-LD	 <b>06</b> PS	 <b>40</b> FE	 <b>41</b> ALU	 <b>50</b> NW
<b>Cardboard</b>	<b>Polyethylene Terephthalate</b>	<b>Low Density Polyethylene</b>	<b>Polystyrene</b>	<b>Steel</b>	<b>Aluminum</b>	<b>Wood</b>
Packing boxes Caps	Flexible film Packaging	Bubble wrap Shrink wrap Plastic bags	Foam	Strapping on pallets	Strapping on pallets	Pallets Lumber

### Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure that the product is packed with at least three inches of shock-absorbing material to prevent shipping damage. Alpha Technologies is not responsible for damage caused by improper packaging of returned products.

### 4.1.6 Check for Damage

Prior to unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior for damage. If any damage is observed contact the carrier immediately. Continue the inspection for any internal damage. In the unlikely event of internal damage, inform the carrier and contact Alpha Technologies for advice on the impact of any damage.

### 4.1.7 General Receipt of Shipment

The inventory included with your shipment is dependant upon the options you have ordered. The options are clearly marked on the shipping container labels and bill of materials.

#### Racks

Consult the packing slip and power system bill of materials to verify that you have the correct number of racks per your order. Material

#### Rectifiers (Purchased Separately)

Consult the packing slip to verify that you have received the correct number of rectifiers per your order.

#### Miscellaneous Small Parts

Review the packing slip and bill of materials to determine the part number of the "configuration kits" included with your system. Review the bill of materials to verify that all the small parts are included.

#### Batteries (Purchased Separately)

Verify that you have the correct number of batteries if applicable. Refer to the packing list. Verify that you have all the necessary parts per your order.

Call Alpha Technologies if you have any questions before you proceed: 1 888 462-7487.

## 4.2 Frame Installation

The BDFB must be mounted in a clean and dry environment. Provide sufficient free space at the front and rear of the system to meet the cooling requirements and to allow for easy access.

### 4.2.1 Floor Drilling for Standard Anchoring

**NOTE:**

**Earthquake anchoring is the type used in earthquake areas up to Zone 4. The BDFB system frame is earthquake qualified when properly anchored to a 3000 psi (2.11 kg per sq. mm) concrete floor.**

The anchoring kit and procedures in this section are for a seismic installation, but they apply equally well in a non-seismic installation. The following figures provide dimensions for both the 24" and the 32" models.

#### Drilling the holes for the anchor bolts

1. If you are installing more than one BDFB snap a chalk line on the floor to align them for mounting.
2. Use a rebar locator to plan for the anchor positions.
3. Refer to the following figures for location, and then mark the anchor hole positions. These diagrams also show the preferred location for the anchor holes within the slots.

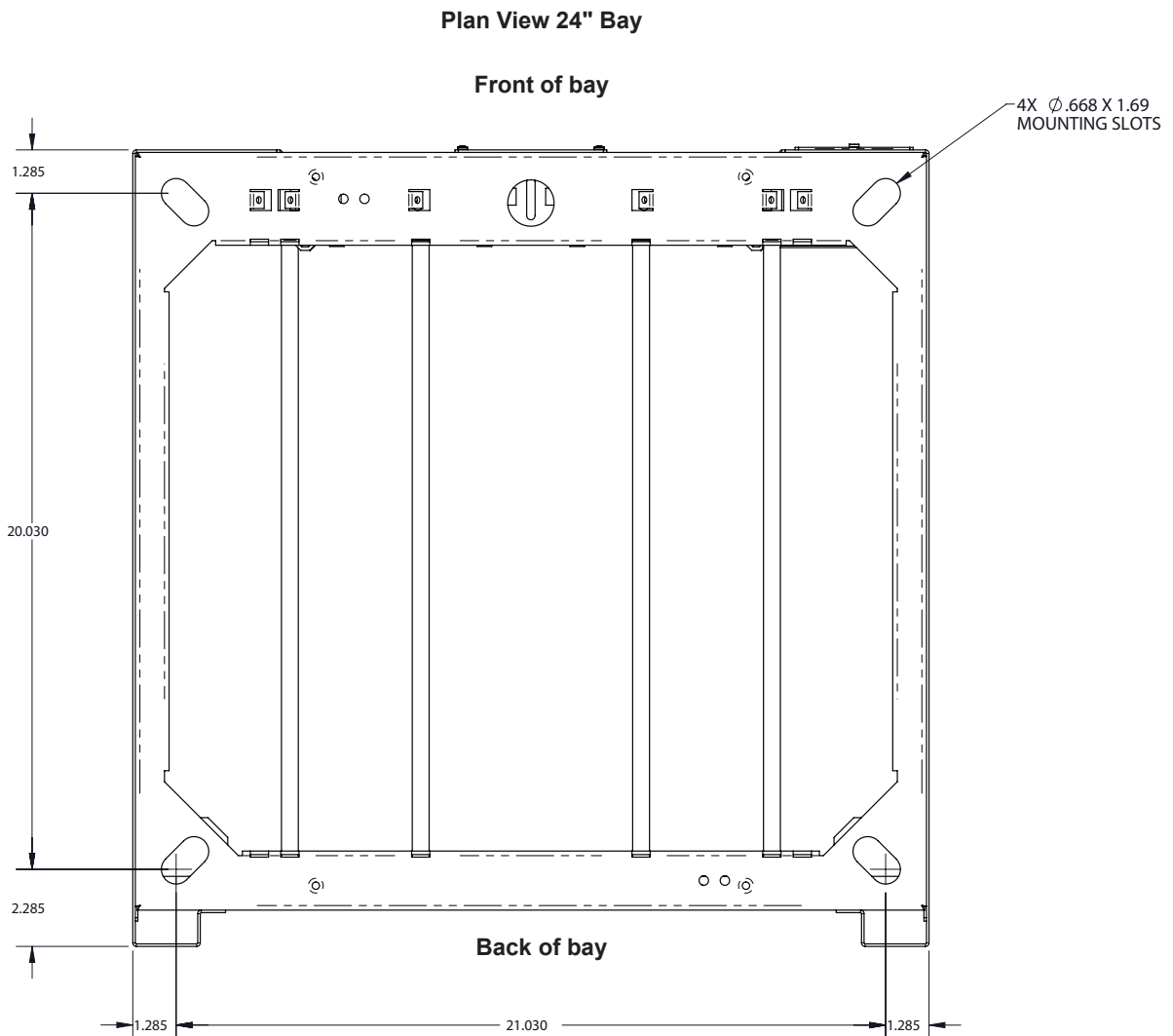


Figure 6 — Base dimensions and mounting holes, 24" wide model

## Plan View 32" Bay

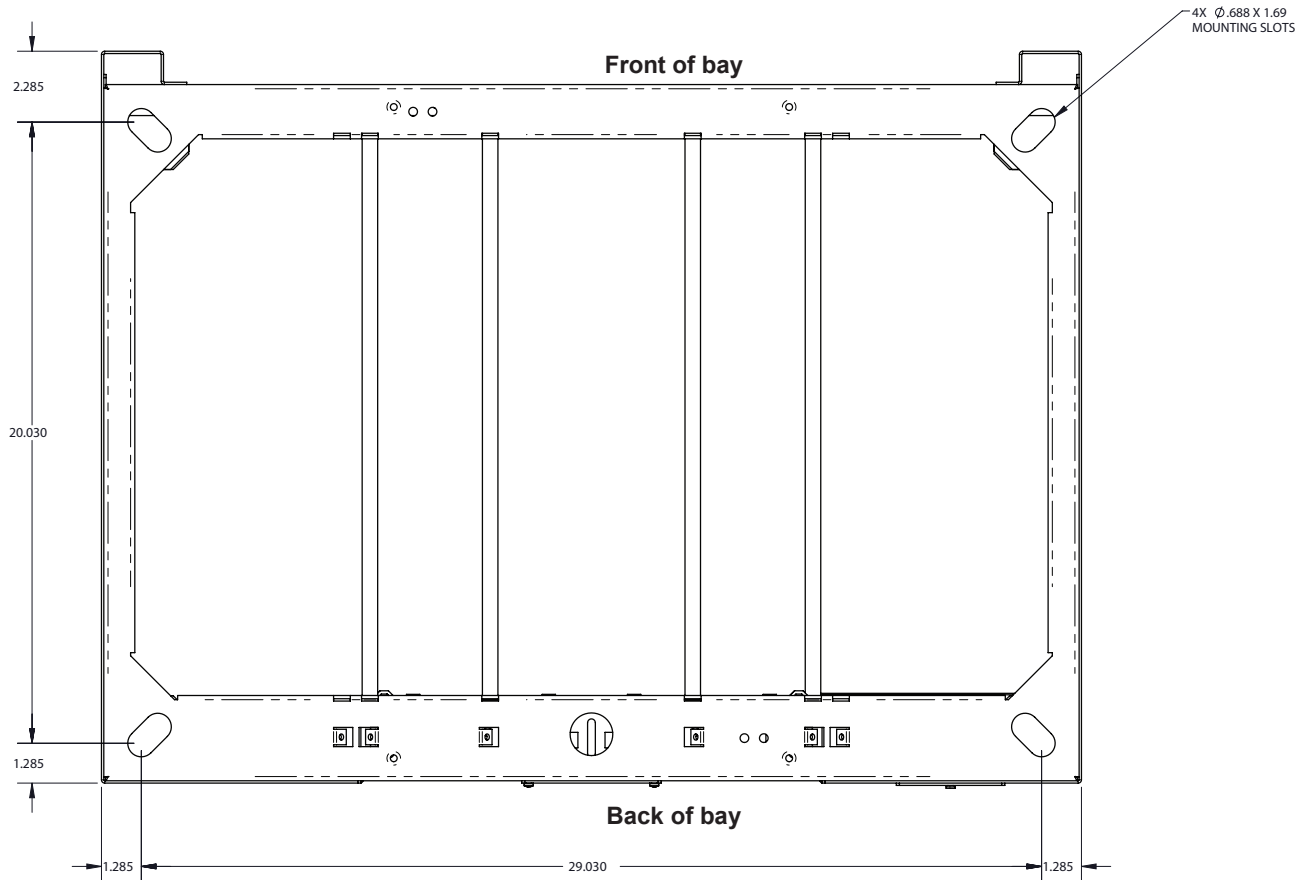


Figure 7 — Base dimensions and mounting holes, 32" wide model

### Setting the Anchors

1. Before setting the anchor, review manufacturer's instructions.
2. Drop the anchor into the drilled hole.
3. Insert the anchor setting tool and hit it with a hammer to expand the anchor until the collar of the setting tool rests against the shoulder of the anchor.

### 4.2.2 Placing and Securing the BDFB to the Floor

#### NOTE:

It is extremely important that the BDFB be properly shimmed in order to prevent any frame distortion. If the floor is not level, shims may be required.

**NOTE: Isolation Kit is available.**

1. Place the BDFB into position over the anchoring holes and the optional isolation pad.
2. Install the anchoring hardware FINGER TIGHT for each anchor.
3. Check that the BDFB is level front-to-back and side-to-side. Install shims if necessary.
4. Once the BDFB is level, tighten all bolts to the appropriate torque.

## 4.3 DC and Grounding Cables Installation

This section provides cabling details and notes on cable sizing for DC applications with respect to the Alpha BDFB secondary distribution system.

- Only qualified personnel should install and connect the BDFB.
- All wiring must be in accordance with applicable electrical codes.

### 4.3.1 Installation Notes

#### Installer Responsibility

The system arrives pre-wired, and the installer is responsible for connecting the following:

- DC input to the system
- System to the load
- Chassis ground
- Alarms
- Auxiliary supply for the BDFB Monitor Interface (optional)
- Return connections for the Monitor Interface and panel LED power

#### Calculating Output Wire Size Requirements

**Although DC power wiring and cabling in telecommunication applications tend to exceed electrical code requirements, mostly due to the voltage drop requirements, all applicable electrical code(s) take precedence over the guidelines and procedures in the present chapter, wherever applicable.**

Wire size is calculated by first determining the appropriate maximum voltage drop requirement. Use the formula below to calculate the circular mil area (CMA) wire size requirement. Determine the size and number of conductors required to satisfy the CMA requirement.

$$\text{CMA} = (\text{A} \times \text{LF} \times \text{K}) / \text{AVD}$$

**A = Ultimate drain in amps**

**LF = Conductor loop feet**

**K = 11.1 constant factor for commercial (TW type) copper wire**

**AVD = Allowable voltage drop**

Check again that the ampacity rating of the cable meets the requirement for the installation application. Consult local electrical codes (NEC, CEC, etc.) for guidelines. If required, increase the size of the cable to meet the code.

Refer to Table A for cable size equivalents.

<b>Cable size</b>	<b>Circular mils</b>	<b>Square millimeters</b>	<b>Equivalent metric cable</b>
20 AWG	1020	0.519	1
18 AWG	1624	0.8232	1
16 AWG	2583	1.309	1.5
14 AWG	4107	2.081	2.5
12 AWG	6530	3.309	4
10 AWG	10380	5.261	6
8 AWG	16510	8.368	10
6 AWG	26250	13.30	16

Cable size	Circular mils	Square millimeters	Equivalent metric cable
4 AWG	41740	21.15	25
2 AWG	66370	33.63	35
0 AWG (or 1/0)	105600	53.48	50 or 70
00 AWG (or 2/0)	133100	67.42	70
0000 AWG (or 4/0)	211600	107.2	120
313 MCM (or kcmil)	313600	159	150 or 185
350 MCM (or kcmil)	350000	177.36	185
373 MCM (or kcmil)	373700	189	185 or 240
500 MCM (or kcmil)	500000	253.36	300
535 MCM (or kcmil)	535300	271	300
750 MCM (or kcmil)	750000	380.00	400
777 MCM (or kcmil)	777700	394	400

### Recommended Torque Values

The recommended torque values for connection to the power system are as follows:

- Clear hole connections (nut and bolt)
- PEM studs
- PEM threaded inserts
- Thread formed connections (in copper bus bar)

1/4"	8.8 ft-lbs (105 in-lb)
3/8"	32.5 ft-lbs (390 in-lb)
1/2"	73 ft-lbs (880 in-lb)

SAE Grade 5 hardware is required for these torque values.

### Cabling Layout

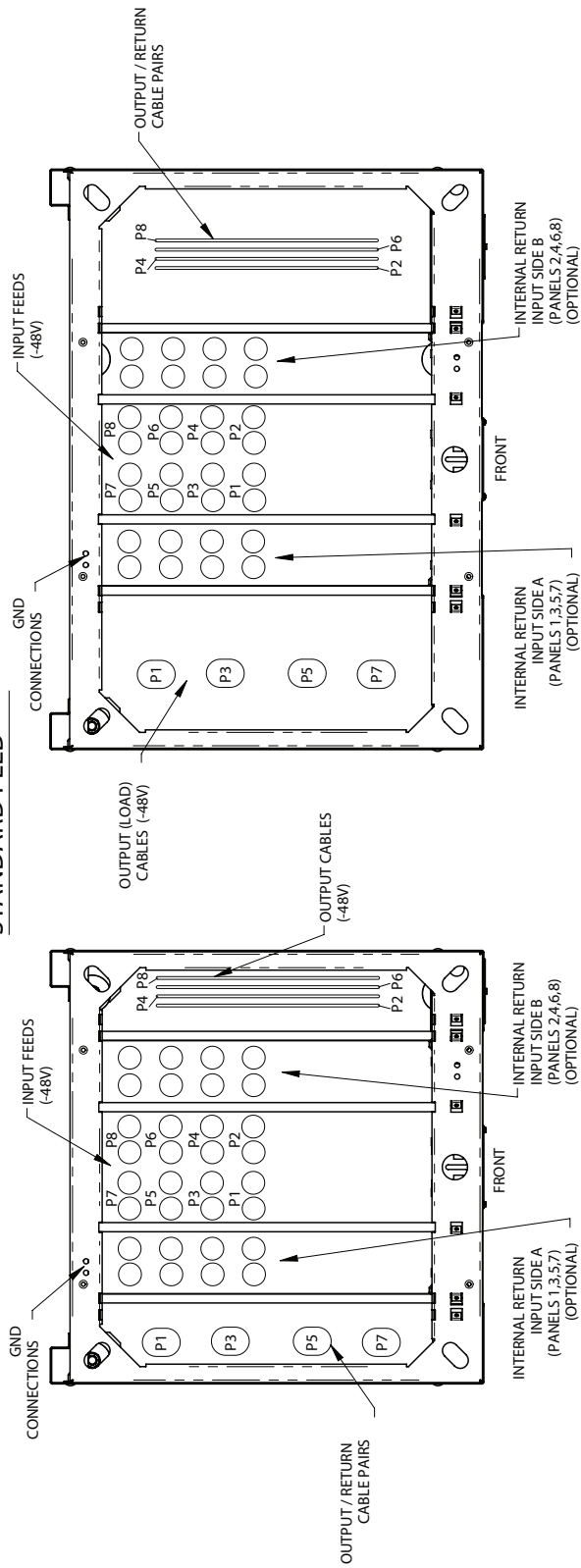
- Connect the DC input cables to the bus bars at the top or bottom of BDFB at the rear.
- The load cables from the BDFB fuse / breaker can exit the unit through the top or bottom.
- All signaling wires connected to external monitoring devices exit the BDFB through the top (factory configured).

### Alarms

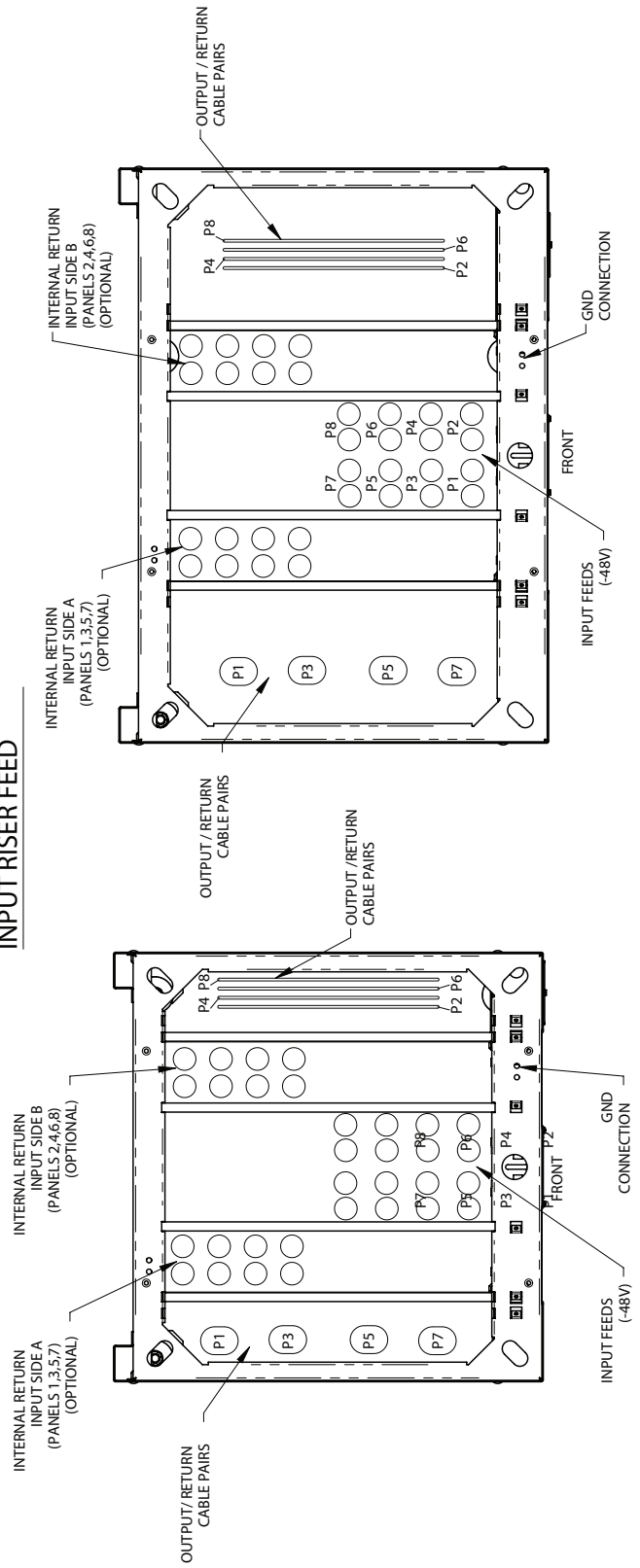
All applicable alarms should be connected to the local alarm-receiving unit from the power system. The BDFB system alarm board provides Form C relay contacts for interconnection.

# Suggested Cabling Layouts

## STANDARD FEED



## INPUT RISER FEED





### 4.3.2 Connecting The Frame Ground

A true, single point ground system means that everything is referenced to a single point which is tied to the external earth ground system. In reality each component and external source is effectively bonded to a single point, which is then bonded to the facility or the site external ground system.



#### CAUTION!

The grounding methods described in this section are generic. Follow local requirements and electrical code.



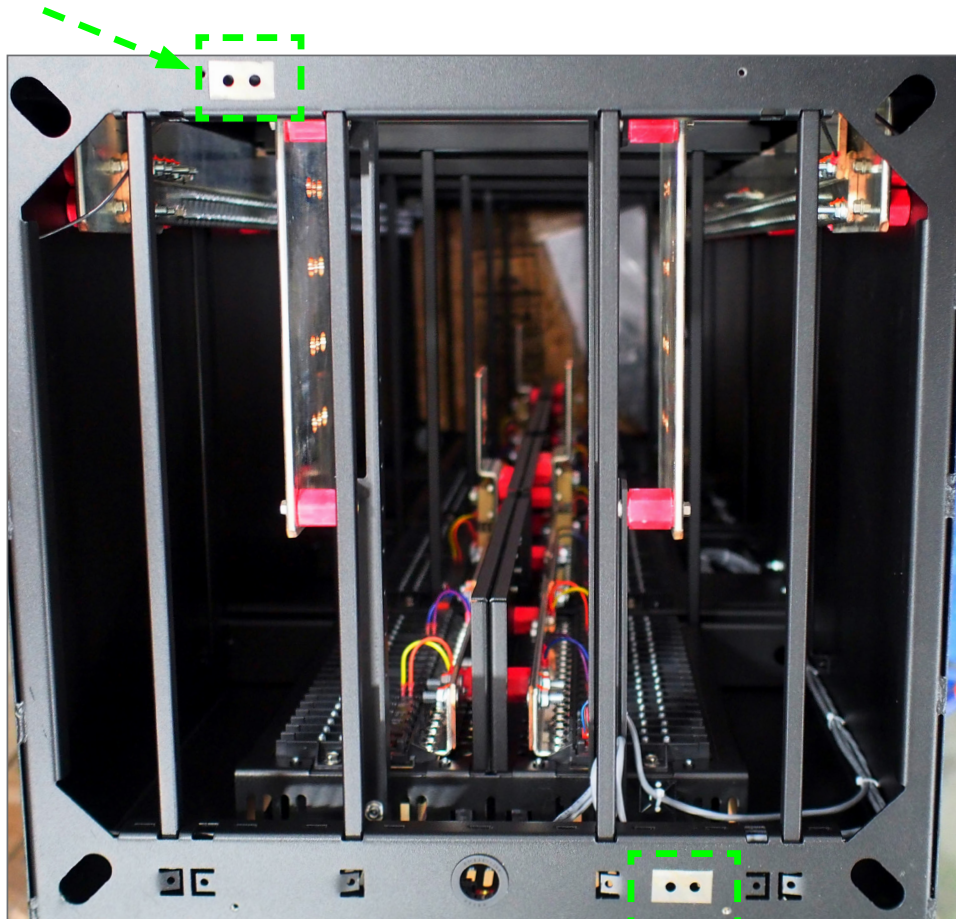
#### NOTE:

This power system is suitable for installation as part of a Common Bonding Network (CBN) and is intended to be used in a DC-C configuration (common DC return)

### 4.3.3 Frame Grounding

Securely ground the rack, containing the BDFB, to the building grounding system. The BDFB has two frame reference ground areas on the top of the unit. One at the front and one at the back.

Frame reference ground  
Top, back of the BDFB unit shown



Frame reference ground  
Top front of the BDFB unit shown

Figure 8 — BDFB frame reference ground images (back and front)



**NOTE:**

---

**Both returns must be connected for accurate voltage measurement.**

#### **4.3.4 Auxiliary Power for the Monitor Interface (MI)**

Alpha provides capability to connect an optional auxiliary supply. This allows the monitor to operate even if all feeds are disconnected. It also facilitates commissioning and calibration if required.



**WARNING!**



**To prevent possible ESD damage, always wear a grounded wrist strap when handling or installing circuit cards.**



**NOTE:**

---

**The return of the auxiliary supply must be near the same potential as the returns for the load feeds.**



**NOTE:**

---

**This cover has a feature that retains it within the enclosure. There is no risk if the assembly hangs. There are no high-energy connections to the MI, and as such there is no risk of performing this operation, although care must be taken not to short connections on the board.**

## Connecting MI Auxiliary Power Supply

1. Undo the single screw on the MI and tilt the board forward.
2. Install the aux wiring into the enclosure and feed it into the MI cavity.
3. Remove the connector from the MI.
4. Connect the aux wiring into the MI connector. Be sure to observe the correct polarity of the aux wiring.
5. The aux wiring should be suitably fused at the source (the MI consumes <100mA of current so fuse appropriately).
6. Plug the connector into the MI.
7. Tilt the MI back into the enclosure.
8. Re-install the screw on the front of the MI panel.

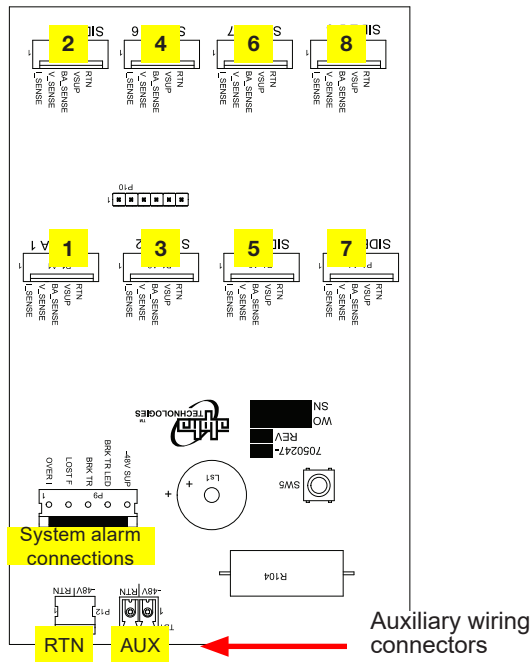


Figure 9 — BDFB auxiliary wiring connector(original)

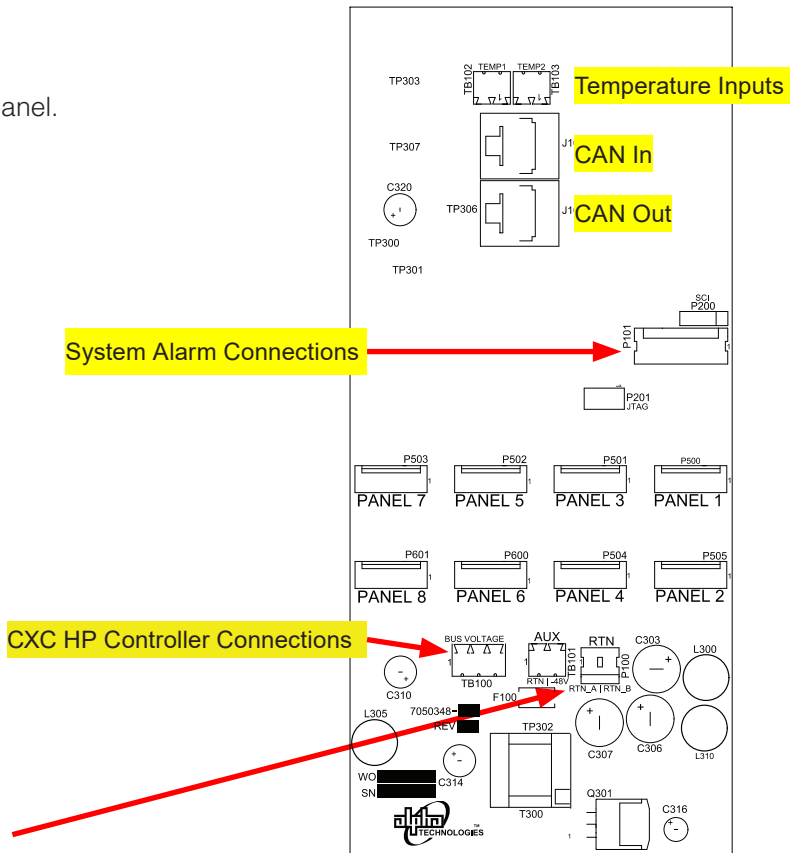


Figure 10 — BDFB auxiliary wiring connector (Smart VI monitor\*)

\* For more information on the BDFB Smart VI monitor see section, 4.4

### 4.3.5 DC Input

#### DC Plant Cables

Connecting the DC plant return cables to the return bus bars can be internal or external. The return bus bars are designed for a connection of 3/8" holes on 1" centers or 1/2" holes on 1 3/4" centers.

#### Live DC Plant Cables

When connecting directly to the live bus bar protect input feeds with a high capacity fuse or circuit breaker. The maximum allowable is an 800A fuse with maximum anticipated load of 640A.

### 4.3.6 Top Termination Option

A top termination option is available for the BDFB to make it easier when adding feeds to the system. The option includes bus bars which extend from the top of the system to the shunt inputs of each panel. During installation the feed cables only need to be brought to the top of the enclosure which requires less cable and is easily accessible. The following images show the 8-panel, 8-load and the 8-panel 4-load options.

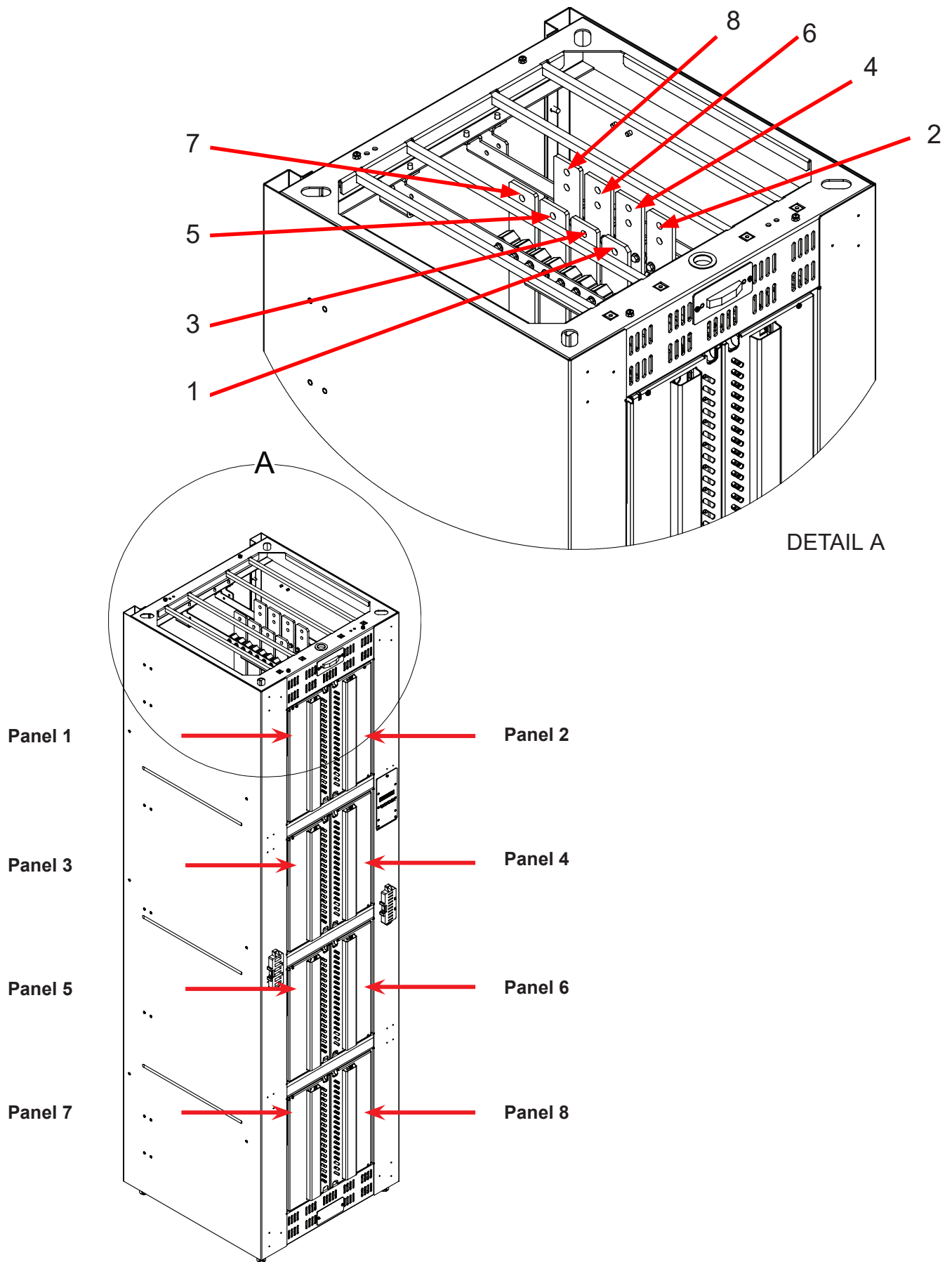


Figure 11 — Detail A, top termination 8 panel, 8 load

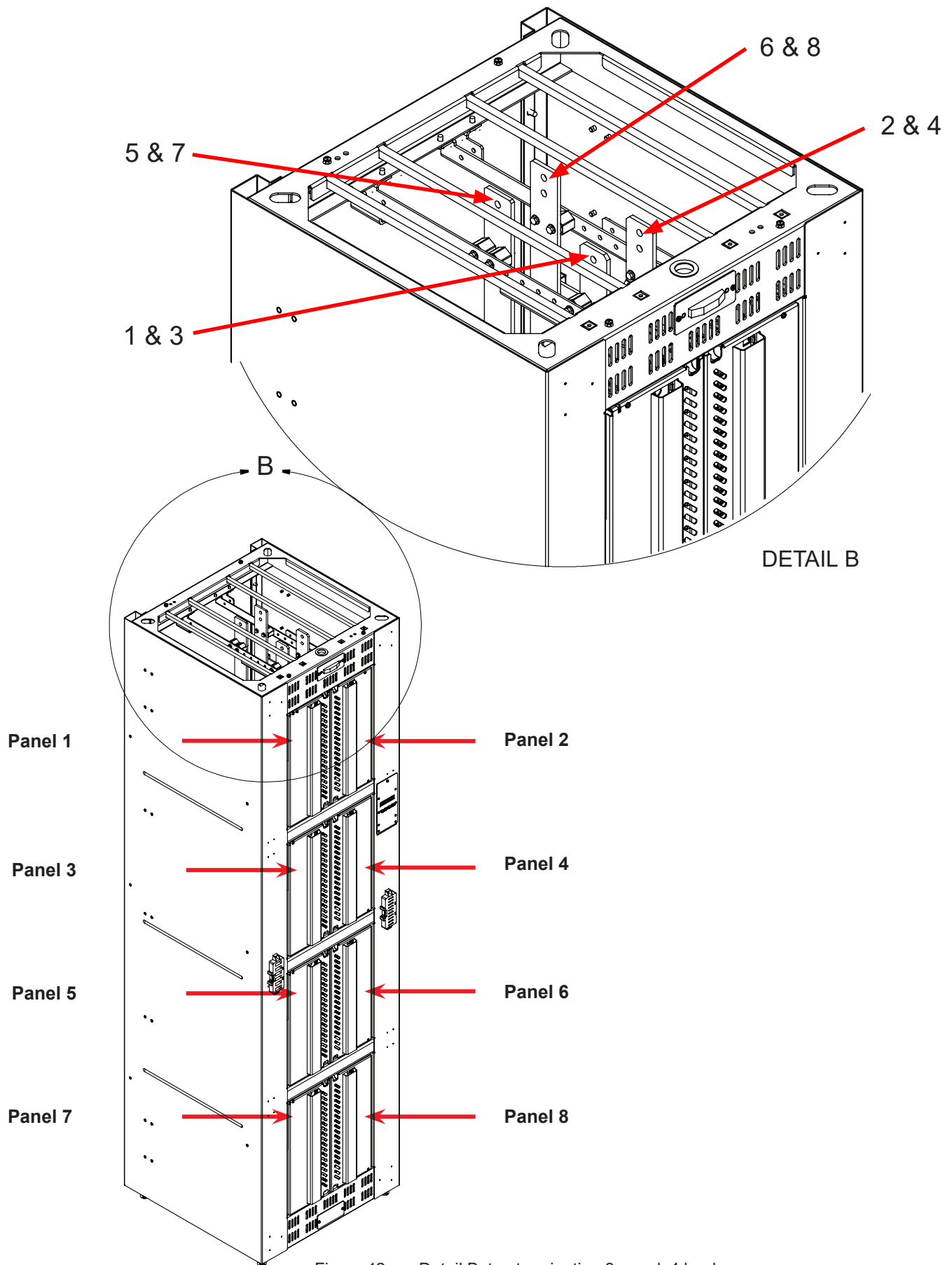
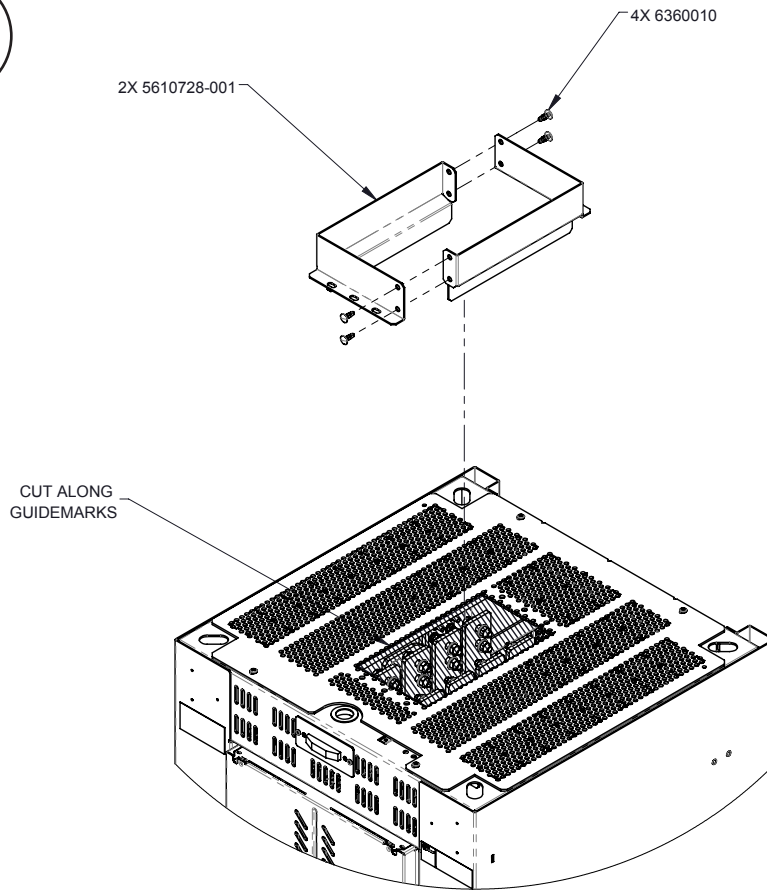


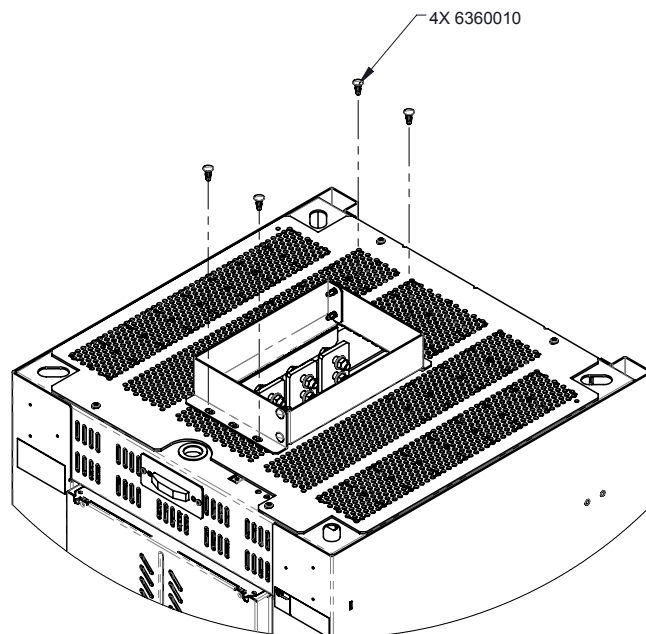
Figure 12 — Detail B, top termination 8 panel, 4 load

### 4.3.7 Boot Installation (for Top Termination)

Step 1



Step 2



### 4.3.8 Wiring the Distribution Panels

Refer to guidelines supplied with the load equipment. Distribution cables are typically sized to provide a 0.5V loop drop at full load as well as meeting the ampacity requirements of the protection fuse or circuit breaker.

#### Before You Begin:

1. Cut cables to length and terminate with a two-hole lug:
  - 2-pole, 3-pole and bullet breaker—3/8" diameter on 1" center
  - 1-pole, bullet breaker or TLS/TPS fuse— 1/4" diameter on 5/8" center
2. Identify each cable with a label that indicates its location within the BDFB.
3. Remove the top Kydex cover (if applicable).
4. Remove the back cover.
5. Connect controller return (A and B). Both must be connected for volt sensing accuracy.

#### Load Cables to Breakers

1. Route the load cables through the top of the BDFB.
2. Remove the protective live terminal cover.
3. Connect the cables to the BDFB.
4. Use the internal cable tie bars for strain relief.
5. Neatly dress and lace cables using cable tie bars.

#### Installing Breakers

1. Open the distribution panel door.
2. Turn breakers off and orient as shown in the following figures for the left hand bank or the right hand bank.

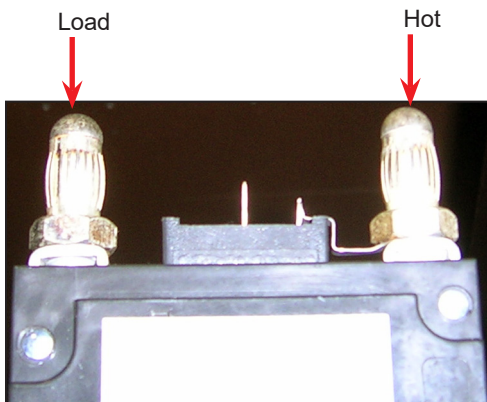


Figure 13 — Left hand bank

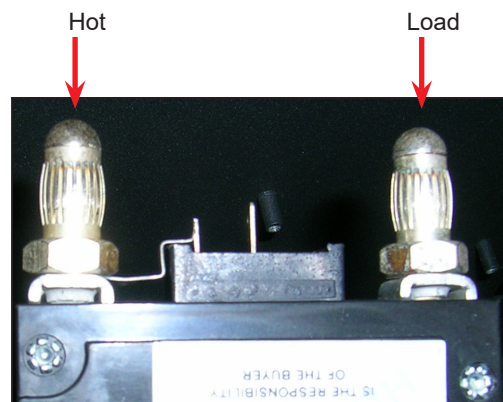


Figure 14 — Right hand bank

3. Align the breaker terminals with the correct holes and carefully push the breaker into position.
4. When all breakers are installed, close the panel door.

### 4.3.9 Alarm Connection Wiring

See the section BDFB LED Status Indicators (on page 33) for a description of available alarm relays.

The wiring connection for the BDFB alarm indicator is routed through the top of the unit.

To wire the alarm panel:

1. Undo the two screws on the front of the plate to access the terminal block.
2. Remove the front plate.
3. Route the signal cable as shown, through the top of the unit to the connector pins.
4. Replace the front plate and tighten the screws into place.

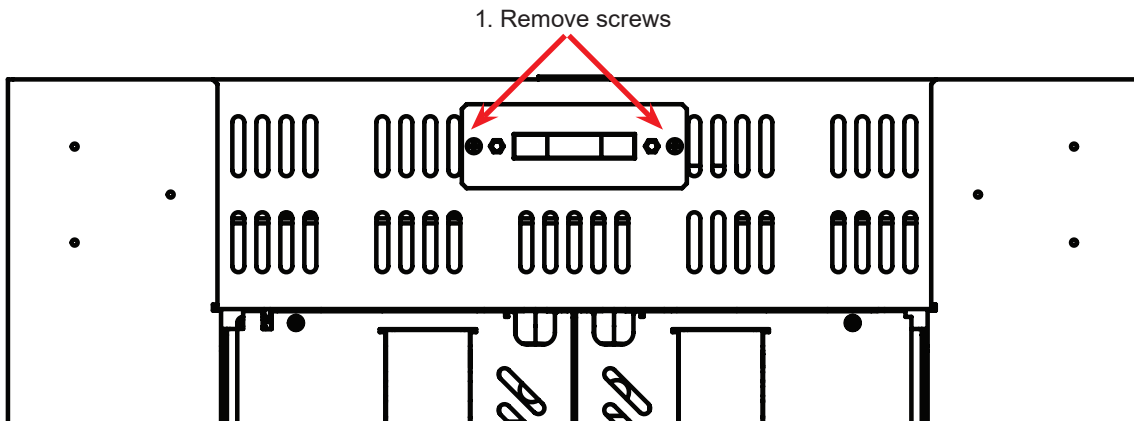
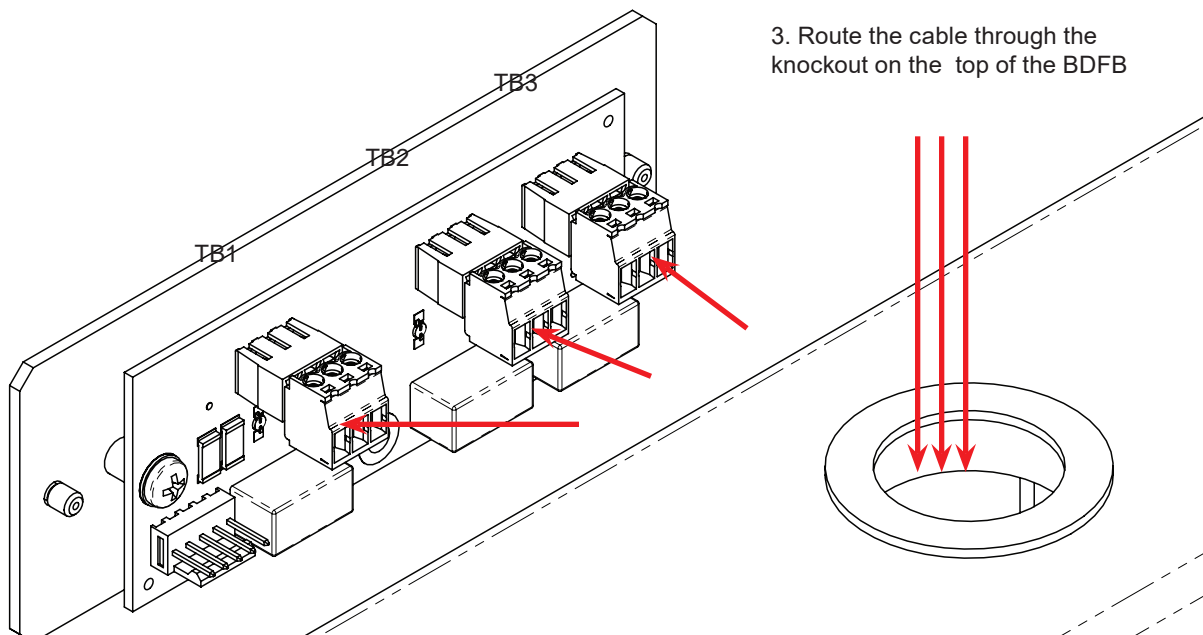


Figure 15 — Top front of the BDFB, removing the alarm panel



3. Route the cable through the knockout on the top of the BDFB

4. Connect the cables to the terminator block.





### 4.3.11 Panel Positions and Labelling

The BDFB cabinet is factory configured for top feed cable entry, however this can be reconfigured if required. The following image shows the location of BDFB's side by side banks of 8 panels as well as the BDFB Monitor.

Load bus designations are stamped on the labels and installed by the user. The BDFB Monitor is programmed to reflect the load bus designations.

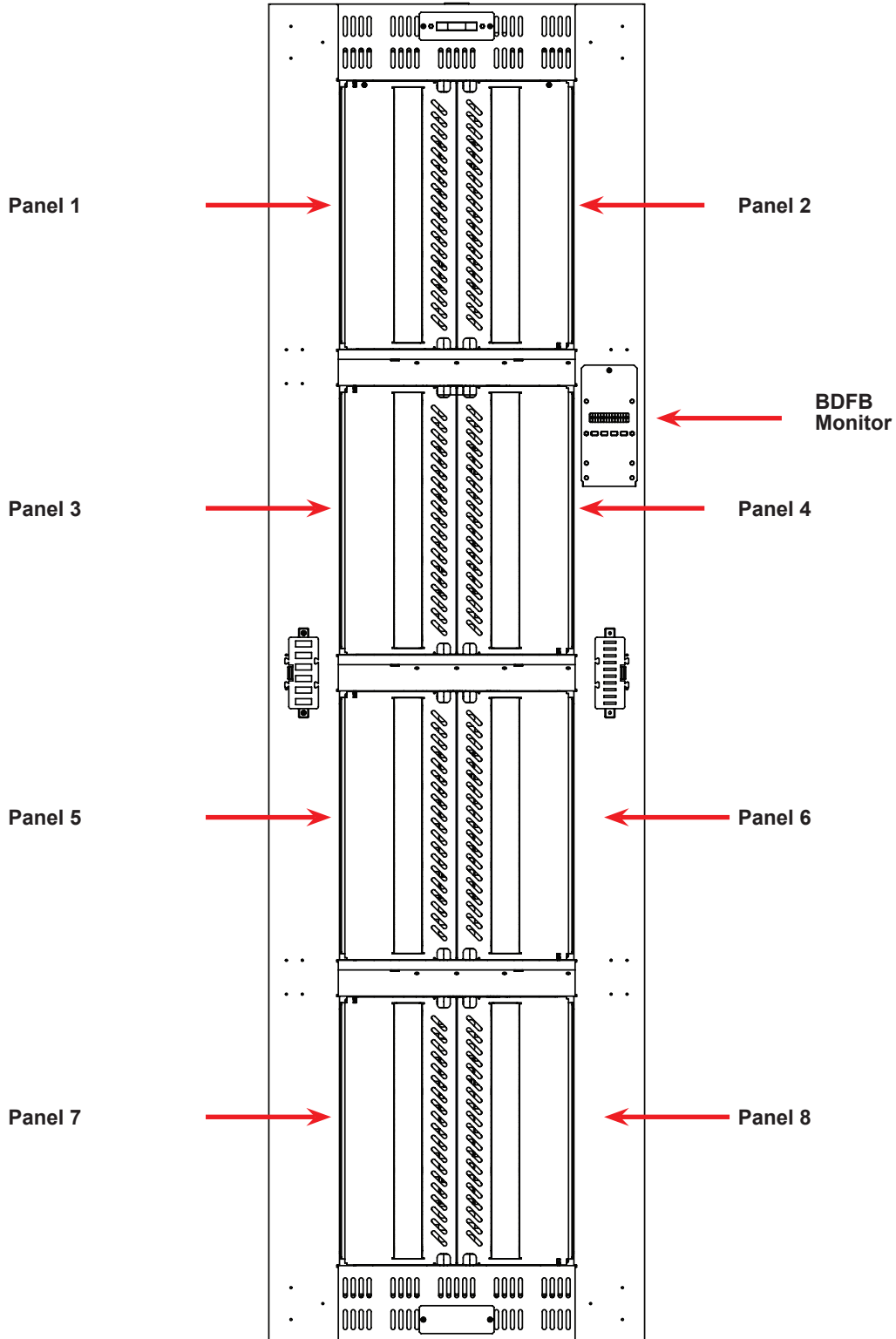


Figure 17 — BDFB breaker panels

### 4.3.12 BDFB LED Status Indicators

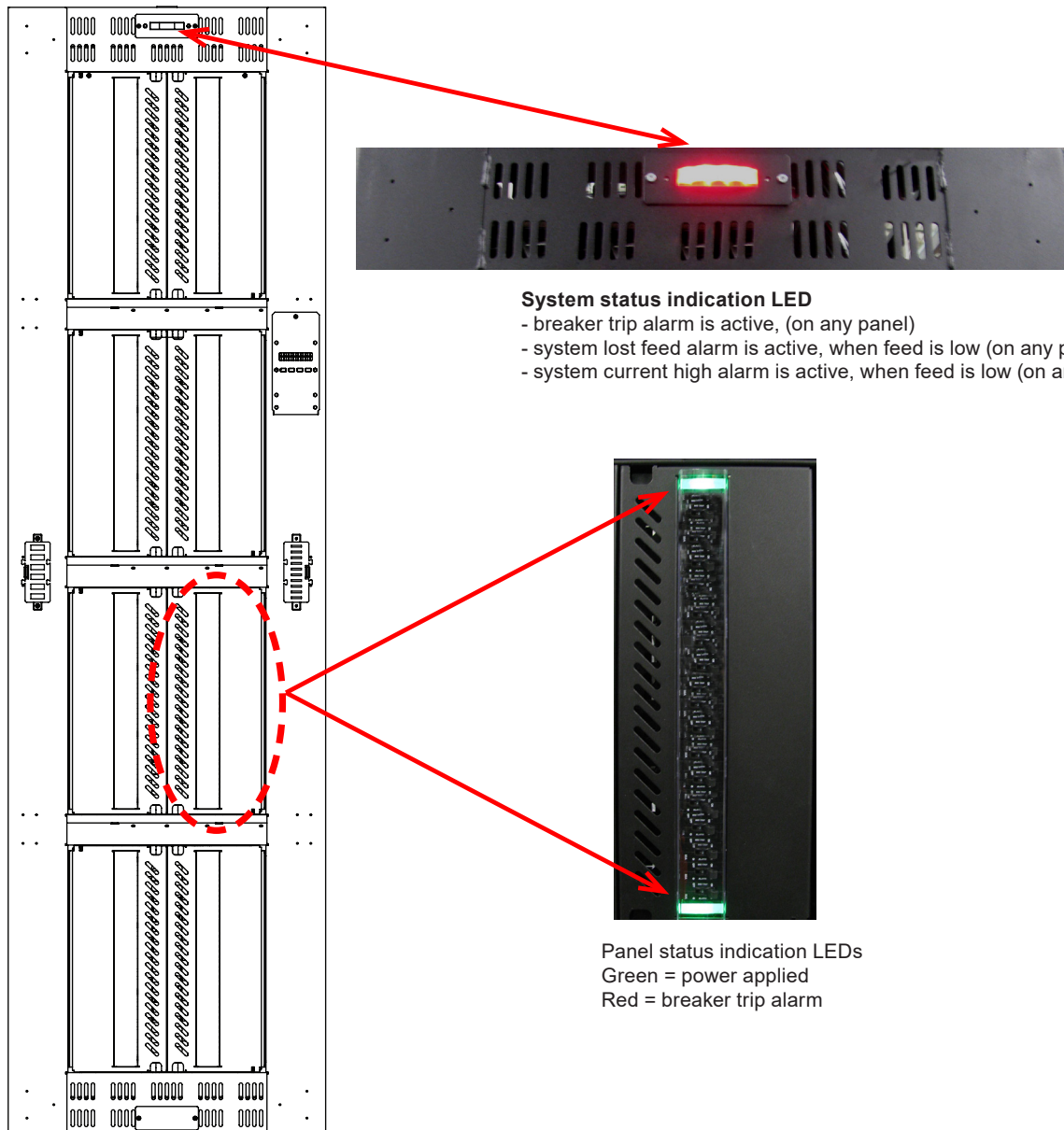
The BDFB has multiple modes to indicate panel and system functionality. The equipment comes with a factory installed LCD monitor interface to monitor the system and make adjustments. In addition to the information available via the monitor there are system alarm LEDs and panel alarm LEDs.

#### System

System alarm indication combine alarms for all panels, it is located at the top of the unit and includes three dry contacts (see section on Alarm Connection Wiring, on page 30). The system alarm LEDs are controlled by the BDFB monitor. Each alarm has a dedicated relay, which can be configured to be Normally Open, Normally Closed (fail safe) or disabled. This system LED can be user configured for each alarm to be disabled, steady or flashing.

#### Panel

Each individual panel has two LED indicators on the top and bottom. The lights are green when power is applied to the panel and red if the power is applied and the breaker is tripped. Individual panel LEDs are analog controlled, they are not controlled by the BDFB monitor. The intensity of these LEDs depends on the applied voltage. The lights will dim as power decreases.



## 4.4 BDFB Smart VI Monitor

The new Smart VI monitor has a full color screen with easy navigation and features both a display mode for monitoring status, and a configuration mode for navigating menus and making adjustments. Additional features include, two temperature inputs, portable field calibration wizard, and optional CAN communication.

**Menus** - The three main menu items are:

- Panel Setup
- Calibration
- Alarm Config

### 4.4.1 Monitor Display

When in display mode the Smart VI monitor has up and down arrow keys to scroll through the status of each panel and looks similar to Figure 18. The Smart VI monitor displays system status, panel selected, and panel status details. Press any button to activate the display. By default the upper left panel is selected via white highlight.

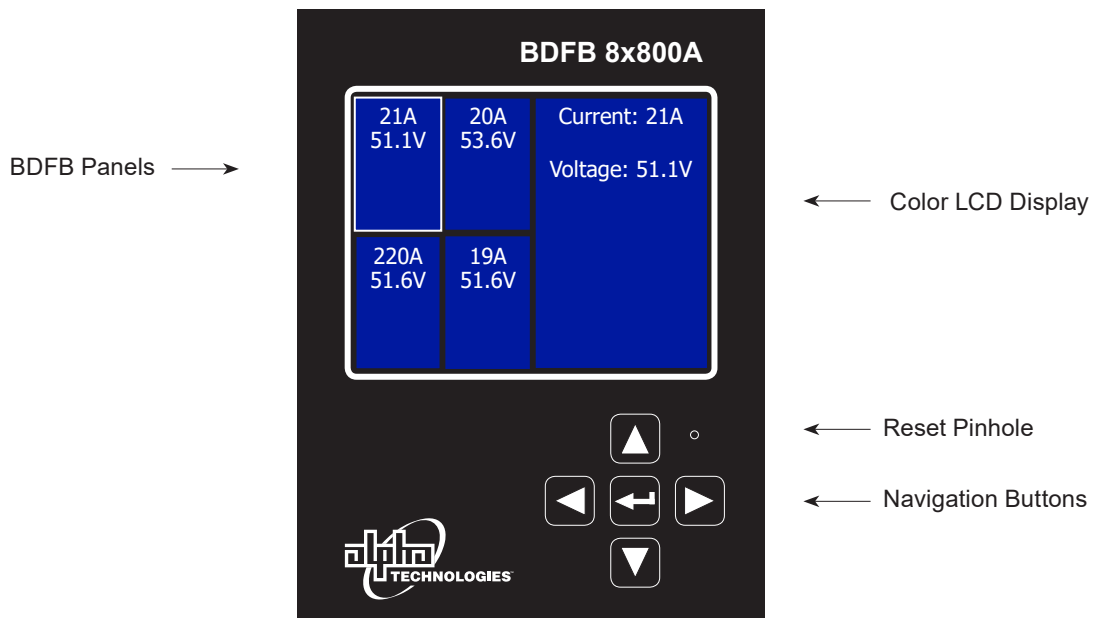


Figure 18 — Monitor Display (8 panel, 4 loads shown)

Below the LCD screen there are five navigation buttons. When in configuration mode, these buttons are used to navigate the menus, make selections and adjust parameters.

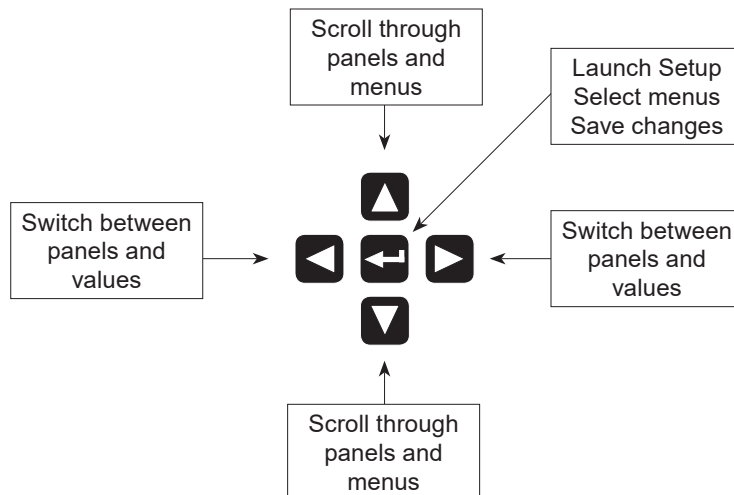


Figure 19 — Smart VI Monitor, navigation buttons

### 4.4.2 Display Mode

When in display mode, use the up and down arrow buttons to scroll through the status of each panel. Each panel's status displays on the LCD screen which is divided into two portions.

The left portion indicates which panel is selected as well any panel alarms if applicable. Panel alarms display in red (see Figure 18). Each panel is represented by a square in a grid.

The right portion of the display contains two lines: details of the selected panel, with current and voltage on the top line and status messages on the second line if there are alarms.

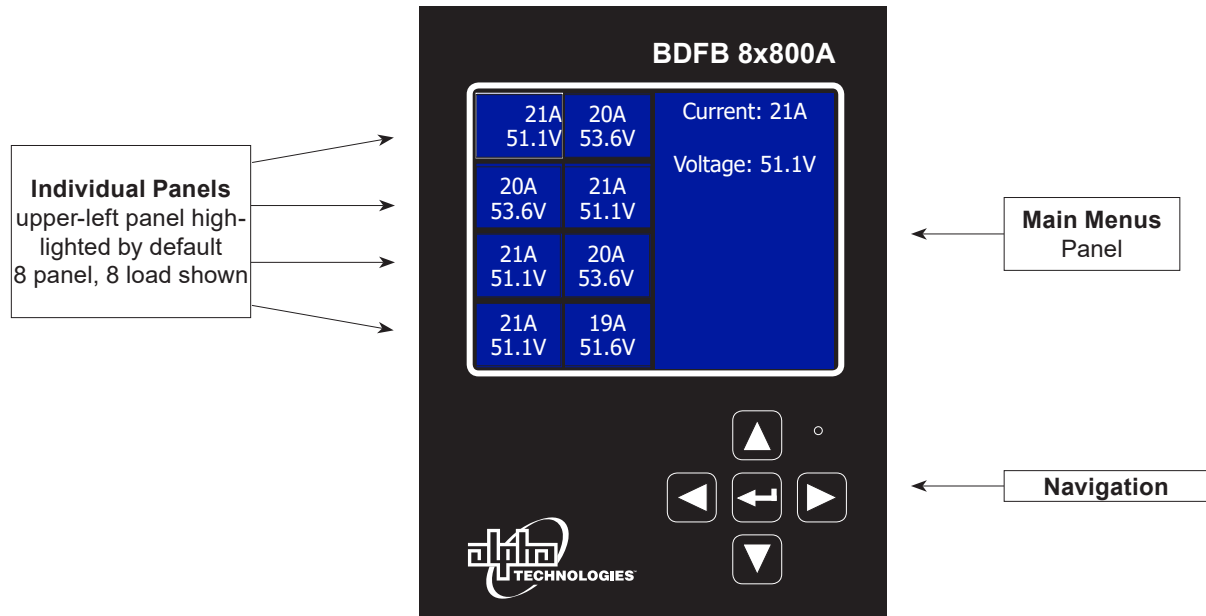


Figure 20 — Smart VI Monitor, Display Mode (8 panel, 8 loads shown)

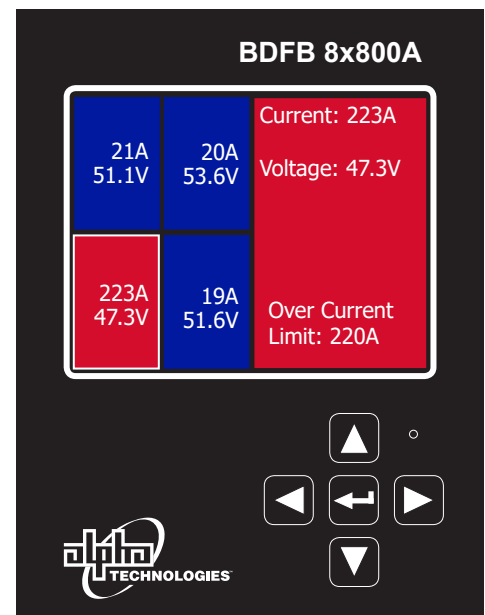
### 4.4.3 Alarm Message Display

When an alarm exists, both the panel in alarm, and the main menu panel display as red.

The alarm error messages are as follows:

- Over Current
- Loss of Input Feed
- Breaker Trip

1. To view the alarm, use the up and down buttons to scroll through the individual panels.
2. Once the panel is highlighted, the alarm type displays on the main menu panel.

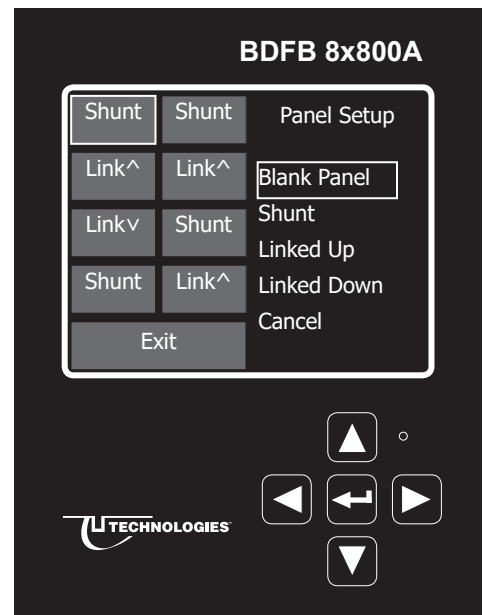
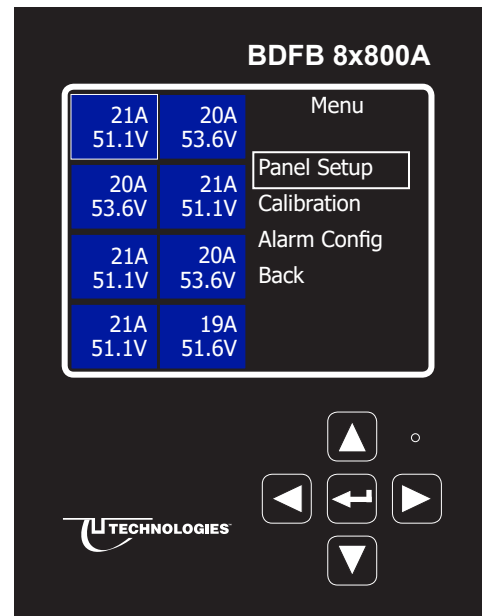


#### 4.4.4 Panel Setup

Use the Smart VI monitor Panel Setup menu to configure and link individual panels. In Panel Setup, the right side of the LCD screen displays the navigation menu. From this menu you can link panels up or down based on your configuration.

Use the up or down buttons to scroll through panels, press the center button to select.

1. Press the center button to activate the Menu.
2. Press the center button again to go into the Panel Setup menu.
3. Use the up/down/right/left buttons to highlight the panel required.
4. Press the center button to select the highlighted panel.
5. Use the up/down buttons to highlight the Shunt / Linked Up / Linked Down.
6. Press the center button to select the highlighted choice.
7. To configure additional panels, start from step three.
8. Once completed, scroll to Exit, and press the center button.

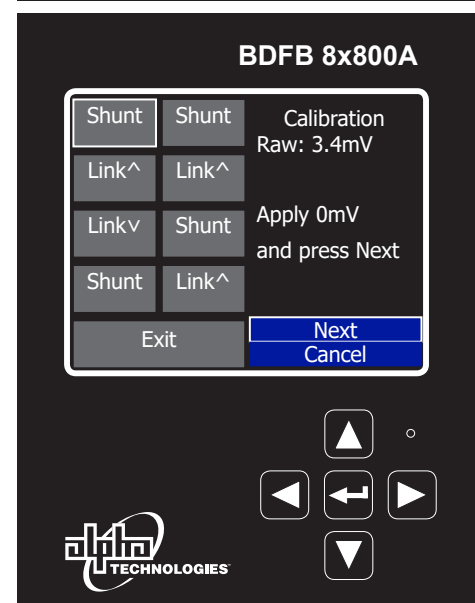
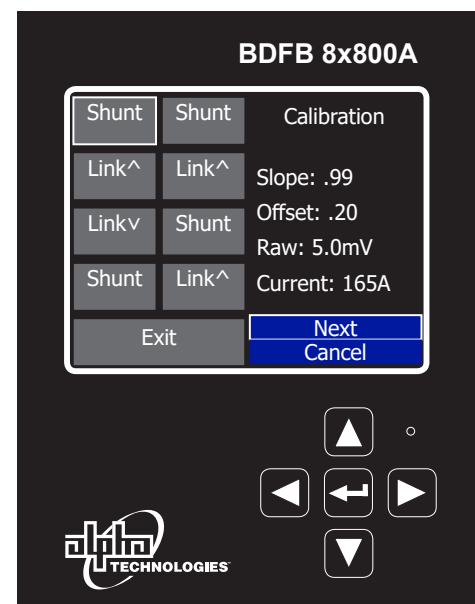
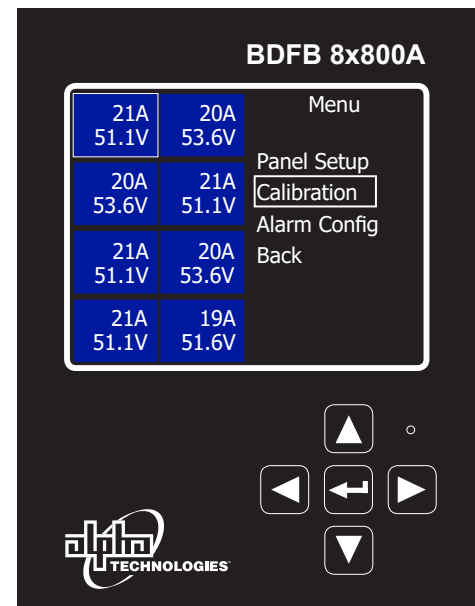


## 4.4.5 Calibration

The BDFB uses 800A 25mV current shunts. The Calibration menu is used to recalibrate the shunt measurement circuitry in the BDFB.

This involves unplugging the current shunt measurement leads from the BDFB and inserting an accurate 25mV in its place. This procedure is helpful when a meter panel within the BDFB is replaced.

1. From the main menu, scroll to Calibration.
2. Press the center button. The Calibration of the default panel displays Slope, Offset, Raw and Current (Raw is the reading before calibration).
3. To calibrate, scroll to the panel required, and then select it.
4. Unplug the shunt measurement leads from the alarm strip and plug a calibration unit (P/N 0370393-001) into the alarm strip PCB connections.
5. Set the switch on the calibration unit to "0mV" and then select Next.
6. Ensure the power switch or the calibration unit is ON and the green LED on the calibration unit is lit.
7. Set the switch on the calibration unit to "25mV" and then select Next.
8. The panel displays a slope and offset. Slope should be approximately 1.0, and the offset should be relatively low - less than 5 or 10.
9. If the values are in an acceptable range, select Save, if not select Cancel and then recheck the wiring before trying again.



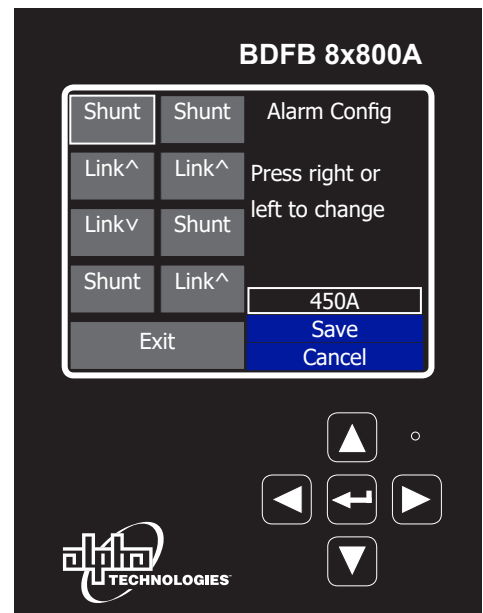
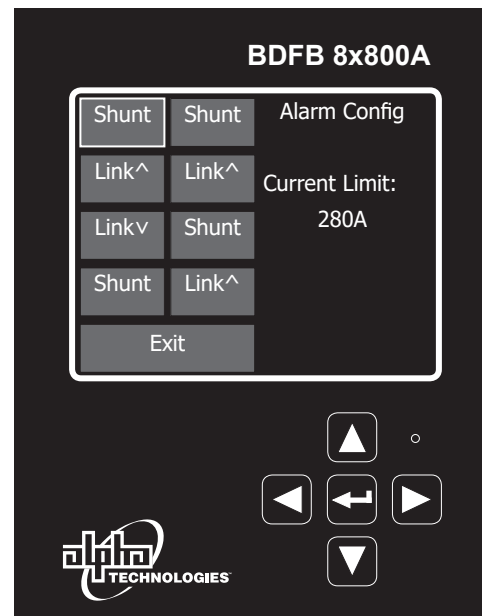
### 4.4.6 Alarm Configuration

The Alarm Config menu allows users to set the overcurrent threshold for an alarm. If the panel goes above this current an alarm is generated.

The default value is 240A, but the value can be adjusted in 10A increments from between 0A up to 800A.

To configure alarms:

1. Press the center button to activate the main menu , scroll to the Alarm Config menu and select.
2. Scroll up/down/ left or right to highlight the panel that requires configuration.
3. Press the left or right buttons to change the alarm threshold.
4. Scroll to Save, press the centre button to accept the changes. Or select Cancel and then start from step two.
5. Repeat from step two to configure the threshold of additional panels.
6. Once completed, scroll to Exit, and press the center button.





## 4.5 Connecting the Smart VI Monitor

### 4.5.1 Stand alone BDFB with Smart VI Monitor panel

- Connect the CAN cables to the Smart VI monitor, and then route them to the top of BDFB for future use
- A CAN adapter is not used

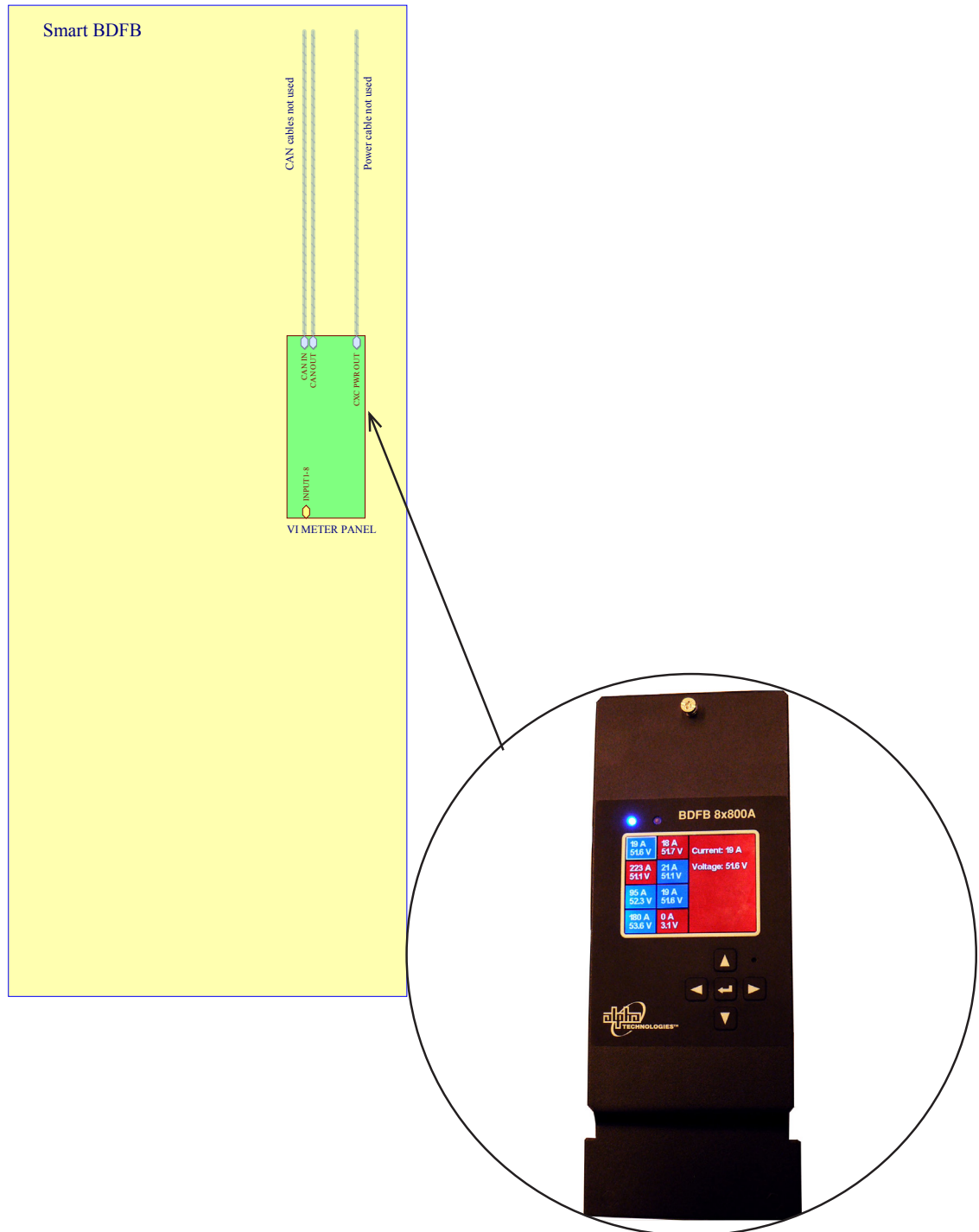


Figure 21 — Stand alone BDFB with Smart VI Monitor

### 4.5.2 Smart BDFB with external CXC HP Controller

- Power cable is not used
- Connect the CAN cables to Smart VI monitor, and then route to the CAN adapter
- An RJ45 cable is used to connect the CAN adapter to the next BDFB. The CAN adapter to allows for runs of greater than 10ft between BDFBs
- If the CXC HP controller is not close to the first BDFB in the chain, an additional CAN adapter will be required to connect the controller to the first BDFB. Use a shielded RJ45 cable.

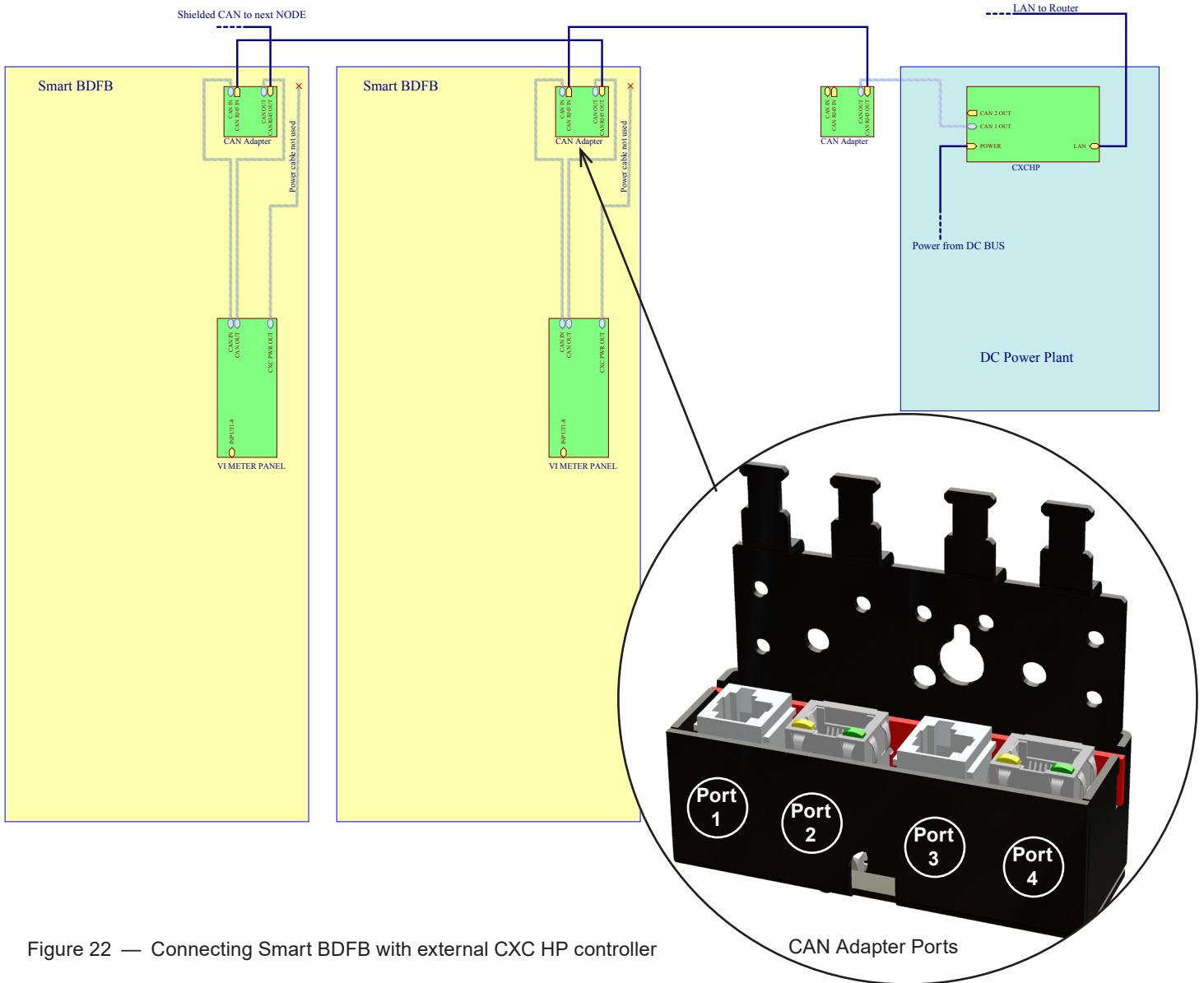


Figure 22 — Connecting Smart BDFB with external CXC HP controller

### 4.5.3 CAN Adapter Ports

**Port 1:** CAN IN, connect the RJ11 cable from the CAN IN on the BDFB VI Monitor to this port

**Port 2:** CAN IN, connect an RJ45 cable from an upstream CAN device to this port (e.g., CXC-HP controller or another BDFB VI Monitor/CAN connector device)

**Port 3:** CAN OUT, connect the RJ11 cable from the CAN OUT on the BDFB VI Monitor to this port

**Port 4:** CAN OUT, connect an RJ45 cable from a downstream CAN device to this port (e.g., another BDFB VIM in the CAN network)

## 4.5.4 Cordex HP Controller

The Cordex™ HP (CXC HP) controller provides centralized setup, control and monitoring of power systems. This ranges from simple monitoring and threshold alarms for temperature, voltage and current, to advanced battery charging and diagnostic features.

The controller supports dual Ethernet ports and a 4.3" LCD screen to allow simultaneous network, LCD and local laptop access to the controller including both web and SNMP interfaces.

The CXC HP supports to dual CAN ports to allow up to 256 power and/or ADIO modules to be controlled and monitored. The controller uses external analog and digital input and output (ADIO) peripherals to monitor electrical signals (temperature, voltage, temperature) and generate electrical signals through relays. The most commonly used ADIO peripheral is the L-ADIO for low voltage systems which includes:

- 8 digital inputs
- 4 voltage sensors
- 4 temperature sensors
- 4 current sensors
- 12 Form C relay outputs

The CXC HP has the following features:

- Front touchscreen: full color LCD touchscreen display, to access controls and menu items by using fingertip touch or a stylus.
- Home button: provides the ability to go directly back to the home screen from any menu.
- Front panel reset: for emergency use only to restart the CXC HP if the unit touch screen or home button are not responding.
- Front panel LEDs: for alarms, progress and status indication.
- Audio speaker: built-in audio tones during active alarms, and can be disabled if required.
- Ethernet: dual ports 10/100 BaseT Ethernet connection on both the front and rear of the controller for remote or local communication.

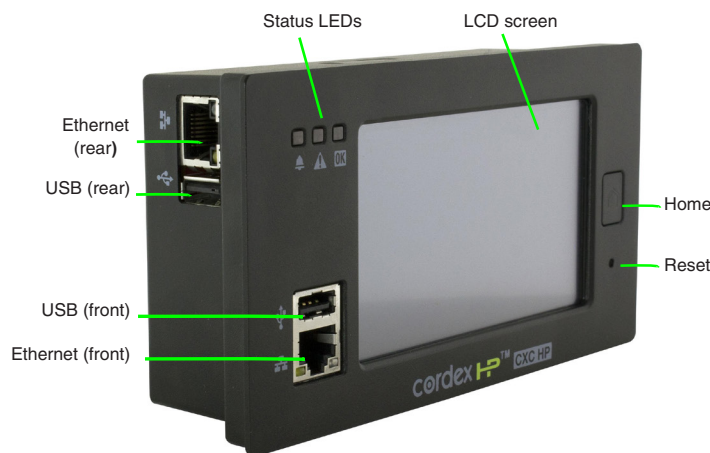


Figure 23 — Cordex CXC HP Controller (left side view)

### 4.5.5 Smart BDFB with integrated CXC HP Controller

- A power cable connects from the Smart VI monitor to power the CXC HP controller
- Connect one CAN cable to the Smart VI monitor CAN out and then route to the CXC HP
- Connect the supplied spare CAN cable from CXC HP to the CAN adapter
- A shielded RJ45 cable is used to connect the CAN adapter of the first BDFB, to the next BDFB in the chain, a CAN adapter to allow runs of greater than 10ft of CAN cable between BDFBs

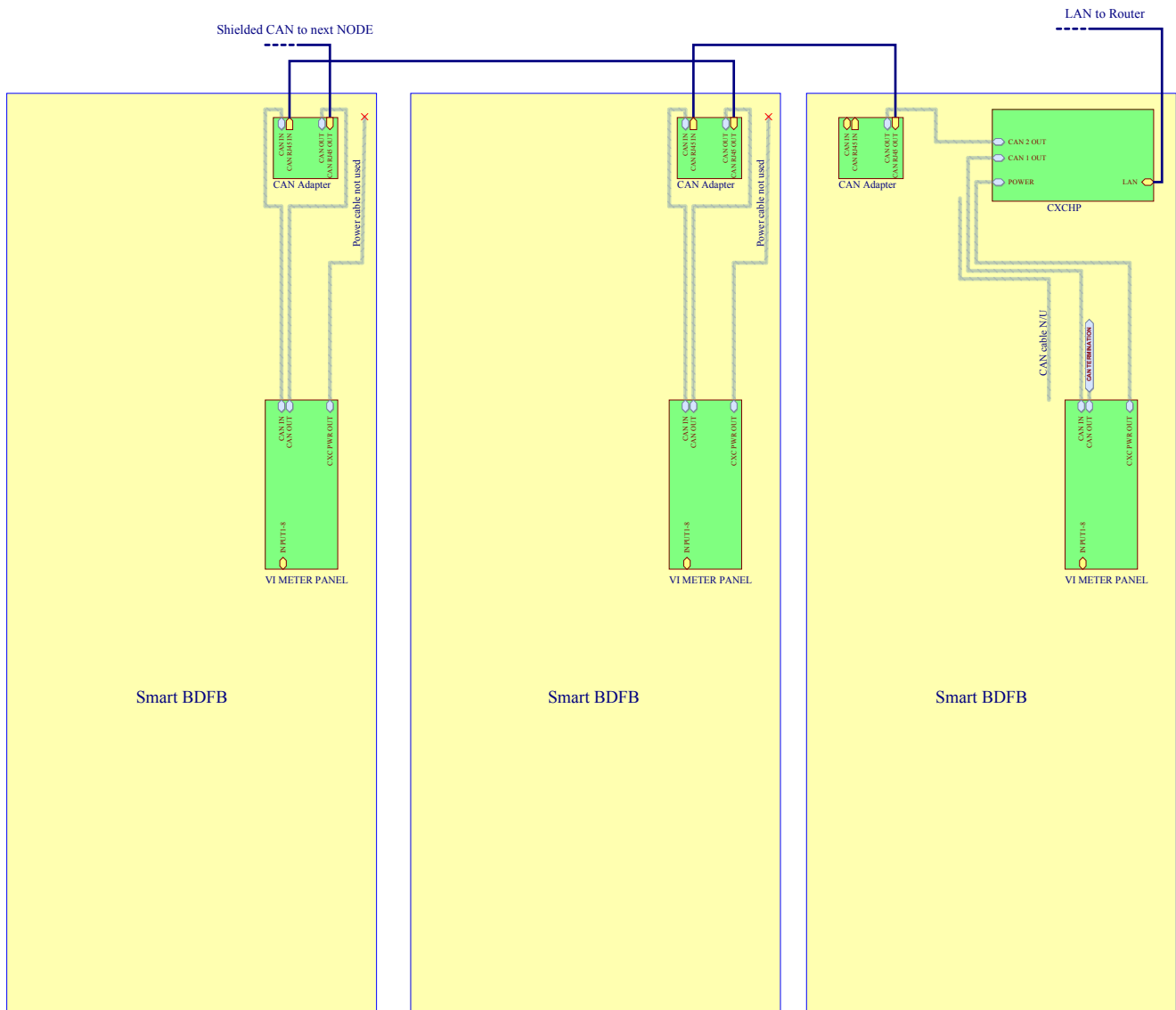


Figure 24 — Smart BDFB with integrated CXC HP controller

## 4.6 BDFB Monitor (original)

### Overview

Each BDFB has up to 8 panels. The current, voltage and breaker trip status are monitored and displayed via the BDFB monitor interface (MI).

The MI features both a display mode for monitoring status, and a configuration mode which is used for navigating menus and making adjustments.

When in display mode, the up and down arrow keys allow users to scroll through the status of each panel. The status of each panel displays on the LCD screen.

**Menus** - The three main menu items are:

- display status,
- panel configuration,
- and system configuration ( which includes alarms and display).

Each menu item has sub items as shown in the menu map (see page 49).

**Keys** - The left and right keys on the MI are used to navigate the menus. The up and down keys are used to accept selections and adjust the parameters.

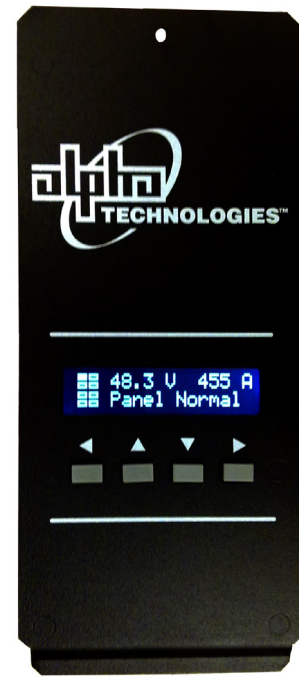


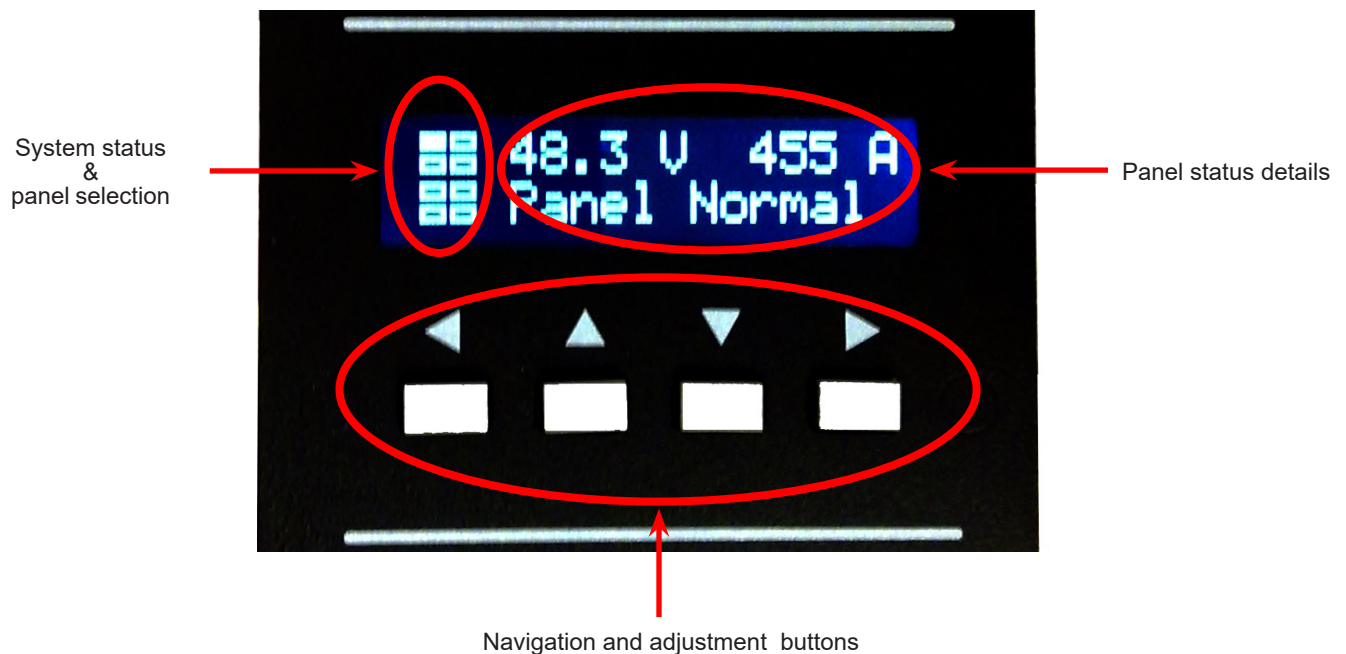
Figure 25 — BDFB monitor interface

### 4.6.1 Monitor LCD Display

When in display mode, the MI will look similar to the following image. The MI displays system status, panel selected, and panel status details. Below the LCD there are four navigation buttons.

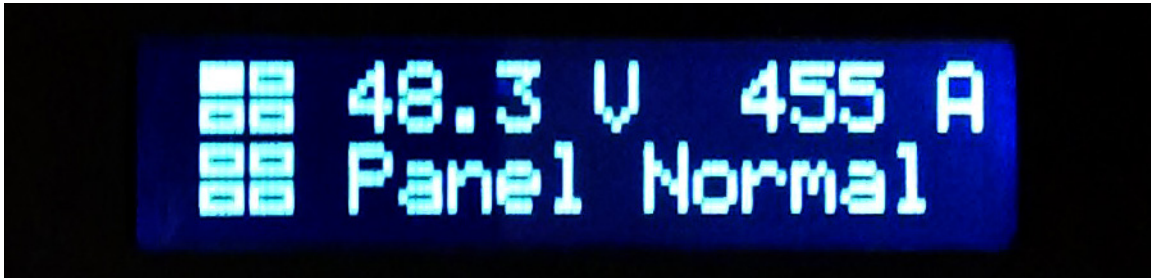
These buttons allow the user to change which panel is being displayed. Left (back), up (previous), down (next) and right (select/enter).

When in configuration mode, these buttons are used to navigate the MI menus, make selections and adjust parameters.



## 4.6.2 Display Mode

When in display mode, the up and down arrow keys allow operators to scroll through the status of each panel. Each panel's status displays on the LCD screen which is divided into two portions.

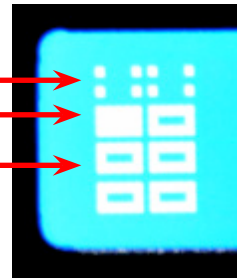


The left portion indicates which panel is selected as well as panel alarms. Each of the eight panels are represented by a 5 by 3 pixel grid. Blinking pixels are an additional indication of panel status. The left-most pixel indicates a breaker trip, the middle pixel indicates current high and the right-most pixel indicates low voltage (feed lost).

**Corners only:** indicates a panel location when no panel is installed

**Solid box:** indicates this panel is selected

**Outlined box:** indicates a panel is present but not selected



The right portion of the display contains two lines: details of the selected panel, with current and voltage on the top line and status messages on the second line. The status reads Normal unless there are alarms.

**Line one:** panel voltage and current

**Line two:** status messages



If a panel does not have a shunt, then the current will read zero. Some panels may share a single feed, in which case, only the panel with the shunt will have valid current, the other panels will be zero (pins shorted). Panels sharing a feed will still display separate voltage readings.

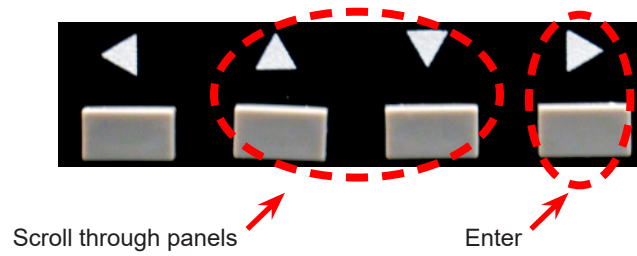
## Alarm Messages

The alarm error messages are as follows:

- Over Current
- Loss of Input Feed
- Breaker Trip

If more than one error exists the message scrolls between errors.

1. To monitor the BDFB, use the up and down buttons to scroll through the individual panels.
2. Press the right arrow key to enter Menu Mode.



### 4.6.3 Configuration Mode

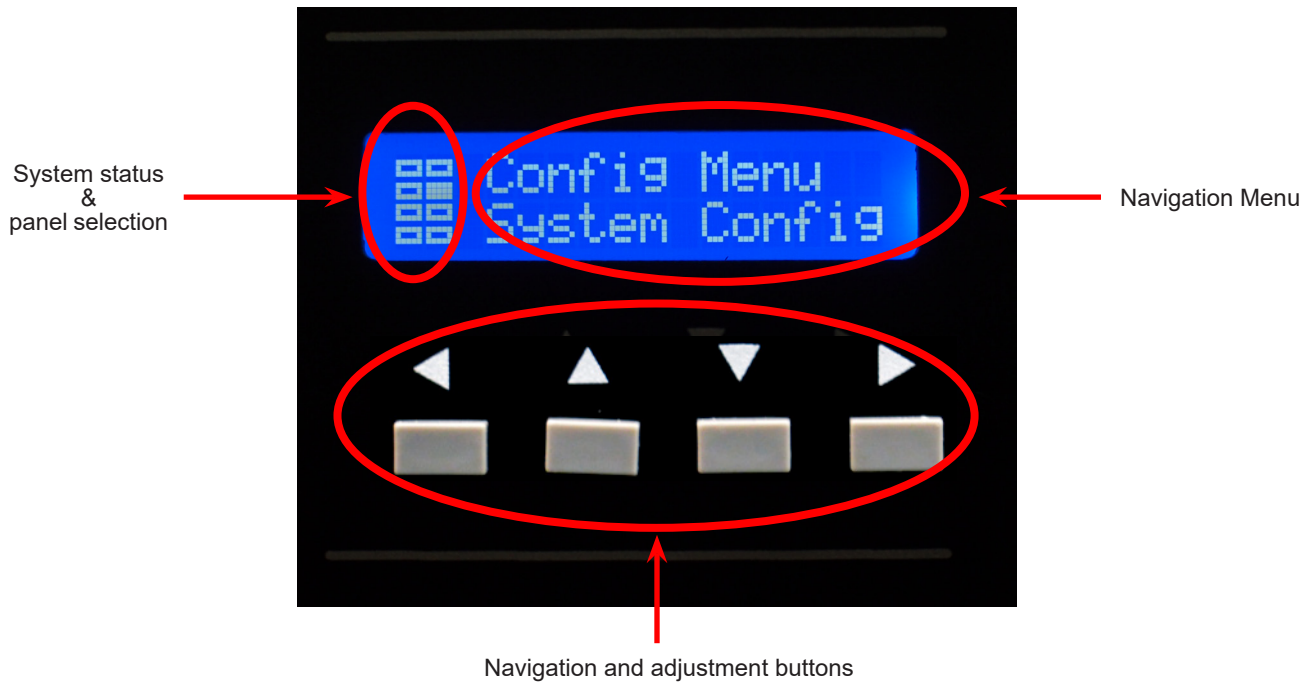
The MI configuration menu is used to set configurations and change parameters. Operators can adjust the parameters until desired functionality is reached, and then save them. Adjusted or restored parameters are not "permanent" until saved at the top level configuration menu (see the Configuration Menu map, on page 49). From the configuration menu the operator can do any of the following:

- Configure individual panels
- Configure system: includes system alarms and display
- Save configuration: saves all parameters to persistent memory (for load after power cycle)
- Revert: sets the BDFB to the previously saved values
- Restore: loads the BDFB parameters to factory default (does not save automatically)

When in the configuration menu mode, the basic appearance is the same, except the right side of the LCD screen displays the navigation menu. The top line will display the menu title, and the second line will display the menu selection. Press the up and down arrows to scroll through the menus.

Press the right arrow to enter a menu and the selected menu displays with the menu title on the top line of the LCD and the menu selection on the second line.

For a full list of all menus options see the configuration menu, on page 49.






#### 4.6.4 To Configure a Panel

1. From **Display Mode**, use the up and down arrows to scroll to the panel to be configured.
2. Press and hold the left and right buttons simultaneously to enter the Configuration mode. **Config Menu** displays on the top line, and the first option, **Panel Config** displays on the second line.
3. Use the up and down arrows scroll to the menu adjustment required.
4. Press the right arrow to enter the menu and this menu selection now displays as the menu title.
5. Modify the parameters.
6. Press the right arrow to save the changes or press the left arrow to cancel. Use the same steps to make changes on other panels.
7. When complete, use the right arrow to go back to the **Config Menu** level, and use the down arrow to scroll to the **Save Config** option to save all changes.



 **NOTE:** 

---

Once changes are made the operator must save any changes from the top-level Save Configuration menu any time before a power cycle.

#### 4.6.5 To Configure System (Alarms or Display)

1. From **Display Mode**, press and hold the left and right buttons simultaneously to enter Configuration mode. **Config Menu** displays on the top line of the display, and the first option, **Panel** displays on the second line.
2. Using the up and down arrows, scroll to **System Config**.



3. Press the right arrow to enter the menu and use the up and down arrows scroll to either **Configure Alarms** or **Configure Display**.
4. Press the right arrow to enter the menu.
5. Modify the parameters.
6. Press the right arrow to save the changes.
7. From the top-level **Config Menu**, scroll down to **Save Config** and save all changes.



## 4.6.6 Configuration Menu

### Top Level Menu

Switch between display mode and configuration mode by holding left and right buttons down simultaneously for 5 seconds.



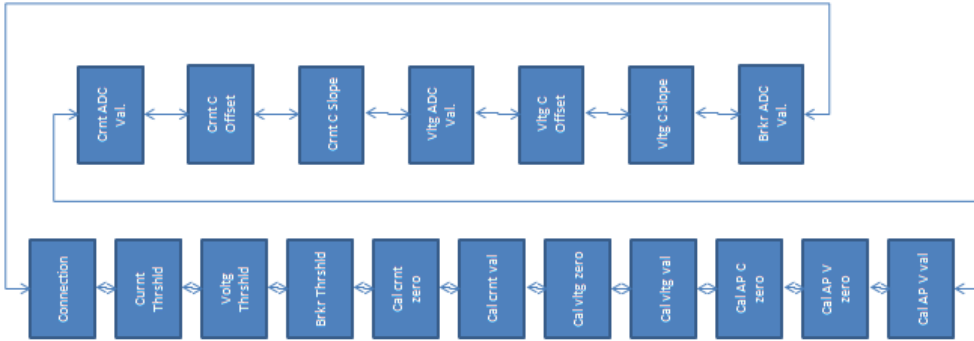
### Configuration Menu

In the configuration menu select Panel or System Configuration, and functions for saving and restoring the configuration.



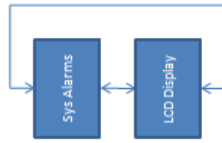
### Panel Configuration

The Panel Configuration provides access to functions for setting the panel type, and calibrating the voltage and current. There is also access provided to view sampled data.



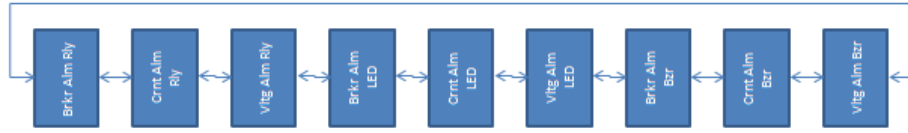
### System Configuration Menu

The System Configuration Menu provides access to the System Alarm menu and LCD Display Menu



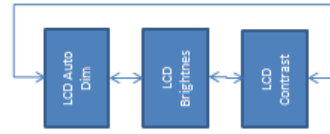
### System Alarm Menu

In the system Alarm Menu the desired operation for the buzzer, relays, and system LED can be set for each of the system alarms. The system alarms are for the feed lost, over current, or breaker tripped on any



### LCD Display Menu

In the LCD Display Menu the contrast and brightness of the backlight can be set, as well as the time delay before the backlight turns off.



## 4.7 Separating Panels

The load bus details can be installed at either the top or the bottom panels. The BDFB load bus arrangements are factory configured, but they can be changed in the field. The basic procedure to separate two panels is to add a shunt bus connector kit to the panel to be separated, connect the shunt kit and then remove the link bar between panels.

In an A-B system, separating panels should ideally be done on one side at a time with the power disconnected.

However where interrupting redundancy is not acceptable, the panels can be separated while the system runs live as long as the voltage potential between the primary feeds is the same.

If the primary feeds are not at the same potential or if the sources are isolated, then there is a possibility of current flowing between the sources which could damage the equipment and/or create an arc when the link bar is removed.

If this procedure is done live, it should only be done by a qualified technician who understands the requirements.



### WARNING!

**Hazardous voltages are present at the input of power systems. The DC output from rectifiers and batteries, though not dangerous in voltage, has a high short-circuit current capacity that may cause severe burns and electrical arcing.**

- Before working with any live battery or power system, follow these precautions:
  - a. Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
  - b. Wear safety glasses with side shields at all times during the installation.
  - c. Use OSHA approved insulated hand tools.

#### To Separate BDFB panels:

1. Cover any live parts with electrashield or a similar product.
2. Install glastics on the panel (these are the glastics to which the shunt and input feed connector are attached).
3. Install input feed connector onto the panel.
4. Connect existing input feed to the new input feed connector using a jumper wire to prevent arcing.
5. Install the primary load onto input feed(s) connector.
6. Check that the new input feed is properly connected at the power source.
7. Install the shunt between input feed connector and input bus bar. At this stage the new feed will be powered by the existing feed through the input bus bars/inter link bar.
8. Ensure that the new input feed is at the same potential/voltage) as the original, and then power up the input feed.
9. Check that the current from both input feeds is into the load (i.e. one feed is not powering the other).
10. Remove the four nuts on the link bar.
11. Remove the link bar.
12. Remove the jumper wire.
13. Adjust the MI to configure the panel for a shunt/feed connection.
14. Calibrate the new input shunt if necessary.

## 4.8 Combining Panels

BDFB load bus arrangements are factory configured, when the system is ordered, but they can be changed in the field. The basic procedure to combine two panels is to install a link bar between the panels, and then remove one shunt feed.

Combining panels should ideally be done one side at a time with the power disconnected.

However where interrupting redundancy is not acceptable, the panels can be combined while the system runs live as long as the voltage potential between the primary feeds is the same.

If the primary feeds are not at the same potential, or if the sources are isolated, then there is a possibility of current flowing between the sources which could damage the equipment and/or create an arc when the link bar is removed.

If this procedure is done live, it should only be done by a qualified technician who understands the requirements.

### **WARNING!**

**Hazardous voltages are present at the input of power systems. The DC output from rectifiers and batteries, though not dangerous in voltage, has a high short-circuit current capacity that may cause severe burns and electrical arcing.**

- Before working with any live battery or power system, follow these precautions:
  - a. Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
  - b. Wear safety glasses with side shields at all times during the installation.
  - c. Use OSHA approved insulated hand tools.

#### **To Combine the BDFB panels:**

1. Cover any live parts with electrashield or a similar product.
2. Measure voltage difference between each panel, if there is a voltage difference then do not start this procedure on a live system.
3. Install jumper wire between input connectors of the panels to be separated.
4. Remove the nuts on the input bus bar where the link bars will attach
5. Insert the link bar (retain the link bar and the nuts).
6. Remove the jumper wire.
7. Disconnect the feed of the panel on which the input is being removed.
8. Remove the shunt of the panel on which the input is being removed.
9. Remove the input connector of the panel on which the input is being removed.
10. Remove the glastics that held the shunt and input connector (optional).
11. Adjust the MI to configure the panel for a linked connection.

## 4.9 Installing/Changing the Load Shunt Bus Kit

The BDFB comes factory configured for top fed installation. Each bank of panels can be reconfigured to meet customer equipment power needs as required. To reconfigure the BDFB, a load shunt bus kit, as well as a link bar kit and the necessary hardware are needed. The BDFB has two banks, and each of the panels on the banks can carry 640A of feed loads, or the 640A loads can be distributed among multiple panels by using a load shunt bus kit and link bar.

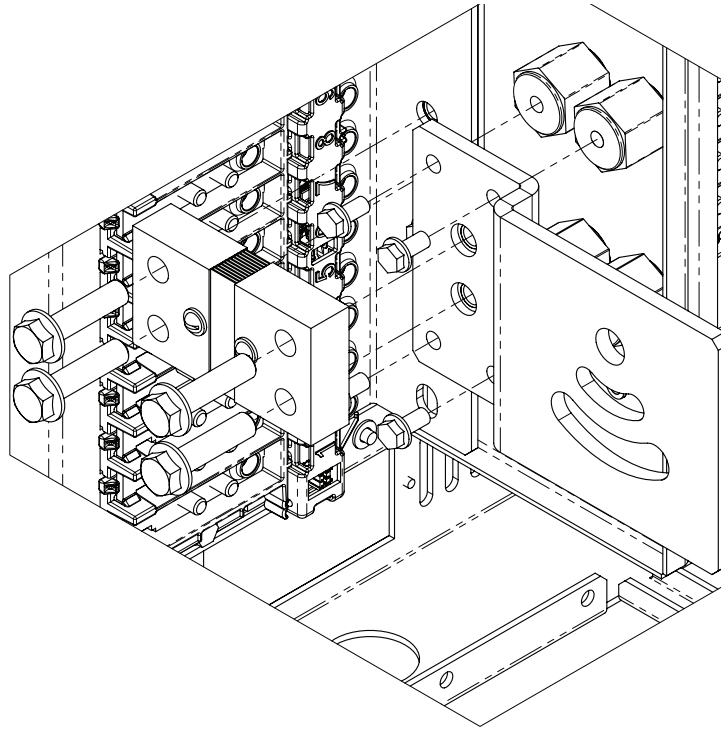


Figure 26 — Installing a load shunt bus kit

## 4.10 Installing/Changing the Inter Link Bar Kit

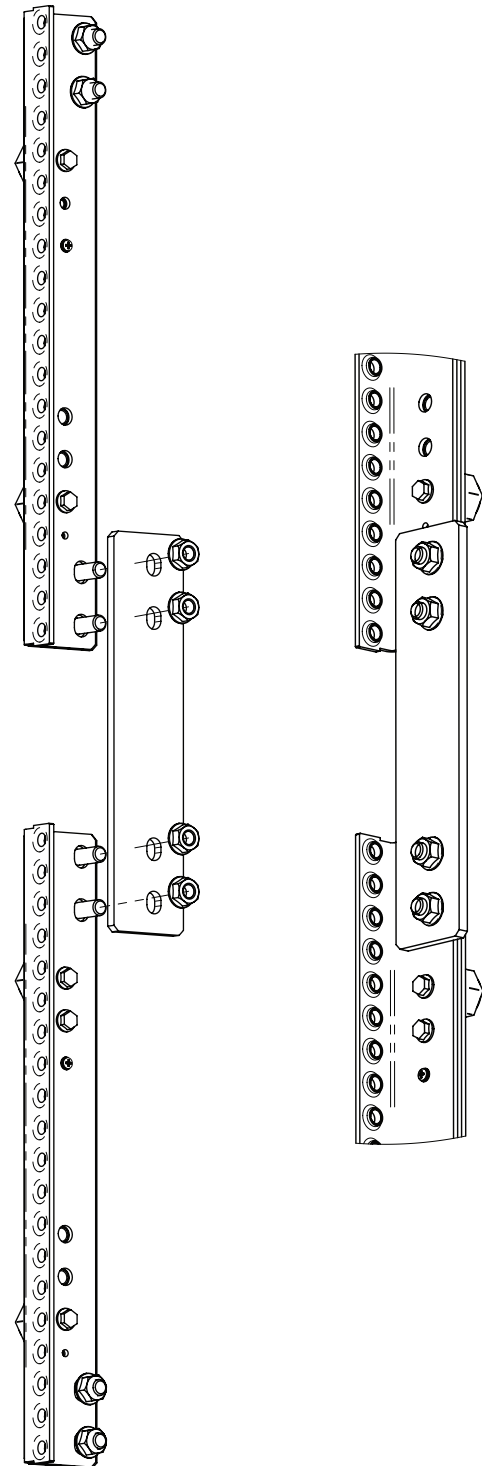
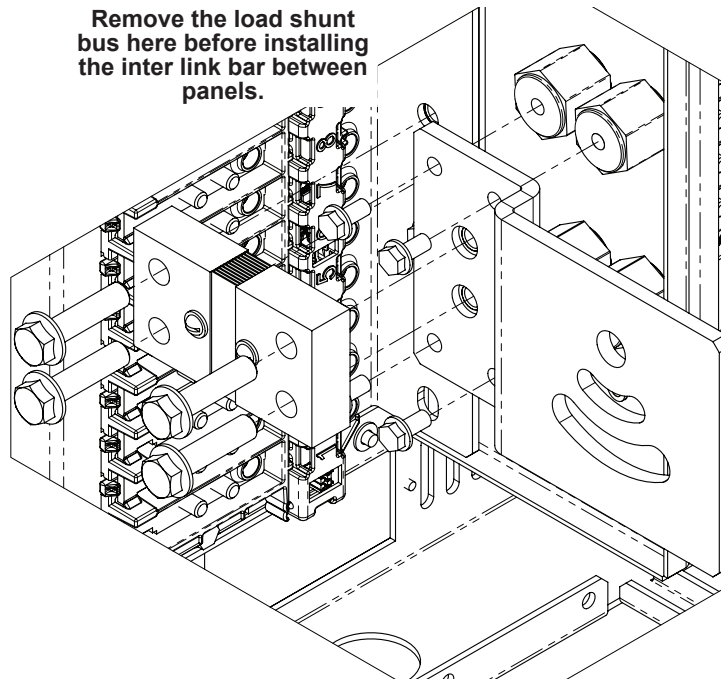
To reconfigure the BDFB, a shunt and or interlink bar kits and the necessary hardware will be needed.

Install the shunt load kit and then install inter link bar between the panels.



### NOTE:

When converting the BDFB, unscrew the bolts to remove the inter link bar between panels, and then reinstall the bolts on the existing PEM studs to ensure connection between the laminate bar and the input bus bar.



## 4.11 Converting the BDFB System

The following diagram shows the connection for a top feed, 8 panel, 2-load BDFB system.

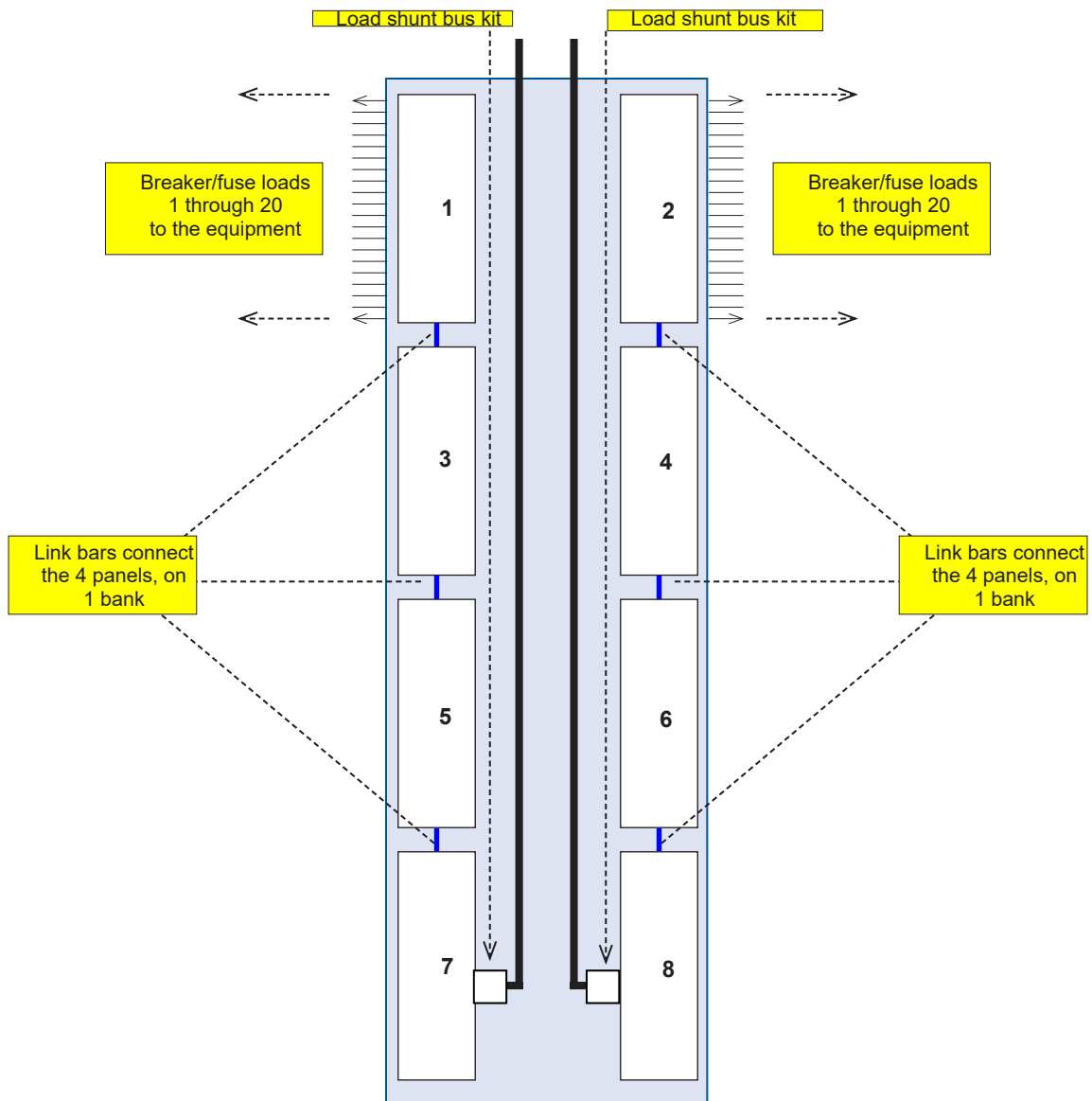


Figure 27 — 8-Panel, top fed BDFB



### 4.11.1 Converting from a 2-load to a 4-load

To convert the BDFB from a 2-load to a 4-load system do the following:

1. Remove the interlink bars between panels 3 and 5, and between panels 4 and 6. See page 55.
2. Install a load shunt bus kit on panels 5 and 6. See page 56.

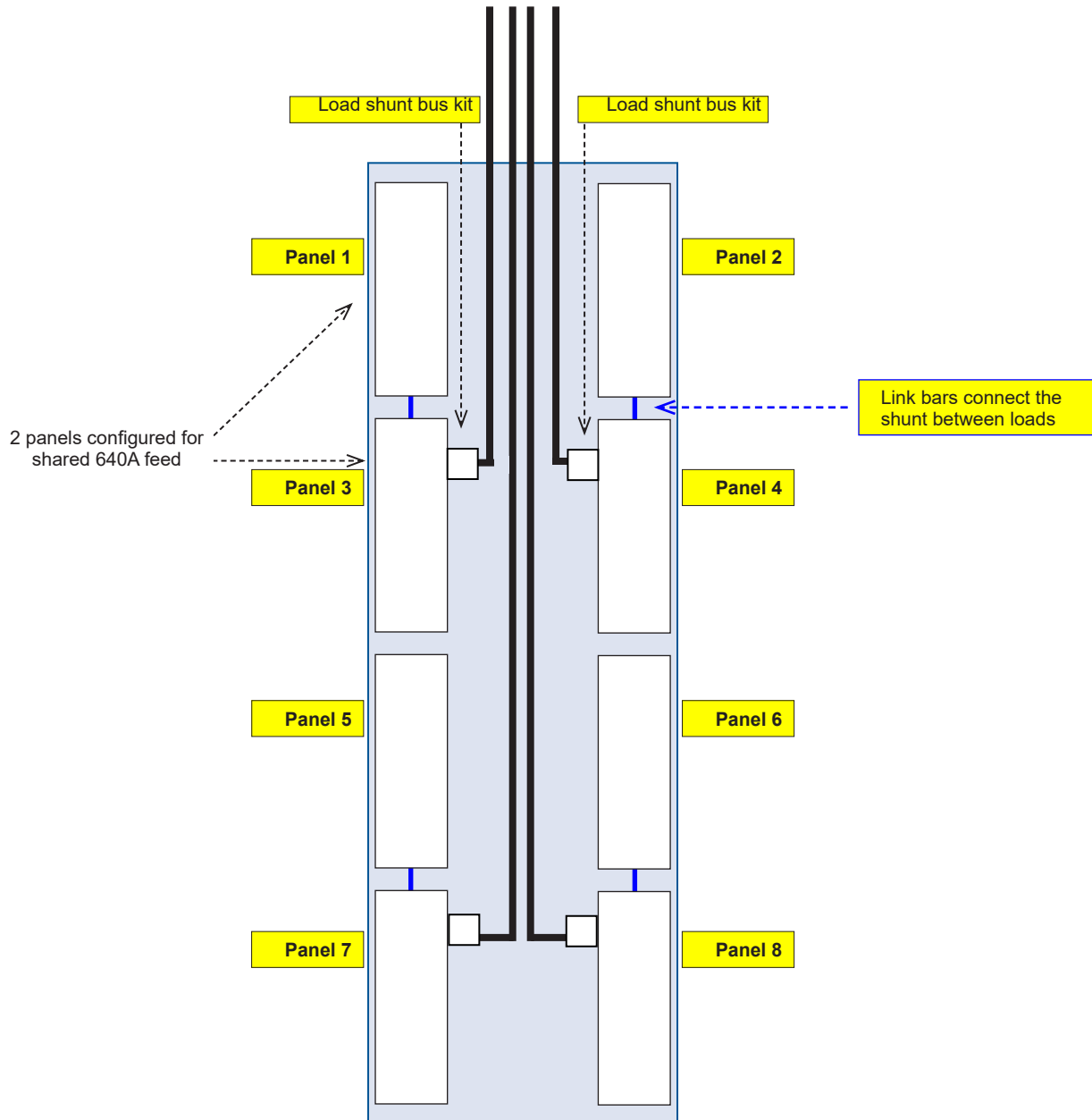


Figure 28 — Top fed, 4-load system

### 4.11.2 Converting from a 4-load to a 8-load

To convert the BDFB from a 4-load to an 8-load system do the following:

1. Remove the interlink bars between panels 1 and 3, 2 and 4, 5 and 7, and between panels 6 and 8. See page 55.

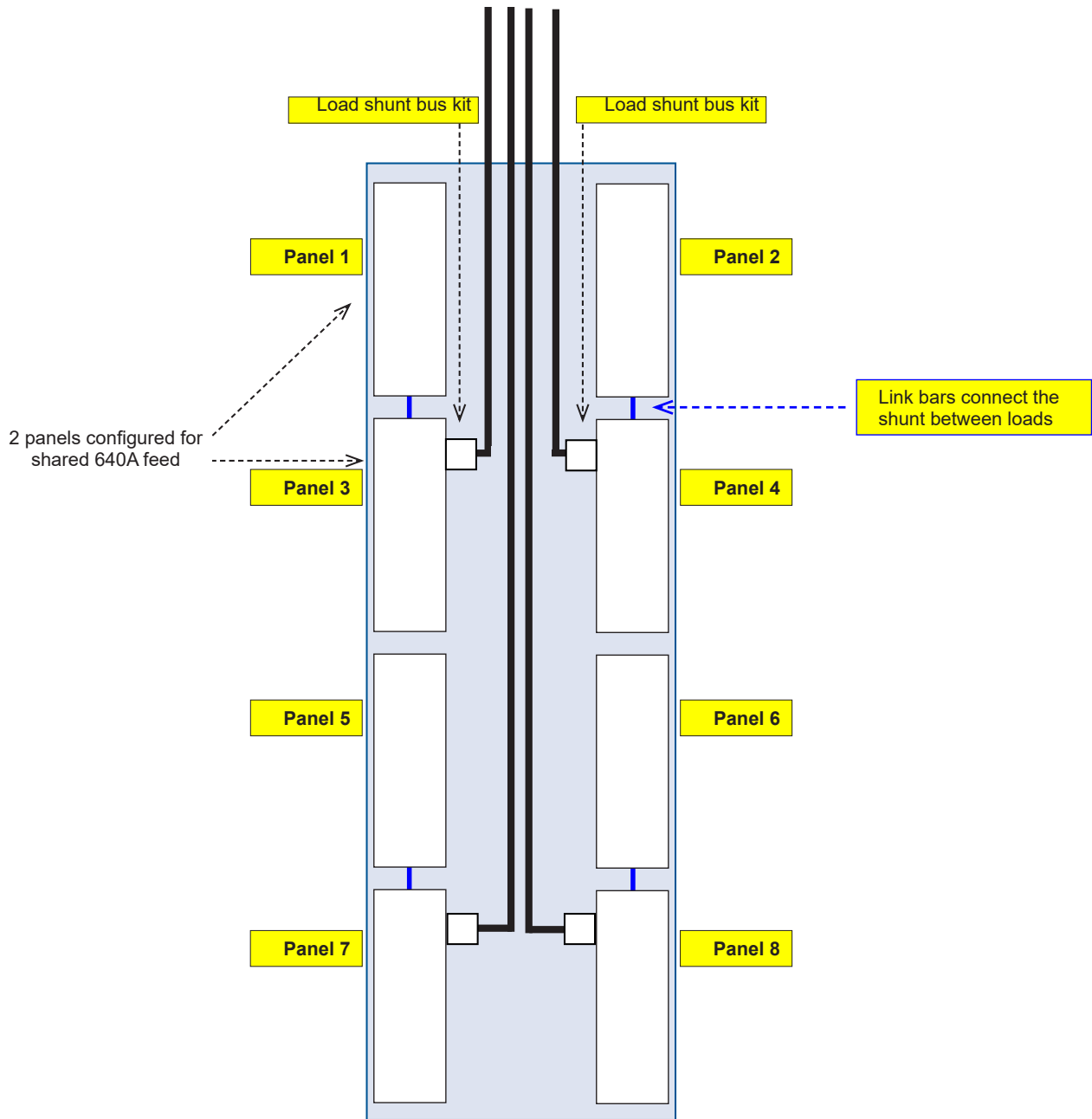


Figure 29 — Converting a 4-load system

2. Install a load shunt bus kit on panels 3, 4, 7 and 8. See following figure.

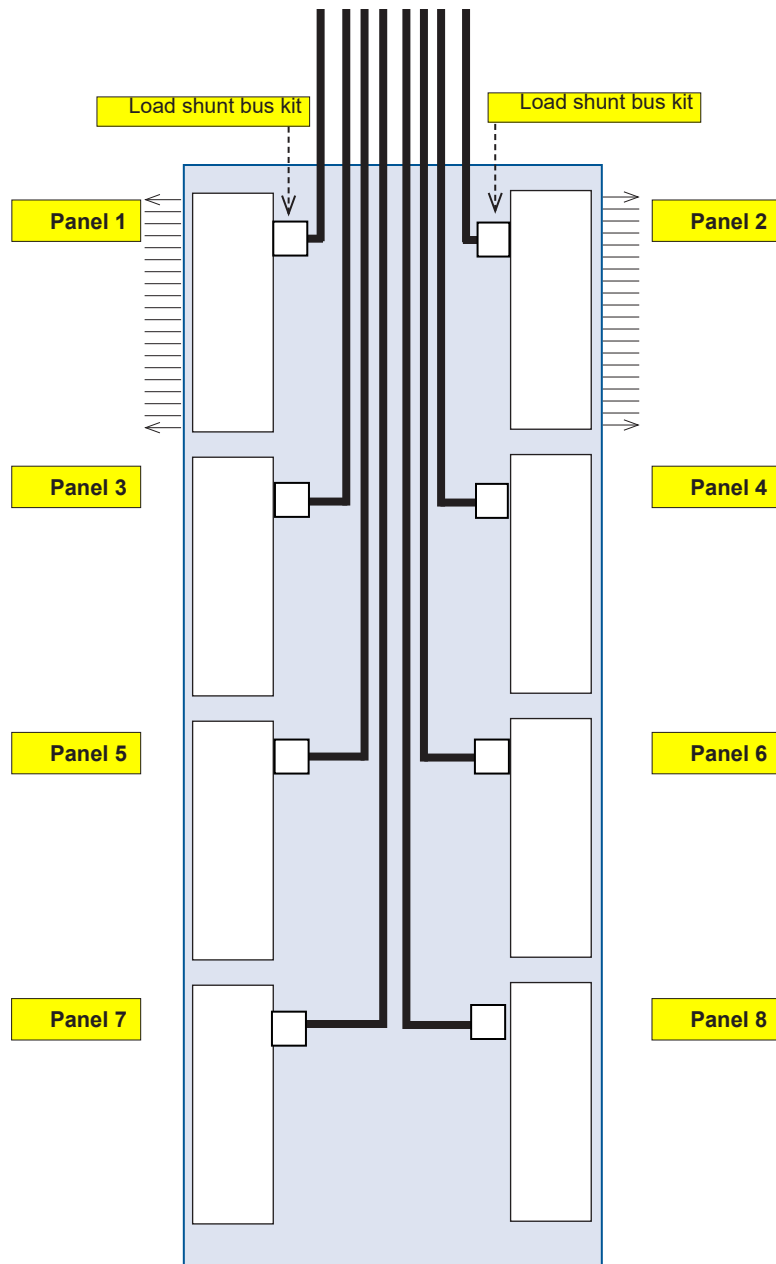


Figure 30 — Top fed 8-load system

## 4.12 Internal Return

The BDFB internal return bus (if ordered) comes factory configured in either 2 or 8-load configuration which can be field upgraded to suit the specific needs of the installation.

The internal return load bus kits can be ordered as follows:

- 0380260-001, 2-load to 4-load bus conversion kit
- 0380261-001, 4-load to 6- or 8-load bus conversion kit
- 0380262-001, 2-load to 6- or 8-load bus conversion kit

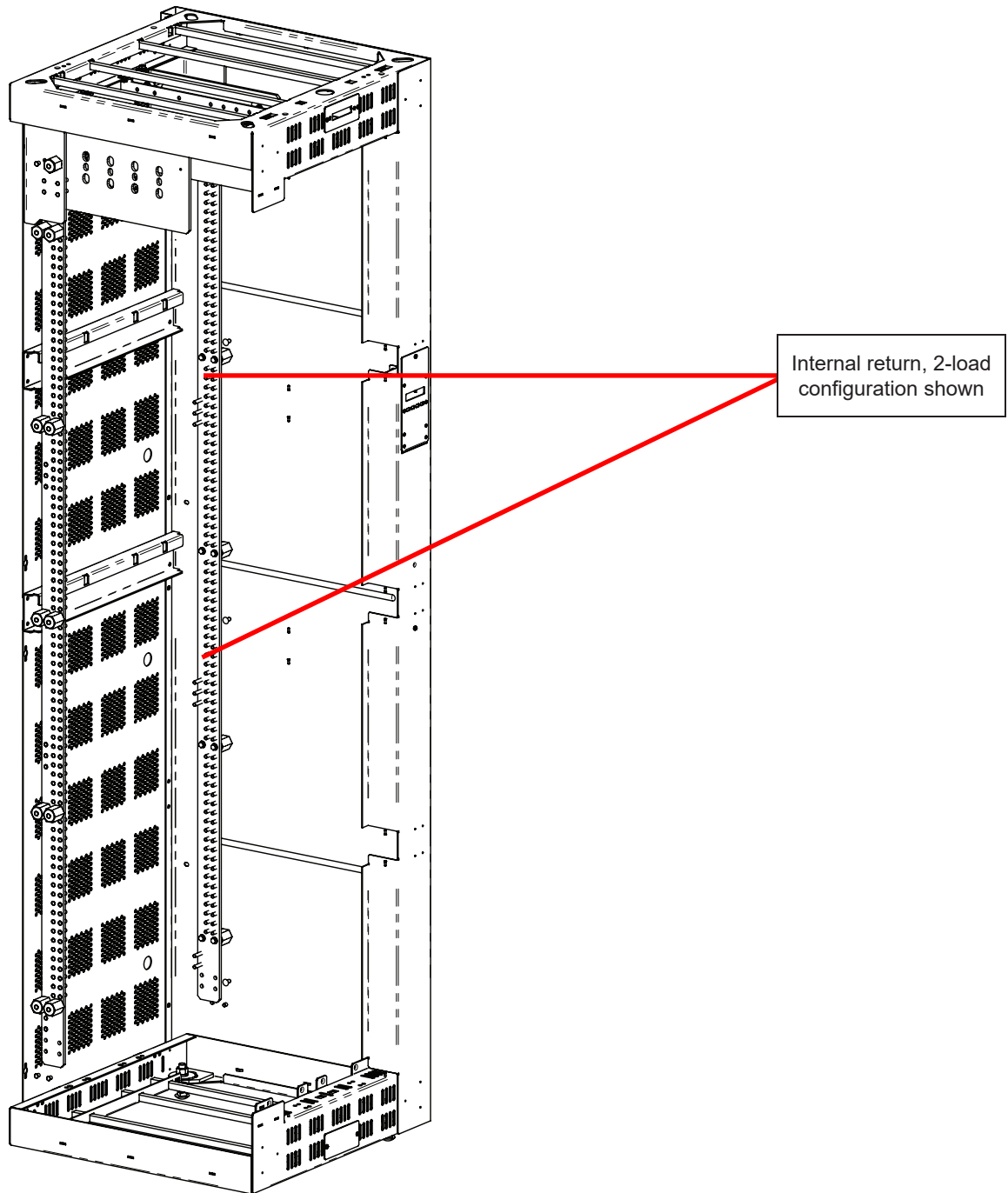


Figure 31 — BDFB side-view, showing internal return option

### 4.13 Converting the Internal Return from 2-load to a 4-load

To convert from a 2-load to a 4-load system, add booster bar with the supplied hardware. See "Booster Bar Installation" on page 61.

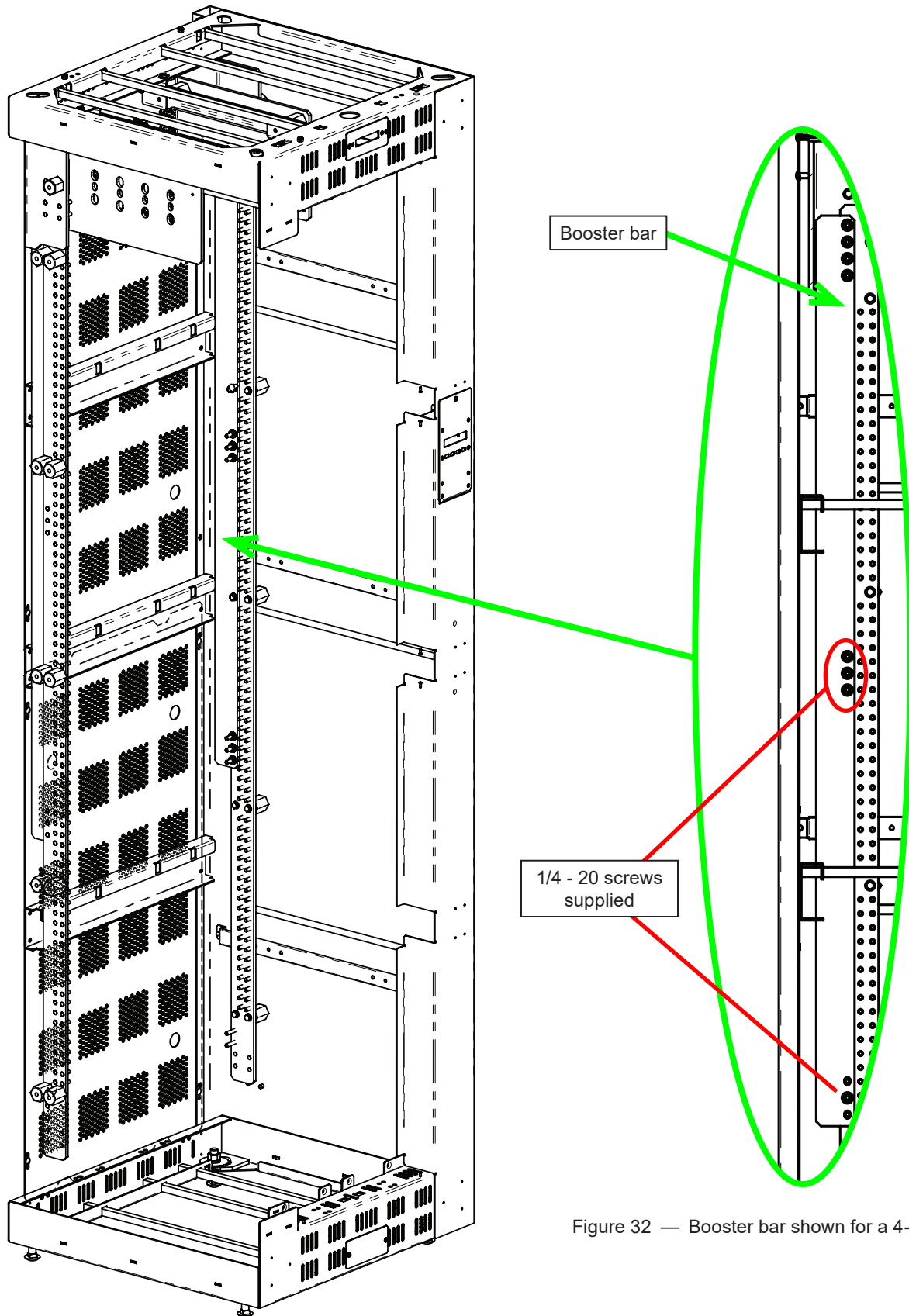


Figure 32 — Booster bar shown for a 4-load system

## 4.14 Converting the Internal Return to a 6- or 8-load System

To convert to a 6- or 8-load system, add booster bars with the supplied hardware. See "Booster Bar Installation" on page 61.

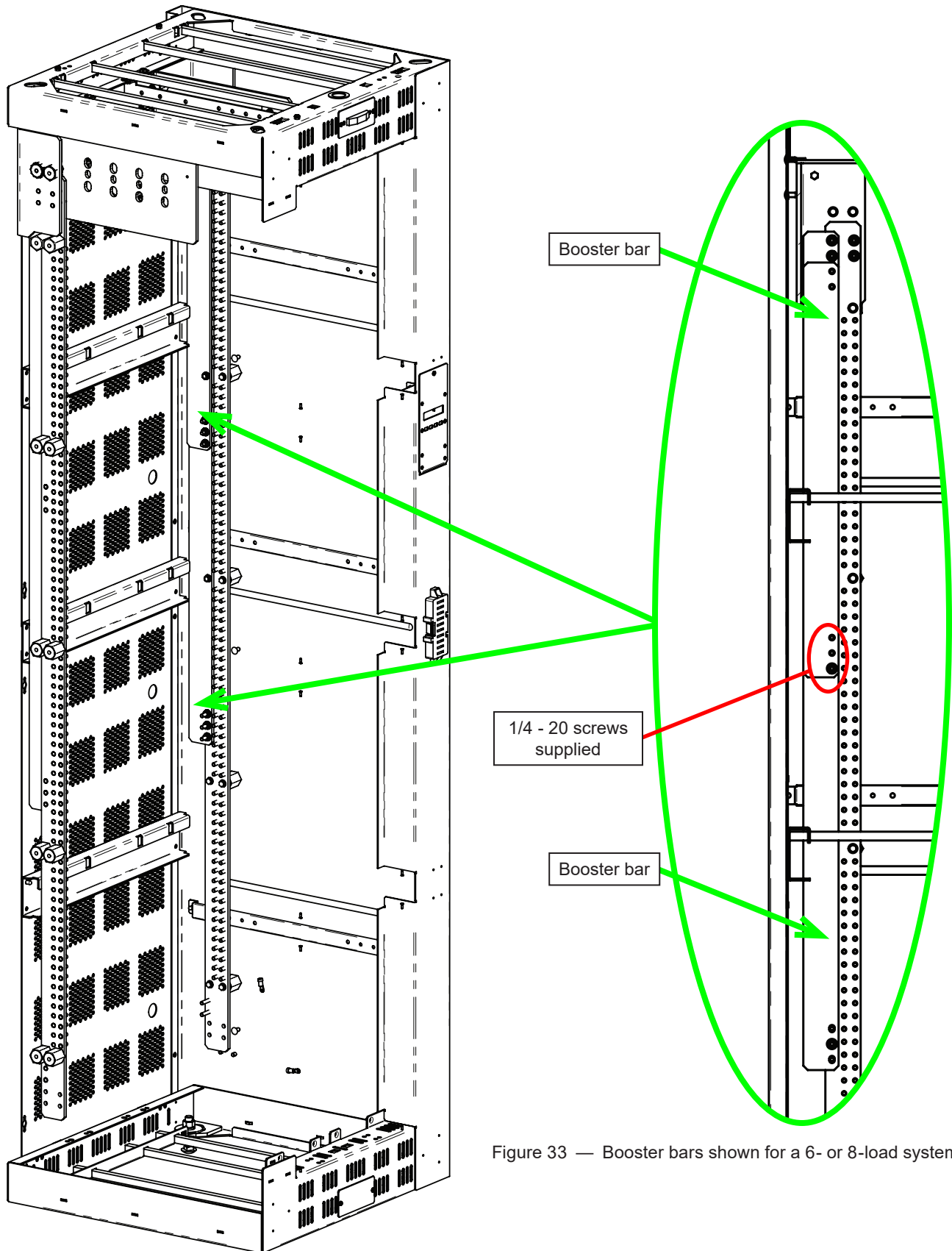


Figure 33 — Booster bars shown for a 6- or 8-load system

## 4.15 Booster Bar Installation

### 4.15.1 Installing a 24" booster bar

If possible, in an A-B system it is recommended to turn off the side in which the booster bar is being installed.

1. There are a total of six nuts which hold the main internal return and the input connector together (only two should be removed).
  2. Remove the two bottom nuts that are vertically in line, and nearest the back of the system. Keep the nuts.
  3. Remove the two bolts that hold the main internal return bar to the glastics that are mounted on the side panel. These two bolts are the ones closest to the back panel and closest to the input connector.
  4. Cover the booster bar with electrashield if desired.
  5. Have the booster bar oriented with the two mounting holes at the top and the side with the holes towards the front of the BDFB.
  6. Insert the bottom end of the booster bar at a steep downward angle into the fourth opening at the top of the enclosure.
  7. Once the booster bar is inside the enclosure, rotate it into a vertical position.
  8. Lift it straight up, and then hang it on the top two mounting PEMs (the ones from which the two nuts were removed).
  9. Re-install the two nuts (that were removed in step 2) on the top of the booster bar.
  10. Install three more nuts along the length of the bar wherever the PEMs protrude (see note below on correct bolts size).
  11. Install the bolts through the booster bar and the main return bar into the glastics which mount to the side.
- Refer to Table C on page 21 for the correct torque values.



#### **NOTE:**

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#### **Use the correct bolts.**

**New bolts are provided in the upgrade kit for this purpose; the original bolts are not the correct length for sufficient engagement and if the bolts are too long they will bottom out in the glastic before the parts are properly clamped. There are different lengths of bolts to be used if the 24" bar is being mounted to the main bar directly or if it is being mounted over a 48" bar.**

### 4.15.2 Installing a 48" Booster Bar

If possible, in an A-B system it is recommended to turn off the side in which the booster bar is being installed.

1. There are a total of six nuts which hold the main internal return and the input connector together (only four should be removed).
  2. Remove the four that are vertically in line and are nearest the back of the system. Keep the nuts.
  3. Remove the three bolts that hold the main internal return bar to the glastics which are mounted on the side panel. These three bolts are the ones closest to the back panel and closest to the input connector.
  4. Cover the booster bar with electrashield if desired.
  5. Have the booster bar oriented with the 4 mounting holes at the top and the side with the holes towards the front of the BDFB.
  6. Insert the bottom end of the booster bar at a steep downward angle into the third opening at the top of the enclosure.
  7. Once inside the enclosure rotate it into a vertical position.
  8. Lift it straight up, and then hang it on the top four mounting PEMs. (The ones from which the four nuts were removed).
  9. Re-install the four nuts (that were removed in step 2) on the top of the booster bar.
  10. Install six more nuts along the length of the bar wherever the PEMs protrude. (see note below on correct bolt size).
  11. Install the bolts through the booster bar and the main return bar into the glastics which mount to the side.
- Refer to Table C on page 21 for the correct torque values.



#### NOTE:

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##### **Use the correct bolts.**

**New bolts are provided in the upgrade kit for this purpose; the original bolts are not the correct length for sufficient engagement and if the bolts are too long they will bottom out in the glastic before the parts are properly clamped. There are different lengths of bolts to be used if the 24" bar is being mounted to the main bar directly or if it is being mounted over a 48" bar.**



## 4.16 External Return Installation

### 4.16.1 Mounting the External Return Base Kit (optional)

The external return base kit is an option for return connections for the loads. It serves as the common connecting point for the positive side of the power section.

The external return kit has a capacity of 640A per kit. External return adder kits can be installed onto the base kit to increase its total capacity. Each side of the BDFB can have a maximum 1 base kit and 3 adder kits to provide a capacity to 2560A per side, for a total system capacity of 5120A.

1. Before joining return bar components together, ensure that all contact surfaces on the busbars are clean and coated with a thin coat of NO-OX-ID "A" compound (or approved equivalent).
2. Follow the instructions included with the kit to assemble and mount on the customer-supplied auxiliary framing superstructure away from the system.

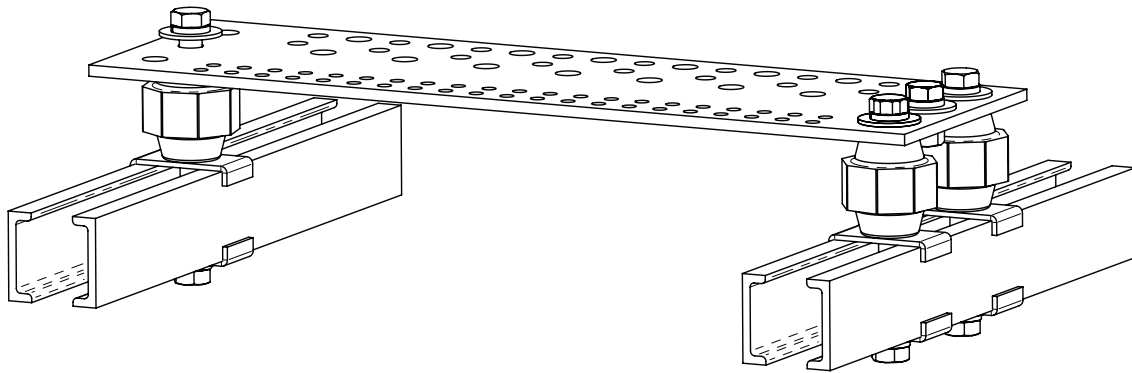


Figure 34 — External return base kit

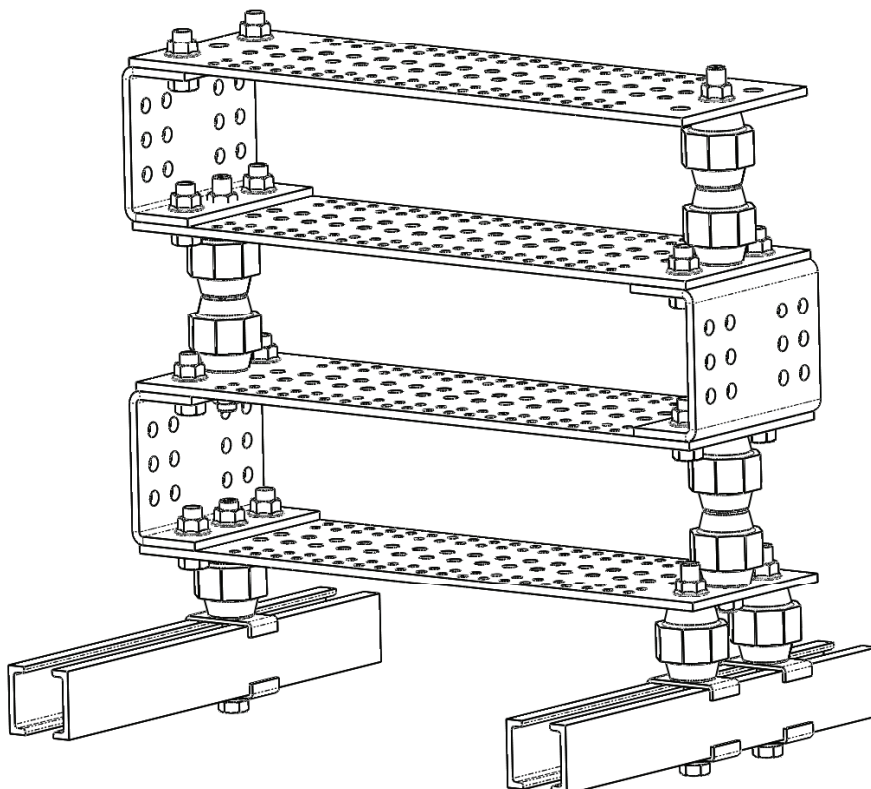


Figure 35 — External return adder kit, 3 kits shown

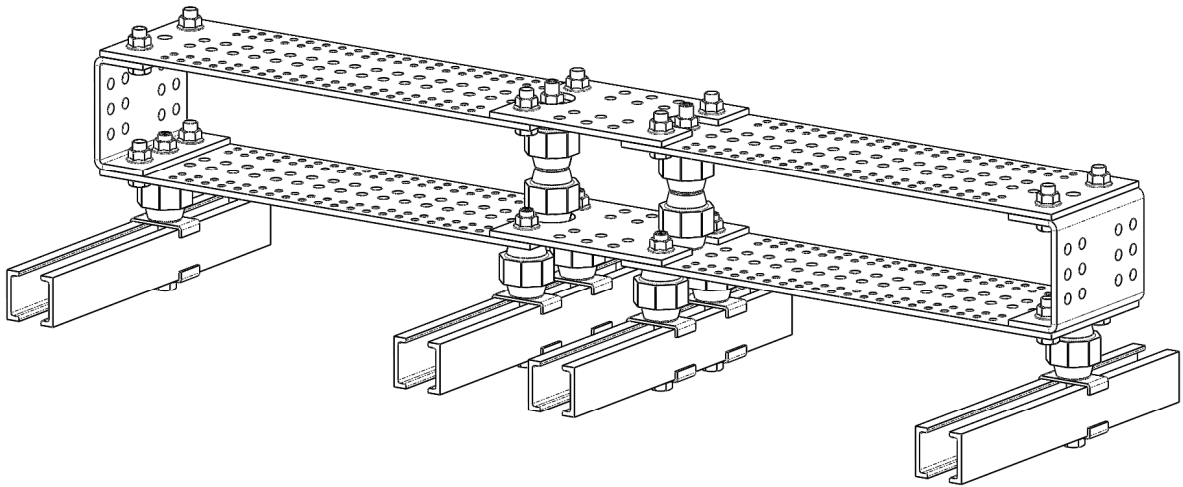


Figure 36 — External return, 4-bar, horizontal configuration

### 4.16.2 Return Connection

When installing a BDFB with the external return option, separate return wires need to be connected to the A and B sides to power the BDFB controller panel.

The connection landings can be accessed via the rear of the BDFB and are labeled CONTROLLER BUS 'A' RETURN (RTN A), and CONTROLLER BUS 'B' RETURN (RTN B) respectively, see Figure 37. The minimum wire size is 20 AWG.

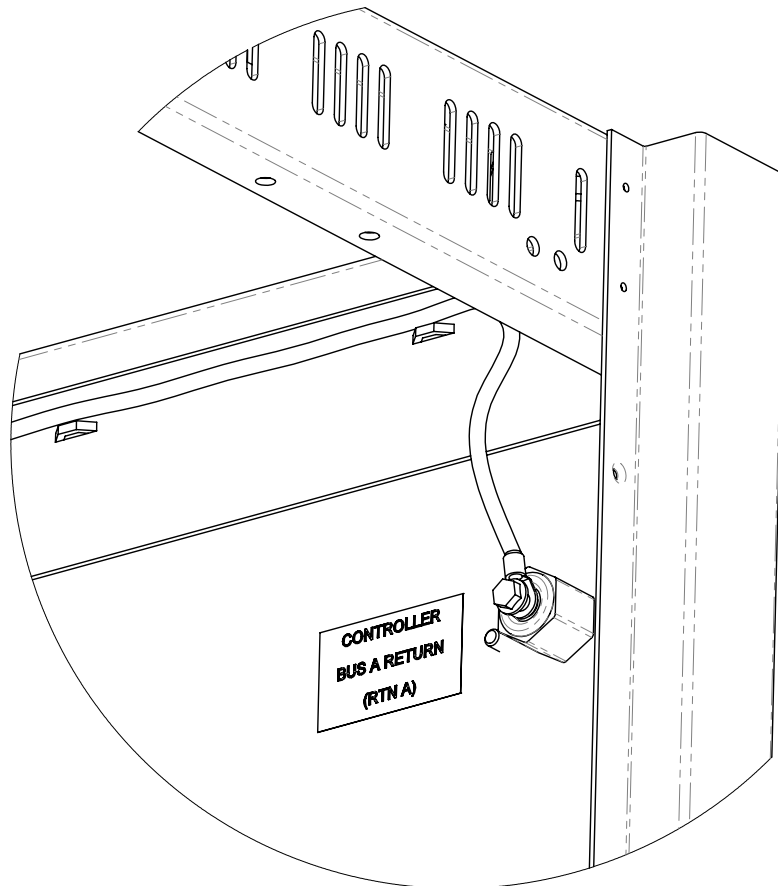


Figure 37 — External return connection, (Return A shown)

### 4.16.3 Landing Cables on External Return

When landing cables on the bus bar for the external return bar kit follow the instructions in the Figure 21.

#### Return Bar to Loads Wiring

Always start system and load wiring from the same side. When wiring the system always space the input and output cables evenly across the entire length of the bar to ensure the load current is evenly distributed.

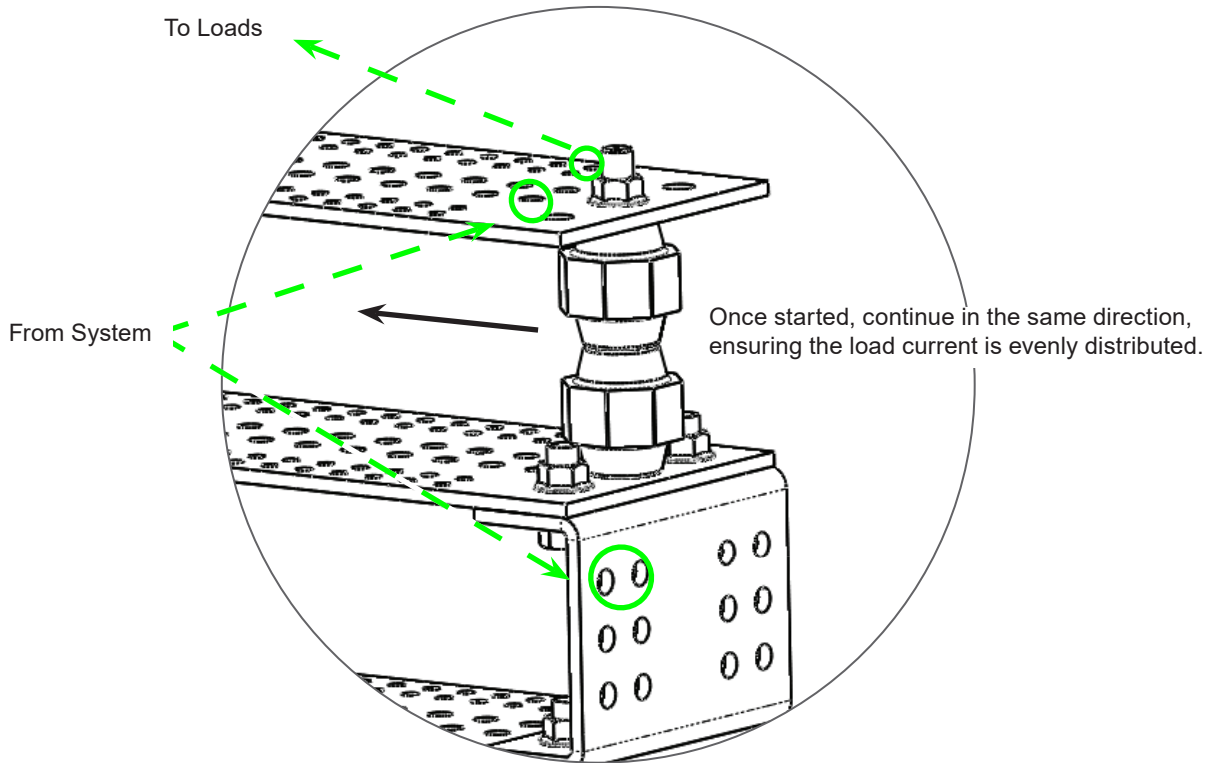


Figure 38 — Landing the cables

# 5. Maintenance

Although very little maintenance is required with Alpha systems, routine checks and adjustments are recommended to ensure optimum system performance. Qualified service personnel should do the repairs.

The following table lists a few maintenance procedures for this system. These procedures should be performed at least once a year.



## WARNING!

**Use extreme care when working inside the unit while the system is energized. Do not make contact with live components or parts.**

**Circuit cards, including semi-conductor devices, can be damaged by static electricity. Always wear a grounded wrist strap when handling or installing circuit cards.**

**Ensure redundant modules or batteries are used to eliminate the threat of service interruptions while performing maintenance on the system's alarms and control settings.**

Table D — Sample maintenance log

Procedure	Date Completed
Clean ventilation openings.	
Inspect all system connections. Re-torque if necessary.	
Verify alarm/control settings.	
Verify alarm relay operation.	

## 5.1 Breaker Panel Interface Replacement (alarm strip)

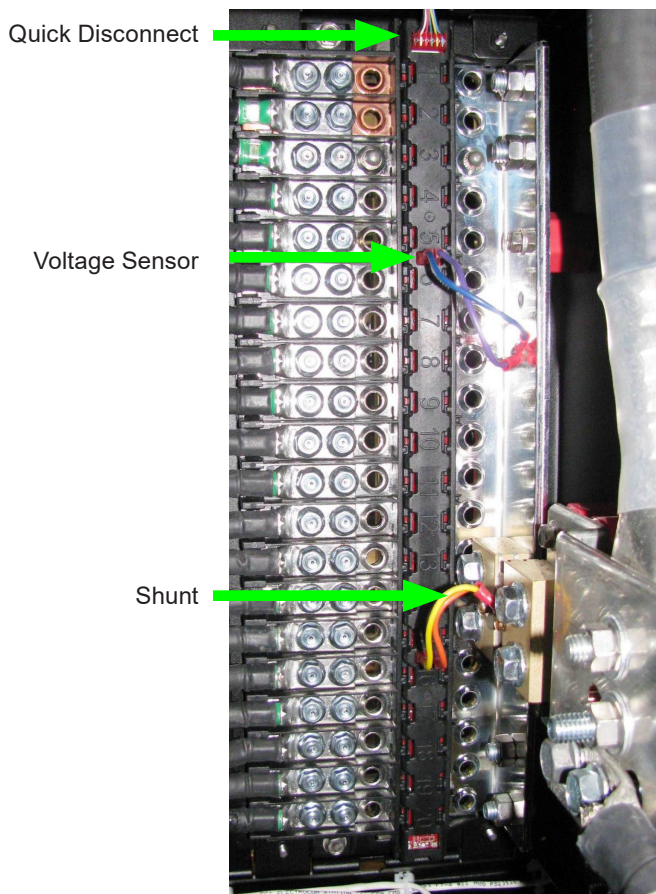
This procedure outlines how to remove and replace the breaker panel interface boards (P/N 7050244-001).

The alarm strip boards are difficult to install when the breakers are in place. It is recommended that all breakers be removed before installing the alarm strips.

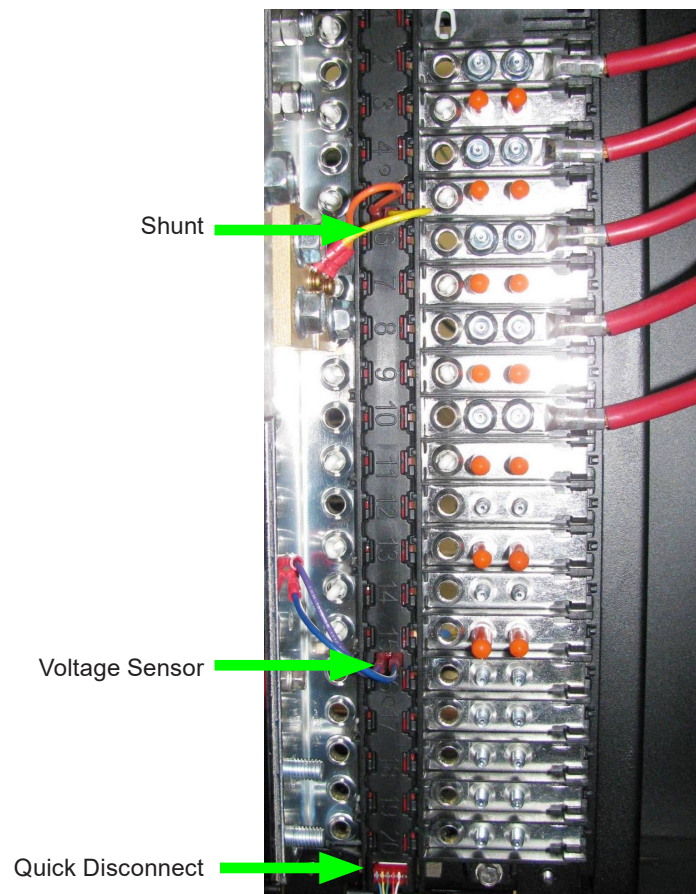
### WARNING!

**Hazardous voltages are present at the input of power systems. The DC output from rectifiers and batteries, though not dangerous in voltage, has a high short-circuit current capacity that may cause severe burns and electrical arcing.**

- Before working with any live battery or power system, follow these precautions:
  - a. Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
  - b. Wear safety glasses with side shields at all times during the installation.
  - c. Use OSHA approved insulated hand tools.



Left side



Right side



**NOTE:**

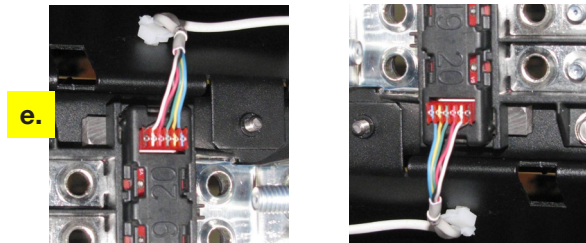
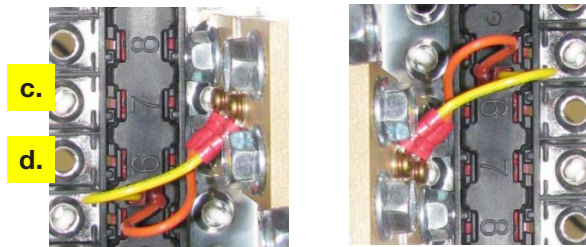
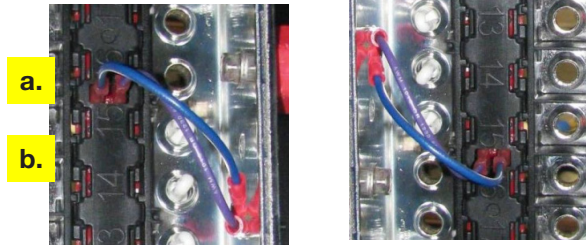
The alarm boards are calibrated to specific inputs on the monitor interface labelled 1 through 8. Do not swap locations. The frame is always pre-wired to all locations. Recalibrate the board after installation (use kit available from Alpha).

**To remove the interface connections:**

These wires have insulated quick connectors to reduce chance of shorting as there is -48Vdc with high current potential on the leads. Fasten wires in safe location or insulate the ends to prevent an accidental short.

1. Remove the breaker panel interface connections as follows:

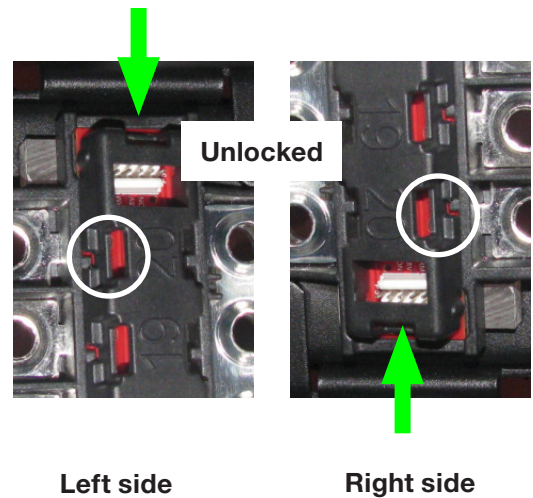
- a. Disconnect Voltage Supply (blue)
- b. Disconnect Voltage Sense (violet)
- c. Disconnect Shunt (-) (yellow)
- d. Disconnect Shunt (+) (orange)
- e. Unplug the Quick Disconnect
- f. Tape ends of loose wires after disconnection.



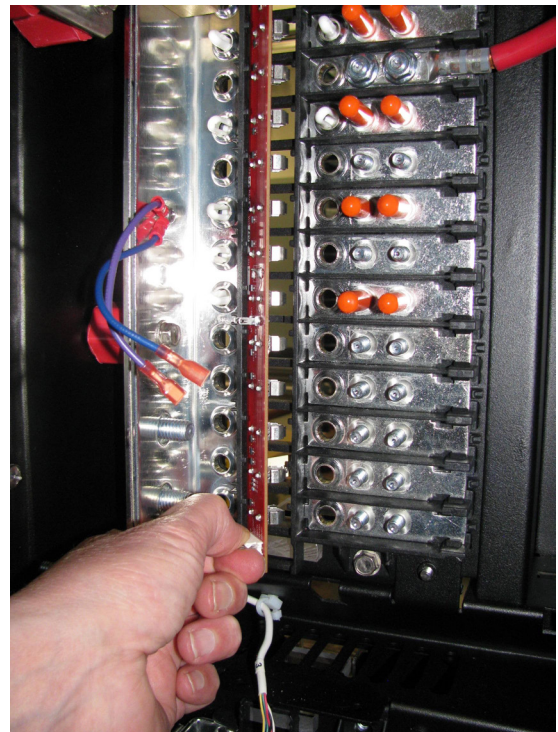
Left side

Right side

2. Remove the cover from the breaker panel interface as follows:
  - a. Gently hold the cover with one hand.
  - b. Push up on the bottom of the cover for the right side. Push down on the top for the left side.
  - c. A click will be heard when the cover unlatches, and then gently pull it away from the breaker panel.




3. Remove the interface board:
  - a. Swing the interface card clockwise (<math><45^\circ</math>) for the right side (illustrated). Swing the interface card counter-clockwise for the left side.
  - b. Slide the card gently away from the panel, do not force board past stops.
4. Follow these steps in reverse order (from step 3 to step 1) to insert the new interface board.



## 5.2 Smart VI Monitor / Display Replacement

This procedure outlines how to remove and replace the existing system monitor display interface with either the original system monitor or the new Smart VI monitor

 **WARNING!**

**Hazardous voltages are present at the input of power systems. The DC output from rectifiers and batteries, though not dangerous in voltage, has a high short-circuit current capacity that may cause severe burns and electrical arcing.**

- Before working with any live battery or power system, follow these precautions:
  - a. Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
  - b. Wear safety glasses with side shields at all times during the installation.
  - c. Use OSHA approved insulated hand tools.

**WARNING!**

**To prevent possible ESD damage, always wear a grounded wrist strap when handling or installing circuit cards.**

**To remove the system Monitor Interface:**

1. Remove the mounting screw and set aside.
2. Swing down the mounting plate to gain access to the connectors.
3. Hold the mounting plate securely, and then remove the connectors, one at a time.
4. Remove the Smart VI monitor board assembly and place it on a flat working surface.
5. Remove the two mounting screws and set aside, and then remove the old board.
6. Replace with the new board.
7. Follow these steps in reverse order (from step 6 to step 1) to insert the new board.

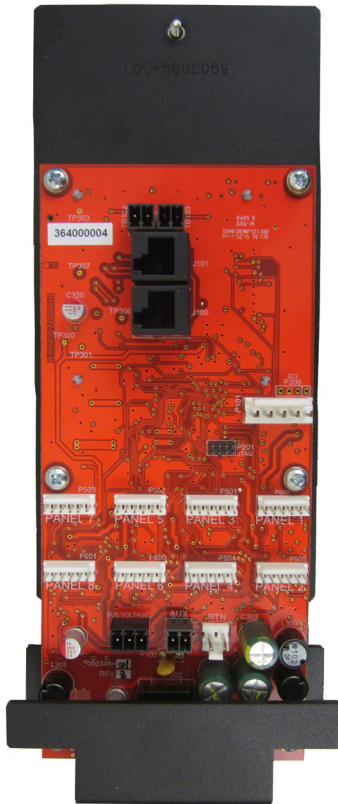


Figure 39 — Smart VI Monitor Board

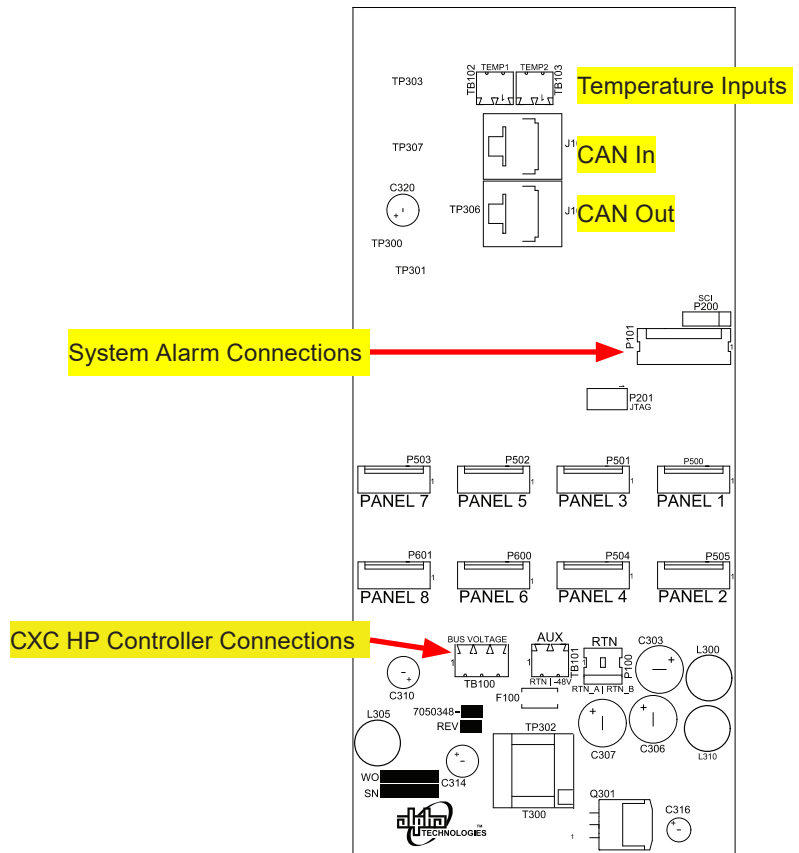


Figure 40 — Cable Assignment



## 6. Warranty Statement and Service Information

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### 6.1 Technical Support

In Canada and the USA, call toll free 1-888-462-7487.

Customers outside Canada and the USA, call +1-604-436-5547.

### 6.2 Warranty Statement

For full information details review Alpha's online Warranty Statement at [www.alpha.ca/support](http://www.alpha.ca/support).

### 6.3 Product Warranty

Alpha warrants that for a period of two (2) years from the date of shipment its products shall be free from defects under normal authorized use consistent with the product specifications and Alpha's instructions, the terms of the manual will take precedence.

The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period.

There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

### 6.4 Battery Warranty

Note that battery warranty terms and conditions vary by battery and by intended use. Contact your Alpha sales representative or the Technical Support team at the above number to understand your entitlements under Battery Warranty.

### 6.5 Warranty Claims

Any claim under this Limited Warranty must be made in writing to Alpha BEFORE sending material back. Alpha will provide Product return instructions upon approval of return request. A Service Repair Order (SRO) and / or Return Authorization (RA) number will be issued ensuring that your service needs are handled promptly and efficiently.

Claims must be made online at: [www.alpha.ca](http://www.alpha.ca).

### 6.6 Service Information

For a list of international service centers, refer to the Alpha website: [www.alpha.ca](http://www.alpha.ca).

## 7. Acronyms and Definitions

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AC	Alternating current
ANSI	American National Standards Institute
AWG	American Wire Gauge
BTU	British thermal unit
CAN	Controller area network
CEC	Canadian Electrical Code
CSA	Canadian Standards Association
CX	Cordex™ series; e.g., CXC for Cordex System Controller
DC	Direct current
DHCP	Dynamic Host Configuration Protocol
EIA	Electronic Industries Alliance
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ERM	Electromagnetic Compatibility and Radio Spectrum Matters
ESD	Electrostatic Discharge
FCC	Federal Communications Commission (for the USA)
GSM	Group Speciale Mobile (global system for mobile communications)
HVSD	High voltage shutdown
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
LED	Light emitting diode
LVD	Low voltage disconnect
MIL	One thousandth of an inch; used in expressing wire cross sectional area
MOV	Metal oxide varistor
MTBF	Mean time between failures
NC	Normally closed
NEC	National Electrical Code (for the USA)
NO	Normally open
OSHA	Occupational Safety & Health Administration
OVP	Over voltage protection
RAM	Random access memory
RU	Rack unit (1.75")
TCP/IP	Transmission Control Protocol / Internet Protocol
THD	Total harmonic distortion
UL	Underwriters Laboratories
VRLA	Valve regulated lead acid

# 8. Certification

## About CSA and NRTL

CSA (Canadian Standards Association also known as CSA International) was established in 1919 as an independent testing laboratory in Canada. CSA received its recognition as an NRTL (Nationally Recognized Testing Laboratory) in 1992 from OSHA (Occupational Safety and Health Administration) in the United States of America (Docket No. NRTL-2-92). This was expanded and renewed in 1997, 1999, and 2001. The specific notifications were posted on OSHA's official website as follows:

- Federal Register #: 59:40602 - 40609 [08/09/1994]
- Federal Register #: 64:60240 - 60241 [11/04/1999]
- Federal Register #: 66:35271 - 35278 [07/03/2001]

When these marks appear with the indicator “C and US” or “NRTL/C” it means that the product is certified for both the US and Canadian markets, to the applicable US and Canadian standards. (1)

Alpha rectifier and power system products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 60950-01 and UL 60950-1. Alpha UPS products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 107.3 and UL 1778.

As part of the reciprocal, US/Canada agreement regarding testing laboratories, the Standards Council of Canada (Canada's national accreditation body) granted Underwriters Laboratories (UL) authority to certify products for sale in Canada. (2)

Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

### NRTLs capabilities

NRTLs are third party organizations recognized by OSHA, US Department of Labor, under the NRTL program.

The testing and certifications are based on product safety standards developed by US based standards developing organizations and are often issued by the American National Standards Institute (ANSI). (4)

The NRTL determines that a product meets the requirements of an appropriate consensus-based product safety standard either by successfully testing the product itself, or by verifying that a contract laboratory has done so, and the NRTL certifies that the product meets the requirements of the product safety standard. (4)

### Governance of NRTL

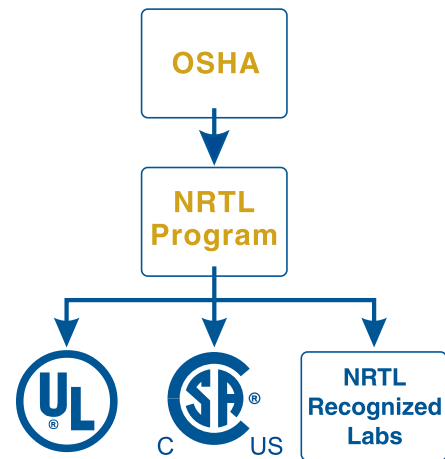
The NRTL Program is both national and international in scope with foreign labs permitted.

(1) [www.csagroup.org](http://www.csagroup.org)

(2) [www.scc.ca](http://www.scc.ca)

(3) [www.ulc.ca](http://www.ulc.ca)

(4) [www.osha.gov](http://www.osha.gov)











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