

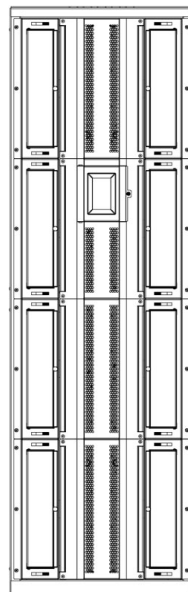


an EnerSys® company

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# PowerBay+™ Full Size BDFB Secondary DC Power Distribution System Technical Manual

Effective: January 2020



# Safety Notes

Alpha Technologies Services, Inc. considers customer safety and satisfaction its most important priority. To reduce the risk of injury or death and to ensure continual safe operation of this product, certain information is presented differently in this manual. Alpha® tries to adhere to ANSI Z535 and encourages special attention and care to information presented in the following manner:



## WARNING! GENERAL HAZARD

GENERAL HAZARD WARNING provides safety information to PREVENT INJURY OR DEATH to the technician or user.



## WARNING! ELECTRICAL HAZARD

ELECTRICAL HAZARD WARNING provides electrical safety information to PREVENT INJURY OR DEATH to the technician or user.



## WARNING! FUMES HAZARD

FUMES HAZARD WARNING provides fumes safety information to PREVENT INJURY OR DEATH to the technician or user.



## WARNING! FIRE HAZARD

FIRE HAZARD WARNING provides flammability safety information to PREVENT INJURY OR DEATH to the technician or user.

There may be multiple warnings associated with the call out. Example:



## WARNING! ELECTRICAL & FIRE HAZARD

This WARNING provides safety information for both Electrical AND Fire Hazards



## CAUTION!

CAUTION provides safety information intended to PREVENT DAMAGE to material or equipment.



## NOTICE:

NOTICE provides additional information to help complete a specific task or procedure.

## ATTENTION:

ATTENTION provides specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.

The following sections contain important safety information that must be followed during the installation and maintenance of the equipment and batteries. Read all of the instructions before installing or operating the equipment, and save this manual for future reference.

# PowerBay<sup>+</sup>™ BDFB

## Secondary DC Power Distribution System

### Technical Manual

C048-740-30 R02, Rev. C

Effective: January 2020

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### Disclaimer

Images contained in this manual are for illustrative purposes only. These images may not match your installation. 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, please contact Alpha Technologies Services, Inc. or your nearest Alpha representative.

Alpha shall not be held liable for any damage or injury involving its enclosures, power supplies, generators, batteries or other hardware if used or operated in any manner or subject to any condition not consistent with its intended purpose or is installed or operated in an unapproved manner or improperly maintained.

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# 1.0 Purpose and Applicability

This document covers the installation and operation of the PowerBay+™ Full-Size BDFB.

## 1.1 Product Model

This document applies to Alpha® products in the following model configurations:

- C016-1900-10 through C016-1924-10 Dual-Bus, Quad-Bus, and Eight-Bus PowerBay+ Full-Size BDFB configurations (r02)

## 2.0 Theory of Operation

The PowerBay+ Full-Size BDFB provides advanced high density secondary DC power distribution for multiple applications.

### 2.1 Features

- Modular design
- Unmatched safety & reliability features
- Easy bus reconfiguration
- Dual-bus, Quad-bus, and Eight-bus configurations (1200A per bus)
- Up to (8) 800A or 1200A rated distribution panels
- Up to 176 AM breaker positions
- Individual LED breaker trip indication
- Supports AM and GJ breakers as well as TPS, TLS, and GMT fuses
- Internal or external returns
- Top or bottom feed
- Optional LCD touchscreen controller with Ethernet (SNMP, Modbus, HTTP)
- Optional per-circuit current monitoring and RedundancyTracker™

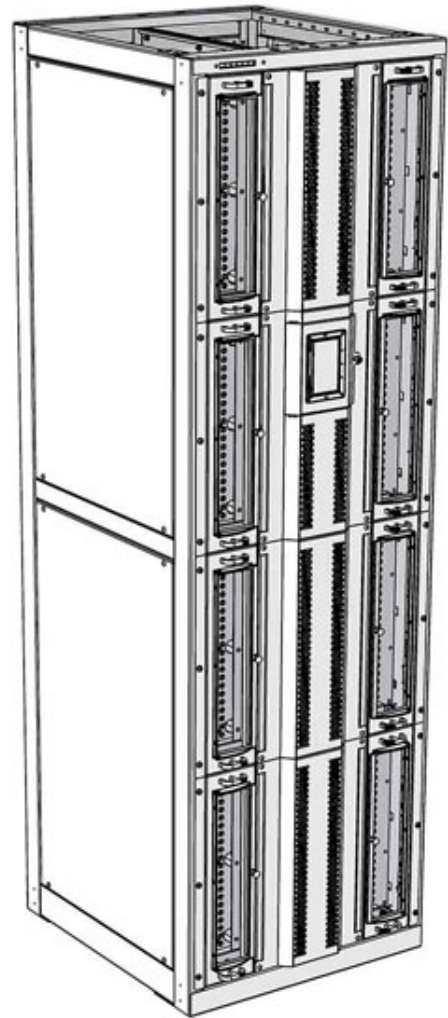


Figure 1. PowerBay+ Full-Size BDFB

## 3.0 Unpacking and Inspection

The Alpha PowerBay+ Full-Size BDFB was carefully packaged and securely bolted to a pallet at the factory to withstand the normal rigors of shipping, however, you should carefully inspect all packaging and contents to confirm that no damage has occurred in transit. Most shipping carriers require notification of shipping damage within twenty-four hours of delivery, and it is the responsibility of the recipient to inspect the shipment immediately upon receipt.

### 3.1 Package Contents

- PowerBay+ Full-Size BDFB
- Installation Hardware Kit
- Setup and operation manual
- Quickstart installation guide
- Distribution panels pre-installed (if so ordered)

## 4.0 Installation

### 4.1 Installation Preparation



**NOTICE:**

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THIS PRODUCT MUST BE INSTALLED WITHIN A RESTRICTED ACCESS LOCATION WHERE ACCESS IS THROUGH THE USE OF A TOOL, LOCK AND KEY, OR OTHER MEANS OF SECURITY, AND IS CONTROLLED BY THE AUTHORITY RESPONSIBLE FOR THE LOCATION. THIS PRODUCT MUST BE INSTALLED AND MAINTAINED ONLY BY QUALIFIED TECHNICIANS.



**NOTICE:**

---

ENSURE THAT THERE IS ADEQUATE GROUND AND CEILING SPACE FOR PLACEMENT OF THE BDFB.

#### 4.1.1 Elevated Operating Ambient

Install the BDFB and associated equipment in an environment compatible with the maximum ambient temperature (TMA) specified by the manufacturer.

#### 4.1.2 Reduced Air Flow

Installation of the BDFB and associated equipment should be such that the amount of air flow required for safe operation of the equipment is not compromised.

#### 4.1.3 Mechanical Loading

Mounting of the BDFB and associated equipment should be such that a hazardous condition is not achieved due to uneven mechanical loading.

#### 4.1.4 Circuit Overloading

Give consideration to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Use appropriate consideration for equipment nameplate ratings when addressing this concern.

#### 4.1.5 Reliable Earthing

Maintain reliable earthing of BDFB and associated equipment. Pay particular attention to supply connections other than direct connections to the branch circuit (e.g., use of power strips).

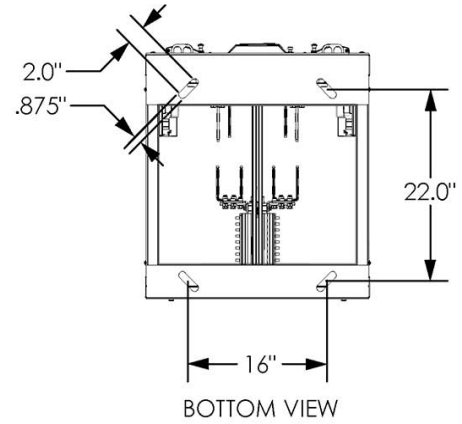
#### 4.1.6 Disconnect Device

A readily accessible disconnect device must be incorporated into the building installation wiring.

## 4.2 Mounting

The Full-Size BDFB will need to be securely mounted to the ground by the use of (4) Hilti concrete anchors.

- Step 1.** Remove the rear covers of the BDFB.
- Step 2.** Measuring the distance between the four slotted mounting locations found on the base of the rack, mark and drill holes into desired concrete location for rack placement (see Figure 2).
- Step 3.** Carefully move the BDFB into place while aligning the slotted mounting holes with the holes drilled in Step 2. Insert a drop-in Hilti Anchor for each hole.
- Step 4.** Insert and securely fasten all (4) Hilti anchor bolts into the anchors (see Figure 3).



**Figure 2. Rack Footprint**

## 4.3 Grounding

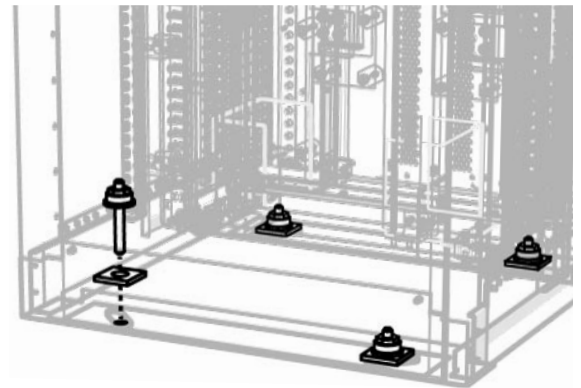


**CAUTION!**

**DO NOT ENERGIZE THE BDFB BEFORE GROUND IS CONNECTED.**

**Table 1. Ground Specifications**

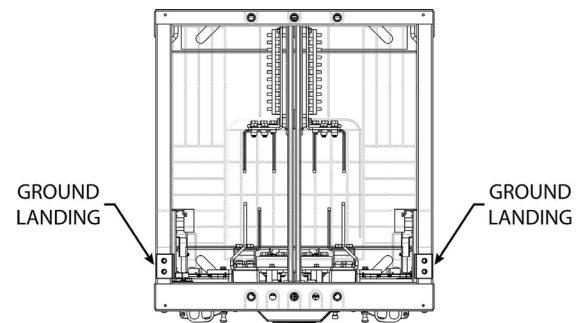
TWO HOLE LANDING TYPE	HOLE/STUD SIZE	CENTER TO CENTER	RECOMMENDED TORQUE VALUE
Threaded Insert	3/8 in.	1 in.	350 in·lbs



**Figure 3. Anchoring Rack**

The ground landings are located on the left and right side on the top of the BDFB rack assembly. Refer to mechanical drawings found in Appendix A for greater detail regarding grounding locations.

- Step 1.** Select the desired grounding location and break away the associated knock-out points found on the plastic top cover (see Figure 4).
- Step 2.** Connect the ground cable with 3/8 in hardware. Ensure heat shrink and no-oxide compound are applied appropriately prior to termination.
- Step 3.** Torque the fasteners to 350 in·lbs.



**Figure 4. Grounding Locations (Top View)**



## 4.4 Input Connections



### WARNING! ELECTRICAL HAZARD

INPUTS MUST BE PROTECTED BY A LISTED CIRCUIT BREAKER OR BRANCH RATED FUSE. THE CIRCUIT BREAKER OR FUSE MUST BE RATED AT 1200A MAX.

MULTIPLE POWER SOURCES ARE PRESENT. ENSURE ALL INPUT POWER FEEDS ARE NOT ENERGIZED BEFORE INSTALLING THEM. ELECTRICAL INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONNEL WITH PROPER TOOLS AND PROTECTIVE SAFETY EQUIPMENT.



### NOTICE:

MAKE SURE THAT ALL FEEDER CABLES HAVE HEAT SHRINK APPLIED PRIOR TO TERMINATION, AND THAT NO-OXIDE COMPOUND IS APPLIED TO ALL COPPER-TO-COPPER CONNECTIONS.

Table 2. Input Specifications

TERMINATION TYPE	HOLE/STUD SIZE	CENTER TO CENTER	RECOMMENDED TORQUE VALUE
Through Hole	3/8 in.	1 in.	350 in-lbs

The Full-Size BDFB can be cabled in dual, quad, and eight-bus configurations. Each of the eight HOT (-) and RTN (+) input positions are individually labeled throughout the BDFB buswork (see Figure 7). The Full-Size BDFB is also capable of connecting to external RTN buses.

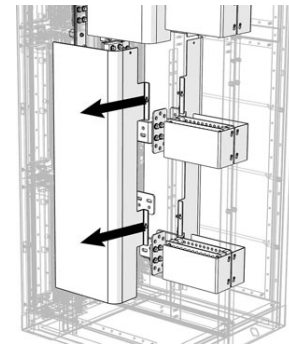


Figure 5. Input Bus Plastic Safety Shields

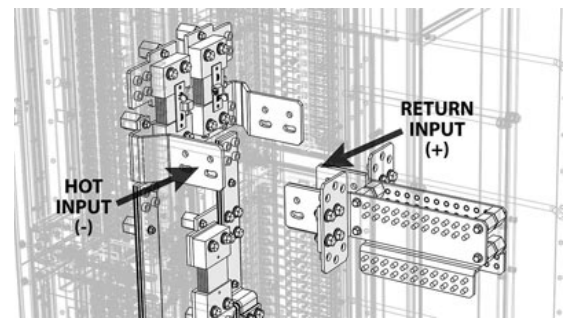


Figure 6. HOT/RTN Input Bus Locations

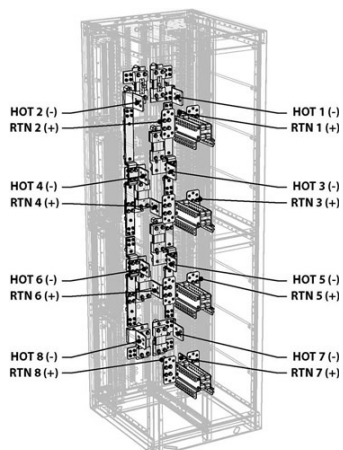


Figure 7. Numbered Input Bus Locations (Internal RTN Shown)

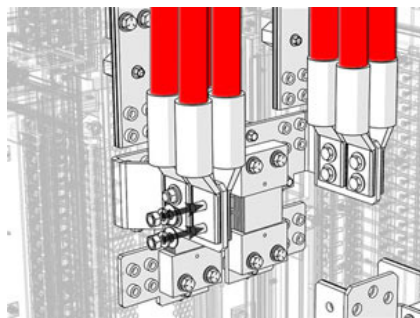


Figure 8. HOT Input Cable Termination

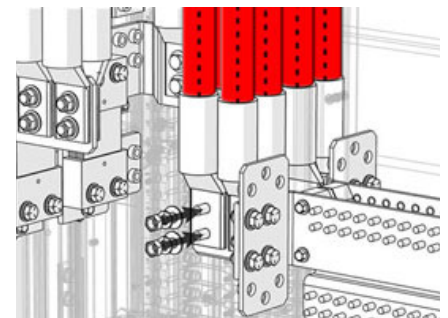
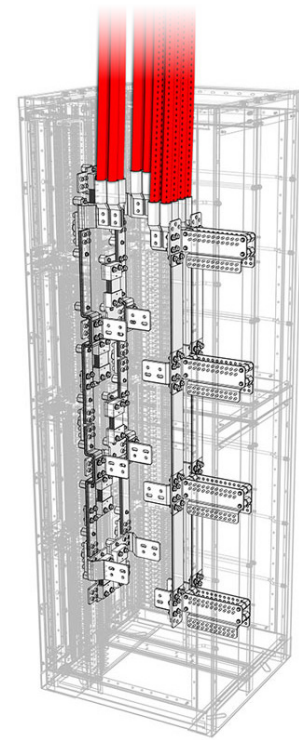


Figure 9. RTN Input Cable Termination

#### 4.4.1 Dual-Bus Input Connections (with Internal RTN)

The hot and return buses on the dual-bus configuration are all equipped with interconnection jumpers, thus hot/return input cables are to be installed only on hot/return positions 1-2 on this configuration (see Figure 10). For more detailed information, refer to Appendix B and C for input bus and cable layout.

- Step 1. Remove the input bus plastic safety covers (see Figure 5 on Page 9).
- Step 2. Install the hot input cables/lugs to hot input positions 1-2 (see Figure 8 on Page 9).
- Step 3. Install the return input cables/lugs to return input positions 1-2 (see Figure 9 on Page 9).
- Step 4. Bolt all lugs to the bus bars using a flat and lock washer. Tighten all of the hardware and ensure that the lugs are straight and parallel with each other as they mount to the bus bars.
- Step 5. Reattach the input bus plastic safety covers.

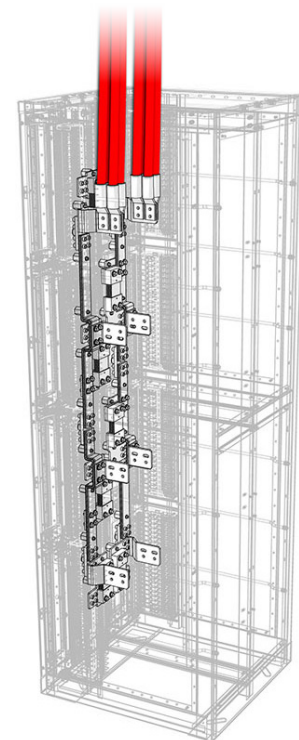


**Figure 10. Dual-Bus HOT/RTN Input Connections (with Internal RTN)**

#### 4.4.2 Dual-Bus Input Connections (without Internal RTN)

The hot buses on the dual-bus configuration are all equipped with interconnection jumpers, thus hot input cables are to be installed only on hot positions 1-2 on this configuration (see Figure 11). For more detailed information, refer to Appendix B and C for input bus and cable layout.

- Step 1. Remove the input bus plastic safety covers (see Figure 5 on Page 9).
- Step 2. Install the external return input connections.
- Step 3. Install the hot input cables/lugs to hot input positions 1-2 (see Figure 8 on Page 9).
- Step 4. Bolt all lugs to the bus bars using a flat and lock washer. Tighten all of the hardware and ensure that the lugs are straight and parallel with each other as they mount to the bus bars.
- Step 5. Reattach the input bus plastic safety covers.

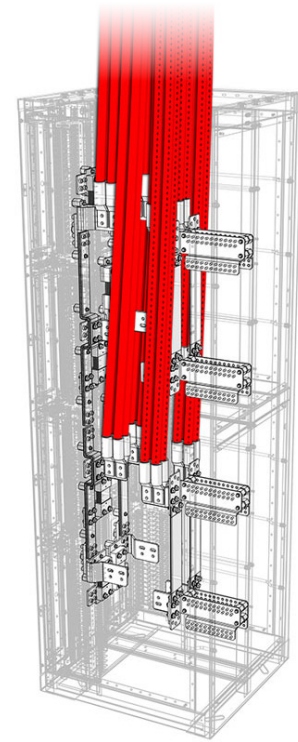


**Figure 11. Dual-Bus HOT Input Connections (without Internal RTN)**

### 4.4.3 Quad-Bus Input Connections (with Internal RTN)

The hot and return buses on the quad-bus configuration are equipped with interconnection jumpers between hot/return positions 1-4 and positions 5-8, thus hot/return input cables are to be installed only on hot/return positions 1-2 and positions 5-6 on this configuration (see Figure 12). For more detailed information, refer to Appendix B and C for input bus and cable layout.

- Step 1. Remove the input bus plastic safety covers (see Figure 5 on Page 9).
- Step 2. Install the hot input cables/lugs to hot input positions 1-2 and 5-6 (see Figure 8 on Page 9).
- Step 3. Install the return input cables/lugs to return input positions 1-2 and 5-6 (see Figure 9 on Page 9).
- Step 4. Bolt all lugs to the bus bars using a flat and lock washer. Tighten all of the hardware and ensure that the lugs are straight and parallel with each other as they mount to the bus bars.
- Step 5. Reattach the input bus plastic safety covers.

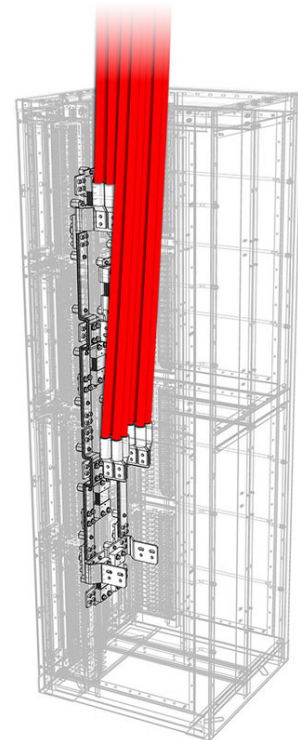


**Figure 12. Quad-Bus HOT/RTN Input Connections (with Internal RTN)**

### 4.4.4 Quad-Bus Input Connections (without Internal RTN)

The hot buses on the quad-bus configuration are equipped with interconnection jumpers between hot positions 1-4 and positions 5-8, thus hot input cables are to be installed only on hot positions 1-2 and positions 5-6 on this configuration (see Figure 13). For more detailed information, refer to Appendix B and C for input bus and cable layout.

- Step 1. Remove the input bus plastic safety covers (see Figure 5 on Page 9).
- Step 2. Install the external return input connections.
- Step 3. Install the hot input cables/lugs to hot input positions 1-2 and 5-6 (see Figure 8 on Page 9).
- Step 4. Bolt all lugs to the bus bars using a flat and lock washer. Tighten all of the hardware and ensure that the lugs are straight and parallel with each other as they mount to the bus bars.
- Step 5. Reattach the input bus plastic safety covers.



**Figure 13. Quad-Bus HOT Input Connections (without Internal RTN)**

#### 4.4.5 Eight-Bus Input Connections (with Internal RTN)

The hot and return buses on the eight-bus configuration each exist without interconnection jumpers, thus hot/return input cables are to be installed on all eight hot/return input connections for this configuration (see Figure 14). For more detailed information, refer to Appendix B and C for input bus and cable layout.

- Step 1. Remove the input bus plastic safety covers (see Figure 5 on Page 9).
- Step 2. Install the hot input cables/lugs to all eight hot input positions (see Figure 8 on Page 9).
- Step 3. Install the return input cables/lugs to all eight return input positions (see Figure 9 on Page 9).
- Step 4. Bolt all lugs to the bus bars using a flat and lock washer. Tighten all of the hardware and ensure that the lugs are straight and parallel with each other as they mount to the bus bars.
- Step 5. Reattach the input bus plastic safety covers.

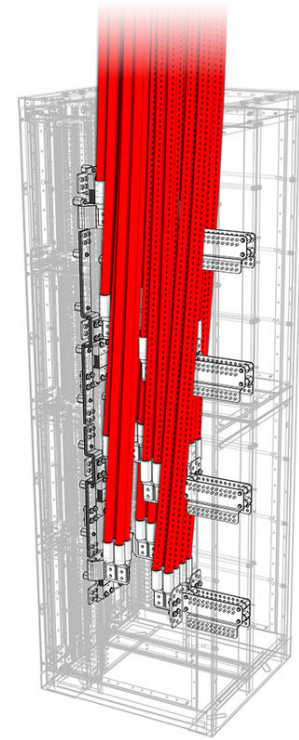


Figure 14. Eight-Bus HOT/RTN Input Connections (with Internal RTN)

#### 4.4.6 Eight-Bus Input Connections (without Internal RTN)

The hot buses on the eight-bus configuration each exist without interconnection jumpers, thus hot input cables are to be installed on all eight hot input connections for this configuration (see Figure 15). For more detailed information, refer to Appendix B and C for input bus and cable layout.

- Step 1. Remove the input bus plastic safety covers (see Figure 5 on Page 5).
- Step 2. Install the external return input connections.
- Step 3. Install the hot input cables/lugs to all eight hot input positions (see Figure 8 on Page 5).
- Step 4. Bolt all lugs to the bus bars using a flat and lock washer. Tighten all of the hardware and ensure that the lugs are straight and parallel with each other as they mount to the bus bars.
- Step 5. Reattach the input bus plastic safety covers.

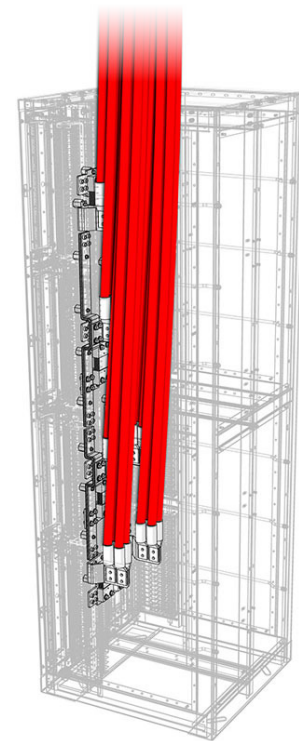


Figure 15. Eight-Bus HOT Input Connections (without Internal RTN)



## 4.5 Output Connections



### CAUTION!

DO NOT PERFORM THIS STEP ON CIRCUITS WITH BREAKERS OR FUSES INSTALLED. ENSURE NO POWER IS PRESENT ON THE CIRCUIT BEING WIRED BEFORE PROCEEDING. MAKE SURE THAT ALL CABLES HAVE INSULATED TERMINALS OR HEAT SHRINK APPLIED PRIOR TO TERMINATION, AND THAT NO-OXIDE COMPOUND IS APPLIED TO ALL COPPER-TO-COPPER CONNECTIONS.

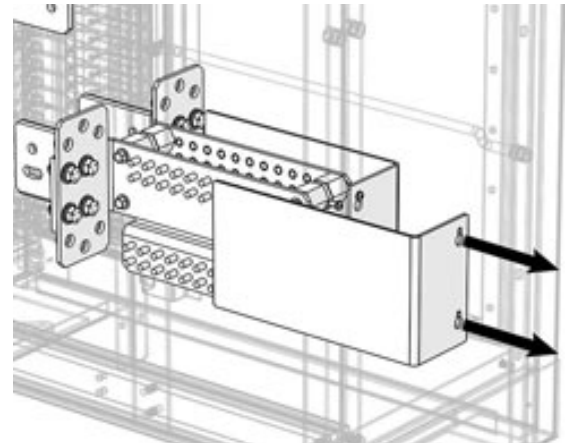


Figure 16. RTN Output Bus Plastic Cover

Table 3. Output Specifications

TERMINATION TYPE	HOLE/STUD SIZE	CENTER-TO-CENTER	RECOMMENDED TORQUE VALUE
Threaded Stud	1/4-20	5/8 in.	100 in·lbs

Each panel has a total of 22 breaker/fuse holder positions. Refer to the label located next to each panel on the front of the BDFB for channel mapping.

- Step 1. Remove the return output bus plastic safety covers (see Figure 16).
- Step 2. Beginning with the bottom bus and working upwards, install all hot output cables/lugs to the studs located on the back of each panel and tighten hardware (see Figure 17).
- Step 3. Install all return output cables/lugs to the return output studs located on the return output bus and tighten hardware (see Figure 18).
- Step 4. Route the output cables upwards in an organized fashion by tying to the lacing bars located throughout the BDFB rack assembly.
- Step 5. Reattach the return output bus plastic safety covers.

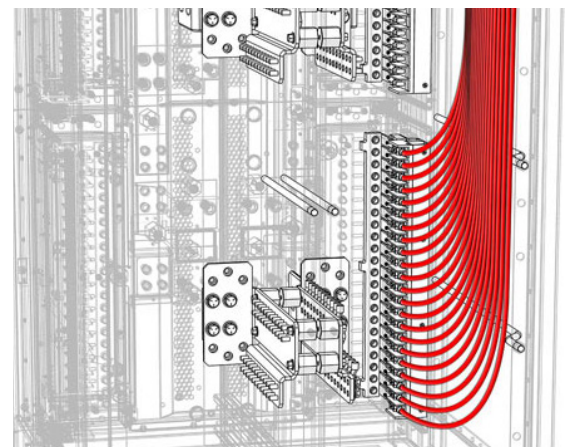


Figure 17. HOT Output Connections

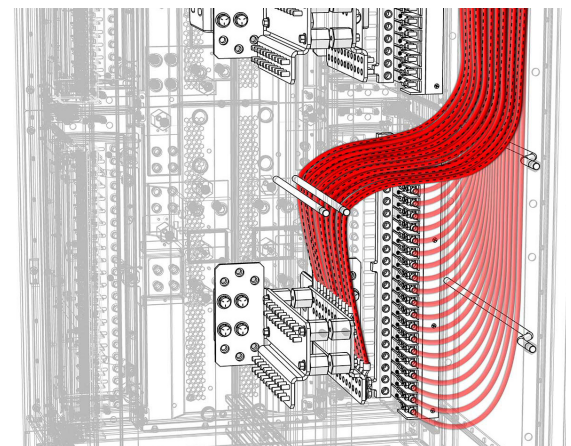


Figure 18. RTN Output Connections

## 4.5.1 Output Adapters

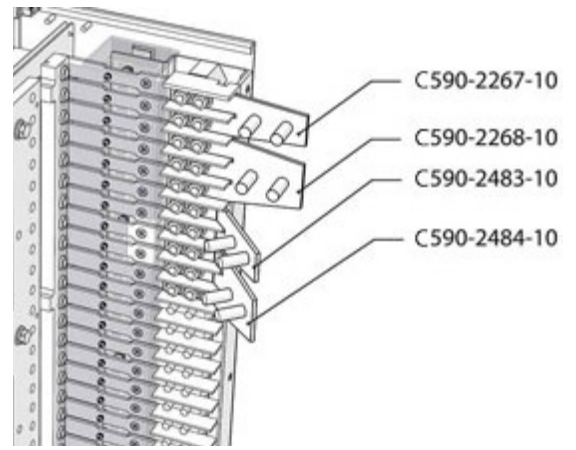
Output adapters are an available option for the AM and GJ breaker panels. These adapters are offered in straight, 45, and 90 degree angled orientations.

**Table 4. Output Adapter Options (see Figures 19-23)**

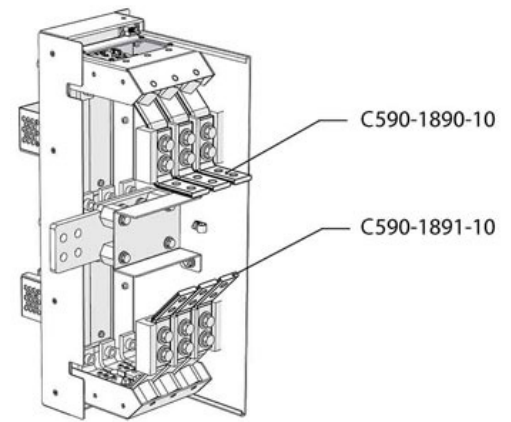
PART NUMBER	DESCRIPTION
C590-2267-10	2 pole output adapter; straight; AM breaker panel
C590-2268-10	3 pole output adapter; straight; AM breaker panel
C590-2483-10	2 pole output adapter; 45 deg; AM breaker panel
C590-2484-10	3 pole output adapter; 45 deg; AM breaker panel
C590-1891-10	Single pole output adapter; 45 deg; GJ breaker panel
C590-1890-10	Single pole output adapter; 90 deg; GJ breaker panel
C590-2409-10	2 pole output adapter; 45 deg; GJ breaker panel
C590-2410-10	3 pole output adapter; 45 deg; GJ breaker panel
C590-2411-10	2 pole output adapter; 90 deg; GJ breaker panel
C590-2412-10	3 pole output adapter; 90 deg; GJ breaker panel
C590-2408-10	3 pole output adapter; straight; internal return; AM & GJ breaker panel
C590-2407-10	2 pole output adapter; straight; internal return; AM & GJ breaker panel

**Table 5. Output Adapter Specifications**

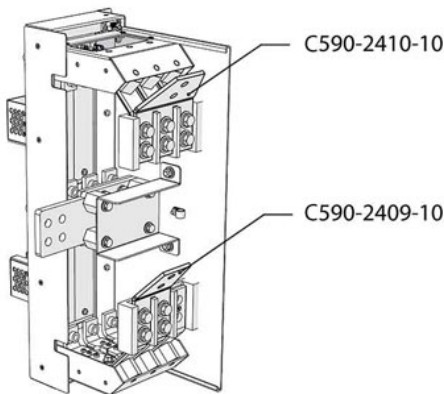
OUTPUT TYPE	TERMINATION TYPE	HOLE/STUD SIZE	CENTER-TO-CENTER	RECOMMENDED TORQUE VALUE
AM Breaker Panel	Threaded Stud	3/8 in.	1 in.	350 in·lbs
GJ Breaker Panel	Through Hole	3/8 in.	1 in.	350 in·lbs
Internal Return	PEM	3/8 in.	1 in.	350 in·lbs



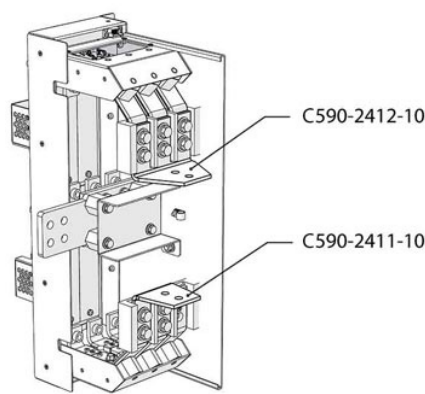
**Figure 19. AM Breaker Panel Output Adapters**



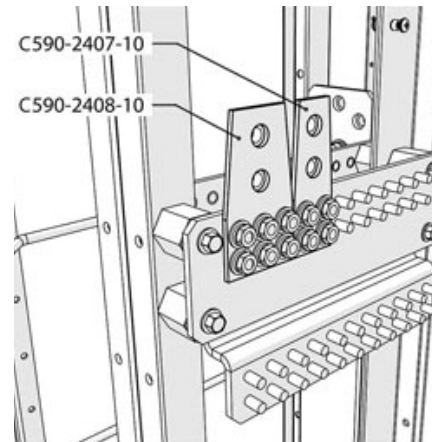
**Figure 20. GJ Breaker Panel Output Adapters**



**Figure 21. GJ Breaker Panel Output Adapters**



**Figure 22. GJ Breaker Panel Output Adapters**



**Figure 23. RTN Output Adapters (AM and GJ)**

## 4.6 Safety Cover Installation



### WARNING! ELECTRICAL HAZARD

FAILURE TO INSTALL/REINSTALL THE SAFETY COVERS WILL CREATE AN ELECTRICAL HAZARD.

### 4.6.1 Bus Safety Covers

The BDFB will ship from the factory with plastic safety covers either mounted in place or packaged inside the rack. However, as noted in the previous installation procedures, they will require removal for cable termination access. Once installation of all cabling is complete, ensure that each plastic safety cover has been reattached to its original position before proceeding to output cable installation (see Figures 5 & 16).

### 4.6.2 Top Cover

The Full-Size BDFB includes a plastic top cover that is scored with knock-out points intended for various configurations of input and output cable entry through the top of the rack (see Figure 24). Once BDFB installation is complete, it is important to reuse as much of the top cover as possible by removing only unnecessary knock-out points to allow cable to be fed into the bay while minimizing the chance of foreign objects from entering.

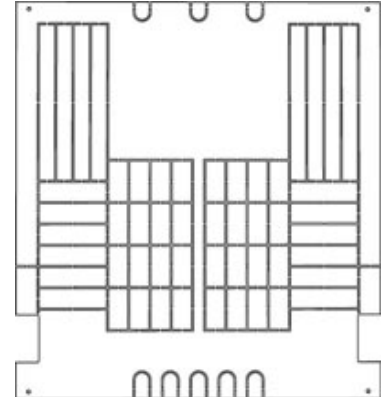


Figure 24. Top Cover Knock-Out Points

## 4.7 Circuit Breaker Installation



### WARNING! ELECTRICAL HAZARD

ELECTRICAL INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONNEL WITH PROPER TOOLS AND PROTECTIVE SAFETY EQUIPMENT.

### 4.7.1 AM Circuit Breakers

For a list of compatible AM breakers, see Appendix E on Page 50.

- Step 1.** Ensure that breaker is in the OFF position before installing into panel (see Figure 25).
- Step 2.** Open the AM breaker panel access door and view the channel mapping inside of the panel for correct LOAD/LINE breaker orientation, then insert breaker(s) into the bullet sockets (see Figure 26).

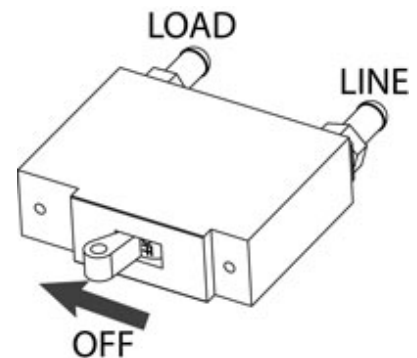


Figure 25. Turn Breaker Off

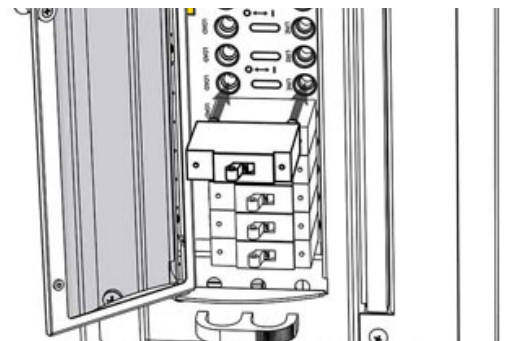
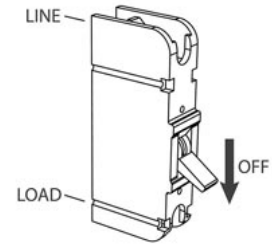


Figure 26. Insert Breaker

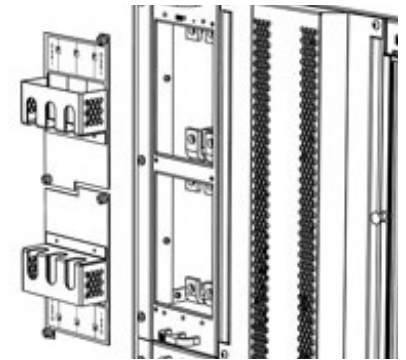
## 4.7.2 GJ Circuit Breakers

For a list of compatible GJ breakers, see Appendix E on Page 50.

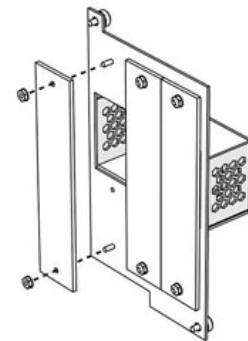
- Step 1.** Ensure that breaker is in the OFF position before installing into panel (see Figure 27).
- Step 2.** Remove breaker shield(s) from GJ breaker panel by loosening the captive thumbscrews (see Figure 28).
- Step 3.** Depending on number of breakers selected, remove the plastic blanking cover(s) by uninstalling the 6-32 hex nuts (see Figure 29).
- Step 4.** To ensure correct breaker polarity, view the channel mapping label located on the breaker shield removed in Step 2 for correct LOAD/LINE breaker orientation. Secure breaker(s) into place by tightening the 3/8 in hardware (see Figure 30).
- Step 5.** Reattach breaker shield(s) from Step 2.



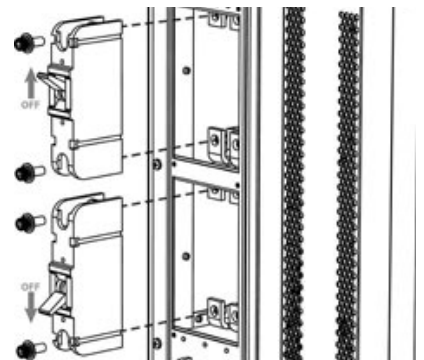
**Figure 27. Turn Breaker Off**



**Figure 28. Remove Breaker Shield(s)**



**Figure 29. Remove Blanking Cover(s)**



**Figure 30. Install Breaker(s)**



## 4.8 Bus Reconfiguration



### WARNING! ELECTRICAL HAZARD

MULTIPLE POWER SOURCES ARE PRESENT. ELECTRICAL INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONNEL WITH PROPER TOOLS AND PROTECTIVE SAFETY EQUIPMENT.



### NOTICE:

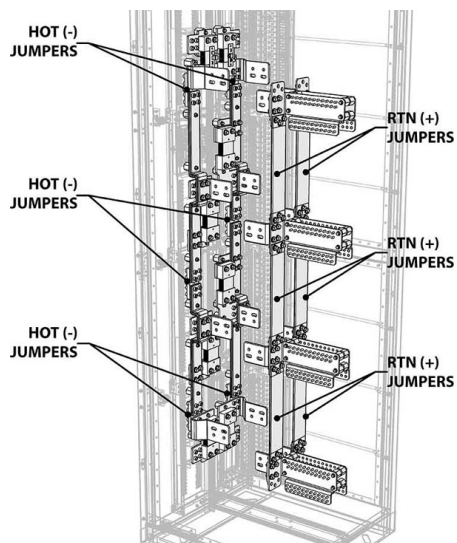
MAKE SURE THAT NO-OXIDE COMPOUND IS APPLIED TO ALL COPPER-TO-COPPER CONNECTIONS.

**Table 6. Interconnection Jumper Specifications**

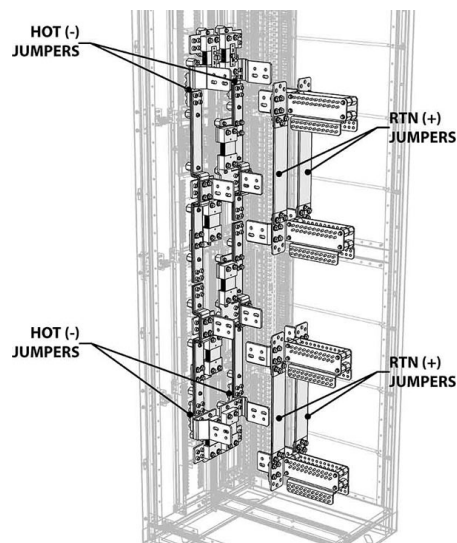
TERMINATION TYPE	HOLE/STUD SIZE	CENTER TO CENTER	RECOMMENDED TORQUE VALUE
Threaded Insert	3/8 in.	1 in.	350 in·lbs

The Full-Size BDFB was designed so that its buswork and distribution panels can be reconfigured at any time later on to meet the desired needs of the customer. It is possible to reconfigure the buswork to create a dual-bus, quad-bus, or an eight-bus BDFB. Figures 31-33 below represent the different interconnection jumper layouts that can be achieved by simply adding or removing jumpers. For more detailed information, refer to Appendix B for bus locations and layout.

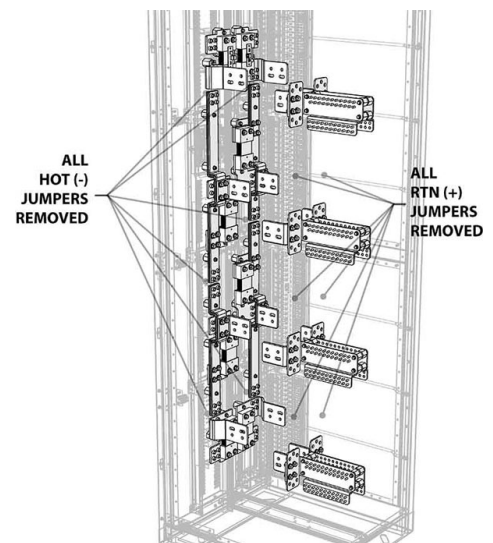
To assemble a dual-bus configuration, install the hot/return jumpers between all hot/return buses (see Figure 31). To assemble a quad-bus configuration, install the hot/return jumpers on all hot/return buses except for the middle position (see Figure 32). To assemble an eight-bus configuration, remove all hot/return jumpers (see Figure 33). Refer to 4.8.1 and 4.8.2 on Page 18 for detailed interconnection jumper installation instructions.



**Figure 31. Dual-Bus Jumper Configuration**



**Figure 32. Quad-Bus Jumper Configuration**



**Figure 33. Eight-Bus Configuration (No Jumpers)**

## 4.8.1 Return Bus Interconnection Jumper Installation (Models with Internal RTN)

- Step 1. Depending on the selected configuration, align the return jumper in place between the return buses.
- Step 2. For each return jumper, insert the six 3/8 in. bolts with flat and lock washers through the pems located on the return buses. Take caution as to not drop any hardware during this process (see Figure 34).
- Step 3. Ensure that each jumper is straight and parallel with the return buses, then tighten all hardware.

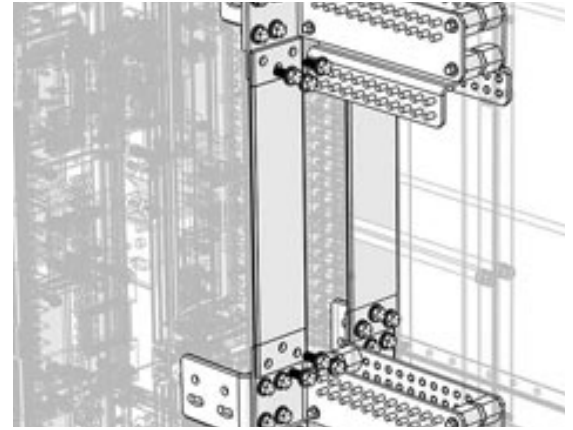


Figure 34. RTN Jumper

## 4.8.2 Hot Bus Interconnection Jumper Installation

- Step 1. Remove the center panel by loosening the four pan head screws (see Figure 35).
- Step 2. Remove the hot jumper access panel by removing the two #6-32 screws (see Figure 36).
- Step 3. Firmly holding onto the plastic handle, carefully insert the hot jumper into the hot jumper access compartment and align it with the hot buses.
- Step 4. Insert the eight 3/8 in. socket cap bolts with flat and lock washers through the hot jumper and into the pems of the hot buses. Take caution as to not drop any hardware during this process (see Figure 37).
- Step 5. Ensure that each jumper is straight and parallel with the hot buses, then tighten all hardware.
- Step 6. Reattach the hot jumper access panel and the center panel.

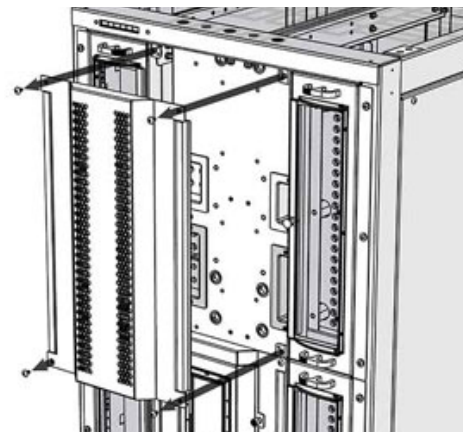


Figure 35. Center Panel

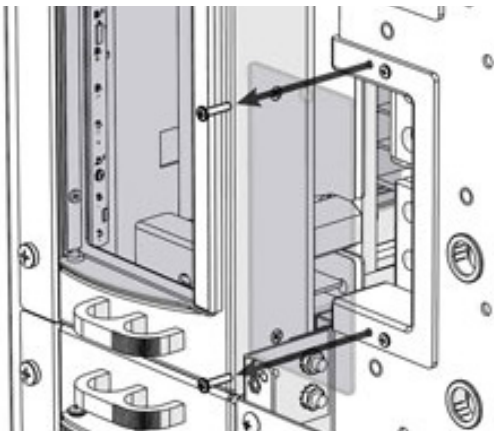


Figure 36. HOT Jumper Access Panel

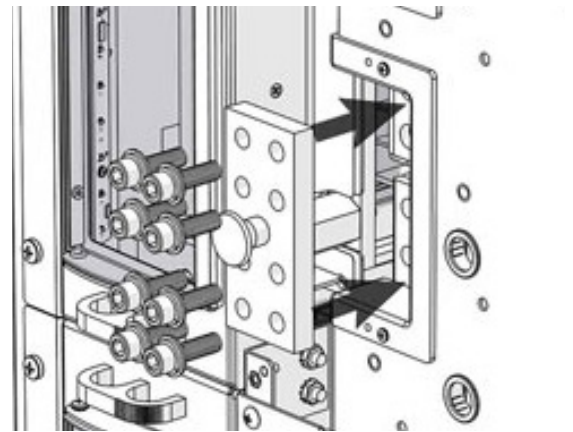


Figure 37. HOT Jumper

## 4.9 Distribution Panel Installation

Depending on the configuration ordered, the BDFB may have empty panel positions that are covered with blanking plates. If extra distribution is needed anytime in the future, these plates can be easily removed and replaced with breaker panels by following these instructions.

- Step 1.** Remove the center panel by loosening the four pan head screws (see Figure 38).
- Step 2.** Remove the panel blanking plate by removing the three #12-24 screws from the mounting ear (see Figure 39).
- Step 3.** Carefully insert the AM breaker panel into the slot (see Figure 40; also applicable for GJ breaker panel). Take caution as to not damage the panel mount interface connector during panel insertion (see Figure 41).
- Step 4.** Secure the panel to the rack assembly by inserting and tightening down the three #12-24 screws from Step 2 into the mounting ear.
- Step 5.** Install and tighten the supplied 3/8 in. hardware to connect the panel to the hot bus (see Figure 42).
- Step 6.** Reattach the center blanking panel from Step 1 and tighten screws.

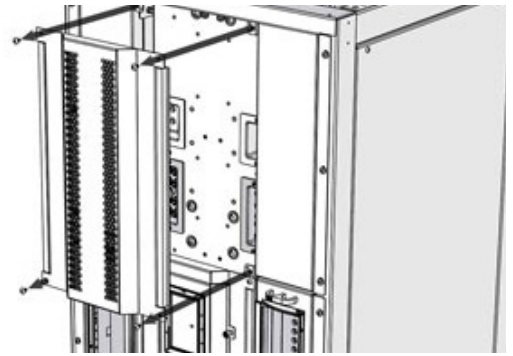


Figure 38. Center Panel

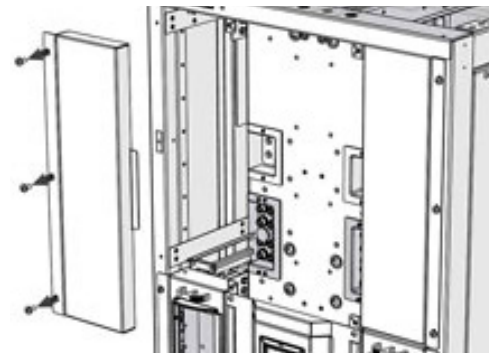


Figure 39. Panel Blanking Plate

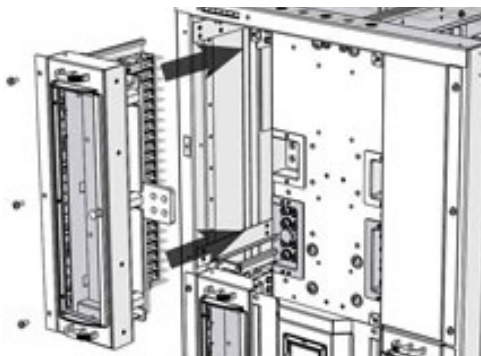


Figure 40. AM Breaker Panel Insertion

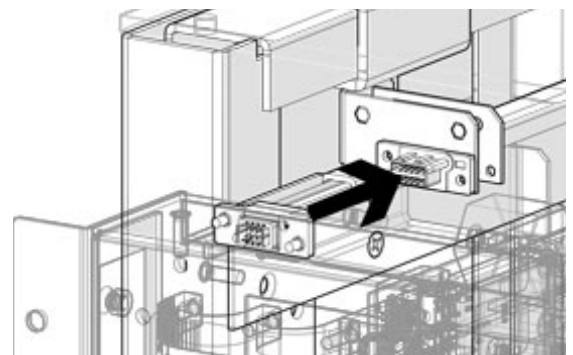


Figure 41. Panel Mount Interface Connector

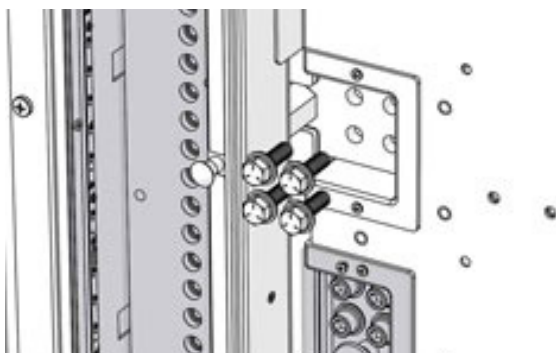


Figure 42. Panel Connection Hardware

## 5.0 Product Specifications

### 5.1 PowerBay+ Full-Size BDFB Specifications

Table 7. Mechanical

Width	26 in.
Height	84 in.
Depth	28 in.
Weight	775 lbs.

Table 8. Electrical

Voltage	-48VDC
Load Current Per Bus	960A Max. Continuous
Number of Busses	2, 4, 6, or 8
Alarm Contacts	Form-C, 60VDC @ 0.5A Max.
Circuits	Up to 176
Input Current	7680A Max.
Maximum Input Interruption Device	1200A
Interrupt Rating	10000A

Table 9. Environmental

Temperature	0 to 40°C Operating
Humidity	0 to 95% RH Non-Condensing
Elevation	-500 to 3000m

Table 10. Approvals

UL File Number	E473904
UL Standard	ANSI/UL 60950-1

### 5.2 AM Breaker Panel Specifications

Table 11. Mechanical (All Models)

Width	9 in.
Height	20 in.
Depth	10.5 in.

**Table 12. Electrical (AM800 Breaker Panel)**

Total Load Current	640A Continuous
Load Current Per Pole	100A Continuous
Supported Protection Devices	Single-Pole AM Circuit Breaker Up to 125A; Double-Pole AM Circuit Breaker Up to 200A; Triple-Pole AM Circuit Breaker Up to 300A; TPS/TLS Plug-In Fuse Holder

**Table 13. Electrical (AM1200 Breaker panel)**

Total Load Current	960A Continuous
Load Current Per Pole	100A Continuous
Supported Protection Devices	Single-Pole AM Circuit Breaker Up to 125A; Double-Pole AM Circuit Breaker Up to 200A; Triple-Pole AM Circuit Breaker Up to 300A; TPS/TLS Plug-In Fuse Holder

### 5.3 GJ Breaker Panel Specifications

**Table 14. Mechanical (All Models)**

Width	9 in.
Height	20 in.
Depth	11.25 in.

**Table 15. Electrical (GJ1200 Breaker Panel)**

Total Load Current	960A Continuous
Load Current Per Pole	200A Continuous
Supported Protection Devices	Single-Pole GJ Circuit Breaker Up to 250A; Double-Pole GJ Circuit Breaker Up to 400A; Triple-Pole GJ Circuit Breaker Up to 700A








## 6.0 Operation

The Full-Size BDFB is available with an optional supervisory controller module to allow for precise monitoring of bus, panel, and breaker alarms.

### 6.1 Menu Icons

Navigation within the supervisory controller is performed by tapping the icons located at the top of the screen.

**Table 16. Icon Key**

ICON	FUNCTION	ICON	FUNCTION
	Settings		Breaker Ampacity
	Home		Load Calibration
	Return		Mute Volume
	Breaker Inventory		

### 6.2 Alarms

Each type of alarm is assigned a specific color. Normal operation for the panel alarm status on the A-side of the BDFB is represented by a light shade of red, while normal operation on the B-side is represented by the color blue. The bus identification number is represented by the larger number shown on the panel icon and the panel identification number for the corresponding bus is represented by the smaller number. Bus voltage and amperage status is displayed in the smaller colored icons shown next to the BDFB icon.

**Table 17. Panel Alarm Status**

COLOR	STATUS
Light Red	Normal Operation (A-Side)
Blue	Normal Operation (B-Side)
Orange	Minor Alarm
Light Orange	Minor Alarm
Red	Major Alarm
Light Gray	Empty Panel Position

**Table 18. Bus Alarm Status**

COLOR	STATUS
Green	Normal Operation
Orange	Minor Alarm
Red	Major Alarm




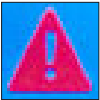
**Figure 43. Home Screen (Quad-Bus Configuration Shown)**



## 6.2.1 Alarm Severity

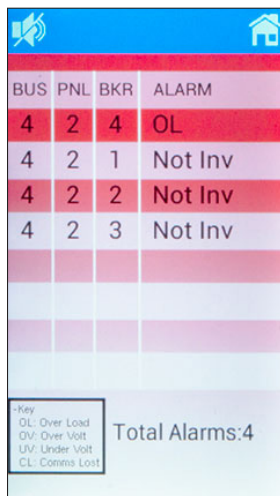
If an alarm occurs, a caution triangle will appear at the top of the screen on the left side. The triangle will appear orange if there is a minor alarm or red if there is a major alarm.

**Table 19. Alarm Severity**

ICON	STATUS	CAUSES
	Minor Alarm	Bus Overload Warning Panel Overload Warning Breaker Overload Warning Breaker Not Inventoried
	Major Alarm	Breaker Trip Bus Overload Panel Overload Breaker Overload Bus Over Voltage Bus Under Voltage Panel Communication Lost

**Step 1.** Tap the alarm triangle to view alarm details. This will open an alarm list that displays alarm locations, cause of alarms, and number of alarms (see Figure 44). This list will show up to eight of the highest priority alarms only.

**Step 2.** To mute volume, tap the volume icon located at the top of the screen.



BUS	PNL	BKR	ALARM
4	2	4	OL
4	2	1	Not Inv
4	2	2	Not Inv
4	2	3	Not Inv
=Key OL: Over Load OV: Over Volt UV: Under Volt CL: Comms Lost			Total Alarms:4

**Figure 44. Alarm Info**  
(Major Alarm Shown)

## 6.3 Settings Menu

The Settings menu (⚙️) allows the user to monitor and fine-tune the BDFB system settings. Refer to interface map below for menu layout.

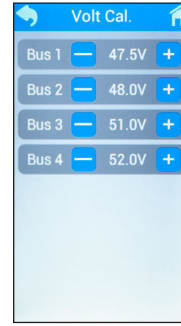
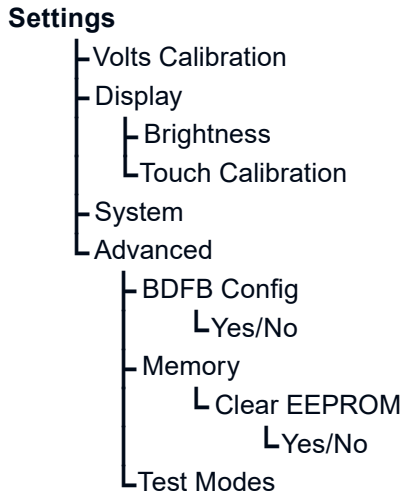


Figure 45. Volt Cal.

### 6.3.1 Volts Calibration

To calibrate the voltage per bus, adjust the voltage of each bus by tapping the (-) or (+) buttons (see Figure 45).

### 6.3.2 Display

The Display menu allows access to adjustment of screen brightness as well as access to the touch calibration feature.

#### └ Brightness:

Screen brightness can be adjusted by moving the slider horizontally (see Figure 46).

#### └ Touch Calibration:

This feature is used by tapping the circles that will appear at three points on the screen to calibrate the touch screen display (see Figure 47). Note: This causes the controller to reset.

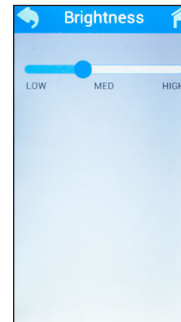


Figure 46. Brightness

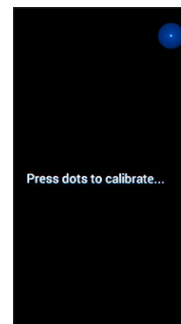


Figure 47. Touch Cal.



### 6.3.3 System

The System menu allows adjustment to the buzzer volume, ON/OFF power to the accent lighting, and a readout of the current bus/panel ampacity. The firmware version is located at the bottom of this screen. To access this feature, select the System button in the Settings menu (see Figure 48).

### 6.3.4 Advanced

The Advanced menu allows access to BDFB functionality and configuration adjustments.

#### └ BDFB Config:

This feature allows reconfiguration of the bus and panels (see Figure 49). See Section 6.4 on Page 26 for detailed instructions.

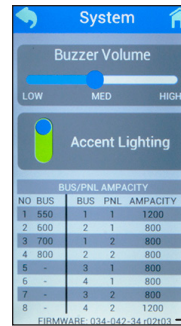
#### └ Memory:

This feature allows the EEPROM to be cleared (see Figure 50).

Note: configuration, system settings, calibration, and inventory will be set to default.

#### └ Test Modes:

This feature allows access to simulation of a major alarm and/or minor alarm (see Figure 51).



Firmware Version

Figure 48. System

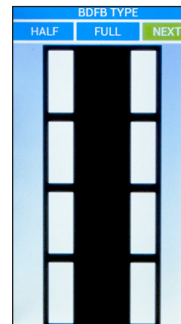


Figure 49. BDFB Config



Figure 50. Memory

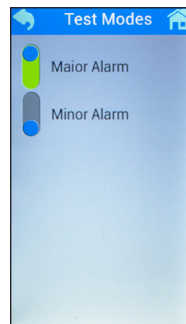


Figure 51. Test Modes

## 6.4 BDFB Configurator

The BDFB supervisory controller allows for flexible configuration and reconfiguration of distribution panels and bus layouts at the touch of a button. The following illustrations depict a quad-bus BDFB configuration, however these instructions are applicable for all other panel/jumper configurations offered.

- Step 1.** Access the settings menu by tapping the gear icon located in the upper right-hand corner (see Figure 52).
- Step 2.** Select the Advanced button (see Figure 53).
- Step 3.** Select the BDFB Config button (see Figure 54).
- Step 4.** Select **YES** to proceed to the BDFB configuration screen (see Figure 55).
- Step 5.** Select FULL for BDFB Type and then select NEXT (see Figure 56).
- Step 6.** Select the distribution panel icons (rectangular outlines) to assign panels. A check mark will appear for each selected panel. Assign bus jumpers (J1/J2/J3) by tapping the area between the distribution panel icons. The jumper icons will appear as a bronze color when selected (see Figure 57). Once the panel/jumper positioning has been chosen, select NEXT.
- Step 7.** Tap the distribution panel icons to change ampacity between 800A and 1200A as needed (see Figure 58).
- Step 8.** Select BUS to access the feeder fuse size menu. Within each bus, the fuse value can be adjusted by intervals of 50A by tapping the fuse amperage number until the required amperage is met (see Figure 59). Select BACK to return to the BUS AMP./PANEL TYPE menu. The range is between 300 - 1200A. 0 means the fuse is not installed.
- Step 9.** Select FINISH to complete the BDFB configuration process.

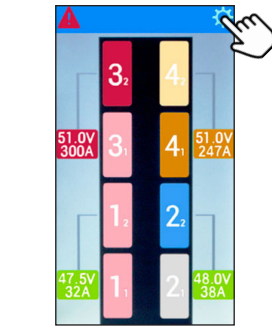


Figure 52. Main Menu

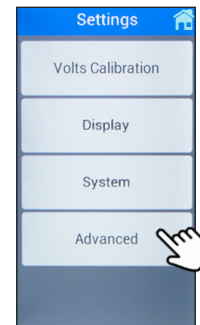


Figure 53. Settings

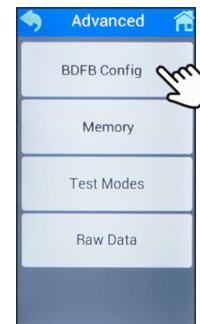


Figure 54. Advanced

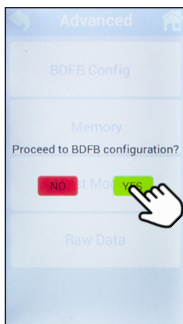


Figure 55. Proceed to BDFB Configuration

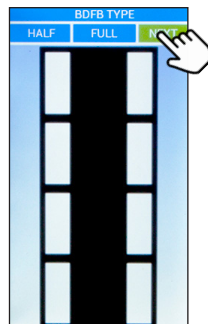


Figure 56. BDFB Type

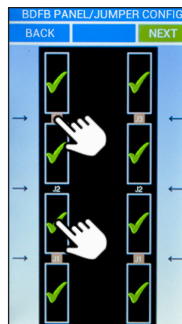


Figure 57. Panel/Jumper Configuration

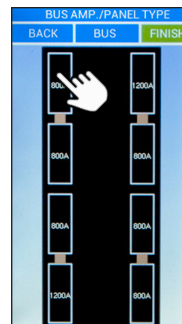


Figure 58. Panel Ampacity

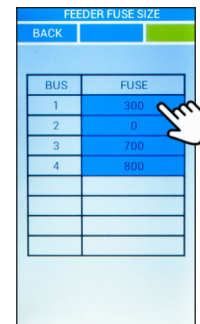


Figure 59. Feeder Fuse Size

## 6.5 Breaker Settings

To access breaker settings (calibration/ampacity/inventory), select a panel from the Home screen. Once selected, breaker load and ampacity data will be displayed along with any breaker alarms (see Figure 60). Refer to alarm key shown on this screen for alarm severity.

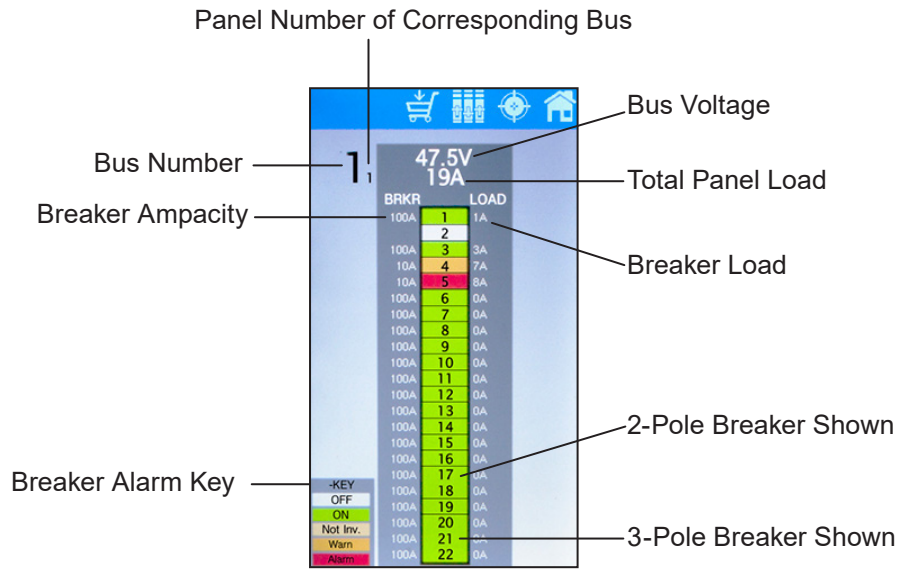


Figure 60. Breaker Data

### 6.5.1 Load Calibration

- To access load calibration, select the load calibration icon (⚙️) at the top of the screen. The Load Cal screen will appear with all 22 breakers shown. Select the breaker to be calibrated (see Figure 61). The individual breaker calibration screen will then appear with load data, breaker position, and manual offset adjustment. Tap the (-) or (+) buttons to manually adjust offset by 10A (see Figure 62).
- To set load offset for all 22 breakers at once, select Panel Lvl Ofst. Tap the (-) or (+) buttons to manually adjust panel level offset. This feature applies manual offset to all 22 breakers on the corresponding panel and is useful before connecting any load if all of the breakers are showing 1-2A per channel. (see Figure 63).
- To set the load of all breakers to zero, select Zero Offset. This setting can only be applied if breakers are OFF. Select Save to proceed (see Figure 64).

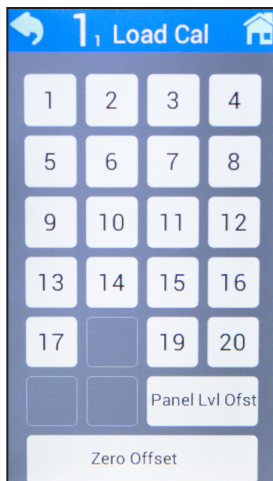


Figure 61. Load Calibration

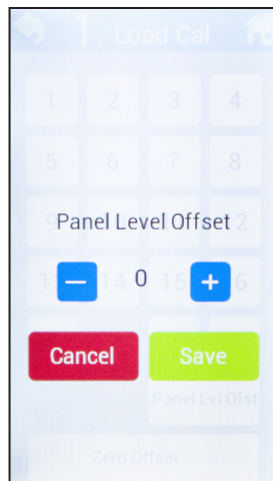


Figure 62. Panel Level Offset

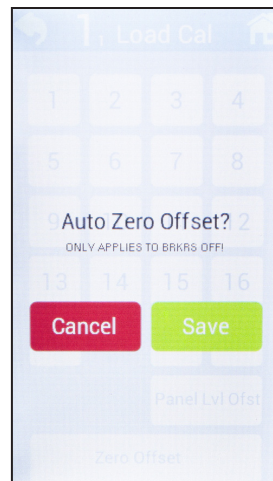


Figure 63. Auto Zero Offset

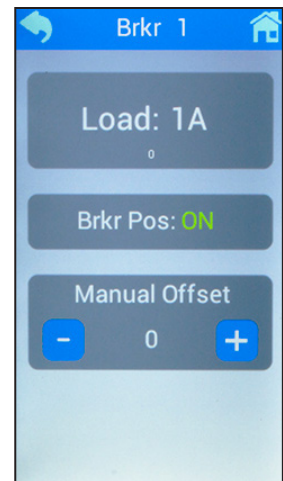


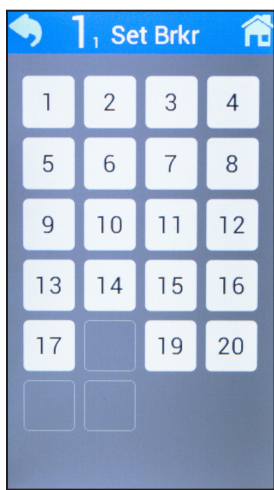
Figure 64. Calibration

## 6.5.2 Breaker Ampacity

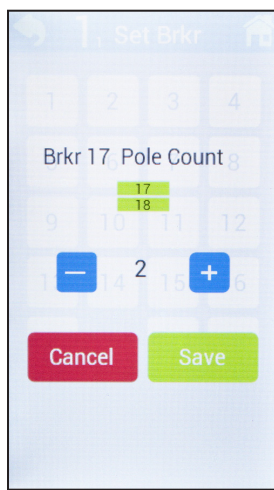
To access breaker ampacity settings, select the breaker ampacity icon (⚡) at the top of the screen. The Set Brkr screen will appear with up to 22 breakers shown (see Figure 65). Select the breaker that is to be adjusted, then select pole count (1-3) using the (+) or (-) buttons. Once pole count is chosen, select Save (see Figure 66). The individual breaker ampacity screen will then appear with a keypad to modify the current ampacity (see Figure 67). When entering digits below 100A, ensure that a 0 is placed in front (ex. 20A would be entered in as 020). See Table 20 for max values per pole count. Tap SAVE once proper adjustments have been made.

**Table 20. AM Breaker Max Ampacity Value**

NUMBER OF POLES	MAX RATING
1	125A
2	200A
3	300A



**Figure 65. Breaker Ampacity**



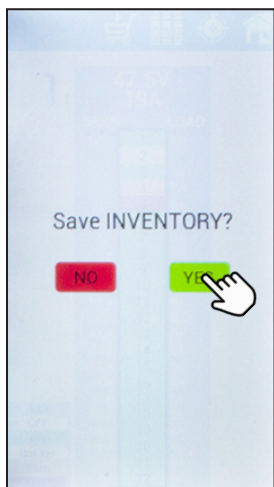
**Figure 66. Breaker Pole Count**



**Figure 67. Current Ampacity**

## 6.5.3 Breaker Inventory

To save breaker inventory, select the breaker inventory icon (⚡) at the top of the screen. Select YES when the screen asks to save inventory (see Figure 68).



**Figure 68. Save Inventory**

## 6.6 How to Review System Status via the Embedded Webserver

The optional embedded ethernet module provides remote monitoring via IP-based ethernet networks and a web browser.

By default, the ethernet module is configured at the factory with static network settings. Use these settings to set up a local network to communicate with the embedded webserver. Begin by entering the following static IP address into a web browser:

- **192.168.123.123**

Once you establish a connection to the embedded ethernet module, use the following credentials to gain access to the protected data and administrative pages:

- Username: **root**
- Password: **password**

### 6.6.1 Default Static Network Settings

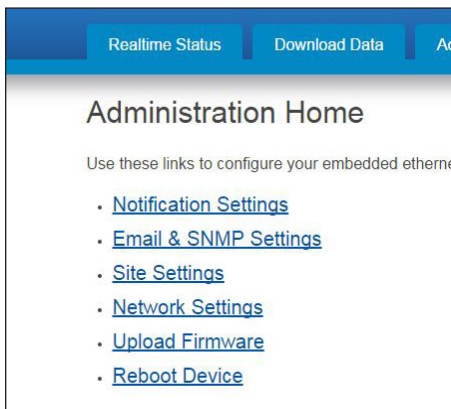
Use these settings to set up a local network to communicate with the embedded webserver. Enter the static IP address into a web browser.

- IPv4 Address: **192.168.123.123**
- Subnet Mask: **255.255.255.0**
- Default Gateway: **192.168.123.1**
- Default DNS: **192.168.123.1**
- Secondary DNS: **8.8.8.8**

## 6.7 Navigating the Webserver

Once you access the webserver you will be able to review the status of the BDFB system.

You can also access and change notification, network, and other settings via the Administration tab (see Figure 69).



**Figure 69. Webserver Navigation**



## 6.8 Realtime Status

By clicking on the Realtime Status tab located at the top of the home page, BDFB bus and panel detail will be shown (see Figure 70 & 71).

For bus detail, a table will display:

- Bus number
- Load
- Feeder fuse size
- Voltage

For panel detail, a table will display:

- Panel communication status
- Channel number
- Load per channel
- Ampacity per channel
- Inventory per channel (yes/no)
- Breaker status per channel (on/off)

Alarms: If communication with a panel is lost, Comms Lost will appear with a red background at the top of the Panel Detail table. If communication is not lost, Comms OK will appear with a green background. See Table 21 below for inventory and breaker status alarms.

**Table 21. Inventory and Breaker Status Alarms**

ALARM	COLOR	CAUSE
Minor	Orange	Breaker not inventoried; Breaker ON
Major	Red	Breaker inventoried; Breaker OFF

## 6.9 Administration Home

To access the configuration settings of your embedded ethernet module, select the Administration tab located at the top of the home page.

### 6.9.1 Notification Settings

This page allows the user to specify the SNMP and email notification settings (See Figure 72).

**BDFB**

Site Information

- Site Name: default
- Site Location: default

**Bus Detail**

Bus	Load	Feeder Fuse Size	Voltage
1	500.0A	800A	54.9V
2	400.0A	800A	55.0V
3	450.0A	800A	55.0V
4	800.0A	1200A	55.0V
5	-	0A	-
6	-	0A	-
7	-	0A	-
8	-	0A	-

**Figure 70. Bus Detail**

**Panel Detail**

Bus: 1 Panel: 1						Bus: 2 Panel: 1					
Comms OK						Comms OK					
Channel	Load	Ampacity	Inventory	Brkr Status		Channel	Load	Ampacity	Inventory	Brkr Status	
1	-	-	NO	OFF		1	0.0A	30A	YES	ON	
2	-	-	NO	OFF		2	0.0A	110A	YES	ON	
3	-	-	NO	OFF		3	0.0A	120A	YES	ON	
4	-	-	NO	OFF		4	0.0A	40A	YES	ON	
5	-	-	NO	OFF		5	0.0A	110A	YES	ON	
6	-	-	NO	OFF		6	0.0A	120A	YES	ON	
7	-	-	NO	OFF		7	0.0A	50A	YES	ON	
8	-	-	NO	OFF		8	0.0A	110A	YES	ON	
9	-	-	NO	OFF		9	0.0A	120A	YES	ON	
10	-	-	NO	OFF		10	0.0A	40A	YES	ON	
11	-	-	NO	OFF		11	-	-	NO	OFF	
12	-	-	NO	OFF		12	-	-	NO	OFF	
13	-	-	NO	OFF		13	-	-	NO	OFF	
14	-	-	NO	OFF		14	-	-	NO	OFF	
15	-	-	NO	OFF		15	-	-	NO	OFF	
16	-	-	NO	OFF		16	-	-	NO	OFF	
17	-	-	NO	OFF		17	-	-	NO	OFF	
18	-	-	NO	OFF		18	-	-	NO	OFF	
19	-	-	NO	OFF		19	-	-	NO	OFF	
20	-	-	NO	OFF		20	-	-	NO	OFF	
21	-	-	NO	OFF		21	-	-	NO	OFF	
22	-	-	NO	OFF		22	-	-	NO	OFF	

**Figure 71. Panel Detail**

**Alert Email Settings**

Enabled Disabled

Breaker Trip Alerting

Exceeded Threshold Alerting

Email SNMP Trap Both

Notification Type \*

1 2 3 Continuous

Notifications Per Alert \*

Minutes Between Email Notifications

Notification Rate

**Figure 72. Notification Settings**

## 6.9.2 Email & SNMP Settings

This page allows the user to configure the SNMP source address (IP address of the ethernet module) and the SNMP trap destination address (IP address of SNMP data receiver). Once all settings have been entered, click Save SNMP Settings.

This page also allows the user to configure email settings. Once all settings have been entered, click Save Email Settings. To confirm that entered configuration settings are correct, click Send Test Email Message to receive a test email (see Figure 73).

## 6.9.3 Site Settings

This page allows the user to assign a site name and a site location. Once these fields have been updated, click Save Site Settings (see Figure 74).

## 6.9.4 Network Settings

This page allows the user to change or configure factory network settings to communicate with the embedded webserver (see Figure 75).

Enter desired network settings and click Apply. A reboot will then be required (see Section 6.9.6 on Page 32).

The screenshot shows two sections: 'Configure SNMP Settings' and 'Configure Email Settings'. The SNMP section has two input fields: 'SNMP Trap Source Address' with the value '192.168.123.123' and 'SNMP Trap Destination Address' with the value '0.0.0.0'. Below these is a 'Save SNMP Settings' button. The Email section has several input fields: 'Outgoing SMTP Server' (smtp.example.com), 'Email Server Port' (25), 'User Name (Email Address)' (default@example.com), 'Password' (masked with dots), and a list of 'Recipient' fields, with the first one containing 'sample@example.com'. At the bottom are 'Save Email Settings' and 'Send Test Email Message' buttons.

Figure 73. Email & SNMP Settings

The screenshot shows the 'Configure Site Settings' page with two input fields: 'Site Name' and 'Site Location', both containing the value 'default'. Below the fields is a 'Save Site Settings' button.

Figure 74. Site Settings

The screenshot shows the 'Network Configuration Settings' page. It has two main sections: 'IP v4 Settings' and 'IP v6 Settings'. In the IP v4 section, the radio button 'Use the following IP address' is selected. Below it are input fields for 'IP v4 Address' (192.168.123.123), 'Subnet Mask' (255.255.255.0), 'Default Gateway' (192.168.123.1), 'Primary DNS' (192.168.123.1), and 'Secondary DNS' (8.8.8.8). The IP v6 section has checkboxes for 'Enable DHCP v6' (unchecked) and 'Use the following static IP v6 address' (checked). Below these are input fields for 'IP v6 Address' (::) and 'Prefix Length' (64). At the bottom is an 'Apply' button.

Figure 75. Network Settings

## 6.9.5 Upload Firmware

This page allows the user to upgrade the firmware on the embedded ethernet module. Follow the on-screen instructions to upload/upgrade firmware (see Figure 76).

## 6.9.6 Reboot Device

This page allows the user to reboot the embedded ethernet module. Click Reboot to proceed (see Figure 77).

### Upload Firmware

Use this web form to upgrade the firmware on your embedded ethernet module.  
Important Note: All firmware images are labeled according to their type and function.  
Only upload firmware files described as below:

- **image.bin** is the main firmware package for this ethernet module.
- **backup.bin** is a firmware backup/recovery package for this ethernet module.
- **rom.bin** is a firmware boot loader package for this ethernet module.

Firmware Upgrade Procedure:

- Upload rom.bin file.
- After submitting form wait approximately 45 seconds for device to restart.
- Reload the Upload Firmware page under "Administration" tab.
- Upload image.bin
- After submitting form wait approximately 45 seconds for device to restart.
- Reload the web interface in your web browser. Firmware should now be successfully upgraded.
- Check that the release version in the page footer below matches new version number provided by customer support.

Firmware Upload Form:

Select Image:  No file chosen

**Figure 76. Upload Firmware**

### Reboot Device

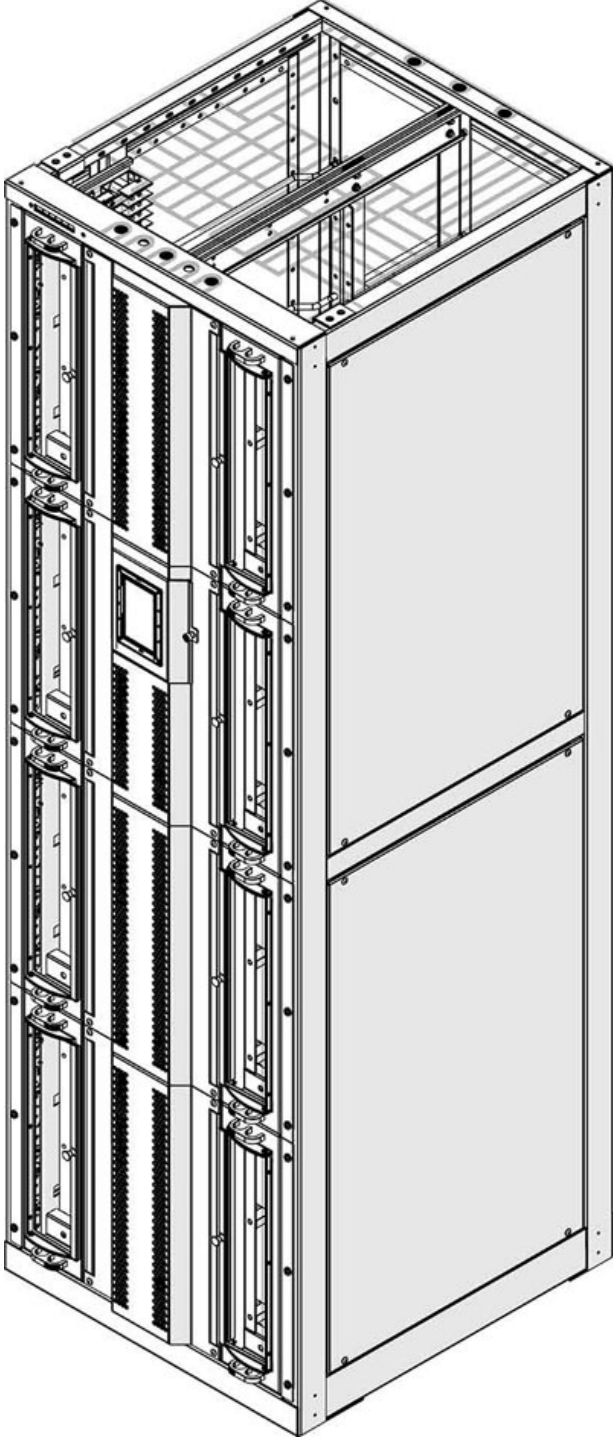
Note: This reboots embedded ethernet module and does NOT disrupt normal operation of power equipment.  
Click Reboot to reboot this device.

**Figure 77. Reboot Device**

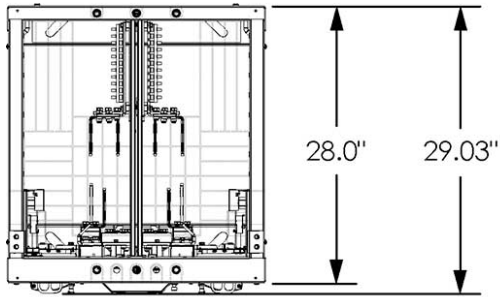


# Appendix A: Mechanical Drawings

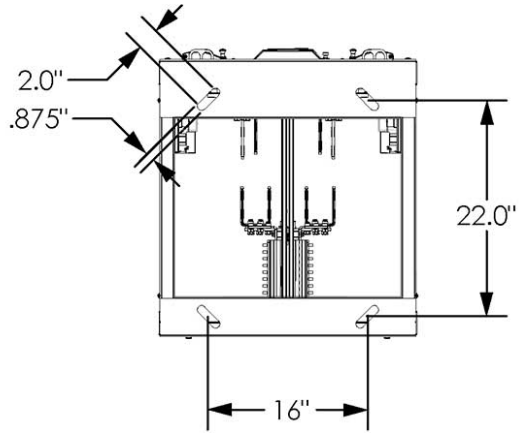
## A.1 PowerBay+ Full BDFB Isometric View



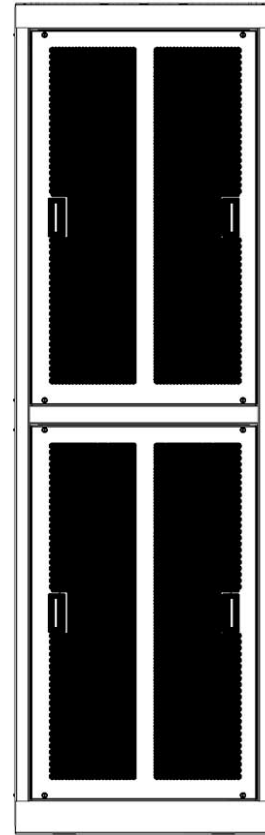
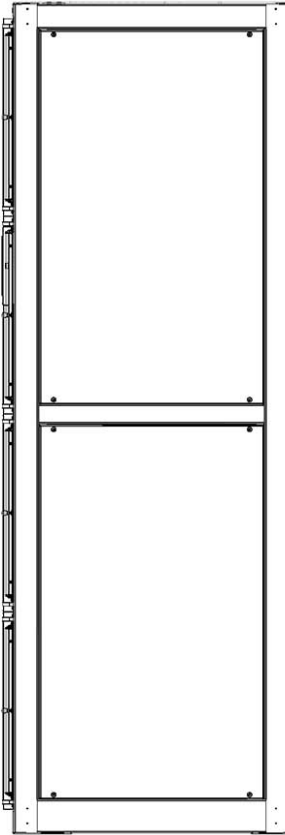
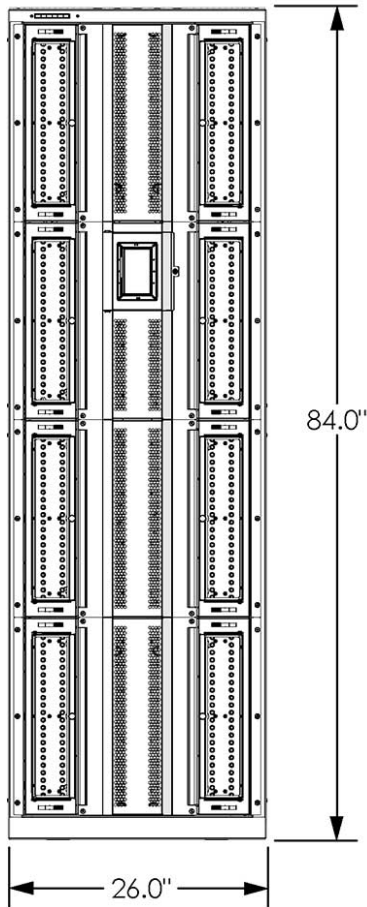
## A.2 PowerBay+ Full BDFB Dimensions



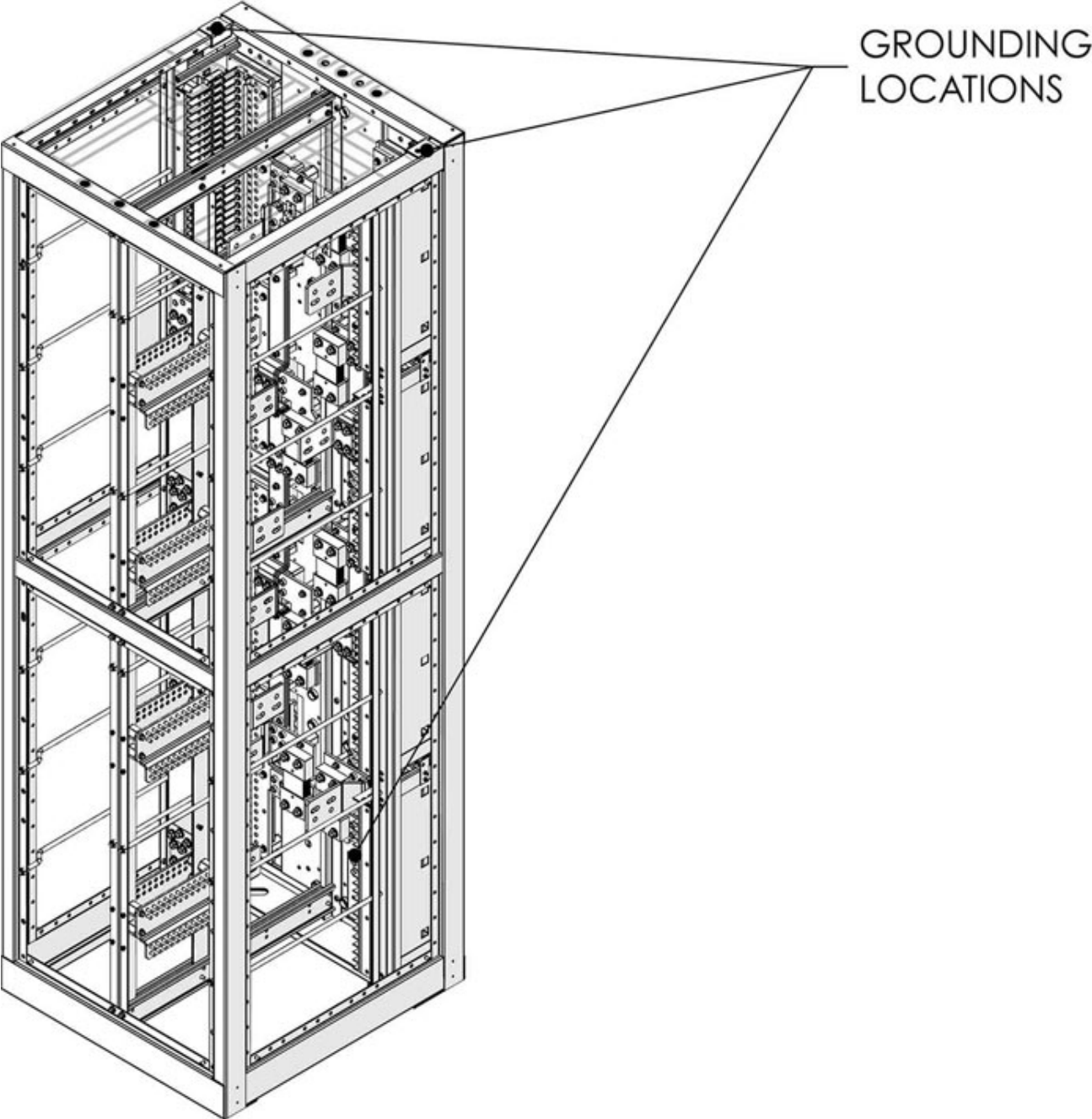
TOP VIEW



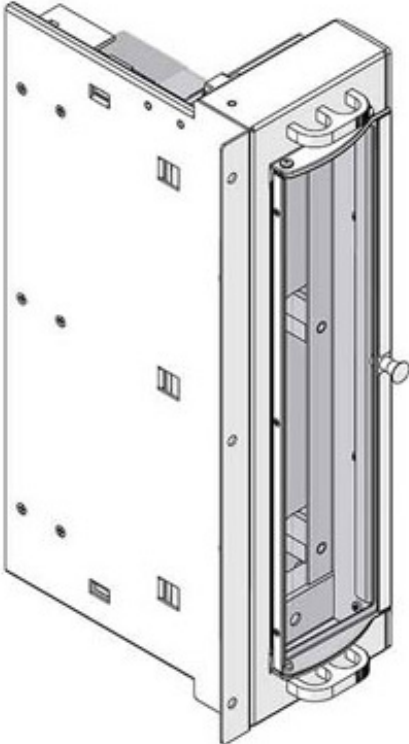
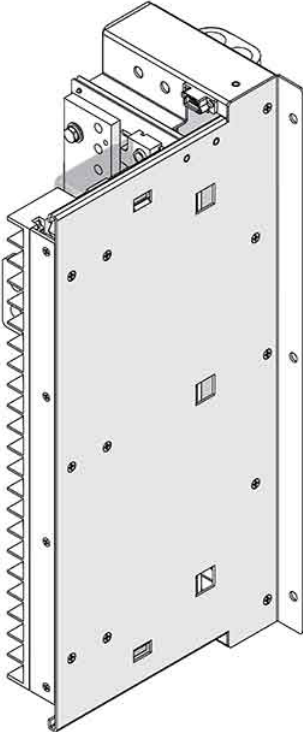
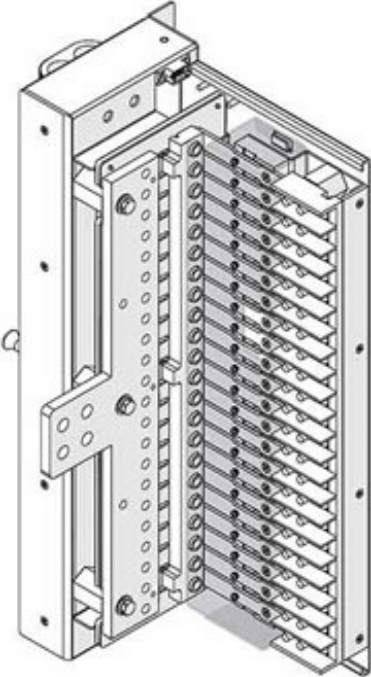
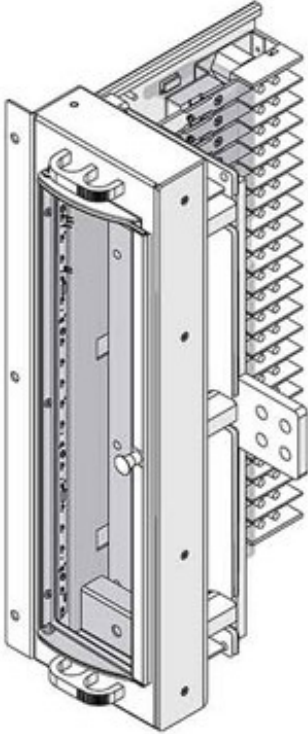
BOTTOM VIEW



### A.3 PowerBay+ Full BDFB Grounding Locations

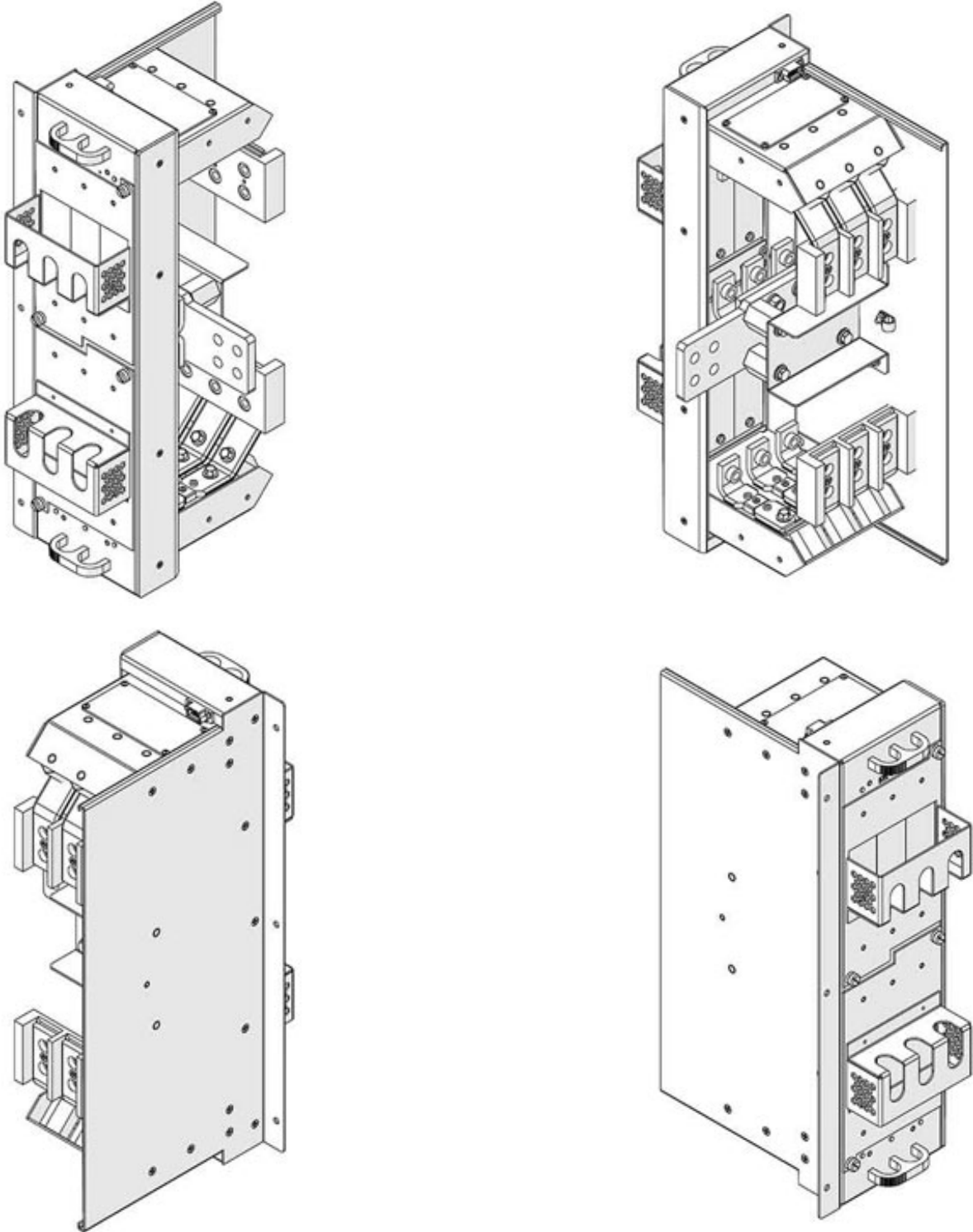


# A.4 AM Breaker Panel Isometric Views



(Left mount panel configuration shown)

# A.5 GJ Breaker Panel Isometric Views

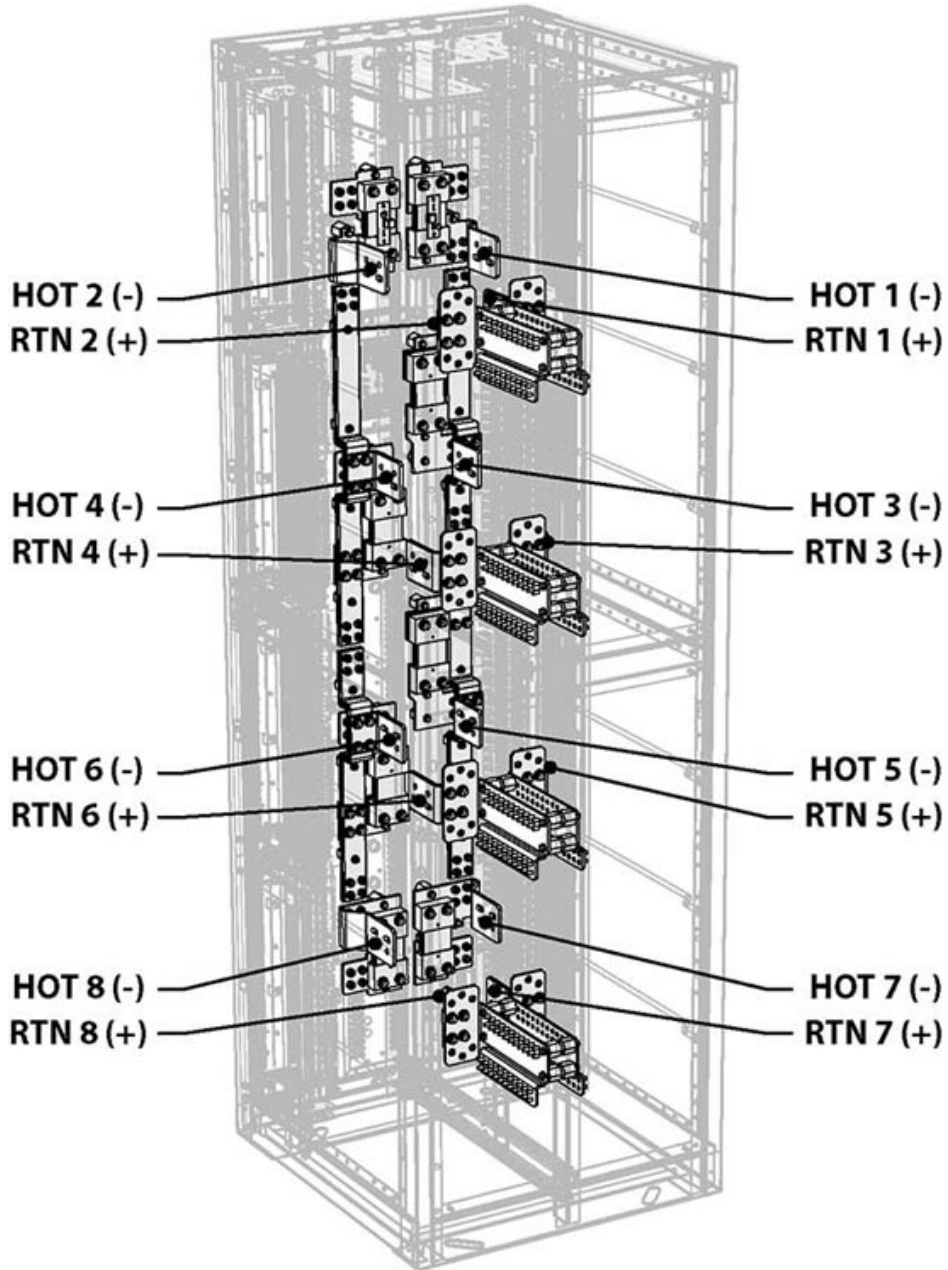


(Left mount panel configuration shown)

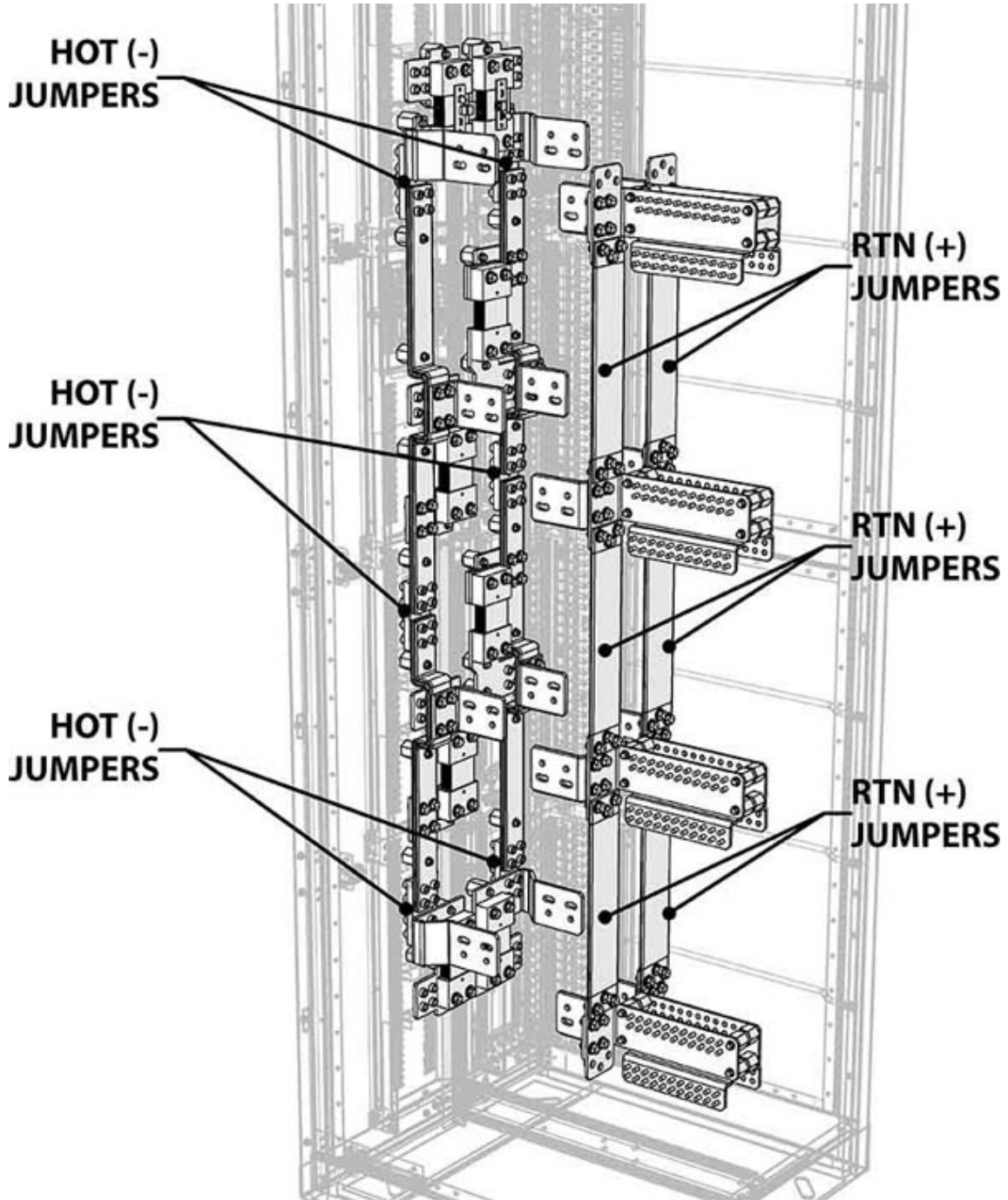


# Appendix B: Bus Layout and Jumper Configurations

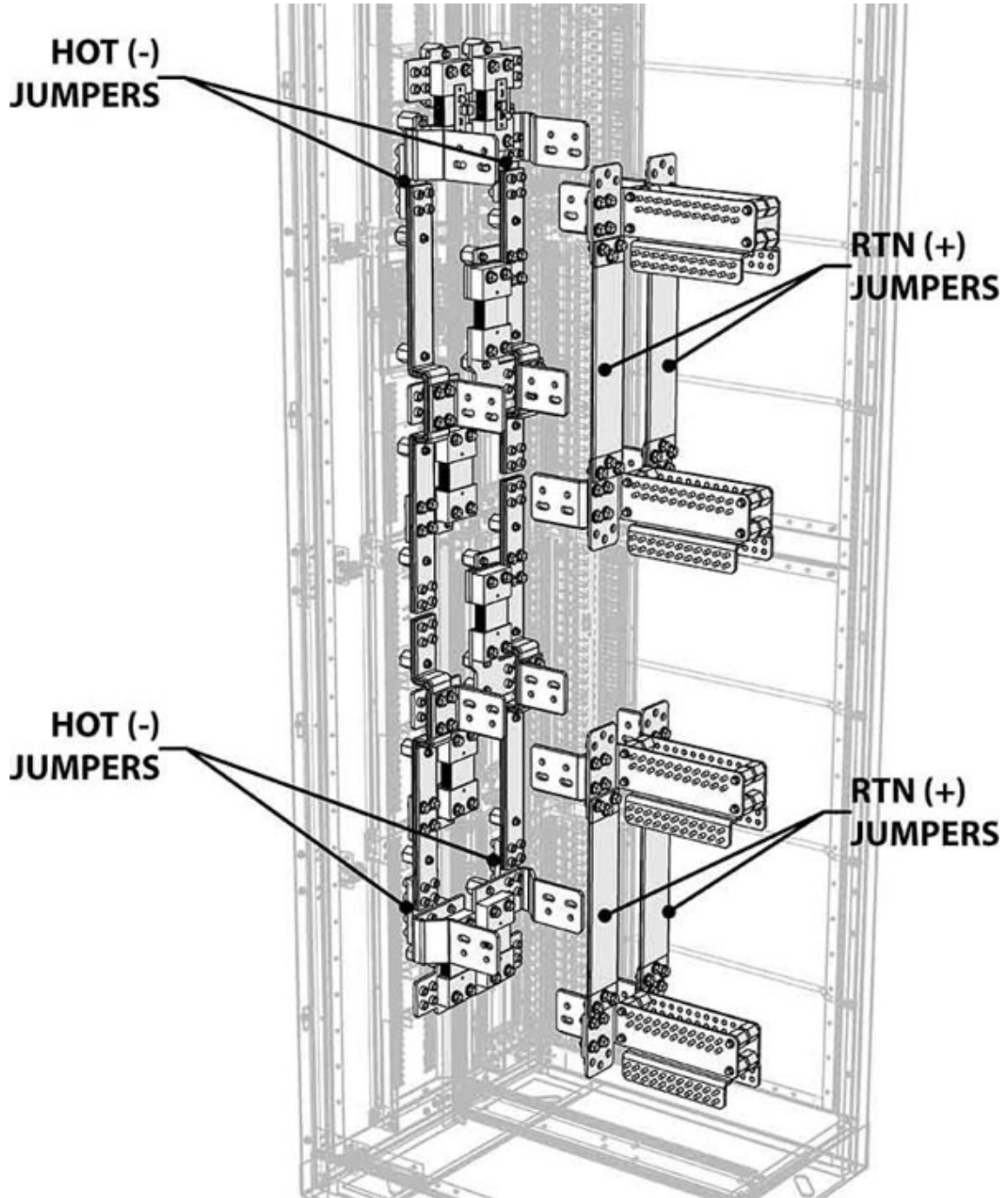
## B.1 HOT/RTN Input Bus Locations



## B.2 Dual-bus HOT/RTN Jumper Configuration (w/Internal RTN)

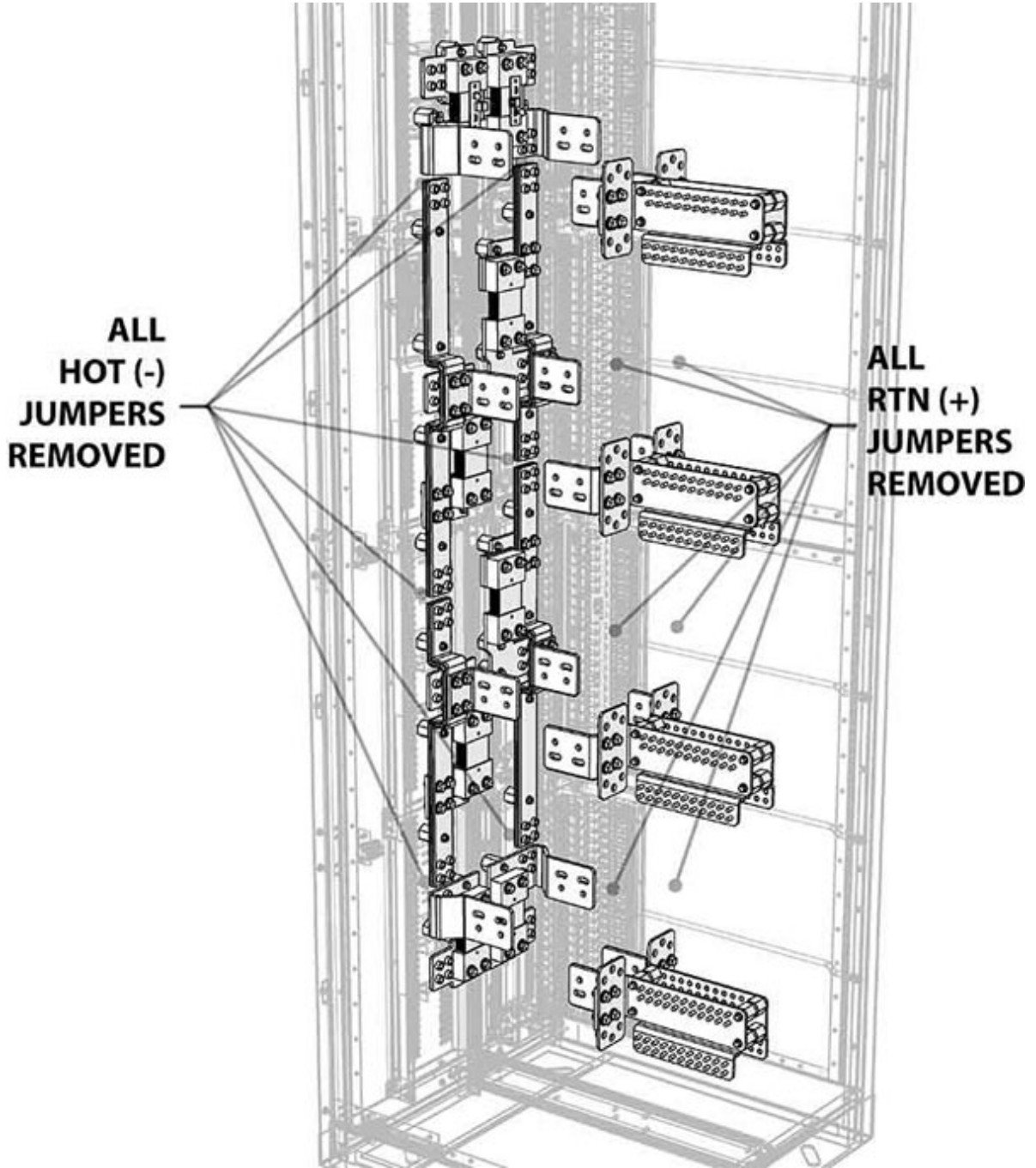


### B.3 Quad-bus HOT/RTN Jumper Configuration (w/Internal RTN)



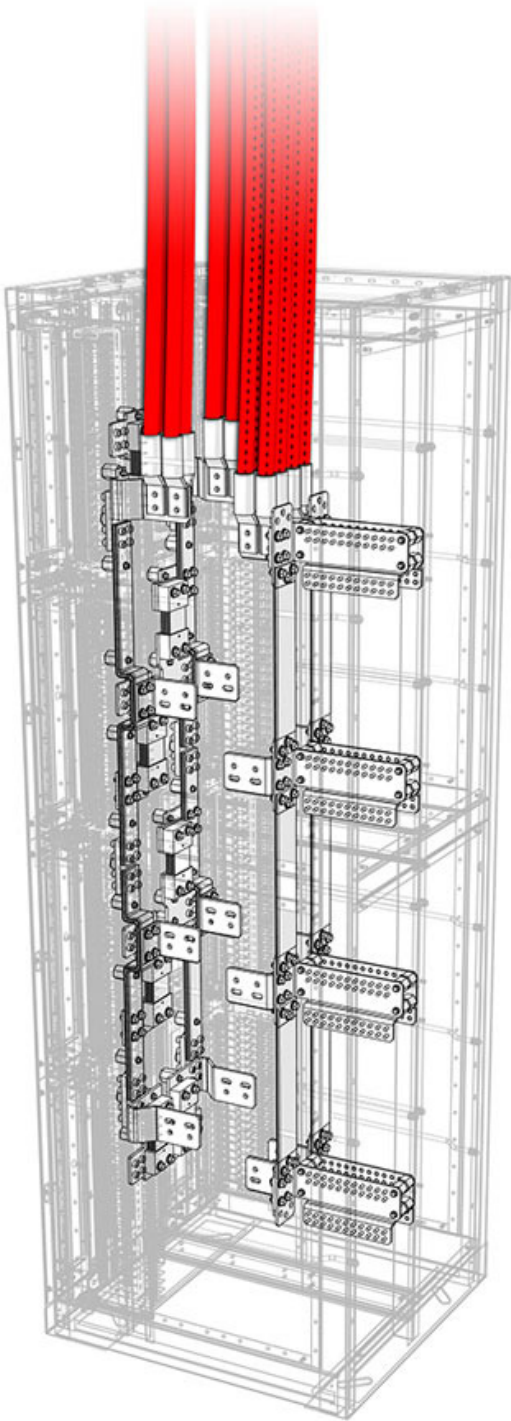


## B.4 Eight-bus H<sup>OT</sup>/RTN Jumper Configuration (w/Internal RTN)

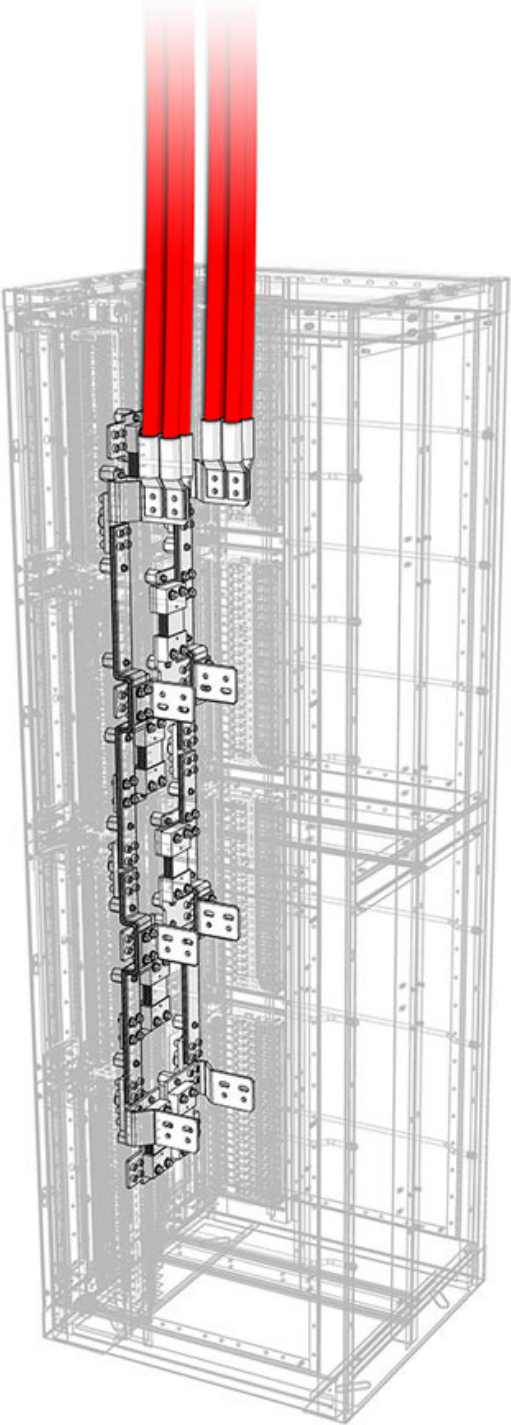


# Appendix C: Input Cable Configurations

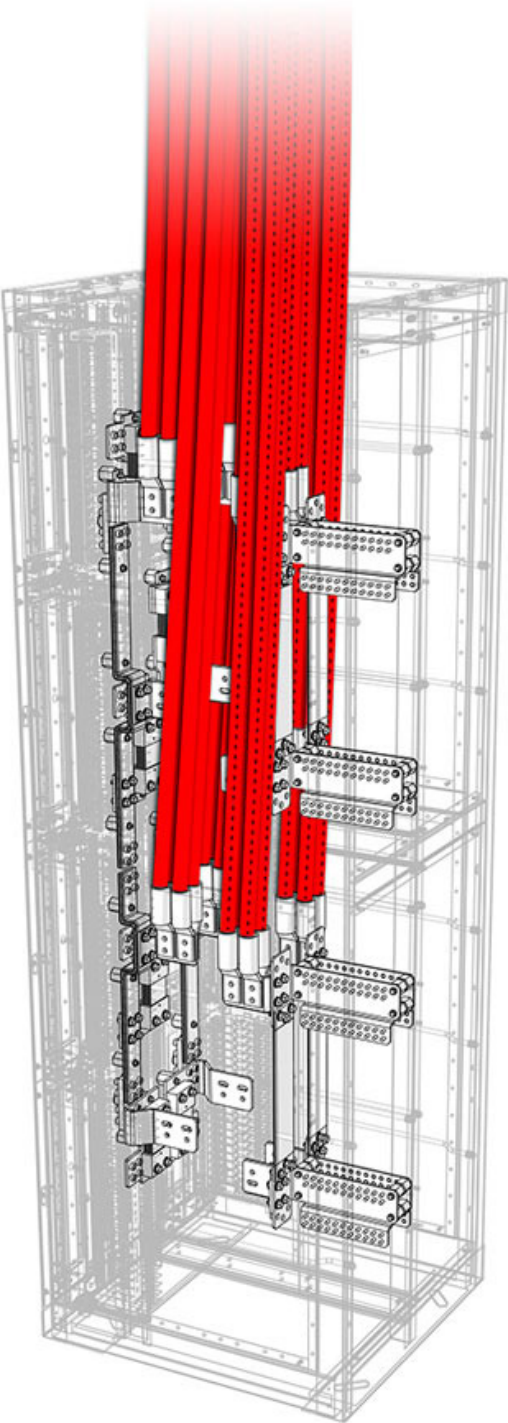
## C.1 Dual-bus Input Cable Positions (w/Internal RTN)



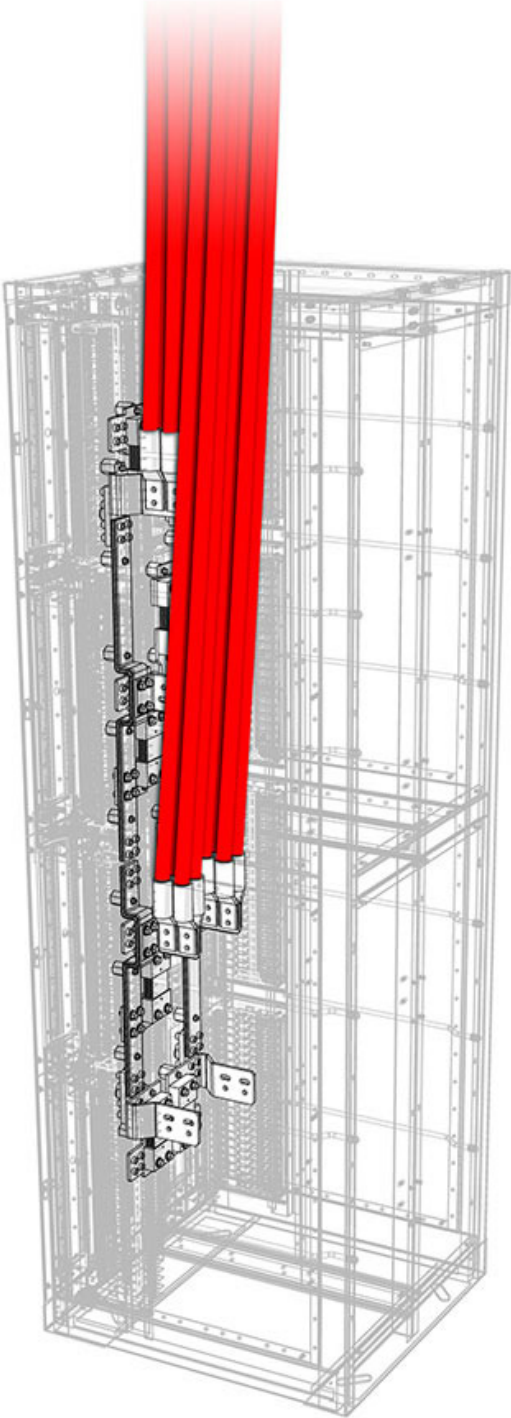
## C.2 Dual-bus HOT Input Cable Positions (w/o Internal RTN)



### C.3 Quad-bus HOT/RTN Input Cable Positions (w/Internal RTN)

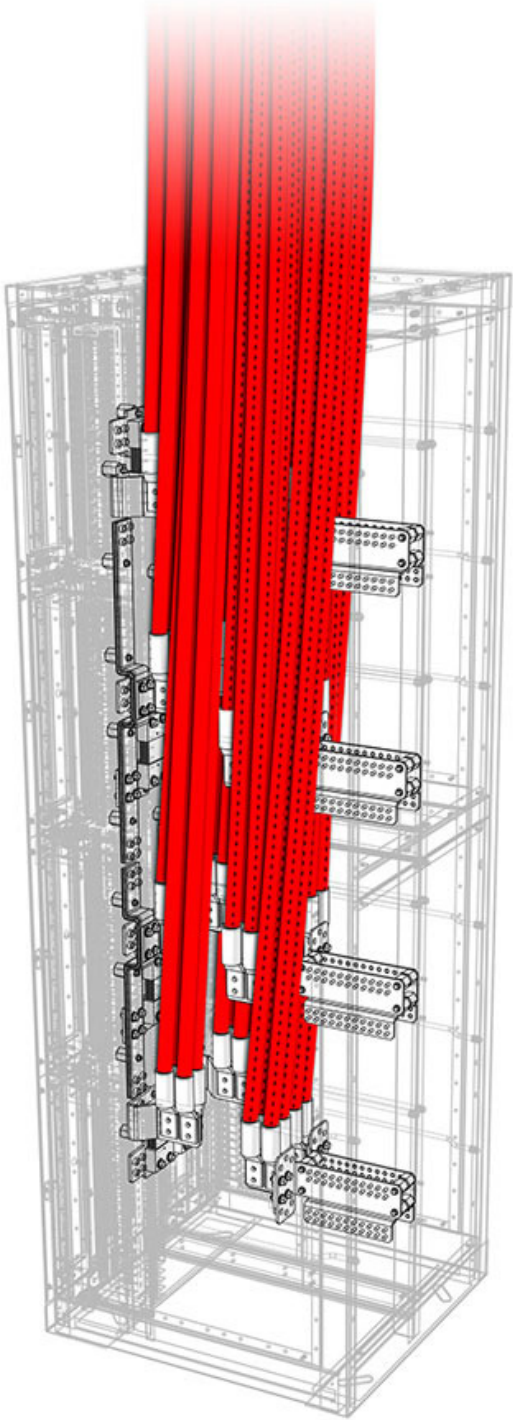


### C.4 Quad-bus HOT Input Cable Positions (w/o Internal RTN)

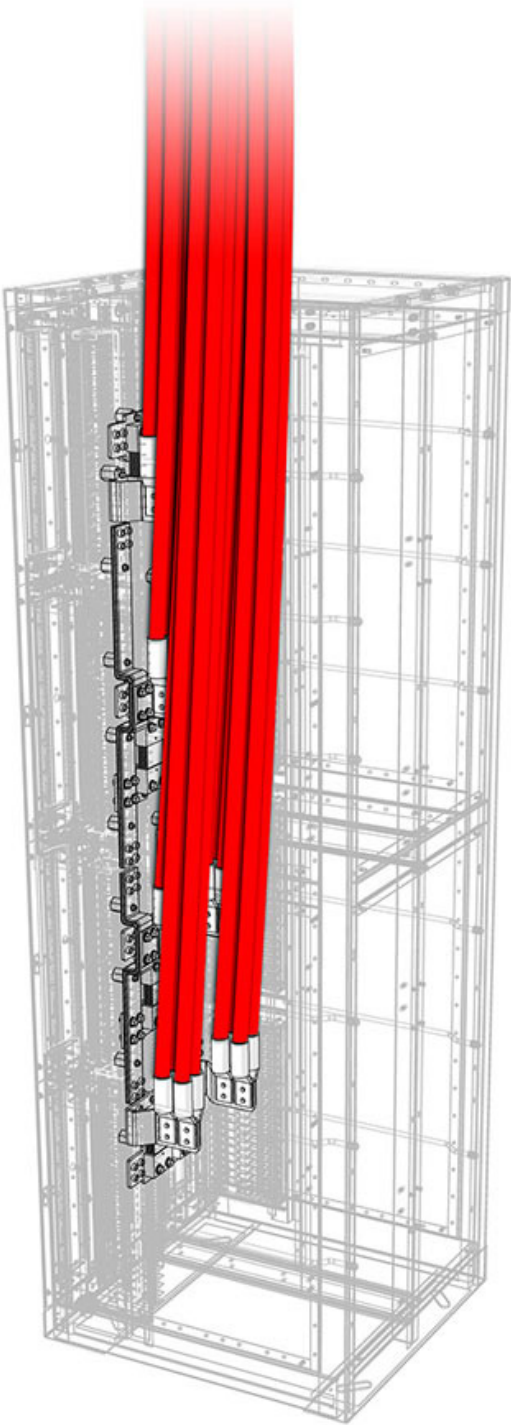




**C.5 Eight-Bus HOT/RTN Input Cable Positions  
(w/Internal RTN; All HOT/RTN Positions Cabled)**



**C.6 Eight-Bus HOT Input Cable Positions  
(w/o Internal RTN; All HOT Positions Cabled)**





## Appendix D: Supported Lugs For Termination

**Table 22. Supported Lugs for Input Connections**

WIRE GAUGE SUPPORTED	PART NUMBER	DESCRIPTION	MANUFACTURER	MANUFACTURER PART NUMBER	CRIMP DIE REQUIRED
4/O AWG	C538-102-10	Lug; Long Barrel; 3/8" holes; 1" CTC	Burndy	YAZV282TC38FX	Burndy U28RT, W28VT, W28CRT, X28RT
4/O AWG	C538-133-10	Lug; Standard Barrel; 3/8" holes; 1" CTC	Burndy	YAV28L2TC38FX	Burndy U28RT, W28VT, W28RT, X28RT
4/O AWG	C538-220-10	Lug; Standard Barrel; Narrow Tongue; 3/8" holes; 1" CTC	Burndy	YAV28L2NT38FX	Burndy U28RT, W28VT, W28RT, X28RT
4/O AWG	C538-221-10	Lug; Long Barrel; Narrow Tongue; 3/8" holes; 1" CTC	Burndy	YAZV282NT38FX	Burndy U28RT, W28VT, W28RT, X28RT
4/O AWG	C538-245-10	Lug; Short Barrel; Narrow Tongue; 3/8" holes; 1" CTC	Burndy	YAV29L2NT38FX	Burndy U29RT, W29VT, W29RT, X29RT
350 MCM	C538-070-10	Lug; Long Barrel; 3/8" holes; 1" CTC	Burndy	YAZ342NT38FX	Burndy U32RT, W32VT, W32RT
350 MCM	C538-118-10	Lug; Standard Barrel; 3/8" holes; 1" CTC	Burndy	YA34L2TC38FX	Burndy U32RT, W32VT, W32RT
500 MCM	C538-072-10	Lug; Long Barrel; 3/8" holes; 1" CTC	Burndy	YAZ382NT38FX	Burndy U38XRT
500 MCM	C538-131-10	Lug; Standard Barrel; 3/8" holes; 1" CTC	Burndy	YA38L2NT38FX	Burndy U38XRT
750 MCM	C538-073-10	Lug; Long Barrel; 3/8" holes; 1" CTC	Burndy	YAZ442NT38FX	Burndy U44XRT
750 MCM	C538-138-10	Lug; Standard Barrel; 3/8" holes; 1" CTC	Burndy	YA44L2NT38FX	Burndy U44XRT

**Table 23. Supported Lugs for Output Connections (Internal Returns)**

WIRE GAUGE SUPPORTED	PART NUMBER	DESCRIPTION	MANUFACTURER	MANUFACTURER PART NUMBER	CRIMP DIE REQUIRED
#6 AWG	C538-094-10	Lug; Long Barrel; 1/4" holes; 5/8" CTC	Burndy	YAZV282TC38FX	Burndy U5CRT, W5CVT, W5CR, X5CRT
#4 AWG	C538-085-10	Lug; Long Barrel; 1/4" holes; 5/8" CTC	Burndy	YAZV4C2TC14FX	Burndy U4CRT, W2CVT, W2CRT, X2CRT
#2 AWG	C538-173-10	Lug; Short Barrel; 1/4" holes; 5/8" CTC	Burndy	YAV2CL2NT14FX	Burndy U2CRT, W4CVT, W4CRT, X4CRT

**Table 24. Supported Lugs for Output Connections (AM Breaker Panel)**

WIRE GAUGE SUPPORTED	PART NUMBER	DESCRIPTION	MANUFACTURER	MANUFACTURE PART NUMBER	CRIMP DIE REQUIRED
#6 AWG	C538-094-10	Lug; Long Barrel; 1/4" holes; 5/8" CTC	Burndy	YAZV282TC38FX	Burndy U5CRT, W5CVT, W5CR, X5CRT
#4 AWG	C538-085-10	Lug; Long Barrel; 1/4" holes; 5/8" CTC	Burndy	YAZV4C2TC14FX	Burndy U4CRT, W2CVT, W2CRT, X2CRT
#2 AWG	C538-173-10	Lug; Short Barrel; 1/4" holes; 5/8" CTC	Burndy	YAV2CL2NT14FX	Burndy U2CRT, W4CVT, W4CRT, X4CRT

**Table 25. Supported Lugs for Output Connections (GJ breaker panel)**

WIRE GAUGE SUPPORTED	PART NUMBER	DESCRIPTION	MANUFACTURER	MANUFACTURE PART NUMBER	CRIMP DIE REQUIRED
4/O AWG	C538-102-10	Lug; Long Barrel; 3/8" holes; 1" CTC	Burndy	YAZV282TC38FX	Burndy U28RT, W28VT, W28RT, X28RT
4/O AWG	C538-133-10	Lug; Standard Barrel; 3/8" holes; 1" CTC	Burndy	YAV28L2TC38FX	Burndy U28RT, W28VT, W28RT, X28RT
4/O AWG	C538-220-10	Lug; Standard Barrel; Narrow Tongue; 3/8" holes; 1" CTC	Burndy	YAV28L2NT38FX	Burndy U28RT, W28VT, W28RT, X28RT
4/O AWG	C538-221-10	Lug; Long Barrel; Narrow Tongue; 3/8" holes; 1" CTC	Burndy	YAZV282NT38FX	Burndy U25RT, W25VT, W25RT, X25RT
4/O AWG	C538-245-10	Lug; Short Barrel; Narrow Tongue; 3/8" holes; 1" CTC	Burndy	YAV29L2NT38FX	Burndy U29RT, W29VT, W29RT, X29RT
350 MCM	C538-070-10	Lug; Long Barrel; 3/8" holes; 1" CTC	Burndy	YAZ342NT38FX	Burndy U32RT, W32VT, W32RT
350 MCM	C538-118-10	Lug; Standard Barrel; 3/8" holes; 1" CTC	Burndy	YA34L2TC38FX	Burndy U32RT, W32VT, W32RT

## Appendix E: Supported Circuit Breakers

**Table 26. AM Circuit Breakers**

PART NUMBER	AMPERAGE
C470-401-10	5A; Single-pole
C470-235-10	10A; Single-pole
C470-409-10	15A; Single-pole
C470-402-10	20A; Single-pole
C470-403-10	30A; Single-pole
C470-267-10	35A; Single-pole
C470-407-10	40A; Single-pole
C470-408-10	45A; Single-pole
C470-405-10	50A; Single-pole
C470-400-10	60A; Single-pole
C470-411-10	70A; Single-pole
C470-406-10	80A; Single-pole
C470-404-10	100A; Single-pole
C470-270-10	150A; 2-pole
C470-271-10	200A; 2-pole

**Table 27. GJ Circuit breakers**

PART NUMBER	AMPERAGE
C470-098-10	100A; Single-pole
C470-093-10	125A; Single-pole
C470-097-10	150A; Single-pole
C470-460-10	175A; Single-pole
C470-104-10	200A; Single-pole
C470-094-10	225A; Single-pole
C470-095-10	250A; Single-pole
C470-464-10	300A; 2-pole
C470-087-10	400A; 2-pole





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