Vertiv™ NetSure™ 5100 Series -48 VDC Power System

Installation Manual

Specification Number: 582137200
Model Number: 5100

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Technical Support Site

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

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

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Admonishments Used in this Document



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



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



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



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



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



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



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

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Important Safety Instructions

Safety Admonishments Definitions

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

Safety and Regulatory Statements

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

Déclarations de Sécurité et de Réglementation

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

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1 Customer Documentation Package

This document (IM582137200) provides *Installation Instructions* for the Vertiv™ NetSure™ 5100 -48 VDC Power System: Model 5100, Spec. No. 582137200.

The complete Customer Documentation Package consists of…

-48 VDC Power System Installation Manual

- Power System Installation Instructions: IM582137200

NCU Controller User Manual

- NCU Controller User Instructions: UM1M830BNA

USB Drive with All Customer Documentation

- Power System Installation Instructions: IM582137200
- Power System User Instructions: UM582137200
- Power System "System Application Guide": SAG582137200
- NCU Controller User Instructions: UM1M830BNA
- Rectifier Instructions: UM1R482000e3
- Engineering Drawings
  - SD582137200
  - T582137200
- Also provided on the USB drive is a controller configuration drawing and the controller configuration files loaded into the controller as shipped.

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

2 Installation Acceptance Checklist

Provided in this section is an Installation Acceptance Checklist. This checklist helps ensure proper installation and initial operation of the system. As the procedures presented in this document are completed, check the appropriate box on this list. If the procedure is not required to be performed for your installation site, also check the box in this list to indicate that the procedure was read. When installation is done, ensure that each block in this list has been checked. Some of these procedures may have been factory performed for you.



NOTE! *The system is not powered up until the end of this checklist.*



NOTE! *Some of these procedures may have been performed at the factory for you.*

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Installing the System

- ❑ Relay Rack Secured to Floor (if furnished)
- ❑ System Secured to Relay Rack or Cabinet Equipment Rack (if required)
- ❑ System Secured to Suitable Wall (if required)
- ❑ Optional Battery Tray Installed
- ❑ Optional Battery Tray Battery Disconnect Circuit Breaker Installed
- ❑ Circuit Breakers and/or Fuses Installed

Setting Jumper and Switch Options

- ❑ Jumper on System Interface Circuit Card Set
- ❑ Factory Switch Setting on IB2 (Controller Interface Board) Verified

Making Electrical Connections

- ❑ Relay Rack / Cabinet Frame Grounding Connection Made
- ❑ System Shelves Frame Grounding Connection Made
- ❑ Central Office Ground Connection Made
- ❑ Rectifier AC Input and AC Input Equipment Grounding Connections Made
- ❑ External Alarm, Reference, Monitoring, and Control Connections to System Interface Circuit Card Made
- ❑ External Alarm, Reference, Monitoring, and Control Connections to IB2 (Controller Interface Board) Made
- ❑ External Device (such as SM-Temp Module) Connection to NCU Controller CAN Bus Made (if required)
- ❑ NCU Controller Ethernet Port Connection Made
- ❑ NCU Controller Second Ethernet Port Connection Made (if required)
- ❑ Factory NCU Control Bus Connections between NCU Controller and System Shelves Verified
- ❑ Load Connections Made
- ❑ Battery Connections Made
    - o Batteries Installed and Connected in an Optional Battery Tray
    - o Batteries Installed and Connected in an Optional Battery Cabinet
    - o External Batteries Connected

Installing the Modules

- ❑ Rectifier Modules Installed

Initially Starting the System

- ❑ System Started, Configured, and Checked

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3 Installing the System

3.1 General Requirements

- The installer should be familiar with the installation requirements and techniques to be used in securing the relay rack (if furnished) to the floor.
- The installer should be familiar with the installation requirements and techniques to be used in securing the system to a relay rack or equipment rack.
  - The top rear cover needs to be removed to access the battery and CO ground connection points. If other equipment is mounted above the shelf, leave enough clearance to access the screws securing the cover.
- The installer should be familiar with the installation requirements and techniques to be used in securing the system to a suitable wall (if required).
- This product is intended only for installation in a restricted access location on or above a non-combustible surface.
- This product must be located in a controlled environment with access to crafts persons only.
- This product is intended for installation in network telecommunication facilities CO, vault, hut or other electronic equipment enclosure that maintains temperature from -5 °C to +50 °C for Class 1 equipment or from -40 °C to +65 °C for Class 2 equipment.
- This product is intended for connection to the common bonding network in a network telecommunication facility (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).
- The DC return connection to this system can remain isolated from system frame and chassis (DC-I).
- This system is suitable for installation as part of the Common Bonding Network (CBN).
- System ventilating openings must not be blocked and temperature of air entering rectifiers must not exceed rated operating ambient temperature range found in SAG582137200.
- Clearance requirements are (relay rack):
  - Recommended minimum aisle space clearance for the front of each bay is 2' 6".
  - Recommended minimum aisle space clearance for the rear of each bay is 2’ 0”.
- Clearance requirements are (cabinet or wall mounting):
  - Recommended minimum clearance for the rear of the system is 4”.

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3.2 Physical Security

This product is designed and intended to be deployed and operated in a physically secure and network firewall-protected location. Vertiv recommends a review of the physical security and operating environment of the unit. Since an attacker or disgruntled user can cause serious disruption, below are some recommended best practices that include, but are not limited to:

- Restrict access to areas, racks, and units with encrypted card RFID/badges, unique multi-factor passcode authentication for access, man traps, and biometric scanners for physical access to the equipment.
- Have trusted and background-checked security guards with 24x7x365 physical presence and written logs to help document and note physical access to a data center, building, rack, and so on.
- Restrict physical access to telecommunications equipment and network cabling. Physical access to the telecommunications lines and network cabling should be restricted to protect against attempts to intercept or sabotage communications. Best practices include use of metal conduits for the network cabling running between equipment cabinets.
- All USB, RJ45, and/or any other physical ports should be restricted on the units.
- Do not connect removable media (such as USB devices, SD cards, and so on) for any operation (such as firmware upgrade, configuration change, or boot application change) unless the origin of media is known and trusted. Before connecting any portable device through a USB port or SD card slot, scan the device for malware and viruses.

3.3 Securing the Relay Rack to the Floor (if furnished)

Secure the relay rack to the floor per site requirements. Refer to “General Requirements” on page 3.

Ventilation Requirements

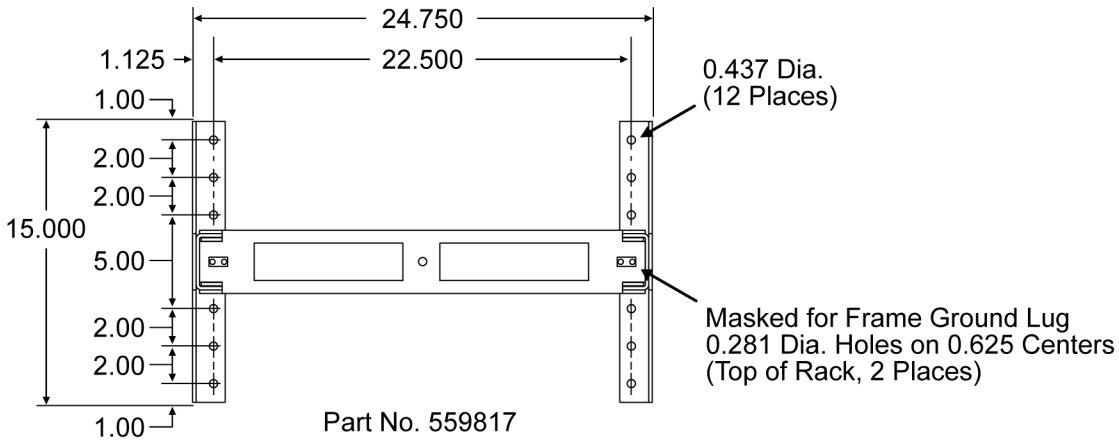
Refer to “General Requirements” on page 3.

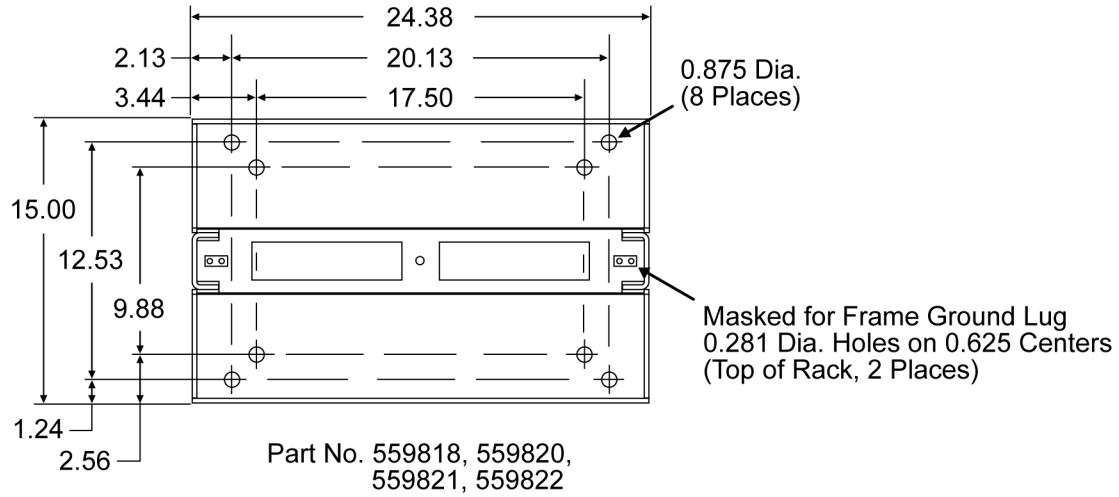
Relay Rack Floor Mounting Dimensions

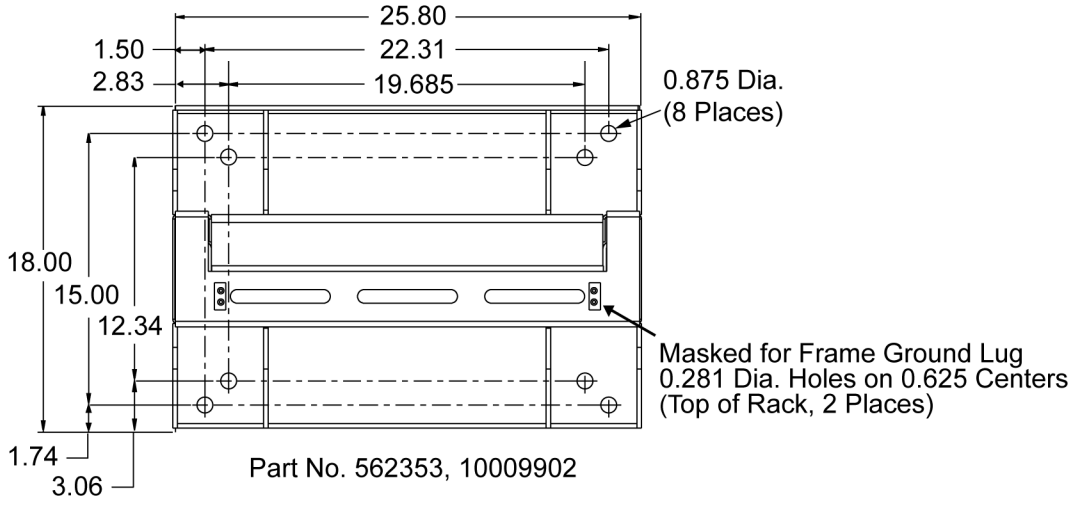
Refer to Figure 3.1 and Figure 3.2 for relay rack floor mounting dimensions.

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Figure 3.1 Relay Rack Floor Mounting Dimensions - 23”



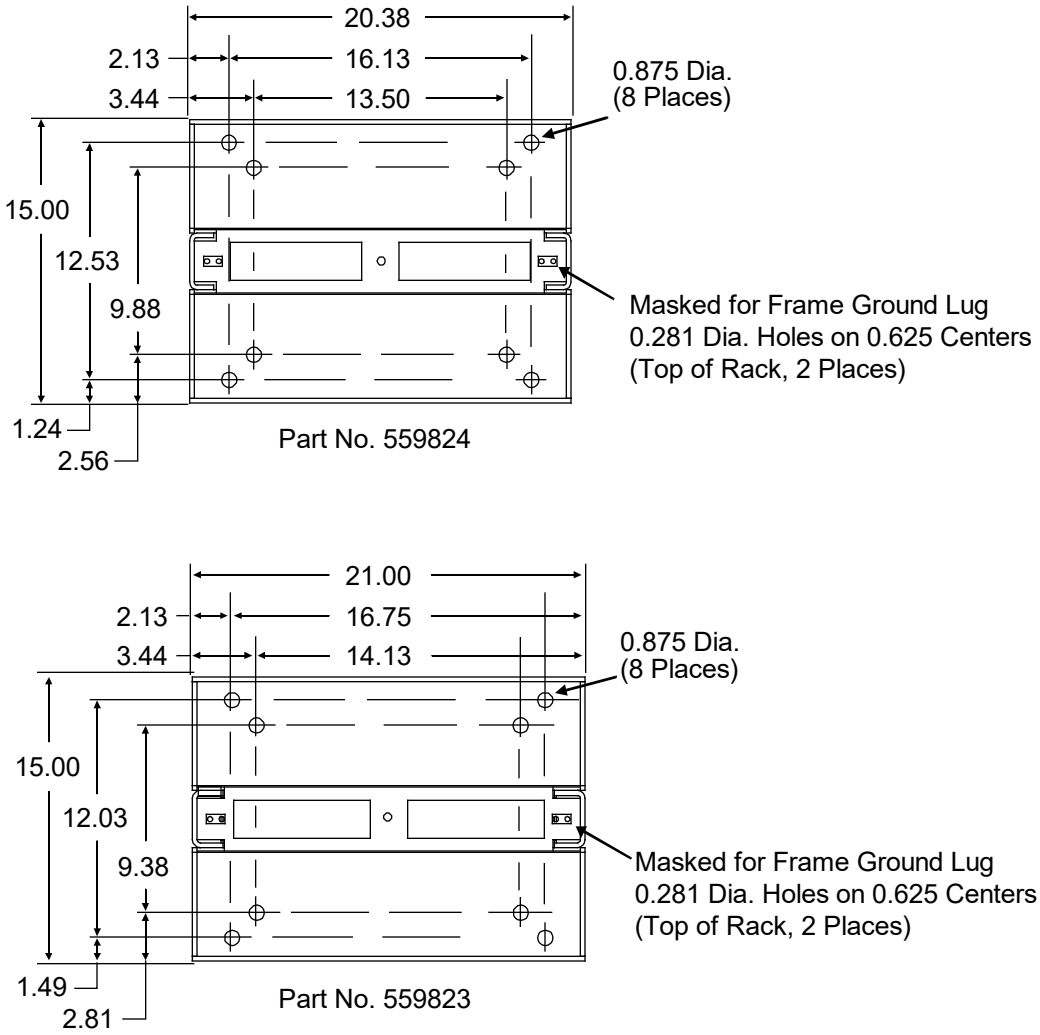




Notes:
1. All dimensions are in inches.

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Figure 3.2 Relay Rack Floor Mounting Dimensions - 19”



Notes:
1. All dimensions are in inches.

3.4 Securing the System to a Relay Rack or a Cabinet Equipment Rack (if required)

DANGER! If the system is mounted in a relay rack, the relay rack must be securely anchored to the floor before the system is installed.

NOTE! *If the power system was ordered in a relay rack, these procedures have been performed at the factory.*

NOTE! *Refer to “General Requirements” on page 3 for mounting restrictions and ventilation requirements.*

NOTE! *The distribution unit is factory connected to the rectifier/controller shelf. The distribution unit with rectifier/controller shelf is mounted as a complete system.*

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NOTE! *The system is furnished for 19" mounting as standard. This requires rear AC connections for the controller/rectifier shelf. 23" mounting bracket adapters are available for 23" mounting. If the front accessed AC connector option was ordered, the AC option is built into the mounting bracket and requires 23" mounting. The expansion rectifier shelf is always furnished with 19' mounting brackets and rear AC connectors. 23" mounting bracket adapters are available for 23" mounting. Wall mounting options are also available.*

NOTE! *Refer to UM582137200 for a procedure for field installing an expansion rectifier shelf to the system.*

This power system is designed to mount in a standard 19" or 23" relay rack or equipment rack having 1" or 1 3/4" multiple drillings. Refer to System Application Guide SAG582137200 for overall dimensions and a list of available relay racks.

Procedure

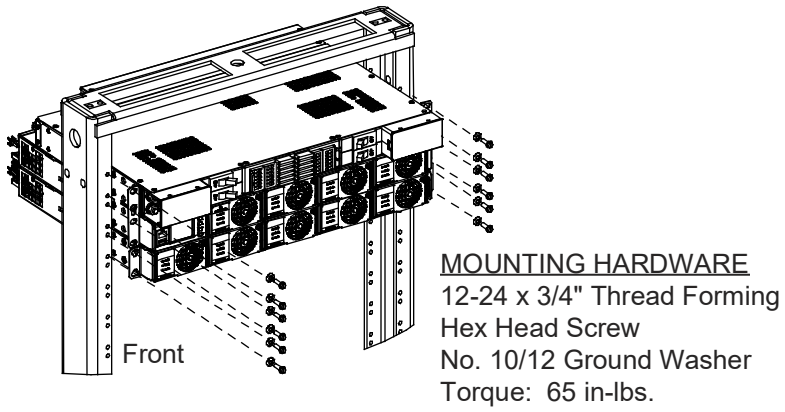
1. Position the system in the relay rack or cabinet equipment rack.
2. Secure the system to the relay rack or cabinet equipment rack using hardware as shown in Figure 3.3 (see Figure 3.3 for recommended torque). Use grounding washers as indicated in Figure 3.3.

NOTE! *Install (orient) the ground washers so the teeth dig into the mounting angles for a secure ground connection.*

NOTE! *Compliance with Telcordia GR-1089-CORE requires that prior to mounting the system to the equipment rack:*

- All paint must be removed from the front surface of each equipment rack rail where it mates with a shelf-mounting bracket, so that good metal-to-metal contact can be established between the shelf and rack.
- The shelf-to-rack mating surfaces must be cleaned.
- Electrical anti-oxidizing compound must be applied to the shelf-to-rack mating surfaces.

Figure 3.3 Mounting the System in a Relay Rack or a Cabinet Equipment Rack



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3.5 Securing the System Vertically to a Wall with P/N 553203 Kit (if furnished)

An optional wall mount bracket kit (P/N 553203) is available for vertical wall mounting of the system.

NOTE! *Refer to "General Requirements" on page 3 for mounting restrictions and ventilation requirements.*

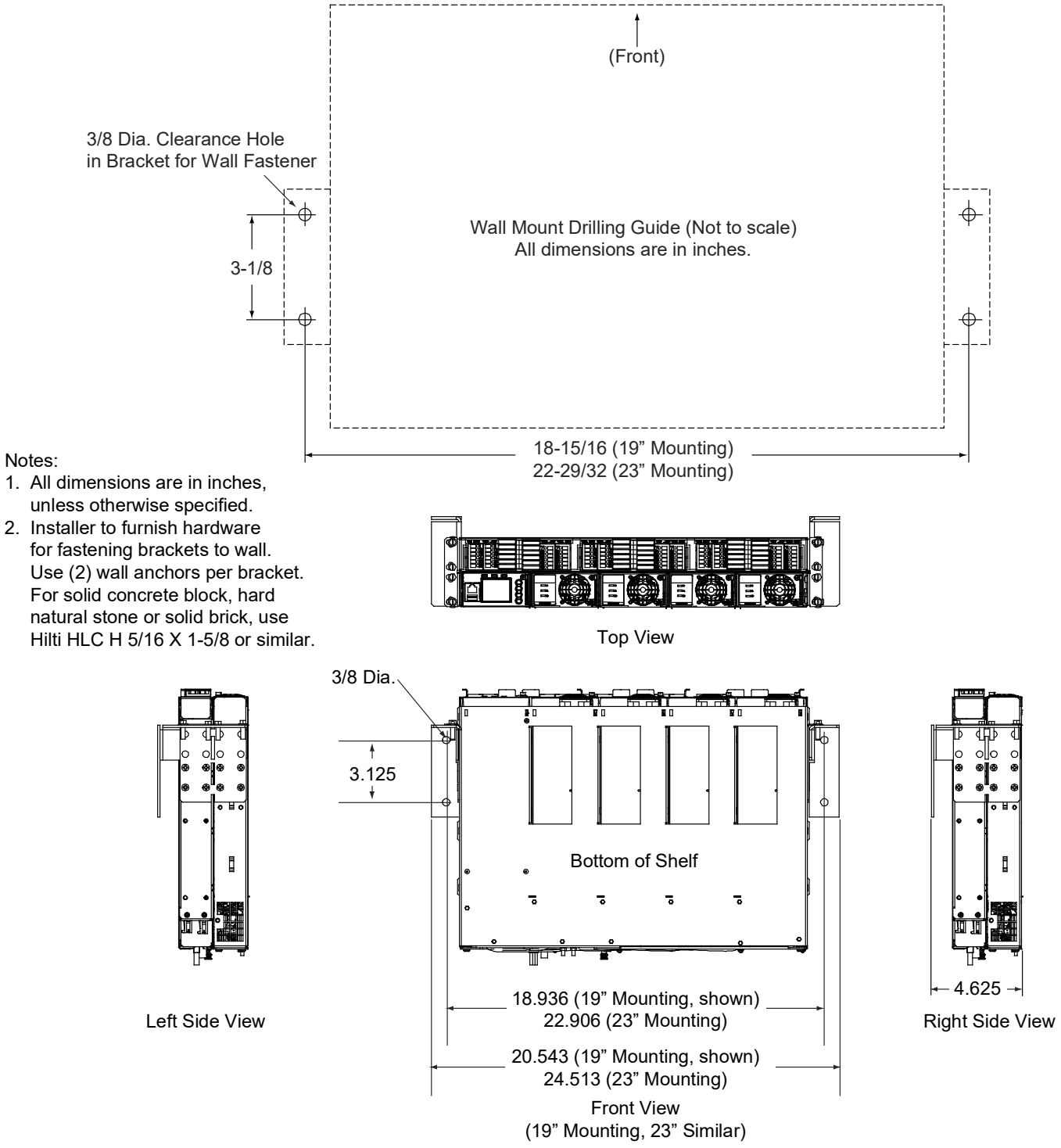
NOTE! *Refer to Figure 3.4 when performing this procedure.*

Procedure

1. The installer must provide fasteners for securing the system to a wall or other vertical surface. Ensure that the wall and fastening technique are suitable for supporting the weight of the system. Suggested anchors are listed in the illustrations. Refer to System Application Guide SAG582137200 for system weight and additional dimensions.
2. Attach the brackets to the system mounting angles using kit-furnished screws. Torque to 60 in-lbs.
3. Use drill guide dimensions in the illustration to prepare the wall for customer-furnished fasteners. Secure the system to the wall.

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Figure 3.4 Vertical Wall Mounting with P/N 553203



Notes:
1. All dimensions are in inches, unless otherwise specified.
2. Installer to furnish hardware for fastening brackets to wall. Use (2) wall anchors per bracket. For solid concrete block, hard natural stone or solid brick, use Hilti HLC H 5/16 X 1-5/8 or similar.

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3.6 Securing the System Horizontally to a Wall with P/N 552537 or P/N 552535 Kit (if furnished)

An optional wall mount bracket kit (P/N 552537 for 19" mounting and P/N 552535 for 23" mounting) is available for horizontal wall mounting of the system.

NOTE! *Refer to "General Requirements" on page 3 for mounting restrictions and ventilation requirements.*

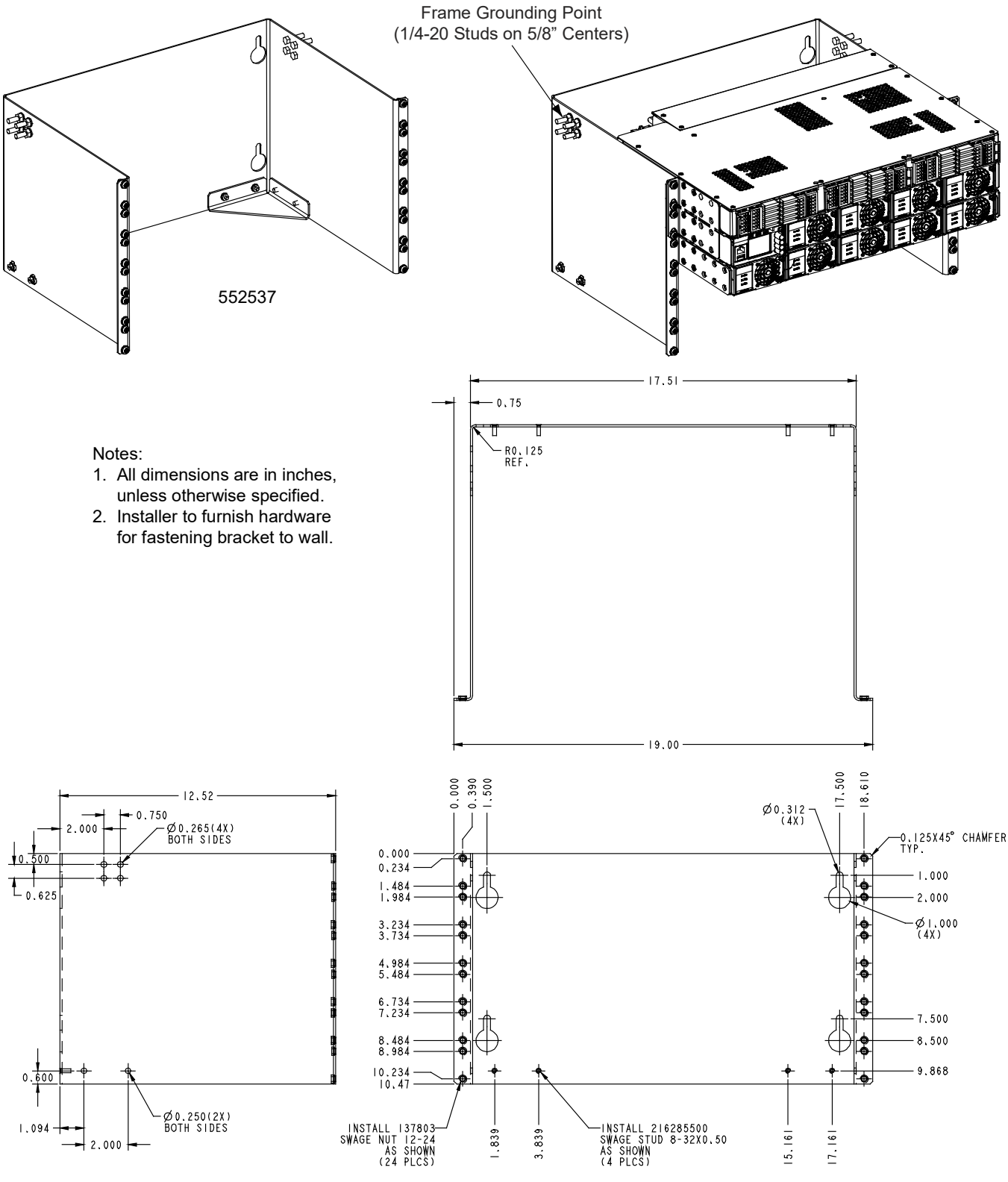
NOTE! *Refer to Figure 3.5 or Figure 3.6 when performing this procedure.*

Procedure

1. The installer must provide fasteners for securing the system to a wall or other horizontal surface. Ensure that the wall and fastening technique are suitable for supporting the weight of the system. Refer to System Application Guide SAG582137200 for system weight and additional dimensions.
2. Prepare the wall for customer-furnished fasteners. Secure the wall bracket to the wall.
3. Attach the system to the wall bracket using the standard mounting technique. See "Securing the System to a Relay Rack or a Cabinet Equipment Rack (if required)" on page 6.

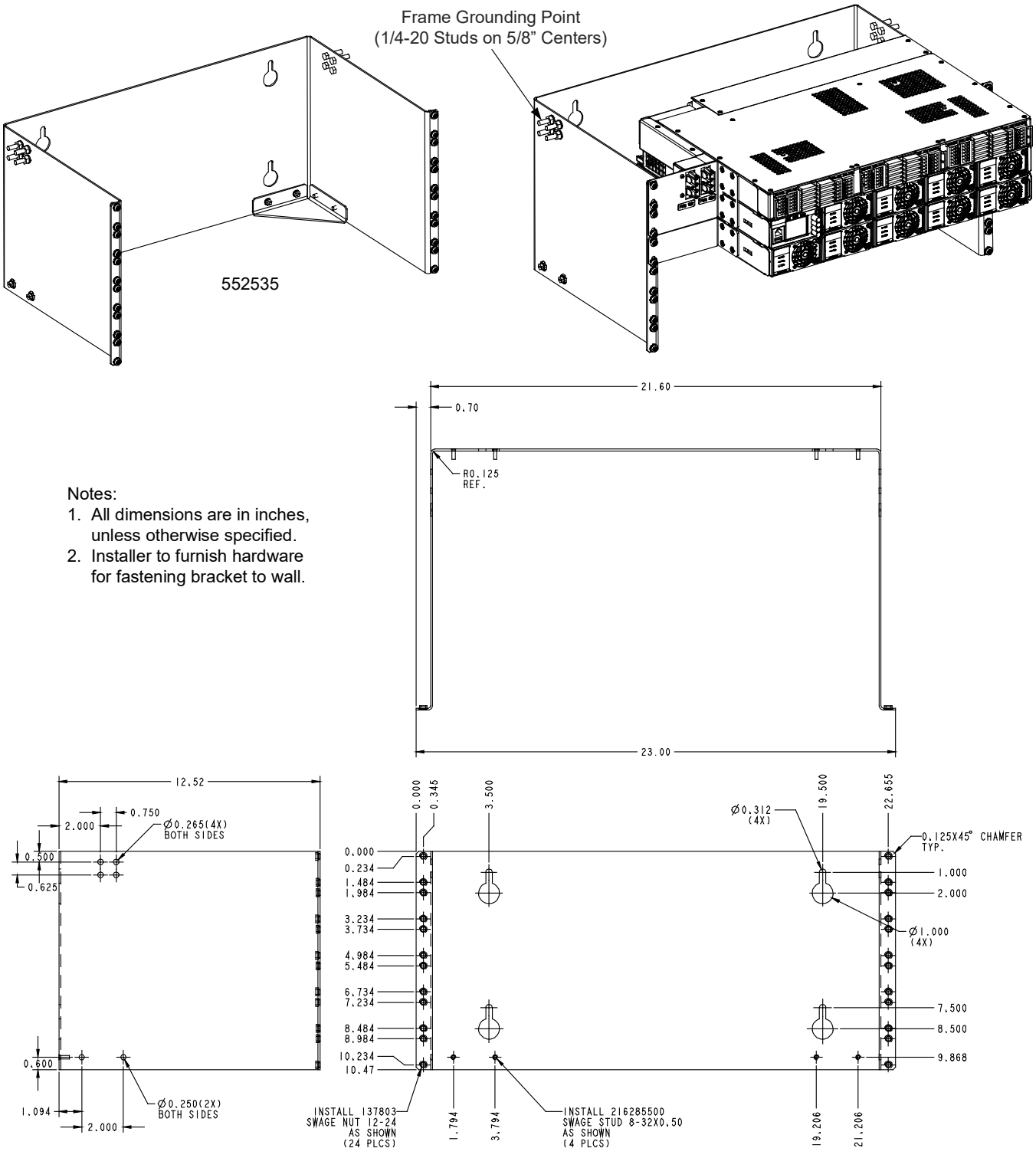
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Figure 3.5 Horizontal Wall Mounting with P/N 552537



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Figure 3.6 Horizontal Wall Mounting with P/N 552535



Notes:
1. All dimensions are in inches, unless otherwise specified.
2. Installer to furnish hardware for fastening bracket to wall.

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3.7 Installing a List 93, 94 Battery Tray

Perform the following procedures to install a battery tray.



DANGER! The relay rack must be securely anchored to the floor before a battery tray is installed.

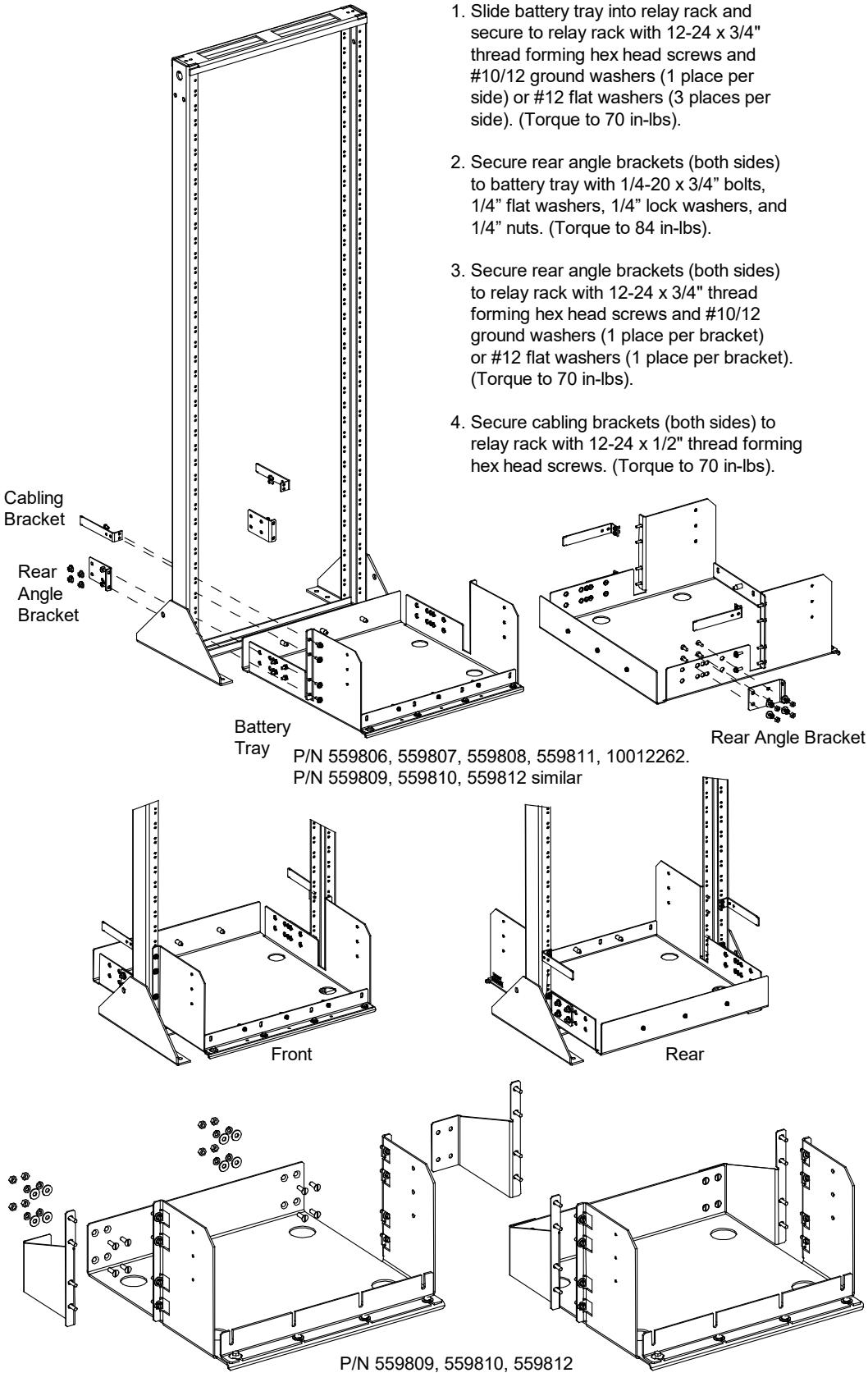
Battery Tray Installation

Procedure

1. To install a battery tray, perform the procedure detailed in Figure 3.7. See also Figure 3.8, Figure 3.9, Figure 3.10, Figure 3.11, Figure 3.12, Figure 3.13, and Figure 3.14.

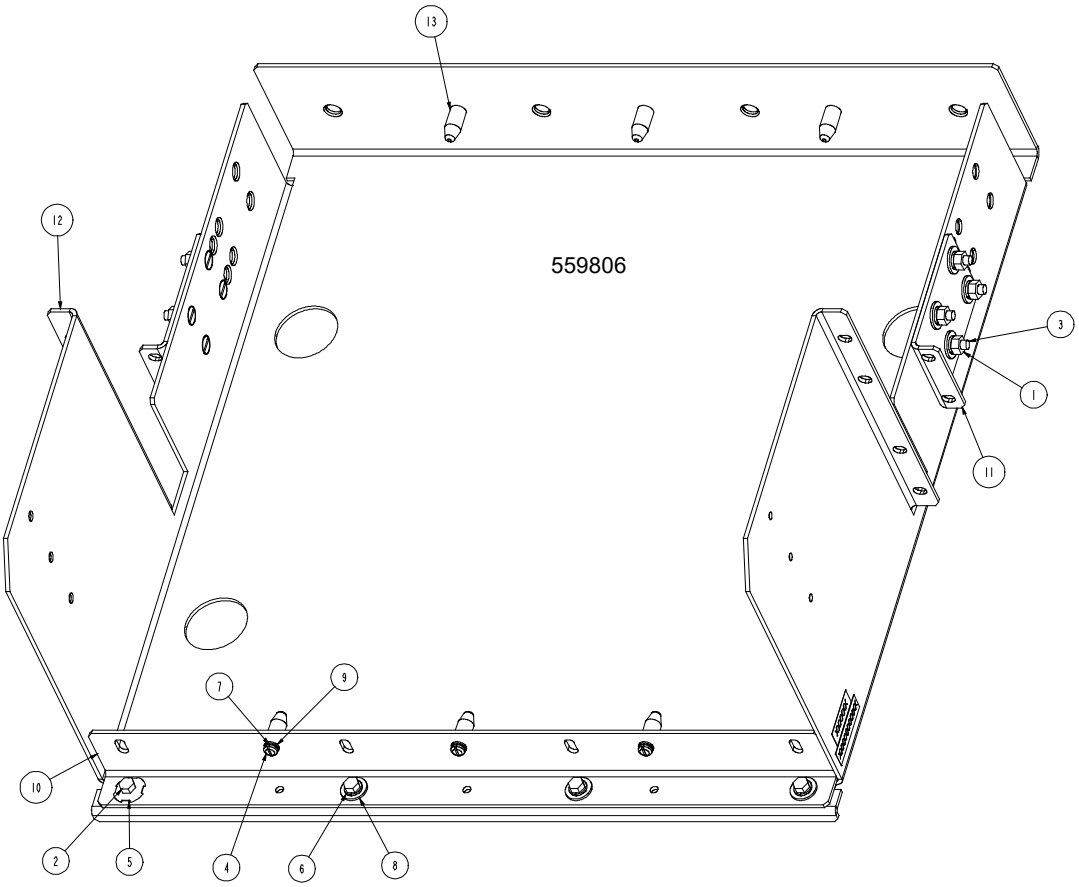
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Figure 3.7 Installing a List 93, 94 Battery Tray



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Figure 3.8 559806 Battery Tray

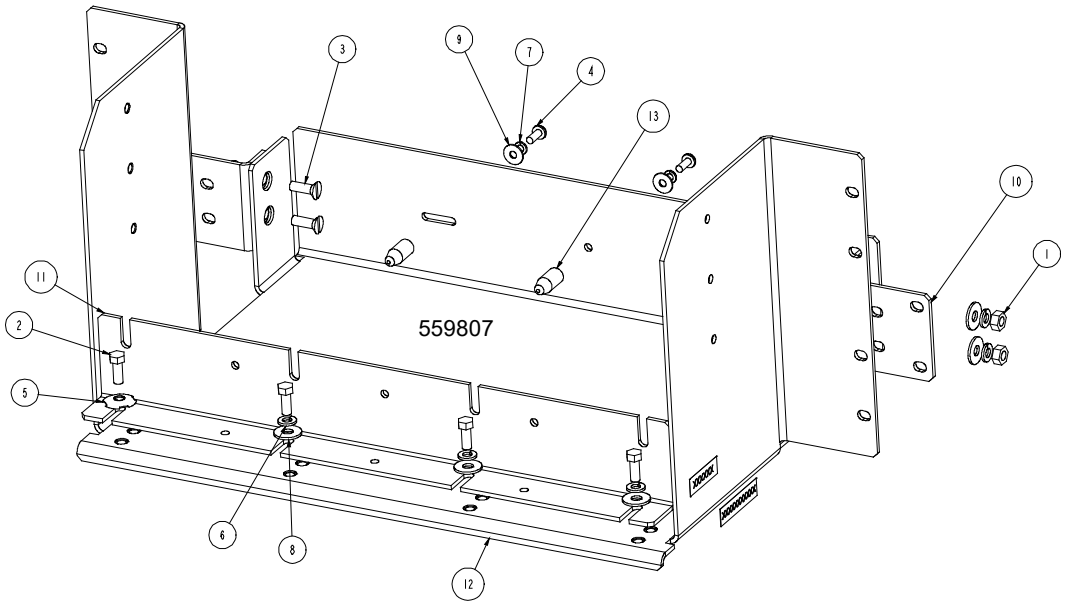


INDEX	PART NO.	DESCRIPTION	QTY
13	525095	SPACER, BATTERY	6
12	SXK2300175/1	TRAY, BATTERY	1
11	SXA2300174/1	BRACKET, BATTERY TRAY, MOUNTING	2
10	SXA2300173/1	BRACKET, BATTERY	1
9	214108100	FW, NO.10, .406 OD, .040 THK	6
8	214110200	FW, 1/4, .734 OD, .063 THK	11
7	215110900	LW, NO.10, .344 OD, .047 THK	6
6	215111100	LW, 1/4, .489 OD, .062 THK	11
5	215640800	GND.W, 1/4	1
4	221631400	PH, 10-32 X 1/2, SLOTTED	6
3	224430600	FH, 1/4-20 X 3/4	8
2	227640300	HHCS, 1/4-20 X 5/8	4
1	228557100	NUT, - HEX -, 1/4-20	8

PARTS/MATERIAL LIST

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Figure 3.9 559807 Battery Tray

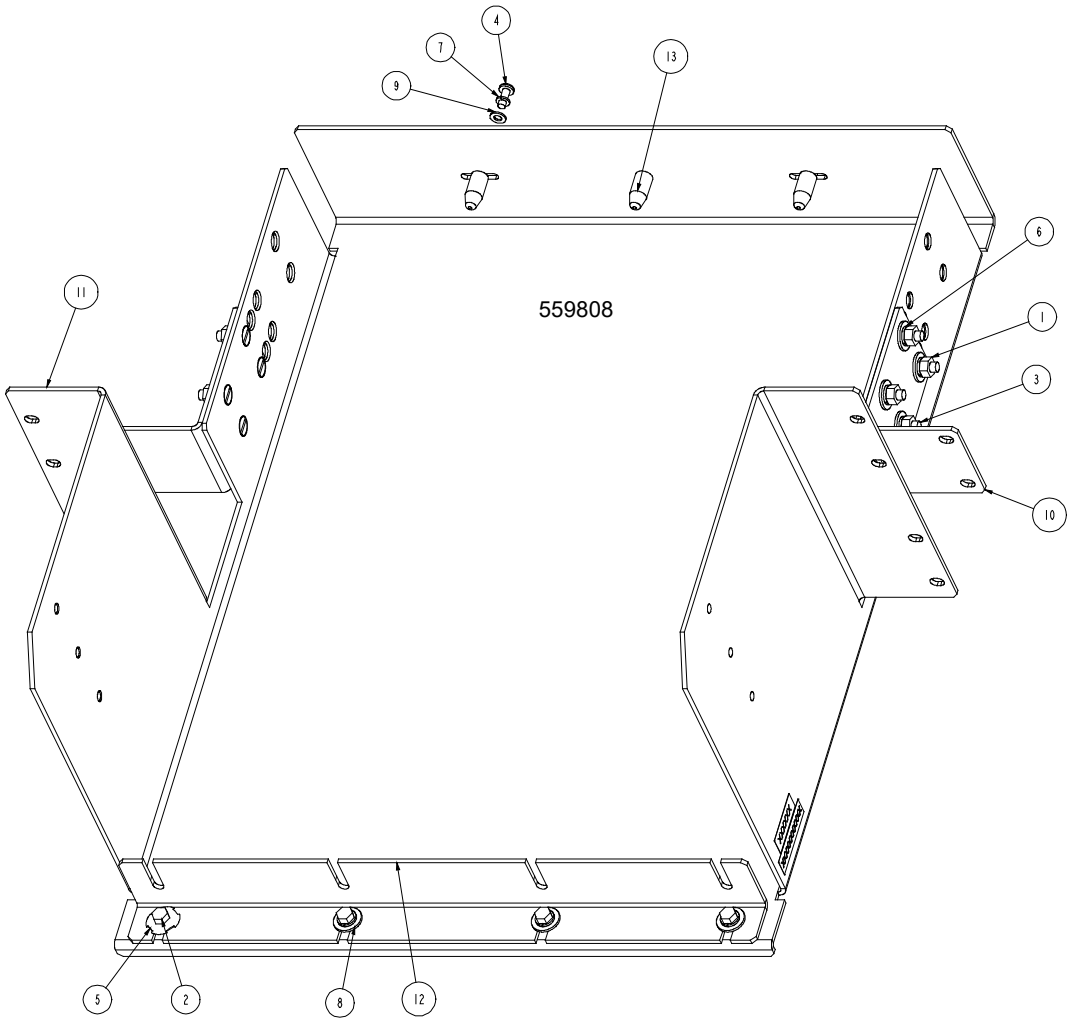


INDEX	PART NO.	DESCRIPTION	QTY
13	525095	SPACER, BATTERY	3
12	SXK2300172/1	TRAY, BATTERY, 23 IN, MTG	1
11	SXA2300171/1	BRKT, BAT. HLDR, 19 IN	1
10	SXA2300170/1	BRKT, BAT TRAY, MTG	2
9	214108200	FW, NO.10, .562 OD, .040 THK	3
8	214110200	FW, 1/4, .734 OD, .063 THK	7
7	215110900	LW, NO.10, .344 OD, .047 THK	3
6	215111100	LW, 1/4, .489 OD, .062 THK	7
5	215640800	GND.W, 1/4	1
4	221631400	PH, 10-32 X 1/2, SLOTTED	3
3	224430600	FH, 1/4-20 X 3/4	4
2	227640300	HHCS, 1/4-20 X 5/8	4
1	228557100	NUT, - HEX -, 1/4-20	4

PARTS/MATERIAL LIST

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Figure 3.10 559808 Battery Tray

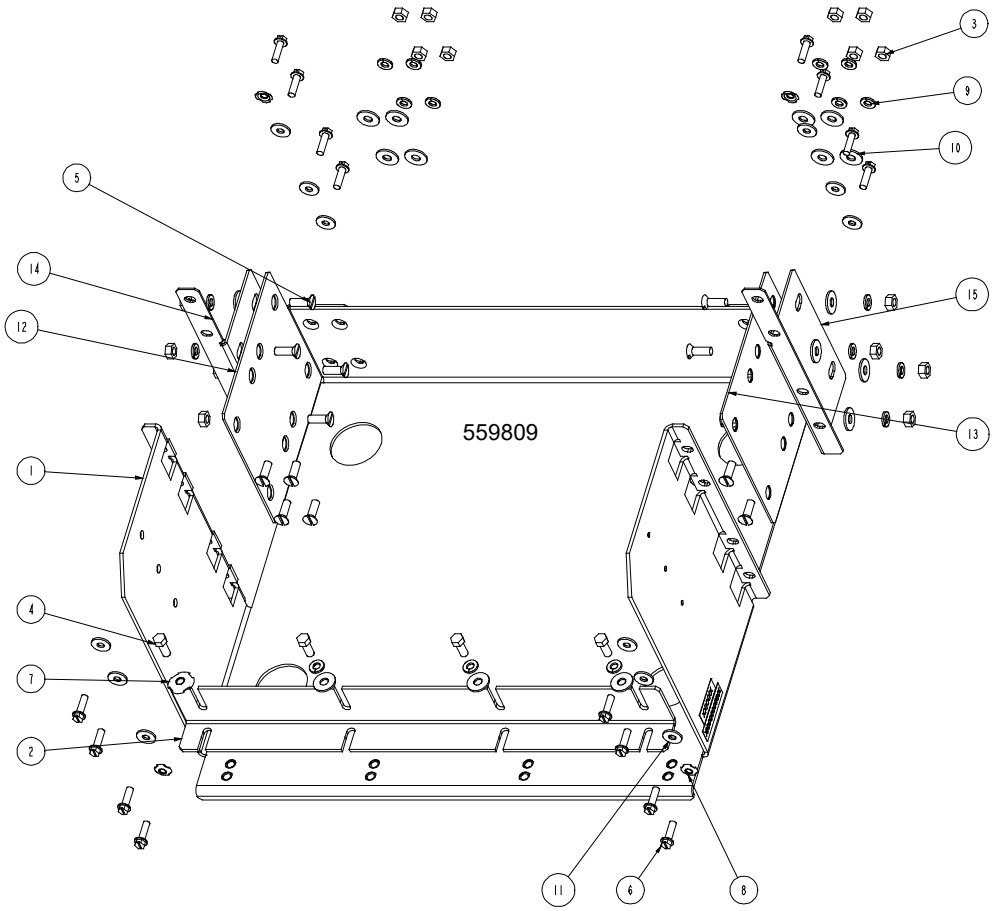


INDEX	PART NO.	DESCRIPTION	QTY
13	525095	SPACER, BATTERY	3
12	SXA2300177/1	BRACKET, BATTERY	1
11	SXK2300178/1	TRAY, BATTERY	1
10	SXA2300176/1	BRKT, BATTERY TRAY, MOUNTING	2
9	214108100	FW, NO.10, .406 OD, .040 THK	3
8	214110200	FW, 1/4, .734 OD, .063 THK	11
7	215110900	LW, NO.10, .344 OD, .047 THK	3
6	215111100	LW, 1/4, .489 OD, .062 THK	11
5	215640800	GND.W, 1/4	1
4	221631400	PH, 10-32 X 1/2, SLOTTED	3
3	224430600	FH, 1/4-20 X 3/4	8
2	227640300	HHCS, 1/4-20 X 5/8	4
1	228557100	NUT, - HEX -, 1/4-20	8

PARTS/MATERIAL LIST

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Figure 3.11 559809 Battery Tray

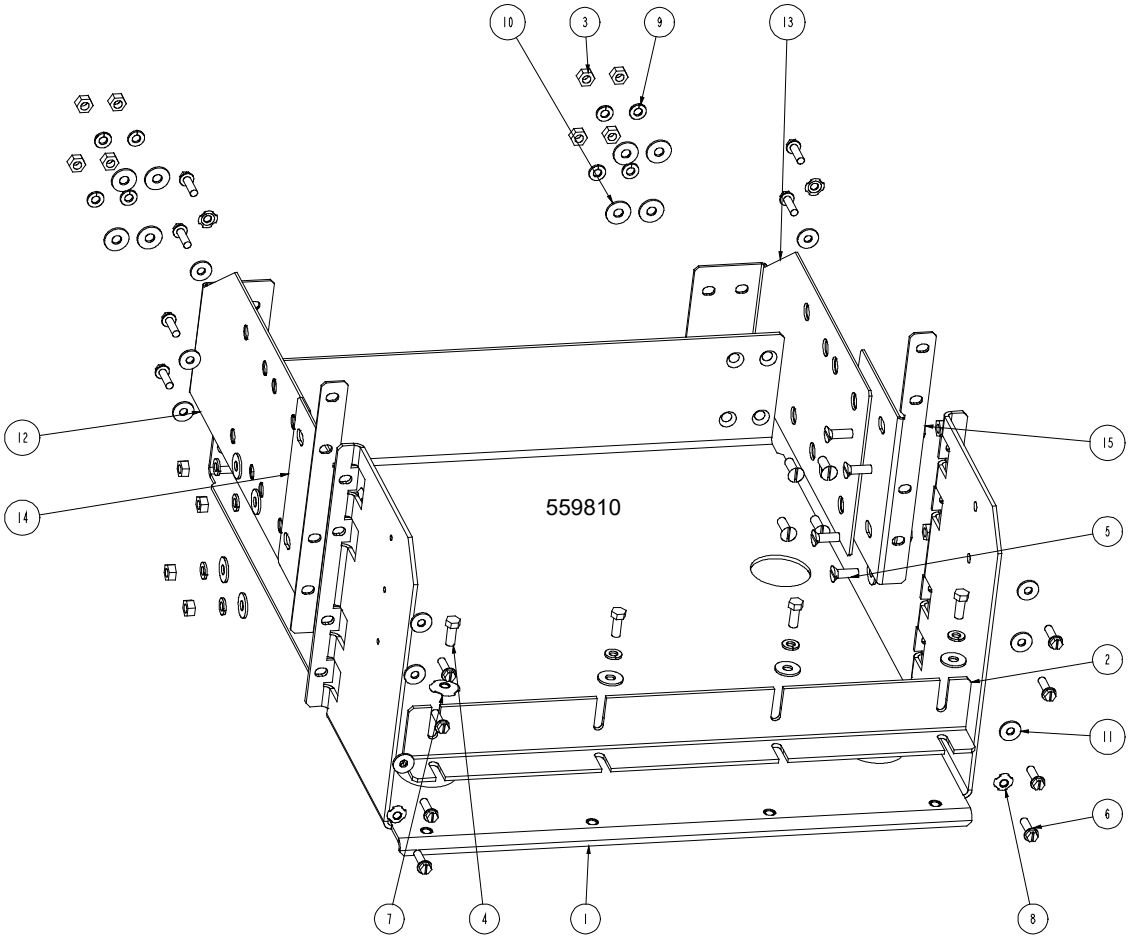


INDEX	PART NO.	DESCRIPTION	QTY
15	565089	BRKT, BATT TRAY, RIGHT MTG	1
14	565090	BRKT, BATT TRAY, LEFT MTG	1
13	565091	BRKT, BATT TRAY, RIGHT	1
12	565092	BRKT, BATT TRAY, RIGHT	1
11	214109200	FW, NO.12, .625 OD, .063 THK	12
10	214110200	FW, 1/4, .734 OD, .063 THK	19
9	215111100	LW, 1/4, .489 OD, .062 THK	19
8	215640600	GND.W, 10/12	4
7	215640800	GND.W, 1/4	1
6	218710600	TFHH, 12-24 X 3/4	16
5	224430600	FH, 1/4-20 X 3/4	16
4	227640300	HHCS, 1/4-20 X 5/8	4
3	228557100	NUT, - HEX -, 1/4-20	16
2	SXA2300177/1	BRACKET, BATTERY	1
1	SXK2300200/1	TRAY, BATTERY, 19" MTG	1

PARTS/MATERIAL LIST

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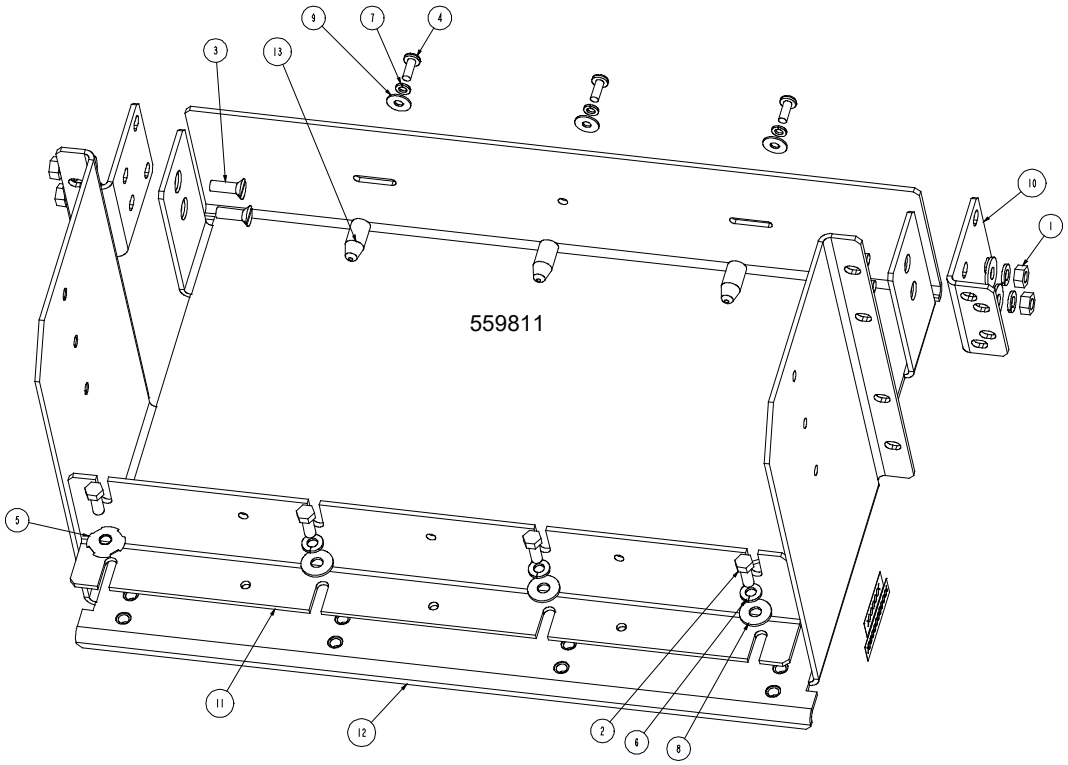
Figure 3.12 559810 Battery Tray



15	564857	BRKT, BATT TRAY, RIGHT MTG	1
14	564858	BRKT, BATT TRAY, LEFT MTG	1
13	564859	BRKT, BATT TRAY, RIGHT	1
12	564860	BRKT, BATT TRAY, LEFT	1
11	214109200	FW, NO.12, .625 OD, .063 THK	12
10	214110200	FW, 1/4, .734 OD, .063 THK	19
9	215111100	LW, 1/4, .489 OD, .062 THK	19
8	215640600	GND.W, 10/12	4
7	215640800	GND.W, 1/4	1
6	218710600	TFHH, 12-24 X 3/4	16
5	224430600	FH, 1/4-20 X 3/4	16
4	227640300	HHCS, 1/4-20 X 5/8	4
3	228557100	NUT, - HEX -, 1/4-20	16
2	SXA2300177/1	BRACKET, BATTERY	1
1	SXK2300193/1	TRAY, BATTERY, 19" MTG	1
INDEX	PART NO.	DESCRIPTION	QTY
PARTS/MATERIAL LIST			

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Figure 3.13 559811 Battery Tray

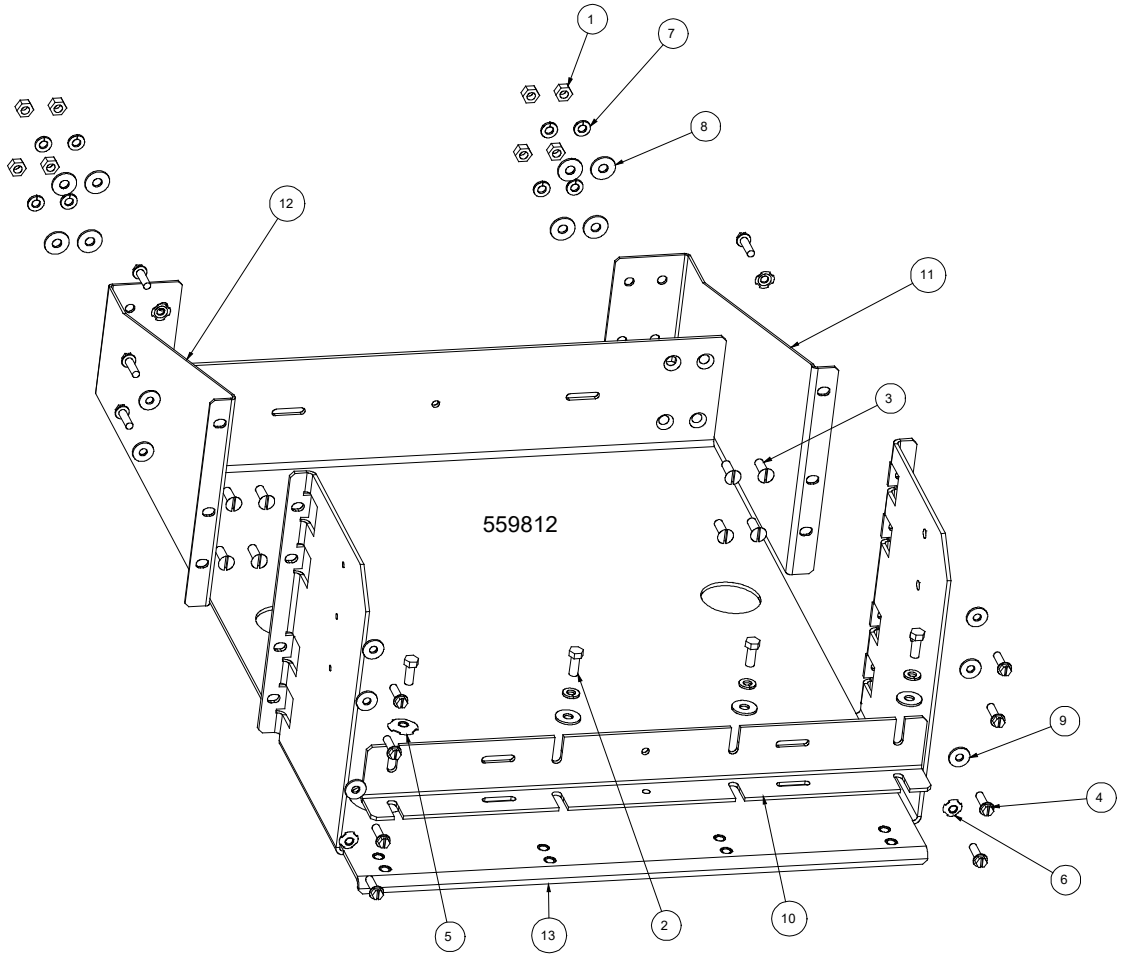


INDEX	PART NO.	DESCRIPTION	QTY
13	525095	SPACER, BATTERY	3
12	SXK2300197/1	TRAY, BATTERY, 19 IN, MTG	1
11	SXA2300171/1	BRKT, BAT. HLDR, 19 IN	1
10	SXA2300196/1	BRKT, BAT TRAY, MTG	2
9	214108200	FW, NO.10, .562 OD, .040 THK	3
8	214110200	FW, 1/4, .734 OD, .063 THK	7
7	215110900	LW, NO.10, .344 OD, .047 THK	3
6	215111100	LW, 1/4, .489 OD, .062 THK	7
5	215640800	GND.W, 1/4	1
4	221631400	PH, 10-32 X 1/2, SLOTTED	3
3	224430600	FH, 1/4-20 X 3/4	4
2	227640300	HHCS, 1/4-20 X 5/8	4
1	228557100	NUT, - HEX -, 1/4-20	4

PARTS/MATERIAL LIST

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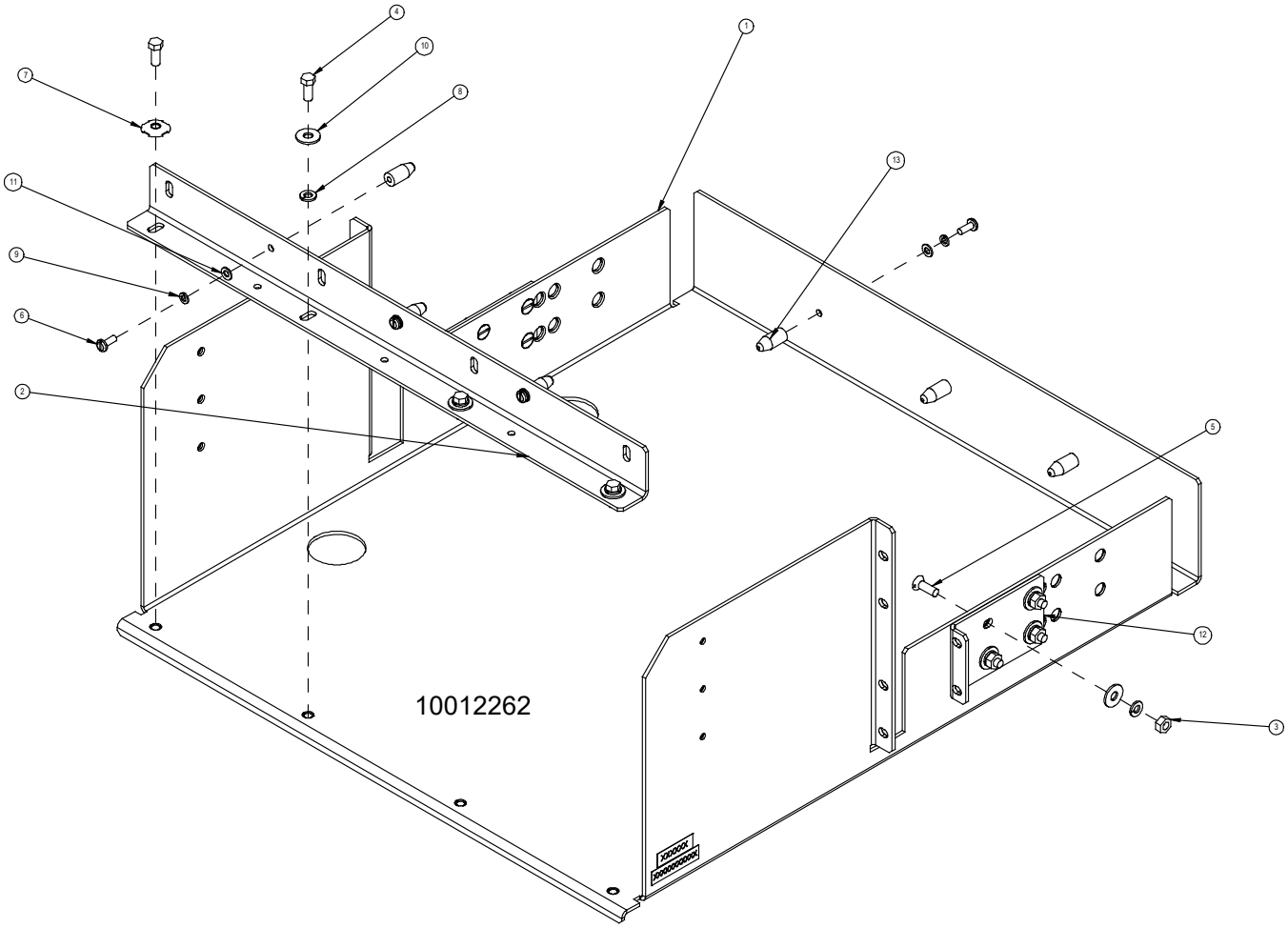
Figure 3.14 559812 Battery Tray



INDEX	PART NO.	DESCRIPTION	QTY
PARTS/MATERIAL LIST			
13	SXK2300204/1	TRAY, BATTERY, 19" MTG	1
12	SXA2300203/1	BRKT, BATT TRAY, LEFT, MTG	1
11	SXA2300202/1	BRKT, BATT TRAY, RIGHT, MTG	1
10	SXA2300205/1	BRACKET, BATTERY	1
9	214109200	FW, NO.12, .625 OD, .063 THK	10
8	214110200	FW, 1/4, .734 OD, .063 THK	11
7	215111100	LW, 1/4, .489 OD, .062 THK	11
6	215640600	GND.W, 10/12	4
5	215640800	GND.W, 1/4	1
4	218710600	TFHH, 12-24 X 3/4	14
3	224430600	FH, 1/4-20 X 3/4	8
2	227640300	HHCS, 1/4-20 X 5/8	4
1	228557100	NUT, - HEX -, 1/4-20	8

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Figure 3.15 10012262 Battery Tray



13	525095	SPACER, BATTERY,	6
12	SXA2300174_I	BRACKET, BATTERY TRAY, MOUNTING	2
11	214108100	FW, NO.10, .406 OD, .040 THK,	6
10	214110200	FW, 1/4, .734 OD, .063 THK,	11
9	215110900	LW, NO.10, .344 OD, .047 THK,	6
8	215111100	LW, 1/4, .489 OD, .062 THK,	11
7	215640800	GND.W, 1/4,	1
6	221631400	PH, 10-32 X 1/2, SLOTTED	6
5	224430600	FH, 1/4-20 X 3/4,	8
4	227640300	HHCS, 1/4-20 X 5/8,	4
3	228557100	NUT, - HEX -, 1/4-20	8
2	SXA2300173_I	BRACKET, BATTERY,	1
1	10012261	TRAY, BATTERY, 23"	1
INDEX	PART NO.	DESCRIPTION	QTY

PARTS/MATERIAL LIST

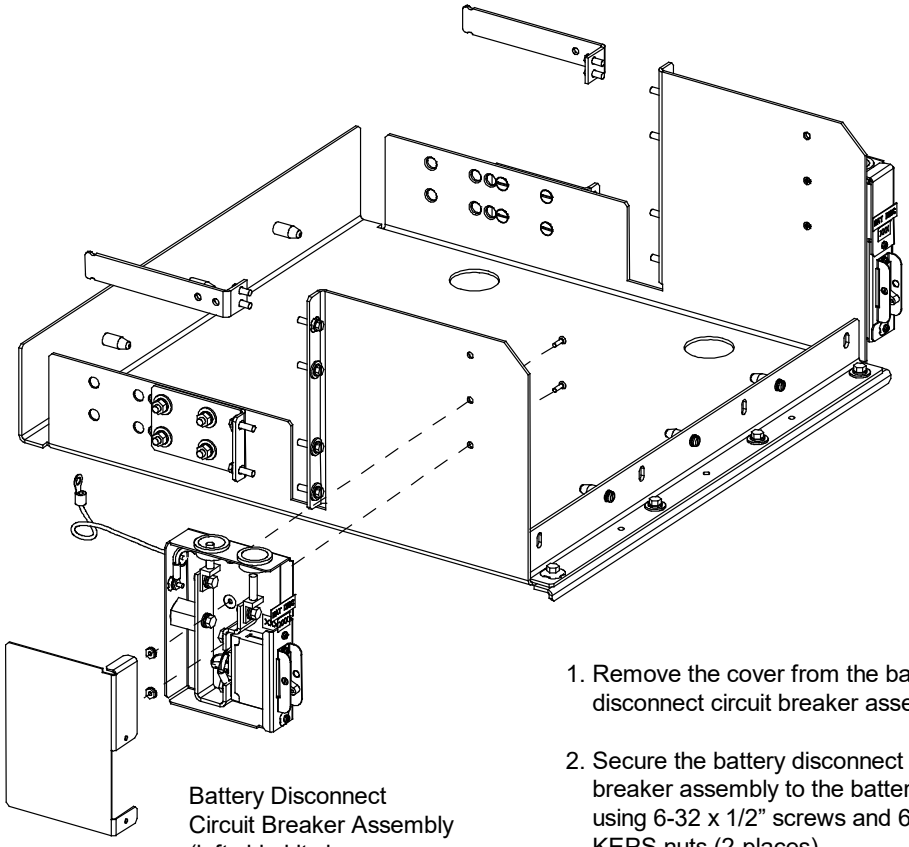
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Installing Optional Battery Disconnect Circuit Breaker onto a List 93, 94 Battery Tray

Procedure

1. To install an optional battery disconnect circuit breaker onto the battery tray, perform the procedure detailed in Figure 3.16.
2. Battery tray wiring is shown in “Installing and Connecting Batteries in an Optional List 93 or 94 Battery Tray (if furnished)” on page 68.

Figure 3.16 Installing Optional Battery Disconnect Circuit Breaker onto a List 93, 94 Battery Tray



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3.8 Installing Circuit Breakers and Fuses

Circuit breakers and/or fuses may have been factory installed for you. If so, verify their positions and sizes.

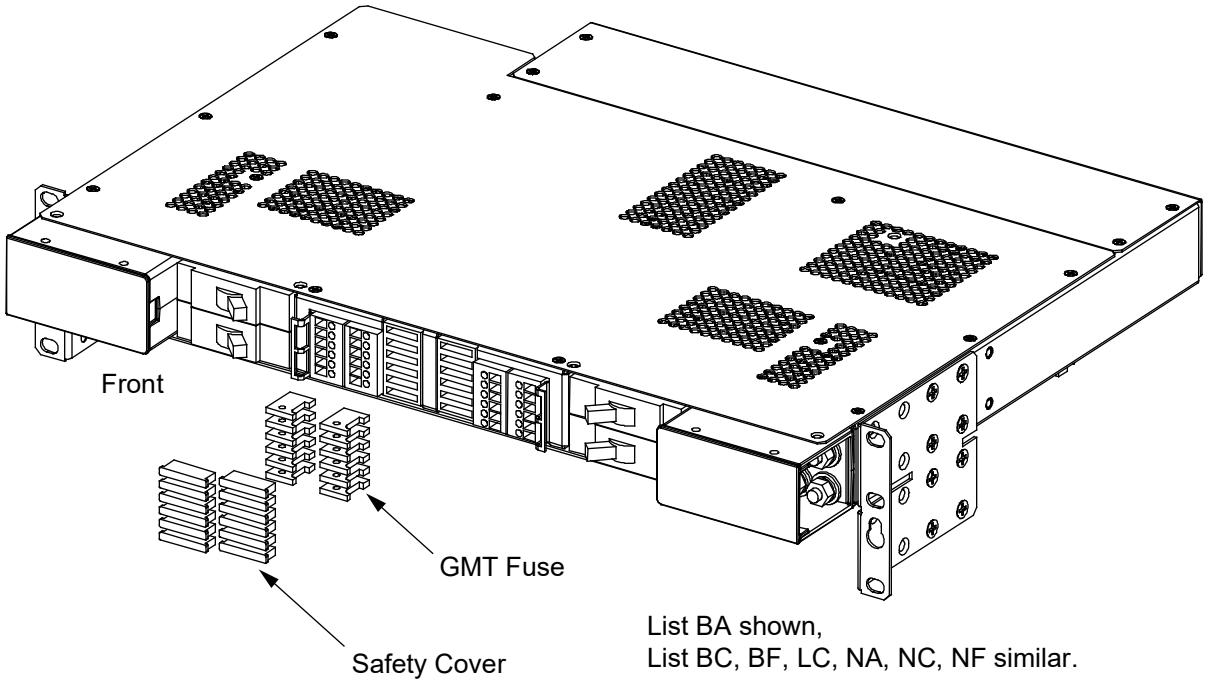
Refer to SAG582137200 for any temperature, sizing, and spacing restrictions.

GMT Load Distribution Fuses (List BA, BC, BF, LC, NA, NC, NF)

Procedure

1. Install correctly sized GMT fuses into the fuseholders located on the front of the distribution unit, as required. If a dummy fuse is installed, first remove the dummy fuse. Install a safety fuse cover over each GMT fuse. Install a dummy fuse in all unused fuse positions. See to Figure 3.17.

Figure 3.17 Installing GMT Load Distribution Fuses



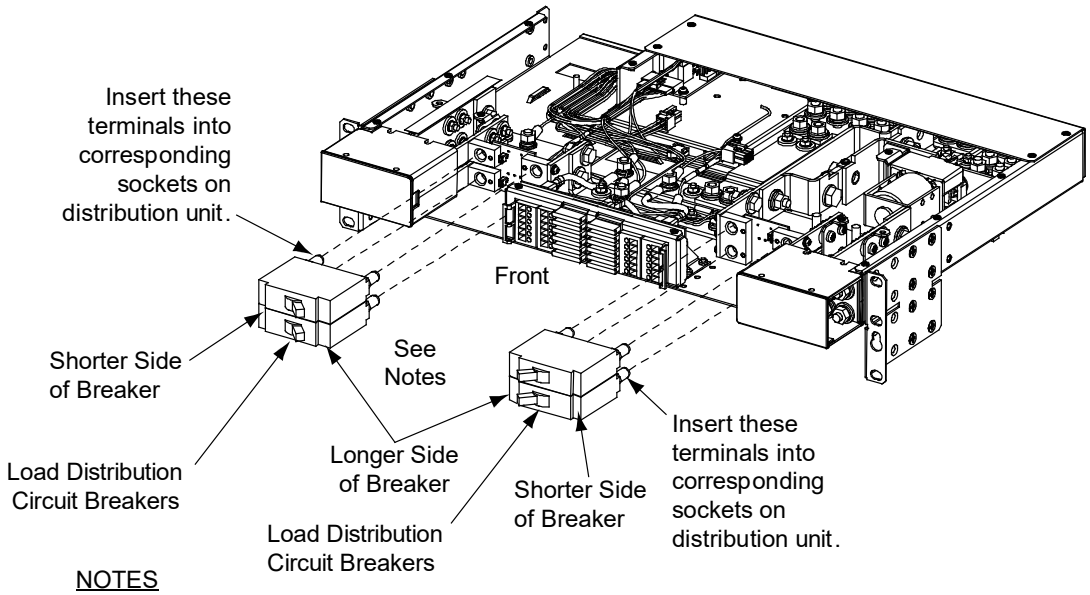
Installing Bullet Nose Type Circuit Breakers (List BA, BC, BF, LC, NA, NC, NF)

Procedure

1. Ensure that the circuit breaker is in the OFF position and is of the correct rating. Orient the circuit breaker as shown in Figure 3.18 or Figure 3.19. Insert the terminals on the rear of the circuit breaker into their corresponding sockets on the distribution unit. Ensure the alarm contact on the back of the circuit breaker makes contact with the alarm terminal on the distribution unit. Push distribution device in firmly until fully seated in the distribution unit.

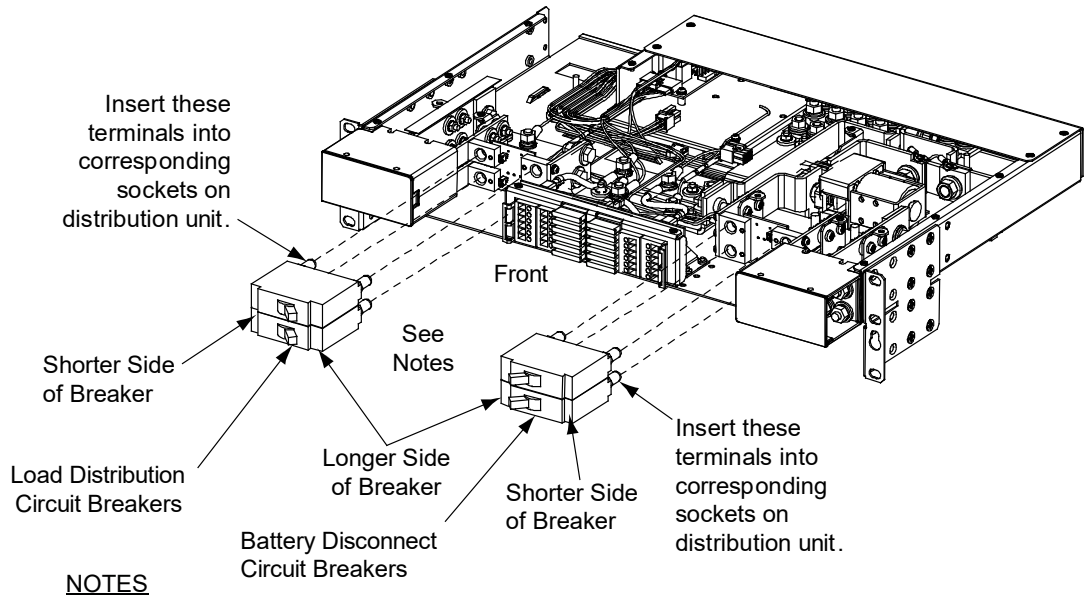
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Figure 3.18 Installing Bullet-Nose-Type Load Distribution Circuit Breakers (List BC, LC, NC)



NOTES
1. Turn circuit breaker off before installing.
2. When installing breakers, orient breaker so that when in off position the handle is towards the center (as shown in the illustration).
3. List BC shown, List LC, NC similar.
4. Components removed in illustration for clarity only.

Figure 3.19 Installing Bullet-Nose-Type Battery Disconnect and Load Distribution Circuit Breakers (List BA, NA)



NOTES
1. Turn circuit breaker off before installing.
2. When installing breakers, orient breaker so that when in off position the handle is towards the center (as shown in the illustration).
3. List BA shown, List NA similar.
4. Components removed in illustration for clarity only.

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3.9 Installing an Optional Battery Cabinet

Vertiv NetSure 211BC Battery Cabinet, P/N 541434

Refer to the battery cabinet instructions (Section 6023).

Vertiv NetSure 211BC Battery Cabinet, P/N 545534

Refer to the battery cabinet instructions (Section 6033).

Vertiv NetSure 211BC Battery Cabinet, P/N 554631

Refer to the battery cabinet instructions (UM554631).

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3.10 Installing an Optional External IB5 Kit P/N 60203173

NOTE! *IB5 boards with a 10M/100M/1G Ethernet port replaced IB4 boards with a 10M/100M Ethernet port. This transition enables the support of connected devices that communicate up to 1G. While both boards are physically interchangeable, the IB5 board does require the NCU to have V1.2.80 or higher software loaded.*

Procedure

NOTE! *Refer to Figure 3.20 as this procedure is performed.*

1. Mount the external IB5 module within 6.5 feet of the system interface connector.
2. Plug cable P/N RPM2300028/1 (furnished with the external IB5 module) between the module and the system interface connector as shown in Figure 3.20.

NOTE! *Kit P/N 60203173 contains two (2) cables. Only cable P/N RPM2300028/1 is used with the 582137200 power system.*

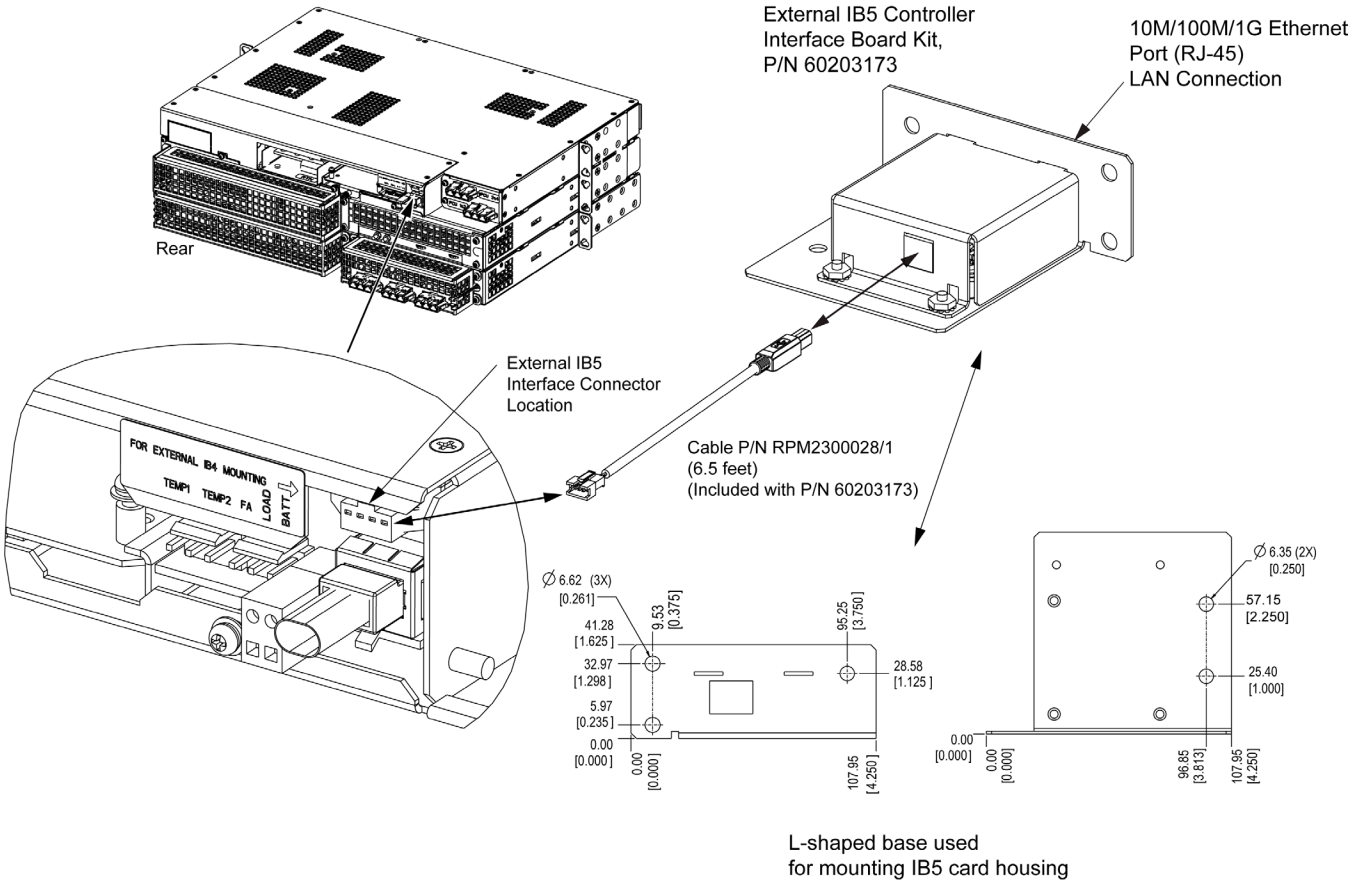
3. If the system is in operation, reboot the NCU.

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

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

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Figure 3.20 Installing an Optional External IB5 Kit P/N 60203173



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3.11 Attaching the USB Drive Pouch to the System

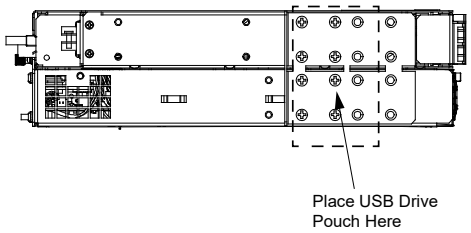
The system is provided with a USB drive that contains the controller configuration files loaded into the controller as shipped. Also provided on the USB drive is a controller configuration drawing and all customer documentation. The USB drive is to be stored in the pouch provided. The pouch needs to be attached to the system or near the system by the customer.

Systems with a 5" Front Projection Mounting

Procedure

1. Attach the pouch to the system in the location shown in Figure 3.21.
2. Make sure the surface is clean, then peel the backing of the pouch fastener and adhere it to the surface.
3. Attach the pouch to the pouch fastener to secure the pouch to the system.

Figure 3.21 Attaching the USB Drive Pouch to a System with a 5" Front Projection Mounting

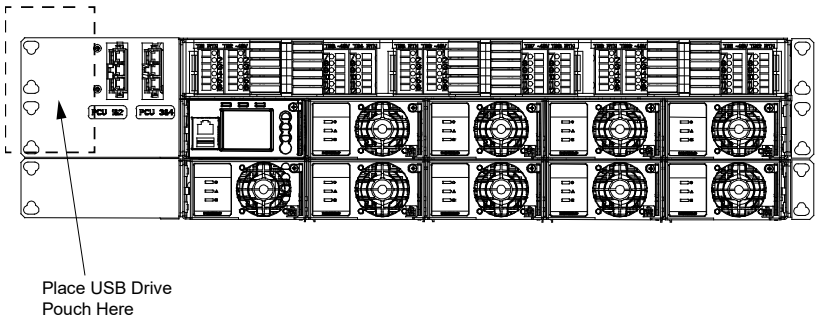


Systems with 23" Mounting

Procedure

1. Attach the pouch to the system in the location shown in Figure 3.22.
2. Make sure the surface is clean, then peel the backing of the pouch fastener and adhere it to the surface.
3. Attach the pouch to the pouch fastener to secure the pouch to the system.

Figure 3.22 Attaching the USB Drive Pouch to a System with 23" Mounting



Systems with Flush Front Mounting

Procedure

1. Customer must choose a location near the system to attach the USB drive pouch to.
2. Make sure the surface is clean, then peel the backing of the pouch fastener and adhere it to the surface.
3. Attach the pouch to the pouch fastener to secure the pouch to the system.

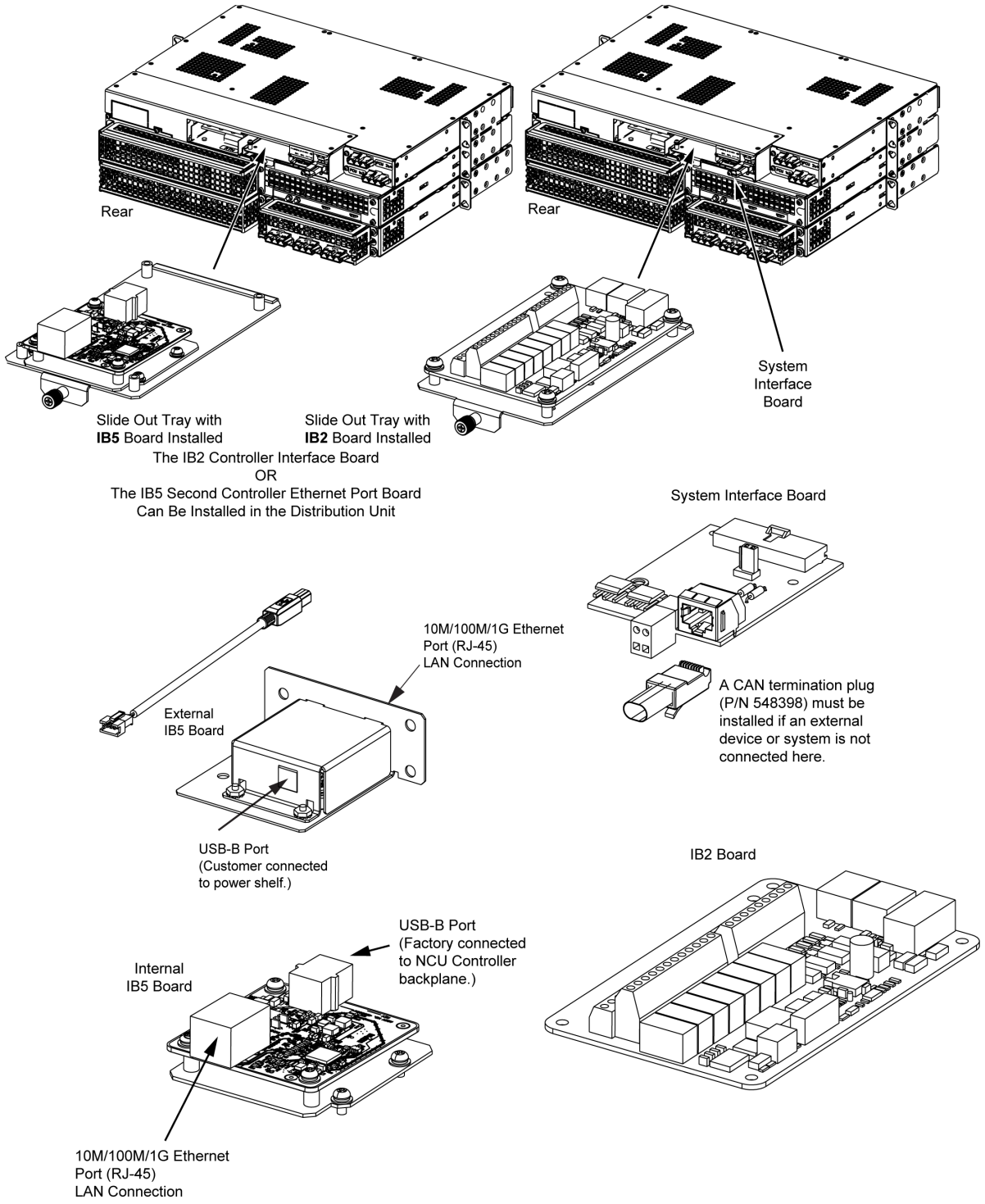
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4 Setting Jumper and Switch Options

4.1 Circuit Card Locations

Refer to Figure 4.1.

Figure 4.1 Circuit Card Location



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4.2 Jumper Settings on the System Interface Circuit Card

Perform the following procedure to make the required setting per your site requirements.
This procedure can also be used to make adjustment on a replacement circuit card.

Controller Power Option

This option allows the controller to remain powered if a battery LVD is furnished and it opens. The controller is powered from the internal "system" bus. Rectifiers and battery are connected to this "system" bus, so the controller is powered both by the rectifiers and by the battery. A jumper option allows the controller to be powered from the "system side" of a battery LVD contactor (if furnished) or the "battery side" of a battery LVD contactor (if furnished). Refer to Figure 4.2 for circuit card location and jumper location.

- Jumper in "No Battery Power" Position: The controller is powered from the "system side" of a battery LVD contactor (if furnished). Note if a battery LVD contactor is not furnished, the controller is powered by both rectifiers and battery. If a battery LVD contactor is furnished and opens, the controller is powered by the rectifiers (if functional).

  If you lose AC power and your BLVD opens, the controller will shut down.

- Jumper in "Battery Power" Position: The controller is powered from the "battery side" of a battery LVD contactor (if furnished). Note if a battery LVD contactor is not furnished, the controller is powered by both rectifiers and battery. If a battery LVD contactor is furnished and opens, the controller is powered by the battery and the battery will drain. The controller's power consumption is 5W.

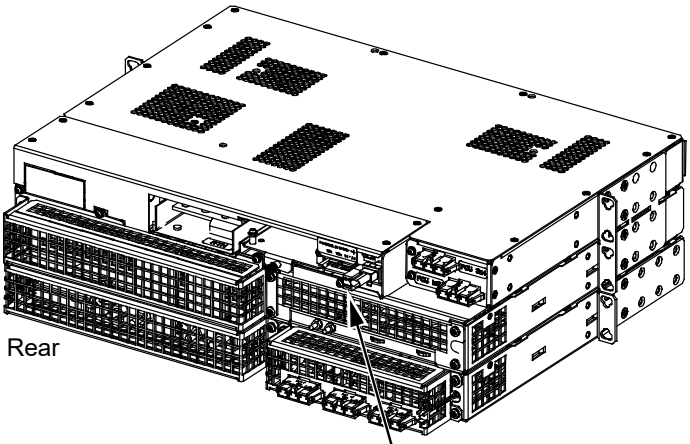
  If you lose AC power and your BLVD opens, the controller will continue to operate.

Procedure

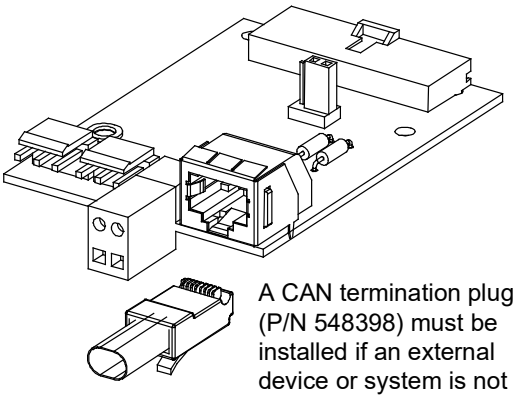
1. Refer to Figure 4.2 and place the jumper on J4 in the "Battery Power" or "No Battery Power" position.

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Figure 4.2 System Interface Board Jumper Location and Settings

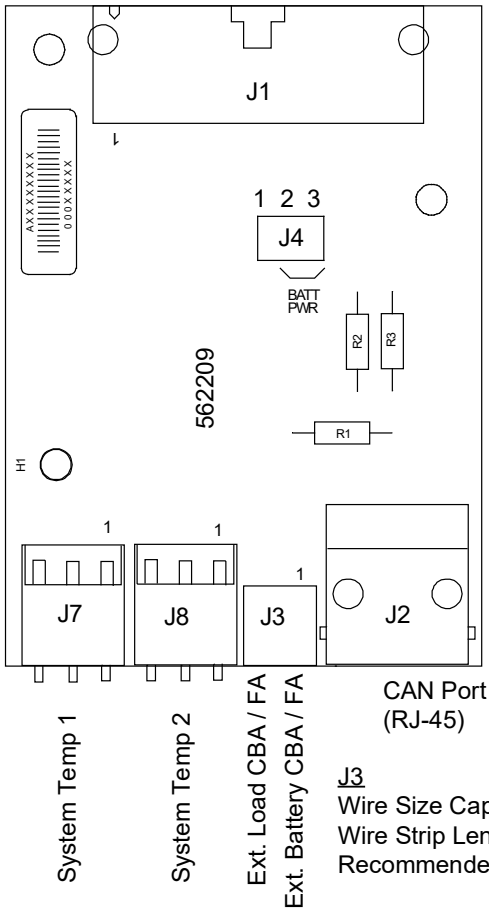


System Interface Board

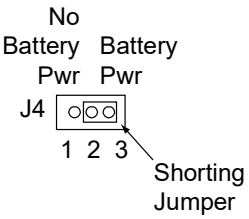


A CAN termination plug (P/N 548398) must be installed if an external device or system is not connected here.

System Interface Board P/N 562209



J4
Selects to power controller from "Battery Power" or not if a battery LVD contactor is furnished.



J3
Wire Size Capacity: 16 AWG to 30 AWG.
Wire Strip Length: 0.32 inch.
Recommended Torque: 2.3 in-lbs.

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4.3 Switch Settings on the IB2 (Controller Interface Board) (if furnished)

Perform the following procedure to verify the factory setting.

This procedure can also be used to make adjustment on a replacement circuit card.

Communications Addressing

Dip Switch SW1 on the IB2 board is used to set the communications address for this board. Refer to Table 4.1 for SW1 settings. Refer to Figure 4.3 for circuit card location and SW1 location.

Procedure

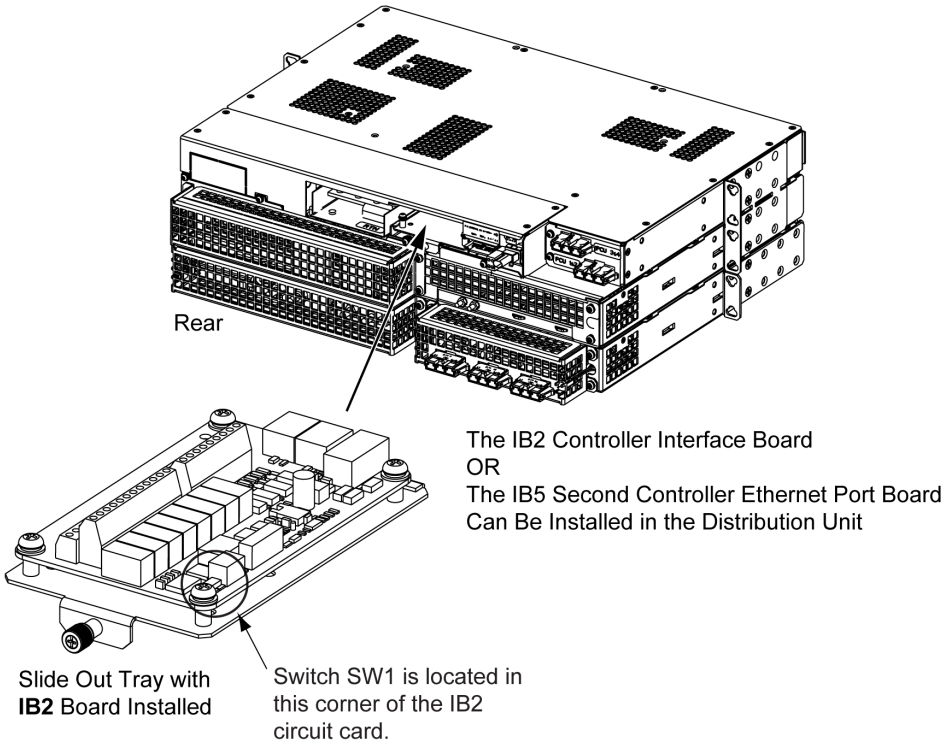
1. Ensure SW1 is set per Table 4.1. Refer to Figure 4.3 for location.

Table 4.1 IB2 Controller Interface Board Switch Settings

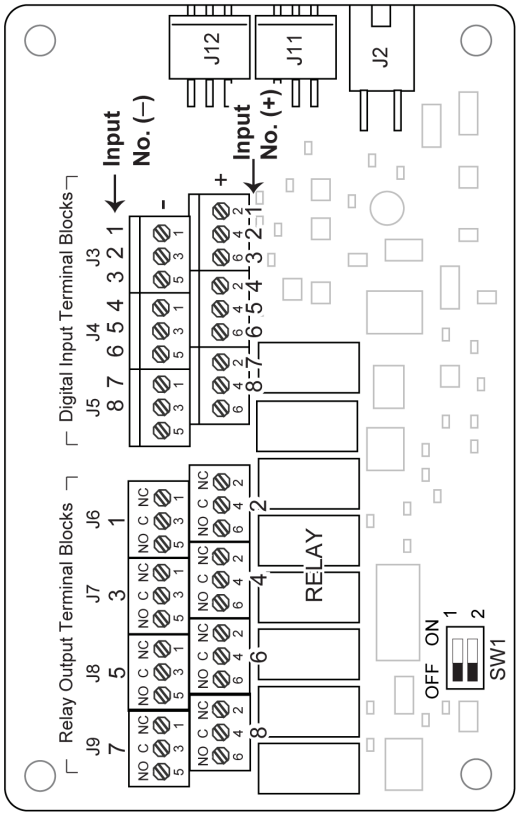
Setting	DIP Switch SW1	
	1	2
IB2	OFF	OFF

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Figure 4.3 IB2 Controller Interface Board Switch Location and Settings



IB2 (Controller Interface Board)





Setting	DIP Switch SW1	
	1	2
IB2	OFF	OFF

SW1
In this system, switch settings must be in positions shown.

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5 Making Electrical Connections

5.1 Important Safety Instructions

DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

5.2 Wiring Considerations

All wiring and branch circuit protection should follow the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.

For wire size, branch circuit protection, crimp lug, and general wiring recommendations; refer to System Application Guide SAG582137200.

Lugs should be crimped per lug manufacturer’s specifications.

Refer to Table 5.1 for supplemental lug crimping information when using the special application crimp lug / strap combination.

Table 5.1 Supplemental Lug Crimping Information when Using the Special Application Crimp Lug / Strap Combination

Crimp Lug Part No.		Crimp Tool Required[1], T&B Model TBM12 or TBM15 Hydraulic Heads		
		Color Key	Die Index/ Code No.	Die Cat. Number
245393500	Burndy: YA25L-4TCG1	Pink	42H	15508
245393600	Burndy: YA26L-4TCG1	Black	45	15526
245393700	Burndy: YA27L-4TCG1	Orange	50	15530
245393800	Burndy: YA28L-4TCG1	Purple	54H	15511

[1] The lugs should be crimped to the specifications given in the manufacturer’s instructions furnished with the crimp tool or lug.

5.3 Relay Rack / Cabinet Frame Grounding Connection

For relay rack / cabinet frame grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

Attach a customer grounding network lead to the equipment mounting rack per site requirements. Holes are provided on the top of each relay rack for installing a lead with a two-hole lug that has 1/4" bolt clearance holes on 5/8" centers. When using 1/4-inch hardware, recommended torque is 84 in-lbs. when a standard flat washer and lock washer are used. Refer to Figure 5.1 for locations.

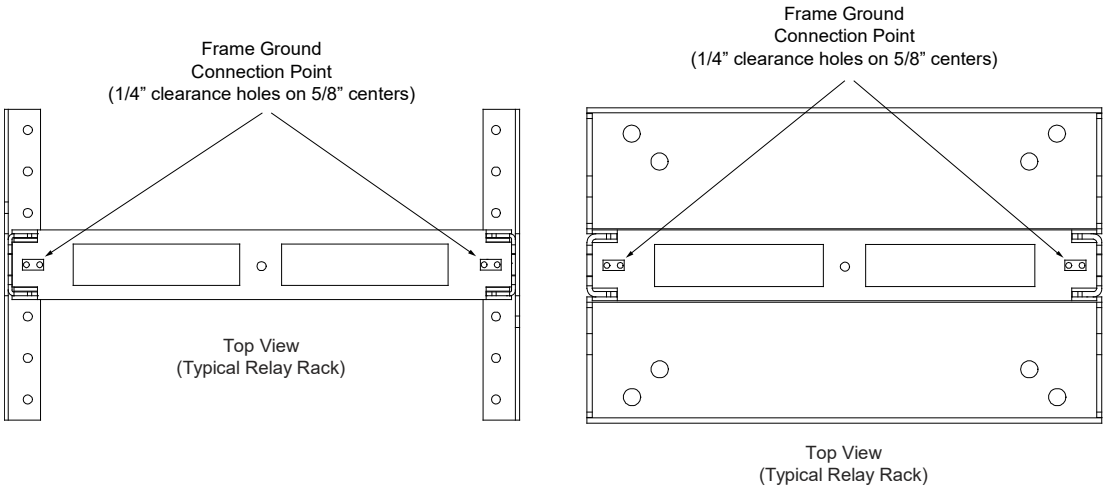
NOTE! *REMOVE TAPE FROM HOLE LOCATIONS BEFORE INSTALLING LUG*

NOTE! *The DC return connection to this system can remain isolated from system frame and chassis (DC-I).*

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NOTE! *This system is suitable for installation as part of the Common Bonding Network (CBN).*

Figure 5.1 Relay Rack Frame Grounding Connection Points



5.4 System Shelves Frame Grounding Connection

For shelf grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

NOTE! *The DC return connection to this system can remain isolated from system frame and chassis (DC-I).*

NOTE! *This system is suitable for installation as part of the Common Bonding Network (CBN).*

Relay or Cabinet Rack Procedure

1. The frame grounding connection to the shelf is made by using grounding washers with the mounting hardware used to secure the shelf to the relay rack or cabinet. Refer to "Securing the System to a Relay Rack or a Cabinet Equipment Rack (if required)" on page 6. Ensure that the relay rack or cabinet is properly grounded.

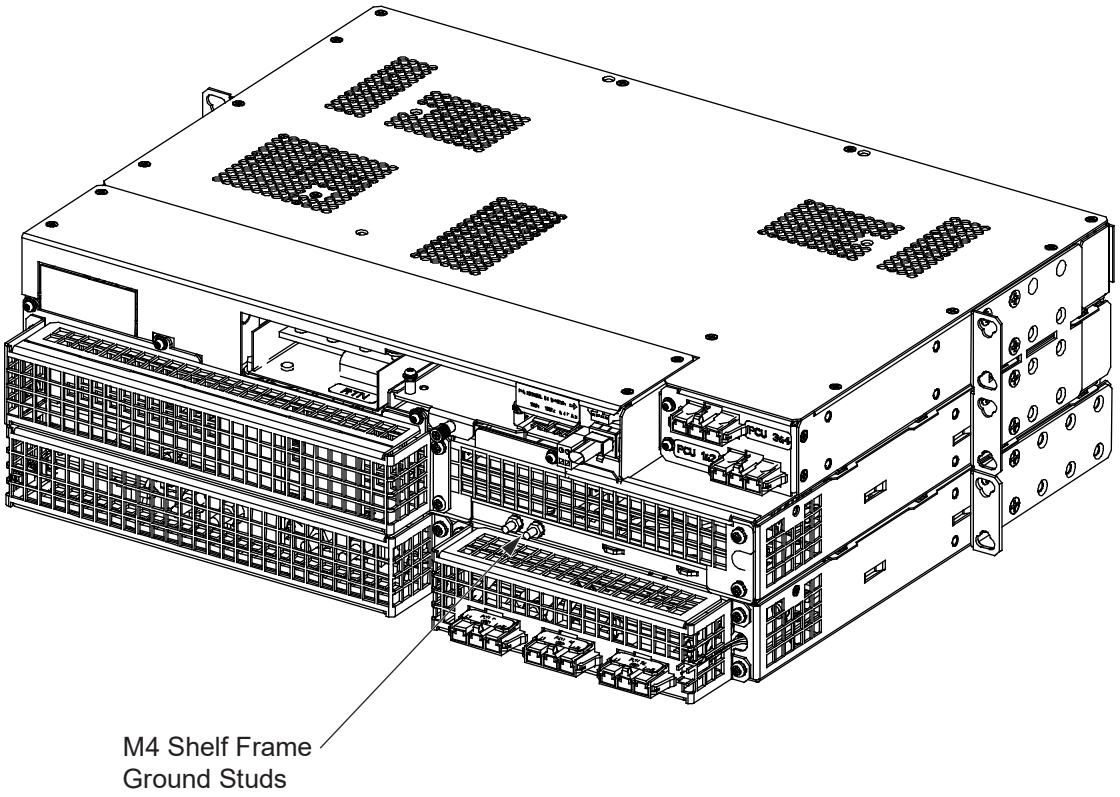
NOTE! *M4 frame ground studs are located on the rear of the system shelf. Provide a grounding lead, if required. Refer to Figure 5.2 for location.*

Wall Mounting Procedure

1. M4 frame ground studs are located on the rear of the system shelf. Refer to Figure 5.2 for location.
2. Frame ground studs (1/4-20) are located on the horizontal wall mounting bracket. Refer to Figure 3.5 and Figure 3.6 for location.

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Figure 5.2 System Shelves Frame Grounding Connection Points



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5.5 Central Office Ground Connection

Landing points are provided on the battery return bus for a central office ground lead (see Figure 5.14, Figure 5.15, or Figure 5.16). For central office grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

5.6 Rectifier Nominal 120 VAC / 208 VAC / 240 VAC Input and AC Input Equipment Grounding Connections

DANGER! Adhere to the "Important Safety Instructions" starting on page vi.

General

The system is equipped with plug-in AC input connectors located on the front or rear of the system. Mating connectors and cable assemblies or line cords are available (see SAG582137200).

Each List 01 shelf requires two (2) AC input cable assemblies or line cords. Each feeds two (2) rectifiers.

Each List 02 shelf requires three (3) AC input cable assemblies or line cords. Two feed two (2) rectifiers, the other one (1) rectifier.

NOTE! *This system may also be hardwired into an AC distribution center of an OSP cabinet. Refer to the cabinet documentation for rectifier AC wiring.*

Wiring Considerations

Refer to SAG582137200 for AC input cable assembly and line cord options and recommended branch circuit protection.

Front AC Input Connections Option

AC input connections are made using the AC input cable assemblies or line cords ordered with the system. These are connected to the plug-in Molex connectors located on the side of the shelf. Connect the other end of the AC input cable assemblies or line cords to a properly wired AC outlet or distribution box. Refer to Figure 5.3.

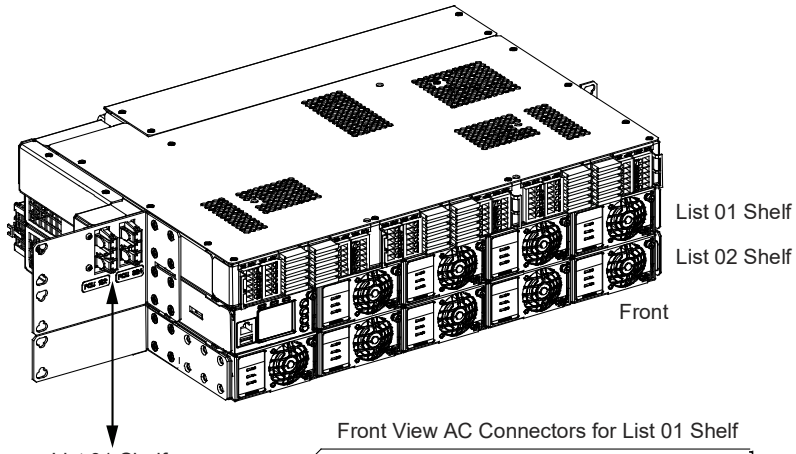
NOTE! *Front AC input connectors are not available for a List 02 Expansion Shelf.*

Rear AC Input Connections Option

AC input connections are made using the AC input cable assemblies or line cords ordered with the system. These are connected to the plug-in Molex connectors located on the rear of the shelf. Connect the other end of the AC input cable assemblies or line cords to a properly wired AC outlet or distribution box. Refer to Figure 5.4.

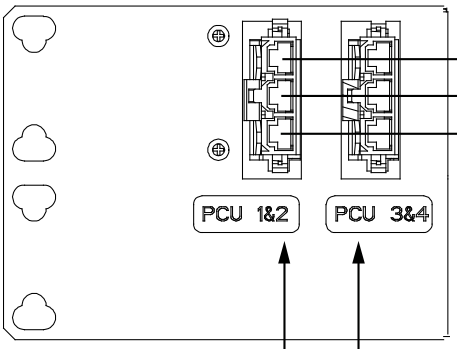
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Figure 5.3 Front AC Input Connections



List 01 Shelf:
AC input connections are made using the supplied AC input cable assemblies or line cords connected here.

Front View AC Connectors for List 01 Shelf



	AC Input Cable Assembly	AC Input Line Cord
L2-N	Blue*	White*
Ground	Green/Yellow*	Green*
L1	Brown*	Black*

* Color of AC input cable assembly or line cord lead.

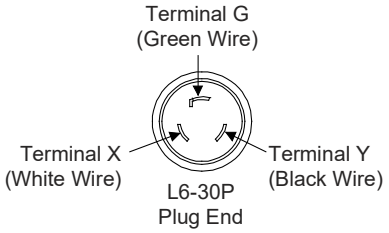
Nominal 120 VAC / 208 VAC / 240 VAC AC Input for Main Shelf Rectifier Module #1 and #2

Nominal 120 VAC / 208 VAC / 240 VAC AC Input for Main Shelf Rectifier Module #3 and #4

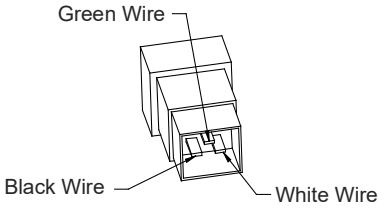
Rectifiers are numbered left to right as viewed from the front.

AC Input Cable Assembly / Line Cords

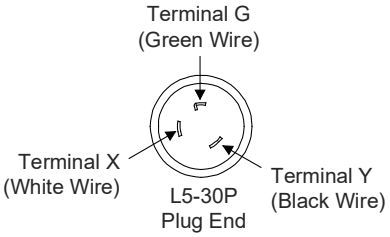
Part Number	Customer End
535232	unterminated
553202	unterminated
545252	L5-30P
540946	L6-30P
545616	L6-30P
547525	L5-30P
559301	L6-30P
559302	L6-30P
559842	L6-30P
548196	IEC320 C20



L6-30P
Plug End
(208 VAC / 240 VAC, 30 A)
Rectifier AC Input



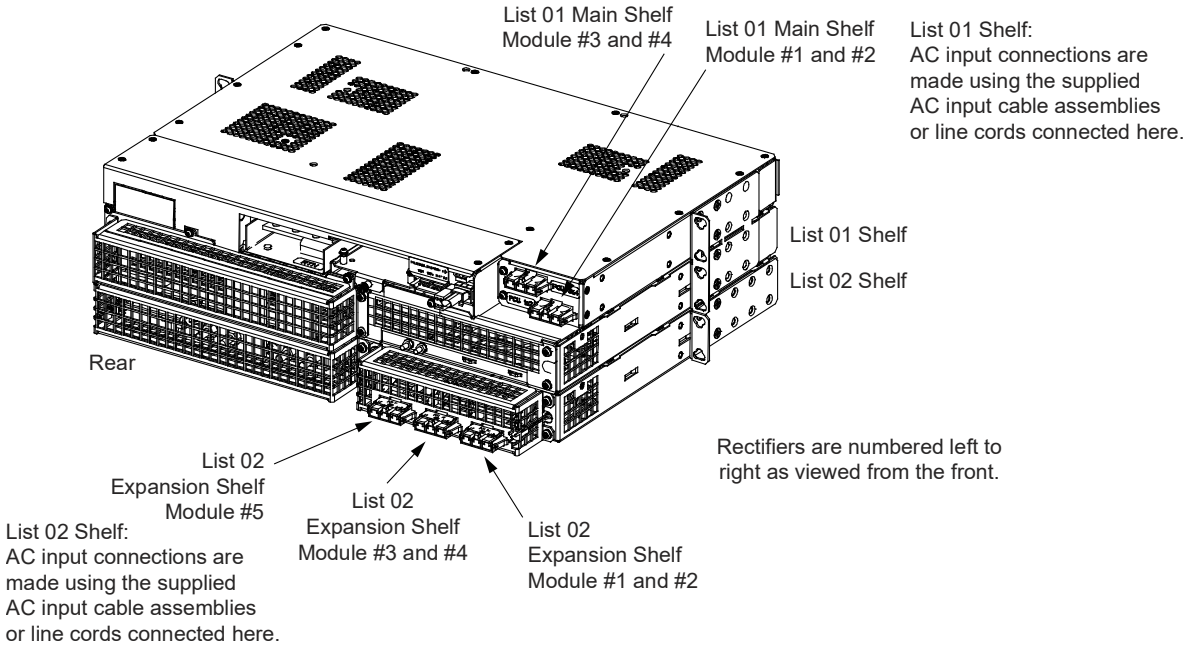
IEC320 C20
Plug End
(16 A @ 250 VAC [international rating],
20 A @ 250 VAC [US rating])
Rectifier AC Input

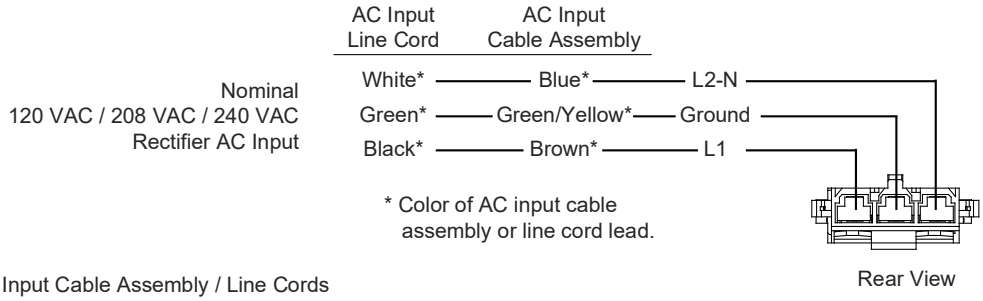


L5-30P
Plug End
(120 VAC, 30 A)
Rectifier AC Input

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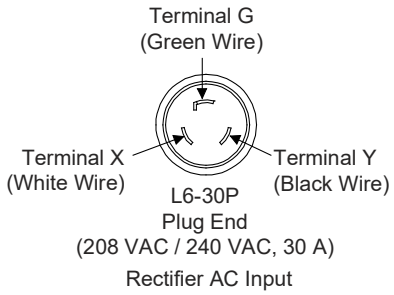
Figure 5.4 Rear AC Input Connections

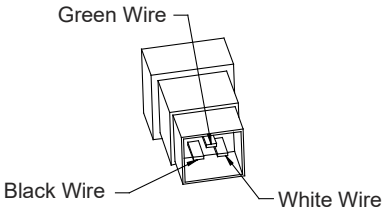


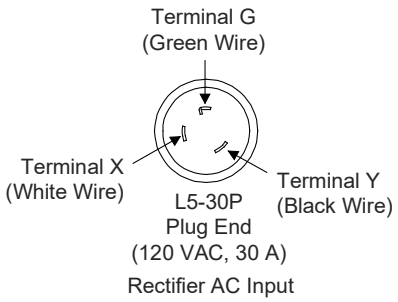


AC Input Cable Assembly / Line Cords

Part Number	Customer End
535232	unterminated
553202	unterminated
545252	L5-30P
540946	L6-30P
545616	L6-30P
547525	L5-30P
559301	L6-30P
559302	L6-30P
559842	L6-30P
548196	IEC320 C20







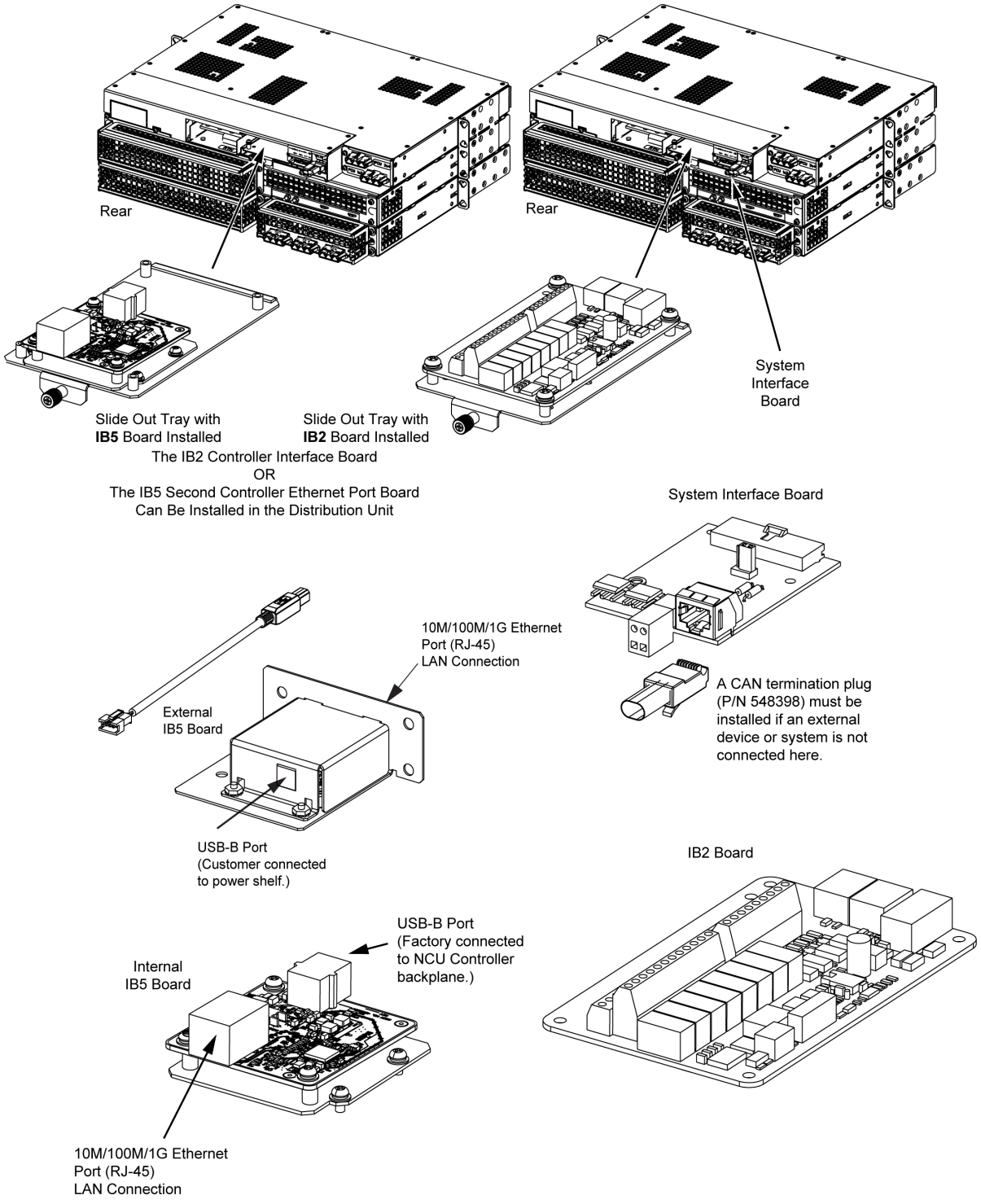
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5.7 External Alarm, Reference, Monitoring, and Control Connections

5.7.1 Circuit Card Locations

Refer to Figure 5.5.

Figure 5.5 External Alarm, Reference, Monitoring, and Control Circuit Card Locations



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5.7.2 RS-485 Connection (used for Communication with SM Modules)

The RS-485 connector is located near the IB5 or IB2 board. It is a dangling connector with a red and black wire harness.

- Red Wire (Pin 1): RS485+
- Black Wire (Pin 2): RS485-

Use cable P/N 547674 to interface with SM-AC, SM-BAT, SM-RC, or SM-IO supervisory modules.

5.7.3 Temperature Probes

NOTE! *Each temperature probe consists of two or three pieces that plug together to make a complete probe. See SAG582137200 for part numbers and descriptions.*

Two temperature probes can be connected to the System Interface Board. See Figure 5.6.

Two temperature probes can be connected to the IB2 (Controller Interface Board), if furnished. See Figure 5.10.

Any combination of the temperature probes can be programmed to monitor ambient temperature and/or battery temperature. A temperature probe set to monitor battery temperature can also be used for the rectifier battery charge temperature compensation feature, or the battery charge temperature compensation feature can be programmed to use the average or highest value of all battery temperature probes. The battery charge temperature compensation feature allows the controller to automatically increase or decrease the output voltage of the system to maintain battery float current as battery temperature decreases or increases, respectively. Battery life can be extended when an optimum charge voltage to the battery with respect to temperature is maintained. A temperature probe set to monitor battery temperature can also be used for the BTRM (Battery Thermal Runaway Management) feature. The BTRM feature lowers output voltage when a high temperature condition exists to control against battery thermal runaway.

The temperature sensor end of the probe contains a tab with a 5/16" clearance hole for mounting.

A temperature probe programmed to monitor battery temperature should be mounted on the negative post of a battery cell to sense battery temperature. A temperature probe used for battery charge temperature compensation and/or BTRM (Battery Thermal Runaway Management) should also be mounted on the negative post of a battery cell. A temperature probe programmed to monitor ambient temperature should be mounted in a convenient location, away from direct sources of heat or cold.

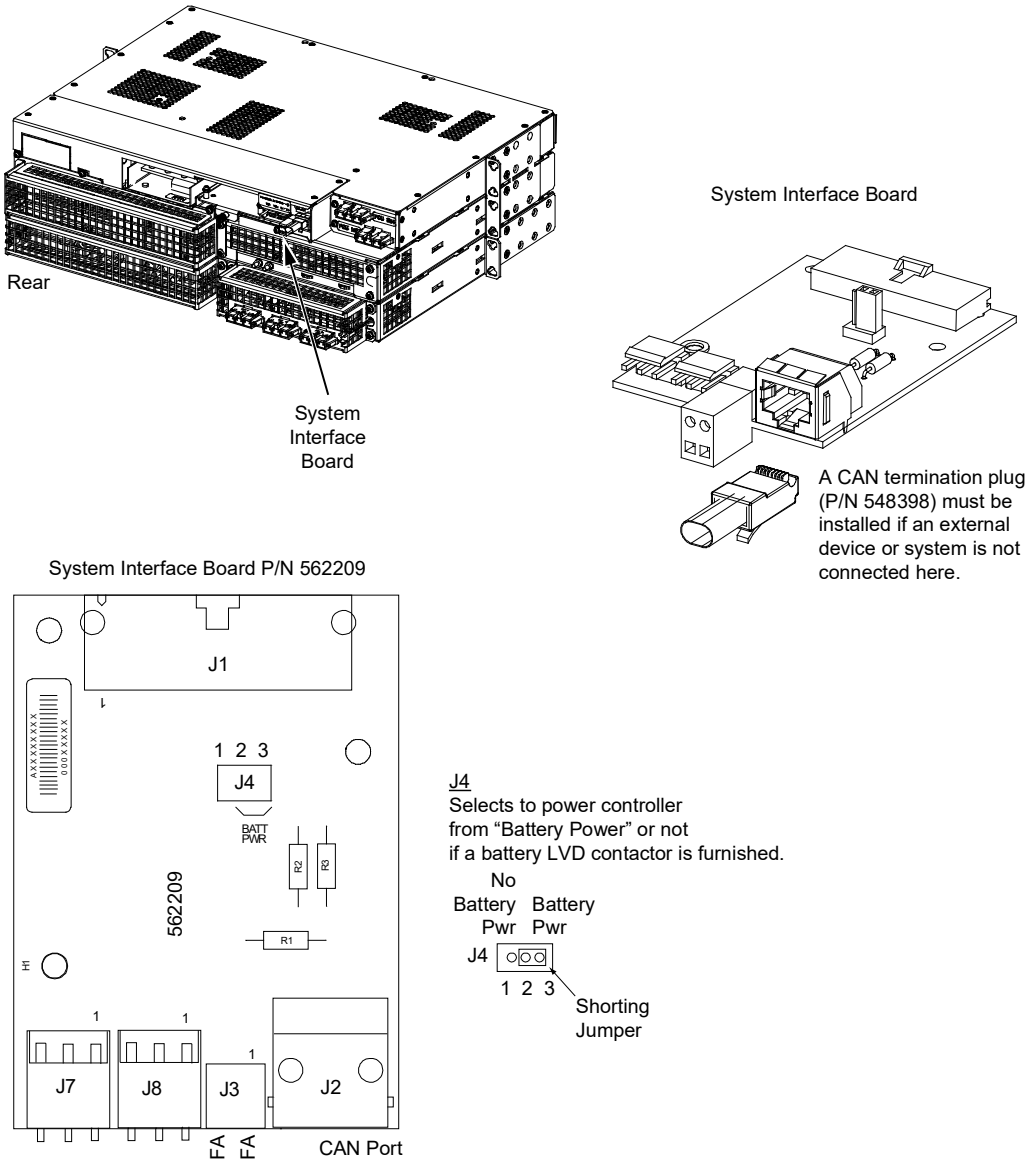
5.7.4 System Interface Circuit Card Connections (if required)

The system interface circuit card provides connections for the following. Refer to Figure 5.5 for circuit card location. Refer to Figure 5.6 for connections details.

- Temperature Probes (see "Temperature Probes" starting on page 42)
- NCU CAN Port (see "Connecting a Device or System to the NCU CAN Bus (if required)" starting on page 58)
- External Load and Battery Circuit Breaker / Fuse Alarm Circuits

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Figure 5.6 System Interface Circuit Card Connections



External Battery Circuit Breaker Alarm Connections

Circuit Breaker Alarm Connections to External Battery Disconnect Unit

Connect the circuit breaker alarm lead from an optional external battery disconnect unit to terminal 1 of J3 located on the System Interface Board. Refer to Figure 5.7.

Circuit Breaker Alarm Connections to Battery Disconnect Circuit Breakers on Battery Trays

Connect the circuit breaker alarm lead from an optional battery tray to terminal 1 of J3 located on the System Interface Board. Refer to Figure 5.8.

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Circuit Breaker Alarm Connections to Battery Disconnect Circuit Breakers on Battery Cabinets

Connect the circuit breaker alarm lead from an optional battery cabinet to terminal 1 of J3 located on the System Interface Board. Refer to Figure 5.9.

5.7.5 IB2 (Controller Interface Board) Connections (if furnished)

NOTE! *The distribution unit can contain either an IB2 board or an internal IB5 board, not both.*

The IB2 (Controller Interface Board) provides connection points for digital inputs, programmable relay outputs, and temperature probes. The IB2 interface board is mounted inside the distribution unit. A slide out tray is provided on the rear of the distribution unit to access the circuit card. Refer to Figure 5.5.

Digital Inputs and Programmable Relay Outputs

Digital input and relay output leads are connected to screw-type terminal blocks located on the IB2. Recommended torque for these connections is 2.2 in-lbs. Refer to Figure 5.10 for terminal locations. Refer to Table 5.2, Table 5.4, Table 5.5, and Table 5.6 for pin-out information.

NOTE! *Two sets of alarm cables are available (see SAG582137200 for part numbers). One set for the digital inputs and another set for the relay outputs. Refer to Table 5.2 and Table 5.6 for color scheme. If the relay outputs alarm cable or digital inputs alarm cable is ordered, one half is factory connected in the distribution unit. The other half has a mating connector on one end and is un-terminated on the other end.*

NOTE! *If the power system includes the custom digital input cable (P/N 545591), refer to Table 5.4 for color scheme.*

NOTE! *If the power system includes the custom digital input cable (P/N 563753), refer to Table 5.5 for color scheme.*

CAUTION! All conductors in this harness may be connected within the shelf. Shorting or grounding of unused conductors may result in service interruption or equipment damage. Therefore insulate all conductor ends not being used in your application.

Digital Inputs

Connect up to eight (8) digital inputs to the IB2. Note that you must supply both paths for the digital input (either a positive or a negative signal and the opposite polarity return path). Observe proper polarity. Refer to Figure 5.10 for terminal locations and Table 5.2 or Table 5.4 or Table 5.5 for pin-out information.

The digital inputs can be programmed to provide an alarm when the signal is applied (HIGH) or removed (LOW). Refer to the NCU Instructions (UM1M830BNA) for programming information.

Digital Input Ratings: Refer to the following.

a) Maximum Voltage Rating: 60V DC.

b) Active High: > 19V DC.

c) Active Low: < 1V DC.

The digital inputs may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.

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ESTOP Function

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

For Systems NOT Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will close after the "LVD Reconnect Delay" has elapse (customer configurable via the controller) if battery voltage is present on the bus. Rectifiers will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish).

For Systems Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will remain open. Rectifiers will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). When the rectifiers restart, LVD contactors (battery and load type) will close after the "LVD Reconnect Delay" has elapse (customer configurable via the controller).

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

Programmable Relay Outputs

The IB2 provides eight (8) programmable alarm relays with dry Form-C contacts. Connect up to eight (8) relay outputs to the IB2. Refer to Figure 5.10 for terminal locations and Table 5.6 for pin-out information.

Refer to the NCU Instructions (UM1M830BNA) for programming information.

Relay Ratings: Refer to the following.

a) Steady State: 0.5 A @ 60V DC; 1.0 A @ 30V DC.

b) Peak: 3 A @ 30V DC.

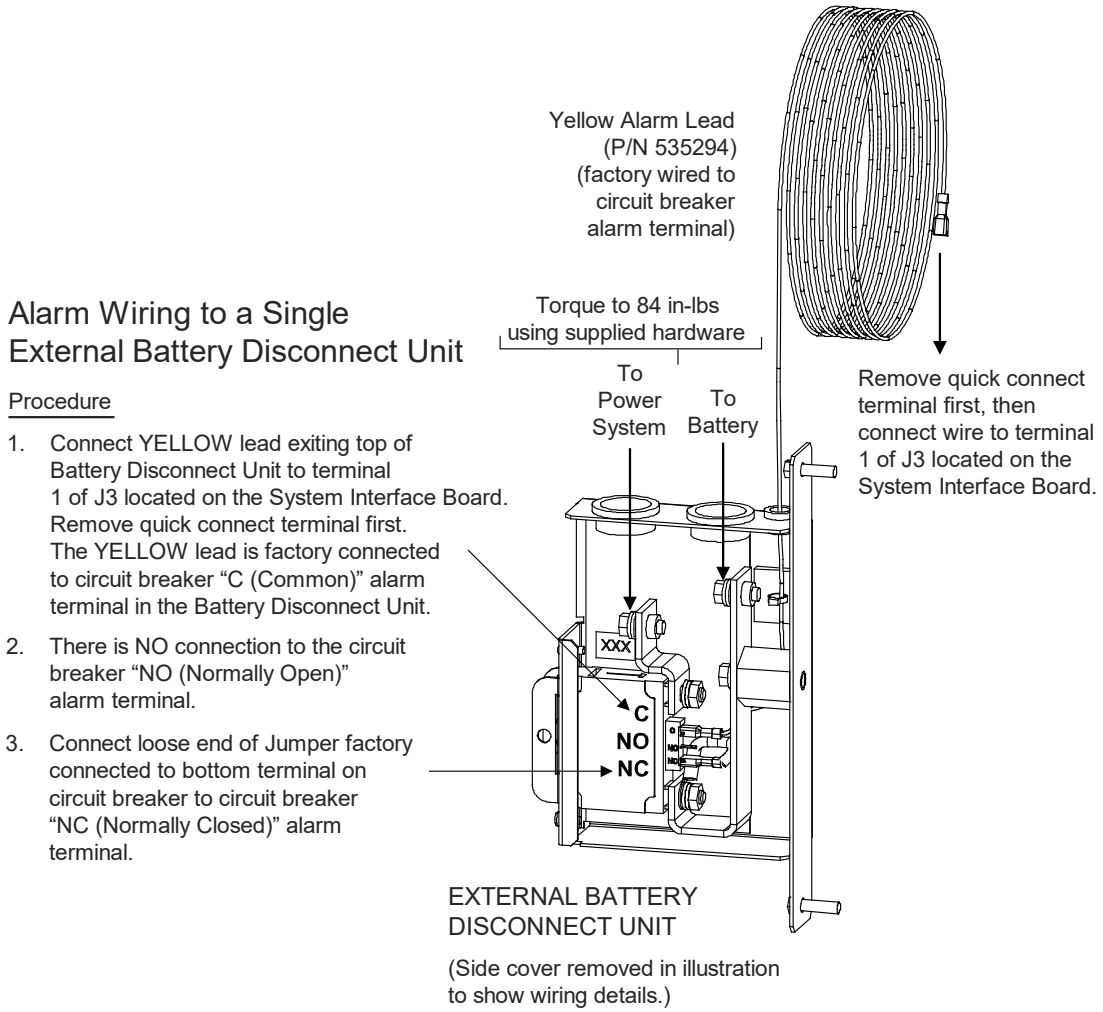
The relays may be preprogrammed for specific functions. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.

Temperature Probes

See "Temperature Probes" starting on page 42.

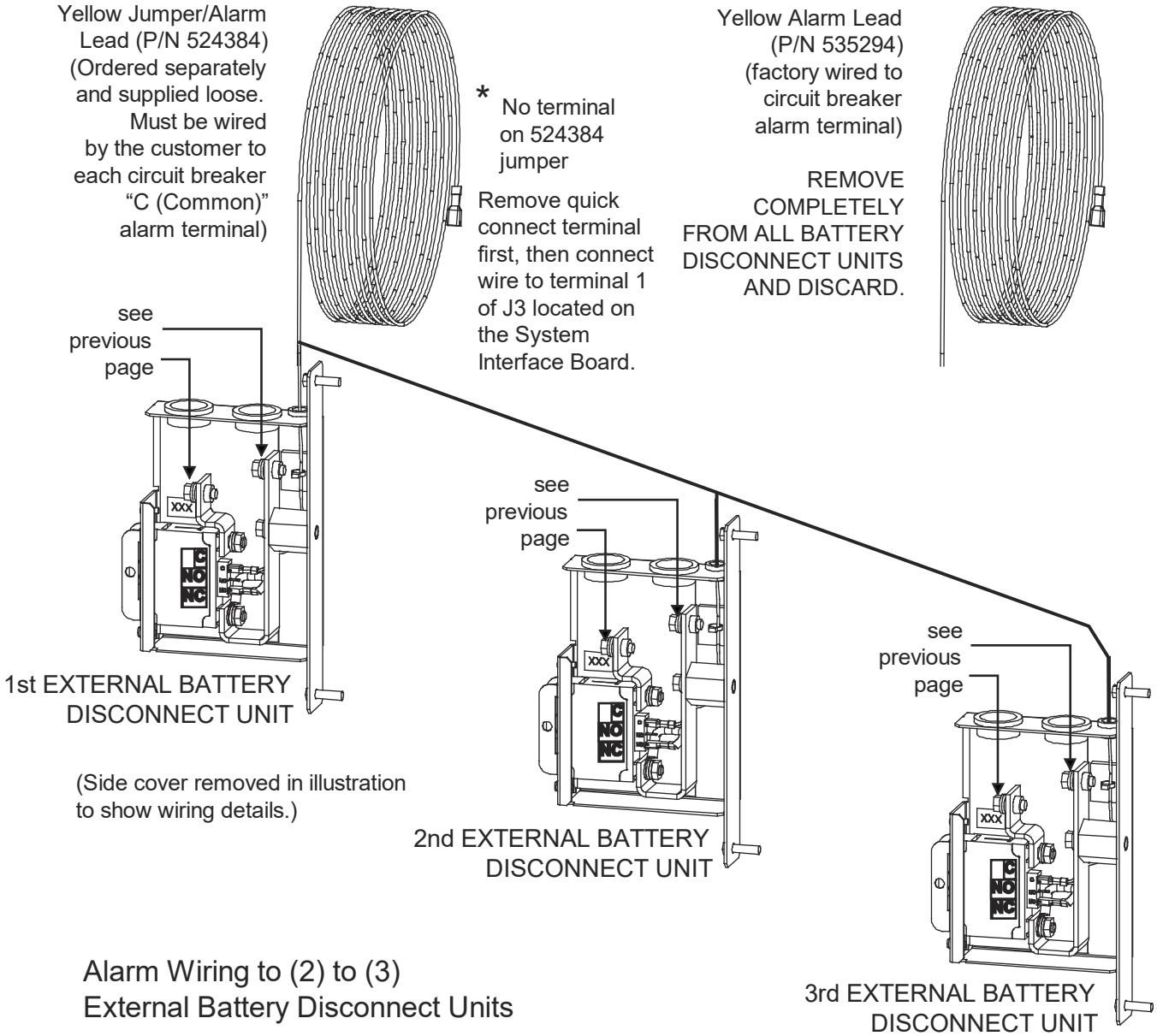
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Figure 5.7 Circuit Breaker Alarm Connections to External Battery Disconnect Unit (cont'd on next page)



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Figure 5.7 Circuit Breaker Alarm Connections to External Battery Disconnect Unit (cont'd from previous page)



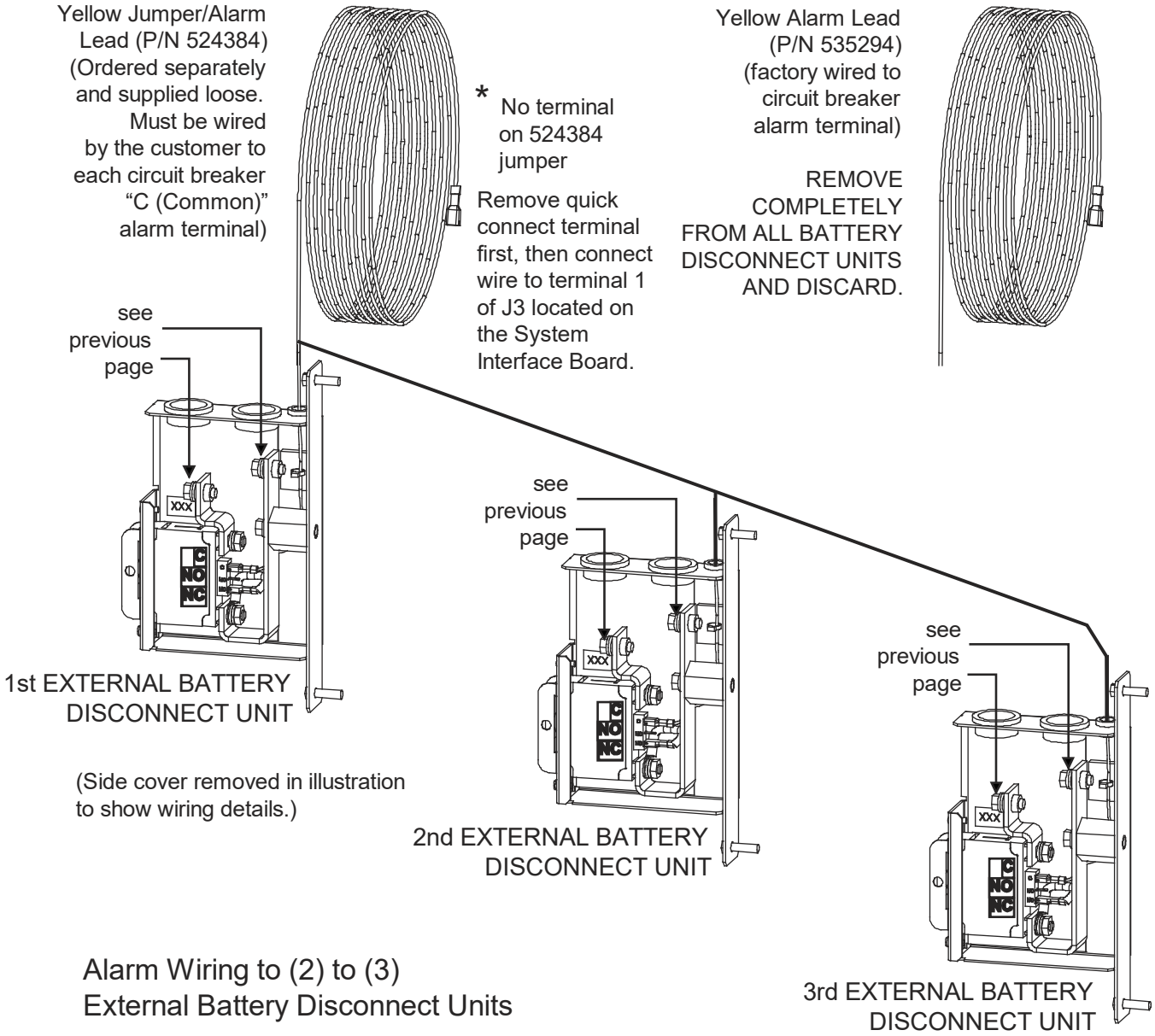
Alarm Wiring to (2) to (3) External Battery Disconnect Units

Procedure

1. Completely remove YELLOW lead exiting top of ALL Battery Disconnect Units and discard.
2. Connect separately ordered YELLOW jumper/alarm lead (P/N 524384) to circuit breaker "C (Common)" alarm terminals in ALL Battery Disconnect Units. Connect remaining end to terminal 1 of J3 located on the System Interface Board.
3. There is NO connection to the circuit breaker "NO (Normally Open)" alarm terminal.
4. In ALL Battery Disconnect Units, connect loose end of Jumper factory connected to bottom terminal on circuit breaker to circuit breaker "NC (Normally Closed)" alarm terminal.

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Figure 5.8 Circuit Breaker Alarm Connections to Battery Disconnect Circuit Breakers on Battery Trays



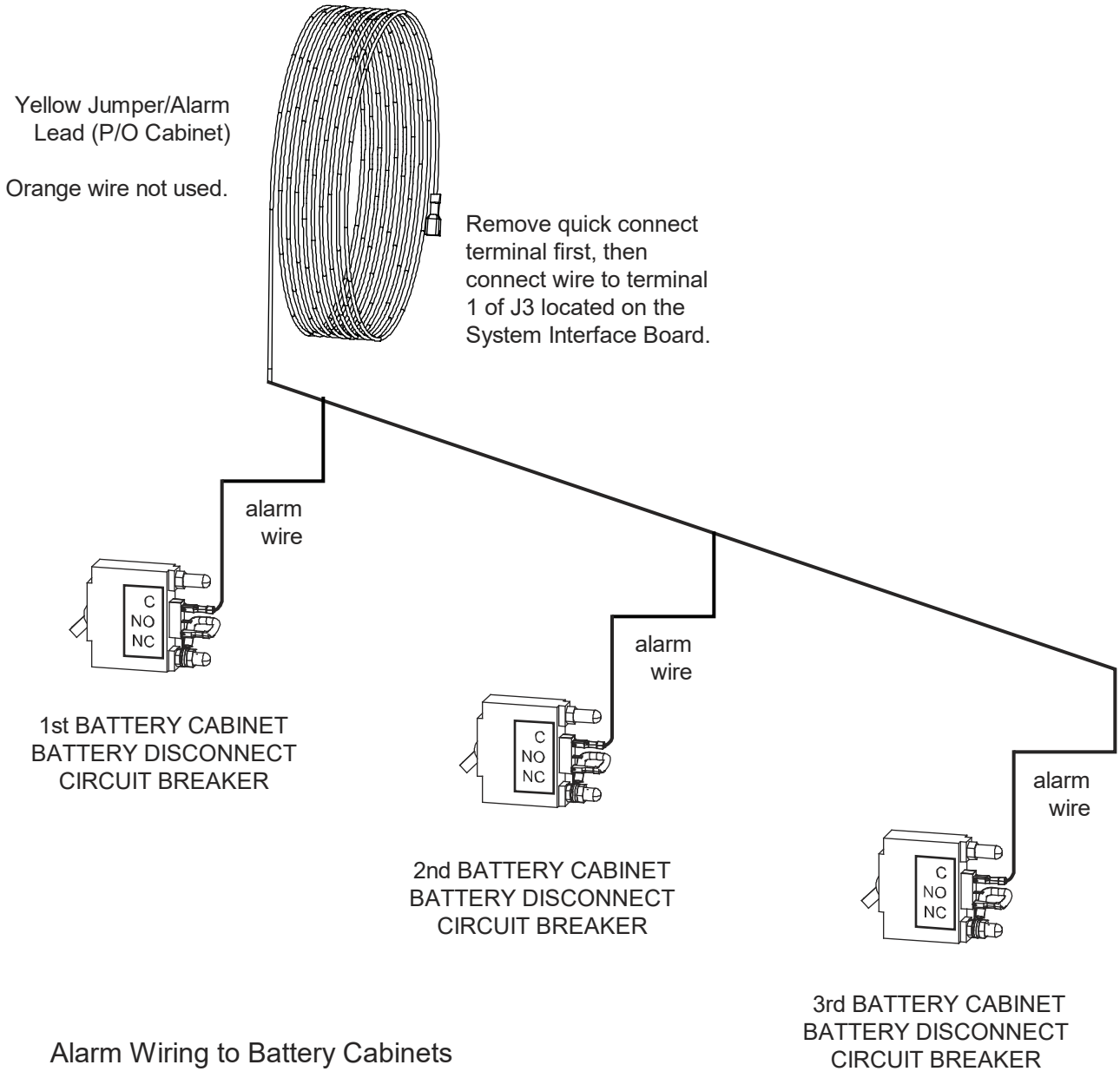
Alarm Wiring to (2) to (3) External Battery Disconnect Units

Procedure

1. Completely remove YELLOW lead exiting top of ALL Battery Disconnect Units and discard.
2. Connect separately ordered YELLOW jumper/alarm lead (P/N 524384) to circuit breaker "C (Common)" alarm terminals in ALL Battery Disconnect Units. Connect remaining end to terminal 1 of J3 located on the System Interface Board.
3. There is NO connection to the circuit breaker "NO (Normally Open)" alarm terminal.
4. In ALL Battery Disconnect Units, connect loose end of Jumper factory connected to bottom terminal on circuit breaker to circuit breaker "NC (Normally Closed)" alarm terminal.

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Figure 5.9 Circuit Breaker Alarm Connections to Battery Disconnect Circuit Breakers on Battery Cabinets



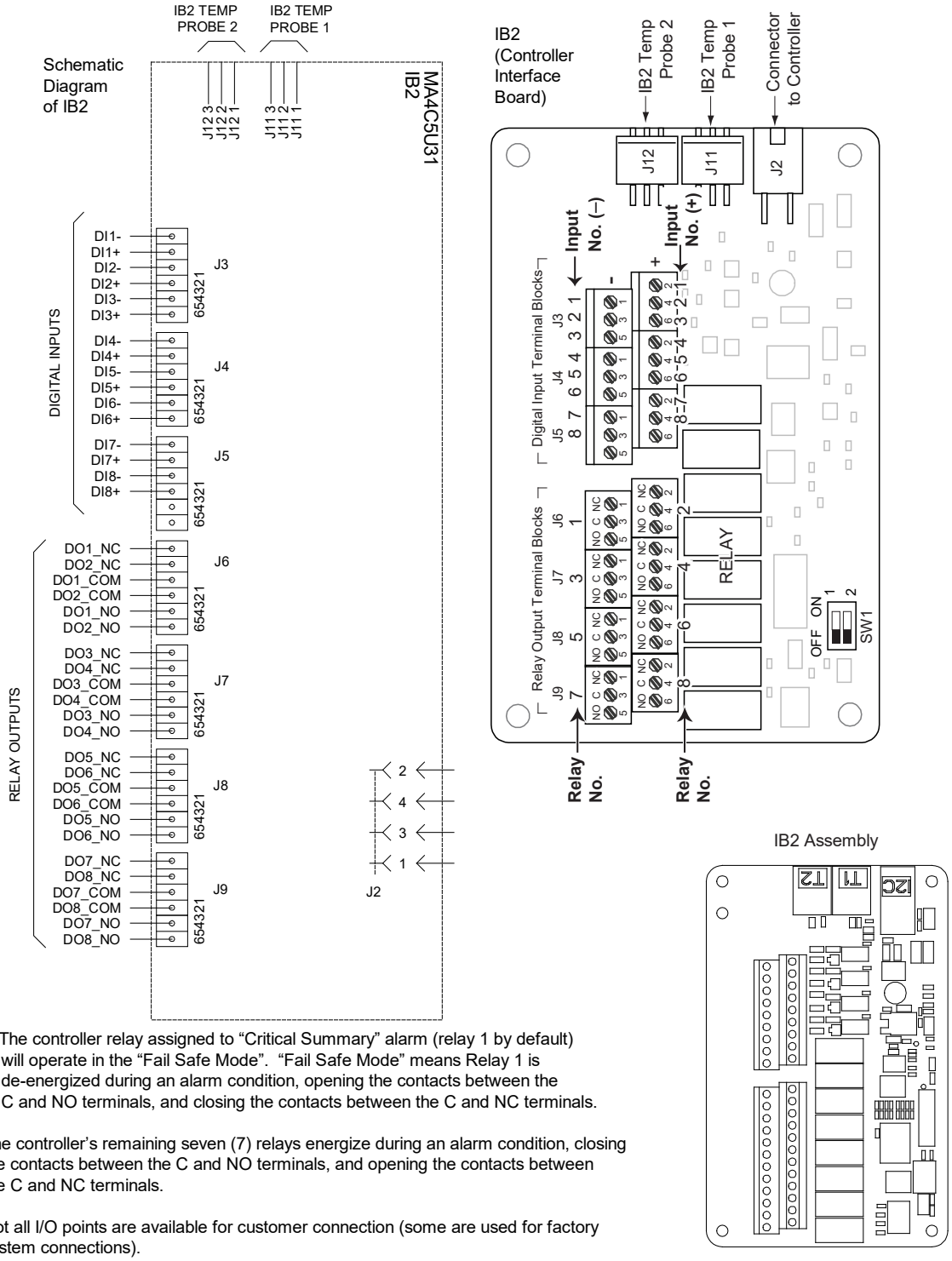
Alarm Wiring to Battery Cabinets

Procedure

1. Remove quick connect terminal from YELLOW battery cabinet alarm lead and connect to terminal 1 of J3 located on the System Interface Board.

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Figure 5.10 IB2 (Controller Interface Board) Connections



* The controller relay assigned to “Critical Summary” alarm (relay 1 by default) will operate in the “Fail Safe Mode”. “Fail Safe Mode” means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals.

The controller’s remaining seven (7) relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Not all I/O points are available for customer connection (some are used for factory system connections).

J3-J9:
Wire Size Capacity: 16 AWG to 26 AWG.
Wire Strip Length: 0.20 inch.
Recommended Torque: 2.2 in-lbs.

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NOTE! *In the fourth quarter of 2026, P/N 541310 and P/N 541311 were updated. As a result of the reduction in pairs the color code changed, and additional cables were added and bundled together. The color code is the same in each bundled cable. Each cable is labeled with a specific letter to allow identification of the correct wires. Refer to Table 5.2 and Table 5.3 for color code information prior to and after the fourth quarter of 2026.*

Table 5.2 Programmable Digital Inputs (Factory Default) – IB2, Standard Cable P/N 541310 / P/N 541311 Color Codes after the Fourth Quarter of 2026

Programmable Digital Input	IB2 Pin No.		Digital Input Cable Color Scheme	Dedicated to...
1	J3-2	+	Cable A (W-G)	User Defined
	J3-1	–	Cable A (G)	
2	J3-4	+	Cable A (W-BR)	User Defined
	J3-3	–	Cable A (BR)	
3	J3-6	+	Cable A (W-BL)	User Defined
	J3-5	–	Cable A (BL)	
4	J4-2	+	Cable A (W-O)	User Defined
	J4-1	–	Cable A (O)	
5	J4-4	+	Cable B (W-G)	User Defined
	J4-3	–	Cable B (G)	
6	J4-6	+	Cable B (W-BR)	User Defined
	J4-5	–	Cable B (BR)	
7	J5-2	+	Cable B (W-BL)	User Defined
	J5-1	–	Cable B (BL)	
8	J5-4	+	Cable B (W-O)	Emergency Stop (User Pre-Defined)
	J5-3	–	Y (factory wired) (see note below)	
--	J5-5		Not Used	Not Used
--	J5-6			

CAUTION! All conductors in this harness may be connected within the cabinet. Shorting or grounding of unused conductors may result in service interruption or equipment damage. Therefore, insulate all conductor ends not being used in your application.

NOTE! *-48V is factory wired to the Digital Input #8 (-) terminal for your convenience and function predefined for ESTOP. Customer-furnished system ground applied to terminal Digital Input #8 (+) activates the ESTOP function.* *See ESTOP Function on page 45.*

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Table 5.3 Programmable Digital Inputs (Factory Default) – IB2, Standard Cable P/N 541310 / P/N 541311 Color Codes Prior to the Fourth Quarter of 2026

Programmable Digital Input	IB2 Pin No.		Digital Input Cable Color Scheme	Dedicated to...
1	J3-2	+	R-G	User Defined
	J3-1	–	G-R	
2	J3-4	+	R-O	User Defined
	J3-3	–	O-R	
3	J3-6	+	R-BL	User Defined
	J3-5	–	BL-R	
4	J4-2	+	W-S	User Defined
	J4-1	–	S-W	
5	J4-4	+	W-BR	User Defined
	J4-3	–	BR-W	
6	J4-6	+	W-G	User Defined
	J4-5	–	G-W	
7	J5-2	+	W-O	User Defined
	J5-1	–	O-W	
8	J5-4	+	W-BL	Emergency Stop (User Pre-Defined)
	J5-3	–	Y (factory wired) (see note below)	
--	J5-5		Not Used	Not Used
--	J5-6			

CAUTION! All conductors in this harness may be connected within the cabinet. Shorting or grounding of unused conductors may result in service interruption or equipment damage. Therefore, insulate all conductor ends not being used in your application.

NOTE! *-48V is factory wired to the Digital Input #8 (-) terminal for your convenience and function predefined for ESTOP. Customer-furnished system ground applied to terminal Digital Input #8 (+) activates the ESTOP function.* *See ESTOP Function on page 45.*

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Table 5.4 Programmable Digital Inputs (Factory Default) – IB2, Special Application Cable P/N 545591 (Part of Special Application Digital input kit P/N 562884)

Programmable Digital Input	IB2 Pin No.		Special Application Cable P/N 545591 Color Scheme	Dedicated to...
1	J3-2	+	None	User Defined
	J3-1	–	None	
2	J3-4	+	None	User Defined
	J3-3	–	None	
3	J3-6	+	None	User Defined
	J3-5	–	None	
4	J4-2	+	Slate	User Defined
	J4-1	–	-48 VDC Applied Internally	
5	J4-4	+	Brown	User Defined
	J4-3	–	-48 VDC Applied Internally	
6	J4-6	+	Violet	User Defined
	J4-5	–	-48 VDC Applied Internally	
7	J5-2	+	Orange	User Defined
	J5-1	–	-48 VDC Applied Internally	
8	J5-4	+	None	Emergency Stop
	J5-3	–	Y (factory wired) (see note below)	
--	J5-5		not used	--
	J5-6			

CAUTION! All conductors in this harness may be connected within the cabinet. Shorting or grounding of unused conductors may result in service interruption or equipment damage. Therefore, insulate all conductor ends not being used in your application.

NOTE! *-48V is factory wired to the Digital Input #8 (-) terminal for your convenience and function predefined for ESTOP. Customer-furnished system ground applied to terminal Digital Input #8 (+) activates the ESTOP function.* *See ESTOP Function on page 45.*

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Table 5.5 Programmable Digital Inputs (Factory Default) – IB2, Special Application Cable P/N 563753 (Part of Special Application Digital input kit P/N 10063192)

Programmable Digital Input	IB2 Pin No.		Special Application Cable P/N 563753 Color Scheme	Dedicated to...
1	J3-2	+	None	User Defined
	J3-1	–	None	
2	J3-4	+	Brown	User Defined
	J3-3	–	-48 VDC Applied Internally	
3	J3-6	+	Orange	User Defined
	J3-5	–	-48 VDC Applied Internally	
4	J4-2	+	Violet	User Defined
	J4-1	–	-48 VDC Applied Internally	
5	J4-4	+	Slate	User Defined
	J4-3	–	-48 VDC Applied Internally	
6	J4-6	+	Black	User Defined
	J4-5	–	-48 VDC Applied Internally	
7	J5-2	+	Blue	User Defined
	J5-1	–	-48 VDC Applied Internally	
8	J5-4	+	White	Emergency Stop or User Defined
	J5-3	–	Y (factory wired) (see note below)	
--	J5-5		not used	--
	J5-6			

CAUTION! All conductors in this harness may be connected within the cabinet. Shorting or grounding of unused conductors may result in service interruption or equipment damage. Therefore, insulate all conductor ends not being used in your application.

NOTE! *-48V is factory wired to the Digital Input #8 (-) terminal for your convenience and function can be predefined for ESTOP or another function defined by the User. If defined as ESTOP, customer-furnished system ground applied to terminal Digital Input #8 (+) activates the ESTOP function.* *See ESTOP Function on page 45.*

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NOTE! *In the fourth quarter of 2026, P/N 541308 and P/N 541309 were updated. As a result of the reduction in pairs the color code changed, and additional cables were added and bundled together. The color code is the same in each bundled cable. Each cable is labeled with a specific letter to allow identification of the correct wires. Refer to Table 5.6 and Table 5.7 for color code information prior to and after the fourth quarter of 2026.*

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Table 5.6 Relay Outputs (Factory Default) – IB2, P/N 541308 / P/N 541309 Color Codes after the Fourth Quarter of 2026

NOTE! *The output relay configuration may not be set according to the factory default setting. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.*

Programmable Relay Output		IB2 Pin No.	Alarm Cable Color Scheme	Alarms Assigned to this Relay (Default)	Alarms Assigned to this Relay (Custom)
1 *	NO	J6-5	Cable A (W-BL)	Any Critical Alarm	
	COM	J6-3	Cable A (BL)		
	NC	J6-1	Cable A (W-O)		
2	NO	J6-6	Cable A (O)	Any Major Alarm	
	COM	J6-4	Cable A (W-G)		
	NC	J6-2	Cable A (G)		
3	NO	J7-5	Cable A (W-BR)	DC Volt High #1	
	COM	J7-3	Cable A (BR)		
	NC	J7-1	Cable B (W-BL)		
4	NO	J7-6	Cable B (BL)	Batt Discharge DC Volt Low #1	
	COM	J7-4	Cable B (W-O)		
	NC	J7-2	Cable B (O)		
5	NO	J8-5	Cable B (W-G)	DC Volt Low #2	
	COM	J8-3	Cable B (G)		
	NC	J8-1	Cable B (W-BR)		
6	NO	J8-6	Cable B (BR)	AC Failure	
	COM	J8-4	Cable C (W-BL)		
	NC	J8-2	Cable C (BL)		
7	NO	J9-5	Cable C (W-O)	Fuse Alarm	
	COM	J9-3	Cable C (O)		
	NC	J9-1	Cable C (W-G)		
8	NO	J9-6	Cable C (G)	Load Share Alarm Rect Not Respond Rect HVSD Rect AC Fail Rect Failure Rect Protect Rect Fan Fail Rect Derated Rect Temp Alarm	
	COM	J9-4	Cable C (W-BR)		
	NC	J9-2	Cable C (BR)		

CAUTION! All conductors in this harness may be connected within the cabinet. Shorting or grounding of unused conductors may result in service interruption or equipment damage. Therefore insulate all conductor ends not being used in your application.

NOTE! ** The controller relay assigned to "Critical Summary" alarm (relay 1 by default) will operate in the "Fail Safe Mode". "Fail Safe Mode" means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals. The controller's seven (7) remaining relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.*

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Table 5.7 Relay Outputs (Factory Default) – IB2, P/N 541308 / P/N 541309 Color Codes Prior to the Fourth Quarter of 2026

NOTE! *The output relay configuration may not be set according to the factory default setting. Refer to the configuration drawing (C-drawing) supplied with your system for your system's specific configuration.*

Programmable Relay Output		IB2 Pin No.	Alarm Cable Color Scheme	Alarms Assigned to this Relay (Default)	Alarms Assigned to this Relay (Custom)
1 *	NO	J6-5	W-BL	Any Critical Alarm	
	COM	J6-3	BL-W		
	NC	J6-1	W-O		
2	NO	J6-6	O-W	Any Major Alarm	
	COM	J6-4	W-G		
	NC	J6-2	G-W		
3	NO	J7-5	W-BR	DC Volt High #1	
	COM	J7-3	BR-W		
	NC	J7-1	W-S		
4	NO	J7-6	S-W	Batt Discharge DC Volt Low #1	
	COM	J7-4	R-BL		
	NC	J7-2	BL-R		
5	NO	J8-5	R-O	DC Volt Low #2	
	COM	J8-3	O-R		
	NC	J8-1	R-G		
6	NO	J8-6	G-R	AC Failure	
	COM	J8-4	R-BR		
	NC	J8-2	BR-R		
7	NO	J9-5	R-S	Fuse Alarm	
	COM	J9-3	S-R		
	NC	J9-1	BK-BL		
8	NO	J9-6	BL-BK	Load Share Alarm Rect Not Respond Rect HVSD Rect AC Fail Rect Failure Rect Protect Rect Fan Fail Rect Derated Rect Temp Alarm	
	COM	J9-4	BK-O		
	NC	J9-2	O-BK		

CAUTION! All conductors in this harness may be connected within the cabinet. Shorting or grounding of unused conductors may result in service interruption or equipment damage. Therefore insulate all conductor ends not being used in your application.

NOTE! ** The controller relay assigned to "Critical Summary" alarm (relay 1 by default) will operate in the "Fail Safe Mode". "Fail Safe Mode" means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals. The controller's seven (7) remaining relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.*

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5.7.6 Connecting a Device or System to the NCU CAN Bus (if required)

A supporting device or system may be connected to the NCU CAN Port located on the System Interface Circuit Card. Refer to Figure 5.5 for circuit card location. Refer to Figure 5.6 for connections details. Refer to Table 5.8 for pinouts. Refer also to the external device's or system's instruction manual.

General Procedure

1. Remove the CAN termination plug from the CAN Port connector (see Figure 5.6 for location). Connect the device or system to the NCU Controller's CAN port. Refer to Table 5.8 for pinouts. Ensure that the last device on the controller's CAN bus has a CAN termination plug. Refer also to the external device's or system's instruction manual.

Optional SM-Temp Module Procedure

The analog output of the SM-Temp Module may be connected to an NCU temperature port input. In lieu of connecting the analog output of the SM-TEMP module to an NCU temperature port input, the SM-TEMP module can simply be connected at the end of the NCU CAN bus. Refer to the SM-Temp Module Instructions (UM547490) for details.

Connecting the SM-Temp Module to the Controller's CAN Bus

1. Remove the CAN termination plug from the CAN Port connector (see Figure 5.6 for location). Connect the SM Temp Module CAN bus to the CAN Port connector using separately ordered SM-Temp CAN bus interface cable (P/N 562868). Refer to Table 5.8 for pinouts. Ensure the last SM-Temp Module (or if only one) has a CAN termination strap as shown in the SM-Temp Module Instructions (UM547490).

Table 5.8 CAN Port Connections

NCU CAN Port (RJ-45)		SM-Temp Module CAN Port Pin Number
Pin Number	Function	
1	CAN L	TB1-5 (CAN L)
2	CAN H	TB1-3 (CAN H)
3	--	--
4	--	--
5	--	--
6	--	--
7	--	--
8	--	--

5.8 NCU Controller Ethernet Connection (if required)

The NCU Controller provides a Web Interface via an Ethernet connection to a TCP/IP network. This interface can be accessed locally on a computer or remotely through a network. An RJ-45 10BaseT jack is provided on the front of the NCU for connection into a customer's network. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 5.11 for location and Table 5.9 for pin outs. Use shielded Ethernet cable (grounded at both ends). Note that the NCU RJ-45 jack is connected to chassis ground. Refer to the NCU Instructions (UM1M830BNA) for operational details.

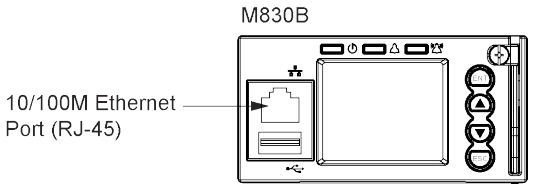
NOTE! *You can access the Web pages of the power system locally by using a "crossover" or "straight" cable connected directly between your PC and the NCU.*

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WARNING! The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to the interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

The intra-building port (RJ-45) of the equipment or subassembly must use shielded intra-building cabling/wiring that is grounded at both ends.

Figure 5.11 NCU Ethernet Port



NOTE! *If your system has an IB5 board, DO NOT connect your Local Area Network (LAN) to the NCU front Ethernet port. See "NCU Controller Second Ethernet Port Connection (if IB5 board furnished)" on page 59.*

Table 5.9 NCU RJ-45 Ethernet Port Pin Configuration

Port Pin Number	Name	Definition
1	Tx+	Write Signal +
2	Tx-	Write Signal -
3	Rx+	Read Signal +
4	--	no connection
5	--	no connection
6	Rx-	Read Signal -
7	--	no connection
8	--	no connection

NCU Controller Second Ethernet Port Connection (if IB5 board furnished)

NOTE! *The distribution unit can contain either an IB2 board or an internal IB5 board, not both.*

Your system may be furnished with an internal IB5 board connected to the NCU backplane via a factory furnished and connected cable. An external IB5 board kit is available. The IB5 board provides a second Ethernet port. The Ethernet port located on the NCU Controller's front panel can ONLY be used to connect a computer directly to the NCU. The Ethernet port located on the IB5 board can be used to connect the NCU to your Local Area Network (LAN).

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NOTE! *If your system has an IB5 board, DO NOT connect your Local Area Network (LAN) to the NCU front Ethernet port.*

An RJ-45 10BaseT jack is provided on the IB5 board for connection into a customer's network. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 5.12 for location and Table 5.9 for pin outs. Use shielded Ethernet cable (grounded at both ends). Note that the IB5 board's RJ-45 jack is connected to chassis ground. Refer to the NCU Instructions (UM1M830BNA) for operational details.

Default IB5 Ethernet Port Parameters

IPv4

IP Address:	192.168.1.2
Subnet Mask:	255.255.255.0
Default Gateway:	192.168.1.1

IPv6

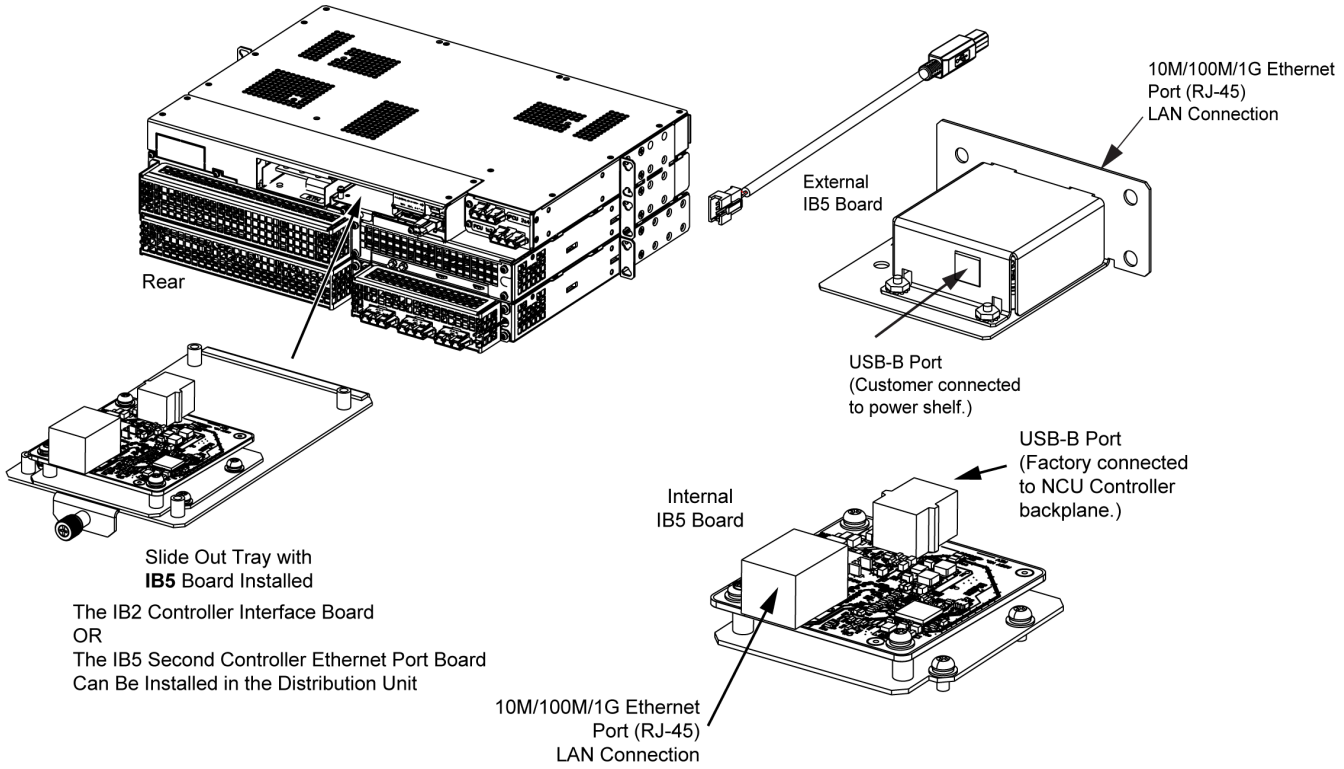
IPv6 Address:	20fa:fffd:fffc:fffb:fffa:fff9:fff8:fff7
IPv6 Prefix:	0
IPv6 Gateway:	20fa:1:fffe:ffff:fffe:fffd:ffff:fffe

WARNING! The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to the interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

The intra-building port (RJ-45) of the equipment or subassembly must use shielded intra-building cabling/wiring that is grounded at both ends.

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Figure 5.12 IB5 Board NCU Controller Second Ethernet Port



5.9 Control Bus Connections between Controller and System Shelves

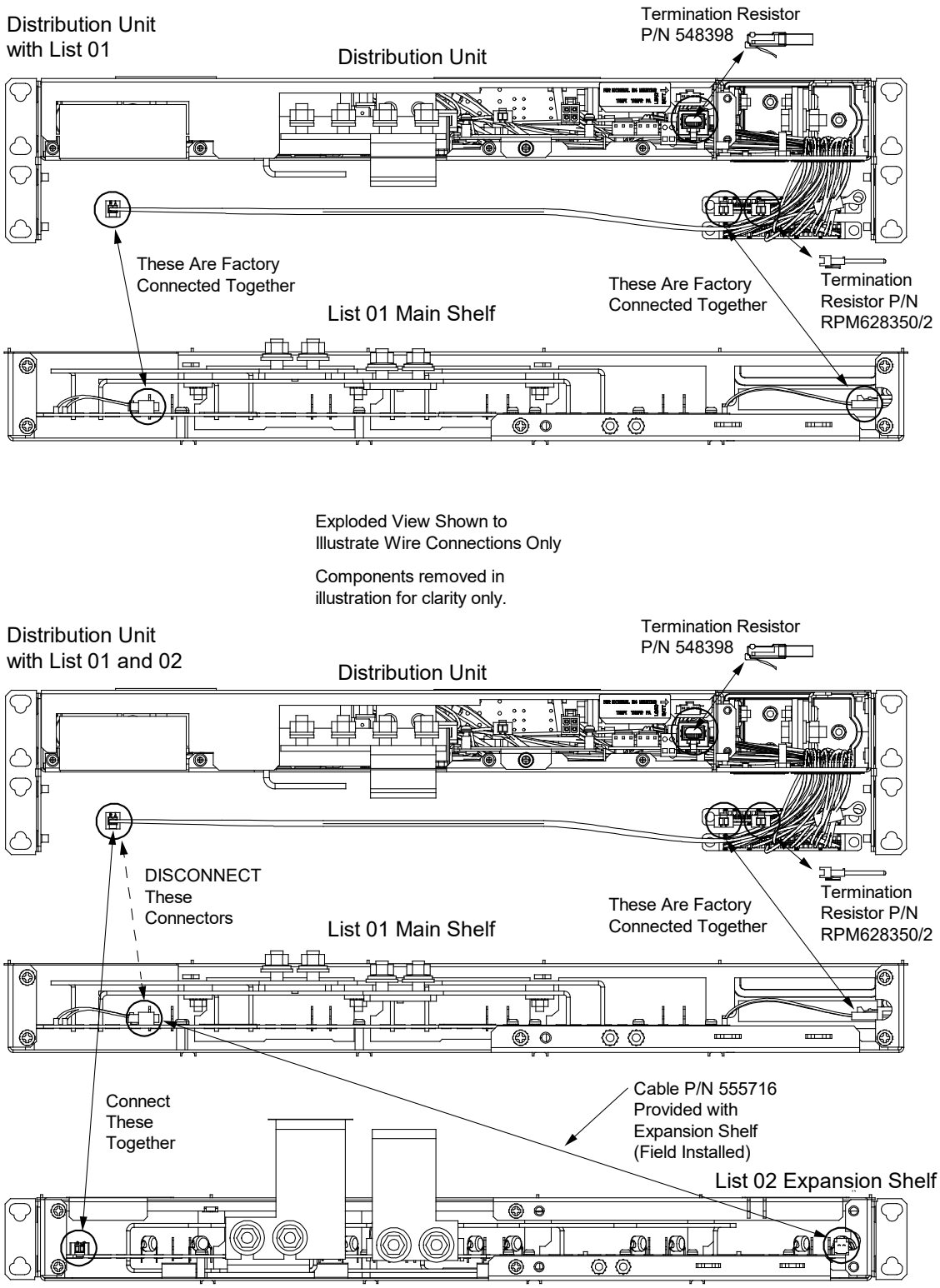
General

Each system shelf in the system is daisy-chained to the controller. NCU CAN bus connectors are located at the left and right rear of each rectifier shelf. These connectors are used to interconnect the shelf to the controller and to other shelves.

Refer to Figure 5.13 for connector locations and an interconnect diagram. These connections are factory made for shelves factory installed. For field expansion, the new shelf must be tied into the interconnect scheme as shown in Power System User Instructions UM582137200.

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Figure 5.13 Control Bus Connections between Controller and System Shelves



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5.10 Load Distribution Wiring, Input Battery Wiring, and CO Ground Wiring

WARNING! Check for correct polarity before making connections.

5.10.1 Load Distribution Wiring, Input Battery Wiring, and CO Ground Wiring To List BF and NF

Refer to Figure 5.14.

CO Ground Wiring

Refer to “Central Office Ground Connection” on page 38.

Load Distribution Wiring to GMT Fuse Blocks

Load and load return leads are connected to screw-type terminal blocks located on the front of the distribution unit. Refer to Figure 5.14 for terminal block wire size capacity and recommended torque.

Input Battery Wiring

Input battery and battery return leads terminated in two-hole lugs are connected to threaded studs located on the rear inside of the distribution unit. Refer to Figure 5.14 for stud size/spacing and recommended torque.

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5.10.2 Load Distribution Wiring, Input Battery Wiring, and CO Ground Wiring to List BC, LC, And NC

Refer to Figure 5.15.

CO Ground Wiring

Refer to “Central Office Ground Connection” on page 38.

Load Distribution Wiring to GMT Fuse Blocks

Load and load return leads are connected to screw-type terminal blocks located on the front of the distribution unit. Refer to Figure 5.15 for terminal block wire size capacity and recommended torque.

Load Distribution Wiring to Distribution Circuit Breakers

Load distribution and load return leads terminated in two-hole lugs are connected to threaded studs located on the front sides of the distribution unit. Refer to Figure 5.15 for stud size/spacing and recommended torque.

NOTE! *An insulated thin wall tool may be required to tighten these connections.*

Input Battery Wiring

Input battery and battery return leads terminated in two-hole lugs are connected to threaded studs located on the rear inside of the distribution unit. Refer to Figure 5.15 for stud size/spacing and recommended torque.

5.10.3 Load Distribution Wiring, Input Battery Wiring, and CO Ground Wiring to List BA And NA

Refer to Figure 5.16.

CO Ground Wiring

Refer to “Central Office Ground Connection” on page 38.

Load Distribution Wiring to GMT Fuse Blocks

Load and load return leads are connected to screw-type terminal blocks located on the front of the distribution unit. Refer to Figure 5.16 for terminal block wire size capacity and recommended torque.

Load Distribution Wiring to Distribution Circuit Breakers

Load distribution and load return leads terminated in two-hole lugs are connected to threaded studs located on the left front side (as viewed from the front) of the distribution unit. Refer to Figure 5.16 for stud size/spacing and recommended torque.

NOTE! *An insulated thin wall tool may be required to tighten these connections.*

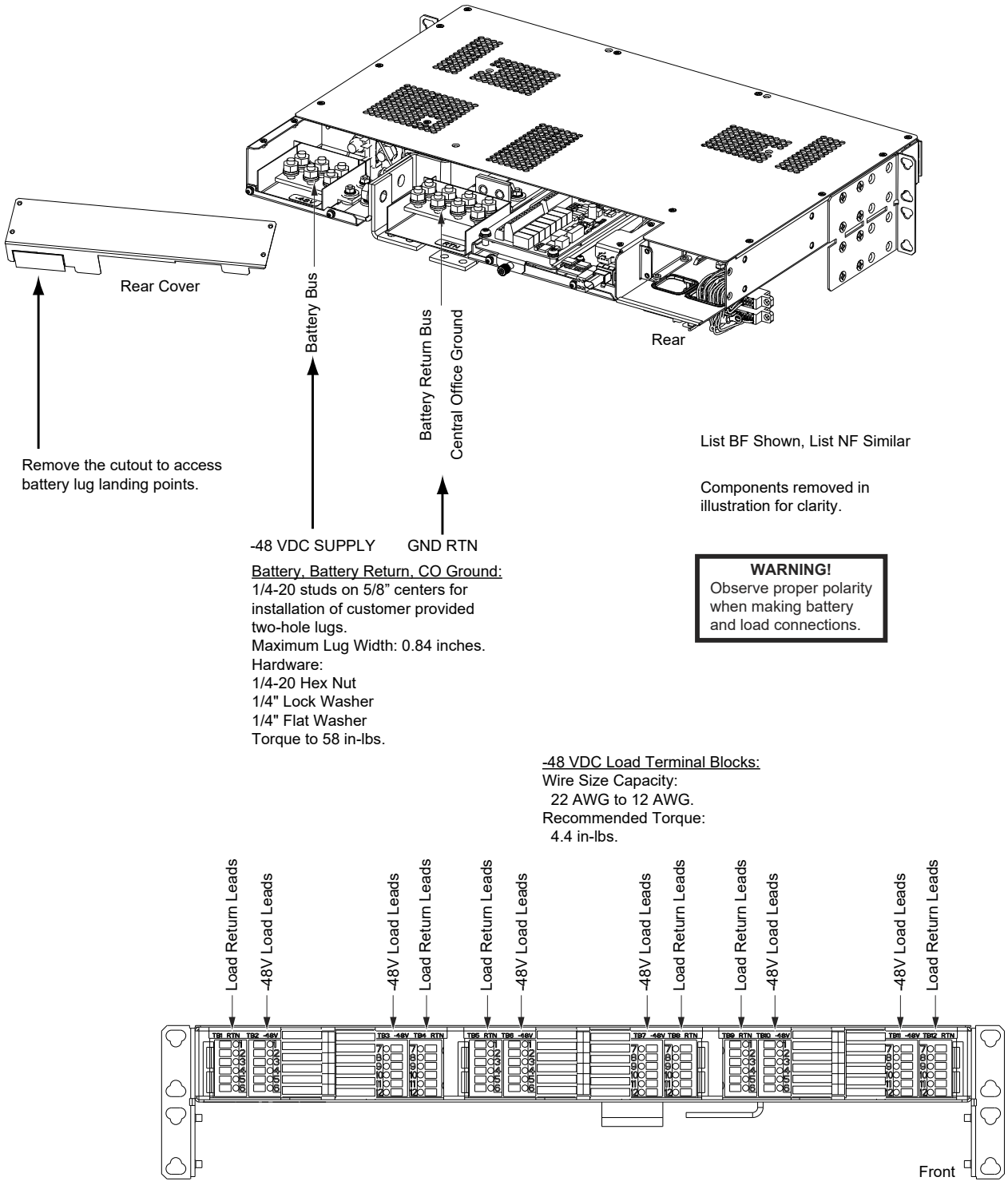
Input Battery Wiring to Distribution Circuit Breakers

Input battery and battery return leads terminated in two-hole lugs are connected to threaded studs located on the right front side (as viewed from the front) of the distribution unit. Refer to Figure 5.16 for stud size/spacing and recommended torque.

NOTE! *An insulated thin wall tool may be required to tighten these connections.*

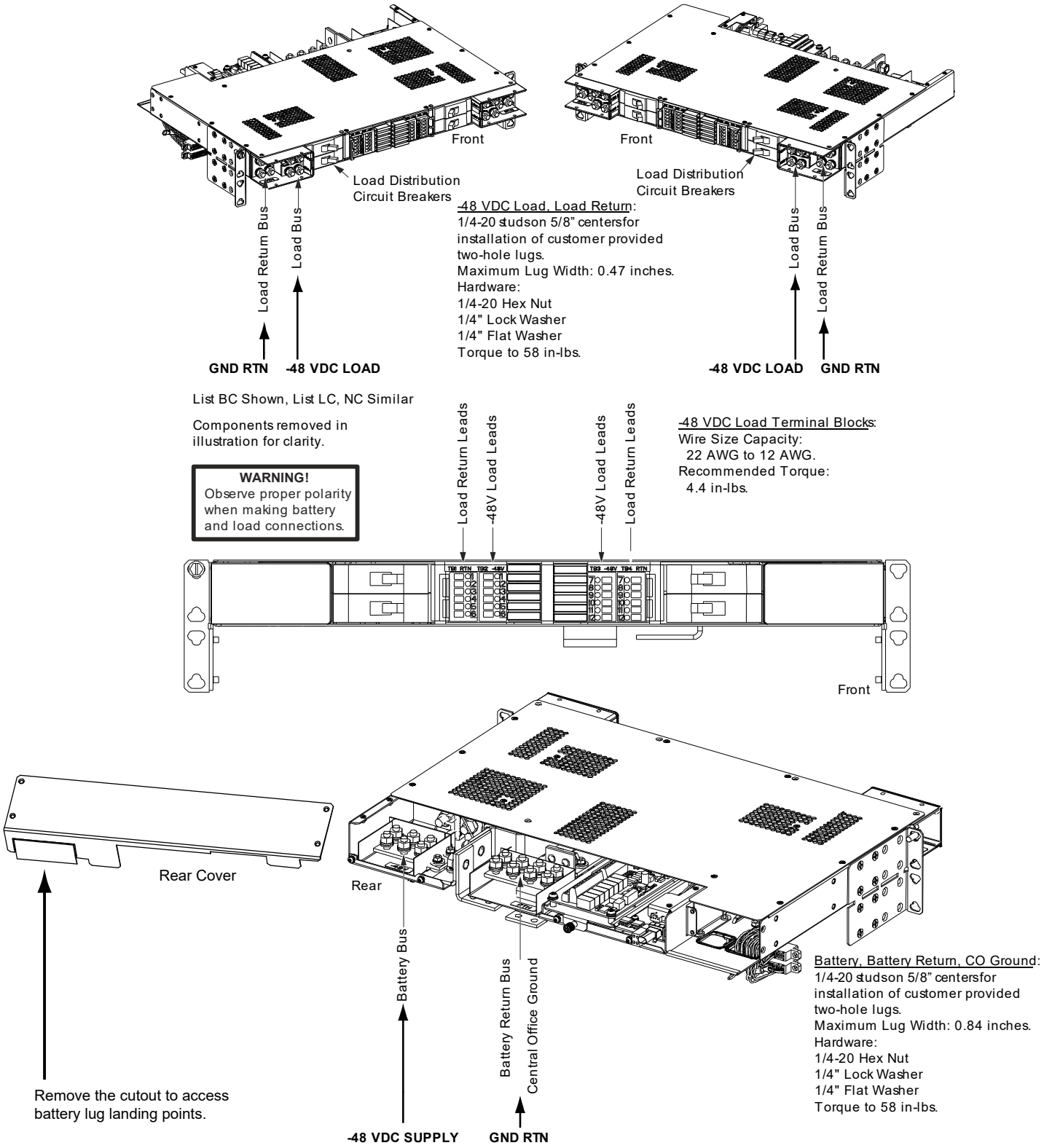
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Figure 5.14 Load Distribution Wiring, Input Battery Wiring, and CO Ground Wiring (Lists BF and NF)



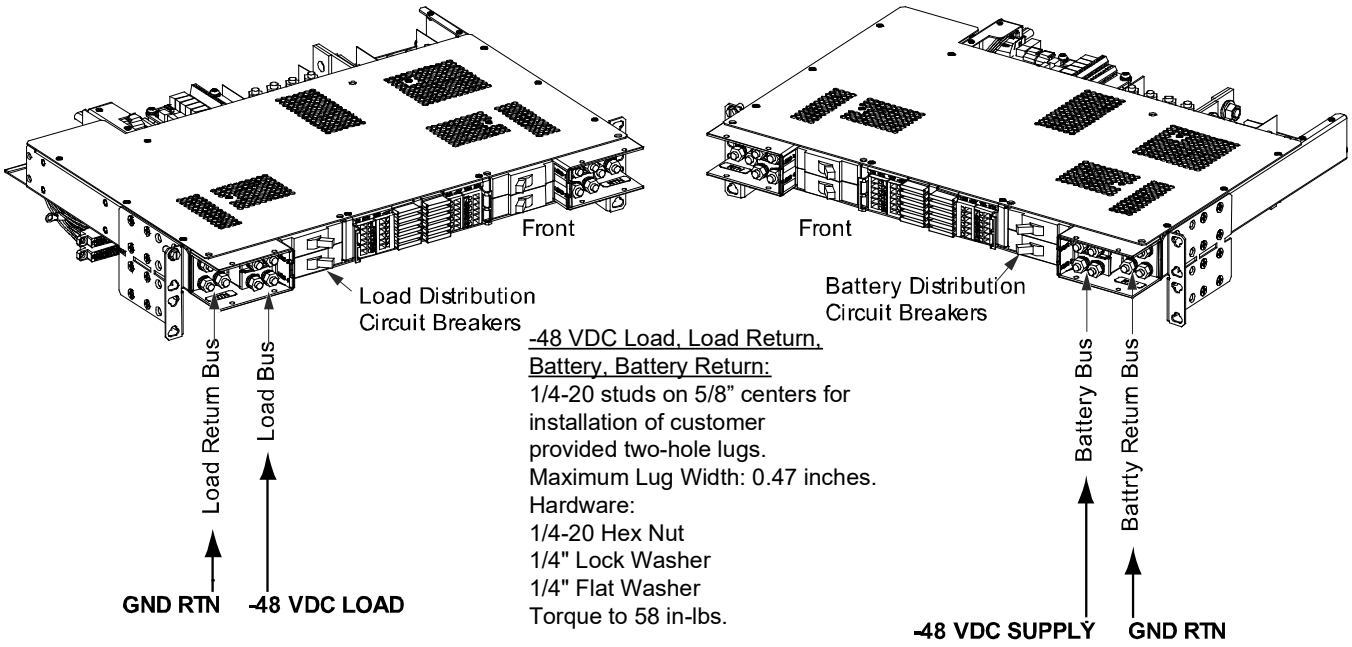
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Figure 5.15 Load Distribution Wiring, Input Battery Wiring, and CO Ground Wiring (Lists BC, LC and NC)



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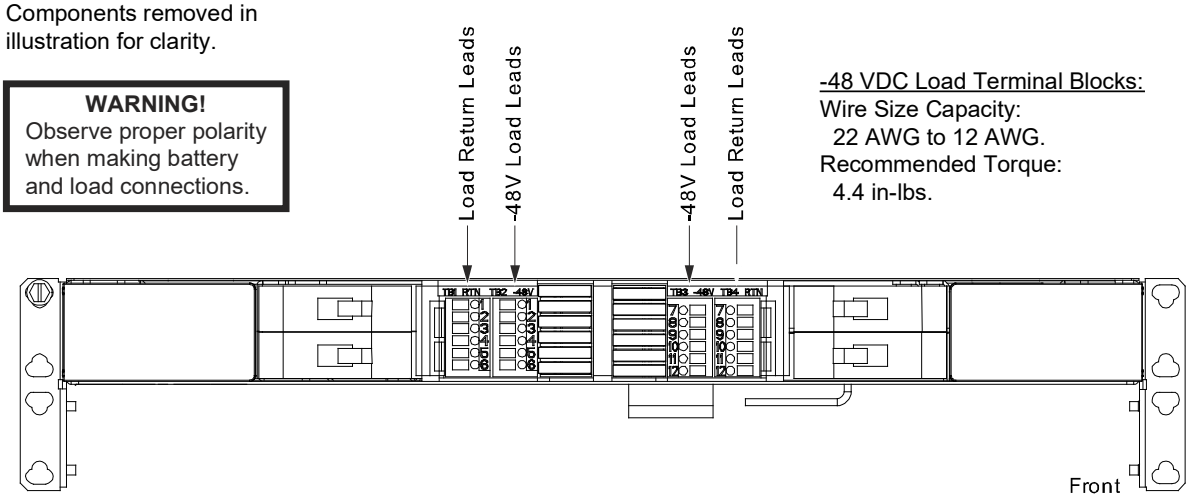
Figure 5.16 Load Distribution Wiring, Input Battery Wiring, and CO Ground Wiring (Lists BA and NA)



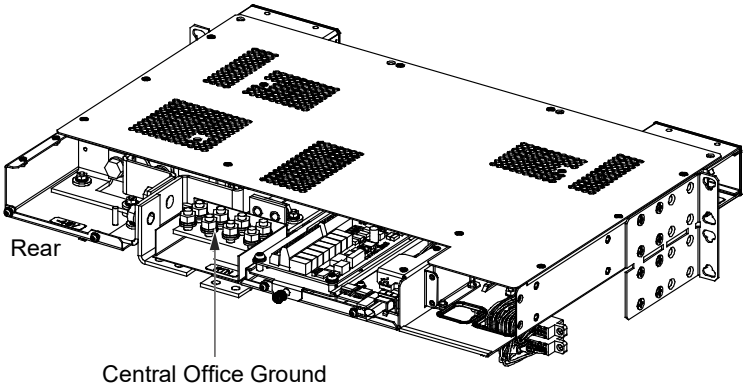
List BA shown, List NA similar.

Components removed in illustration for clarity.

WARNING!
Observe proper polarity when making battery and load connections.



-48 VDC Load Terminal Blocks:
Wire Size Capacity:
22 AWG to 12 AWG.
Recommended Torque:
4.4 in-lbs.



CO Ground:
1/4-20 studs on 5/8" centers for installation of customer provided two-hole lugs.
Maximum Lug Width: 0.84 inches.
Hardware:
1/4-20 Hex Nut
1/4" Lock Washer
1/4" Flat Washer
Torque to 58 in-lbs.

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5.11 Connecting to an Optional Battery Cabinet

Vertiv NetSure 211BC Battery Cabinet, P/N 541434

Refer to the battery cabinet instructions (Section 6023).

Vertiv NetSure 211BC Battery Cabinet, P/N 545534

Refer to the battery cabinet instructions (Section 6033).

Vertiv NetSure 211BC Battery Cabinet, P/N 554631

Refer to the battery cabinet instructions (UM554631).

5.12 Installing and Connecting Batteries in an Optional List 93 or 94 Battery Tray (if furnished)

Important Safety Instructions

DANGER! Adhere to the "Important Safety Instructions" starting on page vi.

Battery Manufacturer Information

Refer to System Application Guide SAG582137200 for specifications and manufacturers of batteries that can be installed in this power system. These are only suggested batteries. Other batteries may be used as approved by your company.

Installing and Connecting Batteries

Procedure

Tray P/N 559806 is used in the following procedure. The procedure for all other available trays is similar.

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

1. **If Battery Trays are Equipped with a Circuit Breaker:** Turn OFF the battery Disconnect circuit breaker located on all battery trays. Refer to Figure 5.17 for locations. Follow local lockout/tagout procedures to ensure circuit breakers remain in the off position during installation.
2. Remove the battery retention bracket as shown in Figure 5.17. To do so, remove the four 1/4-20 x 5/8" bolts and associated washers.
3. Slide batteries into the tray, with the battery terminals toward the front as shown in Figure 5.17. Slide batteries into the tray as far as they will go.

NOTE! *The battery retention bracket can be oriented two ways to accommodate batteries of different lengths. A correctly oriented bracket will fit snuggly against the batteries. If your batteries require the alternate bracket orientation shown in Detail A of Figure 5.17, remove and reinstall the bullet-shaped spacers (trays P/N 559806 and 559807 only) as shown in Detail A before performing the next step.*

4. Reinstall the battery retention bracket. The spacers on the bracket should separate the batteries from each other. Secure with the hardware removed in a previous step. Refer to Figure 5.17 for washer location.

NOTE! *The spacers on the bracket are used to accommodate the various sizes of batteries available. Install or remove the spacers as required so that the batteries are tight in the battery tray.*

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5. Connect three links supplied by the battery manufacturer between pairs of battery terminals as shown in Figure 5.17. Use hardware furnished by the battery manufacturer. Torque hardware to battery manufacturer's recommendations.
6. Ensure the battery cable ends in all trays are insulated with sleeving before performing the next step.

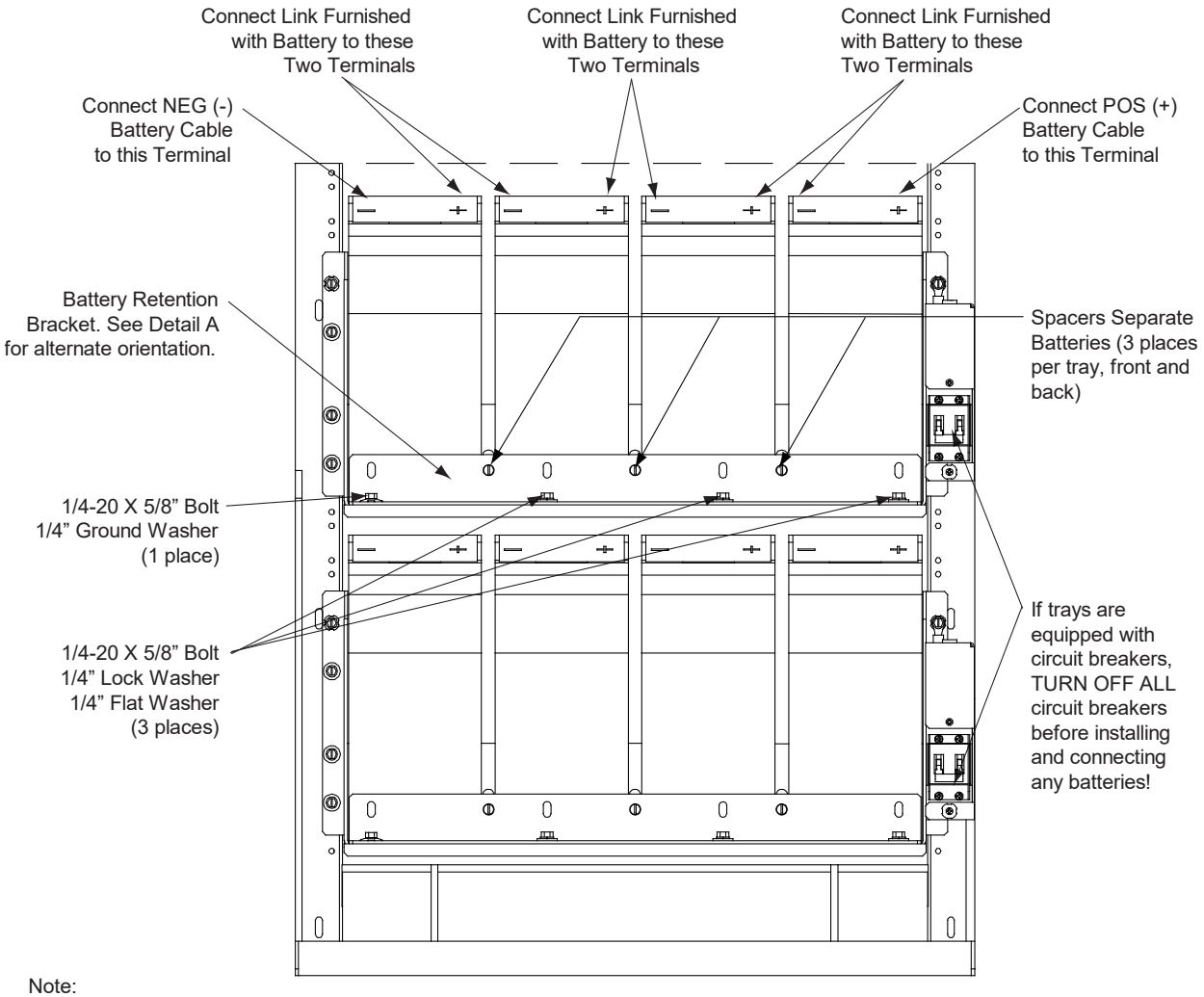
DANGER! In multiple-tray installations, when batteries in one tray are connected, the battery cables in all trays will be energized. Remove sleeving from and connect one cable at a time. Do not allow a cable end to contact the battery tray or equipment rack.

WARNING! In the next step, observe correct polarity. Connect only cables labeled "+" to battery terminals labeled "+". Likewise, connect only cables labeled "–" to battery terminals labeled "–".

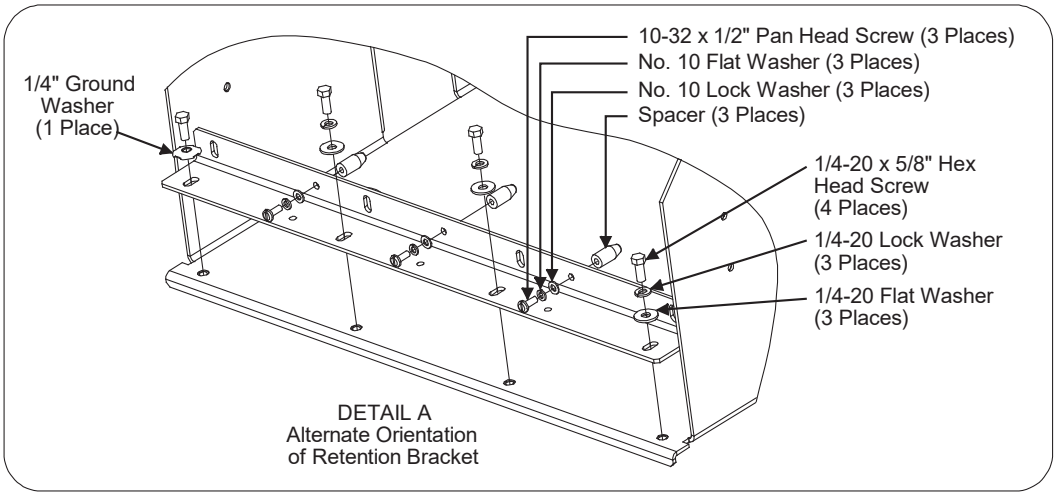
7. Connect the cables found in the battery tray to the battery terminals, "+" to "+" and "–" to "–". Observe correct polarity. Refer to Figure 5.17. Secure with hardware furnished with the battery. Torque hardware to battery manufacturer's recommendations.
8. Repeat steps 1 through 7 for any remaining battery trays.
9. **If Battery Trays Are Equipped With a Circuit Breaker:** To connect the batteries to the power system, turn ON the battery disconnect circuit breaker located on all battery trays.

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Figure 5.17 List 93 and 94 Battery Tray Battery Installation Details



Note:
1. Two trays shown as example.
2. Cabling detail omitted.



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6 Installing Rectifier Modules

Refer to the rectifier instruction manual 1R482000E3 for a rectifier installation procedure.

7 Initially Starting, Configuring, and Checking System Operation

CAUTION! Performing various steps in the following procedures may cause a service interruption and/or result in the extension of alarms. Notify any appropriate personnel before starting these procedures. Also, notify personnel when these procedures are completed.

7.1 Initial Startup Preparation

- Ensure that all blocks (except the last one) in the “Installation Acceptance Checklist” on page 1 have been checked.
- Ensure that rectifier mounting positions are filled by a rectifier module or a blank panel as required.
- Refer to the separate NCU User Manual supplied with your power system for complete controller operating information.
- Refer to the configuration drawing (C-drawing) supplied with your power system documentation for factory settings of adjustable parameters.

7.2 Initially Starting the System

Procedure

1. Apply battery power to the system by closing the external battery disconnect(s) or protective device(s) that supplies battery power to the system, if furnished. Close the system’s internal battery disconnect circuit breakers, if furnished.
2. Apply rectifier AC input power to the system by closing ALL external AC disconnects or protective devices that supply rectifier AC power to the rectifier mounting shelves. Rectifiers automatically start.
3. Place each distribution circuit breaker (if furnished) to the ON position.

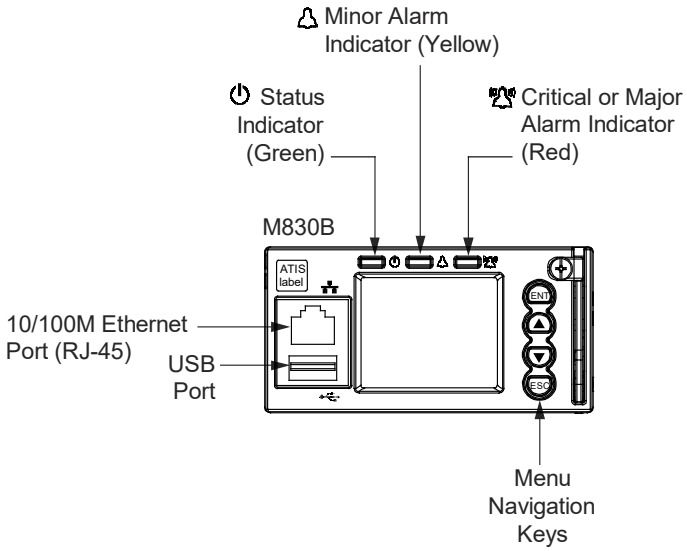
7.3 NCU Controller Initialization

Refer to the NCU Instructions (UM1M830BNA) for detailed instructions.

Refer to Figure 7.1 for locations of the NCU local indicators and navigation keys.

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Figure 7.1 NCU Local Indicators and Navigation Keys



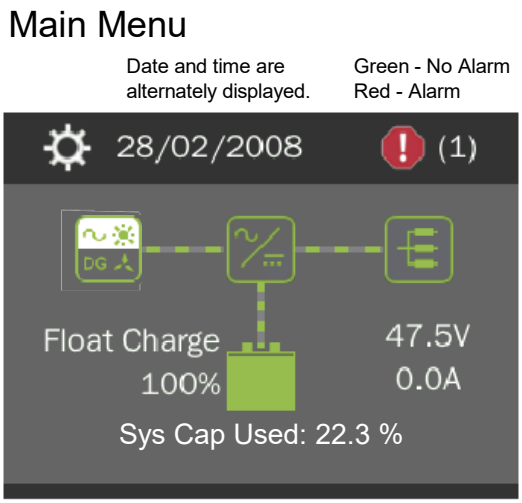
Procedure

NOTE! *The initialization routine takes several minutes. During that time various alarm indicators may illuminate on the NCU front panel and an audible alarm may sound. Disregard all alarms. An audible alarm can be silenced at any time by momentarily depressing the ENT key on the NCU Controller.*

1. After the NCU is powered on, the display shows the logo screen. The controller is initializing.
2. When initialization is complete, the language screen appears. Press the UP or DOWN arrow key to select the desired language. Press the ENT key to confirm the selection.
3. The Main Menu displays. See Figure 7.2.

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Figure 7.2 NCU Local Display Main Menu



Graphics	Menu Name	Description
	Alarm (Green - No Alarm) (Red - Alarm)	View active alarms and alarm history.
	Settings	Gain access to the NCU Controller's settings menus.
	Input Power	View AC, Solar, DG, and Wind related information.
	Module	View rectifier, solar converter, and converter module related information.
	DC	View DC equipments related information.
	Battery	View battery related information.

NOTE! *"Sys Cap Used" is based on the number of installed rectifiers and solar converters (if furnished).*

4. System information is displayed in multiple screens. Press the ESC key to view other system information. Press the down arrow key to view the next screen. Press the ESC key to return to the Main Menu.
5. From the Main Menu, press the UP and DOWN keys to highlight the desired Menu graphic in the Main Menu. Press the ENT key to enter the selected menu.

NOTE! *Repeatedly press the "ESC" key to return in reverse order level by level from any submenu until the Main Menu appears.*

6. Refer to the following procedures to verify and set the NCU controller as required for your application.

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7.4 Verifying and Setting the NCU Controller as Required for Your Application

Refer to the NCU Instructions (UM1M830BNA) for additional information.

Temperature Probes: Depending on if NCU temperature probe inputs are enabled or disabled in the NCU configuration, you may have to program the NCU for any temperature probes being used. Note that some temperature probe inputs may not be enabled by default. Refer to the C-drawing supplied with your system to determine if temperature probe inputs are enabled and pre-programmed. Refer to "Setting Temperature Sensors" in the "Common Tasks Performed via the Local Keypad and/or Web Interface" section of the NCU controller manual (UM1M830BNA) if temperature probe inputs require programming.

NOTE! *Verify the NCU temperature probe configuration if temperature probes are installed from the factory. Refer to the C-drawing supplied with your system.*

Refer also to "NCU Start Wizard" on page 74.

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

NCU Start Wizard

For initial startup, you can perform the Start Wizard from the local keypad and display to enter basic programmable parameters in one session. Refer to the "Start Wizard" section in the NCU Instructions (UM1M830BNA).

Verifying the Configuration File

Your NCU was programmed with a configuration file that sets all adjustable parameters. The version number of the configuration file can be found on the configuration drawing (C-drawing) that is supplied with your power system documentation, and on a label located on the NCU. You can verify that the correct configuration file has been loaded into your NCU by performing the following procedure.

Procedure

1. With the Main Menu displayed, press ESC. A screen displays the NCU name, serial number, IP number, software version, hardware version, and configuration version number.
2. Press ESC to return to the Main Menu.

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Checking Basic System Settings

Navigate through the controller menus and submenus to check system settings. You can adjust any parameter as required. Note that these settings can also be checked (and changed if required) via the WEB Interface. Refer also to "NCU Start Wizard" on page 74.



NOTE! *Repeatedly press the "ESC" key to return in reverse order level by level from any submenu until the Main Menu appears.*

Procedure

1. **To Select a Sub-Menu:**
   Press the UP and DOWN keys to highlight the desired sub-menu. Press the ENT key to enter the selected sub-menu.

2. **To Select a User:**
   To select a User, use the UP and DOWN keys to move the cursor to the Select User field. Press ENT. Use the UP and DOWN keys to select a User previously programmed into the NCU. Press ENT to select the User. Note that only Users programmed into the NCU are shown. Users are programmed via the Web Interface. The default User is admin.

3. **To Enter a Password:**
   If a password screen opens, a password must be entered to allow the User to make adjustments. To enter a password, use the UP and DOWN keys to move the cursor to the Enter Password field. Press ENT. Use the UP and DOWN keys to choose a character. Press ENT to accept and move to the next character. Continue this process until all characters are entered. Press ENT again to accept the password. The default password is 640275.

4. **To Change a Parameter:**
   Press the UP and DOWN keys to move up and down the list of parameters. Press ENT to select the parameter. Press the UP and DOWN keys to change the parameter. Press ENT to make the change. Press ESC to cancel the change.

5. Table 7.1 shows the menu navigation for some basic settings. Refer to the separate NCU Manual (UM1M830BNA) supplied with your power system for complete Local Display menus.

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Table 7.1 NCU Basic Settings Menu Navigation

Parameter	Menu Navigation
Date	Main Menu / Settings Icon / Sys Settings / Date.
Time	Main Menu / Settings Icon / Sys Settings / Time.
IP Communications Parameters (IP address, subnet mask address, gateway address)	Main Menu / Settings Icon / Comm Settings / enter parameters.
Float Voltage	Main Menu / Settings Icon / Batt Settings / Charge / Float Voltage.
Equalize Voltage	Main Menu / Settings Icon / Batt Settings / Charge / EQ Voltage.
Battery Current Limit	Main Menu / Settings Icon / Batt Settings / Charge / Curr Limit Mode and Batt Curr Limit.
Battery Capacity	Main Menu / Settings Icon / Batt Settings / Batt1 Settings or Batt2 Settings / Rated Capacity.
Reset Battery Capacity	Main Menu / Settings Icon / Batt Settings / Basic Settings / Reset Batt Cap
BTRM Feature	**Web Menu Navigation Only:** Settings Menu / Battery Tab.
Battery Charge Temperature Compensation	Main Menu / Settings Icon / Batt Settings / Temp Comp (enter parameters).
HVSD Limit	**Web Menu Navigation Only:** Settings Menu / Rectifiers Tab / HVSD (set to enabled) then set HVSD Limit.
Rectifier Current Limit	Main Menu / Settings Icon / Rect Settings / Current Limit (set to enabled) then set Curr Limit Pt.
Over Voltage Alarm 1	Main Menu / Settings Icon / Other Settings / Over Voltage 1.
Over Voltage Alarm 2	Main Menu / Settings Icon / Other Settings / Over Voltage 2.
Under Voltage Alarm 1	Main Menu / Settings Icon / Other Settings / Under Voltage 1.
Under Voltage Alarm 2	Main Menu / Settings Icon / Other Settings / Under Voltage 2.

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Changing Battery Capacity Rating in the NCU

NOTE! *After setting the battery capacity, the User should also reset the battery capacity (battery must be fully charged).*

1. Change the battery capacity setting of the NCU to match the battery connected to the power system.

   Local Menu Navigation:
   Main Menu / Settings Icon / Batt Settings / Batt1 Settings or Batt2 Settings / Rated Capacity.

   Web Menu Navigation:
   Settings Menu / Battery Tab / Batt1 Rated Capacity and Batt2 Rated Capacity.

2. Reset the battery capacity (resets the battery capacity calculation).

NOTE! *Only reset the battery capacity when the battery is fully charged; otherwise, the battery charge status may not be accurate.*

Local Menu Navigation:
Main Menu / Settings Icon / Batt Settings / Basic Settings / Reset Batt Cap.

Web Menu Navigation:
Settings Menu / Battery Tab / Reset Battery Capacity.

Refer to the NCU Instructions (UM1M830BNA) for detailed instructions.

Configuring the NCU Identification of Rectifiers and Assigning which Input Feed is Connected to the Rectifiers

When rectifiers are all installed prior to applying power and starting the system, the order in which the NCU identifies the rectifiers is by serial number (lowest serial number is Rect 1, next lowest is Rect 2, etc.). If you prefer the NCU to identify the rectifiers by position in the system, perform the following procedure.

Upon power up, the NCU arbitrarily assigns Feed AC1, AC2, or AC3 to each rectifier. This assignment is used to display rectifier AC input feed voltage(s). The User may reassign the feed to each rectifier per your specific installation by following the procedure below.

Local Menu Navigation:
None.

Web Menu Navigation:
Refer to the NCU Instructions (UM1M830BNA) for detailed instructions.

NCU Alarm Relay Check

The following procedures can be used to verify operation of the external alarm relays in a power system equipped with an NCU with the factory default configuration. Note that alarm relays on an NCU with a custom configuration may operate differently.

NOTE! *There are two methods to check alarm relays. The first is by actually causing an alarm. The second is by using the NCU alarm relay check function. The first method is used in the following procedures.*

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Checking the AC Fail Alarm

Procedure



NOTE! *Battery must be connected during this procedure.*

1. Verify system is operating and no alarms are present.
2. Verify the NCU displays the Main Menu. If not, press ESC repeatedly to return to the Main Menu.
3. Open the external AC disconnect(s) or protective device(s) that supply power to all of the rectifier modules.
   a) **Requirement:** An audible alarm sounds. Alarm will be silenced in Requirement d.
   b) **Requirement:** On subject rectifier module(s), the "Protection" indicator goes from off to yellow. After approximately 30 seconds, the green "Power" and yellow "Protection" indicators go off.
   c) **Requirement:** NCU "Critical/Major" alarm indicator goes from off to red.
   d) **Requirement:** NCU displays "Rect AC Fail" alarm.

      To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The Active Alarm screen lists two critical alarms. "**Power System CAN Comm Fail Critical**" is displayed. Scroll down by pressing the down arrow key. "**Rect Mains Failure Critical**" is displayed.
   e) **Requirement:** External "AC Fail" (Relay 6) and "Critical" (Relay 1) alarms activate.
4. Return external AC disconnect(s) or protective device(s) to the ON position.
   a) **Requirement:** "Power" indicator on subject rectifier modules goes from off to green.



NOTE! *A "Rect Group All Rect No Response" alarm may activate briefly.*

   b) **Requirement:** NCU "Critical/Major" alarm indicator goes from red to off.
   c) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays "No Alarm".
   d) **Requirement:** All external alarms deactivate.

Checking Rectifier Alarm

Procedure

1. Verify system is operating and no alarms are present.
2. Verify the NCU displays the Main Menu. If not, press ESC repeatedly to return to the Main Menu.
3. Pull one rectifier module half way out of the shelf. To do this, first loosen the captive fastener securing the top of the latch mechanism to the front of the rectifier module. Pull the top of the latch mechanism away from the rectifier module (this will retract the latch mechanism located on the underside of the rectifier module).
   a) **Requirement:** An audible alarm sounds. Alarm will be silenced in Requirement c.
   b) **Requirement:** NCU "Critical/Major" alarm indicator goes from off to red.

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c) **Requirement:** NCU displays “Alarm”.

To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The “Active Alarm” screen lists one major alarm. “**Rect (###) Comm Fail Major**” is displayed.

d) **Requirement:** External “Rectifier” (Relay 8) and “Major” (Relay 2) alarms activate.

NOTE! *If the system is equipped with only one rectifier, skip step 4.*

4. Pull a second rectifier module half way out of the shelf, as described in Step 3.

   a) **Requirement:** An audible alarm sounds. The alarm will cancel in Requirement c.

   b) **Requirement:** NCU “Critical/Major” alarm indicator stays red.

   c) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays “Alarm”.

   To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The Active Alarm screen lists one critical and two major alarms. “**Rect Group Multi-Rect Fail Critical**” is displayed. Use arrow keys to scroll through the list of alarms. “**Rect ### Comm Fail Majo**r” is displayed for each removed rectifier.

   d) **Requirement:** External “Rectifier” (Relay 8) and “Major” (Relay 2) alarms remain in alarm state and “Critical” (Relay 1) alarm activates.

5. Reinstall the rectifier module(s).

   a) **Requirement:** “Power” indicator on subject rectifier(s) goes from off to green.

   b) **Requirement:** NCU “Critical/Major” alarm indicator goes from red to off.

   c) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays “No Alarm”.

   d) **Requirement:** All external alarms deactivate.

Checking System Over Voltage Alarm 1 and Over Voltage Alarm 2

1. Verify system is operating and no alarms are present.
2. Verify the NCU displays the Main Menu. If not, press ESC repeatedly to return to the Main Menu.
3. Record the system voltage displayed on the NCU Main screen.
4. Navigate to the Settings Menu.
5. With the Settings menu screen displayed, navigate to “Over Voltage 1”. Main Menu / Settings Icon / Other Settings / Over Voltage 1. Record the displayed voltage setpoint.
6. Press the Enter (ENT) key; then use the UP or DOWN keys to adjust the “Over Voltage 1” value to below the system voltage recorded in step 3. Press ENT.

   a) **Requirement:** An audible alarm sounds. The alarm will be silenced in Requirement c.

   b) **Requirement:** NCU “Critical/Major” alarm indicator goes from off to red.

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c) **Requirement:** Press ESC repeatedly to return to the Main Menu. NCU displays "Alarm".

To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The Active Alarm screen lists one critical alarm. "**Power System Over Voltage 1 Critical**" is displayed.

d) **Requirement:** External "DC Over Voltage 1" (Relay 3) and "Critical" (Relay 1) alarms activate.

7. Without readjusting the "Over Voltage 1" setpoint, navigate to "**Over Voltage 2**". Main Menu / Settings Icon / Other Settings / Over Voltage 2. Record the displayed voltage setpoint.
8. Press the Enter (ENT) key; then use the UP or DOWN keys to adjust the "Over Voltage 2" value to below the system voltage recorded in step 3. Press ENT.

a) **Requirement:** An audible alarm sounds. Alarm will be silenced in Requirement d.

b) **Requirement:** NCU "Critical/Major" alarm indicator stays red.

c) **Requirement:** Press ESC repeatedly to return to the Main Menu. NCU displays "Alarm".

To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The Active Alarm screen lists two critical alarms. "**Power System Over Voltage 2 Critical**" is displayed. Use arrow keys to scroll through the list of alarms. "**Power System Over Voltage 1 Critical**" is displayed.

d) **Requirement:** External "DC Over Voltage 1" (Relay 3) alarm and "Critical" (Relay 1) alarm remain active.

9. Navigate to "Over Voltage 2". Main Menu / Settings Icon / Other Settings / Over Voltage 2.
10. Press ENT; then use the UP or DOWN keys to adjust the "Over Voltage 2" setting to the value recorded in step 7. Press ENT.

NOTE! *Over Voltage 2 alarm will retire. The audible alarm will be silenced in the next step.*

11. Use the UP or DOWN keys to scroll up to "**Over Voltage 1**".
12. Press ENT; then use the UP or DOWN keys to adjust the "Over Voltage 1" setting to the value recorded in step 5. Press ENT.

a) **Requirement:** NCU "Critical/Major" alarm indicator goes from red to off.

b) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays "No Alarm".

c) **Requirement:** All external alarms deactivate.

Checking System Under Voltage Alarm 1 and Under Voltage Alarm 2

1. Verify system is operating and no alarms are present.
2. Verify the NCU displays the Main Menu. If not, press ESC repeatedly to return to the Main Menu.
3. Record the system voltage displayed on the NCU Main screen.
4. Navigate to the Settings Menu.
5. With the Settings Menu screen displayed, navigate to "**Under Voltage 1**". Main Menu / Settings Icon / Other Settings / Under Voltage 1. Record the displayed voltage setpoint

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6. Press the Enter (ENT) key; then use the UP or DOWN keys to adjust the “Under Voltage 1” value to above the system voltage recorded in step 3. Press ENT.

   a) **Requirement:** An audible alarm sounds. The alarm will be silenced in Requirement c.

   b) **Requirement:** NCU “Critical/Major” alarm indicator goes from off to red.

   c) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays “Alarm”.

      To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The Active Alarm screen lists one critical alarm. “**Power System Under Voltage 1 Critical**” is displayed.

   d) **Requirement:** External “DC Under Voltage 1” (Relay 4) and “Critical” (Relay 1) alarms activate.

7. Without readjusting the “Under Voltage 1” setpoint, navigate to “**Under Voltage 2**”. Main Menu / Settings Icon / Other Settings / Under Voltage 2. Record the displayed voltage setpoint.

8. Press the Enter (ENT) key; then use the UP or DOWN keys to adjust the “Under Voltage 2” value to above the system voltage recorded in step 3. Press ENT.

   a) **Requirement:** An audible alarm sounds. Alarm will be silenced in Requirement c.

   b) **Requirement:** NCU “Critical/Major” alarm indicator stays red.

   c) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays “Alarm”.

      To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The Active Alarm screen lists two critical alarms. “**Power System Under Voltage 2 Critical**” is displayed. Use arrow keys to scroll through the list of alarms. “**Power System Under Voltage 1 Critical**” is displayed.

   d) **Requirement:** External “DC Under Voltage 2” (Relay 5) alarm activates, “DC Under Voltage 1” (Relay 4) alarm resets, and “Critical” (Relay 1) alarm remains active.

9. Navigate to “**Under Voltage 2**”.

10. Press ENT; then use the UP or DOWN keys to adjust the “Under Voltage 2” setting to the value recorded in step 7. Press ENT.



NOTE! *Low Voltage 2 alarm will retire. The audible alarm will be silenced in the next step.*

11. Use the UP or DOWN keys to scroll up to “**Under Voltage 1**”.

12. Press ENT; then use the UP or DOWN keys to adjust the “Under Voltage 1” setting to the value recorded in step 5. Press ENT.

   a) **Requirement:** NCU “Critical/Major” alarm indicator goes from red to off.

   b) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays “**No Alarm**”.

   c) **Requirement:** All external alarms deactivate.

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Checking Circuit Breaker/Fuse Alarm



NOTE! *For all shelves equipped with battery disconnect circuit breakers, an open battery disconnect circuit breaker will not activate the fuse/circuit breaker alarm unless a battery (or a temporary test load) is connected to the system battery terminals. The battery fuse input is looking for a delta voltage across a battery circuit breaker to activate the alarm. You will not have a reference if there is no battery (or a temporary test load) connected.*

1. Verify system is operating and no alarms are present.
2. Verify the NCU displays the Main Menu. If not, press ESC repeatedly to return to the Main Menu.
3. Open the front door of the distribution unit at the right-hand side of the shelf.



NOTE! *The following procedure is to be used only with circuit breakers that provide an alarm indication when manually placed to the OFF (open) position (black handle). Electrical trip alarm circuit breakers (white handle) cannot be easily tested in the field.*

4. Do one of the following: (1) Remove a good fuse or a dummy fuse from a GMT fuse position, and replace it with a blown fuse, or (2) Place the handle (if black) of a load circuit breaker in the OFF (open) position.
   a) **Requirement:** An audible alarm sounds. The alarm will be silenced in Requirement c.
   b) **Requirement:** NCU "Critical/Major" alarm indicator goes from off to red.
   c) **Requirement:** NCU displays "**Alarm**".

      To see the specific alarm(s), navigate to the Alarm Menu and press **ENT**. The Active Alarm screen lists one critical alarm. "**Power System Load Fuse Brkr Critical**" is displayed.
   d) **Requirement:** External "Fuse/Circuit Breaker Alarm" (Relay 7) and "Critical" (Relay 1) alarms activate.
5. Do one of the following: (1) Replace the blown GMT fuse with a known good fuse (or a dummy fuse), or (2) place the handle of the circuit breaker in the ON (closed) position.
   a) **Requirement:** NCU "Critical/Major" alarm indicator goes from red to off.
   b) **Requirement:** Press ESC repeatedly to return to the Main screen. NCU displays "**No Alarm**".
   c) **Requirement:** All external alarms deactivate.

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7.5 Checking System Status

Procedure

1. Observe the status of the indicators located on the controller, rectifiers, solar converters, and -48 VDC to +24 VDC converters (if furnished). If the system is operating normally, the status of these is as shown in Table 7.2.

Table 7.2 Status and Alarm Indicators

Component	Indicator		Normal State
NCU		Status (Green)	On
		Minor Alarm (Yellow)	Off
		Critical or Major Alarm (Red)	Off
Rectifier Modules		Power (Green)	On
		Protection (Yellow)	Off
		Alarm (Red)	Off

7.6 Final Steps

Procedure

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

NOTE! *Provided on a USB drive furnished with the system is a controller configuration drawing (C-drawing) and the controller configuration files loaded into the controller as shipped.*

2. Verify all rectifier modules and the controller are fully seated, latched, and the latch handle screws secured.

3. Verify there are no external alarms and the local indicators are as shown in Table 7.2.

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