an EnerSys® company

Cordex® CXPS-E105

225 A Edge Power Systems

User Guide ID: 0922001-J0
Effective: 03/2023

Read this document carefully.
Learn how to protect your equipment from damage and fully understand its functions.

Cordex® CXPS-E105
225 A Edge Power Systems

NOTICE

For the latest version of software, firmware, and product documentation, visit the Alpha® website, www.alpha.com or www.alpha.ca.

NOTICE

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

NOTICE

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

NOTICE

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

Copyright notice

Contents

Figures

1. Safety

Save these instructions

This document contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this document before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies Ltd. or the nearest Cordex® power system representative.

1.1 Safety symbols

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

Symbol	Type	Description
	**WARNING**	Risk of serious injury or death Equipment in operation poses a potential electrical hazard which could result in serious injury or death to personnel. This hazard may continue even when power is disconnected.
	**CAUTION**	Cautions indicate the potential for injury to personnel.
	**CAUTION**	Risk of burns A device in operation can reach temperature levels which could cause burns.
	**ATTENTION**	The use of attention indicates specific regulatory or code requirements that may affect the placement of equipment or installation procedures. Follow the prescribed procedures to avoid equipment damage or service interruption.
	**GROUNDING**	This symbol indicates the location or terminal intended for the connection to protective earth. An enclosure that is not properly connected to protective earth presents an electrical hazard. Only a licensed electrician can connect AC power and protective earth to the enclosure.
	**NOTICE**	A notice provides additional information to help complete a specific task or procedure or general information about the product.
	**OPERATING INSTRUCTIONS**	Operating instructions

1.2 General warning and cautions

WARNING

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

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

1.3 Electrical safety

WARNING

Hazardous voltages are present at the input of power systems.

The DC output from rectifiers, though not dangerous in voltage, has a high short-circuit current capacity that can cause severe burns and electrical arcing. Do not touch the output connections or the bullet terminal in distribution panel when under power. Ensure that power has been removed from the outputs before working on them.

The DC output from converters is a potentially hazardous voltage. Do not touch the output connections when under power. Ensure that power has been removed from the outputs before working on them.

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

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

WARNING

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

- Do not work alone under hazardous conditions.
- A licensed electrician is required to install permanently wired equipment. Input voltages can range up to 480 Vac. Ensure the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.

WARNING

High leak and touch current

Earth connection is essential before connecting the supply.

1.4 Battery safety

- Servicing and connection of batteries must be performed by, or under the direct supervision of, personnel knowledgeable of batteries and the required safety precautions.
- Always wear eye protection, rubber gloves, and a protective vest when working near batteries. Remove all metallic objects from your hands and neck.
- Use OSHA approved insulated hand tools. Do not rest tools on top of batteries.
- Batteries contain or emit chemicals known to cause cancer and birth defects or other reproductive harm. Battery post terminals and related accessories contain lead and lead compounds. Wash your hands after handling batteries.

WARNING

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

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

ATTENTION

Battery safety data sheets

Read the battery safety data sheet (SDS) before installing batteries in the power system. The SDS provides important information including hazard identification, first aid measures, handling and storage, and PPE.

2. Introduction

2.1 Document scope

This document covers the features, options, installation, and startup of Cordex® CXPS-E105 edge power systems. Images contained in this document are for illustrative purposes only and may not exactly match your installation. To assist with installation, refer to the drawings at the end of this document.

In addition to this document, the following may be included in the documentation package that ships with Cordex® CXPS-E105 edge power systems:

- Cordex® CXC HP controller software user guide (0350058-J0)
- Cordex® CXDM-E1 DC distribution panel user guide (0200066-J0)
- Cordex® HP 2.4/3.0 kW rectifier and shelf user guide (0100037-J0)

2.2 Product overview

Cordex® CXPS-E105 edge power systems are complete integrated 48 Vdc power systems. Each system uses the advanced Cordex® CXCi HP controller and Cordex® HP 2.4 kW or 3.0 kW rectifier modules. The Cordex® CXDM-E1 1RU 225 A distribution panel provides front access for DC distribution circuit breakers.

Cordex® HP rectifier modules use a high frequency, switched mode conversion technique to provide a fully regulated and isolated DC output from the AC mains. The rectifier input accepts a wide range of input voltages, allowing the flexibility to connect to supply mains rated 120/208-277 Vac and 50/60 Hz. The system has derated output below 187 Vac input.

The rectifier power modules are hot swappable meaning they can be inserted or removed from the shelf without cutting power to or from the system or the load. Rectifier modules are not included with the base system, but may be purchased along with the system at the time of ordering or added after the shelf has been installed. The shelf rectifier system includes the system controller.

The system controller allows the user to configure, monitor, and control the entire DC power system locally or remotely via a web browser. Features of the unit include temperature compensation, auto equalization, remote access, email alarm notification, battery diagnostics, as well as web server and SNMP support for configuration and monitoring.

Details of the controller operation are provided in the software documentation.

Figure 1: Front view of the Cordex® CXPS-E105 225 A edge power system (19-inch)

2.3 System configurations

The following configurations are currently available for Cordex® CXPS-E105 edge power systems.

Table A — Cordex® CXPS-E105 edge power system configurations

Rack size	Current rating	Rectifier capacity	Load breakers	Battery breakers	Shunt	LVBD	Height
19-/23-inch	187.5 A max.	3 x 2.4 kW	10	2	250 A	225 A	2RU
		3 x 3.0 kW					
23-inch	200 A max.	4 x 2.4 kW	10	2	250 A	225 A	2RU
		4 x 3.0 kW					

2.3.1 Three module position shelf with Cordex® CXCi HP controller and IEC input connectors (PN: 0922001-001)

- Cordex® CXDM-E1 high density 1U 225 A DC distribution panel
- Cordex® CXCi HP system controller
- Cordex® HP 2.4/3.0 kW rectifier shelf
- Top and bottom rear Kydex covers
- User switchable 19-inch rack mount bracket for flush or center mount
- 19-inch to 23-inch rack mount adapters
- IEC C20 receptacles

2.3.2 Three module position shelf with Cordex® CXCi HP controller and TB input connectors (PN: 0922001-002)

- Cordex® CXDM-E1 high density 1U 225 A DC distribution panel
- Cordex® CXCi HP system controller
- Cordex® HP 2.4/3.0 kW rectifier shelf
- Top and bottom rear Kydex covers
- User switchable 19-inch rack mount bracket for flush or center mount
- 19-inch to 23-inch rack mount adapters

2.3.3 Four module position shelf with Cordex® CXCi HP controller and TB input connectors (PN: 0922001-003)

- Cordex® CXDM-E1 high density 1U 225 A DC distribution panel
- Cordex® CXCi HP system controller
- Cordex® HP 2.4/3.0 kW rectifier shelf
- Top and bottom rear Kydex covers
- User switchable 23-inch rack mount bracket for flush or center mount

NOTICE

Rectifier modules, DC distribution breakers, temperature sensors, and AC input cables are not included in the basic configuration.

2.4 Product part numbers

Product	Part number
Modules	
Cordex® HP 2.4 kW rectifier	0100003-001
Cordex® HP 3.0 kW rectifier	0100037-001
Cordex® CXCi HP controller (card edge version)	0180053-002
Temperature sensors	
Temperature sensor assembly, 1/4 inch lug, 1.8 m (6 ft)	747-028-20-071
Temperature sensor assembly, 1/4 inch lug, 3.6 m (12 ft)	747-028-20-072
Temperature sensor assembly, 3/8 inch lug, 1.8 m (6 ft)	747-082-20-071
Temperature sensor assembly, 3/8 inch lug, 3.6 m (12 ft)	747-082-20-072
Bracket kit	
2-pole bracket kit	0370298-001
Battery breakers	
100 amp, 80 Vdc, series-trip, plug-in style, 5/16 inch bullet terminals, 1-pole	470-347-10
125 amp, 80 Vdc, series-trip, plug-in style, 5/16 inch bullet terminals, 1-pole	4700187
200 amp, 80 Vdc, series-trip, plug-in style, 5/16 inch bullet terminals, 2-pole	4700153
Blanking plate	
2.4/3.0 kW module blanking plate	7400424-001
Replacement fan	
Fan assembly replacement	5000050

3. Specifications

3.1 Cordex® CXPS-E105 225 A edge power systems

Table B — Cordex® CXPS-E-105 225 A edge power system specifications

Electrical Input specifications		
	Cordex® HP 3.0 kW rectifier systems	**Cordex® HP 2.4 kW rectifier systems**
Input voltage	208 to 277 Vac (nominal)	
	208 to 250 Vac (nominal) IEC option	
	90 to 187 Vac (derated)	
Input frequency	45 to 66 Hz	
Input current (per module)	15.5 A max. (nominal)	
	14.2 A max. (derated)	
System AC requirements	**19-inch systems:** 3 × 20 A feeds	
	23-inch systems: 1 × 40 A feeds or 2 × 20 A feeds	
Power factor	>98% (50 to 100% load)	>99% (50 to 100% load)
Output specifications		
Output voltage	–48 Vdc (nominal)	
	–42 to –58 Vdc (range)	
Output power	**19-inch systems:** 9,000 W max.	
	23-inch systems: 10,800 W max. or 9,600 W max. continuous to load	
Output current	**19-inch systems:** 187.5 A max.	
	23-inch systems: 225 A max. or 200 A max. continuous to load	
Characteristics		
	Cordex® HP 3.0 kW rectifier systems	**Cordex® HP 2.4 kW rectifier systems**
Efficiency	>96.5%	96.2%
Acoustic noise	<55 dBa Measured at 1m (3 ft.) and 30°C (86°F)	<60 dBa Measured at 1m (3 ft.) and 30°C (86°F)
Static load regulation	<±0.5%	<±0.7%
Dynamic load regulation (40 to 90%, 90 to 40%)	≤±3.0% for any load change within rated limits	
Static line regulation	<±0.1%	
Temperature stability	≤100 ppm/°C (55.6 ppm/°F) over operating temperature	
Time stability	≤0.2% per year	
Electrical noise (nominal voltages)		
	Cordex® HP 3.0 kW rectifier systems	**Cordex® HP 2.4 kW rectifier systems**
Voice band	<53 dBrnC	<38 dBrnC
Wide band 10 kHz to 10 MHz	<260 mVrms	<20 mVrms
Wide band 10 kHz to 100 MHz	<180 mVpk-pk	<150 mVpk-pk
Psophometric	<2 mV RMS	

Features	
Rectifiers	Cordex® HP 3.0 kW rectifier (option)
	Cordex® HP 2.4 kW rectifier (option)
Controller	Cordex® CXCi HP system controller
Distribution	• 10 × plug-in load breaker positions • 2 × battery breaker positions • 225 A low voltage disconnect • 250 A battery shunt
Adjustments	• Output voltage • High voltage alarm • Low voltage alarm • High voltage shutdown • Start delay timer
Protection	• Current limit/short circuit • Startup delay • Input/output fuses • Output high voltage shutdown • Power limiting • Over-temperature
LEDs	
Module	**Steady green:** AC input OK (module)
	Steady green: DC output OK (module)
	Steady red: Module fail (module)
Distribution	**Steady green:** Power OK (distribution)
	Steady yellow: LVD inhibit (distribution)
	Steady red: Breaker alarm (distribution)
Mechanical	
Mounting	Flush or center mount
Dimensions (H × W × D)	**19-inch systems:** 133 x 482 x 476 mm (3.5 x 19 x 18.75 in.)
	23-inch systems: 133 x 584 x 476 mm (3.5 x 23 x 18.75 in.)
Hot positions	12 × sets of 1/4 inch studs on 5⁄8 inch centers
Return positions	13 × sets of 1/4 inch studs on 5⁄8 inch centers
Weight (system)	**19-inch systems:** 18.3 kg (40.4 lb)
	23-inch systems: 19.5 kg (43.1 lb)
Weight (rectifier)	1.83 kg (4.04 lb)
Access	Front access after installation
Environmental	
Temperature[1]	**Operation:** –40 to 30°C (–40 to 86°F) 200 A max. –40 to 40°C (–40 to 104°F) 160 A max.
	Storage: –40 to 85°C (–40 to 185°F)
Relative humidity	0 to 95% non-condensing
Elevation	Up to 2,800 m (9,186 ft)
Cooling	Fan-cooled (front to rear)
Heat dissipation	**19-inch systems:** 514 Watts (1,755 BTU/h) worst case
	23-inch systems: 684 Watts (2,334 BTU/h) worst case

[1] Operation temperature range is for applications without active cooling.

Agency compliance	
Safety	CSA 22.2 No. 62368-1 Ed. 2
	UL 62368-1 Ed. 2
	IEC/EN 62368-1 Ed. 2
EMC	FCC CFR 47 PART 15/B – Class A
	CAN ICES-003(A)/NMB-003(A)
	ETSI 300 386 V1.6.1
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.	

4. Features

4.1 Cordex® CXDM-E1 DC distribution panel

The Cordex® CXDM-E1 DC distribution panel is an integrated 1RU DC system distribution panel designed for small to mid-sized power applications.

All distribution cables are connected with two-hole termination lugs. The system has 10 positions for mid-trip type load breakers, at up to 100 amps per position, and two positions for series-trip type plug-in battery breakers at 125 amps maximum per single pole position or one 200 amp two pole.

A battery current shunt and low voltage battery disconnect are factory installed. A terminal block is provided on the rear of the distribution panel to communicate with the Cordex® CXCi HP controller integrated in the Cordex® HP 2.4/3.0 kW rectifier shelf.

The distribution panel has rear busbars for rectifier input for either cabling or busbar connections for system integration with Cordex® HP rectifier shelves.

4.1.1 Distribution panel status indicators

The LEDs, located on the front panel, indicate the following information:

Table C — Status indicators

POWER (green)	Power to the shelf
INHIBIT (yellow)	LVD switch in override
ALARM (red)	Breaker tripped

4.1.2 Distribution configurations

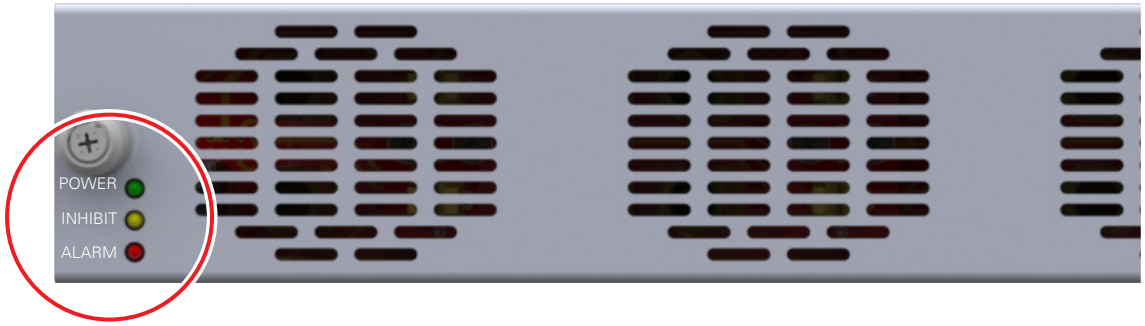


Figure 2: Front panel status indicators

The Cordex® CXDM-E1 distribution panel contains 12 plug-in breaker positions with two-hole lug connection points for both breaker output and the return bus. The breaker distribution is configured as 10 load breaker positions and two battery breaker positions.

NOTICE

Use mid-trip plug-in bullet style breakers as load breakers, and series-trip plug-in bullet style breakers as battery breakers.

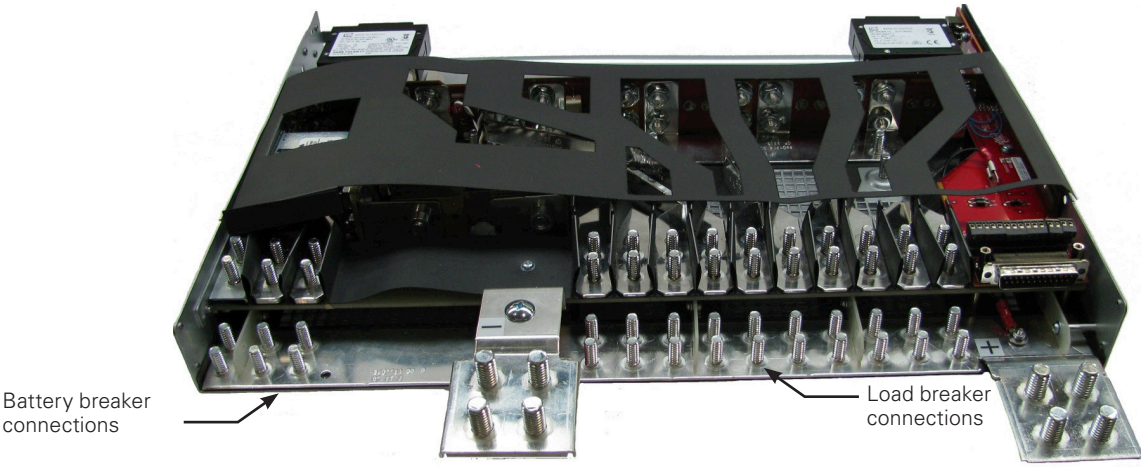


Figure 3: Cordex® CXDM-E1 distribution panel rear output connections

4.1.3 Low voltage battery disconnect

A 225 amp low voltage battery disconnect (LVBD) is installed in series with the batteries. The LVBD override switch is located behind the front panel, which can be removed by loosening the thumbscrews. The switch can then be used to override LVBD contactor operation as a safeguard during controller maintenance.

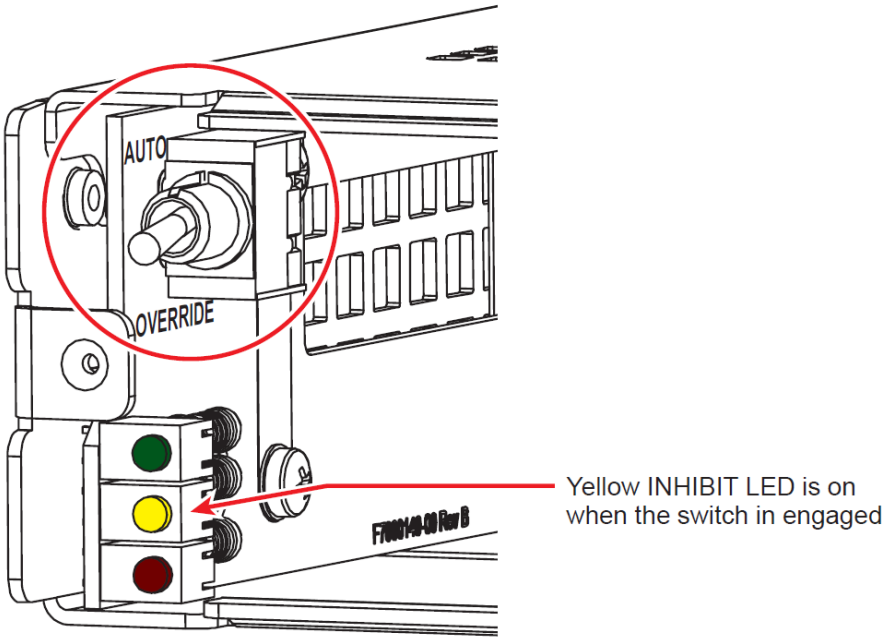


Figure 4: LVBD override switch (front cover removed)

4.2 Cordex® CXCi HP controller

The Cordex® CXCi HP controller is mounted in the power system shelf and brings advanced monitoring technology to the power system. This compact system controller is equipped with the complete range of software features, including the following:

- Ethernet port for local and remote communications
- User definable alarms
- Daily logging of power system events and system statistics.

Cordex® CXCi HP in-shelf controllers have an OLED display. This display shows 30 characters total (five lines high, six characters wide) and the controller has three navigation buttons and one reset button.

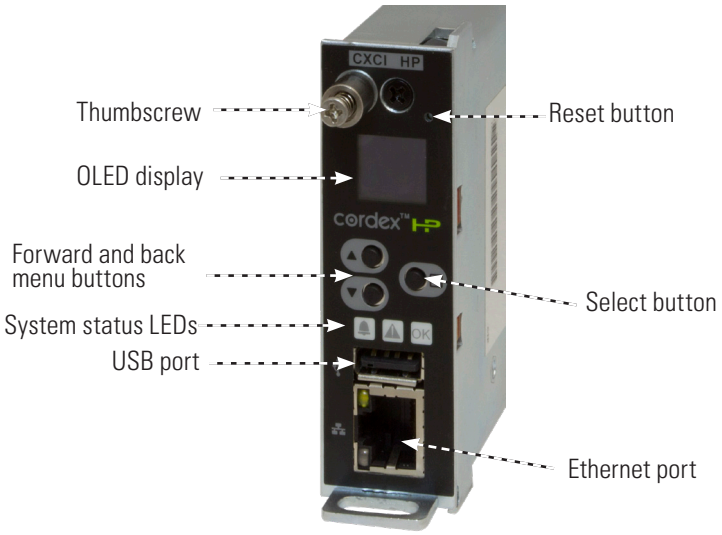


Figure 5: Cordex® CXCi HP controller front panel

The in-shelf display has three main operating modes: dashboard, menu, and screen saver. After 20 minutes with no activity, the in-shelf controller goes into screen saver mode and the display shuts off. From screen saver mode, select any of the three navigation buttons to re-activate the screen and enter dashboard mode.

4.2.1 Display

In dashboard mode, the in-shelf display shows the key operating parameters of a system. For example, output voltage and load current. If more than one system is defined, you can cycle between systems using the **Forward** and **Back** buttons. With multiple systems, you can specify a default system, which is then displayed first.

Refer to the software manual for set up information. The following figure shows screen examples.

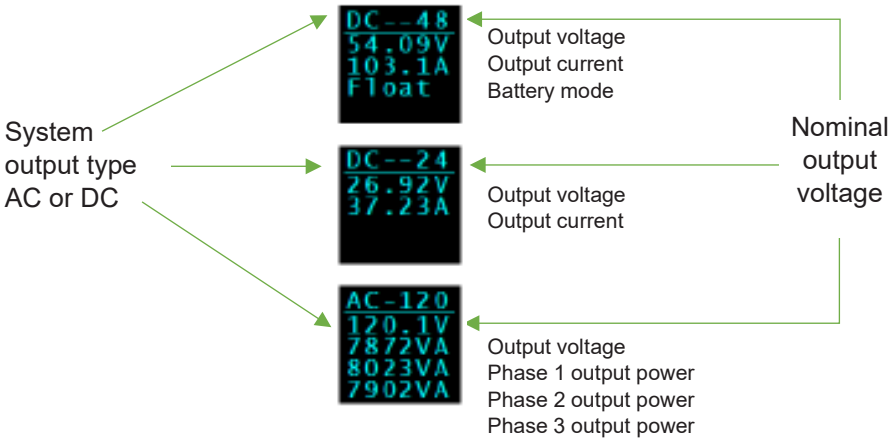


Figure 6: Cordex® CXCi HP controller menu

4.2.2 In-shelf display menu

From the OLED dashboard, use the Select button to enter a menu. From the menu, the OLED display lets you execute a set of commands much like the LCD on the 2RU Cordex® CXC HP controller.

When you enter a menu, the top item is highlighted. To go to another menu, scroll through using the **Forward** and **Back** buttons. To execute a highlighted menu item, select the **Select** button.

To exit a menu and return to the main dashboard, scroll to the **Back** command, and then select the **Select** button. The following table provides a full list of menus available via the in-shelf display.

Menu label	Description
ALCO	Perform the alarm cut-off command.
Restrt	Perform a software restart of the controller.
IPv4	Display the IPv4 address, subnet, and gateway for this controller.
IPv6	Display the IPv6 address assigned to this controller.
AutoIP	Set the IP address to **Automatic** (obtained from the DHCP server).
RstIP	Reset the IP address to **Static Default** (IP: 10.10.10.201, subnet: 255.255.255.0).
Port	Displays the port number for the controller.
Backup	Backup the controller application and configuration to a file on a USB drive.
Resto	Restore the controller application and configuration from a file on a USB drive.
Upgra...	Upgrade the controller application from a file on a USB drive.
OS Upg	Upgrade the controller's operating system from a file on a USB drive.
Info	Display controller information including serial number, part number, software, and hardware version.
Rotate	Rotate the in-shelf controller display information by 90 degrees.
ExpInv	Export all inventory to USB drive. This is a large file and may take a while to export. The data can be used for analysis in a spreadsheet program.
RemCfg	When **Remote Configuration Lockout** has been enabled, this menu allows the lockout to be temporarily overridden for a pre-configured amount of time.
Back	Exit the menu and return to the dashboard.

4.2.3 In-shelf controller buttons

The following figure shows how the buttons are interpreted.

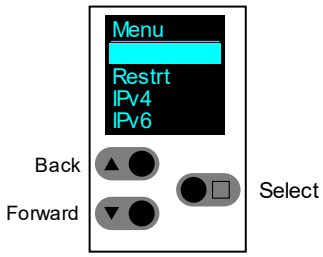


Figure 7: In-shelf controller buttons

4.2.4 Controller I/O

Ethernet port

The Ethernet port is designed for connection to a user supplied network (TCP/IP secured by user) via a front panel RJ45 jack and a standard network cable. Local access (for example, a laptop computer) is also possible from the Ethernet port connection using a standard network cable.

Network connection and remote communication

The system can be set up, monitored, and tested via an Ethernet connection. The communication protocol supports a web interface. All alarming and control of the rectifiers is accomplished with a controller via CAN bus.

USB port

A USB 2.0 port is located on the front of the controller. It is used for upgrading operating system software.

4.3 Cordex® HP rectifiers

4.3.1 Cordex® HP 2.4 kW rectifier (option)

Rectifier features

- High performance compact 50 A rectifier for 48 Vdc Telecom applications
- High efficiency (96.2 percent) for reduced OPEX and carbon footprint
- High temperature operating range for installation in non-controlled environments
- Multiple configurations providing up to 250 A or 12 kW in a compact 1RU form factor
- High power density (28 W/in³) yields more space for revenue generating equipment
- Wide AC input operating range for global installation requirements
- Extended operating temperature range up to 75°C (167°F) for deployment in the harshest outdoor environments

4.3.2 Cordex® HP 3.0 kW rectifier (option)

Rectifier features

- High performance compact 62.5 A rectifier for 48 Vdc Telecom applications
- High efficiency (96.5 percent) for reduced OPEX and carbon footprint
- High temperature operating range for installation in non-controlled environments
- Multiple configurations providing up to 312 A or 15 kW in a compact 1RU form factor
- High power density (35 W/in³) yields more space for revenue generating equipment
- Wide AC input operating range for global installation requirements
- Extended operating temperature range up to 75°C (167°F) for deployment in the harshest outdoor environments

4.3.3 Front panel LEDs

The front panel LEDs indicate the rectifier status summary and patterned response to Locate Module command.

	**Alarm/Fault**	The red LED is on during an active Module Fail alarm if the module is unable to source power due to a fault condition. Refer to the relevant controller manual for fault details. The LED flashes (~2 Hz) when a minor alarm is detected if the module's output capability has been reduced or a minor failure is detected. The red LED will remain active if the module is receiving power from the DC bus.
	**DC ON**	The green LED is on when the rectifier is delivering power to the load. The LED goes out when the rectifier is off. For example, when commanded by the controller.
	**AC ON**	The green LED is on when the AC input voltage is qualified and within the operational AC input range and input frequency.

LED activity during the Locate Module command from controller

The **Locate Module** command from the controller, causes the LEDs of the target rectifier to flash in a cyclical pattern. This flashing normally lasts 60 seconds.

LED activity during power save

When a rectifier is put into power save mode, only the **AC ON** LED remains illuminated.

4.3.4 Rectifier features.

True module fail alarm

The power modules have a true fail alarm. This provides a true indication of the power module's ability to source current. When the module's output current drops below 2.5 percent of the rated output a low output current condition is detected and the **Module Fail** detection circuit is activated. This circuit momentarily ramps up the output voltage to determine if the module will source current. If no increase in current is detected, the **Module Fail** alarm is activated. The module will test once every 60 seconds for the condition until current is detected. Output voltage ramping will cease upon detection of current.

A minimum 2.5 percent load is required to avoid the **Ramp Test Fail** alarm; this can typically be provided with the parallel system battery. Activation of this alarm could indicate a failed module or a failed load.

NOTICE

For Cordex® HP rectifier systems without batteries (or with a very light load; below 2.5 percent of rated output) it is recommended that the ramp test be disabled to avoid nuisance alarms. The Ramp Test feature is enabled and disabled via the controller. Refer to the software manual for detailed information.

Heat dissipation

Each rectifier module is equipped with a front-mounted, variable-speed fan. The fan speed is determined based on ambient temperature, rectifier temperature, and the load. Air flow is front-to-rear with the exhaust air exiting through internal vents at the rear of the unit. The fan may spin in required situations.

Over temperature protection

Blockage or obstruction to the air flow can result in the internal temperature to rise and reduce the output power or even shut down the rectifier. The rectifier will resume normal operation when the temperature reduces to a safe level. Over temperature shut down can also occur when a fan failure has occurred. The rectifier; to protect itself from ambient over temperature scenarios; will limit its output power.

Wide AC range

The rectifier delivers full power between 187 Vac and 310 Vac input voltage. The rectifier can deliver up to 58 percent power between 90 Vac and 187 Vac. During start up the rectifier begins to provide power for input voltage >95 Vac and shuts down if the input voltage drops below 85 Vac. The THD and power factor will be out of specification for input >277 Vac.

AC inrush/transient suppression

An external surge suppressor is not required at the AC input, modules are protected from input lightning and transient surges in accordance with IEEE/ANSI C62.41 Category B3.

Soft start

To eliminate an instantaneous demand on the AC source, a soft start feature is employed. Soft Start, sometimes referred to as current walk-in, works by gradually (up to five seconds) ramping the current limit up from zero to the actual or defined customer setting. The rectifier output voltage is ramped up from the minimum voltage to the float voltage.

NOTICE

Under normal conditions, a battery connected to the output of the rectifier will draw current when the voltage ramp occurs. Therefore the rectifier fail alarm will not be generated with a battery connected.

Start delay

The rectifier modules are equipped with a delay timer in order to stagger start a series of modules to prevent excessive loading of generators upon start up. The built-in timer delays the turn on of the module depending on the value selected (up to 120 seconds) via the controller. A minimum one-second delay is preset to allow charging of the input capacitors.

Current limit/short circuit protection

The current limit function determines the maximum output current limit of the rectifier module, regardless of output voltage or power. Maximum output current is limited to a constant value down to short circuit condition. Current limiting can be used to mate the rectifier output current ampacity to the needs of the load and parallel battery to minimize excessive battery recharge current.

The rectifier will sustain a continuous short circuit at the output terminals. The maximum short circuit current will not exceed 50 amps (Cordex® HP 2.4 kW rectifiers) or 62.5 amps (Cordex® HP 3.0 kW rectifiers) per module.

Power limiting

Each rectifier module is designed to limit power output to the module specification. This enables more current to be supplied at lower output voltages, and allows matching of output to the demand of constant power loads, normally seen with Telecom equipment.

This feature may also be used for a faster recharge of flooded batteries paralleled with the load.

NOTICE

Current limiting overrides the power-limiting feature.

High voltage shutdown

The high voltage shutdown (HVSD) feature provides protection to the load from over voltage conditions originating from the rectifiers. It operates by shutting down the offending rectifier module when a high output voltage condition occurs. Indication is through the red alarm (**Module Fail**) LED. Modules will restart automatically; however, if more than three over voltage conditions occur in one minute, the module will latch off and remain shut down until it is reset.

Battery eliminator operation

Rectifier modules maintain all specifications (except where indicated) with or without a battery attached in parallel to the output; however, if a battery or another module supplying DC voltage in parallel is not present, there will be no monitoring or control activity if there is an AC power failure or input fuse failure.

5. Inspection

5.1 Packing materials

Alpha Technologies Ltd. is committed to providing products and services that meet our customers' needs and expectations in a sustainable manner, while complying with all relevant regulatory requirements. As such Alpha strives to follow our quality and environmental objectives from product supply and development through to the packaging for our products.

Rectifiers and batteries are shipped on individual pallets and are packaged according to the manufacturer's guidelines.

Almost all Alpha Technologies Ltd. packaging material is from sustainable resources and or is recyclable.

5.2 Returns for service

NOTICE

Alpha Technologies Ltd. is not responsible for damage caused by improper packaging of returned products.

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure that the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

5.3 Check for damage

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

5.4 General receipt of shipment

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

5.5 Miscellaneous small parts

Review the packing slip and bill of materials to determine the part number of the configuration kits included with your system. Review the bill of materials to verify that all the small parts are included. Contact us if you have any questions before you proceed.

6. Installation

Only qualified personnel should install and connect the power components within the power system. For battery installation, refer primarily to the manufacturer's documentation.

Frequent reference is made to drawings located at the end of this document.

6.1 Safety precautions

Refer to the Safety section near the beginning of this document.

6.2 Tools required

Various insulated tools are essential for the installation. Use this list as a guide:

- Battery lifting apparatus if required
- Electric drill with hammer action, 1/2 inch capacity
- Various crimping tools and dies to match lugs used in installation
- Load bank of sufficient capacity to load largest rectifier to its current limit
- Digital voltmeter equipped with test leads
- Cable cutters
- Torque wrench: 1/4 inch drive, 0 to 17 Nm (0 to 150 in-lb)
- Torque wrench: 3/8 inch drive, 0 to 135 Nm (0 to 100 ft-lb)
- Insulating canvases as required
- Various insulated hand tools including:
  - Combination wrenches
  - Ratchet and socket set
  - Various screwdrivers
  - Electricians knife
- Battery safety spill kit required for wet cells only
- Cutters and wire strippers 2.5 to 0.34 mm² (14 AWG to 22 AWG)

6.3 Assembly and mounting

CAUTION

Cordex® CXPS-E105 edge power systems must be installed above a non-combustible surface.

The power system must be mounted in a clean and dry environment. Sufficient free space must be provided at the front and rear of the power system in order to meet the cooling requirements of the rectifiers and to allow easy access to the power system components.

The distribution panel requires at least 2RU (8.9 cm; 3.5-inch) of space above the unit to access connections points and provide adequate cooling.

6.3.1 Rack mounted systems

Attach the power system to the customer-provided relay rack using mounting screws and star washers. This will ensure an electrical bond between the system chassis and relay rack.

The system may be mounted into a 19-inch rack in a center mount position. Use the 19-inch to-23-inch rack adapters to mount into a 23-inch rack.

6.4 Rectifier installation

6.4.1 To insert a module

1. Place the module on the shelf and slide it into the rear connector.
2. Apply pressure to the module to ensure it connects properly.
3. Lower the rectifier handle to lock the module in place.

NOTICE

Do not force a module into position if it does not seat properly. All modules are keyed to ensure that the correct module is used.

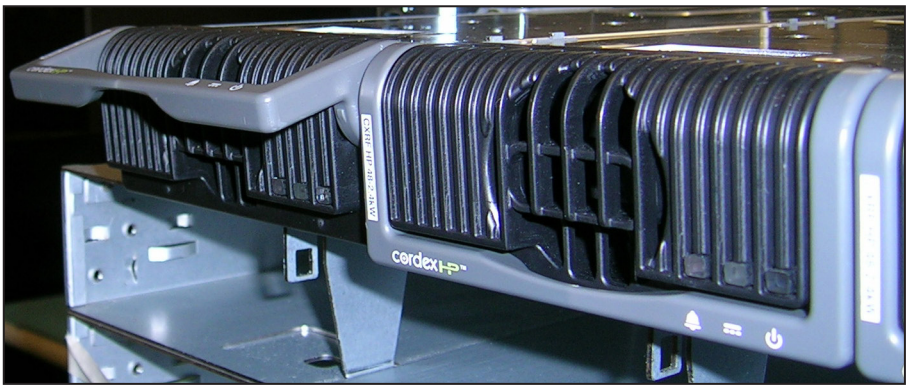


Figure 8: Locking handle disengaged and engaged

6.5 Breaker installation

6.5.1 To install a breaker

1. Ensure mid-trip breakers are used for load and series-trip breakers are used for battery connections.
2. Turn the breaker OFF.
3. Orient the breaker so that the actuator is pointing to the right, with the breaker in the OFF position.
4. Align the breaker terminals with the correct holes.
5. Carefully push the breaker into position.
6. Ensure that the breaker is fully inserted so that the flat face of the hexagonal nut is against the mounting surface.

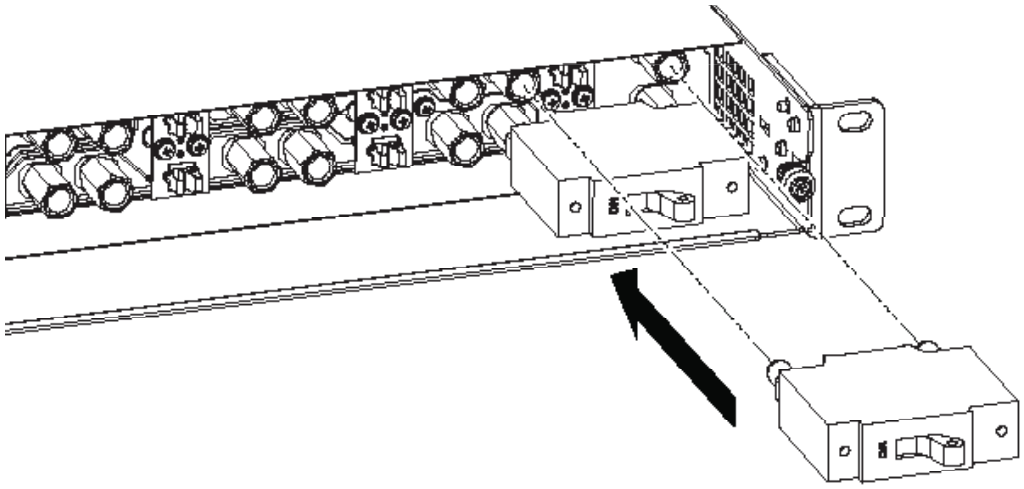


Figure 9: Breaker installation

6.5.2 To remove a breaker

1. Turn breaker off.
2. Use the breaker removal tool to pull the breaker out of position.

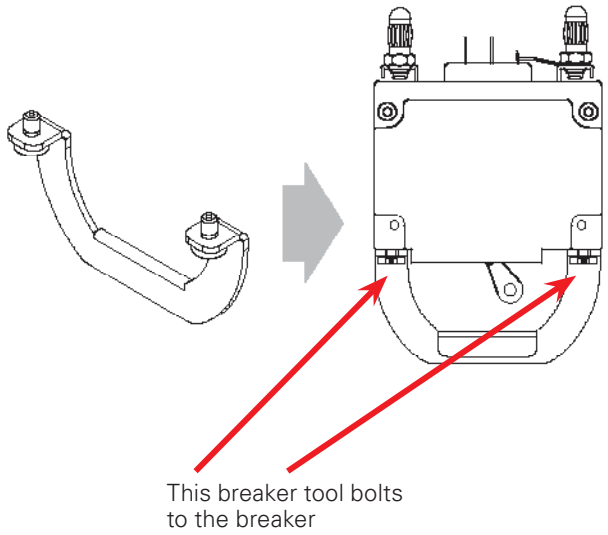


Figure 10: Breaker removal tool

6.6 Installation of external batteries

WARNING

Follow the battery manufacturer's safety recommendations when working around battery systems and review the safety instructions provided in this document.

This information is provided as a guideline and is not meant to imply that batteries are part of this power system.

Batteries should be located in a temperature-controlled environment, regulated to approximately 25°C (77°F). Significantly lower temperatures reduce performance and higher temperatures decrease life expectancy.

Provide adequate ventilation. VRLA batteries, though not requiring the special ventilation requirements of a flooded battery, should not be installed in an airtight enclosure. Hydrogen gas can be emitted from a failed battery.

If applicable, clean the cells before assembly according to the battery manufacturer's recommendations. First neutralize any acid with a baking soda and water solution; then wipe the cells with a soft cotton cloth dampened with clean water and wipe dry.

6.6.1 Installing the batteries

WARNING

Verify that all battery breakers, DC circuit breakers, and fuses on the distribution panels are either in the OFF position or removed.

Verify that all battery breakers, DC circuit breakers, and fuses on the distribution panels are either in the OFF position or removed.

Apply a corrosion-inhibiting agent, such as NO-OX-ID® "A", on all battery terminal connections.

1. If required, assemble the battery rack and the cells or mono-blocks as per the installation instructions supplied with the batteries.
2. Ensure that the battery output cabling can reach the positive [+] and negative [–] terminals of the series battery string and that the batteries are oriented correctly for easy installation of the inter-unit "series" connectors.
3. Remove any NO-OX-ID® "A" grease from battery terminals.
4. Burnish the terminal posts with a non-metallic brush, polishing pad, or 3M Scotch Brite® scouring pad.
5. Apply a light coating of NO-OX-ID® "A" grease to the terminal posts.
6. If lead plated inter-unit connectors are used, they should also be burnished and NO-OX-ID® "A" grease applied as above. Install the inter-unit connectors.
7. Connect the temperature sensor.
8. After all battery connections are completed, torque the connections as per the battery specifications typically 11.4 Nm (100 in-lb).

Refer to the system startup procedure before connecting the batteries online.

6.7 Battery maintenance report

After assembly, number the batteries and take as received readings, including specific gravity, cell voltage, and temperature. Designate one cell as the pilot cell. This is usually the cell with either the lowest specific gravity or voltage. Refer to the manufacturer's documentation for guidelines. See the following table for typical maintenance report:

Company:	Date:	
Address:		
Battery location and number:		
Number of cells:	Type:	Date new:
Date installed:	Float voltage:	Ambient temperature:

Table D — Typical VRLA battery maintenance report

Cell number	Serial number	Voltage	Specific	Ohms	Mhos	Observations

Remarks and recommendations:
Readings taken by:

7. Wiring

This chapter provides cabling details and notes on cable sizing for DC applications with respect to the product.

WARNING

Ensure that the power is switched off by switching off rectifiers and turn off battery breakers before attempting work on the wiring. Use a voltmeter to verify the absence of a voltage. Clearly mark the correct polarity of the battery leads before starting work on DC connections.

7.1 Installation notes

Refer to the Installation section for safety precautions and tools required.

ATTENTION

Cordex® CXPS-E105 edge power systems must be installed above a non-combustible surface.

7.1.1 Calculating output wire size requirements

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

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

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

A = Ultimate drain in amps.

LF = Conductor loop feet.

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

AVD = Allowable voltage drop.

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

Refer to the following table for cable size equivalents.

Table E — Cable size equivalents (AWG to Metric)

Cable size	Circular mils	Square millimeters	Equivalent metric cable
20 AWG	1020	0.519	1
18 AWG	1624	0.8232	1
16 AWG	2583	1.309	1.5
14 AWG	4107	2.081	2.5
12 AWG	6530	3.309	4
10 AWG	10380	5.261	6
8 AWG	16510	8.368	10
6 AWG	26250	13.30	16
4 AWG	41740	21.15	25
2 AWG	66370	33.63	35
0 AWG (or 1/0)	105600	53.48	50 or 70

Table E — Cable size equivalents (AWG to Metric)			
Cable size	**Circular mils**	**Square millimeters**	**Equivalent metric cable**
00 AWG (or 2/0)	133100	67.42	70
0000 AWG (or 4/0)	211600	107.2	120
313 MCM (or kcmil)	313600	159	150 or 185
350 MCM (or kcmil)	350000	177.36	185
373 MCM (or kcmil)	373700	189	185 or 240
500 MCM (or kcmil)	500000	253.36	300
535 MCM (or kcmil)	535300	271	300
750 MCM (or kcmil)	750000	380.00	400
777 MCM (or kcmil)	777700	394	400

7.1.2 Recommended torque values

Table F lists the recommended torque values for connection to the power system with the following hardware:

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

Grade 5 rated hardware is required for these torque values.

Table F — Recommended torque values	
Size	**Torque value**
1/4 inch	11.93 Nm (8.8 ft-lb)
3/8 inch	44.06 Nm (32.5 ft-lb)
1/2 inch"	98.97 Nm (73 ft-lb)

7.2 Grounding

Connect the isolated power system battery return bus (BRB) to the building master ground bus (MGB), or floor ground bus (FGB) in a larger building. This acts as a system reference and as a low impedance path to the ground for surges, transients and noise. The MGB or FGB must have a direct low impedance path to the building grounding system.

The cable from the power system to the MGB or FGB must be sized to provide sufficient ampacity to clear the largest fuse or breaker on the power system, excluding the battery protection fuse or circuit breaker. This is the minimum requirement. Other factors including length of cable and special grounding requirements of the load must also be factored in. The insulated cable must be equipped with two-hole crimp type lugs and must not have any tight bends or kinks.

Table G — Typical ground reference conductor selection	
Power system ampacity	**Recommended ground reference conductor size**
<30 A	6 mm² (10 AWG)
30 A to 100 A	16 to 35 mm² (6 to 2 AWG)
100 A to 400 A	107 mm² (0000 AWG)
400 A to 800 A	185 mm² (350 MCM)
>800 A	400 mm² (750 MCM)

The power system frame must also be connected to the MGB or FGB. This is done for personnel safety and to meet many Telecom grounding requirements. Each bay must have its own frame or site ground connection. Refer also to the customer connections drawing at the end of this document.

7.3 AC feeder protection and sizing

To maximize system reliability, each feed should have a dedicated protection feeder breaker located at the AC distribution panel. The feeder breaker can also act as the disconnect device for the connected modules.

CAUTION

To minimize EMI disturbances, route the AC input wires in flexible or rigid conduit and located as far away as possible from the DC power wires.

7.4 AC wiring

Ensure that all modules are removed from the shelf. Refer to customer connections drawing. The shelf incorporates IEC receptacles, which require line cords with C19R type plugs (19-inch systems) or with terminal blocks (19-inch or 23-inch systems). Contact Alpha Technologies Ltd. for information on available cords.

7.5 DC wiring

WARNING

Leave the cables or busbars disconnected at the battery and verify the output polarity using a voltmeter. Make the battery connections only after all other wiring is complete.

DC output wire must be UL approved XHHW or RHH/RHW (RW90 type for Canadian users). Control and sense wires must be UL approved Style 1015 (TEW type for Canadian users).

Terminate the cable leads with appropriate crimp lugs.

Secure the positive and negative DC output cables to the shelf output post of the correct polarity; for example +Vcable to +Vpost. Ensure that the washers are placed on the bolts in the same order in that they were shipped from the factory.

Connect the common output leg of the rectifier system to the ground. This is typically done at the load common termination point.

7.6 System and battery connections

WARNING

Ensure that the correct polarity is used for all input cable terminations.

CAUTION

To reduce the risk of electrical shock, insulate the barrel section of the lug with clear heat shrink tube and be careful when connecting and removing cables.

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

Size the battery cables for a 0.25 volt drop from the battery to the power system at full load, including anticipated additional loads. The cables must also meet ampacity requirements. Cables terminating directly on battery posts or connection details must be secured so that there is no stress on the battery posts. To reduce corrosion, use lead plated lugs and lead plated or stainless steel hardware on all terminations of vented batteries.

Prepare, route, and connect cables from the power system to the battery termination points. Burnish the terminating points and apply a corrosion-inhibiting agent, such as NO-OX-ID®, to all battery terminal connections.

Do not make the final connections to the live batteries. Switch off the battery contactors or remove the battery fuses. See system startup procedure before connecting batteries online.

7.7 Distribution cabling

7.7.1 Load planning and breaker spacing

1. Any single pole breaker rated at 100 amps or less can be mounted in any position without spacing.
2. The highest rated single pole breaker that can be used for a load is 100 amps for temperatures up to 40°C (104°F). The highest rated single pole breaker that can be used for batteries is 100 amps for temperatures up to 40°C (104°F) and 125 amps for temperatures up to 30°C (86°F).
3. Load /Battery should not exceed 80 percent of the bullet circuit breaker rating.
4. A minimum of 2RU (89 mm; 3.5 in.) spacing is required above system.
5. A 125 A breaker should not be used vertically above or below another 125 A breaker.

7.7.2 Load connections

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

Terminate distribution cabling with 1/4 inch to 5/8 inch center lugs for connecting to the power system.

NOTICE

Connect load breaker returns before hot connections.

Connect load breaker return connections

1. Secure cables with two hole lugs to the 1/4 inch studs on 5/8 inch centers using the supplied hardware.
2. Run cables directly out of the rear of the distribution panel.
3. Secure cables to the cable tie brackets.

Connect load breaker hot connections.

1. Secure cables with two hole lugs to the 1/4 inch studs on 5/8 inch centers using the supplied hardware.
2. Run cables directly out the rear of the distribution panel above the breaker return cables.

7.7.3 Battery breaker connections

NOTICE

Final connection to battery live is not made until system startup (see the System startup section). Insulate and leave disconnected or remove the battery fuses. Switch battery contactors off (if used).

1. Connect battery ground connections using same guidelines as load returns.
2. Connect battery breaker (hot) connections first using same guidelines as the load breaker return connections.
3. Cables should run directly out of the rear of the distribution panel.

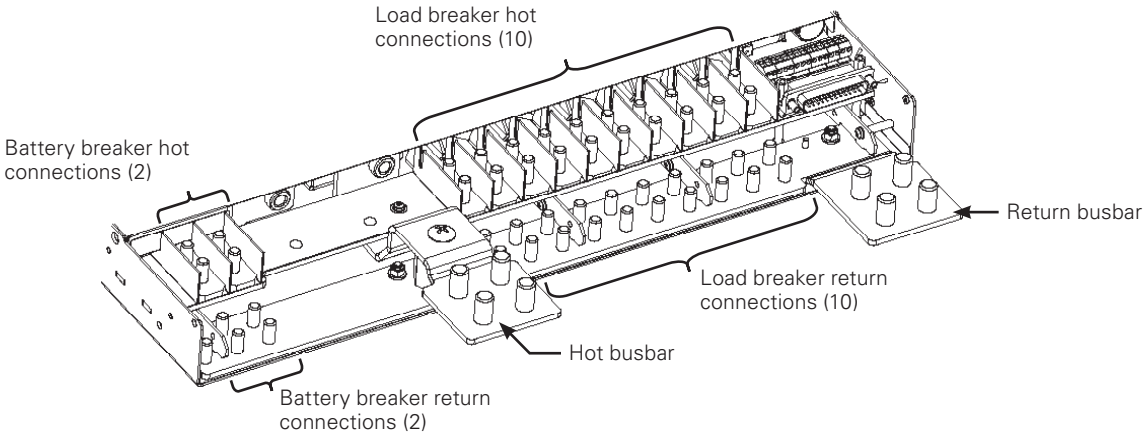


Figure 11: Battery, load, and return connection locations

7.8 Alarm and signal connections

1. The terminal blocks are located below the controller. The power system is factory wired to the distribution panel through the DB25 cable assembly. T1, K2 and K3 are available for customer connections.
2. Connect these alarms and signals to the local alarm-sending unit. Use wire sizes 1.5 to 0.14 mm² (16 to 26 AWG).

Figure 12: Alarm and signal connections

7.9 Signal wiring connections for controller

Reference is made to drawings located at the rear of this manual. Custom configurations may be detailed within the power system documentation package.

For terminal block connections, the recommended wire sizes are 1.5 to 0.14 mm² (16 to 26 AWG) for the temperature range of 0 to 50°C (32 to 122°F) as per UL/CSA.

CAUTION

To reduce risk of fire, use only 0.14 mm² (26 AWG) or larger wire.

7.9.1 Alarm (relay) outputs

Terminals provide contacts for extending various alarm or control signals. Each relay output can be wired for normally open (NO) or normally closed (NC) operation during an alarm or control condition.

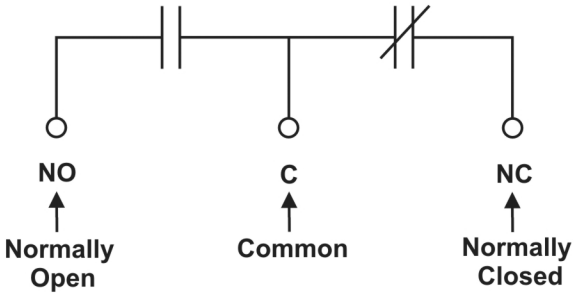


Figure 13: Relay connections

Relays can be programmed to energize or de-energize during an alarm condition. See the controller software manual. All relays will de-energize when the controller reset button is pressed or when the power is lost.

7.9.2 Digital inputs

The factory-installed digital input channels are used to monitor various alarm and control signals. All input channels are voltage activated and directly accept a bipolar (negative or positive) DC signal.

7.9.3 Analog inputs

The analog input channels are used to monitor various types of electrical signals. Some of the analog channels are reserved for specific signals, while others are designated as general-purpose inputs, which accommodate various types of analog signals. The input cables should be bundled together and routed through the entry holes.

Default configurations and terminal numbers described in this chapter have been summarized in the drawings located at the end of this document.

Voltage input

The voltage input #1 (V1) terminal is located on the shelf to provide connections to an optional secondary voltage input. For example, this input can be terminated to the load side of an LVD contactor to monitor the load voltage.

Temperature sensor

The temperature sensor input channel (T1) provide connections for a temperature sensor. A voltage is supplied to these terminals for sensor measurements.

Current input

The current input #1 terminal (I1) is factory wired to the battery shunt.

7.10 CAN serial ports

The CAN serial ports are located on the sides of each rectifier shelf. CAN serial ports are modular jacks with center latches that are used to communicate with the rectifiers and other CAN-enabled equipment (nodes) on the same system.

This system has a limit of four rectifiers installed. They do not have self-powered CAN bus nodes.

7.10.1 CAN termination

A CAN termination jumper is located beside each of the CAN serial port jacks on the rectifier shelves. See the customer connection drawing and schematic that describes your system at the rear of this manual.

7.11 Network and remote communication

The system can be set up, monitored and tested via an Ethernet IEEE 10/100 BASE-T serial data connection and accessed via the controller or a web interface. Pin-outs are shown in the customer connections drawing.

Some standard scenarios are described:

- Network connection: The Ethernet port is designed to connect the controller to a user supplied network (TCP/IP supplied by the user) via a front panel RJ45 port. Use a standard network cable for this connection.
- Local connection: The Ethernet port can also be used for local access such as using a laptop computer. Use a standard Ethernet cable for this connection.

8. System startup

8.1 Check system connections

- Ensure that the AC input is switched off, the battery breaker is off, and all power modules are removed from the shelf.
- Triple-check the polarity of all the connections.

8.2 Verify AC input and power up rectifier shelf

1. Install one rectifier module.
2. Verify that the AC input voltage is correct and switch on the corresponding feeder breaker.
3. The controller OK LED light should illuminate continuously after a preset start delay.
4. Using the controller, test the functionality of all module alarms and controls.

8.3 Check battery polarity and connect the batteries

1. Verify the polarity of all the batteries with a voltmeter to ensure that no cells or batteries are reversed.
2. Switch on the appropriate battery breaker.
3. Install the remaining power modules.
4. From the **Systems > DC System > System Functions > Battery Maintenance > Equalize & Boost** menu of the controller, set the float and equalize voltage to the levels specified by the battery manufacturer.
5. Using the controller, test the functionality of various module alarms and controls. In addition, perform a load test with the system using a resistive load box if needed.
6. Enable the temperature compensation feature in the **Systems > DC System > System Functions > Temperature Compensation** menu. Program the settings for slope and breakpoints (upper and lower) with respect to the specific batteries used.

8.4 Controller alarm configuration for nominal 120 Vac operation

The default setting for the low AC input alarm is 180 Vac and the high AC input alarm is 300 Vac. For a nominal 120 Vac input, these values will need to be changed.

1. Select **Alarms > All Alarm**. Search for **AC Input** in the **All Alarm Settings** search field.
2. Select and modify the activation value for **AC Input Voltage Low** to 100 Vac and **AC Input Voltage High** to 150 Vac.

ATTENTION

Before removing a controller from a live system or performing controller maintenance, an external LVD inhibit or override is required to prevent a service disruption.

8.5 Controller reset

8.5.1 Soft reset

Use the reset button on the front panel of the optional controller is to restart the microprocessor. When pressed momentarily, the unit beeps twice and then resets. The front-panel LEDs will illuminate temporarily and then turn off after the system has finished its 15-second self-test.

ATTENTION

During reset the controller may need to run a defragmentation cycle. Cycling of the LEDs in the front panel indicate that defragmentation is in progress. All full defragmentation can take up to 20 minutes to perform do not power down the controller during this time.

8.5.2 Controller IP address reset

To reset the IP address, press and hold the front panel reset button for three seconds. The controller unit will beep three times, the IP address will be reset (to 10.10.10.201), and DHCP will be disabled. The settings will be saved and the unit will then reset.

This allows local access, for example to a laptop via an Ethernet cable. See the software manual for details.

8.6 LVD control

ATTENTION

Before removing a controller from a live system or performing controller maintenance, an external LVD inhibit or override is required to prevent a service disruption.

The LVD control functions are hardwired directly from the assigned relay output to an optional front panel LVD override control. Place the LVD auto/override switch to the **INHIBIT** position to keep the LVD contactor engaged.

To allow the controller to resume automatic control of the LVD contactor, check that the LVD status LED is turned off.

ATTENTION

Do not leave the switch in the INHIBIT position. Doing so may result in a complete discharge of the batteries during a power failure situation.

8.6.1 Operation of the LVD auto and bypass switch and status LED

The LVD auto and bypass switch is used to control the operation mode of the LVD contactor. The **INHIBIT** mode should only be used by qualified personnel and only as a temporary measure. During normal operation the switch is in the **AUTO** position. In this mode of operation, the LVD contactor is supplied by the controller and the LVD green LED is turns on. In the event of input power loss due to a rectifier failure or loss of AC power, the controller will disconnect the battery supply if the voltage falls to a preset voltage.

To manually bypass the controller and force the LVD to stay on regardless of the input from the controller or the battery voltage, move the LVD auto/override switch toggle to the **OVERRIDE** position. The **INHIBIT** mode is indicated by the LVD status LED which changes from green to yellow. In addition, the alarm LED on the controller also illuminates and the alarm is logged in the event log.

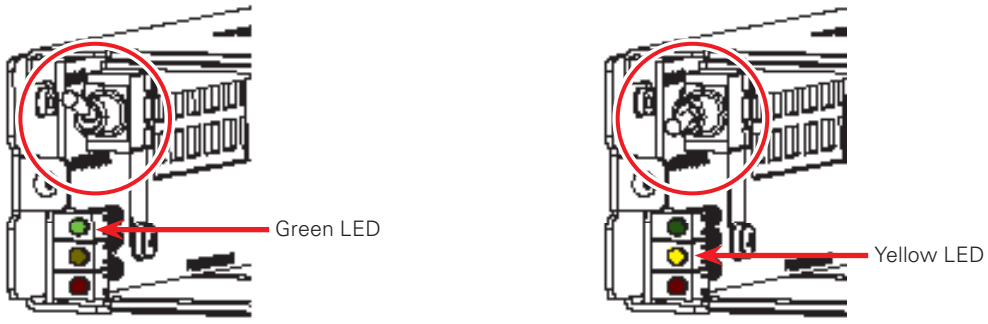


Figure 14: LVD LED status indicators

9. Rectifier modes and factory default values

9.1 Rectifier modes

There are two main rectifier modes: output voltage mode and output current/power mode.

9.1.1 Output voltage modes

Voltage modes, under software control, can directly adjust the output voltage. Situations, such as the rectifier being in current limit, can change the output voltage with no software control.

The following table describes the output voltage modes.

Table H — Output voltage modes

Output voltage modes	Active when…
Float	Output voltage is set to the float voltage setting.
Equalize	Output voltage is set to the equalize voltage setting.
Battery test	Output voltage is set to the battery test voltage setting.
Safe	Output voltage is set to the safe mode voltage setting.
Manual test	Output voltage can be manually adjusted outside of the standard adjustment ranges.

9.1.2 Output current and power modes

The output current and power modes directly affect the output current and power:

Table I — Output current/power modes

Output current/power mode	Active when…
Temperature foldback mode	High temperature of the heatsink or internal ambient temperature sensor.
AC foldback mode	Low AC input voltage.
Short circuit foldback mode	Short circuit at the output.
Internal fault foldback mode	Internal fault.

NOTICE

AC foldback mode reduces the risk of tripping an AC breaker due to increased AC current draw as the AC voltage decreases.

9.1.3 Factory ranges and default values

Table J lists the rectifier settings, ranges, and default values. Changes are made through the controller interface.

Table J — Rectifier factory ranges and defaults

Setting	Range (minimum to maximum)	Default
Float (FL) Voltage	48 to 58V	54V
Equalize (EQ) Voltage	50 to 58V	55V
Battery Test (BT) Voltage	44 to 52V	46V
Over Voltage Protection (OVP)[1]	59V	57V
Current Limit (CL)	23 to 100%	100%
Power Limit (PL)	0 to 100%	100%
Module Start Delay	0 to 250 s	1 s
System Start Delay	0 to 600 s	0 s
Low Voltage Alarm (LVA)	42 to 52V	44V
High Voltage Alarm (HVA)	52 to 59V	55.5V
EQ Timeout	1 to 2399 h	30 h
BT Timeout	1 to 250 h	8 h
Softstart Ramp-rate	Normal/Fast	Normal
CL/PL Alarm	Enable/Disable	Enable
Remote Shutdown	Enable/Disable	Enable
Ramp Test	Enable/Disable	Enable

[1] The OVP cannot be set below the present system. FL, EQ, BT voltage setting or the safe mode voltage of 51.4V.

10. Maintenance

Although very little maintenance is required with Cordex® power systems, routine checks and adjustments are recommended to ensure optimum system performance. Qualified service personnel should perform all maintenance tasks. The following table lists a few maintenance procedures for this system. These procedures should be performed at least once a year.

To order more breakers refer to the options listed in the specifications. Always replace circuit breakers with the same type and rating.

Consult support or sales for all replacement parts.

WARNING

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

ATTENTION

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

ATTENTION

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

Table K — Sample maintenance log

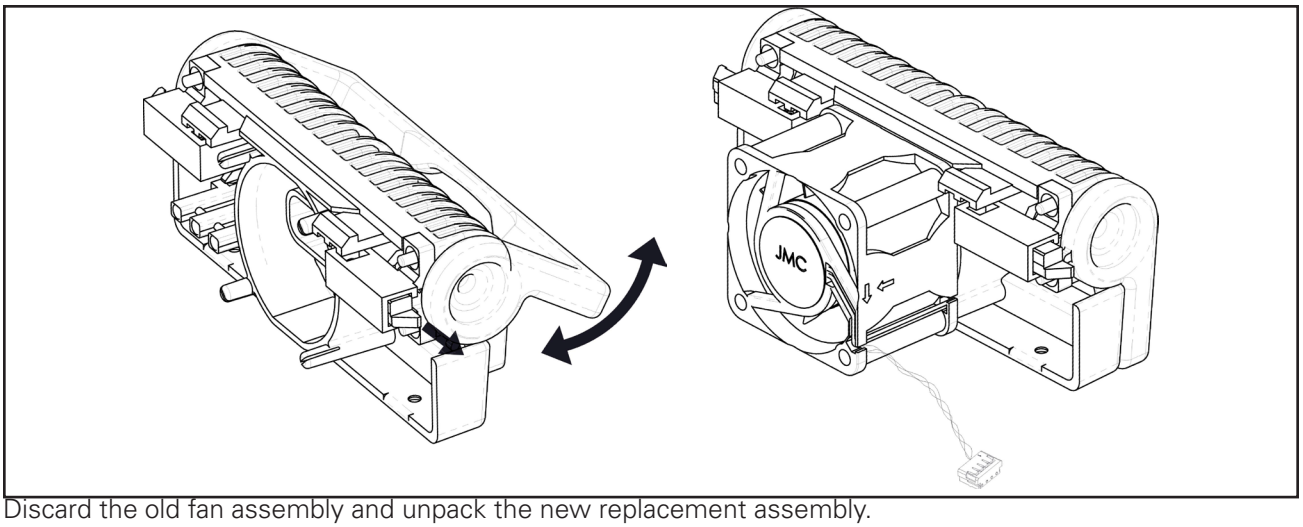
Procedure	Date completed
Inspect all system connections. Re-torque if necessary.	
Verify alarm and control settings.	
Verify alarm relay operation.	
Clean ventilation openings.	

10.1 Rectifiers

The fan on the individual rectifiers is designed for very high reliability and long life. During year six of the life of the product the manufacturer recommends replacement of the fan assembly.

10.1.1 Fan replacement

1. Lift the locking handle and slide the module 10 cm (4 in.) out of the shelf. Wait ten minutes for the module capacitors to discharge and then slide the rectifier out of the shelf.
2. Remove the two bottom screws that secure the front panel to the module chassis.
3. Push in the two plastic protrusions on top of the rectifier and disengage the front panel and attached fan from the rectifier.
4. Disconnect the fan cables from the module by pulling out the fan cable connector.



5. Discard the old fan assembly and unpack the new replacement assembly.
6. Reconnect the fan cable. Insert the connector into the fan connector in the module. Ensure proper polarity and that the wires stay clear of the fan blade.
7. Slide the front panel into the rectifier body.
8. Ensure the metal tabs of the rectifier body aligned with the screw holes of the front panel.
9. Ensure the plastic tabs of the front panel are protruding through the metal cutouts in the rectifier body.
10. Secure the front cover by hand tightening the bottom screws.

10.2 Batteries

It is recommended that checks are made every six months for battery voltage, conductance, temperature, impedance, and connections. See the battery manufacturer's documentation for general maintenance information. Depress the two front latches and tilt the front panel forward and down. Remove the battery from the slot and replace with the same type of battery observing the correct polarity.

10.3 Troubleshooting

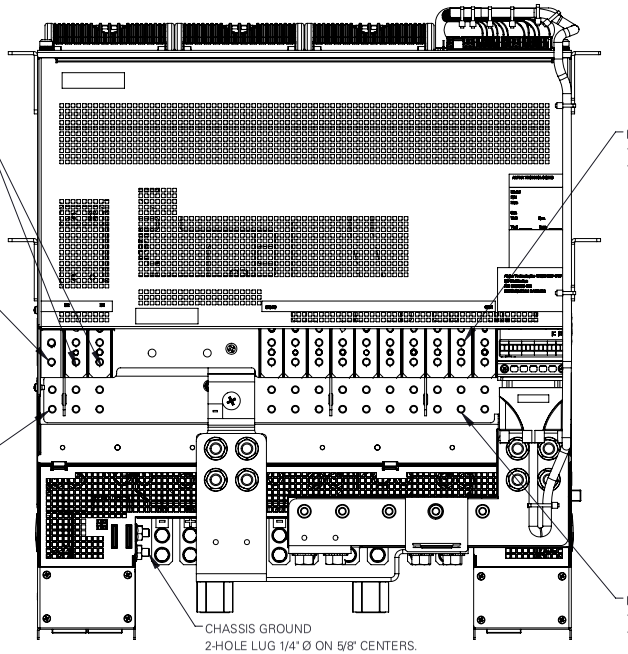
Table L — Troubleshooting

Symptom	Reason	Solution
Distribution is not communicating with the controller.	DB25 cable is not plugged in.	Plug in DB25 cable.
	Distribution panel is turned off.	Slide the POWER on/off switch to the ON (up) position on the logic board.
No load or battery circuit breaker trip alarm in controller, but red trip alarm LED on distribution panel is on, when a breaker trips.	DB25 cable is not plugged in.	Plug in DB25 cable.
Contactor doesn't close when LVD activation countdown is finished.	DB25 cable is not plugged in.	Plug in DB25 cable.
Contactor doesn't close when LVD bypass switch is toggled down and the LVD status LED turned from green to yellow.	DB25 cable is not plugged in.	Plug in DB25 cable.
LVD bypass alarm is on when LVD bypass switch is in AUTO position (up) and off when it is in the OVERRIDE position.	The switch is in bypass position when circuit breakers are inventoried.	Inventory the circuit breakers again with the LVD bypass switch in the AUTO position.
Battery breaker's trip doesn't create an alarm.	DB25 cable is not plugged in.	Plug in DB25 cable.
	The breaker doesn't have an auxiliary switch.	Only use breaker with auxiliary switch.

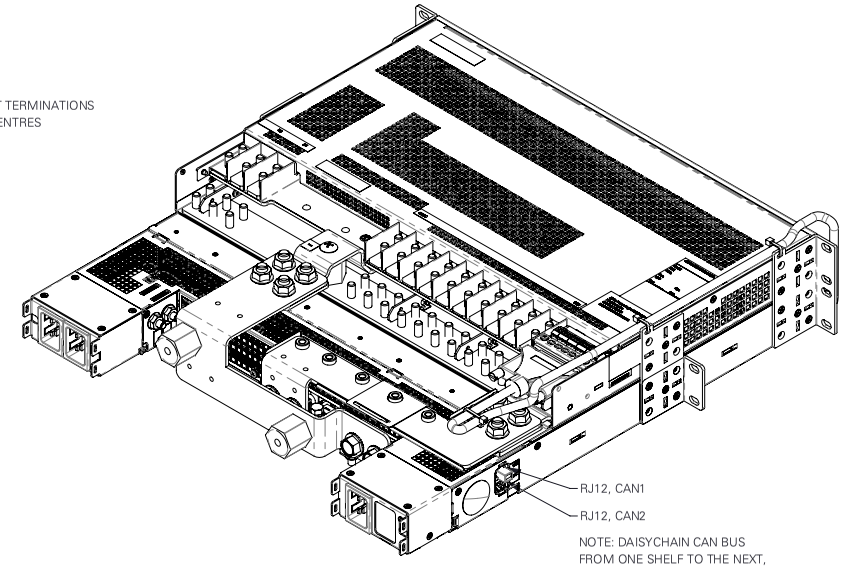
11. Acronyms and definitions

AC	Alternating current
ANSI®	American National Standards Institute
AWG	American Wire Gauge
BTU	British thermal unit
CAN	Controller area network
CEC	Canadian Electrical Code
CSA®	Canadian Standards Association
CX	Cordex® series; CXC for Cordex system controller
DC	Direct current
DHCP	Dynamic Host Configuration Protocol
EIA	Electronic Industries Alliance
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ERM	Electromagnetic Compatibility and Radio Spectrum Matters
ESD	Electrostatic Discharge
FCC	Federal Communications Commission (for the US)
HVSD	High voltage shutdown
IEC®	International Electrotechnical Commission
IEEE®	The Institute of Electrical and Electronics Engineers, Inc.
IP	Internet Protocol
LED	Light emitting diode
LVD	Low voltage disconnect
LVBD	Low voltage battery disconnect
MIL	One thousandth of an inch; used in expressing wire cross sectional area
MOV	Metal oxide varistor
MUX	Multiplexer
MTBF	Mean time between failures
NC	Normally closed
NEC®	National Electrical Code® (for the US)
NO	Normally open
OSHA	Occupational Safety & Health Administration
OSP	Outside Plant
OVP	Over voltage protection
RU	Rack unit (44.45 mm; 1.75 in.)
TCP/IP	Transmission Control Protocol / Internet Protocol
THD	Total harmonic distortion
TVSS	Transient Voltage Surge Suppressor
UL®	Underwriters Laboratories®
UATS	Universal Automatic Transfer Switch
VRLA	Valve regulated lead acid

CUSTOMER CONNECTION,
CXPS-E105,19",CX48-2.4/3.0kW,
CXCI-HP

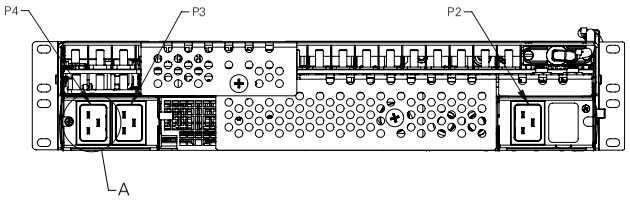


TOP VIEW
(SHOWN w/ REAR COVER REMOVED)

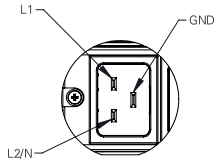


NOTE: DAISYCHAIN CAN BUS
FROM ONE SHELF TO THE NEXT,
INSERT TERMINATOR P/N 5450228-001
IN LAST POSITION.

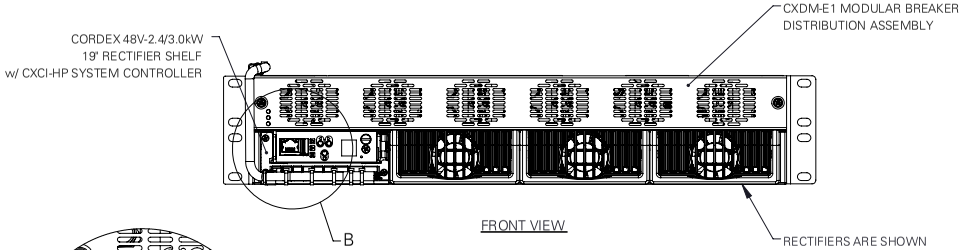
REAR ISO VIEW
(SHOWN w/ REAR COVER REMOVED)



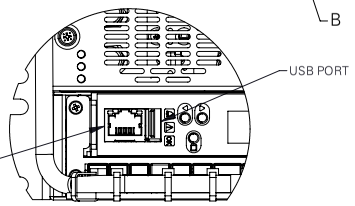
REAR VIEW
(AC INPUT POWER LINE CORD RECEPTACLES 3PL)



DETAIL A
(3 PLACES)

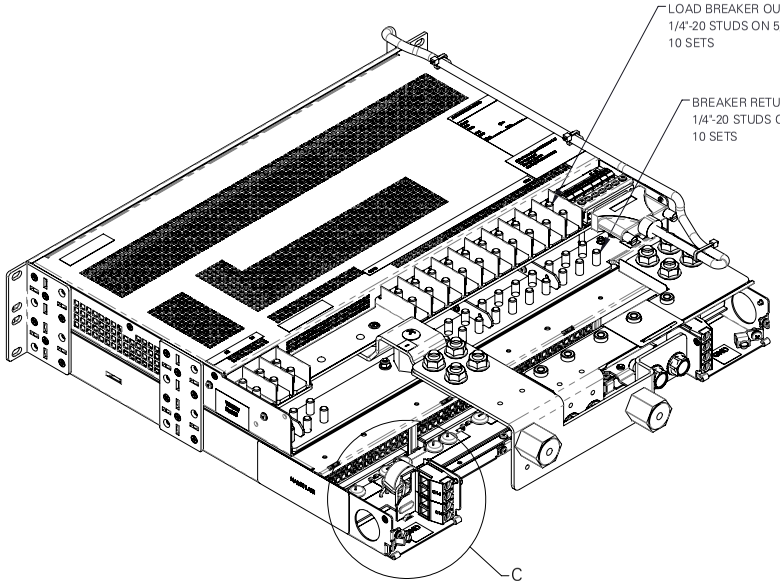


FRONT VIEW

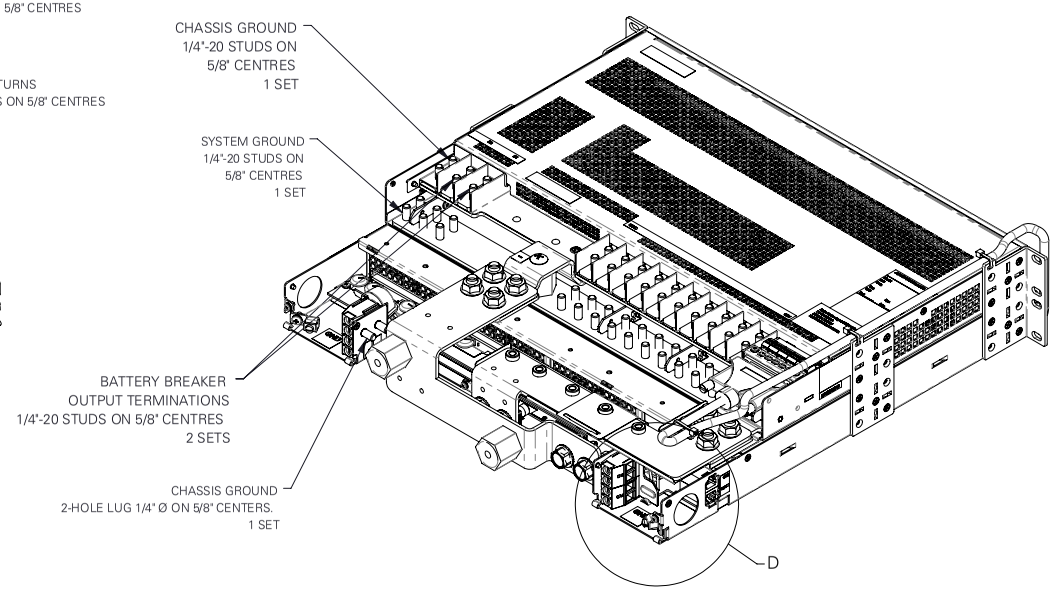


DETAIL B

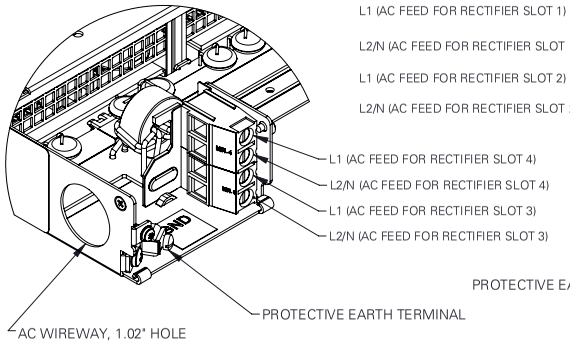
NOTE: AC POWER LINE CORDS ARE NOT INCLUDED WITH POWER SYSTEM



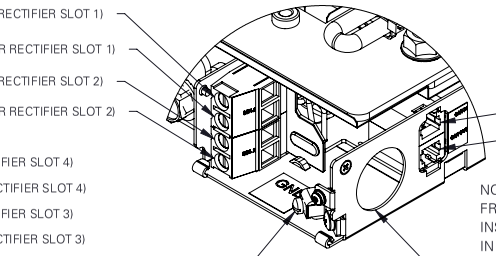
LEFT-REAR ISO VIEW
(SOME COVERS ARE HIDDEN FOR CLARITY)



RIGHT-REAR ISO VIEW
(SOME COVERS ARE HIDDEN FOR CLARITY)

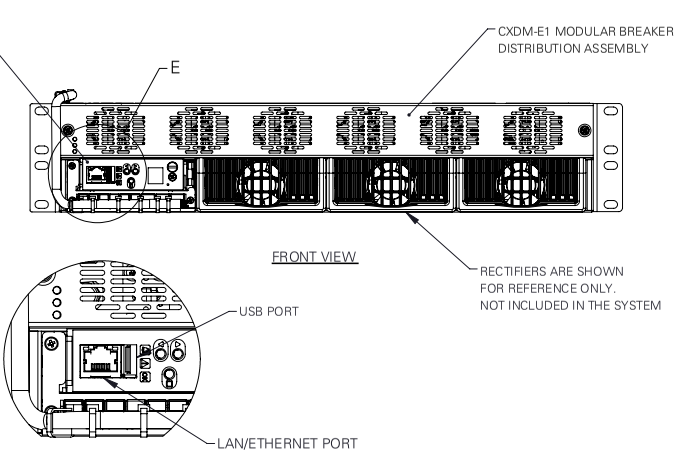


DETAIL C



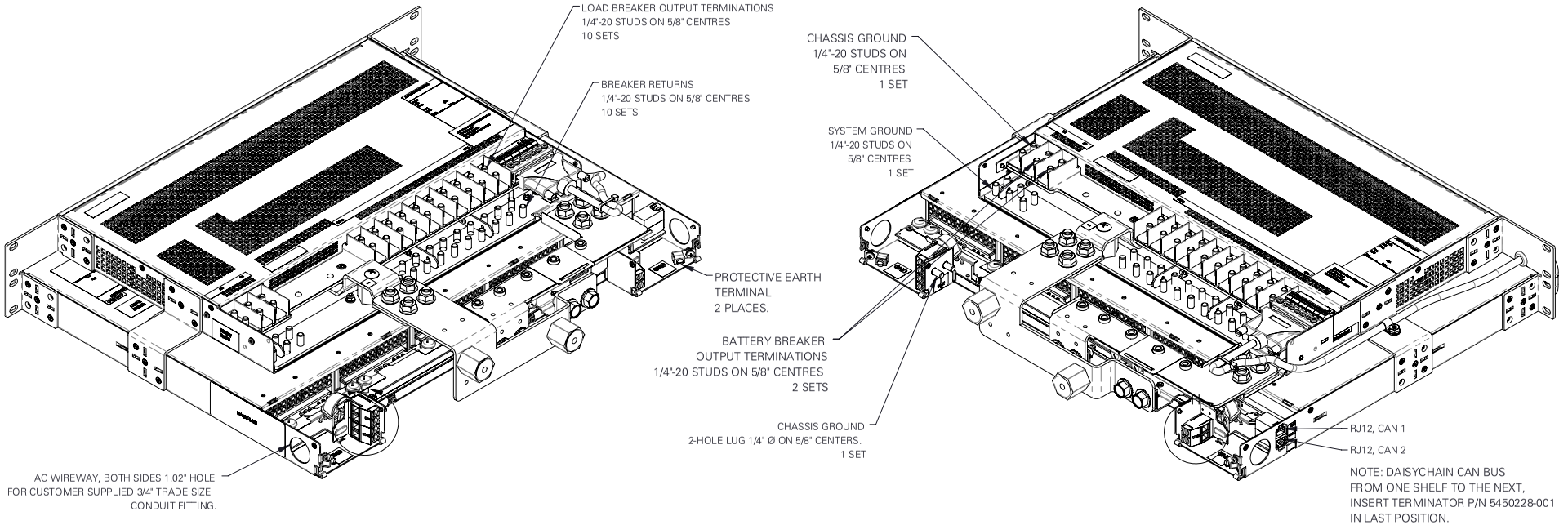
NOTE: DAISYCHAIN CAN BUS
FROM ONE SHELF TO THE NEXT,
INSERT TERMINATOR P/N 5450228-001
IN LAST POSITION.

DETAIL D



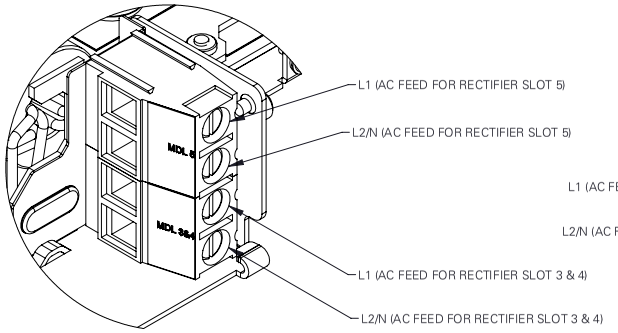
DETAIL E

CUSTOMER CONNECTION,
CXPS-E105,19",CX48-2.4/3.0kW,
CXCI-HP

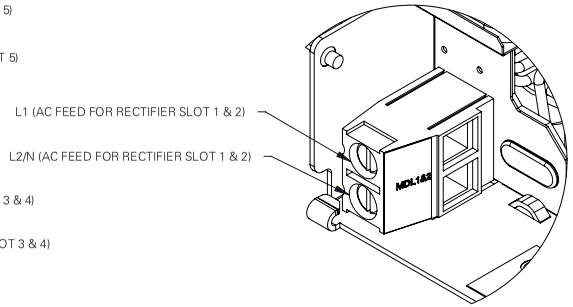


LEFT-REAR ISO VIEW
(SOME COVERS ARE HIDDEN FOR CLARITY)

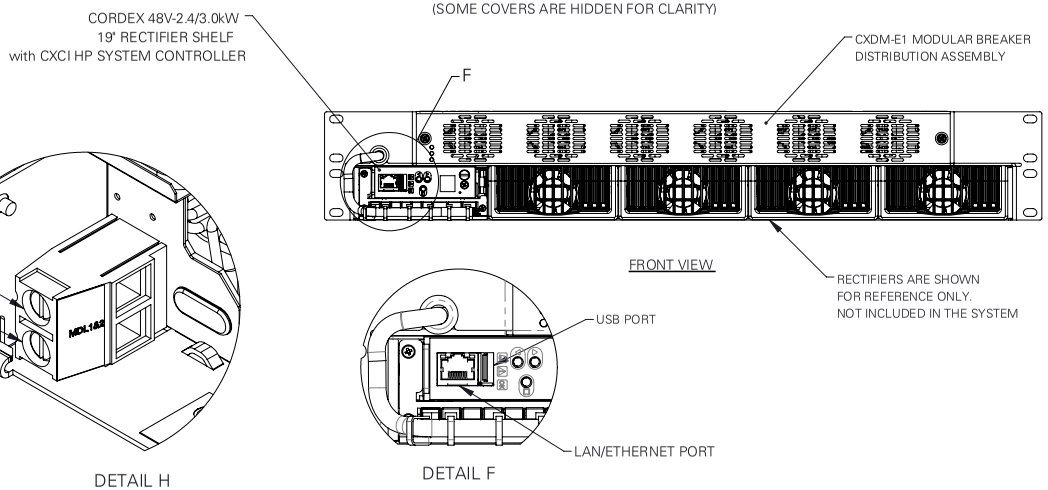
RIGHT-REAR ISO VIEW
(SOME COVERS ARE HIDDEN FOR CLARITY)



DETAIL G



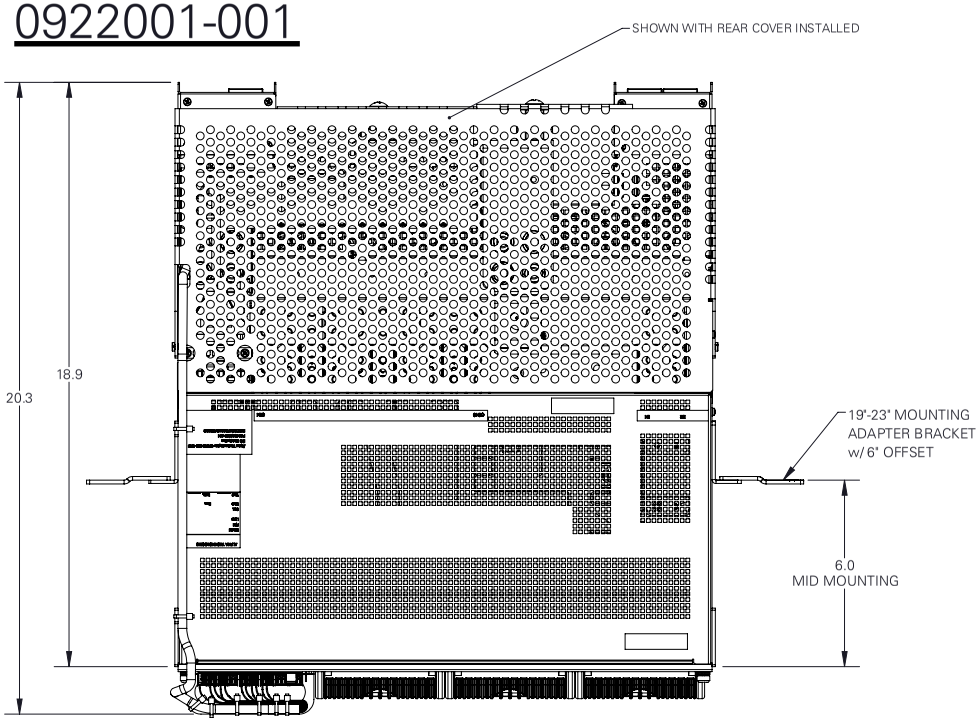
DETAIL H

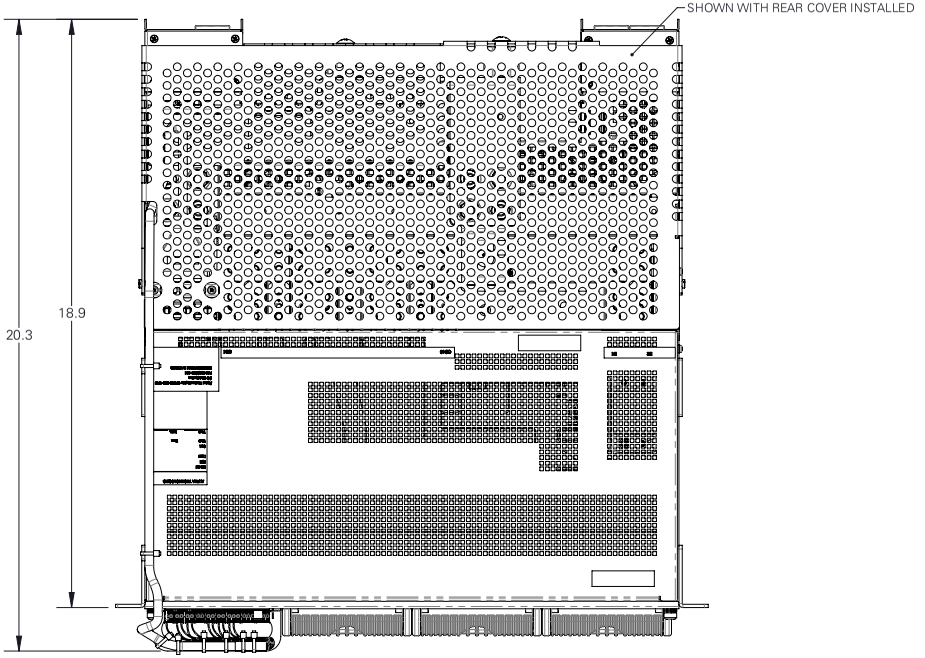


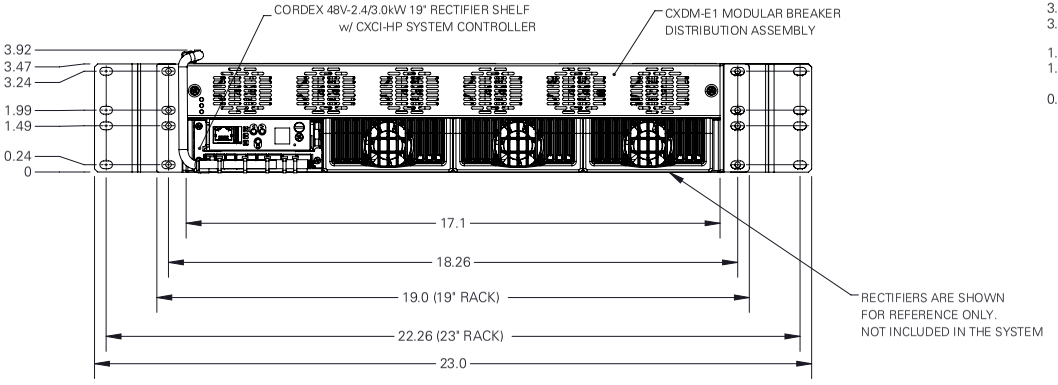
DETAIL F

OUTLINE DRAWING, CXPS-E105,
19"/23",CX48-2.4/3.0KW,CXCI-HP

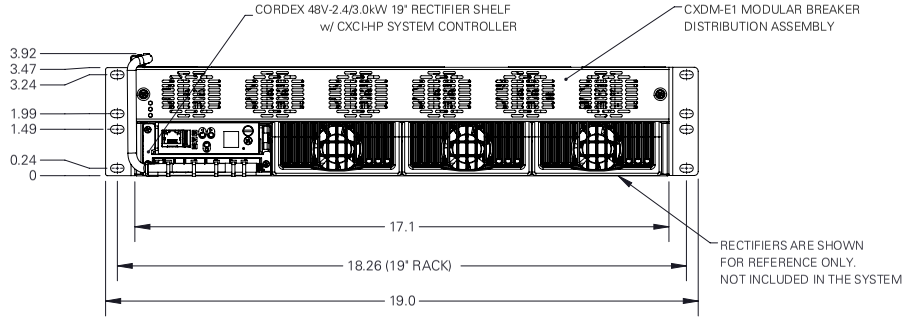
0922001-001





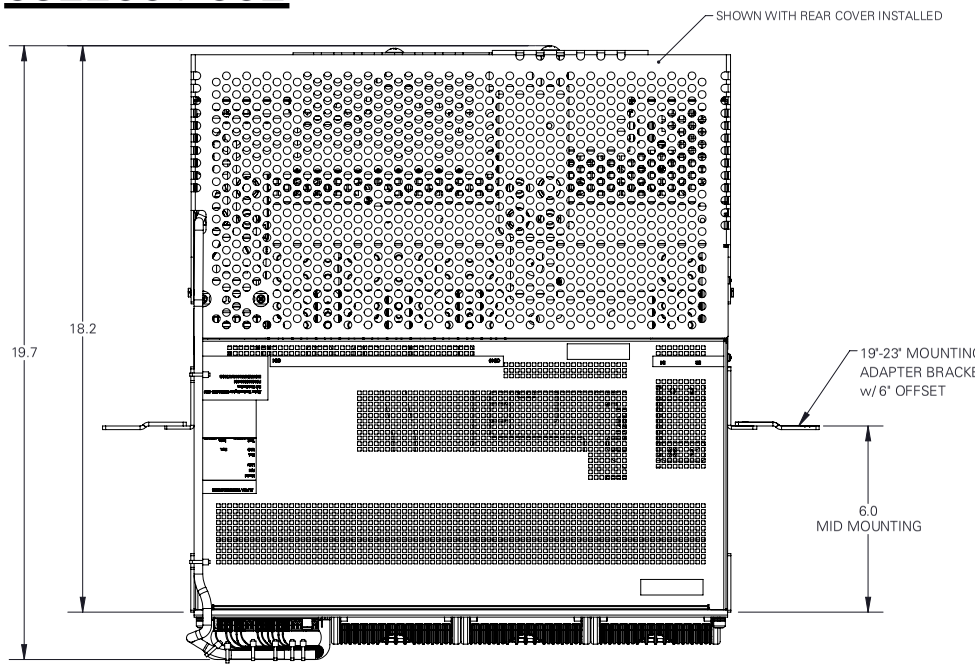


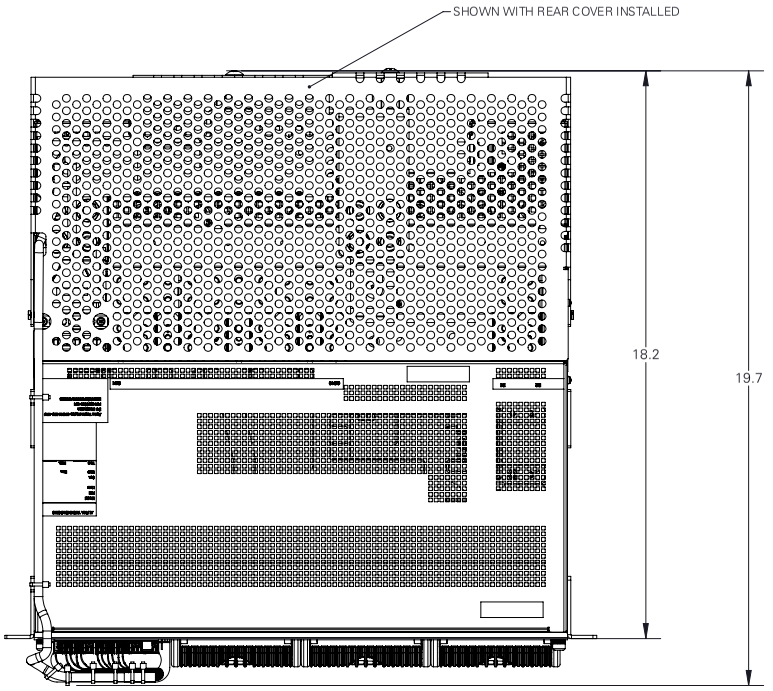
MID MOUNTING w/ 19" - 23" ADAPTER SHOWN

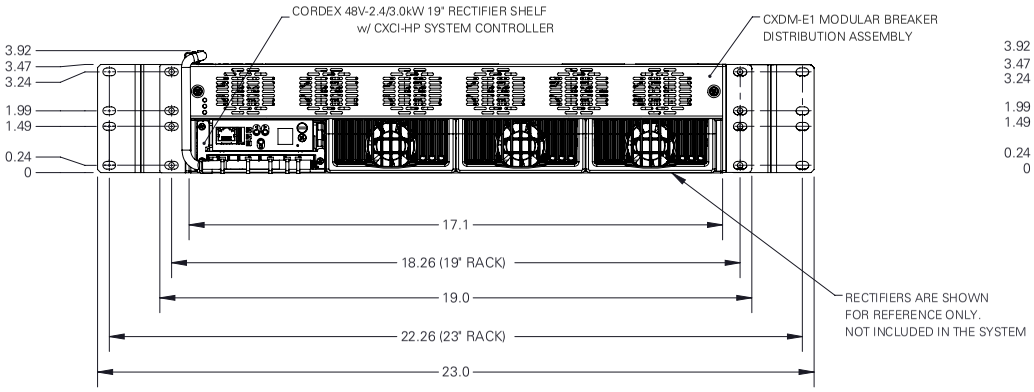


FRONT MOUNTING SHOWN

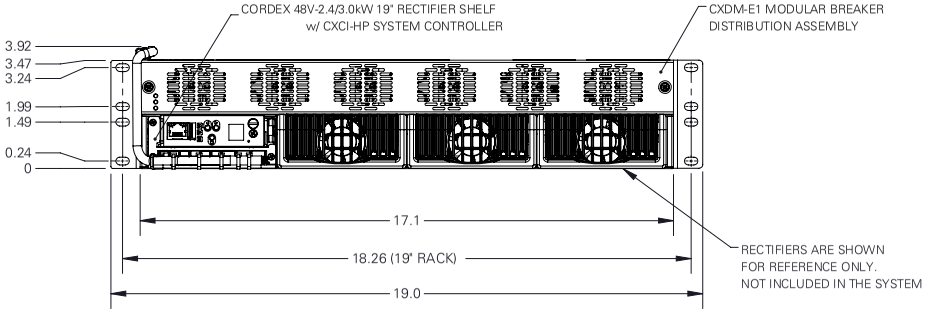
0922001-002





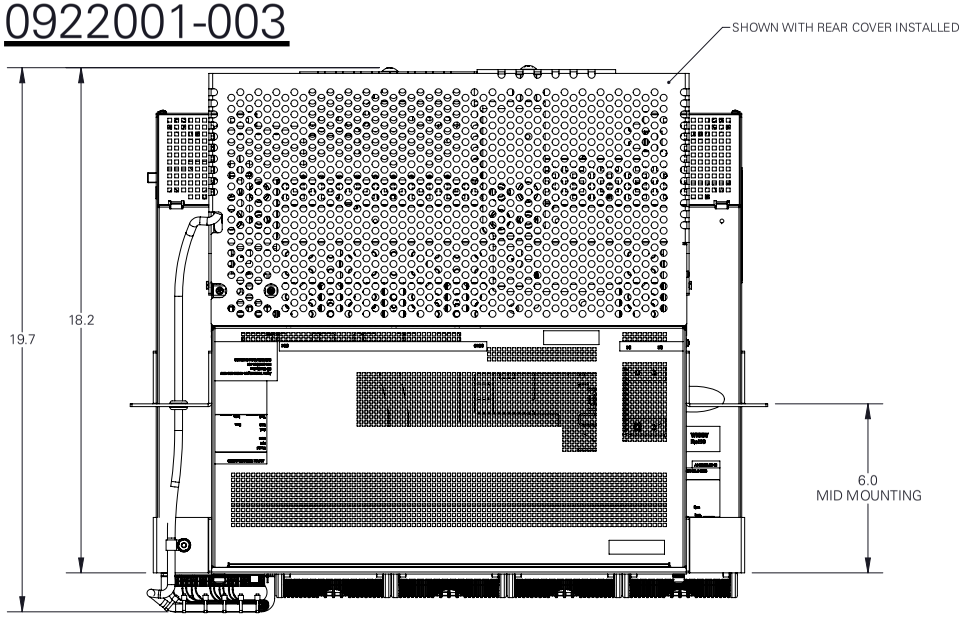


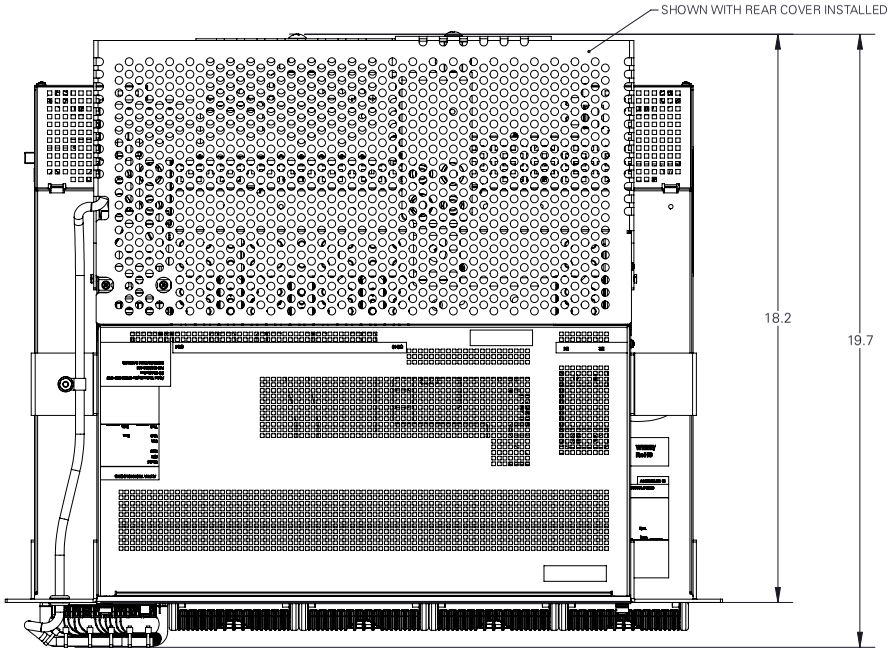
MID MOUNTING w/ 19" - 23" ADAPTER SHOWN

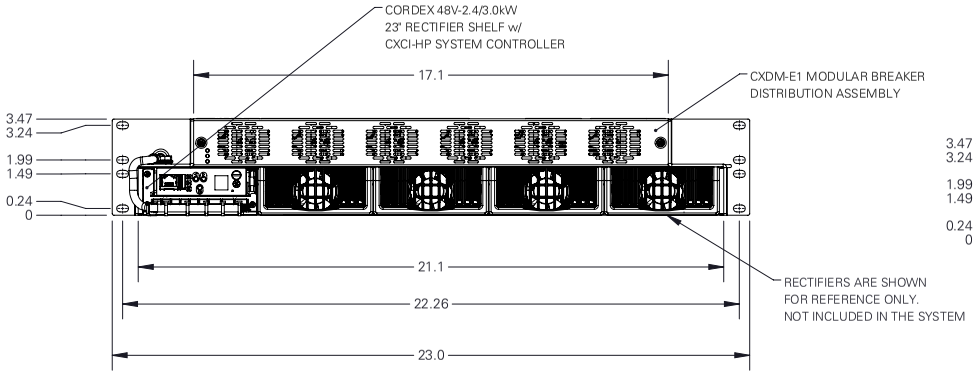


FRONT MOUNTING SHOWN

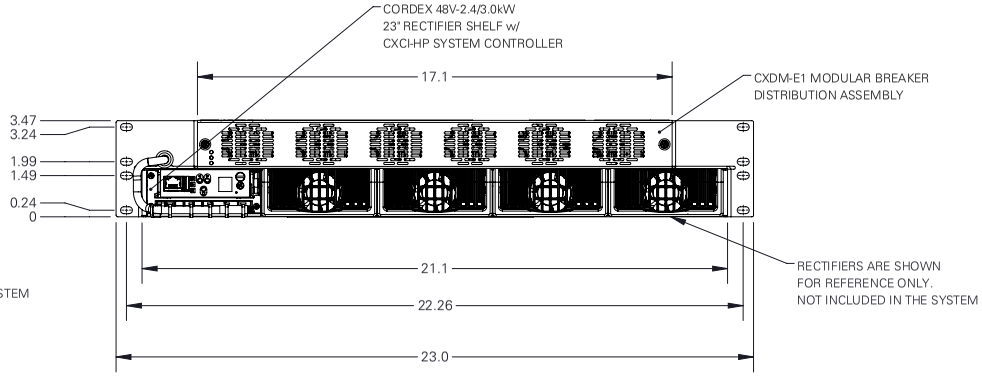
0922001-003





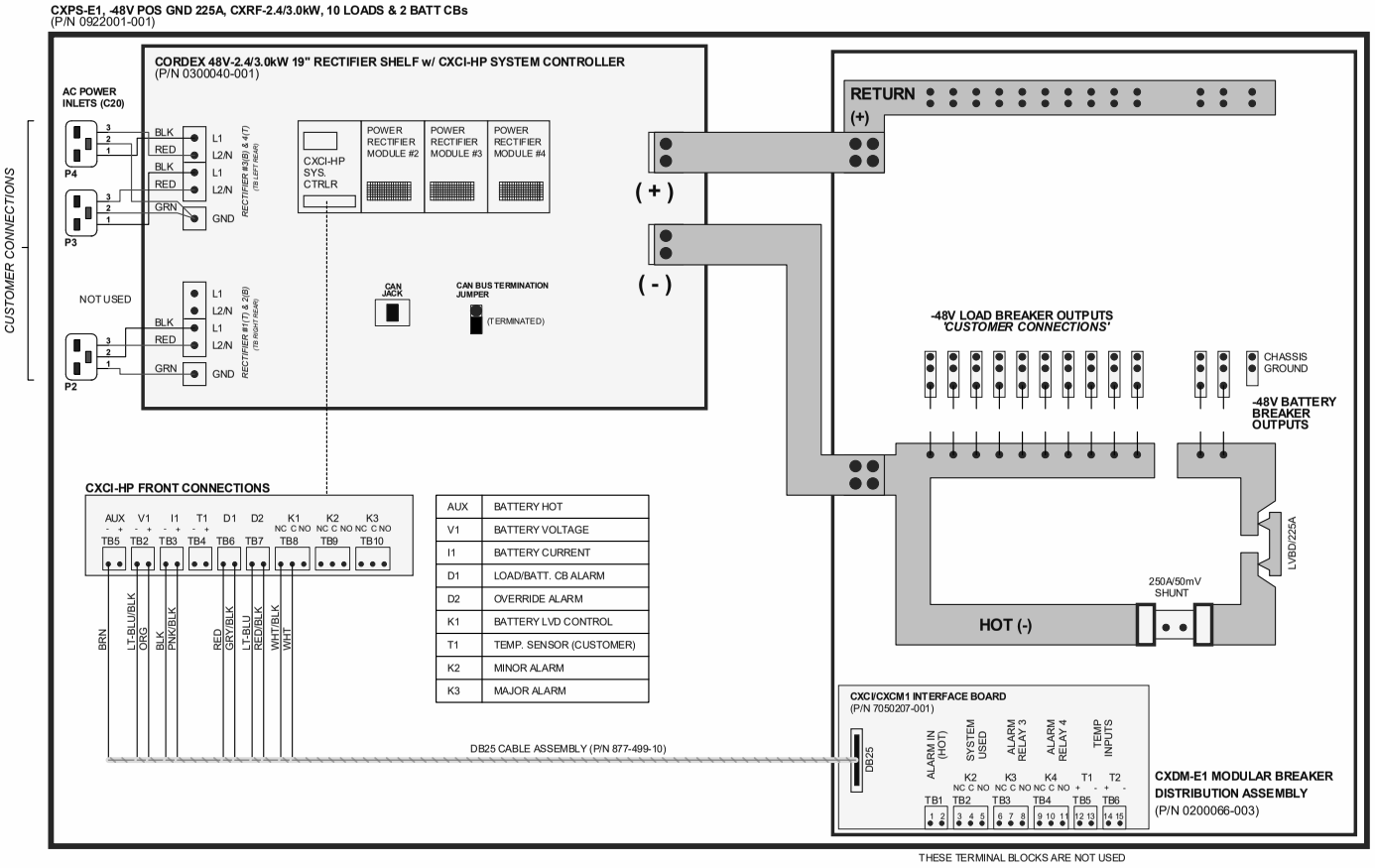


MID MOUNTING SHOWN

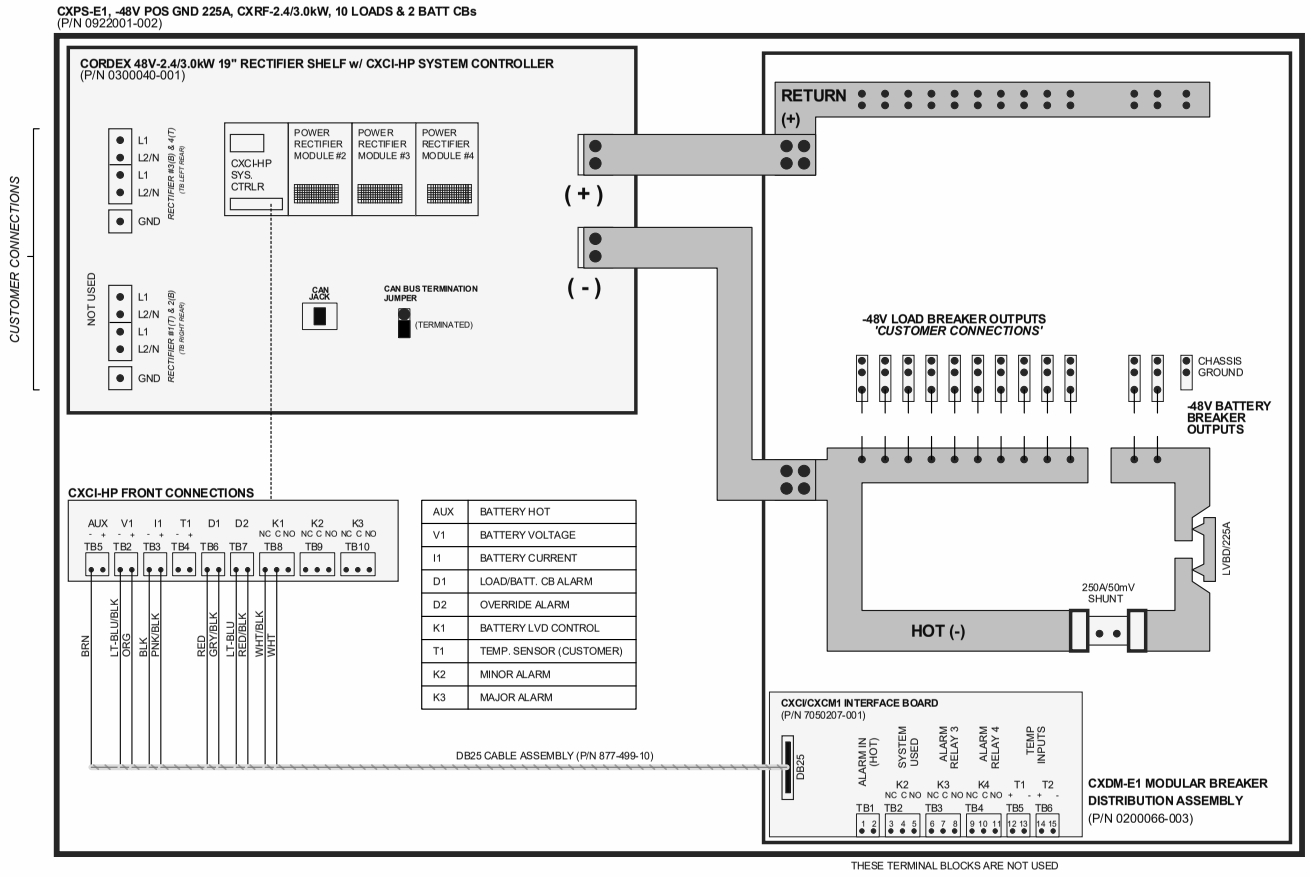


FRONT MOUNTING SHOWN

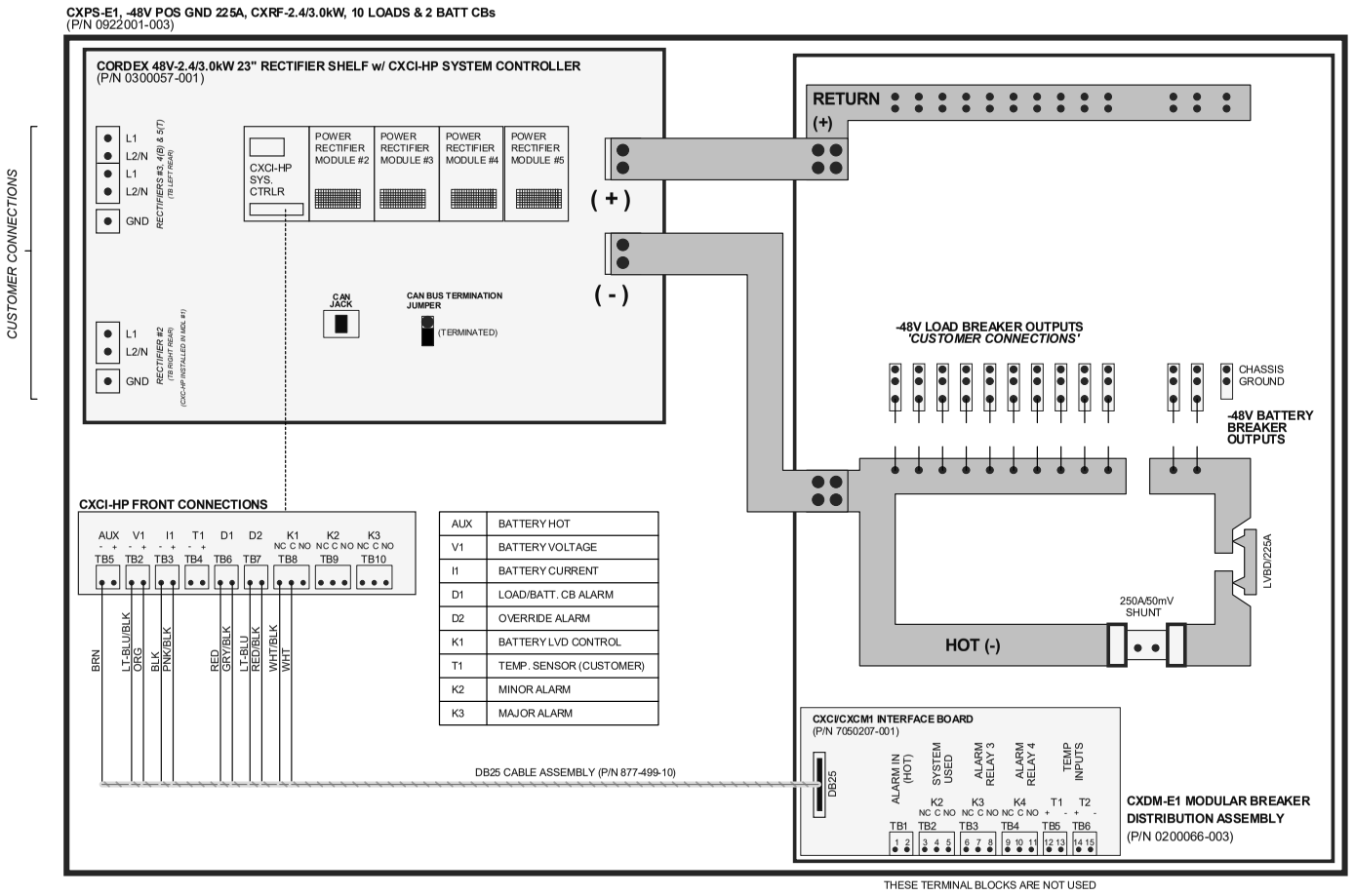
CXPS-E1 INTEGRATED POWER SYSTEM WIRING:



CXPS-E1 INTEGRATED POWER SYSTEM WIRING:



CXPS-E1 INTEGRATED POWER SYSTEM WIRING



AUX	BATTERY HOT
V1	BATTERY VOLTAGE
I1	BATTERY CURRENT
D1	LOAD/BATT. CB ALARM
D2	OVERRIDE ALARM
K1	BATTERY LVD CONTROL
T1	TEMP. SENSOR (CUSTOMER)
K2	MINOR ALARM
K3	MAJOR ALARM

Alpha Technologies Ltd. | 7700 Riverfront Gate, Burnaby, BC V5J 5M4 Canada
Toll Free North America: +1 800-667-8743 | Outside North America +1 604-436-5547 | Technical Support +1 888-462-7487
For more information visit our website at: www.enersys.com

0922001-J0 REV A (03/2023)