CXPS-E3 200A - 400A Power System

Technical Guide: 9400016-J0

Effective: 05/2019

Alpha Technologies Ltd.

an EnerSys company

CXPS-E3 Power System

NOTE:

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

NOTE:

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

NOTE:

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1. Safety

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

1.1 Safety Symbols

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

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

NOTE:

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

CAUTION!

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

WARNING!

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

HOT!

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

1.2 General Warning and Cautions

WARNING!

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

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

1.3 Electrical Safety

WARNING!

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

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

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 that the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.

WARNING!

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

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

2. Introduction

2.1 Scope of the Manual

This manual covers the features, options, installation and startup of Alpha Technologies CXPS-E3 power system. Images contained in this document are for illustrative purposes only and may not exactly match your installation. To assist with installation reference may be made to the drawings at the rear of this manual.

In addition to this manual, the following documents may be included in the documentation package that ships with the CXPS-E3:

- Cordex HP Controller (CXC HP) Software manual: 0350058-J0
- Cordex HP Controller and I/O Peripherals Hardware manual: 0180036-J0
- Cordex 48-2.4 kW Rectifier and Shelf manual: 0300040-J0
- Cordex 48-4 kW Rectifier and Shelf manual: 9400000-J0

2.2 Product Overview

The CXPS-E3 uses high-density rectifiers, a front access distribution center and the advanced CXC HP controller. The E3 is the ideal solution for small to medium-sized 48Vdc applications, providing up to 400 Amps of output current. With universal 19/23" mounting, high temperature operation and high power density, it is the perfect solution for a wide variety of installation scenarios including those in harsh, outdoor environments. The distribution center provides up to 26 load breaker positions, integrated shunt and LVD. All distribution connections and controller I/O contacts are front accessible.

The CXC-HP controller includes a touch screen GUI for simple and convenient local setup. A built-in web server provides alternate setup via local or remote IP access, using a standard internet browser. The E3 can be easily integrated into customer-provided relay racks or enclosures, or can be ordered factory installed into various Alpha relay rack configurations, including systems with pre-wired battery trays.

- Integrated 48V, 400A power system with front access distribution
- Industry leading power system density
- 400A, 26 distribution positions in 5RU
- Advanced CXC-HP controller with touch screen display for full local control
- High temperature rated design for harsh outdoor applications
- Wide range AC input for flexible worldwide deployment

Figure 1 — CXPS-E3 System

2.3 System Configurations

The following four configurations are currently available for the CXPS-E3 power system. For more ordering information, refer to the CXPS-E3 Ordering Guide on the Alpha website.

Table A — CXPS-E3 Configuration

Rack Size	Controller	Expanded I/O	Current Rating	Rectifier Capacity	Load Breakers	Battery Breakers	Shunt	LVD (Optional)	Height
19"	CXC HP	L-ADIO	400A	8x 2.4kW (2 shelves)	21	0	Load	No	5 RU
					16	5	Battery	LVBD	5 RU
23"	CXC HP	L-ADIO	400A	10x 2.4kW (2 shelves)	26	0	Load	No	5 RU
					21	5	Battery	LVBD	5 RU
19"	CXC HP	L-ADIO	400A	5x 4kW (1 Shelf)	21	0	Load	No	7 RU
					16	5	Battery	LVBD	7 RU
23"	CXC HP	L-ADIO	400A	6x 4kW (1 Shelf)	26	0	Load	No	7 RU
					21	5	Battery	LVBD	7 RU

2.3.1 CXPS-E3 19" Systems with 48-2.4kW Rectifiers

- Rated for 400A with two 2.4kW shelves
- 5RU with two 2.4kW shelves
- 21 load breakers with load shunt or 16 load and 5 battery breakers with battery shunt
- CXC-HP controller
- L-ADIO module with extensive I/O capability
- Option for LVBD for battery breaker configuration

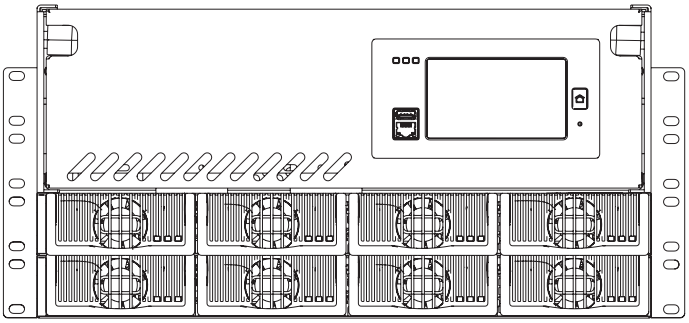


Figure 2 — 19" CXPS-E3 with 48-2.4kW Rectifiers

2.3.2 CXPS-E3 23" Systems with 48-2.4kW Rectifiers

- Rated for 400A with two 2.4kW shelves
- 5RU with two 2.4kW shelves
- 26 load breakers with load shunt or 21 load and 5 battery breakers with battery shunt
- CXC-HP controller
- L-ADIO module with extensive I/O capability
- Option for LVBD for battery breaker configuration

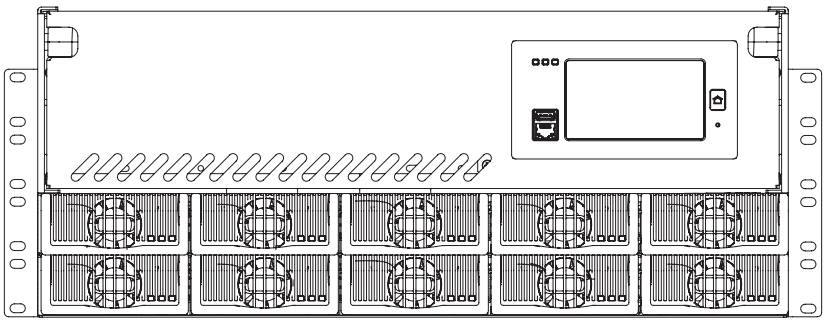


Figure 3 — 23" CXPS-E3 with 48-2.4kW Rectifiers

2.3.3 CXPS-E3 19" Systems with 48-4.0kW Rectifiers

- Rated for 400A with one 4kW shelf
- 7RU with one 4kW shelf
- 21 load breakers with load shunt or 16 load and 5 battery breakers with battery shunt
- CXC-HP controller
- L-ADIO module with extensive I/O capability
- Option for LVBD for battery breaker configuration

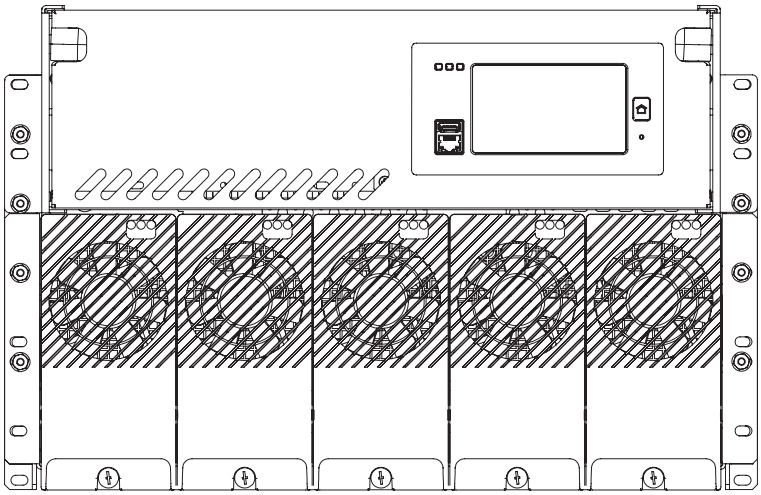


Figure 4 — 19" CXPS-E3 with 48-4.0kW Rectifiers

2.3.4 CXPS-E3 23" Systems with 48-4.0kW Rectifiers

- Rated for 400A with one 4kW shelf
- 7RU with one 4kW shelf
- 26 load breakers with load shunt or 21 load and 5 battery breakers with battery shunt
- CXC-HP controller
- L-ADIO module with extensive I/O capability
- Option for LVBD for battery breaker configuration
- Option for different AC input configurations individual feed, 208 three phase 480/277 three phase

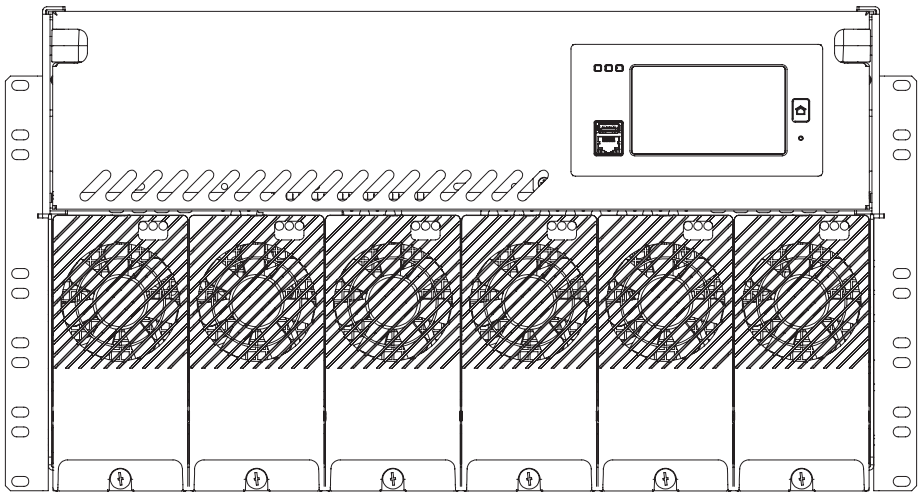


Figure 5 — 23" CXPS-E3 with 48-4.0kW Rectifiers

3. Specifications

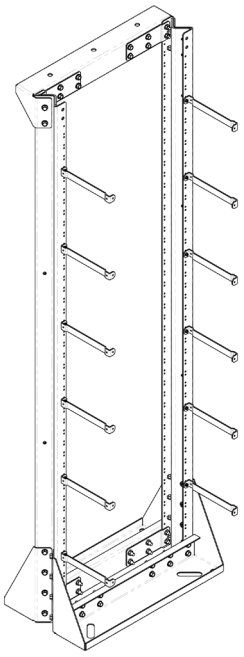
Table B — 48V–2.4kW / 4.0 kW Rectifier System			
Electrical			
		48V–2.4kW	**48V–4kW**
System Capacity (max)		400A	400A
Input	Operating Voltage	187 to 277Vac (Nominal)	208 to 277Vac (Nominal)
	Extended (High)	277 to 310Vac	277 to 310Vac
	Extended (Low)	90 to 187Vac (de-rated O/P power)	90 to 187Vac (de-rated O/P power)
	Recommended AC Breakers	19" System: Up to 8x 20A feeds 23" System: Up to 4x 40A feeds & 2x 20A feeds	19" System: Up to 5x 30A feeds (208-277single phase) 23" System: Up to 6x 30A feeds (208-277single phase) Up to 2x 50A feeds (208 three phase) Up to 2x 30A feeds (480/277 three phase)
	Efficiency	>96% Peak efficiency	>95% Peak efficiency
Output	Current per module	50A @ 48Vdc (nominal I/P)	83.3A @ 48Vdc (nominal I/P)
		25A max @ 48Vdc (120Vac)	
	Rectifier Positions	19" System: Up to 8 rectifiers 23" System: Up to 10 rectifiers	19" System: Up to 5 rectifiers 23" System: Up to 6 rectifiers
Mechanical			
19" System	Mounting	Flush/Center	Flush/Center
	Dimensions	8.75"H x 19"W x 17.4"D	12.25"H x 19"W x 16.6"D
	Hot Positions	21x Load Breakers (or) 16 Load + 5 Battery Breakers	21x Load Breakers (or) 16 Load + 5 Battery Breakers
		21x sets of 1/4" Studs on 5/8" Centers	21x sets of 1/4" Studs on 5/8" Centers
	Return Positions	21x sets of 1/4" Studs on 5/8" Centers	21x sets of 1/4" Studs on 5/8" Centers
	Weight (System)	20.4kg (45lbs)	20kg (44lbs)
23" System	Mounting	Flush/Center	Flush/Center
	Dimensions	8.75"H x 23"W x 17.4"D	12.25"H x 23"W x 17.75"D
	Hot Positions	26x Load Breakers (or) 21 Load + 5 Battery Breakers	26x Load Breakers (or) 21 Load + 5 Battery Breakers
		26x sets of 1/4" Studs on 5/8" Centers	26x sets of 1/4" Studs on 5/8" Centers
	Return Positions	26x sets of 1/4" Studs on 5/8" Centers	26x sets of 1/4" Studs on 5/8" Centers
	Weight (System)	25.8kg (57lbs)	22.7kg (50lbs)
Weight (Rectifier)		1.76kg (3.9lbs) / Module	3.9kg (8.6lbs) / Module
System Access		Front access after initial installation	
Controller		CXC-HP	
Environmental			
Temperature		-40 to 55°C (-40 to 131°F) 55 to 65°C (-40 to 149°F) de-rated output	
Humidity		0 to 95% RH non-condensing	
Elevation		-500 to 2000m (-1640 to 6600ft) -500 to 4000m (-1640 to 13100ft) with de-rated output	
Compliance			
Safety		CSA C22.2 No. 60950-1-07	
		UL 60950-1	

4. Features

4.1 Seismic Racks

The CXPS-E3 system can be installed in a variety of Alpha provided, 19" and 23" seismic racks. These racks have been Z4 rated and NEBS L3 certified. The racks vary in their Z4 seismic capabilities from 500lb to 2500lb and in their heights from a 3.5' to 9' (standard 7' racks are available as well). For more ordering information, refer to the CXPS-E3 Ordering Guide (0470209-00) on the Alpha website.

- 19" or 23" Seismic Rack



4.2 Distribution Centers

The E3 power system has been designed with high density breaker/fuse count for use in 48V applications and is rated for a total ampacity of 400A. It is available either in a 19" or 23" configuration. All systems include a rear top cover for the protection of live customer connections.

4.2.1 19" Power Center

Provides up to 21 breakers which can be configured as all load breakers (21 load breakers) or a mix of load and battery breakers (16 load breakers and 5 battery breakers).

The all load breaker configurations have a shunt that monitors the total load current supplied by the rectifiers to the load.

The load/battery breaker configuration has a shunt that monitors the total battery charge / discharge current and includes a 600A Low Voltage Battery Disconnect (LVBD).

Automatic control of the LVBD can be bypassed using the LVD override feature when necessary such as during maintenance intervals. In addition, the LVD Override feature can be configured to allow parallel remote control or remote disable. See "4.7 LVD Override" on page 18.

Both load and battery hot and return connections are made on 1/4" studs on 5/8" centers using narrow tongue lugs. Adapter kits for landing larger cables are available when higher capacity 2 or 3 pole breakers are required.

4.2.2 23" Power Center

Provides up to 26 breakers which can be configured as all load breakers (26 load breakers) or a mix of load and battery breakers (21 load breakers and 5 battery breakers).

The all load breaker configuration has a shunt that monitors the total load current supplied by the rectifiers to the load.

The load and battery configuration has a shunt that monitors the total battery charge / discharge current and includes a Low Voltage Battery Disconnect (LVBD).

Both the hot and return connections are made on ¼" studs on 5/8" centers using narrow tongue lugs. Adapter kits for landing larger cables are available when higher capacity 2 or 3 pole breakers are required.

4.2.3 Control and Monitoring Methods

The E3 front panel provides inputs and outputs for load and battery voltage, battery or load current, breaker alarms and disconnect control as well as monitoring. Additional I/O (expansion) is available for customer use. See the table below for the details.

Table C — Control and Monitoring Methods

Features	
L-ADIO	
Dedicated I/O:	Bus Voltage Monitoring (2) Breaker Alarm Monitoring (2) Dry Contact– Breaker Alarm (2) Bus Voltage Sense (2)
Expansion I/O (Customer Use):	Temperature Sensor Inputs (4) Form C Relay Outputs (12) Digital Inputs (6) Voltage Sense Inputs (2) Current Shunt Inputs (4)
CXC HP Controller	
	Local connection to L-ADIO Advanced GUI Ethernet Connection

4.2.4 Breaker Labelling

For systems with load only outputs, the numbering goes from left (1) to right (21 for a 19" or 26 for a 23")

For systems with batteries and loads the load numbering goes from left (1) to center/right (16 for a 19" or 21 for a 23") AND the battery labelling goes from right (1) to left (5).

There is a label on top of the front door which can be seen from the top when the door is closed, and from the front when the door is open. This label is larger and suitable for writing information about the breaker position.

There are two additional labels for breaker identification: a thin label above the breaker which can be read from the front (not writable), and one on the back/top near the return breakers which identify the positions of the return (not writable).

4.3 Front Panel with a CXC HP Controller

The front panel includes the CXC HP controller and a pre-wired L-ADIO module.

The CXC HP family of products provide centralized setup, control and monitoring of power systems. This can range from simple monitoring and threshold alarms for temperature, voltage and current, to advanced battery charging and diagnostic features. The controller has a 4.3-inch, full color touch screen display.

The CXC HP provides dual Ethernet ports allowing for simultaneous network, LCD and local laptop access to the controller including both web and SNMP interfaces.

The CXC HP supports dual CAN ports to allow up to 254 power and/or ADIO modules to be controlled and monitored. The CXC HP uses external analog and digital input and output (ADIO) peripherals to monitor electrical signals (temperature, voltage, temperature) and generate electrical signals through relays.

Detailed operation of the controller is provided in the CXC HP software manual.

The most commonly used ADIO peripheral is the L-ADIO for low voltage systems which includes:

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

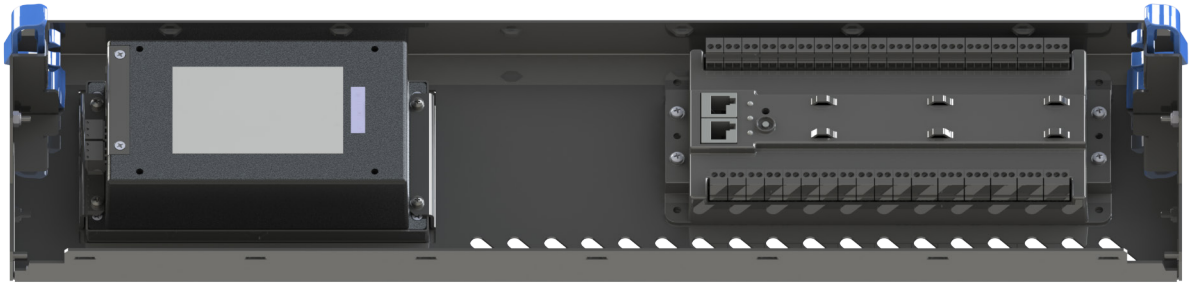


Figure 6 — Front Panel w/ L-ADIO and CXC HP Controller

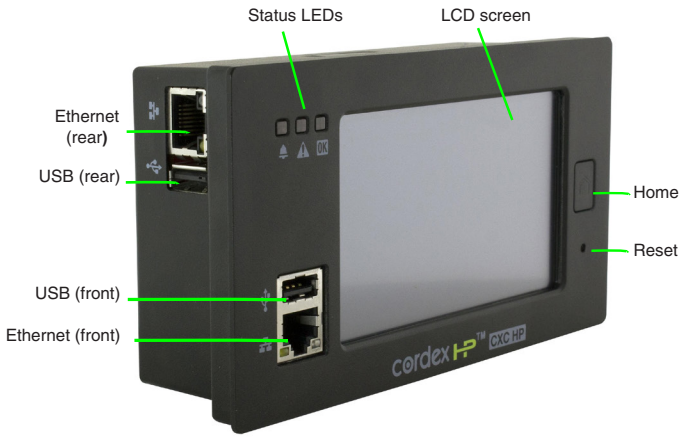


Figure 7 — CXC HP Controller

The CXC HP has the following features:

Front touchscreen: full color LCD touchscreen display, to access controls and menu items by using fingertip touch or a stylus.

Home button: provides the ability to go directly back to the home screen from any menu.

Front panel reset: for emergency use only to restart the CXC HP if the unit touch screen or home button are not responding.

Front panel LEDs: for alarms, progress and status indication.

Audio speaker: built-in audio speaker tones during active alarms and can be disabled if required.

Ethernet: dual ports 10/100BASE-T Ethernet connection on both the front and rear of the controller for remote or local communication.

USB: dual ports on both the front and rear of the controller for upgrades or file management via a standard USB flash drive.

CAN: dual independent CAN bus ports for communication with the Alpha Cordex and AMPS family of products, allowing for a greater number of devices.

Real-time clock: with field replaceable lithium battery, allows for timestamps on alarms and events.

System fail alarm/relay: which activates when there is a major internal failure. During such a condition the unit attempts to reset.

Figure 8 — CXC HP Controller Touchscreen Display

4.4 L-ADIO

4.4.1 Analog Input Channels

The controller is supplied with analog input channels for voltage, current, and temperature.

4.4.2 Voltage Inputs

Two voltage input channels, V1 and V2, are used to monitor the discharge and charge voltage. V1 for Bus A Voltage and V2 for Bus B Voltage. Voltage inputs V3 and V4 are not used in the E3 and are available for customer use.

4.4.3 Temperature Inputs

The E3 panel can accept up to four temperature probes to monitor the surrounding ambient temperatures. These analog values can be used to report high or low temperature alarms.

4.4.4 Digital Input Channels

The E3 panel can accept up to eight digital inputs. Digital Inputs D1 and D2 are wired for Bus 'A' Breaker Alarm and Bus 'B' Breaker Alarm respectively. Digital inputs D3 to D8 are available for customer use.

4.4.5 Alarm and Control Output Relays

The controller contains 12 Form C digital alarm output relays, that are used to extend alarms and control to external apparatus. Each internally generated alarm or control signal may be mapped to any one of these relays, or several signals may be mapped to just one relay or none at all. None of the output relays are pre-configured on the (K1-K12) are available for customer use.

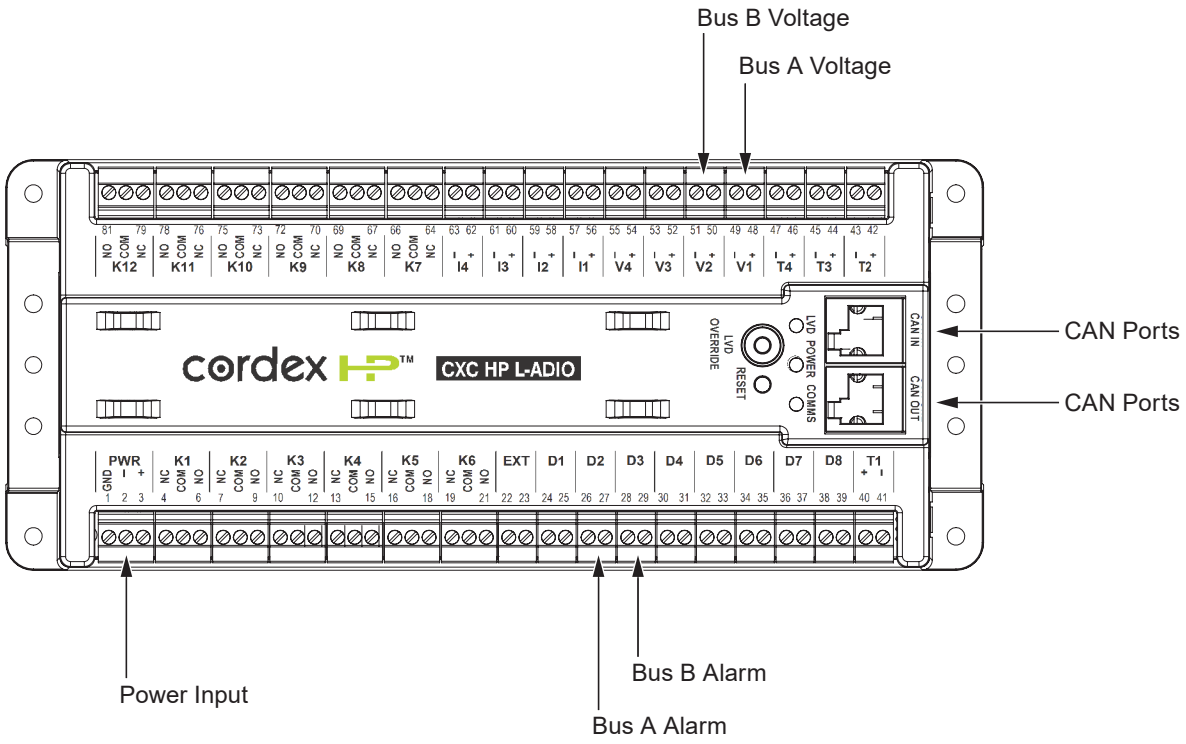


Figure 9 — L-ADIO I/O Peripheral

4.4.6 Network Connection and Remote Communication

A CAN bus is used to transmit all alarm and control functions between the L-ADIO and a remotely located CXC HP controller.

4.4.7 Network Connection and Remote Communications

The Cordex system can be set up, monitored, and tested via an Ethernet 10/100 Base-T serial data connection. The communication protocol supports a web interface. A CAN bus is used to transmit all alarm and control functions between the controller and rectifiers.

Refer to CXC-HP Software Manual (0350058-J0) for operation of controller.

4.4.8 Front Panel Wiring Notes

The terminal blocks on the Indicator Boards are suitable for #26-16AWG wire. As both signals are low current, it is recommend to use thinner wire were possible to make routing easier and to minimize space consumed by in the system. This is especially important with the L-ADIO if many of the expansion I/O capabilities are to be used.

Added wiring should be routed along the same path as the bus connection cable and then extend through the back of the unit. Take care to restrain the wiring sufficiently while providing enough slack so as not to interfere with operation of the door. Use the cable tie locations on the L-ADIO to restrain the cables within the front panel, and use the lance features on the chassis side panels to guide the cabling to the back of the unit.

4.5 2.4kW Rectifier

4.5.1 Rectifier Features

- High performance compact 50A rectifier for 48Vdc telecom application
- High efficiency (96 +%) for reduced OPEX and carbon footprint
- High temperature operating range for installation in non-controlled environments
- Multiple configurations providing 250A or 12kW in a compact 1RU shelf
- High power density (28W/in^3) yields more space for revenue generating equipment
- Wide AC input operating range for global installation requirements
- Extended operating temperature range up to 75°C for deployment in the harshest outdoor environments

4.5.2 LED Status

The three LEDs on the rectifier front panel indicate status:

- AC Input Voltage present (1)
- DC Output Voltage present (2)
- Rectifier Alarm (3)

Figure 10 — Cordex HP 2.4k Rectifier Front Panel LEDs

4.6 4.0kW Rectifier

4.6.1 Rectifier Features

- High performance 83.3A rectifier for 48V telecom applications
- 95.3% efficiency for increased OPEX savings and reduced carbon footprint
- High power density 4RU compact design delivering up to 24kW per 23" shelf
- Power limiting and wide range AC input for global installation requirements
- Extended operating temperature range up to 75°C for deployment in the harshest outdoor environments

4.6.2 LED Status

The three LEDs on the rectifier front panel indicate status:

- AC Input Voltage present (1)
- DC Output Voltage present (2)
- Rectifier Alarm (3)

Figure 11 — Cordex HP 4.0k Rectifier Front Panel LEDs

4.7 LVD Override

For systems with LVBD an over-ride interface is provided, see Figure 12. This interface board includes 3 LEDs indicators to provide visual status indication, and two customer connections for remote control/monitoring:

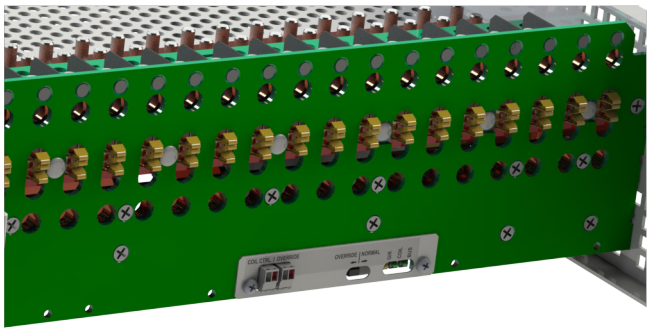


Figure 12 — LVD Override

LEDs

- BUS (Green) Lit when the bus connected to the LVD has power connected.
- COIL (Green) Lit when the LVD coil is energized. This requires the BUS to have power and one of the controls (L-ADIO, REMOTE, or LVD Over-ride) to be active
- O/R (Yellow) Lit when the override switch is in the over-ride position. This should only be on during maintenance.

Connections

- OVERRIDE 48V/5mA signal, active when over-ride switch is in over-ride position.
    - » COIL CTRL Control input for LVBD coil, can be configured for remote control or remote disable: When configured for remote control (default), a dry contact connected to the coil control input can turn on the LVBD independently of the LVD or the automatic control.
    - » When configured for remote disable, the coil control input must be shorted by a dry contact for either the automatic control or the LVD override to operate.

The LVBD override interface is configured for remote control by default for most systems.

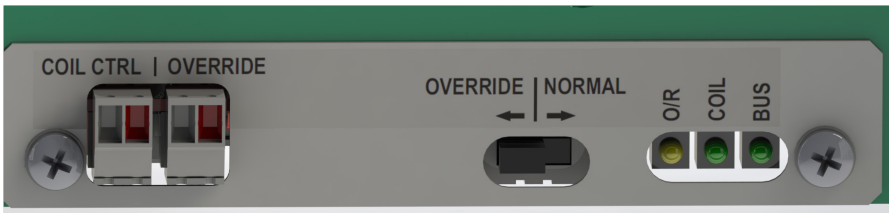


Figure 13 — LVD Override Interface

To change configuration:

This operation must be done with AC and DC power disconnected, ideally prior to commissioning the system.

1. Remove the interface from the E3 by removing the two (2) screws from the front
2. Lower the board, and pull it forward through the opening.
3. Flip the board over, and observe the jumper on the bottom of the board.
4. Move the jumper to the desired position:
    - » CTRL (NO) position: the COIL CTRL is configured for remote control
    - » ENBL (NC), COIL CTRL for remote enable.
5. After the jumper is set check all cable connections (in case they were pulled loose when the board was removed)
6. Reinstall the board and labels using the original screws.

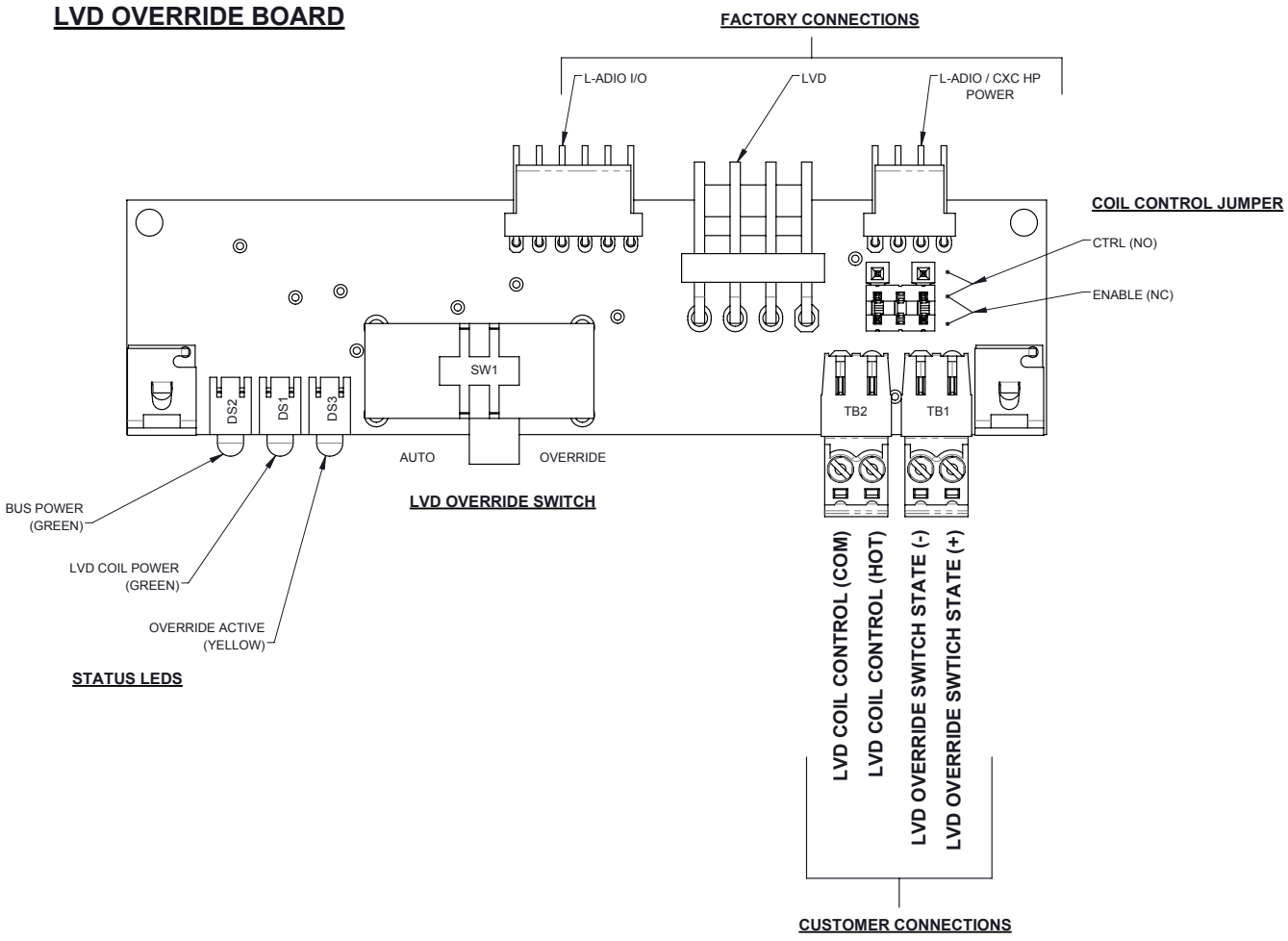


Figure 14 — LVD Override Connections

4.8 Integrated Battery Trays

The CXPS-E3 system is designed to integrate battery trays below the power system. These battery trays can accept standard 12V mono-blocks ranging in height from 6RU-8RU. The battery trays are factory installed and pre-wired for ease of installation. They can be configured for with or without battery breakers as Over Current Protection Devices (OCPD). The battery breakers are installed within a breaker housing on the side of each battery tray. The breaker sizes and its associated cabling can range from 100A–250A.

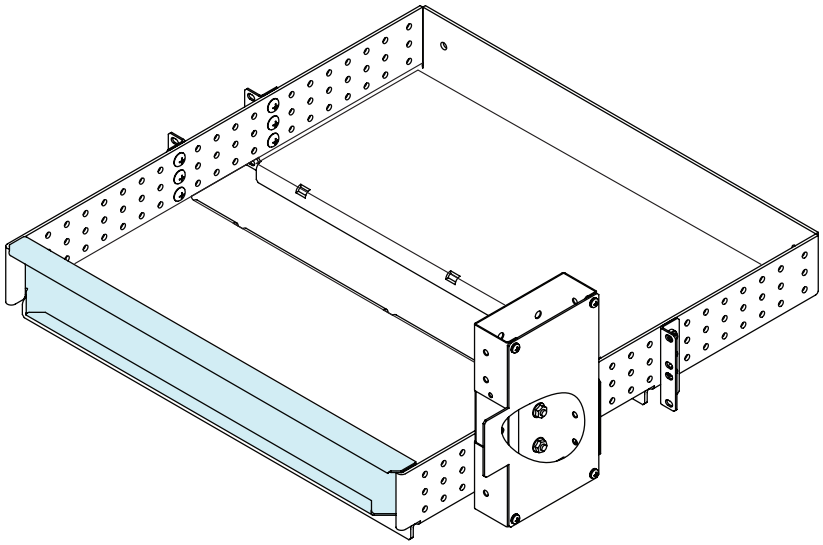


Figure 15 — Integrated Battery Tray

When battery trays are ordered for systems without a Battery Low Voltage Disconnect (BLVD), the battery cable landing bus bar kit will need to be ordered. This kit provides a secure location to terminate each individual battery tray cable to the main power system bus enabling a neat and clean install. In addition, this kit provides sufficient access to customers in the event that a battery tray and its associated cabling needs to be added in the field on a live plant.

4.9 Battery Landing Busbar Kit

The CXPS system can be purchased with an optional Battery Landing Busbar Kit (0250030-550) which provides landing locations for 3 pairs of back-to-back cable lugs (See Figure 16). This kit is customer installed at time of system installation.

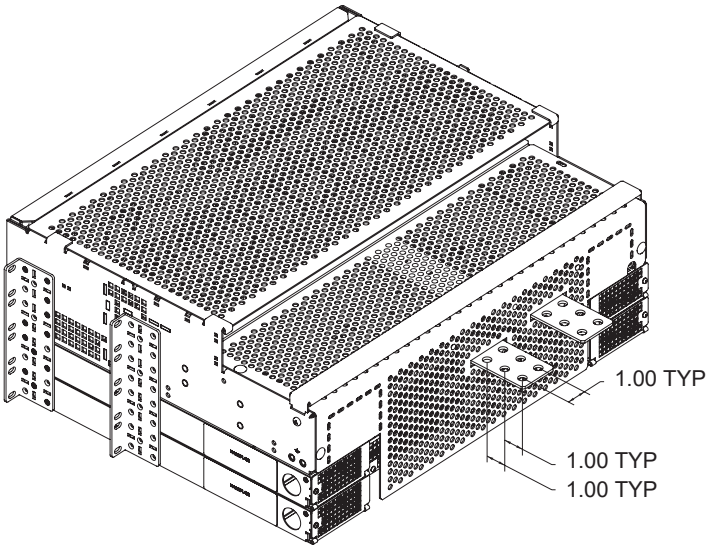


Figure 16 — Battery Landing Busbar Kit

5. Inspection

5.1 Packing Materials

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

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

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

5.1.1 Returns for Service

						
Cardboard	**Polyethylene Terephthalate**	**Low Density Polyethylene**	**Polystyrene**	**Steel**	**Aluminum**	**Wood**
Packing boxes Caps	Flexible film Packaging	Bubble wrap Shrink wrap Plastic bags	Foam	Strapping on pallets	Strapping on pallets	Pallets Lumber

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

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

5.2 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 for advice on the impact of any damage.

5.3 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.

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

6. Installation

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

Frequent reference is made to drawings located at the rear of this manual.

6.1 Safety Precautions

Refer to the Safety section near the front of this manual.

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" 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" drive, 0 - 150 in-lb
- Torque wrench: 3/8" drive, 0 - 100 ft-lb
- Insulating canvases as required (2' x 2', 1' x 1', 3' x 3', etc.)
- Various insulated hand tools including:
  - Combination wrenches
  - Ratchet and socket set
  - Various screwdrivers
  - Electricians knife
- Battery safety spill kit required for wet cells only:
  - Protective clothing
  - Face shields
  - Gloves
  - Baking soda
  - Eye wash equipment
- Cutters and wire strippers (#14 to #22 AWG) [2.5 to 0.34 mm^2]

6.3 Installation of External Batteries

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

WARNING!

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

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 clean water.

6.3.1 Installing the batteries

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 [+] and [–] 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. After all battery connections are completed, torque the connections as per the battery specifications (typically 100 in-lb).

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

6.4 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 literature for guidelines. See the following table for typical maintenance report:

Company: _____ Date: _____
Address: _____
Battery location and/or number:_____
No. of cells: _____ Type: _____ Date new: _____
Date installed: _____ Float voltage: _____ Ambient temp.: _____

Table D — Typical VRLA battery maintenance report

Cell #	Serial #	Voltage	Specific	Ohms	Mhos	Observations

Remarks and recommendations: _____
_____
_____
Readings taken by: _____

6.5 Power System Assembly and Mounting

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. This is to meet the cooling requirements of the rectifiers and to allow easy access to the power system components.

NOTE:

The CXPS-E3 power system requires at least 2RU (3.5") of space above the distribution for tooling access to the load breaker ground connections. Ensure that at least 2RU of space is open in the relay rack above the E3 distribution.

6.5.1 Floor Mounted Systems

Secure the system to a concrete floor using either heavy duty anchors (½" x 2½"), or for wooden floors, heavy-duty lag screws (5/8" x 2½"). Use appropriately sized flat washers.

If required, use isolation kits to isolate system from the floor.

Secure the relay rack to the overhead cable tray. Alpha does not supply the mechanical details necessary for overhead support.

Weight and Dimensions

The weight of the system with no rectifiers or converters installed is approximately 650lb or 295kg. The weight of the systems given below are approximate and exclude rectifiers:

System	Total Weight (lb)	Total Weight (kg)
CXPS-E3 19" Systems e/w 48-2.4kW shelves	37.6	17.1
CXPS-E3 23" Systems e/w 2 x 48-2.4kW shelves	58.0	26.4

Refer to drawing 0250020-06 at the rear of this manual for system dimensions.

Dimensions in Figure 17 and Figure 18 are in inches.

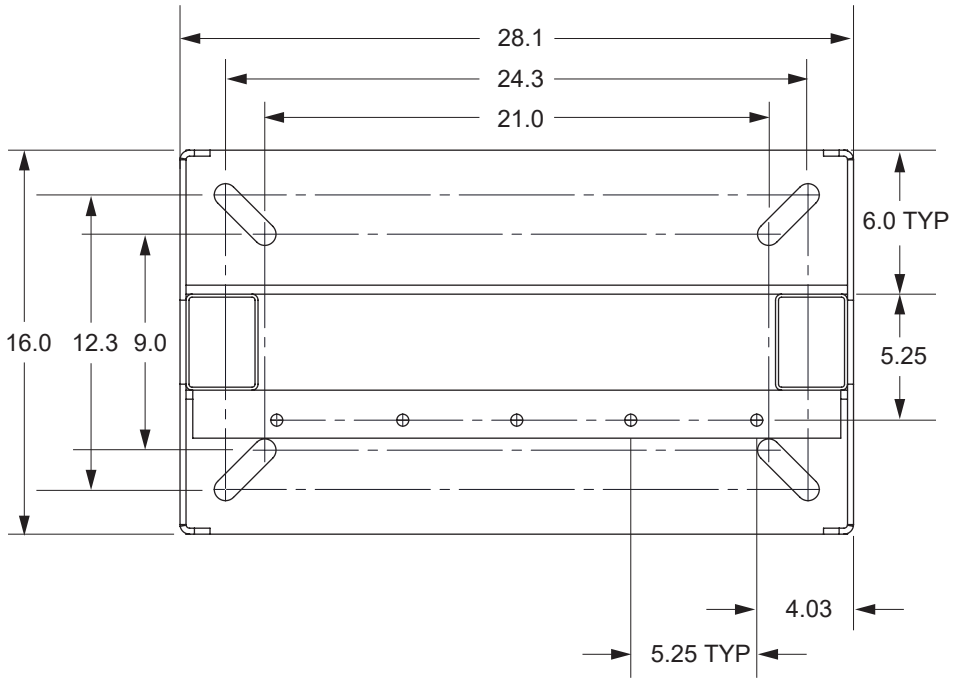


Figure 17 — Rack Mounting Details (top view), Welded Rack

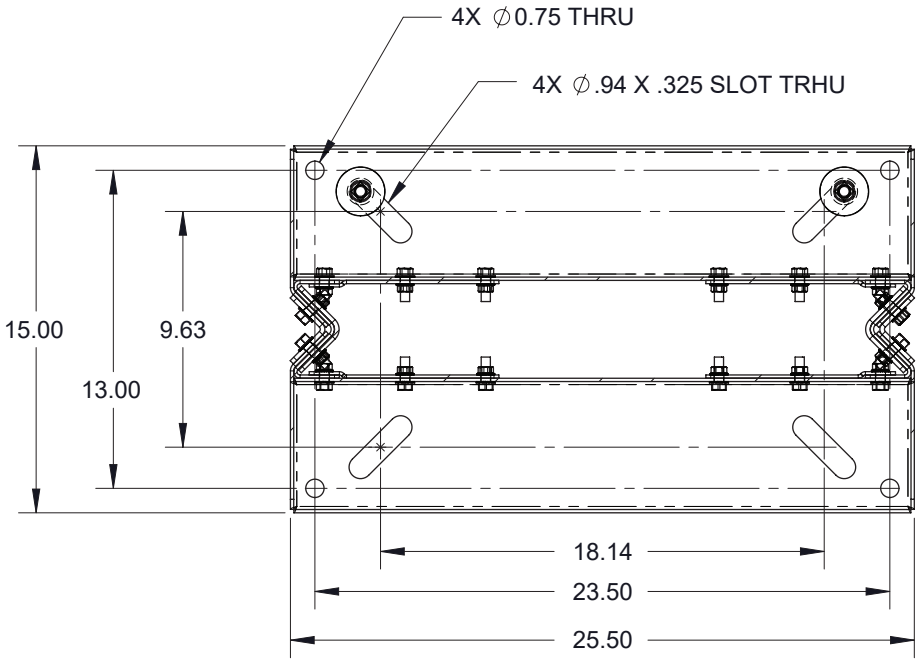


Figure 18 — Rack Mounting Details (top view), Bolted Rack

6.5.2 Rack Mounted Systems

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

The 19" and 23" CXPS-E3 systems may be either flush or center mounted in the relay rack.

6.5.3 Systems Mounted in Outdoor Enclosures/Operated above 40°C

Attach the power system to the customer-provided enclosure using mounting screws and star washers to ensure an electrical bond between system chassis and relay rack. The 19" and 23" CXPS-E3 systems may be either flush or center mounted in the enclosure.

If the system will be operated in ambient temperatures above 55°C the following installation steps must also be followed:

1. The clear polycarbonate top cover shall be removed.
2. The enclosure design must prevent the operator from touching the output bus bars/lug connections.
3. The battery breakers used must be rated 100A or lower.
4. Air circulation within the enclosure should be sufficient to maintain the breaker bullets below 105°C in all operation conditions.

NOTE:

With step 4, the air circulation required is considerably less than what is normally designed into an outdoor enclosure, therefore this should be met by standard designs. However, as cooling performance is very specific to the mechanical implementation, it is recommended to test for compliance under maximum load conditions (using battery discharge test).

6.6 Breaker Installation

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 down 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.

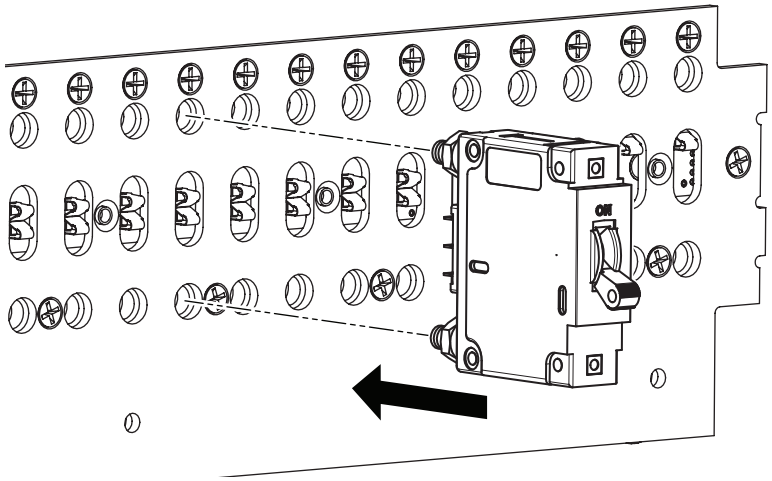


Figure 19 — Breaker Installation

6.6.1 Breaker Removal

1. Turn breaker off.
2. Carefully pull the breaker out of position.

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 removing battery line fuses, 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

WARNING!

The E3 must be installed above a non-combustible surface.

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

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 code(s) take precedence over the guidelines and procedures in the present chapter, wherever applicable.

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

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

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 (NEC, CEC, etc.) for guidelines. If required, increase the size of the cable to meet the code.

Refer to Table E for cable size equivalents.

Table E — Cable size equivalents (AWG to Metric)

Cable size (see notes 1 and 2)	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

Table E — Cable size equivalents (AWG to Metric)			
Cable size (see notes 1 and 2)	**Circular mils**	**Square millimeters**	**Equivalent metric cable**
0 AWG (or 1/0)	105600	53.48	50 or 70
00 AWG (or 2/0)	133100	67.42	70
0000 AWG (or 4/0)	211600	107.2	120
313 MCM (or kcmil)	313600	159	150 or 185
350 MCM (or kcmil)	350000	177.36	185
373 MCM (or kcmil)	373700	189	185 or 240
500 MCM (or kcmil)	500000	253.36	300
535 MCM (or kcmil)	535300	271	300
750 MCM (or kcmil)	750000	380.00	400
777 MCM (or kcmil)	777700	394	400

7.1.2 Recommended Torque Values

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

Grade 5 rated hardware is required for these torque values.

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

Table F — Recommended torque values	
1/4"	8.8 ft-lbs
3/8"	32.5 ft-lbs
1/2"	73 ft-lbs

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, noise, etc. 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**
< 30A	#10
30 – 100A	#6-2
100 – 400A	0000
400 – 800A	350 MCM
>800A	700 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 back of the manual.

7.2.1 Frame Ground

There are two options for connecting a frame ground to the CXPS-E3, in both cases use 2 AWG cable.

Connection to CXPS-E3 Directly

Connect a cable (matched to maximum size breaker, usually 2 AWG or less) between one of the side panels of the CXPS-E3 to the master ground bus (MGB) or floor ground bus (FGB). This connection can be made using a 1/4" x 5/8" lug and two 1/4" x 20 bolts into the PEM nuts indicated in the drawing below.

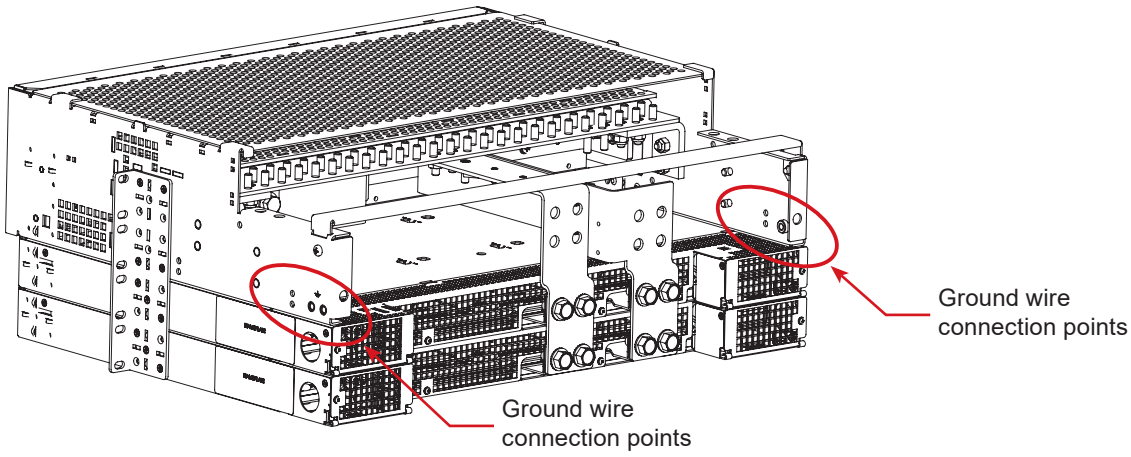


Figure 20 — Connecting the Frame Ground to the CXPS-E3

Connection to Overhead Trays

Connect the CXPS-E3 to the frame using rails using 12-24 self-tapping screws. Ensure paint is removed to ensure a good electrical connection between E3 and frame.

Connect a cable to the frame in which the E3 is installed. The rack upper crossbar (Figure 17) has five 5/8" diameter holes to accommodate threaded rod attachment to the overhead trays. Connect the frame ground 3/8" in 1" centers and 1/4" on 5/8" centers. Remove paint in lug contact area to ensure a good electrical connection.

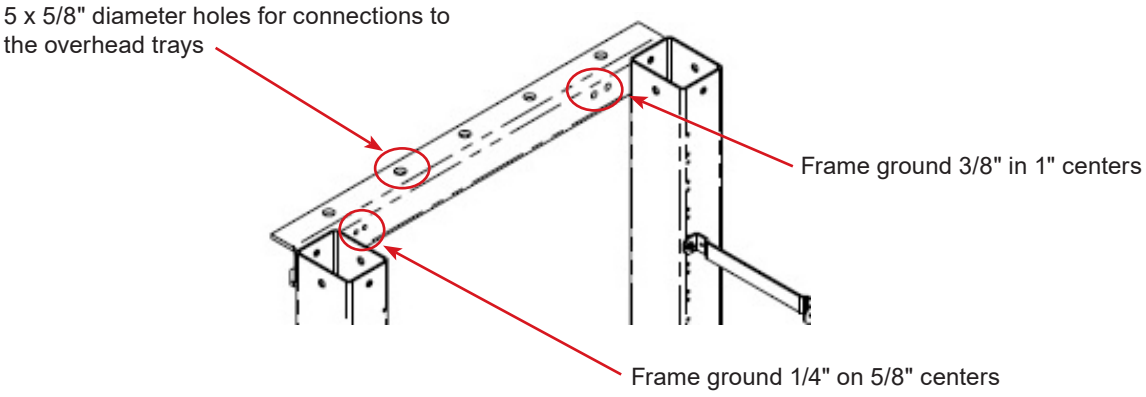
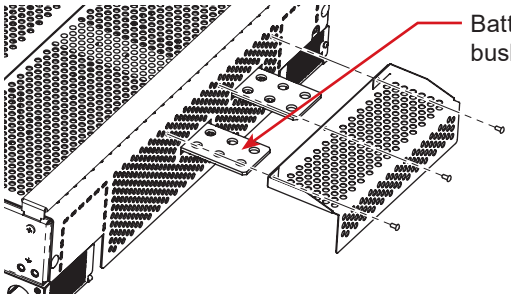
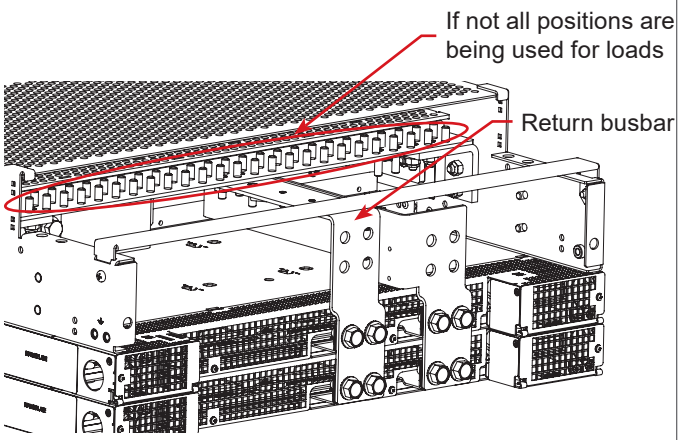


Figure 21 — Connecting the Frame Ground to Overhead Trays

7.2.2 Reference Ground

The reference ground should be connected between the building master ground bus (MGB) or floor ground bus (FGB) and the power system power system internal battery return bus (BRB) in ONLY ONE location. If the MGB or FGB is connected to the power system BRB in more than one location then load current will circulate through the reference ground bond, creating and unsafe condition known as “ground loop”.

Exact connection should be determined by the site engineer, but in general the recommended connection locations are:

Order of Precedence	System Characteristic	Connection Point
1	2V battery stacks	Battery termination bar
2	Connected to larger power system	Power system internal battery return bus (BRB)
3	CXPS-E3 battery landing bus bar	If this option is included (extends out through back cover) 
4	CXPS-E3 return bar location	

7.3 AC Wiring

To ease future access issues, connect the AC circuits to all rectifier shelves at the time of initial installation.

NOTE:

Verify NO rectifiers are installed in the rectifier shelves at this time.

7.3.1 AC Feeder Protection/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.

7.3.2 AC Wiring 2.4kW Rectifier Shelf

The 2.4kW rectifier shelves used within the CXPS-E3 systems are 19- or 23-inches in width. The individual rectifier shelves are wired to the customer provided AC termination panel. The AC input is routed through a one inch knock-out on the side of the shelf for a direct connection. The AC wiring size can vary based on local electrical codes.

The recommended AC breaker and wire gauge sizes are as follows:

Rectifier Shelf	Recommended AC Breaker Size	Recommended AC Wire Size (AWG)
Single Phase , 208 Vac – 277 Vac	23" breaker = 2x 40A & 1x 20A AC breakers 19" breakers = 4x 20A AC breakers	#8 AWG for 40A Breaker #12 AWG for 20A Breaker

Refer the Specifications in Section 3 for further details.

WARNING!

Use care when removing or replacing the covers for the AC input connections. Never assume that an electrical connection or conductor is not energized.

1. Ensure that all modules are removed from the shelf.
2. At the rear of the shelf, remove screw and flip the cover down (two places) to access the AC input terminal blocks: each terminal pair corresponds to either two rectifiers or a single rectifier as shown in Figure 22.
3. The wire way is designed for two customer-supplied, 1" conduit fittings for the AC supplies located on each side of the shelf. Attach the conduit retainers to the wire way hole(s) and route the AC cables through them.
4. Secure the wires to the AC input and AC ground terminals. Refer to the customer connection drawing at the end of the manual.
5. Tighten the cable connector to the AC cable (conduit similar).
6. Replace rear cover(s) once all connections have been completed.

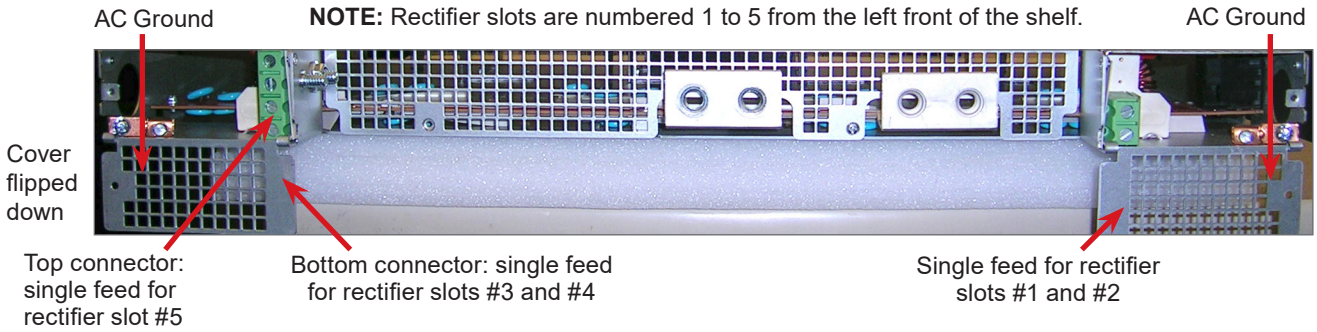


Figure 22 — AC Input and Ground for 23" Shelf

7.4.2 AC Wiring 4.0kW Rectifier Shelf

The 4.0kW rectifier shelves used within the CXPS-E3 systems are 23” in width. The individual rectifier shelves are wired to the customer provided AC termination panel. The AC input is routed through a 1” knockout on the side of the shelf for a direct connection. The AC wiring size depends upon the rectifier shelf voltage configuration and the local electrical code.

The recommended AC breaker and wire gauge sizes are as follows:

Rectifier Shelf	Recommended AC Breaker Size (A)	Recommended AC Wire Size (AWG)
1 Phase , 208Vac – 277 Vac	6x 30A AC breakers	#10 AWG
3 Phase, 208Vac (w/o neutral)	2x 50A AC breakers	#6 AWG
3 Phase, 277/480Vac (e/w neutral)	2x 30A AC breakers	#10 AWG

7.4.3 AC Wiring-4.0kW Rectifier Shelf

Figure 23 shows the AC connections for one of the rectifier shelves. For other AC connection options (e.g. single phase), refer to the rectifier shelf manual that ships with your system.

Terminate flex conduit at rectifier shelves—one connection each side.

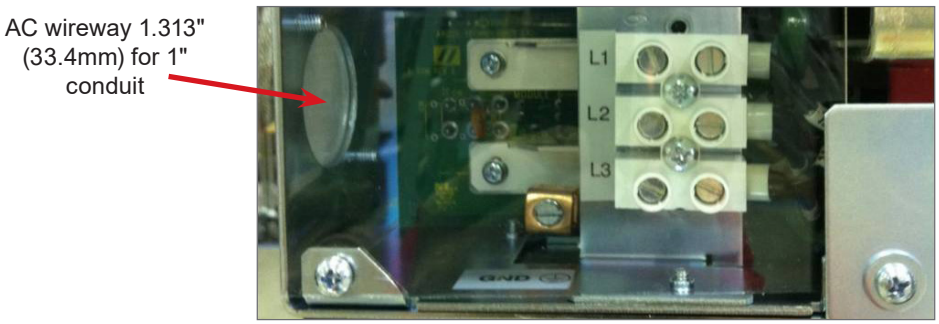


Figure 23 — Shelf AC Connection (3-phase, 3-wire shown with rear cover removed)

7.4 DC Wiring

WARNING!

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

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

The common output leg of the rectifier system must be connected to ground, typically at the battery return bus.

7.4.1 External Battery Bay Output Connections

Battery cables must be sized for a 0.25 V drop from the battery to the power system at full load including anticipated growth. The cables must also meet ampacity requirements. Cables terminating directly on the battery posts or connection details must be secured so that there is no stress on the battery posts. Lead plated lugs and lead plated or stainless steel hardware must be used on all terminations at vented batteries to reduce corrosion.

1. Prepare, route, and connect cables from the power system to the battery termination details— five 3/8" on 1" center lug connections are available for both hot and return.
2. Burnish the terminating points and apply a corrosion-inhibiting agent, such as NO-OX-ID “A”, to all battery terminal connections.
3. Do not complete the final live connections to the battery. Leave open and insulate the final connections or remove the battery fuses. Switch off the battery contacts if used.

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

7.5 Distribution Cabling

7.5.1 Load Planning/Breaker (fuse) Spacing

Because breakers/fuses generate most of the heat in a system, care must be taken in the layout of high current breakers/fuses. Specific guidelines are as follows:

1. Any single pole Over Current Protection Device (OCPD) rated at 125A can be mounted in pairs, but cannot have an OCPD installed on either side of the pair.
2. Any single pole Over Current Protection Device (OCPD) rated at 100A and below can be mounted in any position without spacing.
3. The highest rated bullet fuse that can be used is 125A. The highest rated single pole breakers that can be used for a load is 100A. The highest rated single pole breaker that can be used for batteries is 125A at temperatures below 55°C and 100A for temperatures above 55°C

CAUTION! and HOT!

For applications when the E3 is subjected to ambient temperatures above 55°C it shall be installed inside equipment such that unintentional contact with area of the side panels between the mid-mount bracket and the back of the unit is unlikely. For clarity this is the area marked with a "Caution - Hot" label

While these guidelines require some planning, they do not limit achieving the maximum 400A capacity for any breaker size combination (except if many small breakers are used).

7.5.2 Load Connections

For wire sizing refer to guidelines supplied with the load equipment.

Terminate distribution cabling with 1/4"–5/8" center lugs for connecting to the E3 distribution. Always make the return connection to the E3, and then verify the nut tightening torque before installing the hot connection as once the hot connection is in place it is difficult to access the return connection.

Always use the supplied hardware (nuts) for attaching the lugs. The supplied nuts have a serrated flange which eliminates the need for a second lock washer both allowing more threads to show after a completed connection and avoiding thin hardware which can fall through small gaps in the equipment covers.

Load / Battery Breaker Return Connections

NOTE:

Connect breaker returns before hot connections.

1. Secure cables with two hole lugs to the 1/4" studs on 5/8" centers using the supplied hardware.
2. Run cables directly out the rear of the distribution center.

Load / Battery Breaker Hot Connections

Connect breaker hot connections.

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

7.6 Alarm and Signal Connection

The I/O capabilities of the CXPS-E3 system allow the user to extend various alarm or control signals to an external site monitor via output relays or monitor various analog and digital signals via analog and digital inputs.

For terminal block connections, the recommended wire sizes are 0.14 to 1.50mm² (#26 to #16 AWG) for the temperature range of 0 to 75° C (as per UL/CSA).

CAUTION!

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

Route via wire-ways and use existing cable clamps / lances to secure to existing (factory) wire harness along with customer run signal wires. Ensure signal wires are routed along hinge point of front door so door opening and closing won't require excess wire slack. Refer to Figure 12 for wire routing example.

Terminal block connections for the L-ADIO should be routed along the left side of the E3 (looking at unit from front). Connections to the CXCI+ and 8R/8D ADIO should be routed along the right hand side of the E3. Refer to the customer connections ("–08") drawing at the rear of this manual for details on terminal block assignments.

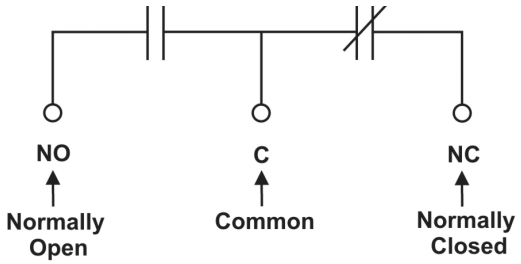


Figure 24 — Alarm (Relay) Connections

7.6.1 Alarm (Relay) Outputs

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

Relays can be programmed to energize or de-energize during an alarm condition. See controller software manual for programming.

7.6.2 Digital Inputs

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

7.6.3 Connection Method

Typical Alpha systems use the "reset with Hot and trigger with Ground" connection. The digital input is wired in such a way that the Hot is wired directly into one of the input terminals; e.g., negative input for 48V systems. The other input terminal is wired to the Ground (common) of the system through a relay (dry contact – usually located on the equipment requiring monitoring). This method (see Figure 25) allows the digital input to receive (or not receive) a Ground signal on an alarm.

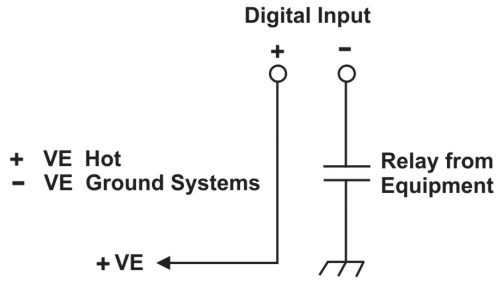


Figure 25 — Digital Input Connection Method

Table H — Voltage level definitions for digital inputs

Voltage Range (Vdc)	Voltage Level (Vdc) Considered As "0" (Off)	Voltage Level (Vdc) Considered As "1" (On)
-60 to +60 (system voltage setting)	-1 to +1	(-60 to -5) or +5 to +60)

7.6.4 Programming the Digital Input

The digital input channels can be programmed for “active high” or “active low.” Active high indicates “alarm on the presence of a ground signal” and active low indicates “alarm on the removal of a ground signal.” See the controller software manual for detailed instruction on programming.

7.6.5 Analog Inputs

CAUTION!

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

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 below have been summarized in the drawings located at the rear of this manual.

7.7 Network and Remote Communication

The system can be set up, monitored and tested via an Ethernet 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 below:

- 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 RJ-45 jack. 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.

7.8 Connecting Battery Temperature Probes

1. Locate the battery temperature probes from the L-ADIO coiled below the distribution center.
2. Uncoil and connect the temperature probes to a battery termination post negative in each battery tray.

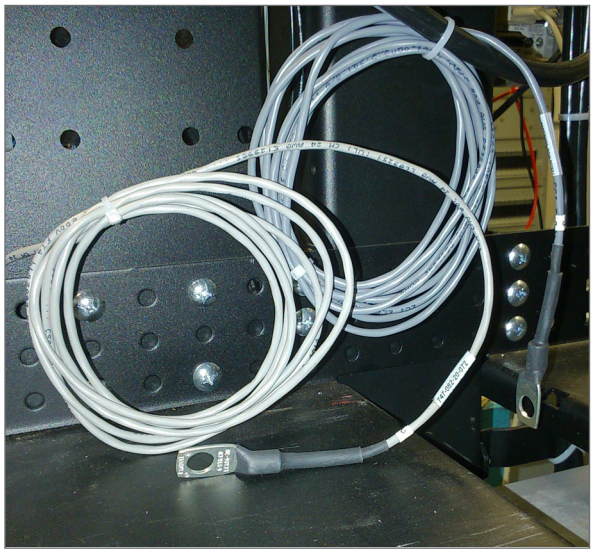


Figure 26 — Battery Temperature Probes

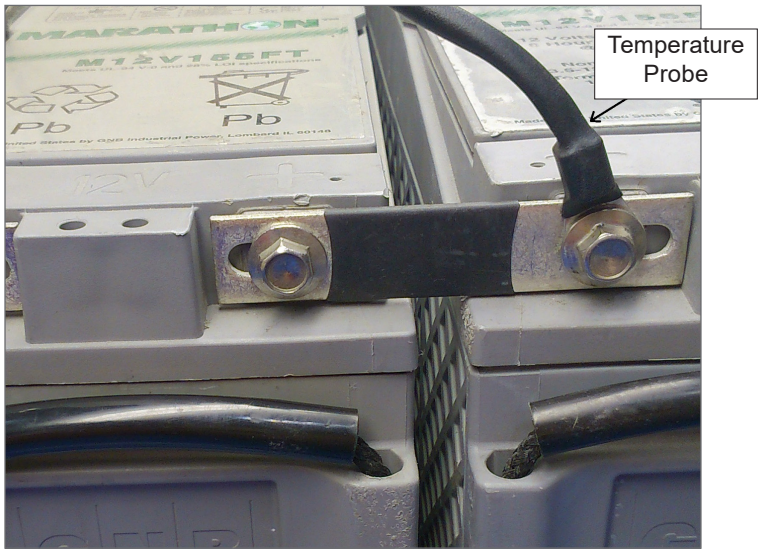


Figure 27 — Battery Temperature Probes—Battery Bay

7.8.1 Load Distribution

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

7.9 High Capacity Breaker Alarm and Shunt Wiring

1. Connect the alarm wire (-HOT) from position NC on the breaker, to one of the available digital inputs on the L-ADIO.
2. Add a (+ RETURN) jumper from the digital input.
3. Connect the shunt wires "Black" and "White" to (-) and (+) current input respectively to a nearest L-ADIO or 6i-ADIO.

7.10 Signal Wiring

1. Use the Form C relay contacts on the L-ADIO to extend various alarm or control signals to an external site monitor. Figure 29 shows the L-ADIO module layout. Table I lists the factory default settings.
2. Use 0.129 mm² (#26 AWG) or larger wire.
3. Bundle signal wires together and route through the top of the bay.

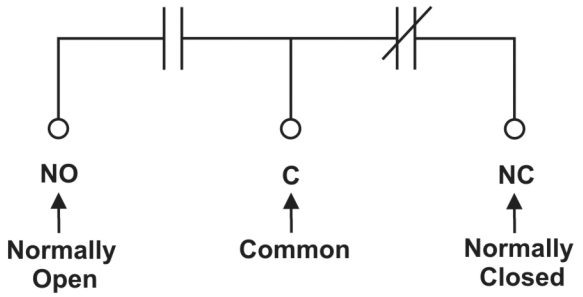


Figure 28 — Relay Connections, Not Energized State

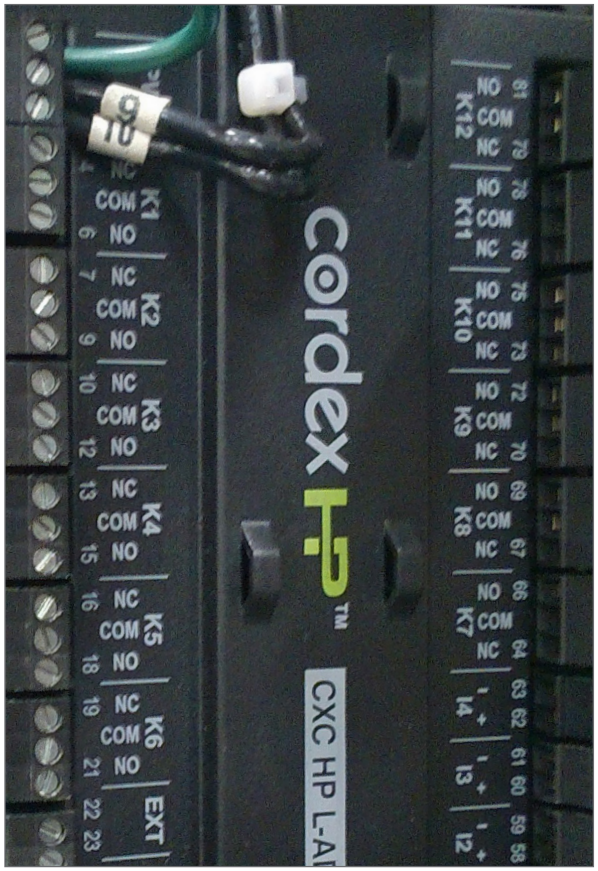


Figure 29 — Alarm Relay Pinouts

Table I — Relay assignments

Channel Description	Factory Default Designation
Relay K0	
Relay K1 -K5	LVD1 or not used
Relay K6-K8	Not used
Relay K9	AC MAINS HIGH/LOW alarm
Relay K10	SYSTEM MINOR alarm
Relay K11	SYSTEM MAJOR alarm
Relay K12	SYSTEM CRITICAL alarm

7.10.1 Relays

Relays can be programmed to be energized or not energized during an alarm condition (see Figure 28 and the controller software manual). Relays can be reassigned in the Relays table. From the controller's main dashboard go to **Modules >ADIOs> L-ADIO**.

For more information refer to the ADIO maintenance section of the controller software manual.

8. System Startup

After completing the system installation and power system wiring, perform the following startup and test procedure to ensure proper operation.

1. Visually inspect the installation thoroughly.
2. Verify:
    - » AC input power is off.
    - » Batteries are disconnected.
    - » All breakers are off and no GMT fuses installed if any loads are connected.
    - » All power modules are removed from the shelf.
3. Triple-check the polarity of all connections.
4. Install one rectifier module into the front left-most position using the side of the shelf as a guide.
    - » Place the rectifier module on the shelf.
    - » Lift the handle and slide the module into the rear connector inside the shelf.
    - » Apply pressure on the module front panel to engage the rear connector in the shelf receptacle.
    - » Flip the handle down to lock the module into place.
5. Verify that the AC input voltage is correct and that the breaker switch for the corresponding feeder breaker is ON.
    - » The power module OK LED will illuminate after a preset start delay.
6. Test the functionality of various module alarms and controls using the controller's LCD screen or web interface.
7. Verify the correct battery polarity using a voltmeter. Ensure that no cells or batteries are reversed.
8. Connect the batteries to the output of the system.
9. Install the remaining power modules.
10. Configure the battery parameters according to the battery manufacturers recommendations. See the CXC HP software manual for detailed instructions on how to configure the batteries.
11. From the **Power System> System Functions> Battery Maintenance> Equalize** menu of the controller, set the float and equalize voltage to the levels specified by the battery manufacturer.
12. Use the controller to test the functionality of various module alarms and controls especially the battery breaker alarm test. Verify alarms are transmitted to site monitor.
13. Perform a load test with the system using a resistive load box.
14. Enable the temperature compensation feature in the **Power System> System Functions> Temperature Compensation** menu. Program the settings for slope and breakpoints (upper and lower) with respect to the specific batteries used.

8.10.1 Factory Ranges and Defaults

Table J shows the rectifier settings/ranges/defaults. Changes are made through the controller interface.

Table J — Rectifier factory ranges and defaults

Setting	Range (minimum to maximum)	Default
Float (FL) Voltage	47.5 – 58.2V	54V
Equalize (EQ) Voltage	49.8 – 60.2V	55V
Battery Test (BT) Voltage	44 – 52V	46V
Over Voltage Protection (OVP)*	63V	63V
Current Limit (CL)	23 – 100%	100%
Power Limit (PL)	0 – 100%	100%
Module Start Delay	0 – 250s	1s
System Start Delay	0 – 600s	0s
Low Voltage Alarm (LVA)	42 – 52V	44V
High Voltage Alarm (HVA)	52 – 63V	55.5V
EQ Timeout	1 – 2399h	30h
BT Timeout	1 – 250h	8h
Softstart Ramp-rate	Normal/Fast	Normal
CL/PL Alarm	Enable/Disable	Enable
Remote Shutdown	Enable/Disable	Enable
Ramp Test	Enable/Disable	Enable

*The OVP cannot be set below the present system/FL/EQ/BT voltage setting or the safe mode voltage of 51.4V.

9. Maintenance

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

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

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

Consult factory 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.

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

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

Table K — Sample maintenance log

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

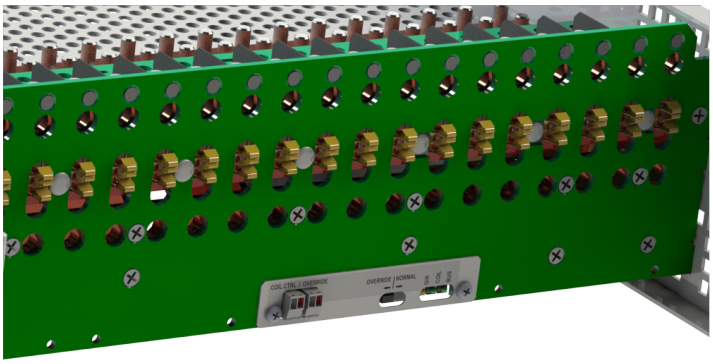
9.1 LVD Override Operation

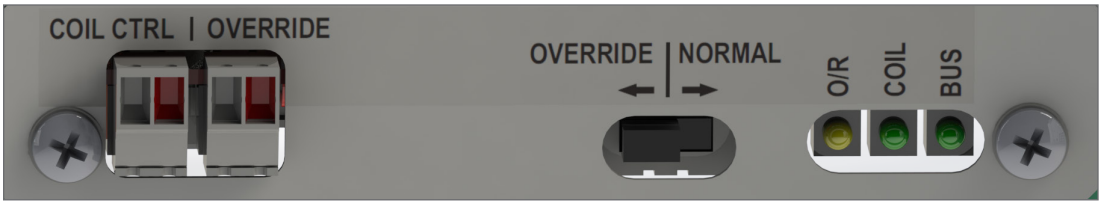
CAUTION!

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

The LVD Control functions are hardwired directly from the assigned relay output to an optional LVD override control located in the E3 distribution panel below the breakers. The override bypasses the LVD Auto control function. The LVD Override board has three indicators:

1. BUS PWR: On (Green) if voltage is present on the bus which powers the LVD coil.
2. COIL PWR: On (Green) if the coil is powered (and LVD is closed). If the LVD Override switch is in the “Normal” position, a Green LED indicates that the controller has activated the LVD.
3. Override: On (Yellow) confirms that the LVD Override switch is on. Note that the status of the LVD Override switch is also available through the controller when present.





Place the LVD Control switch to the OVERRIDE position to keep the LVD contactor engaged.

CAUTION!

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

To allow the controller to resume automatic control of the LVD contactor, check that the AUTO IN (green) LED is lit confirming that the controller will keep the LVD contactor engaged. Then you can return the LVD Control switch to the NORMAL position.

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

11. Warranty and Service Information

11.1 Technical Support

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

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

11.2 Warranty Statement

For full information details review Alpha's online Warranty Statement at www.alpha.ca

11.3 Limited Hardware Warranty

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

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

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

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

11.4 Battery Warranty

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

11.5 Warranty Claims

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

11.6 Service Centers

For a list of international service centers, refer to the Alpha website: www.alpha.ca

12. Certification

12.6.1.1 About CSA and NRTL

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

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

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

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

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

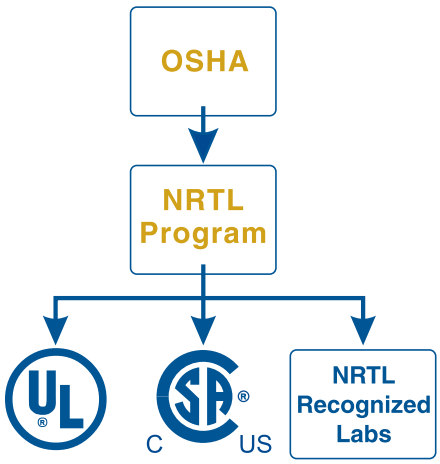
Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

12.6.1.2 NRTLs capabilities

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

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

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



12.6.1.3 Governance of NRTL

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

(1)www.csagroup.org

(2) www.scc.ca
(3) www.ulc.ca
(4) www.osha.gov

REVISIONS				
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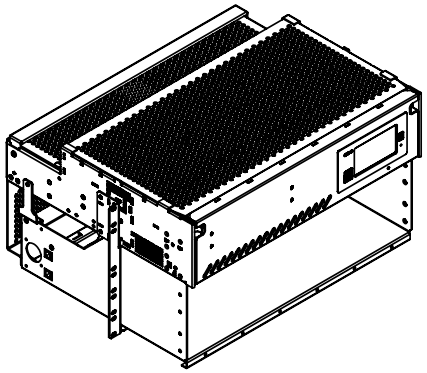

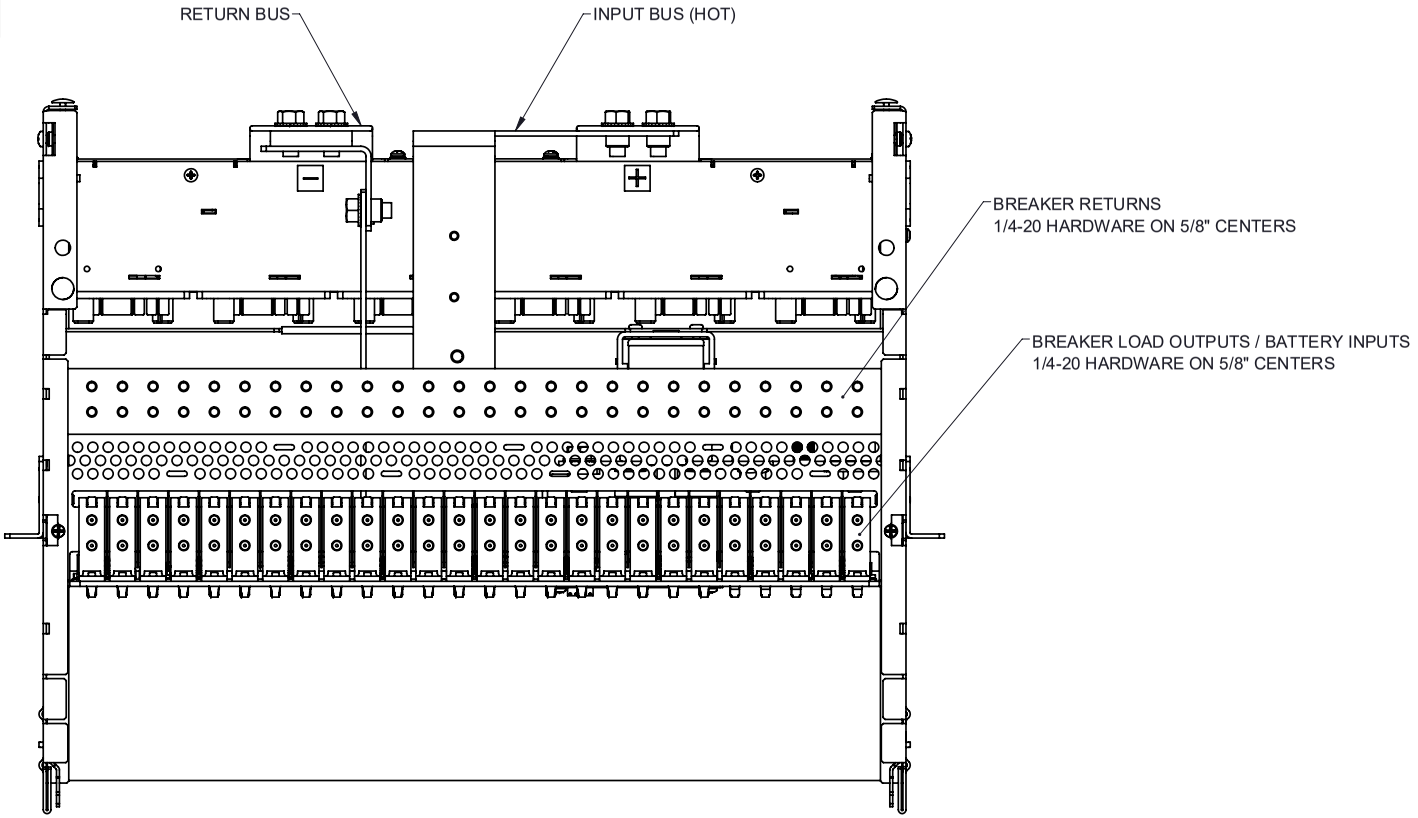

TOP VIEW
DOOR, COVER AND DRESSER BAR REMOVED

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES
X.X ±0.040 X.XX ±0.020
X.XXX ±0.010 ANGULAR: ±1°
INTERPRET DIM AND TOL PER ASME Y14.5-1994
DO NOT SCALE DRAWING
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TITLE: OUTLINE, CXPS-E3, 4KW

SIZE	DWG NO.	REV
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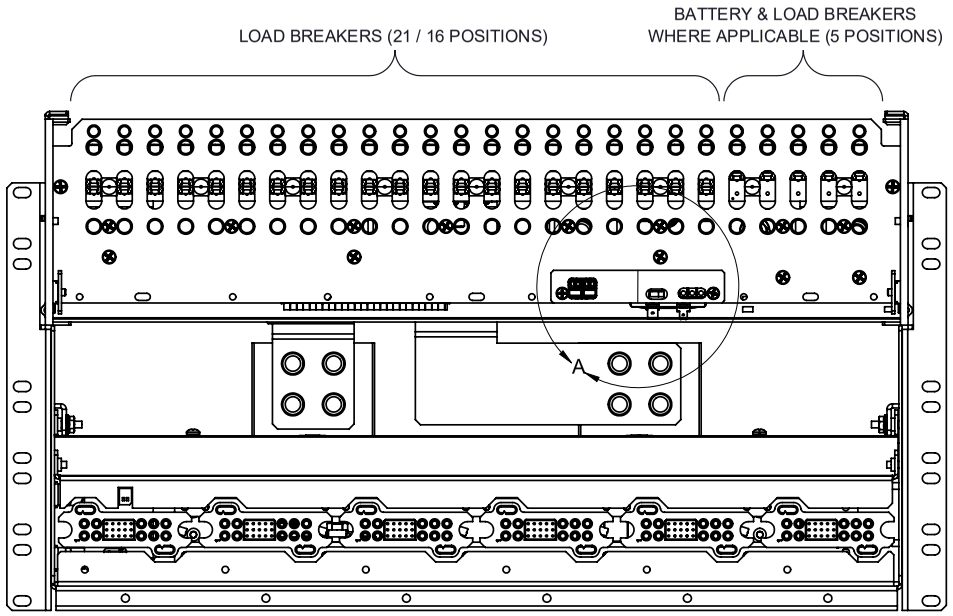
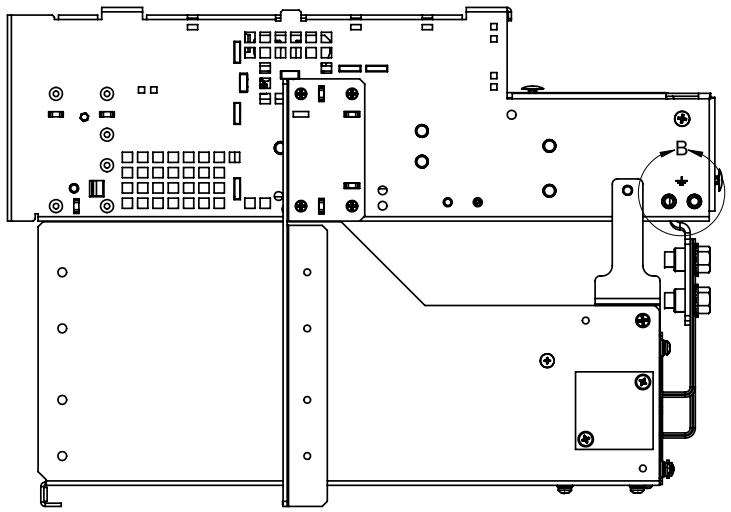
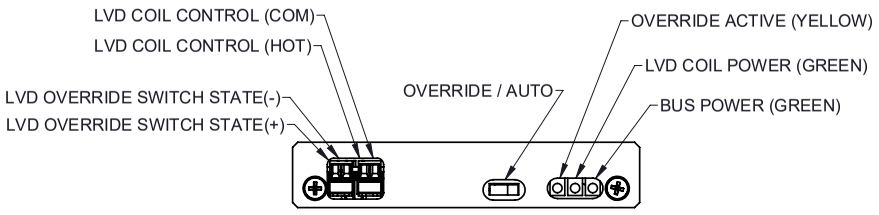
REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHK



FRONT VIEW WITH DOOR REMOVED





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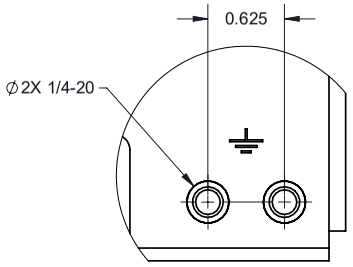

DETAIL B

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES X.X ±0.040 X.XX ±0.020 X.XXX ±0.010 ANGULAR: ±1° INTERPRET DIM AND TOL PER ASME Y14.5-1994 THIRD ANGLE PROJECTION	THESE DESIGNS AND SPECIFICATIONS ARE CONFIDENTIAL, REMAIN THE PROPERTY OF ALPHA TECHNOLOGIES LTD., AND SHALL NOT BE COPIED OR USED WITHOUT ITS WRITTEN CONSENT APPROVALS / DATE DRAWN JM 10-JAN-18 CHECKED DM 10-JAN-18 © ALPHA TECHNOLOGIES LTD	TITLE: OUTLINE, CXPS-E3, 4KW SIZE B DWG NO. 0250029-08 REV A SCALE: 1:8 SHEET 2 OF 2	

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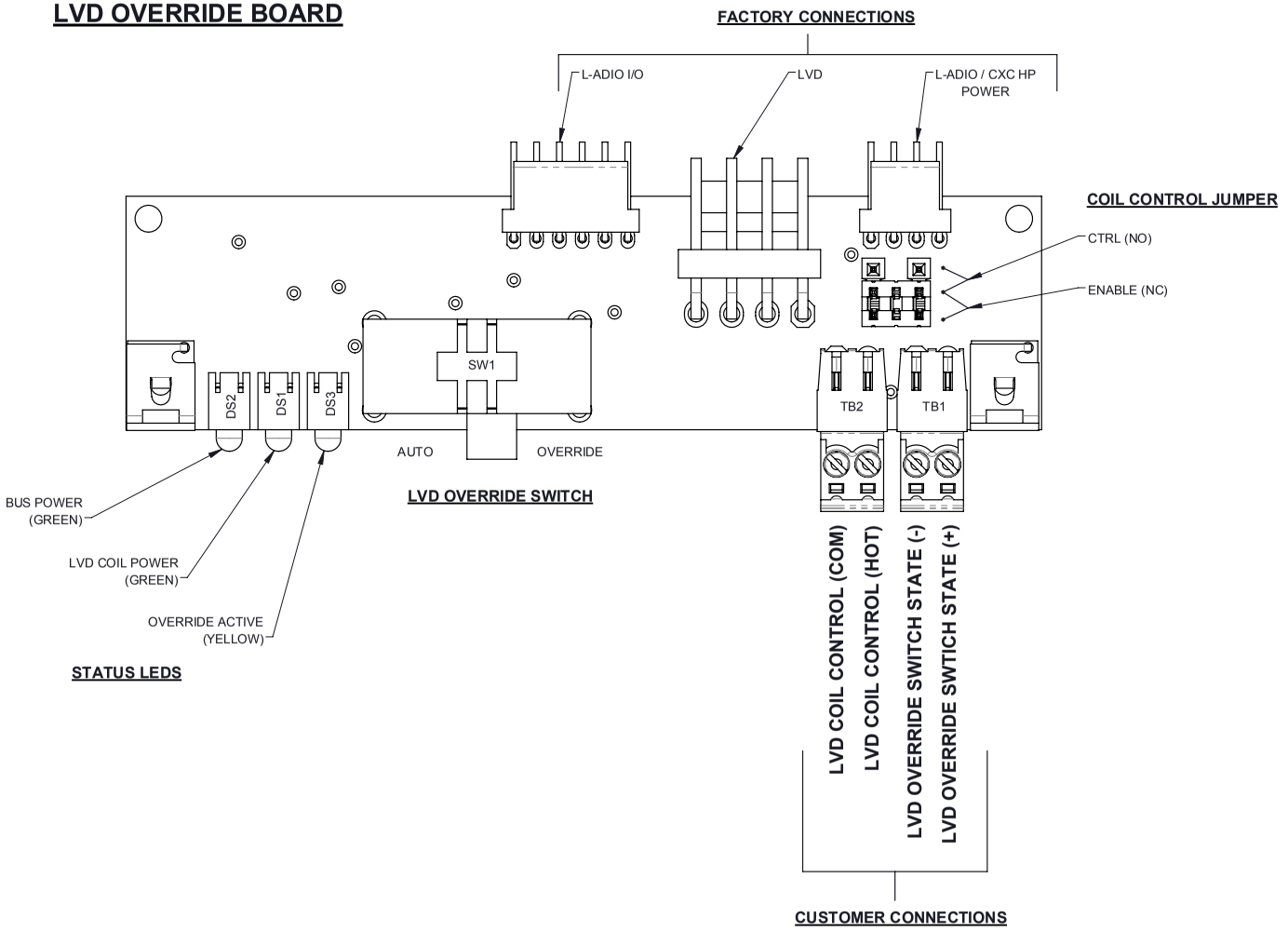
LVD OVERRIDE BOARD



TECHNOLOGIES™		
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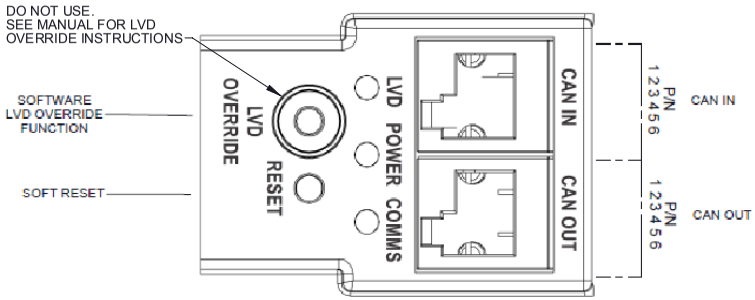
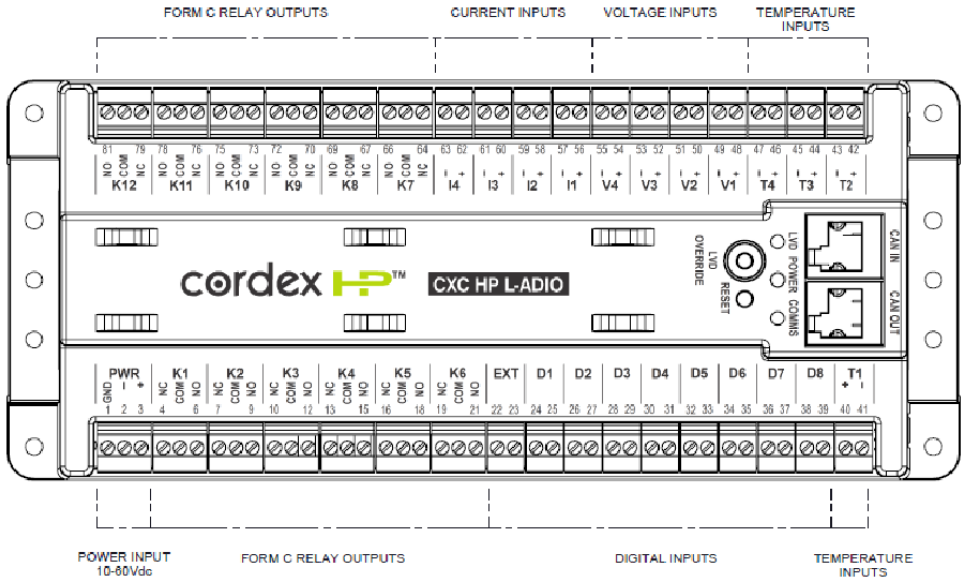
SIZE B	DWG NO. 0919XXX-XXX-08	REV A
SCALE: 1:1	SHEET 2 OF 4	

DO NOT SCALE DRAWING

NOTES:

1. RELAY K1 RESERVED FOR LVD CONTROL (IF EQUIPPED).
2. DIGITAL INPUTS D1-D2 RESERVED FOR DISTRIBUTION PANEL BREAKER / FUSE ALARMS.
3. DIGITAL INPUT D3 RESERVED FOR LVD OPEN ALARM (IF EQUIPPED).
4. VOLTAGE INPUTS V1-V2 RESERVED FOR BATTERY / LOAD VOLTAGE MONITORING.
5. CURRENT SHUNT INPUT I1 RESERVED FOR BATTERY / LOAD SHUNT MONITORING.





CAN RJ12 OFFSET P/N OUT

1.GND
2.CAN High
3.CAN NOT USED
4.CAN Low
5.CAN NOT USED
6.NOT NOT USED

CXC-HP L-ADIO I/O MODULE

TITLE:	CUSTOMER CONNECTION, CXPS, 19" & 23"		
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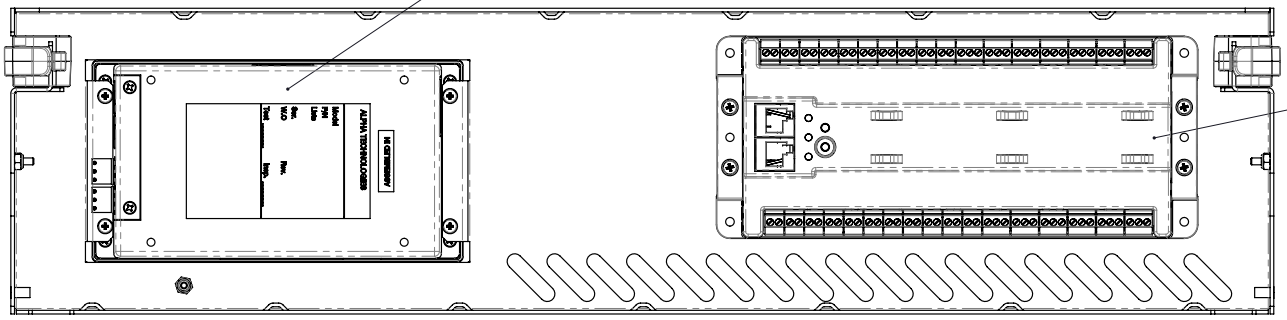
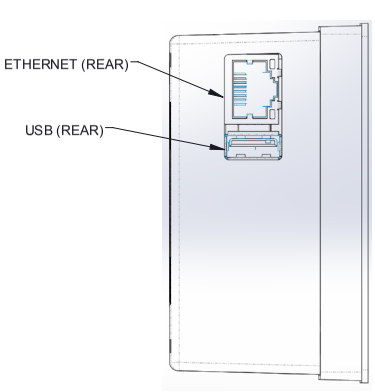
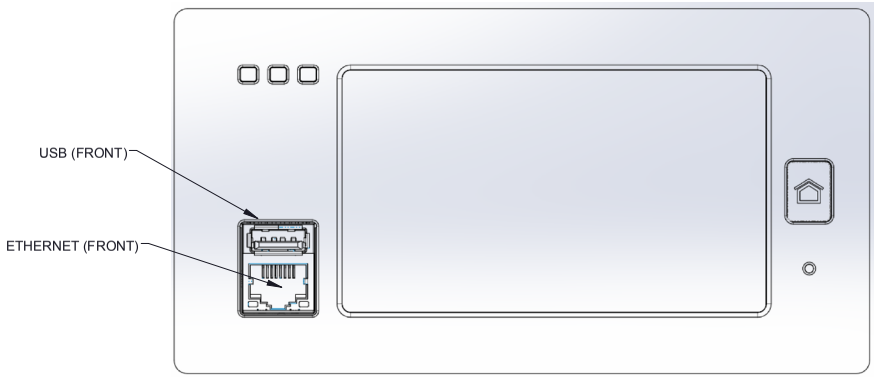
SCALE: 1:2	SHEET 3 OF 4		

DO NOT SCALE DRAWING





CXC HP CONTROLLER
(LEFT SIDE)



CXC HP CONTROLLER
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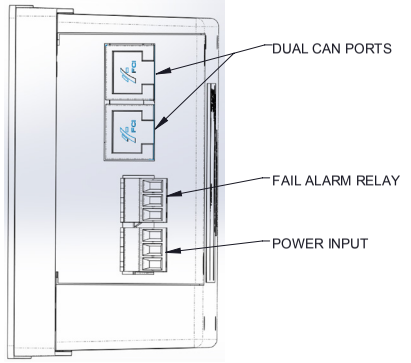
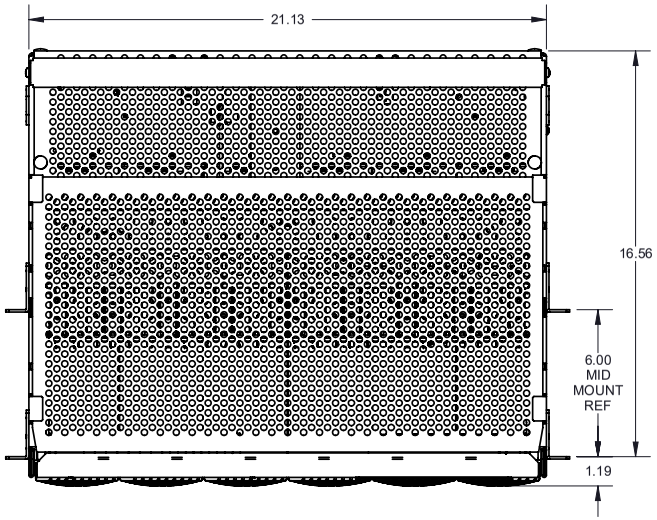
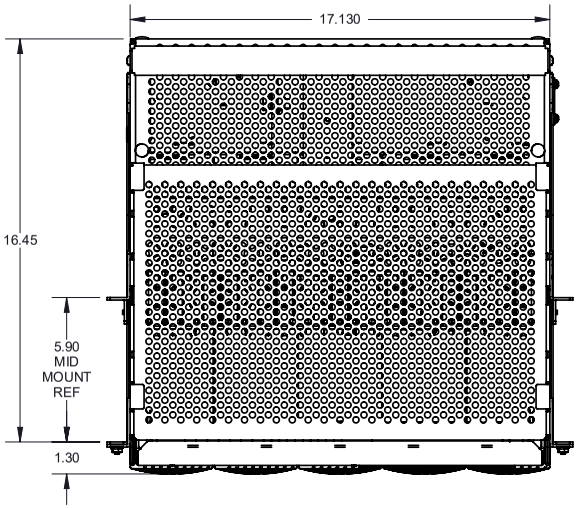


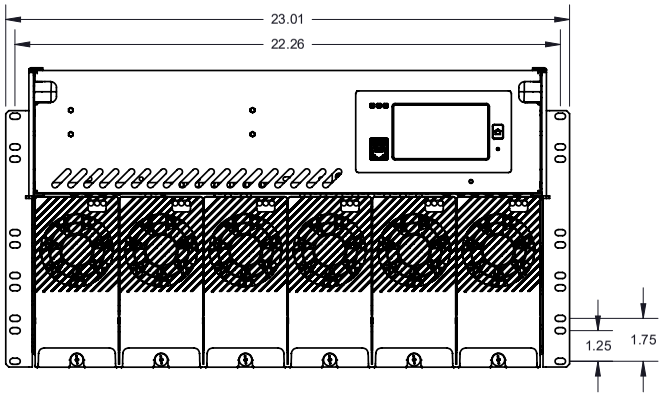
CXC HP CONTROLLER
(RIGHT SIDE)

TITLE: CUSTOMER CONNECTION, CXPS, 19" & 23"			
SIZE B	DWG NO. 0919XXX-XXX-08		REV A
SCALE: 1:4		SHEET 4 OF 4	

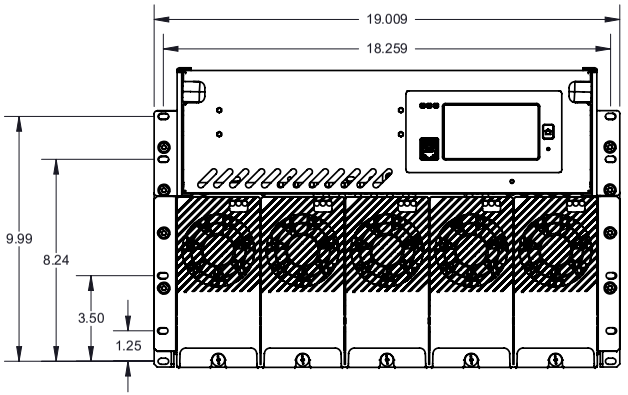
REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHK







0250029-001
0250029-003
0250029-005
0250029-006
0250029-007
0250029-008



0250029-002
0250029-004

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES	
X.X	±0.040
X.XX	±0.020
X.XXX	±0.010
ANGULAR:	±1°
INTERPRET DIM AND TOL PER ASME Y14.5-1994	
THIRD ANGLE PROJECTION	

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APPROVALS		DATE
DRAWN	JM	08-JAN-19
CHECKED	DM	08-JAN-19

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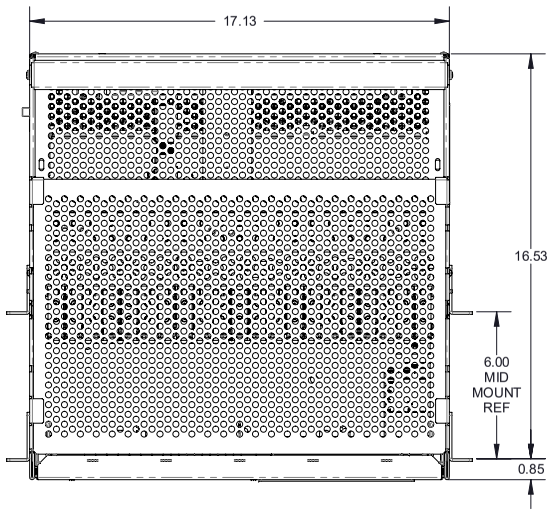
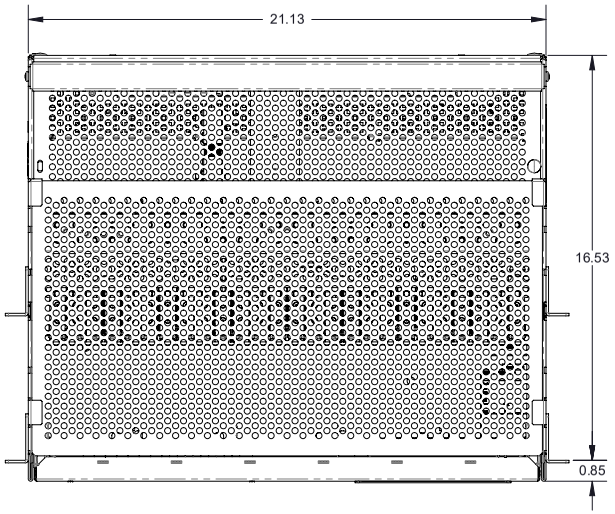
TITLE: OUTLINE, CXPS-E3 - 4KW

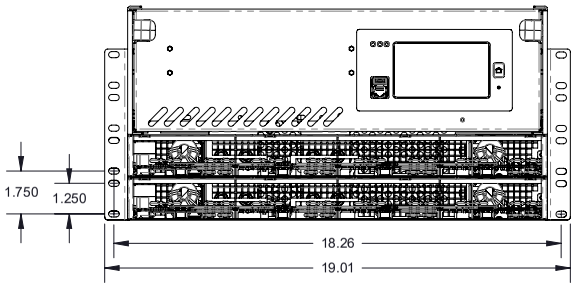
SIZE	DWG NO.	REV
B	0250029-06	A

SCALE: 1:5 SHEET 1 OF 1

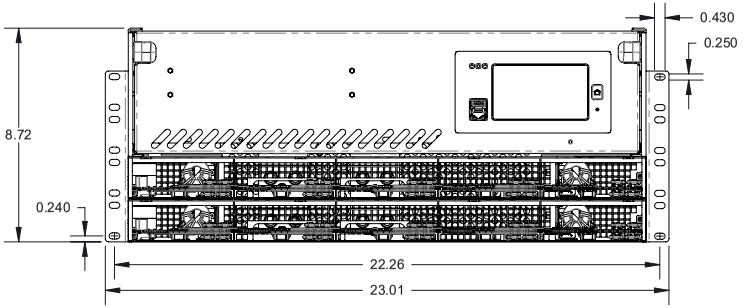
DO NOT SCALE DRAWING







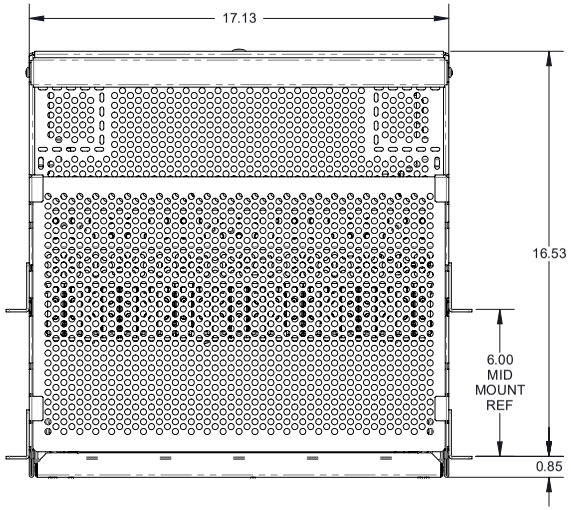
0250030-013
0250030-014
0250030-015
0250030-016

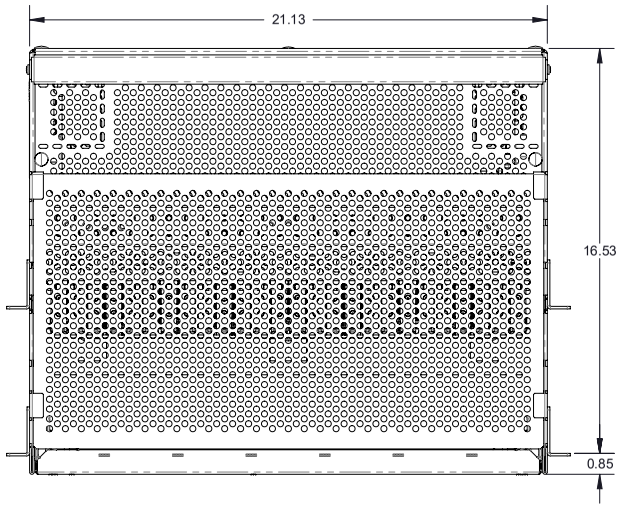


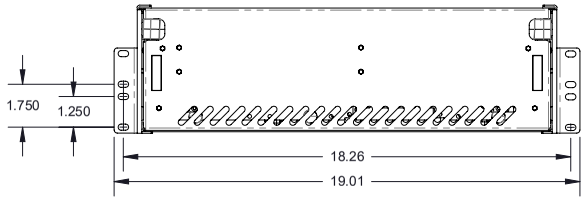
0250030-005
0250030-006
0250030-007
0250030-008

TITLE:	OUTLINE DRAWING CXPS-E3 / CXDM-E3	
SIZE: B	DWG NO. 0250030-06	REV: B
SCALE: 1:5	SHEET 2 OF 4	

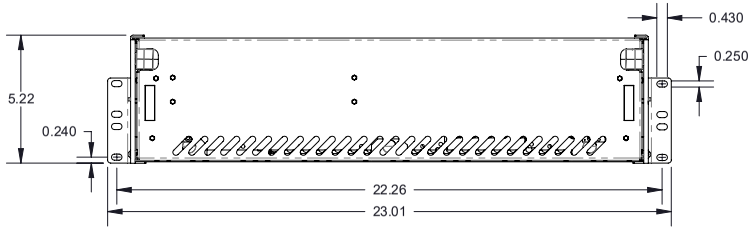
DO NOT SCALE DRAWING







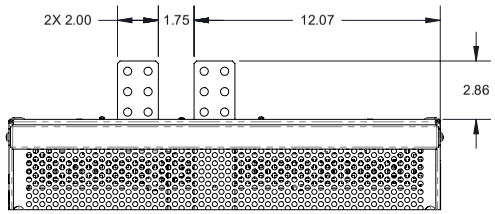
0250030-018
0250030-020

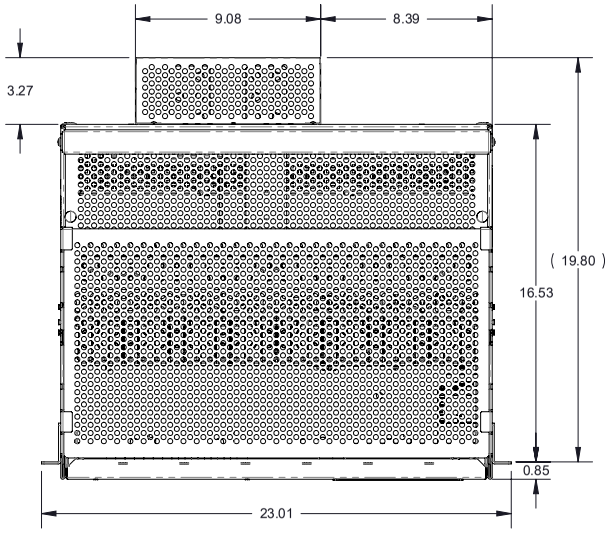


0250030-017
0250030-019

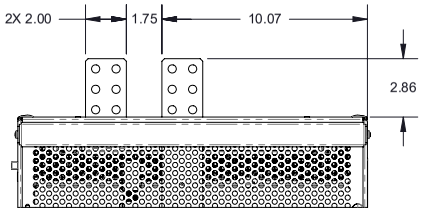
TECHNOLOGIES™		
TITLE:	OUTLINE DRAWING CXPS-E3 / CXDM-E3	
SIZE: B	DWG NO. 0250030-06	REV: B
SCALE: 1:5	SHEET 3 OF 4	

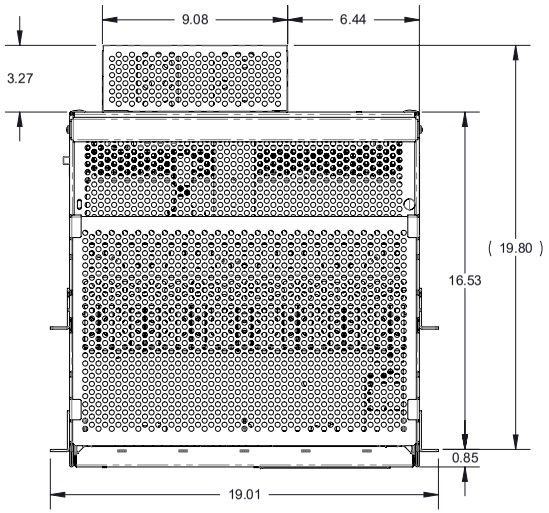
DO NOT SCALE DRAWING





0250030-750
23"





0250030-750
19"

TECHNOLOGIES™

TITLE:	OUTLINE DRAWING CXPS-E3 / CXDM-E3	
SIZE: B	DWG NO. 0250030-06	REV: B
SCALE: 1:6	SHEET 4 OF 4	

Alpha Technologies Ltd.

Canada: Burnaby, British Columbia T: 604.436.5900 F: 604.436.1233
United States: Bellingham, Washington T: 360.647.2360 F: 360.671.4936

For more information visit www.alpha.com

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